1.0 INTRODUCTION

This report presents the results of a remedial investigation at the Palos Verdes Landfill (PVLF), located at 25706 Hawthorne Boulevard, Rolling Hills Estates, in Los Angeles County, California. The PVLF was operated under permit by the County Sanitation Districts of Los Angeles County (Sanitation Districts) as a sanitary landfill from May 1957 through December 1980. This report has been prepared by the Sanitation Districts pursuant to an Enforceable Agreement between the Sanitation Districts and the Department of Toxic Substances Control (DTSC) of the California Environmental Protection Agency. The Enforceable Agreement, signed on March 31, 1988, sets forth the objectives of the Remedial Investigation/Feasibility Study (RI/FS). It also sets forth the minimum requirements for this Remedial Investigation (RI) Report. This report has been prepared to fulfill the objectives and satisfy the requirements for the remedial investigation portion of this program as specified in the Enforceable Agreement.

In conducting this program, various work plans were prepared for and approved by DTSC for implementation. They are discussed in detail in Section 1.2. Appropriate guidance documents, including Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (U.S. EPA, 1988) and Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (U.S. EPA, 1991) were used in preparation of this RI Report.

1.1 OBJECTIVE, PURPOSE, AND SCOPE

The objective of the PVLF RI/FS is to gather information sufficient to support an informed risk management decision regarding the selection of a remedy, if necessary, which appears to be most appropriate for this site. The objective of the RI/FS process is not the unobtainable goal of removing all uncertainty (U.S. EPA, 1988). However, through careful planning, field studies were designed to provide the essential data needed to begin evaluation of potential remedies that may be appropriate for the PVLF. The remedial investigations during which such field studies were performed are documented in this report. They were conducted to gather site characterization information, define site dynamics, and define risks so that a remedial program to mitigate potential adverse public health and environmental impacts can be developed.

The purpose of the PVLF remedial investigations is to thoroughly investigate any release or potential release of hazardous substances or contaminants to the air, surface water, soil, or ground water from the site. The purpose of this RI Report is to present the results of the air, surface water, soil, and ground water investigations performed at the site. The site characterization documented herein is focussed on defining the nature and extent of contamination at or from the PVLF.

To meet the objective of the remedial investigations, several specific activities were undertaken by the Sanitation Districts under the oversight of DTSC. Air, surface water, soil, and ground water investigations were undertaken to determine the nature and full extent of potential contamination in each of these media at and from the PVLF. Potential migration pathways, including the direction, rate, and dispersion of contaminants were identified. Data were developed to allow determination of the extent to which substances on site and off site may endanger public health, welfare, or the environment. These data were then used to conduct a baseline risk assessment for the PVLF and surrounding areas.

The RI Report summarizes the results of the remedial investigations including reduction and interpretation of all data and information generated and compiled during the investigation. It contains the following items, designed to meet the requirements set forth in the Enforceable Agreement for the RI Report:

- Updated site background summary;
- Updated waste characterization;
- Updated summary of site hydrogeology;
- Updated summary of surface hydrologic conditions;
- Description of the nature and extent of soil, sediment, air and water contamination;
- Identification of the existing and potential migration pathways including the direction, rate, and dispersion of contaminant migration;
- Identification and evaluation of interim mitigation measures;
- Determination of the extent to which substances on site and off site may endanger public health, welfare, or the environment;
- Description of a comprehensive ongoing monitoring program;

- Data summaries;
- Identification of remaining deficiencies in data needed to meet the objective of the remedial investigation; and
- Recommendations for additional work needed to correct remaining data deficiencies.

The scope of the RI Report is to present all of the data collected and all of the analyses performed to interpret these data. The results of the field investigations of air, surface water, soil, and ground water, previously reported separately by pathway, are compiled herein. The investigations performed are described, the results are summarized and discussed, and the conclusions from the remedial investigation activities performed at the PVLF are detailed.

1.2 REMEDIAL INVESTIGATION APPROACH

In accordance with the Enforceable Agreement, the Sanitation Districts submitted a Work Plan Outline which described the activities necessary to conduct a complete remedial investigation. The Work Plan Outline was submitted to DTSC in May 1988, and approved by DTSC in June 1988. The work scope described in the Work Plan Outline required the submittal of eight additional work plans to DTSC for specific project functions, such as data management, public relations, health and safety, and sampling and quality assurance/quality control procedures; and for specific field investigations of the pathways of potential concern, including air, surface water and sediment, soil, and ground water. Field work for the remedial investigations were then performed in conformance with the separate work plans. Each of the individual work plans is described below.

Data Management Plan

The Data Management Plan (DMP) was prepared by the Sanitation Districts for use during the RI/FS. The DMP provides procedures for the management of all information generated during the program. Provisions for field data documentation, sample identification documentation, chain of custody control and documentation, laboratory and field data management and storage, inventory and filing systems, quality assurance/quality control (QA/QC) documentation, and project and financial tracking are all contained in the DMP. Appropriate guidance documents, including Guidance on Remedial Investigation Under CERCLA (U.S. EPA, 1985a), Guidelines and

Specifications for Preparing Quality Assurance Program Plans (U.S. EPA, 1983), and National Enforcement Investigations Center Policies and Procedures (U.S. EPA, 1978), were used in preparation of the DMP.

The DMP was submitted to DTSC for review in February 1989. Comments from DTSC on the DMP were received in October 1989; it was revised and resubmitted to DTSC in November 1989. Final approval of the DMP was received from DTSC in December 1989. Field data sheets, chain of custody records, QA/QC documentation, and laboratory analytical results are reported in the appendices of this report in accordance with the procedures outlined in the DMP.

Community Relations Plan

The Community Relations Plan (CRP) was prepared by the Sanitation Districts for use during the RI/FS. The CRP was prepared to ensure that an effective community relations program would be implemented and followed by the Sanitation Districts and other agencies throughout the program. It contains procedures designed to keep the local community informed of planned or ongoing activities at and around the site, to respond to inquiries from concerned members of the community, and to give the community the opportunity to comment on and provide input on technical response decisions regarding the implementation of any remedial responses which may be required. The community relations procedures contained in the CRP were developed to respond to the needs and wants of the community as expressed in interviews with homeowner group representatives and local city officials, during the community relations program previously conducted at the PVLF by the Sanitation Districts, and in informal contacts with community members. Appropriate guidance documents, including Community Relations Plan Preparation, Remedial Action Order and Enforceable Agreement Policy and Procedure (DHS, 1988) and Handbook of Community Relations in Superfund (U.S. EPA, 1986) were used in preparation of the CRP.

The CRP was submitted to DTSC for review in February 1989. Comments from DTSC on the CRP were received in October 1989; it was revised and resubmitted to DTSC in November 1989. Additional comments on the revised CRP were received in the same month, and the CRP was again revised and resubmitted to DTSC in February 1990. Final approval of the CRP was received

from DTSC in March 1990. A summary of the community relations program conducted in conjunction with the remedial investigation program is contained in Appendix F.

Site Health and Safety Plan

The Site Health and Safety Plan (SHSP) was prepared by the Sanitation Districts and the Sanitation Districts' consultant, CH2M Hill. The SHSP identifies potential health and safety hazards posed by tasks related to both the ongoing maintenance and remedial investigation activities performed at the PVLF by Sanitation Districts personnel, and the standard procedures and practices implemented to minimize these hazards. Appropriate guidance documents, including EPA Standard Operating Safety Guidelines (U.S. EPA, 1984), NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (U.S. EPA, 1985b), and Technical Method for Investigating Sites Containing Hazardous Substances (U.S. EPA, 1981), were used in preparation of the SHSP.

The SHSP was submitted to DTSC for review in February 1989. Comments from DTSC on the SHSP were received in October 1989; it was revised and resubmitted to DTSC in November 1989. Final approval of the SHSP was received from DTSC in December 1989.

Site Sampling and Analysis Plan

The Site Sampling and Analysis Plan (SSAP) was prepared by the Sanitation Districts and the Sanitation Districts' consultant, CH2M Hill. The SSAP was prepared to fulfill a number of objectives for the remedial investigation field activities. These objectives included selection and description of sample locations based on the rationale outlined in the SSAP; description of field methods to be used for geophysical surveying, vadose zone monitoring, drilling, soil and ground water sampling, installation of monitoring wells, and aquifer testing; description of laboratory analytical methods to be used for all sample media; guidelines for equipment and personnel decontamination; description of QA/QC procedures; delineation of an operations plan for routine vadose zone and ground water monitoring; and description of statistical comparison procedures for use in monitoring data evaluation.

The SSAP was submitted to DTSC for review in February 1989. Comments from DTSC on the SSAP were received in October 1989; it was revised and resubmitted to DTSC in November 1989. Final approval of the SSAP was received from DTSC in December 1989. The routine vadose zone and ground water monitoring programs outlined in the SSAP were instituted in January 1991 following the completion of the field work for the Soil Characterization and Hydrogeologic Characterization Plans (discussed later in this section). The remedial investigation monitoring program superseded the previous monitoring program required by the Regional Water Quality Control Board (RWQCB), as approved by the RWQCB. However, since a quantity of monitoring data was available from the previous monitoring program, vadose zone and ground water quality data collected from 1986 through 1990 is included in the evaluations performed for this RI Report. Several minor modifications to the SSAP were made beginning with the October 1994 quarterly ground water sampling event. These changes, which serve to standardize the sampling and analytical schedules, were approved by DTSC and are documented in a letter to DTSC from the Sanitation Districts dated September 7, 1994.

Ambient Air/Landfill Gas Characterization Plan

The Ambient Air/Landfill Gas Characterization Plan (AALGCP) was prepared by the Sanitation Districts to investigate one of the pathways of potential concern; namely, the potential for landfill gas migration into the ambient air. The AALGCP defined the scope of and procedures to be used during ambient air/landfill gas field investigations. Seven distinct activities were included in the scope of the AALGCP. They consisted of meteorological monitoring, ambient air sampling, integrated surface gas monitoring and sampling, boundary probe monitoring and sampling, neighborhood meter box monitoring (conducted at water meter boxes in the Country Hills Estates area located northeast of the PVLF), landfill gas sampling, and flare emissions testing.

The AALGCP was submitted to DTSC for review in April 1989. Comments from DTSC on the AALGCP were received in November 1989; it was revised and resubmitted to DTSC in January 1990. Final approval of the AALGCP was received from DTSC in February 1990. The full scope of the AALGCP activities were performed during the period of September 1990 through August 1991. The neighborhood meter box monitoring program, although included in the AALGCP, is actually performed to meet the requirements of the County of Los Angeles Department of Health

Services. This program has been ongoing since the mid-1980's and will continue independent of any RI/FS requirements. Selected portions of the AALGCP scope have been continued on a regular basis from September 1991, and will be continued for an indefinite time period. These activities include surface gas monitoring and sampling at the main site and the South Coast Botanic Garden and boundary probe monitoring and sampling.

Quarterly reports documenting the activities conducted in accordance with the AALGCP were submitted to DTSC in February, August, and November of 1991. A final report on these activities was submitted to DTSC on May 15, 1992. Comments on this report were received from DTSC in June 1994 and were addressed in the Additional Ambient Air Monitoring Work Plan (Sanitation Districts, 1994b).

Surface Water and Sediment Characterization Plan

The Surface Water and Sediment Characterization Plan (SWSCP) was prepared by the Sanitation Districts to investigate one of the pathways of potential concern; namely, the potential for contaminant migration through surface water runoff. The primary mechanism driving surface water runoff and water-transported sediments is rainfall storm events. The SWSCP defined the scope of and procedures to be used during the surface water and sediment field investigations. Programs to sample and analyze surface water runoff and water transported sediments and evaluate site hydrologic characteristics were included in the scope of the SWSCP.

The SWSCP was submitted to DTSC for review in February 1989. Comments and conditional approval from DTSC on the SWSCP were received in August 1989; it was revised and resubmitted to DTSC later in the same month. Final approval of the SWSCP was received from DTSC in September 1989. Field sampling for the SWSCP began in April 1990 and were completed in March 1992. The extended time period was necessitated by drought conditions experienced in Southern California over those years. Since rainwater runoff was targeted as the primary mechanism for potential contaminant transport, it was necessary to collect samples during rainfall storm events. Therefore, extension of the program enabled the collection of a sufficient number of samples at the selected sampling points.

A series of quarterly reports, beginning in October 1989 and extending through August 1991, were submitted to DTSC documenting the activities conducted in accordance with the SWSCP during the preceding three months. A final report on these activities was submitted to DTSC on July 15, 1992. Comments on this report were received from DTSC in December 1992 and are addressed in this RI Report.

Soil Characterization Plan

The Soil Characterization Plan (SCP) was prepared by the Sanitation Districts to investigate one of the pathways of potential concern; namely, the potential for contaminant migration through unsaturated soils. The SCP defined the scope of and procedures to be used during the soil characterization field investigations. In particular, the SCP focused on collection and analysis of background soil and sediment samples. This was identified as a data gap in the preliminary site evaluation conducted for the Work Plan Outline.

The SCP was submitted to DTSC for review in February 1989. Comments from DTSC on the SCP were received in October 1989; it was revised and resubmitted to DTSC in November 1989. Final approval of the SCP was received from DTSC in December 1989. Field sampling for the SCP was conducted concurrently with that of the Hydrogeologic Characterization Plan (discussed below), and began in June 1990. Field sampling for both programs was completed in October 1990.

A final report on the soil sampling activities was submitted to DTSC on July 31, 1991. This report included the results of all soil sampling and analysis conducted as part of the remedial investigation. Both background and other, potentially PVLF impacted, soil samples were collected, analyzed, and evaluated for the Soil Characterization Report. Comments on this report were received from DTSC in December 1991. The report was revised and resubmitted to DTSC under the title Background Sediment Characterization Report in August 1992. Additional comments from DTSC were received in December 1992 and are addressed in this RI Report.

Hydrogeologic Characterization Plan

The Hydrogeologic Characterization Plan (HCP) was prepared by the Sanitation Districts to investigate the geologic and hydrogeologic nature of the site and surrounding area and the final pathway of concern; namely, the potential for ground water contamination. The HCP defined the scope of and procedures to be used during the geologic, hydrogeologic, and ground water field investigations. Programs to define and evaluate the area geology and hydrogeology, and sample and analyze ground water samples were included in the scope of the HCP.

The HCP was submitted to DTSC for review in April 1989. Comments from DTSC on the HCP were received in October 1989; it was revised and resubmitted to DTSC in November 1989. Final approval of the HCP was received from DTSC in December 1989. Field work for the HCP was conducted concurrently with that for the SCP, and began in June 1990. Field sampling for both programs was completed in October 1990. Field reports on this work, prepared by the Sanitation Districts' contractor, Herzog Associates, were submitted to DTSC in January 1991.

Two reports for the HCP have been submitted to DTSC. The first, which contained the results of a literature search for geologic, hydrogeologic, and seismic information for the PVLF area, was submitted on March 29, 1991. No specific comments on this report have been received from DTSC. The second, which contained the results of the field work conducted to investigate geologic, hydrogeologic, and ground water conditions both downgradient and upgradient of the PVLF, was submitted to DTSC on July 2, 1992. Comments on this report were received from DTSC in December 1992 and are addressed in this RI Report.

Work Plan for Additional Remedial Investigation

The Work Plan for Additional Remedial Investigation was prepared by the Sanitation Districts to investigate several data gaps remaining after completion of prior remedial investigations under the AALGCP, SWSCP, SCP, and HCP. This work plan included programs to investigate several pathways of concern; namely, the off site subsurface vapor migration component of the air pathway, the surface soil contamination portion of the surface water/sediment runoff pathway, and the downgradient ground water pathway. Field studies included surface flux chamber sampling, drilling

several borings followed by installation of ground water monitoring wells to the northeast of the landfill, and collection and analysis of additional surface soil cover samples.

This work plan was submitted to DTSC for review in March 1993. Comments from DTSC were received in June 1993. The work plan was revised and resubmitted to DTSC in July 1993; after a few more DTSC comments were received and responded to, final DTSC approval was received in August 1993. Field work for the additional remedial investigations began in September 1993 and were completed in January 1994.

A report on the additional remedial investigations was submitted to DTSC in May 1994. Comments on this report were received from DTSC in August 1994 and are addressed in this RI Report.

Dioxins Sampling Plans

The Sampling and Analysis Plan for Dioxins and Radioactivity, the Sampling and Monitoring Plan for Dioxins, and the Modified Sampling and Monitoring Plan for Dioxins were prepared by the Sanitation Districts to investigate whether dioxins are present in the ground water in the vicinity of the PVLF, and their potential migration via the ground water pathway. Dioxins investigations were begun in response to questions raised by community members at a June 1990 community meeting.

The Sampling and Analysis Plan for Dioxins and Radioactivity was submitted to DTSC for review in October 1990. DTSC approved the plan in November 1990 and field activities for dioxins were performed in December 1990 and February 1991. The results of the dioxin sampling were received and evaluated by the Sanitation Districts; based on the results the Sanitation Districts prepared the Sampling and Monitoring Plan for Dioxins which was submitted to DTSC in March 1991. Comments from DTSC on the Sampling and Monitoring Plan for Dioxins were received in October 1991. The Sanitation Districts agreed verbally to the changes required by DTSC. In July 1992, DTSC requested that the changes agreed to by the Sanitation Districts be incorporated into the written plan. The Sanitation Districts complied, and submitted the Modified Sampling and Monitoring Plan for Dioxins to DTSC in September 1992. Additional changes to this modified plan were requested by

DTSC in December 1992. The requested changes were made by the Sanitation Districts and the revised plan was submitted to DTSC in June 1993. Final approval from DTSC for this plan was received in September 1993. Field activities for the Sampling and Monitoring Plan for Dioxins/Modified Sampling and Monitoring Plan for Dioxins began in June 1991 and were completed in August 1992.

The results of all dioxins testing were documented with the additional remedial investigation results in a report submitted to DTSC in May 1994, as discussed above. Comments on this report were received from DTSC in August 1994 and are addressed in this RI Report.

Radioactivity Sampling Plans

The Sampling and Analysis Plan for Dioxins and Radioactivity and the Sampling and Monitoring Plan for Radioactivity were prepared by the Sanitation Districts to investigate whether radioactive isotopes are present in the ground water in the vicinity of the PVLF, and their potential migration via the ground water pathway. These radioactivity investigations were begun in response to questions raised by community members at a June 1990 community meeting.

The Sampling and Analysis Plan for Dioxins and Radioactivity was submitted to DTSC for review in October 1990. DTSC approved the plan in November 1990 and field activities for radioactivity were performed in December 1990 and May 1991. Following receipt of the analytical results, the Sanitation Districts prepared a report, the Evaluation of Radiation Monitoring Data, and a work plan for additional sampling, the Sampling and Monitoring Plan for Radioactivity. Both the report and work plan were submitted to DTSC in September 1992. Comments from DTSC on the work plan were received in December 1992. The sampling and monitoring plan was revised and resubmitted to DTSC in June 1993. Final approval of the plan was received from DTSC in September 1993. Field activities for the Sampling and Monitoring Plan for Radioactivity began in November 1993 and were completed in September 1994.

The results of all radioactivity testing are documented in this RI Report.

Additional Ambient Air Monitoring Work Plan

The Additional Ambient Air Monitoring Work Plan was prepared by the Sanitation Districts to further investigate the potential for landfill gas migration into the ambient air. This work plan defined the scope of and procedures to be used during additional ambient air monitoring designed to provide additional data to confirm previous results. Different sample collection and analytical methodologies than used during the AALGCP program for ambient air monitoring were employed for these additional monitoring events.

The Additional Ambient Air Monitoring Work Plan was submitted to DTSC for review on May 13, 1994. Approval of this work plan was received from DTSC on May 18, 1994. The field activities for the additional monitoring were conducted during June and July 1994.

A final report on the additional ambient air monitoring activities was submitted to DTSC on October 18, 1994. This report included the results of the additional air monitoring, analyses of the results, and a comparison of the additional results to the ambient air data collected during the AALGCP program. The monitoring results from the additional ambient air study confirmed the results obtained earlier during the AALGCP program. DTSC approved the final report on the additional ambient air monitoring on November 3, 1994.

1.3 SITE BACKGROUND

A large body of knowledge about the site is in existence since the site was operated for many years by the Sanitation Districts, and postclosure maintenance conducted by the Sanitation Districts has been ongoing since site closure in 1980. This section summarizes the most relevant information to provide an overview of the site, and where appropriate to meet the objectives of this investigation, a more detailed account of existing environmental studies and systems. Included in this section are descriptions of the location, history, current use of the site and the surrounding area, previous investigations, and the existing environmental monitoring and control systems.

1.3.1 Site Location

Topographically, the PVLF is located in the north-facing foothills of the Palos Verdes peninsula in the south central portion of Los Angeles County, California (Figure 1.3-1). The landfill site consists of six parcels of land separated into three sections by Hawthorne and Crenshaw Boulevards, as shown in Exhibit 1.3-1. The total area of the landfill is 291 acres.

Parcel 1, consisting of 83 acres, is located south of Crenshaw Boulevard. The site is currently operated by the Los Angeles County (County) Department of Parks and Recreation as the South Coast Botanic Garden.

Parcels 2, 3, 5, and 6 are located between Hawthorne and Crenshaw Boulevards. This area is commonly referred to as the "main site". The total area at the main site is 173 acres. The main site is currently operated by the Sanitation Districts with limited access to the public, the long term plans for this section of the PVLF call for its development as open space under the County Department of Parks and Recreation.

Parcel 4, consisting of 35 acres, is located northwest of Hawthorne Boulevard. The City of Rolling Hills Estates currently operates Ernie Howlett Park on Parcel 4.

1.3.2 Site History

Since the early 1900's, mining and quarrying operations have been conducted at and around the PVLF site. The two principal products of these operations included diatomaceous earth, and sand and gravel. The majority of the mining was open pit, but the modified room-and-pillar method was used for diatomite mining in an area near the northern corner of the main site.

Diatomite was mined and quarried throughout the area of the PVLF site beginning in the early 1900's by the Dicalite Company, among others. In 1944, the Dicalite Company was purchased by the Great Lakes Carbon Corporation and was operated under the name of the Dicalite Division of the corporation. The diatomite mining and quarrying continued until the 1950's when operations were discontinued primarily due to reserve depletion.

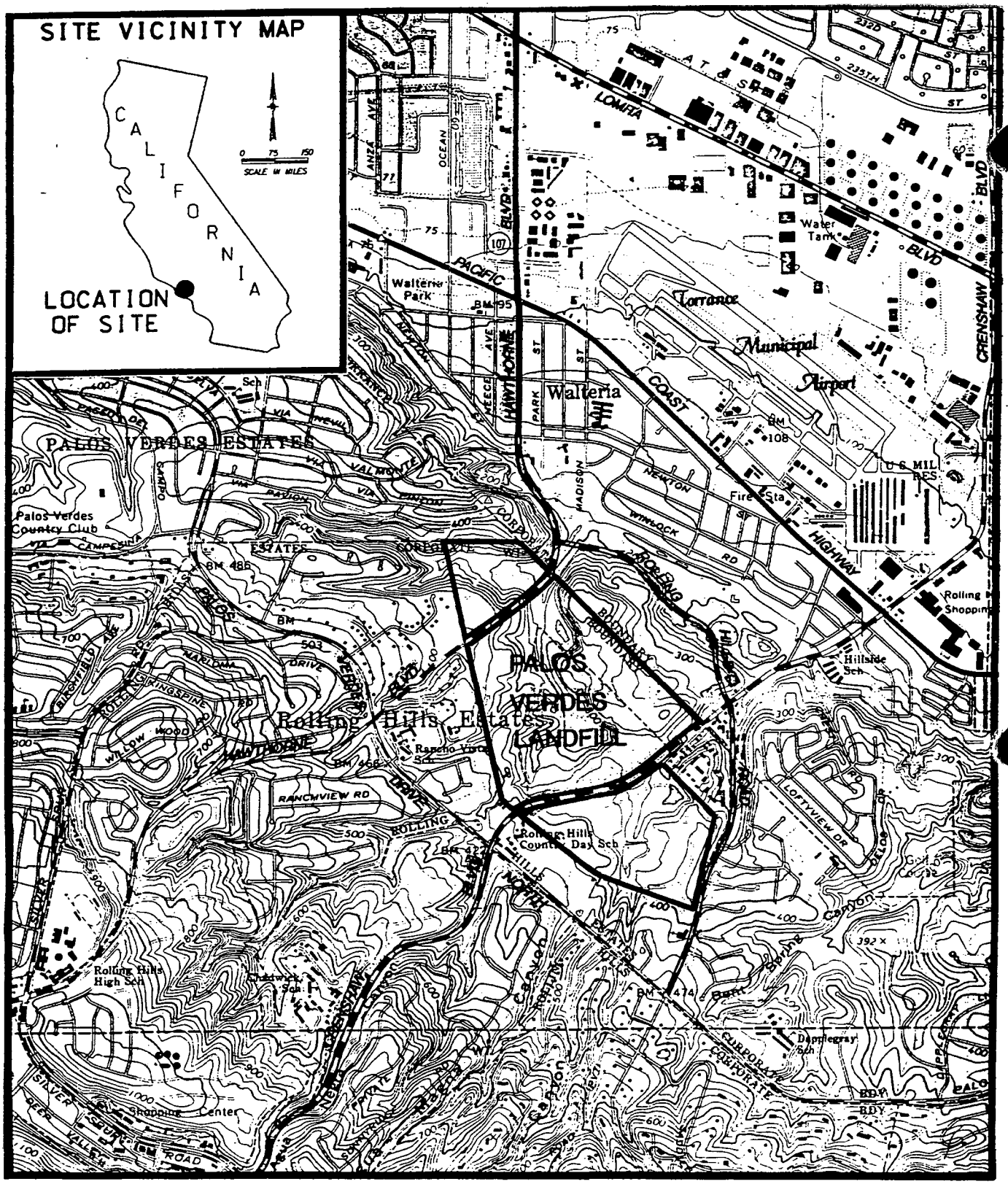


FIGURE 1.3-1

SITE LOCATION MAP

PALOS VERDES LANDFILL
REMEDIAL INVESTIGATION REPORT
SANITATION DISTRICTS, JANUARY 1995

SOURCE: USGS TORRANCE QUADRANGLE
PHOTOREVISED 1981

The diatomite ore in this area was a low grade deposit, generating large amounts of tailings during the mining operations. The tailings were disposed of by pushing them into adjacent canyons and filling previously mined pits as the mining progressed. These activities began the metamorphosis of the PVLF area from its native canyon morphology to the extensively developed residential area currently existing. Sand and gravel quarrying, the other major mining activity, continues to this day in areas near the PVLF; for example, deposits of the San Pedro Formation are excavated nearby at the Chandler Quarry for industrial and commercial use.

Landfill operations began on a small portion of Parcel 1 in 1952 by a private operator (Ben K. Kazarian and Sons). Operations continued on a small scale (records indicate less than 15 acres) until April 1957. The Sanitation Districts reopened Parcel 1 on May 15, 1957, and operated a permitted Class II municipal waste disposal unit until 1965. This area of the landfill was then developed by the County Department of Parks and Recreation as the South Coast Botanic Garden.

The parcels at the main site, Parcels 2, 3, 5, and 6, were opened variously from 1961 through 1971. Parcel 2 was opened in 1961, followed by Parcels 3 and 5 in 1965 and Parcel 6 in 1971. Parcel 6 and sections of Parcels 2, 3, and 5 were permitted as Class I disposal sites and received hazardous materials from April 1964 through October 1980. The remaining portions of the main site and Parcels 1 and 4 (discussed below) were permitted as Class II areas and accepted only nonhazardous solid wastes. Exhibit 1.3-2 shows the Class I and Class II portions of the PVLF. The main site discontinued receiving waste on December 31, 1980, when it reached its final design capacity. Parcels 3, 5, and 6 are currently owned by the Sanitation Districts, while the County owns Parcel 2. Under a joint powers agreement between the County and the Sanitation Districts, ownership of parcels 3, 5, and 6 will eventually be turned over to the County.

Parcel 4 was purchased by the City of Rolling Hills Estates in 1970. Under contractual arrangements between the City of Rolling Hills Estates and the Sanitation Districts, the Sanitation Districts conducted a refuse disposal operation on this parcel between 1970 and 1979. The majority of the materials disposed in Parcel 4 consisted of inert construction and demolition materials, such as concrete, asphalt, and bricks. The City of Rolling Hills Estates subsequently developed Parcel 4 into Ernie Howlett Park.

During its period of operation by the Sanitation Districts, the PVLF accepted approximately 23.6 million tons of waste materials (see Table 1.3-1). Of this total, approximately 18.3 million tons were disposed of at the main site, 3.5 million tons at Parcel 1, and 1.8 million tons at Parcel 4. In addition to nonhazardous solid waste, hazardous and nonhazardous liquid waste disposal occurred at the part of the main site permitted to accept these wastes. The types of hazardous wastes (also referred to as group 1 or Class I wastes as defined by the regulations in effect at the time) accepted were primarily liquid wastes from the following categories: acid wastes, alkaline wastes, solvents, tetraethyl lead sludge, chemical toilet wastes, hazardous tank bottoms, oily wastes, contaminated soil and sand, brine, pesticides, and other hazardous wastes (predominantly refinery, oil field, and oil terminal wastes). The types of nonhazardous liquid wastes (also referred to as group 2 or Class 2 wastes) accepted were mud and water, drilling mud, cannery waste, paint sludge, latex waste, and other nonhazardous wastes (predominantly refinery, oil field, and oil terminal wastes). Liquid wastes, mainly acids and caustics (in Class I permitted areas) were placed separately into wells constructed in the refuse mass. The locations of the liquid waste wells are shown in Exhibit 1.3-2. Other liquid wastes were mixed directly with the refuse before being buried. Table 1.3-2 shows the types and quantities of liquid wastes accepted at the site from October 1972 to October 1980. Prior to October 1972, a summary of the individual waste categories was not maintained. However, an annual record of the total amount of liquid waste disposed at the site was kept during the period between January 1968 and September 1972, and this is also included in the table. Based on these records, it is estimated that approximately fifteen percent of the total waste materials received at the main site were liquid wastes. It is estimated that hazardous wastes made up four to five percent of the total waste disposed of at the main site; this is the equivalent of three to four percent of the overall waste disposed of at the PVLF.

As discussed above, changes to the area morphology were caused by mining, the landfilling operations in Parcels 1 through 6, and residential and commercial development of the areas outside of the landfill boundaries. Due to these various activities, which took place at different times and were performed by many parties, the cover soil materials at and around the PVLF are highly heterogeneous. The cover soil materials were variously generated through general grading, mining operations and development activities. The minimum depth of the soil cover on the PVLF is shown in Exhibit 1.3-3. The soil cover is five feet or more for all areas of the PVLF except in an area

TABLE 1.3-1

WASTE DISPOSAL QUANTITIES

PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

YEAR	WASTE RECEIVED (TONS)	REMARKS	
1957 - 58	154,796*	- -	Opening of Parcel 1 (5/15/57)
1958 - 59	184,796*		
1959 - 60	204,796*		
1960 - 61	237,057*		
1961 - 62	398,512	- -	Opening of Parcel 2
1962 - 63	556,921		
1963 - 64	809,704		
1964 - 65	947,019		Opening of Parcel 3
1965 - 66	757,184	- -	Parcel 1 completed (3,500,000 tons)
1966 - 67	649,379		Opening of Parcel 5
1967 - 68	921,537		
1968 - 69	1,391,685		
1969 - 70	1,612,441		
1970 - 71	1,420,897	- -	Opening of Parcel 4
1971 - 72	1,415,712	- -	Opening of Parcel 6
1972 - 73	1,460,572		
1973 - 74	1,466,222		
1974 - 75	1,465,143		
1975 - 76	1,213,362		
1976 - 77	1,262,239		
1977 - 78	1,441,630		
1978 - 79	1,491,914		
1979 - 80	1,456,502	- -	Parcel 4 completed (1,800,000 tons)
7/80 - 12/80	653,708	- -	Parcels 2, 3, 5, and 6 completed (18,273,728 tons)
	23,573,729		

* Estimates extrapolated from total receipts prior to to 6/30/61.

TABLE 1.3-2

TYPES OF LIQUID WASTE DISPOSED OF AT THE PALOS VERDES LANDFILL (1972 - 1980)

PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Waste Type	Tons	Percent of Liquid	Percent of Total
Class I			
Acid Waste	42,423	3	<1
Alkaline Waste	12,837	1	<1
Pesticides	139	<1	<1
Solvents	2,799	<1	<1
Tetra-Ethyl Lead Sludge	3,705	<1	<1
Chemical Toilet Wastes	162	<1	<1
Hazardous Tank Bottoms	77,621	6	1
Oily Waste	164,686	13	1
Contaminated Soil/Sand	1,204	<1	<1
Brine	12,021	1	<1
Other Hazardous Waste	101,565	8	1
Class I Total	419,164	32	3
Class II			
Paint Sludge	16,192	1	<1
Drilling Mud	44,763	3	<1
Cannery Waste	2,246	<1	<1
Latex Waste	4,806	<1	<1
Mud and Water	347,437	27	3
Nonhazardous Tank Bottoms	223,191	17	2
Other Nonhazardous Wastes	248,832	19	2
Class II Total	887,467	68	7

Notes: Prior to 1972, Class I and Class II wastes were not totaled separately. Overall liquid wastes for the period of January 1968 through September 1972 were as follows:

Year	Quantity of Class I and II Liquid Waste (tons)
1968	158,028
1969	146,125
1970	210,059
1971	191,776
1972 (Jan-Sept)	158,538

Percentages are calculated on a weight basis.

located on the east side of the main site that measures approximately 26 acres. These 26 acres had been previously landscaped and have a minimum of three feet of cover.

Currently, postclosure maintenance and sampling activities at the main site are directed by Sanitation Districts staff permanently assigned to the site, or staff assigned to perform sampling activities at the PVLF and other landfills operated by the Sanitation Districts. The South Coast Botanic Garden and Ernie Howlett Park are under the jurisdiction of and operated by the County and the City of Rolling Hills Estates, respectively. As such, maintenance activities related to the general operation of these parcels are conducted by personnel from these entities.

Postclosure maintenance activities related to environmental control systems (landfill gas and ground water control systems) and sampling activities (gas probe monitoring and ground water sampling) at the South Coast Botanic Garden and Ernie Howlett Park are currently directed by Sanitation Districts staff assigned to the main site. Activities are conducted pursuant to a formal long-term agreement with the County at the main site and the South Coast Botanic Garden. Activities performed at Ernie Howlett Park are conducted under an informal arrangement with the City of Rolling Hills Estates. Under the agreement between the County and the Sanitation Districts, the County has the responsibility for the ultimate development and use of the main site.

1.3.3 Demography and Land Use

The demography and land use of the PVLF are discussed in this section. The demography and current land use within one mile of the PVLF is reviewed, followed by a discussion of possible future land use of the PVLF itself.

1.3.3.1 Current Demography and Land Use Around the PVLF

Figure 1.3-2 shows that within a one mile radius of the PVLF there are six different cities and two pockets of unincorporated County areas. The cities of Palos Verdes Estates, Torrance, and Lomita are located to the north and northeast of the PVLF, and the cities of Rolling Hills Estates, Rolling Hills, and Rancho Palos Verdes are located to the south and southwest of the PVLF. The first unincorporated area is located to the northeast of the South Coast Botanic Garden and is

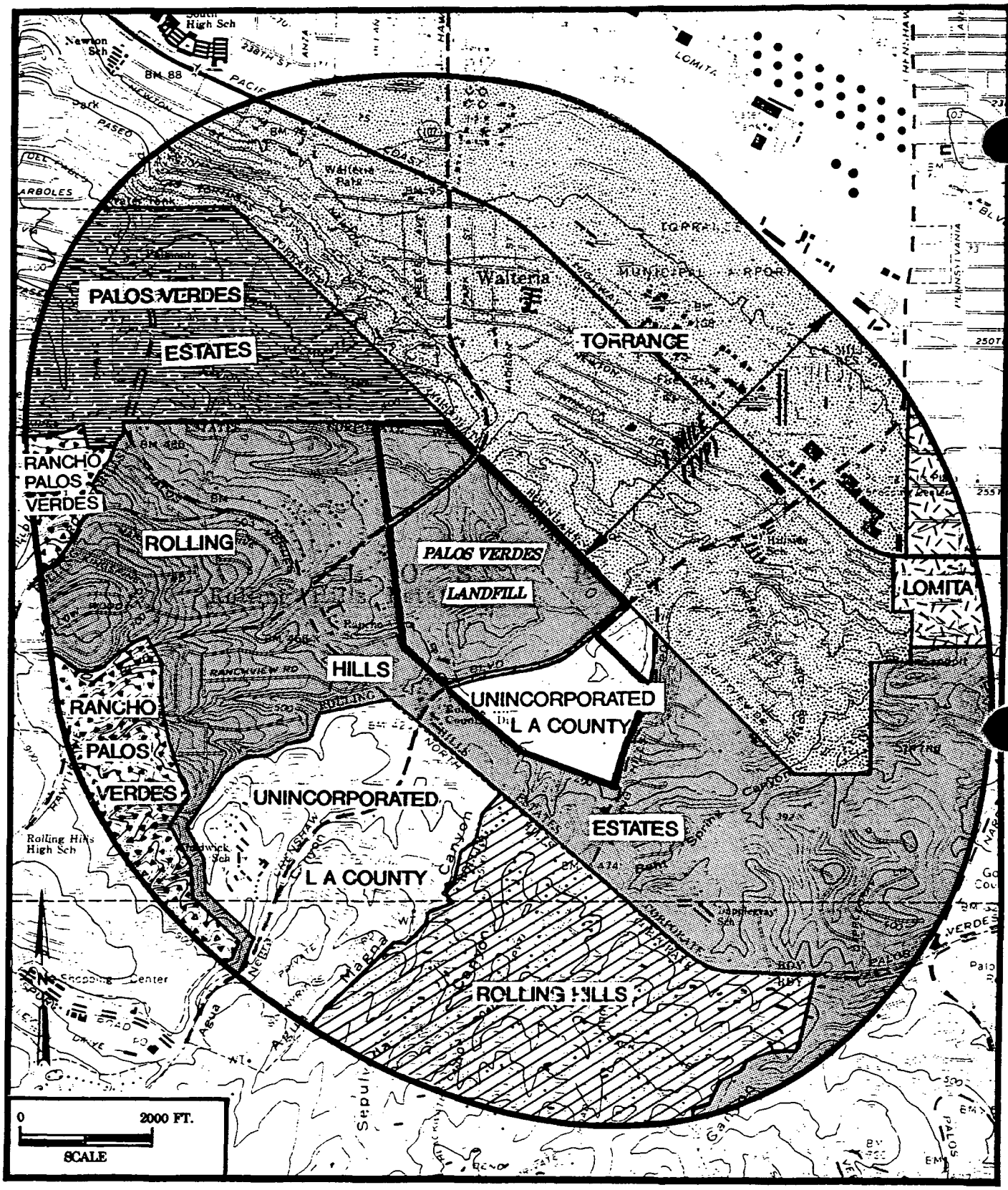


FIGURE 1.3-2

ONE MILE RADIUS CITY LOCATION MAP

LEGEND:

—— PROPERTY LINE

PALOS VERDES LANDFILL
REMEDIAL INVESTIGATION REPORT
SANITATION DISTRICTS, JANUARY 1995

SOURCE: USGS TORRANCE QUADRANGLE
PHOTOREVISED 1981

occupied by the Estates Townhomes and Condominiums which were constructed in 1973. The second unincorporated area is located south of the landfill and is occupied by single family homes. Based on an estimate of the number of houses and the average persons per household (taken from the 1990 census), approximately 14,050 individuals live within a one mile radius of the PVLF. A breakdown of the estimated population by area is given below.

AREA	ESTIMATED POPULATION
Lomita	400
Palos Verdes Estates	1,900
Rancho Palos Verdes	300
Rolling Hills	800
Rolling Hills Estates	2,300
Torrance	6,800
Unincorporated Area #1	750
Unincorporated Area #2	800
Total	14,050

The land use for the area surrounding the PVLF is shown in Figure 1.3-3. The PVLF is predominately surrounded by residential areas. These residential developments were constructed primarily from the late 1950's to the mid 1970's. Single family homes dominate these residential areas. Some areas located in Torrance and Lomita are zoned for commercial and manufacturing use. The Torrance Municipal Airport is located approximately one-half mile to the northeast of the PVLF. Schools within a one mile radius of the PVLF include Hillside Elementary and Walteria Elementary Schools in Torrance; Valmonte Developmental Kindergarten in Palos Verdes Estates; Rancho Vista Elementary School, Rolling Hills Country Day School, and Dapplegray Elementary School in Rolling Hills Estates; and Chadwick School in Unincorporated Area #2.

The public use for the areas within the PVLF is shown in Exhibit 1.3-4. The South Coast Botanic Garden is operated by the County Department of Parks and Recreation. Ernie Howlett Park and the Equestrian Center are operated by the City of Rolling Hills Estates. Access to other parts of the landfill are allowed by the Sanitation Districts on a limited use basis. The recycling center is open to the public Wednesday through Saturday from 8:00 a.m. to 4:00 p.m. It is located on a paved area of the main site accessible from Crenshaw Boulevard. The horse trail is open for public use every day from dawn until dusk. Wood chips generated from on site materials are spread on the horse trail to control dust and demarcate it from the surrounding area. The lawn area is used for overflow

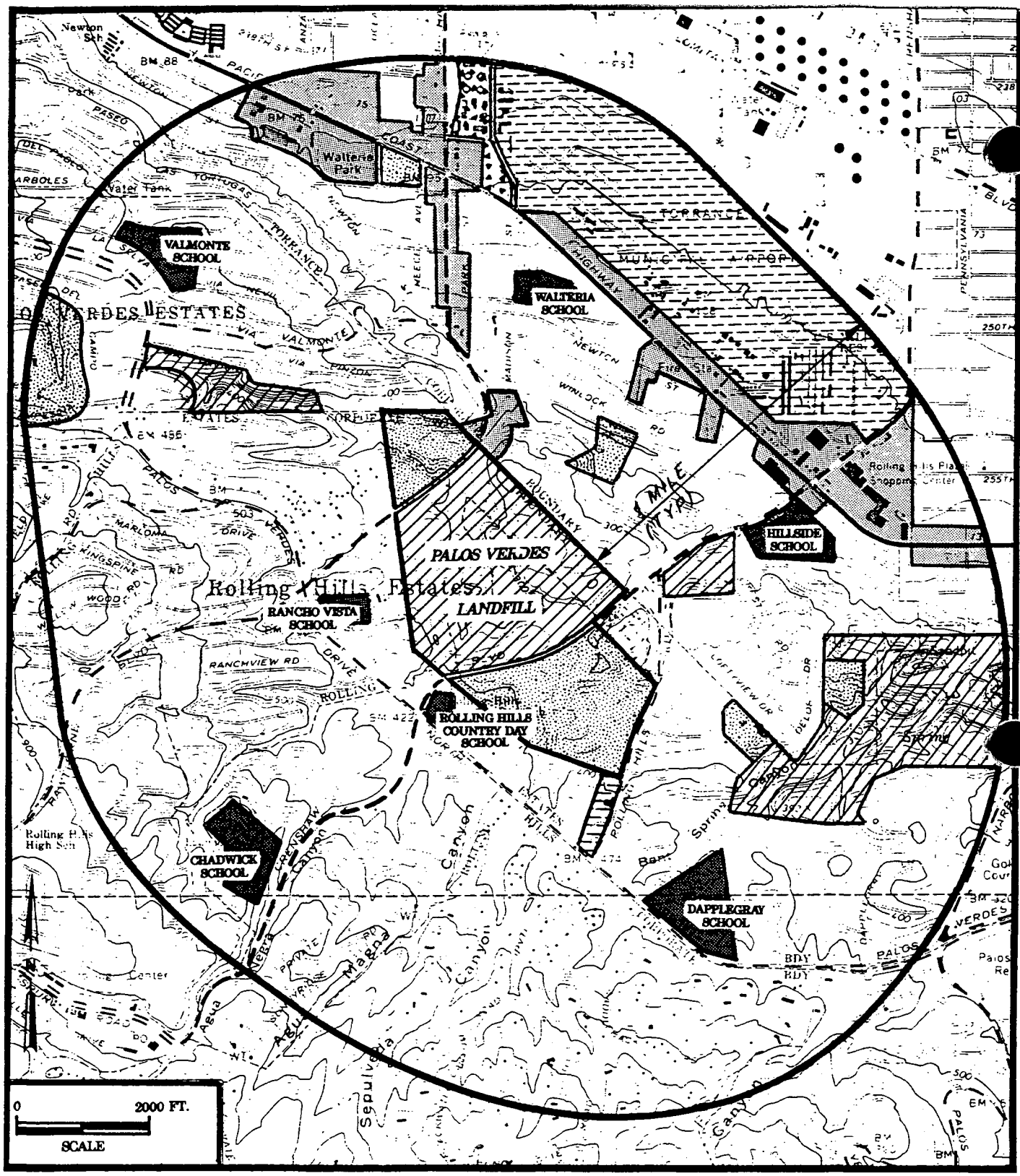


FIGURE 1.3-3

ONE MILE RADIUS LAND USE MAP

LEGEND

- RESIDENTIAL
- COMMERCIAL
- SCHOOL
- MANUFACTURING
- OPEN SPACE
- SPECIAL RECREATION
- PUBLIC & SEMI-PUBLIC DISTRICT
- PROPERTY LINE

PALOS VERDES LANDFILL
REMEDIAL INVESTIGATION REPORT
SANITATION DISTRICTS, JANUARY 1995

SOURCE: USGS TORRANCE QUADRANGLE
PHOTOREVISED 1981

parking for special events in the neighborhood (e.g., the yearly California Classic Driving Event, a horse and buggy race, and the Peninsula Committee of the Children's Hospital Horse Show) two or three times a year. The ham radio area on top of the main deck is used by the Northrop Radio Club once a year. The main site is open to the Chadwick High School cross country running team which runs on the site predominately in the fall. Also, the City of Rolling Hills Estates sponsors an annual 5K and 10K run, and its course often traverses part of the main site.

Future land uses surrounding the PVLF are not expected to change substantially. The communities within one mile of the landfill have been stable during the last twenty years or so. The most recent large developments immediately surrounding the landfill were completed in the 1970's. The land surrounding the PVLF has been developed extensively; at most, it is expected that housing units may be added on existing empty lots.

1.3.3.2 Possible Future Land Use of the PVLF

The total land area of the PVLF is zoned for use as open space. Parcels 1 and 4 have already been developed for community use as the South Coast Botanic Garden and Ernie Howlett Park, respectively. The future land use of these areas is not expected to change.

The remaining section of the PVLF, consisting of parcels 2, 3, 5, and 6, and referred to as the main site, is maintained by the Sanitation Districts. The main site is currently operated by the Sanitation Districts with limited access to the public. The long term plans for this section of the PVLF call for its development as open space under the County Department of Parks and Recreation. The exact nature of the type of development and use has not yet been determined by the County. Several options include continued use for equestrian stables and riding, possible development as a golf course, or possible use as a park.

1.3.4 Existing Environmental Monitoring and Control Systems

Air monitoring has been ongoing at the PVLF since the early 1970's. Ground water monitoring began at an even earlier date to satisfy the conditions of Order No. 64-10, issued by the

RWQCB in 1964. Installation and operation of landfill gas control systems also began in the early 1970's. A subsurface barrier system was installed to control migration of contaminated ground water from the PVLF in 1986. The current extent of the existing air and water monitoring and control systems are discussed in the following sections.

1.3.4.1 Air

For the control of any emissions of landfill gas from the landfill into the ambient air, or off site through subsurface soils, an extensive landfill gas collection system is in operation at the main site and the South Coast Botanic Garden. Landfill gas monitoring is performed around the perimeter of the landfill utilizing boundary probes to confirm that off site gas migration is not occurring. The mechanism of landfill gas production and transport, and the details of the landfill gas collection and monitoring systems are described in the following sections.

1.3.4.1.1 Landfill Gas Production And Transport

Landfill gas is produced by naturally occurring anaerobic biological decomposition of the organic fraction of buried refuse. Under ideal conditions, landfill gas is primarily composed of nearly equal amounts of carbon dioxide and methane with traces of other decomposition by-products, such as volatile organic compounds. The rate of gas generation is affected by many factors such as refuse moisture content, nutrient availability, refuse compaction, temperature, and Ph. It has been observed from the Sanitation Districts' landfills that the landfill gas generation rate is usually at a maximum soon after refuse placement and then decreases over time. Low levels of gas production may continue for long periods of time. This pattern of gas generation can be described by a first order decay mathematical model.

Landfill gas transport usually occurs by two major mechanisms, advection and diffusion. Advection is the bulk gas flow resulting from the total pressure difference in the landfill. Gas advection is generally described by Darcy's Law (Bird, et. al., 1960), i.e., gas flow is proportional to the gas permeability of the refuse and the total pressure gradient. The following equation identifies the mathematical relationship for Darcy's Law.

$$V_x = -\frac{k}{\mu}\frac{\partial P}{\partial x}$$

where: V_x = gas velocity in the x direction;

μ = landfill gas viscosity;

k = landfill gas permeability in refuse; and

P = pressure in the refuse.

Theoretically, gas permeability is a function of such refuse properties as effective porosity, material size distribution, and moisture content. It is expected that the gas permeability of refuse decreases with increasing refuse moisture content and decreasing effective porosity. No standard method exists to measure in place refuse permeability. The Sanitation Districts made final cover hydraulic permeability measurements for the PVLF in 1986. A variety of infiltrometer designs were used to measure permeability including pond, standard single- and double-ring, and covered single- and double-ring. The range of permeability values found was 1.97×10^{-6} to 77×10^{-6} cm/s, or 5.46×10^{-2} to 21.84×10^{-2} ft/day. In terms of intrinsic permeability, which can be used for gas flow calculations, this is equivalent to a range of 2.01×10^{-11} to 79.3×10^{-11} cm^2 (2.04×10^{-3} to 80.4×10^{-3} Darcy).

The process when a gas spreads to occupy any volume accessible to it is called diffusion. Diffusion occurs as a result of concentration (or partial pressure) gradients of a gas species. Fick's First Law commonly describes diffusion, i.e., the diffusion rate is proportional to the gas diffusivity and the concentration gradient.

The total pressure gradient in a landfill is the result of either gas generation from waste decomposition or vacuum applied for gas extraction. Vacuum applied to a gas collection well creates a negative pressure area which results in a gradient towards the well. A zone of vacuum influence can be defined to describe the effectiveness of a gas collection well.

1.3.4.1.2 Landfill Gas Control System

If not properly controlled, landfill gas can migrate through the subsurface and/or escape into the atmosphere as described above. The principal movement of landfill gas can be expected along the path of least resistance, typically vertically through the landfill's top surface. Lateral or horizontal migration can also occur through the front slopes of the site as well as through soils adjacent to the site. Gas movement away from the landfill is usually referred to as migration, whereas gas escaping into the atmosphere through the landfill cover is defined as surface emissions. The primary constituents of landfill gas which are of concern are methane and volatile organic compounds (VOCs). Methane migrating through soils into adjacent structures can result in safety hazards. The VOCs in the migrating landfill gas can potentially cause degradation of ground water quality when the gas comes in contact with an aquifer. The same organic compounds can also be emitted through the landfill surface to degrade ambient air quality. The migration or emission of VOCs can result in health hazards.

Gas collection from a landfill depends on refuse characteristics, gas system design, and gas system operation efficiency. Gas permeability of refuse, spacing and depth of gas wells, and vacuum level used to withdraw gas are all important parameters that impact gas collection efficiency. In general, landfill gas collection efficiency increases with applied vacuum level. However, air intrusion into the gas system occurs if the vacuum becomes excessive. In practice, it is difficult to achieve a high gas collection efficiency without causing air intrusion. Air intrusion into the gas system dilutes the landfill gas and results in methane and carbon dioxide contents less than their theoretical levels.

At the PVLF, an active gas collection and control system is present on the main site and the South Coast Botanic Garden. Ernie Howlett Park received mostly inert solid waste material during its operation. Inert solid waste generates limited quantities of landfill gas because it contains little organic material. Field measurements of surface gas emissions were taken at Ernie Howlett Park during the design of the gas collection systems for the main site and the South Coast Botanic Garden and the methane levels were found to be very low in comparison to the other parcels of the PVLF. Consequently, it was determined that a passive rock trench installed along the western boundary would satisfy gas control needs at Ernie Howlett Park.

At present the PVLF produces approximately 9,000 cubic feet per minute (cfm) of landfill gas containing approximately 19 to 20 percent methane. To collect and control landfill gas, a gas collection system consisting of vertical gas collection wells and horizontal gas trenches has been installed throughout the landfill. These wells and trenches are connected to blowers through a network of header-line pipes, and a vacuum is applied to create a pressure gradient around each well or trench. The gas is drawn from the refuse into the collection system thereby substantially reducing subsurface migration and air emissions. The existing gas collection system at the PVLF currently consists of 458 gas wells, approximately 2,300 feet of gas trenches, a gas-to-energy facility, and two flare stations. The layout of the gas wells and trenches is shown on Exhibit 1.3-5. The locations of the gas-to-energy facility and the flare stations are shown on Exhibit 1.3-6. The installation of the gas control system began in the early 1970's and has occurred in phases over the years. Since August 1991, there have been four expansions of the PVLF gas control system. Three new well were installed along the northeast border near boundary probe MN31. Seven new wells were installed at the South Coast Botanic Garden near the northeastern boundary. Five gas wells at the Equestrian Center on the main site were installed in July 1992. And the latest expansion, consisting of the installation of seven wells, located at the South Coast Botanic Garden along the southern boundary, occurred in August 1993.

The effectiveness of the gas collection system can be measured using integrated surface gas monitoring. This is a method developed by the Sanitation Districts in 1981 at the Puente Hills Landfill. It was later modified by the SCAQMD for use in their Rule 1150.1 gas monitoring and control program. System efficiency is most clearly measured with integrated surface monitoring at a site with no prior gas extraction. The efficiency is calculated as the ratio between the drop in gas levels and the amount of gas observed above background prior to system startup. An alternative method of evaluating the effectiveness of the gas collection system is computer modeling. Integrated surface gas monitoring is discussed below; a detailed analysis using computer modeling is developed in Section 3.1.3.8.3.

By the time integrated surface gas monitoring was developed, the PVLF already had an extensive gas control system and the surface gas levels before gas extraction could not be directly measured. However, the Puente Hills site in 1981 was of comparable size and depth to the PVLF. Its surface gas level prior to gas extraction, 107.7 ppm, can therefore be used as a surrogate for PVLF calculations. The average surface gas level at the PVLF measured from September 1990 through

August 1991 was 8.1 ppm. The average ambient air reading for the same time period was 6.8 ppm. The formula for calculating gas collection efficiency is:

$$E = \frac{(SGb - SGa)}{(SGb - A)} * 100$$

where: E = gas collection efficiency, percent
SGb = surface gas levels before gas extraction, ppm
SGa = surface gas levels after gas extraction, ppm
A = ambient air gas level, ppm

Substituting in the values given above yields an apparent gas collection efficiency on the order of 98.7 percent. These results indicate excellent gas control at the PVLF.

Of the 458 gas wells at the PVLF, 217 are peripheral wells, located at the boundary of the main site and the South Coast Botanic Garden. They have been installed for gas migration control. The remaining 241 wells, located on the top deck and slopes of the main site and in the South Coast Botanic Garden have been installed for gas recovery. The depth of these gas collection wells ranges from 25 to 150 feet.

Gas control trenches are located on the northeast boundary of the main site (660 feet), the southeast boundary of the South Coast Botanic Garden (820 feet), the southwest boundary of the South Coast Botanic Garden (250 feet) and the west boundary of Ernie Howlett Park (600 feet). Trenches under vacuum are referred to as active trenches and those not under vacuum are called passive trenches. The Ernie Howlett Park trench is a passive trench, whereas the remaining are active.

As discussed in the previous section, the primary constituents of landfill gas which are of concern are methane and VOCs. A gas-to-energy facility has been in operation at the PVLF since 1988 which produces electricity through a steam turbine system. The generated electricity is sold to Southern California Edison for use in the local power grid network. The composition of the landfill gas delivered to the gas-to-energy facility is approximately (by volume) nineteen percent methane, sixteen percent carbon dioxide, ten percent oxygen, 50 percent nitrogen, and five percent water; trace quantities of VOCs are also present.

In addition to the gas-to-energy facility, there are two existing landfill gas flare stations located on the main site as shown on Exhibit 1.3-6. They serve as backup disposal facilities for the collected landfill gas when the gas-to-energy facility is being maintained. The components of the landfill gas collection and control system are described in more detail in the following paragraphs.

Gas Collection Wells

There are two basic types of wells present at PVLF; wells placed in soil on the outer perimeter of the landfill (gas migration control wells) and wells placed in refuse material (gas recovery wells). The typical design of an existing gas migration control well is shown in Figure 1.3-4. The well casing typically consists of a six inch diameter PVC pipe installed in a 30 to 36 inch diameter bore hole. The entire length of the pipe except for the upper ten to twelve feet is perforated. The annular space is backfilled with either two to four inch size cobbles or one to three inch size gravel. Well depths vary depending upon the local topography and geologic conditions. The typical well seal employed consists of compacted soils obtained on site. Typical well spacing along the landfill boundaries is 100 to 150 feet, except on the northeast boundary of the main site. In this area, the spacing of the migration control wells averages 30 feet with a maximum spacing of 100 feet. These wells are spaced closer due to the proximity of residences to the landfill.

Currently 241 gas collection wells are placed in refuse on the slopes and the top deck of the main site and South Coast Botanic Garden for gas recovery. The depth of these wells depends on the depth and gas permeability of the refuse and ranges from 25 to 150 feet. Average spacings of the upper bench wells and top deck wells are 100 and 200 feet, respectively. Approximately half (83) of these wells are located on the slopes. Figure 1.3-5 shows a typical design of an existing drilled gas well. Wells located in refuse differ from wells located in soils in that the casing is jointed to allow continued operation as the landfill settles.

On the main site and South Coast Botanic Garden top deck, 95 wells were installed between 1988 and 1991 using pile driving techniques to avoid handling of the refuse drill spoils. A casing of sixteen inches in diameter and 60 feet in length was pile driven through the top deck. A well was then constructed inside the drive casing, the annular space between the driven casing and

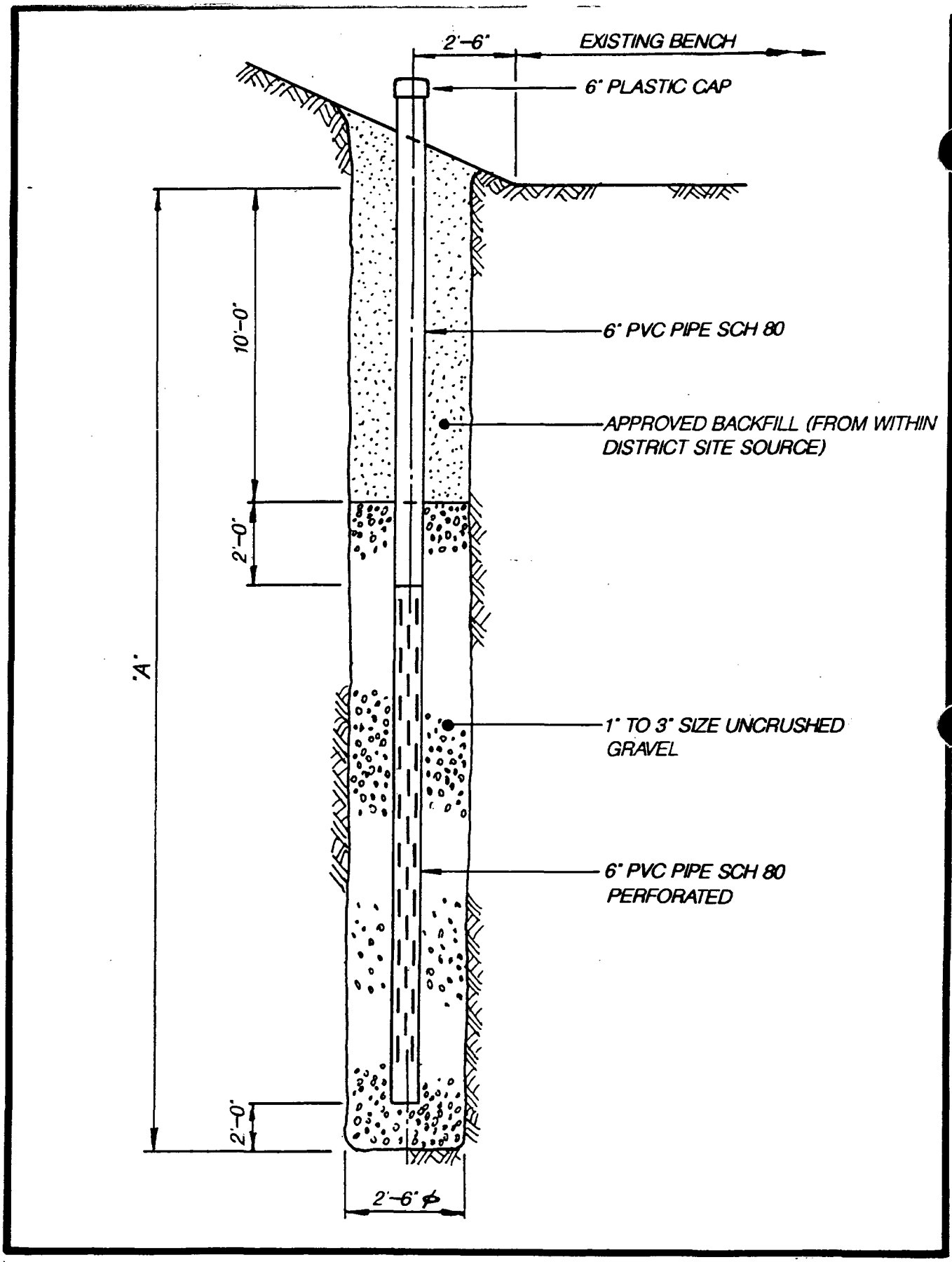
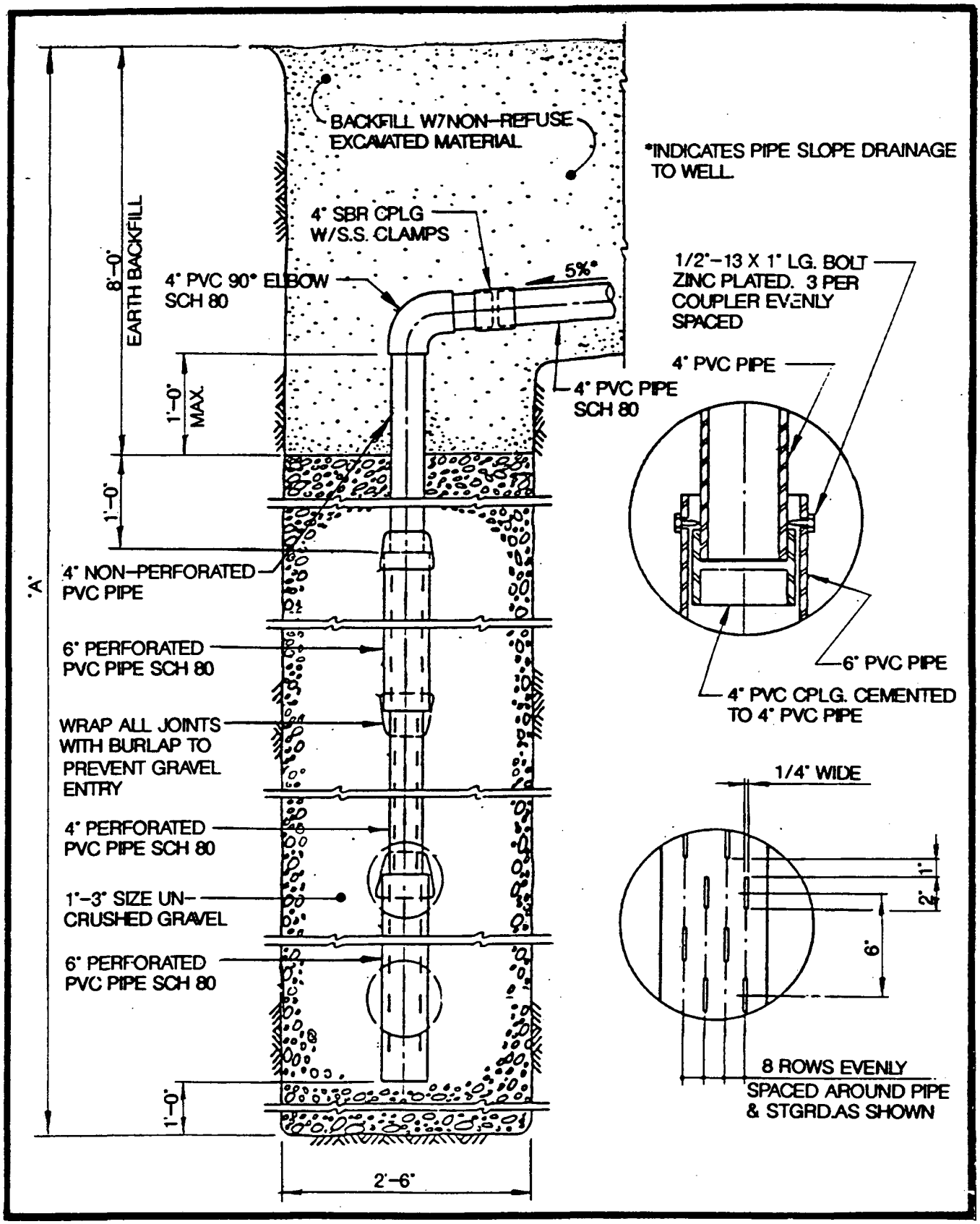


FIGURE 1.3-4

TYPICAL DESIGN OF AN EXISTING GAS MIGRATION CONTROL WELL



TYPICAL DESIGN OF AN EXISTING DRILLED GAS RECOVERY WELL

FIGURE 1.3-5

the well casing was backfilled with gravel and then the driven casing was removed. Figure 1.3-6 shows a typical cross-section of an existing pile-driven gas extraction well.

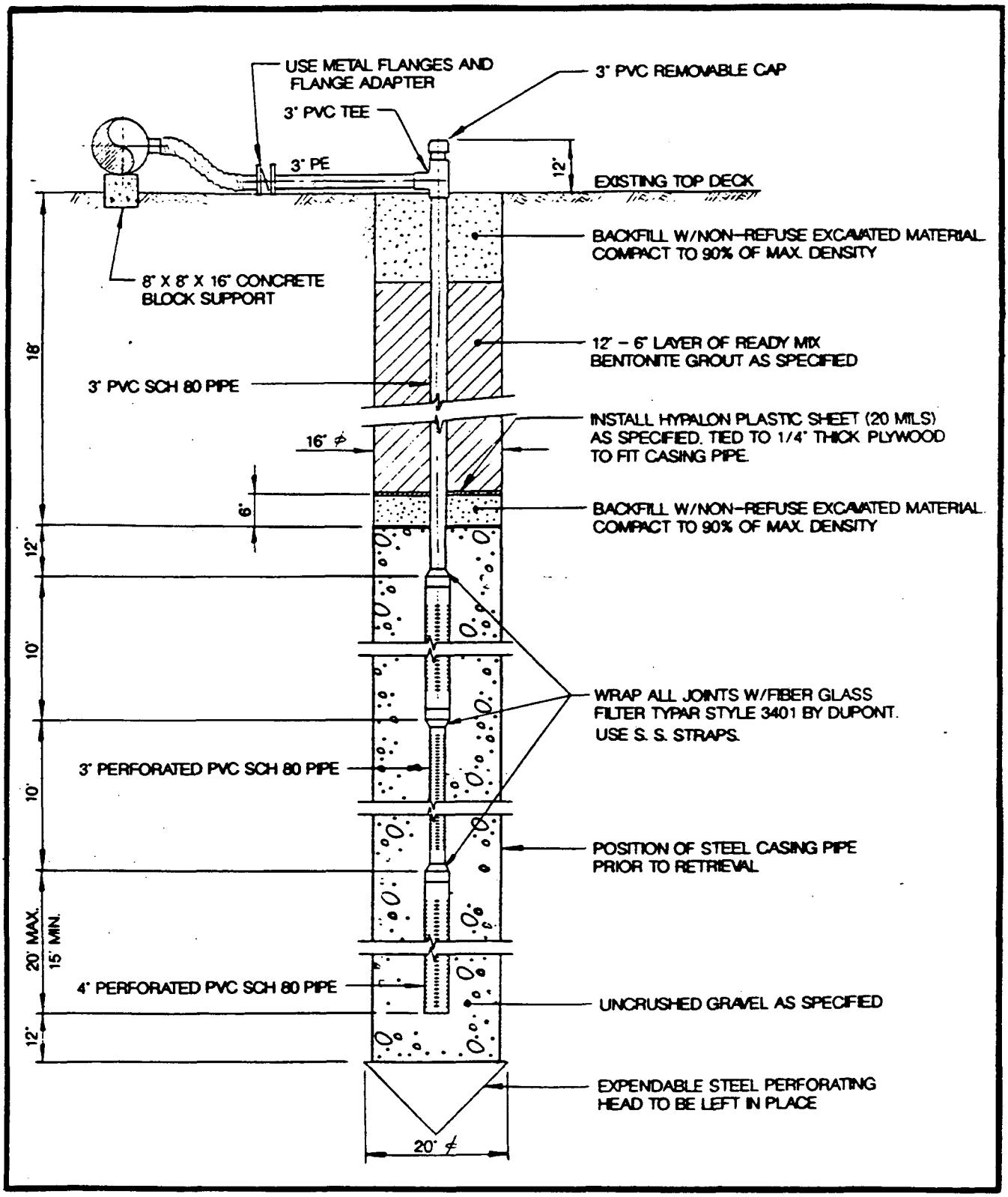
In August 1993, seven shallow gas wells were installed at the South Coast Botanic Garden along the southern boundary using the cone penetration technique. The depth of these wells ranged from 25 to 30 feet. A 1-1/2 inch diameter hollow steel casing was hydraulically pushed into the ground in three foot sections which were threaded together as they were inserted. A one inch CPVC casing was inserted into the steel casing and the steel casing was pulled out.

A summary of gas well design details is given in Table 1.3-3. This table contains the identification number, original depth to bottom, solid pipe length, slotted pipe length, seal material, date of construction, and the most recently measured depth to bottom and depth to liquid for each gas well and trench. Various types of well seals have been used in the refuse wells, but the majority of wells have bentonite clay and volclay saline seals. Some wells have compacted soil seals, which were constructed from on site materials.

At the present time, the Sanitation Districts do not have any plans for a gas system expansion. The Sanitation Districts will inform DTSC when any new gas wells are scheduled to be installed. The Sanitation Districts will also implement a design specification for all new wells that includes a bentonite seal of one foot minimum length or other type of seal (such as a hypalon sheet placed across the well bore at about one foot beneath the ground surface).

Horizontal Gas Collection Trenches

In addition to the gas collection wells described above, the perimeter gas collection and control system at the PVLF also includes rock filled trenches at all three sections of landfill. A total of 660 feet of trenches, 30 inches wide by 18 feet deep, were constructed on the northeast boundary of the main site. Similar trenches with a total of length about 1,070 feet were installed at the South Coast Botanic Garden. Perforated pipes placed horizontally in the trenches are connected to the gas collection system. A typical section of an existing active trench is shown in Figure 1.3-7. Approximately 600 feet of a passive rock filled trench exists in Ernie Howlett Park on the



TYPICAL DESIGN OF AN EXISTING PILE-DRIVEN GAS RECOVERY WELL

FIGURE 1.3-6

TABLE 1.3-3
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
00010	05/04/78	40	8	32	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00020	03/26/78	40	6	34	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00030	03/26/78	52	6	46	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00035	07/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
00038	08/01/86	45	15	30	Bentonite	Soil	N/A	N/A	N/A	N/P
00040	07/26/82	50	N/A	N/A	N/A	Soil	50	N/A	02/04/94	N/P
00045	07/26/82	N/A	N/A	N/A	N/A	Trench	N/A	N/A	N/A	N/P
00050	03/26/78	73	6	67	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00055	07/01/82	Disconneced in 12/82				Trench				
00060	07/26/82	43	N/A	N/A	N/A	Soil	43	N/A	02/04/94	N/P
00070	11/06/77	81	8	73	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00080	07/26/82	80	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00090	03/26/78	84	8	76	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00095	09/03/87	41	N/A	N/A	N/A	Soil	41	N/A	02/04/94	N/P
00100	07/26/82	48	N/A	N/A	N/A	Soil	48	N/A	02/07/94	N/P
00110	03/26/78	85	8	79	Volclay Saline	Soil	78 **	N/A	N/A	N/P
00115	08/01/84	92	22	70	N/A	Refuse	48 **	N/A	N/A	N/P
00120	03/26/78	74	8	66	Volclay Saline	Soil	73 **	N/A	N/A	N/P
00130	03/26/78	83	8	75	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00140	07/26/82	50	N/A	N/A	N/A	Soil	50	N/A	02/07/94	N/P
00150	11/06/77	75	8	67	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00160	03/26/78	Abandoned in 1/80				Soil				
00170	07/26/82	49	N/A	N/A	N/A	Soil	49	31 *	02/07/94	N/P
00180	03/26/78	74	6	68	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00190	11/25/80	69	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00200	11/25/80	72	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00210	11/25/80	79	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00220	11/25/80	76	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00230	11/25/80	82	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00235	8/8/84	94	24	70	N/A	Refuse	N/A	N/A	N/A	N/P
00240	03/26/78	70	6	64	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00260	04/12/81	82	N/A	N/A	N/A	Soil	82	N/A	02/07/94	N/P
00270	04/12/81	68	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00280	04/12/81	55	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00290	04/12/81	86	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00300	04/12/81	84	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00302	11/01/86	63	20	40	Bentonite Grout	Soil	63	N/A	12/01/86	N/P
00305	11/09/84	67	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00310	04/12/81	74	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00320	03/26/78	65	6	59	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00330	04/12/81	50	17	33	N/A	Soil	N/A	35 *	06/24/93	Feb-94
00340	11/01/86	Abandoned in 11/86				Soil				
00342	11/01/86	60	20	40	Bentonite Grout	Soil	N/A	N/A	N/A	Jan-87
00345	11/01/86	60	N/A	N/A	N/A	Soil	60	9 *	06/24/93	Feb-94
00347	11/01/86	64	15	45	Bentonite Grout	Soil	64	N/A	N/A	Jan-87
00349	08/07/84	92	22	70	N/A	Refuse	N/A	N/A	N/A	N/P
00350	11/03/77	57	8	49	Volclay Saline	Soil	39 **	N/A	N/A	Aug-85
00360	04/13/81	82	N/A	N/A	N/A	Soil	82	39 *	06/24/93	N/P
00365	08/16/77	15	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
00370	04/13/81	80	N/A	N/A	N/A	Soil	N/A	N/A	N/A	Aug-85
00380	04/13/81	81	N/A	N/A	N/A	Soil	81	26 *	01/09/89	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
00390	04/13/81	80	N/A	N/A	N/A	Soil	N/A	N/A	N/A	Mar-86
00400	04/13/81	62	N/A	N/A	N/A	Soil	N/A	N/A	N/A	Aug-85
00410	05/03/78	41	8	33	Volclay Saline	Soil	N/A	N/A	N/A	Aug-85
00423	06/07/91	60	20	40	Bentonite Grout	Soil	60	17 *	N/A	Feb-94
00425	05/03/78	N/A	N/P	N/P	N/A	Trench	20	12 *	05/04/89	N/P
00430	05/03/78	Disconnected in 6/91				Refuse				
00432	06/07/91	60	20	40	Bentonite Grout	Soil	60	45 *	06/24/91	Jul-91
00433	06/07/91	60	20	40	Bentonite Grout	Soil	60	N/A	06/24/93	N/P
00435	06/14/83	50	10	40	N/A	Soil	50	50 *	03/08/89	Aug-89
00445	10/03/84	50	10	40	N/A	Soil	N/A	N/A	N/A	Jan-87
00450	05/03/78	Abandoned in 9/87				Soil				
00451	07/01/82	13	N/P	N/P	N/A	Trench	N/A	N/A	N/A	Jun-87
00452	08/07/84	71	21	50	N/A	Refuse	N/A	N/A	N/A	N/P
00455	04/18/86	46	25	20	N/A	Soil	14 **	N/A	N/A	Jan-87
00456	04/18/86	24	10	14	N/A	Soil	N/A	N/A	N/A	N/P
00458	N/A	N/A	N/A	N/A	N/A	Slant	N/A	N/A	N/A	N/P
00460	05/03/78	60	10	50	Volclay Saline	Slant	33 **	N/A	05/04/89	N/P
00468	07/19/84	15	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
00470	05/03/78	49	8	33	Volclay Saline	Soil	45 **	N/A	N/A	Aug-85
00471	11/01/86	60	20	40	Bentonite Grout	Soil	60	N/A	11/01/86	Jul-90
00472	11/01/86	60	15	45	Bentonite Grout	Soil	60	N/A	11/01/86	Jul-90
00473	11/01/86	60	20	40	Bentonite Grout	Soil	60	20 *	06/01/93	Feb-94
00474	10/15/85	50	10	40	N/A	Soil	N/A	30 *	06/01/93	Feb-94
00476	11/01/86	50	10	40	N/A	Soil	50	N/A	N/A	Jan-87
00477	11/01/86	61	16	45	Bentonite Grout	Soil	61	23 *	06/01/93	Feb-94
00478	11/01/86	60	20	40	Bentonite Grout	Soil	60	N/A	06/01/93	Apr-89
00479	04/17/86	N/A	N/A	N/A	N/A	Soil	N/A	30 *	N/A	Feb-94
00480	08/29/83	84	N/A	N/A	N/A	Soil	83 **	22 *	06/01/93	Feb-94
00490	02/18/82	15	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00500	03/24/81	47	10	37	N/A	Soil	47	N/A	N/A	N/P
00505	03/20/85	15	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
00510	03/24/81	80	10	70	N/A	Soil	80	35 *	06/01/93	Feb-94
00520	03/24/81	82	N/A	N/A	N/A	Soil	82	11 *	04/10/89	N/P
00530	03/24/81	83	N/A	N/A	N/A	Soil	N/A	N/A	N/A	N/P
00540	05/03/78	46	8	38	Volclay Saline	Slant	N/A	N/A	N/A	N/P
00545	07/29/86	Abandoned in 8/90				Trench				
00550	02/08/82	81	35	45'	N/A	Soil	81	21 *	06/01/93	Feb-94
00554	08/17/90	7	N/P	N/P	N/A	Trench	N/A	N/A	N/A	Feb-94
00555	04/17/86	60	20	45	N/A	Soil	N/A	N/A	N/A	Jan-88
00557	Eastern End of Trench 00554					Trench				
00559	12/01/86	60	20	40	Bentonite Grout	Soil	N/A	31 *	06/01/93	Oct-94
00560	05/01/79	53	8	45	Volclay Saline	Slant	17 **	12 *	06/01/93	Oct-94
00562	12/86	60	20	40	Bentonite Grout	Soil	N/A	N/A	N/A	Apr-88
00564	11/01/86	48	10	38	Bentonite Grout	Soil	48	27 *	03/01/93	Dec-93
00570	05/03/78	62	8	54	Volclay Saline	Slant	N/A	30 *	N/A	Feb-94
00580	05/01/79	N/A	N/A	N/A	N/A	Slant	35	N/A	N/A	Feb-94
00585	01/18/89	60	20	40	Bentonite	Soil	60	36 *	06/01/93	N/P
00590	05/01/79	66	8	58	Volclay Saline	Slant	49 **	35 *	N/A	N/P
00595	01/18/89	60	20	40	Bentonite	Soil	60	N/A	06/24/93	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
00600	5/79	69	8	61	Volclay Saline	Slant	69	N/A	N/A	N/P
00610	5/79	70	N/A	N/A	Volclay Saline	Slant	70	4 *	06/01/93	Feb-94
00615	02/19/85	46	N/A	N/A	N/A	Soil	46	N/A	07/01/93	N/P
00630	07/26/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
00635	01/14/85	26	N/A	N/A	N/A	Soil	26	N/A	02/07/94	N/P
00640	5/79	69	8	61	Volclay Saline	Slant	N/A	N/A	N/A	N/P
00650	05/03/78	69	8	61	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00655	01/14/85	N/A	N/A	N/A	N/A	Trench	N/A	N/A	N/A	N/P
00660	05/01/79	71	12	59	Volclay Saline	Slant	71	N/A	N/A	N/P
00670	05/01/79	66	13	53	Volclay Saline	Soil	61 **	N/A	N/A	N/P
00680	05/01/79	63	11	52	Volclay Saline	Soil	60 **	N/A	N/A	N/P
00690	05/01/79	40	8	32	Volclay Saline	Soil	N/A	N/A	N/A	N/P
00695	07/01/82	15	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
05005	08/08/84	85	15	70	N/A	Refuse	80 **	N/A	07/08/88	N/P
05007	08/08/84	85	15	70	N/A	Refuse	82 **	N/A	07/08/88	N/P
05010	03/01/79	91	15	70	N/A	Refuse	83 **	N/A	07/08/88	N/P
05020	08/06/80	100	N/A	70	N/A	Refuse	50 **	N/A	07/08/88	N/P
05030	5/0/79	106	15	88	On Site Soil	Refuse	50 **	38 *	07/08/88	N/P
05040	08/05/80	100	N/A	70	N/A	Refuse	27 **	N/A	07/08/88	N/P
05050	02/26/79	105	15	83	On Site Soil	Refuse	27 **	25 *	07/08/88	N/P
05060	8/0/80	100	N/A	85	N/A	Refuse	N/A	N/A	07/08/88	N/P
05070	02/13/79	95	15	83	On Site Soil	Refuse	41 **	31 *	07/08/88	N/P
05080	07/11/80	85	N/A	70	N/A	Refuse	39 **	33 *	07/08/88	N/P
05090	02/13/79	99	15	82	On Site Soil	Refuse	32 **	29 *	07/08/88	N/P
05100	08/01/80	111	N/A	70	N/A	Refuse	32 **	26 *	07/08/88	N/P
05110	10/24/80	100	N/A	70	N/A	Refuse	60 **	29 *	07/08/88	N/P
05120	07/10/80	70	N/A	70	N/A	Refuse	31 **	N/A	07/08/88	N/P
05130	07/31/80	100	N/A	70	N/A	Refuse	35 **	N/A	07/08/88	N/P
05140	10/23/80	100	N/A	70	N/A	Refuse	40 **	N/A	07/08/88	N/P
05150	10/23/80	112	N/A	70	N/A	Refuse	35 **	N/A	07/08/88	N/P
05160	10/23/80	100	N/A	70	N/A	Refuse	34 **	N/A	07/08/88	N/P
05170	5/0/79	80	15	68	On Site Soil	Refuse	34 **	23 *	07/08/88	N/P
05180	07/09/80	96	N/A	70	N/A	Refuse	43 **	16 *	07/08/88	N/P
05190	01/03/79	81	15	65	On Site Soil	Refuse	35 **	7 *	07/08/88	N/P
05200	05/15/80	101	N/A	80	On Site Soil	Refuse	17 **	9 *	07/08/88	N/P
05210	01/29/79	76	15	58	On Site Soil	Refuse	21 **	13 *	07/08/88	N/P
05220	03/28/80	99	N/A	78	On Site Soil	Refuse	38 **	28 *	07/08/88	N/P
05230	06/16/82	88	N/A	70	On Site Soil	Refuse	27 **	17 *	07/08/88	N/P
05240	03/31/80	90	N/A	75	On Site Soil	Refuse	26 **	14 *	08/09/90	N/P
05250	06/11/82	80	N/A	70	On Site Soil	Refuse	28 **	5 *	08/09/90	N/P
05260	05/15/80	85	N/A	75	On Site Soil	Refuse	65 **	N/A	07/08/88	N/P
05270	03/24/80	73	N/A	63	On Site Soil	Refuse	65 **	N/A	07/08/88	N/P
05280	03/21/80	70	N/A	60	On Site Soil	Refuse	52 **	N/A	07/08/88	N/P
05290	03/21/80	70	N/A	60	On Site Soil	Refuse	62 **	41 *	07/08/88	N/P
05300	03/21/80	70	N/A	50	On Site Soil	Refuse	21 **	N/A	07/08/88	N/P
05310	03/20/80	55	N/A	44	On Site Soil	Refuse	50 **	40 *	07/08/88	N/P
05320	03/20/80	50	N/A	40	On Site Soil	Refuse	47 **	39 *	07/08/88	N/P
10001	09/13/84	110	15	95	N/A	Refuse	108 **	N/A	07/12/88	N/P
10002	09/13/84	110	15	95	N/A	Refuse	107 **	N/A	07/12/88	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
10004	09/13/84	110	15	95	N/A	Refuse	106 **	N/A	07/12/88	N/P
10005	02/25/88	60	20	40	Bentonite Grout	Refuse	58 **	N/A	9/0/88	N/P
10006	09/13/84	110	15	95	N/A	Refuse	105 **	N/A	07/12/88	N/P
10008	09/13/84	110	15	95	N/A	Refuse	104 **	N/A	07/12/88	N/P
10010	05/05/82	134	13	114	On Site Soil	Refuse	122 **	N/A	07/12/88	N/P
10020	05/05/82	134	11	114	On Site Soil	Refuse	112 **	N/A	07/12/88	N/P
10030	05/05/82	131	11	114	On Site Soil	Refuse	48 **	N/A	07/06/89	N/P
10040	05/05/82	134	11	114	On Site Soil	Refuse	48 **	N/A	07/06/89	N/P
10050	05/05/82	Abandoned in 11/94				Refuse				
10060	06/29/79	105	15	90	On Site Soil	Refuse	57 **	N/A	07/06/89	N/P
10070	05/05/82	133	11	114	On Site Soil	Refuse	98 **	27 *	07/12/88	N/P
10080	03/16/79	105	15	90	On Site Soil	Refuse	43 **	N/A	07/06/89	N/P
10090	05/05/82	132	11	114	On Site Soil	Refuse	67 **	52 *	07/06/89	N/P
10100	03/15/79	103	15	90	On Site Soil	Refuse	43 **	41 *	07/06/89	N/P
10110	05/05/82	130	11	114	On Site Soil	Refuse	103 **	45 *	07/12/88	N/P
10120	06/29/79	109	15	90	On Site Soil	Refuse	17 **	7 *	07/12/88	N/P
10130	04/27/82	129	11	114	On Site Soil	Refuse	98 **	36 *	03/28/89	N/P
10140	04/27/82	129	11	114	On Site Soil	Refuse	66 **	42 *	07/12/88	N/P
10150	04/27/82	129	11	114	On Site Soil	Refuse	102 **	40 *	07/12/88	N/P
10160	04/27/82	129	11	114	On Site Soil	Refuse	94 **	52 *	07/12/88	N/P
10170	11/19/81	125	11	114	On Site Soil	Refuse	100 **	42 *	07/06/89	N/P
10180	11/23/81	125	11	114	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10190	11/23/81	129	11	114	On Site Soil	Refuse	114 **	62 *	07/06/89	N/P
10200	11/24/81	130	11	114	On Site Soil	Refuse	130	62 *	07/12/88	N/P
10210	11/25/81	131	13	114	On Site Soil	Refuse	95 **	77 *	07/12/88	N/P
10220	12/07/81	115	11	114	On Site Soil	Refuse	94 **	78 *	07/12/88	N/P
10230	12/07/81	120	11	114	On Site Soil	Refuse	106 **	96 *	07/12/88	N/P
10240	12/09/81	115	11	114	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10250	12/14/81	128	11	114	On Site Soil	Refuse	102 **	91 *	07/12/88	N/P
10260	12/16/81	115	11	114	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10270	12/17/81	125	11	114	On Site Soil	Refuse	102 **	92 *	07/12/88	N/P
10280	12/18/81	120	11	109	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10290	12/21/81	110	11	104	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10300	12/22/81	105	11	99	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10310	12/22/81	100	11	99	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10320	12/29/81	100	11	89	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10330	12/29/81	65	11	69	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10340	05/05/82	50	11	39	On Site Soil	Refuse	N/A	N/A	N/A	N/P
10350	05/05/82	27	11	14	On Site Soil	Refuse	11 **	N/A	07/12/88	N/P
15005	10/31/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15010	10/31/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15020	10/31/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15030	10/31/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15040	10/31/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15050	10/31/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15060	10/28/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15070	10/28/77	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15080	05/03/78	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15090	05/03/78	50	13	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
15100	05/03/78	51	14	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
15110	05/04/82	56	17	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15120	05/04/82	55	16	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15130	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15140	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15150	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15160	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15170	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15180	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15190	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15200	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15210	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15220	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15230	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15240	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15250	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15260	05/04/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
15270	05/03/78	N/A	N/A	N/A	On Site Soil	Soil	36	N/A	05/10/94	N/P
15280	05/03/78	38	N/A	N/A	On Site Soil	Soil	38	35 *	04/14/92	N/P
15290	05/03/78	N/A	N/A	N/A	On Site Soil	Soil	33	N/A	03/31/94	N/P
20010	11/01/74	36	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20020	11/01/74	N/A	N/A	N/A	On Site Soil	Soil	41	N/A	N/P	N/P
20030	11/01/74	48	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20040	11/01/74	43	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20050	11/01/74	43	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20060	11/01/74	N/A	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20070	11/01/74	20	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20080	11/01/74	44	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20090	11/01/74	44	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20100	11/01/74	22	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20110	11/01/74	56	10	46	On Site Soil	Soil	N/A	N/A	N/A	N/P
20120	11/01/74	34	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20130	11/01/74	65	10	55	On Site Soil	Soil	N/A	N/A	N/P	N/P
20140	11/01/74	42	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20150	11/01/74	65	10	55	On Site Soil	Soil	N/A	N/A	N/P	N/P
20160	11/01/74	28	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20170	11/01/74	27	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20180	11/01/74	27	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
20190	11/01/74	32	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
25010	03/26/78	N/A	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
25020	03/26/78	N/A	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
25030	03/26/78	44	N/A	N/A	On Site Soil	Soil	44	N/A	02/04/94	N/P
25040	03/26/78	34	N/A	N/A	On Site Soil	Soil	34	N/A	02/04/94	N/P
25050	03/26/78	43	N/A	N/A	On Site Soil	Soil	43	N/A	02/04/94	N/P
25060	03/26/78	43	N/A	N/A	On Site Soil	Soil	43	N/A	02/07/94	N/P
25080	03/26/78	73	13	60	On Site Soil	Refuse	N/A	N/A	N/P	N/P
25090	05/01/79	69	10	59	On Site Soil	Refuse	45 **	N/A	N/A	N/P
25100	03/26/78	Abandoned in 4/81				Refuse				
25110	03/23/81	57	N/A	N/A	N/A	Refuse	N/A	N/A	N/P	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
25140	03/19/81	55	N/A	N/A	N/A	Refuse	N/A	N/A	N/P	N/P
25150	04/21/81	91	52	39	Bentonite	Refuse	91	N/A	07/16/88	N/P
25160	02/05/82	44	7	37	Bentonite	Refuse	44	N/A	07/16/88	N/P
25170	03/26/78	70	10	60	N/A	Soil	26 **	N/A	09/08/88	N/P
25180	02/01/76	N/A	N/A	N/A	N/A	Refuse	80	N/A	N/A	N/P
25190	04/21/81	96	40	50	Bentonite	Refuse	96	N/A	07/16/88	N/P
25200	02/04/82	39	8	26	Bentonite	Refuse	39	N/A	07/16/88	N/P
25210	04/01/79	55	N/A	N/A	N/A	Refuse	N/A	N/A	N/P	N/P
25220	01/28/82	100	N/A	N/A	Bentonite	Refuse	37 **	N/A	06/25/91	N/P
25222	02/04/76	39	N/A	N/A	N/A	Soil	N/A	N/A	N/P	N/P
25225	11/01/74	39	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/P	N/P
25226	11/01/74	61	N/A	N/A	On Site Soil	Soil	61	N/A	02/04/94	N/P
27010	02/01/86	57	20	40	N/A	Refuse	55 **	N/A	11/08/88	N/P
27020	02/01/86	50	20	30	N/A	Refuse	35 **	N/A	11/08/88	N/P
27030	02/01/86	50	20	30	N/A	Refuse	42 **	N/A	11/08/88	N/P
27040	02/01/86	56	20	30	N/A	Refuse	54 **	N/A	11/08/88	N/P
27050	02/01/86	60	20	40	N/A	Refuse	44 **	N/A	11/08/88	N/P
27060	02/01/86	95	N/A	N/A	N/A	Refuse	87 **	N/A	11/08/88	N/P
27070	02/01/86	58	20	40	N/A	Soil	55 **	N/A	01/08/88	N/P
27080	02/01/86	45	10	35	N/A	Soil	N/A	N/A	N/A	N/P
27090	02/01/86	45	10	35	N/A	Soil	N/A	N/A	N/A	N/P
27100	02/01/86	51	10	41	N/A	Soil	N/A	N/A	N/A	N/P
27110	02/01/86	63	10	53	N/A	Soil	N/A	N/A	N/A	N/P
27120	02/01/86	44	10	34	N/A	Soil	N/A	N/A	N/A	N/P
27130	02/01/86	40	10	30	N/A	Soil	N/A	N/A	N/A	N/P
27140	02/01/86	30	10	20	N/A	Soil	N/A	N/A	N/A	N/P
27150	02/01/82	126	40	60	Bentonite	Refuse	N/A	N/A	N/A	N/P
30010	11/28/77	51	14	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
30020	10/27/77	51	14	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
30030	10/27/77	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
30040	10/26/77	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
30050	10/26/77	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
30060	10/26/77	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
30070	10/26/77	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
30080	11/24/81	50	11	39	On Site Soil	Refuse	N/A	N/A	N/A	N/P
30090	11/24/88	50	11	39	On Site Soil	Soil	40 **	N/A	09/20/88	N/P
30100	11/25/81	50	11	39	On Site Soil	Refuse	40 **	N/A	09/20/88	N/P
30102	12/16/91	80	30	50	Bentonite Grout	Refuse	N/A	N/A	N/A	N/P
30104	12/16/91	80	30	50	Bentonite Grout	Refuse	N/A	N/A	N/A	N/P
30106	12/16/91	80	30	50	Bentonite Grout	Refuse	N/A	N/A	N/A	N/P
30108	12/16/91	80	30	50	Bentonite Grout	Refuse	N/A	45 *	05/18/92	N/P
30109	12/01/91	104	17	87	Bentonite Grout	Refuse	N/A	N/A	12/18/91	N/P
30111	12/16/91	80	30	50	Bentonite Grout	Refuse	N/A	N/A	N/A	N/P
30112	12/16/91	80	30	50	Bentonite Grout	Refuse	N/A	N/A	N/A	N/P
30114	12/16/91	80	30	50	Bentonite Grout	Refuse	N/A	N/A	N/A	N/P
30120	05/06/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30135	01/18/89	59	19	39	Bentonite	Refuse	N/A	N/A	N/A	N/P
30140	05/06/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30150	05/06/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
30160	05/06/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30170	05/06/82	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30180	05/08/82	55	16	39	On Site Soil	Soil	40 **	N/A	10/25/88	N/P
30185	05/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
30190	05/08/82	53	14	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30195	05/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
30200	05/08/82	50	11	39	On Site Soil	Soil	48 **	30 *	05/16/94	N/P
30205	05/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
30210	05/05/82	50	16	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30215	05/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
30220	04/28/82	55	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30225	05/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
30230	04/28/82	50	11	39	On Site Soil	Soil	46 **	N/A	09/19/88	N/P
30240	11/23/81	50	11	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
30250	04/28/82	73	14	59	On Site Soil	Soil	N/A	N/A	N/A	N/P
35010	11/23/81	70	11	59	On Site Soil	Refuse	N/A	N/A	N/A	N/P
35018	08/05/93	24	8	15	On Site Soil	Refuse	N/A	N/A	N/A	N/P
35020	05/02/82	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35023	08/05/93	23	8	15	N/A	Refuse	N/A	N/A	N/A	N/P
35028	08/05/93	23	8	15	N/A	Refuse	N/A	N/A	N/A	N/P
35030	11/20/81	60	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35033	08/05/93	25	10	15	N/A	Refuse	N/A	N/A	N/A	N/P
35038	08/05/93	26	11	15	N/A	Refuse	N/A	N/A	N/A	N/P
35040	11/19/81	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35043	08/05/93	24	8	15	N/A	Refuse	N/A	N/A	N/A	N/P
35048	08/05/93	23	8	15	N/A	Refuse	N/A	N/A	N/A	N/P
35050	05/02/82	35	N/A	N/A	On Site Soil	Soil	N/A	N/A	N/A	N/P
35060	11/19/81	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35070	11/19/81	55	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35080	05/02/82	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35090	05/02/82	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35100	05/02/82	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35110	04/20/82	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35120	04/20/82	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35125	04/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
35130	04/20/82	50	N/A	39	On Site Soil	Soil	N/A	N/A	N/A	N/P
35135	04/01/82	N/A	N/P	N/P	N/A	Trench	N/A	N/A	N/A	N/P
35140	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35150	03/26/78	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35160	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35170	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35180	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35200	03/26/78	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35210	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35220	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35230	03/26/78	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35240	03/26/78	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
35250	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
40010	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
40020	11/01/74	45	8	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
40030	12/11/81	65	N/A	49	On Site Soil	Refuse	N/A	N/A	N/A	N/P
40040	12/11/81	60	N/A	49	On Site Soil	Refuse	N/A	N/A	N/A	N/P
40050	12/10/81	60	N/A	49	On Site Soil	Refuse	N/A	N/A	N/A	N/P
40060	12/10/81	60	N/A	49	On Site Soil	Soil	N/A	N/A	N/A	N/P
40070	12/10/81	56	N/A	49	On Site Soil	Soil	N/A	N/A	N/A	N/P
40080	12/09/81	60	N/A	49	On Site Soil	Soil	N/A	N/A	N/A	N/P
40090	12/09/81	60	N/A	49	On Site Soil	Soil	N/A	N/A	N/A	N/P
40100	12/09/81	60	N/A	49	On Site Soil	Soil	N/A	N/A	N/A	N/P
40110	04/26/82	Abandoned in 1/92				Soil				
40115	11/03/87	32	10	20	Bentonite	Soil	32	N/A	01/27/88	N/P
40120	04/26/82	60	N/A	49	On Site Soil	Soil	N/A	N/A	N/A	N/P
40130	10/27/77	49	12	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
40140	10/27/77	51	14	37	Volclay Saline	Soil	N/A	N/A	N/A	N/P
50085	07/01/79	140	55	N/A	N/A	Refuse	118 **	N/A	02/17/83	N/P
50090	07/01/79	150	122	N/A	N/A	Refuse	150	N/A	01/13/83	N/P
50100	07/01/78	188	56	N/A	N/A	Refuse	188	84 *	07/31/91	N/P
50150	06/02/80	160	78	N/A	N/A	Refuse	160	N/A	08/01/91	N/P
55010	08/08/84	87	16	70	N/A	Refuse	55 **	N/A	11/08/88	N/P
55020	08/08/84	87	16	70	N/A	Refuse	75 **	N/A	07/08/88	N/P
55030	01/00/82	117	20	97	N/A	Refuse	41 **	N/A	1/0/82	N/P
55040	04/16/91	105	56	49	N/A	Refuse	N/A	N/A	N/A	N/P
55050	01/01/82	117	20	97'	N/A	Refuse	N/A	N/A	N/A	N/P
55060	04/16/91	105	56	49	N/A	Refuse	N/A	N/A	N/A	N/P
55070	01/01/82	117	20	97'	N/A	Refuse	N/A	N/A	N/A	N/P
55080	04/15/91	105	56	49	N/A	Refuse	N/A	N/A	N/A	N/P
55090	02/04/82	105	40	65	N/A	Refuse	57 **	N/A	08/19/93	N/P
60010	02/08/88	60	20	40	Bentonite Grout	Refuse	22 **	N/A	09/13/88	N/P
60020	02/08/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/13/88	N/P
60030	02/08/88	60	20	40	Bentonite Grout	Refuse	53 **	N/A	09/02/88	N/P
60040	02/09/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/13/88	N/P
60050	02/10/88	60	20	40	Bentonite Grout	Refuse	15 **	N/A	09/13/88	N/P
60060	02/24/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/13/88	N/P
60065	02/15/78	117	35	N/A	N/A	Refuse	65 **	N/A	08/01/91	N/P
60070	02/24/88	60	20	40	Bentonite Grout	Refuse	59 **	N/A	08/23/88	N/P
60080	02/24/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
60090	02/24/88	60	20	40	Bentonite Grout	Refuse	60 **	N/A	09/06/89	N/P
60100	02/24/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	08/24/88	N/P
60110	02/24/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
60120	02/25/88	60	20	40	Bentonite Grout	Refuse	59 **	N/A	09/13/88	N/P
60140	02/25/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
60150	02/25/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/13/88	N/P
60160	02/25/88	60	20	40	Bentonite Grout	Refuse	57 **	N/A	09/13/88	N/P
60170	02/25/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
60180	02/25/88	60	20	40	Bentonite Grout	Refuse	58 **	N/A	09/13/88	N/P
60190	02/25/88	60	20	40	Bentonite Grout	Refuse	59 **	N/A	09/13/88	N/P
60200	02/25/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/13/88	N/P
60210	02/25/88	60	20	40	Bentonite Grout	Refuse	45 **	N/A	09/02/88	N/P
60220	02/23/88	60	20	40	Bentonite Grout	Refuse	54 **	30 *	01/22/93	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
60225	01/28/82	85	N/A	N/A	N/A	Refuse	N/A	N/A	N/A	N/P
60230	02/23/88	60	20	40	Bentonite Grout	Refuse	53 **	N/A	09/13/88	N/P
65010	02/22/88	60	20	40	3:1 Bentonite/Soil	Refuse	60	N/A	11/08/88	N/P
65020	11/22/85	70	40	30	3:1 Bentonite/Soil	Refuse	70	N/A	11/08/88	N/P
65030	11/22/85	78	20	20	3:1 Bentonite/Soil	Refuse	77 **	N/A	11/08/88	N/P
65040	07/27/92	28	13	15	None	Refuse	N/A	N/A	N/A	N/P
65050	07/27/92	30	15	15	None	Refuse	N/A	N/A	N/A	N/P
65060	07/27/92	25	10	15	None	Refuse	N/A	N/A	N/A	N/P
65070	07/27/92	30	15	15	None	Refuse	N/A	N/A	N/A	N/P
65080	11/22/85	63	20	42	3:1 Bentonite/Soil	Refuse	62 **	59 *	11/08/88	N/P
65090	11/22/85	77	40	35	3:1 Bentonite/Soil	Refuse	76 **	69 *	11/08/88	N/P
65100	11/22/85	85	20	20	3:1 Bentonite/Soil	Refuse	84 **	N/A	11/08/88	N/P
65110	07/27/92	27	12	15	None	Refuse	N/A	N/A	N/A	N/P
65120	11/22/85	77	20	55	3:1 Bentonite/Soil	Refuse	66 **	N/A	11/08/88	N/P
65130	11/22/85	46	10	35	3:1 Bentonite/Soil	Refuse	46	N/A	11/08/88	N/P
65140	11/22/85	78	40	40	3:1 Bentonite/Soil	Refuse	78	66 *	11/08/88	N/P
65150	11/02/83	102	40	60	N/A	Refuse	73 **	N/A	11/08/88	N/P
65160	11/01/83	101	40	60	N/A	Refuse	75 **	N/A	11/08/88	N/P
65170	10/28/83	101	40	60	N/A	Refuse	84 **	N/A	11/08/88	N/P
65180	10/27/83	91	30	60	N/A	Refuse	83 **	N/A	11/08/88	N/P
65190	10/26/83	106	45	60	N/A	Refuse	69 **	N/A	11/08/88	N/P
70005	07/15/79	152	82	80	N/A	Refuse	150 **	34 *	08/01/91	N/P
70010	02/10/88	60	20	40	Bentonite Grout	Refuse	54 **	N/A	08/26/88	N/P
70020	02/10/88	60	20	40	Bentonite Grout	Refuse	21 **	N/A	09/06/89	N/P
70030	02/10/88	60	20	40	Bentonite Grout	Refuse	53 **	N/A	09/13/88	N/P
70040	02/10/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	03/29/88	N/P
70050	02/10/88	60	20	40	Bentonite Grout	Refuse	60	N/A	08/24/88	N/P
70060	02/09/88	60	20	40	Bentonite Grout	Refuse	34 **	N/A	09/13/88	N/P
70065	06/02/80	135	58	N/A	N/A	Refuse	135	N/A	08/01/91	N/P
70070	02/09/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
70075	05/30/80	N/A	36	N/A	N/A	Refuse	100	N/A	08/01/91	N/P
70077	04/11/91	105	56	49	N/A	Refuse	N/A	80'	07/31/91	N/P
70080	02/10/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/13/88	N/P
70090	02/12/88	60	20	40	Bentonite Grout	Refuse	53 **	N/A	09/13/88	N/P
70100	02/12/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/02/88	N/P
70110	02/12/88	60	20	40	Bentonite Grout	Refuse	N/A	N/A	N/A	N/P
70120	02/11/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	08/31/88	N/P
70130	02/11/88	60	20	40	Bentonite Grout	Refuse	56 **	43 *	03/16/88	N/P
70140	02/11/88	60	20	40	Bentonite Grout	Refuse	53 **	N/A	08/31/88	N/P
70145	04/11/91	105	56	49	N/A	Refuse	N/A	95 *	07/31/91	N/P
70150	02/11/88	60	20	40	Bentonite Grout	Refuse	50 **	N/A	09/01/88	N/P
70160	02/11/88	60	20	40	Bentonite Grout	Refuse	58 **	N/A	09/28/88	N/P
80010	02/17/88	60	20	40	Bentonite Grout	Refuse	57 **	N/A	08/26/88	N/P
80020	02/16/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
80030	02/16/88	60	20	40	Bentonite Grout	Refuse	54 **	N/A	08/26/88	N/P
80040	02/18/88	60	20	40	Bentonite Grout	Refuse	59 **	N/A	08/26/88	N/P
80050	02/19/88	60	20	40	Bentonite Grout	Refuse	58 **	N/A	09/13/88	N/P
80060	02/23/88	60	20	40	Bentonite Grout	Refuse	50 **	N/A	09/26/88	N/P

TABLE 1.3-3 (CONTINUED)
GAS WELL DETAILS
PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

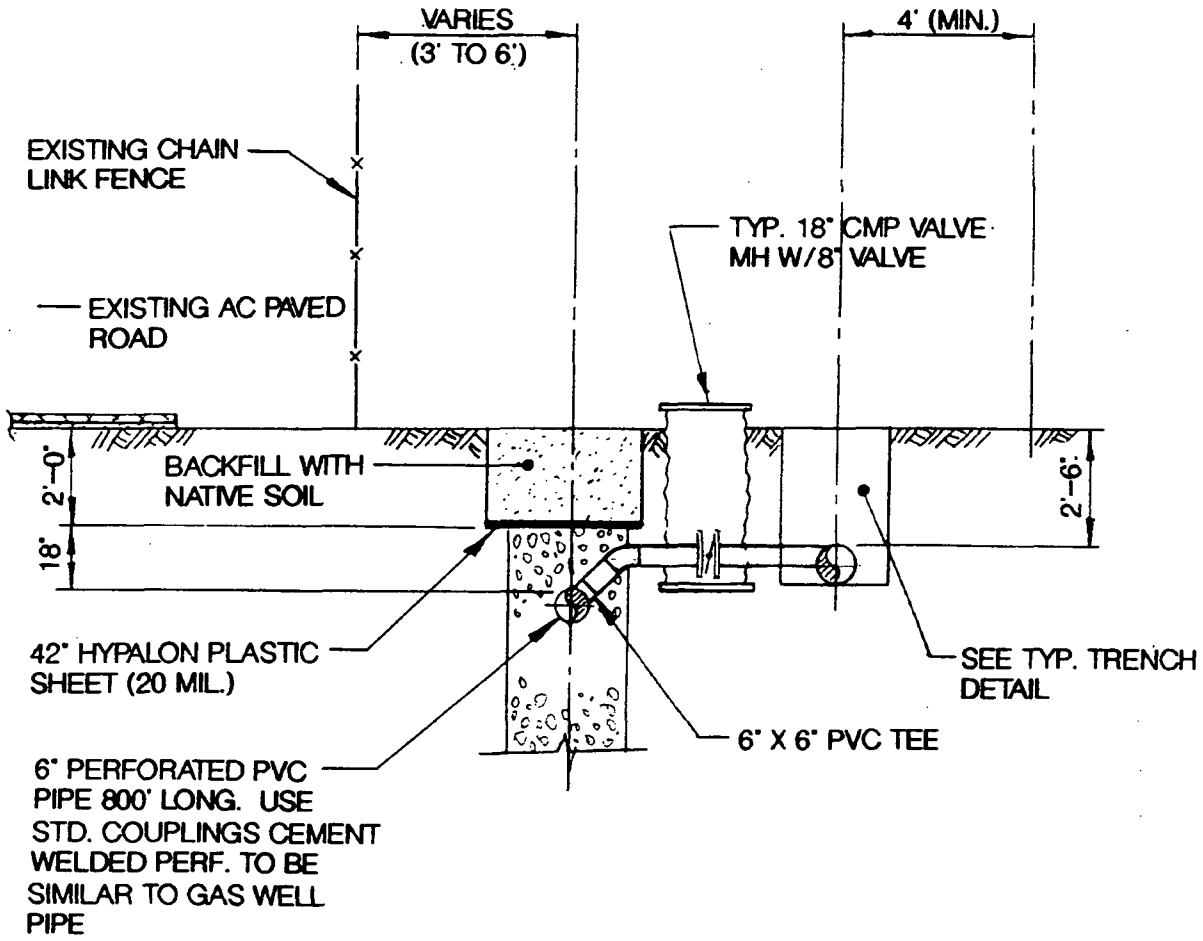
Well I.D.	Date Constructed	Original Depth to Bottom (ft.)	Solid Length (ft.)	Slotted Length (ft.)	Seal Material	Well Type	Recent Depth to Bottom (ft.)	Depth to Liquid (ft.)	Date Measured	Date Pump Installed
80070	02/23/88	60	20	40	Bentonite Grout	Refuse	51 **	N/A	09/13/88	N/P
80080	02/19/88	60	20	40	Bentonite Grout	Refuse	45 **	N/A	08/29/88	N/P
80090	02/19/88	60	20	40	Bentonite Grout	Refuse	58 **	58 *	09/06/89	N/P
80100	02/19/88	60	20	40	Bentonite Grout	Refuse	60	N/A	08/30/88	N/P
80110	02/19/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	08/30/88	N/P
80120	02/17/88	60	20	40	Bentonite Grout	Refuse	22 **	N/A	09/13/88	N/P
80130	02/18/88	60	20	40	Bentonite Grout	Refuse	50 **	N/A	09/02/88	N/P
80140	02/18/88	60	20	40	Bentonite Grout	Refuse	45 **	N/A	09/02/88	N/P
80150	02/18/88	60	20	40	Bentonite Grout	Refuse	58 **	52 *	09/06/89	N/P
80160	02/18/88	60	20	40	Bentonite Grout	Refuse	60	N/A	08/31/88	N/P
80170	02/18/88	60	20	40	Bentonite Grout	Refuse	59 **	N/A	09/22/88	N/P
80180	02/22/88	60	20	40	Bentonite Grout	Refuse	57 **	N/A	09/13/88	N/P
80190	02/19/88	60	20	40	Bentonite Grout	Refuse	58 **	N/A	09/06/89	N/P
80200	02/23/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/22/88	N/P
80220	02/19/88	60	20	40	Bentonite Grout	Refuse	N/A	N/A	09/13/88	N/P
80230	02/23/88	60	20	40	Bentonite Grout	Refuse	57 **	N/A	09/13/88	N/P
80250	02/19/88	60	20	40	Bentonite Grout	Refuse	58 **	N/A	09/13/88	N/P
80260	02/23/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
80270	02/19/88	60	20	40	Bentonite Grout	Refuse	60	N/A	08/22/88	N/P
80275	04/01/91	105	56	49	N/A	Refuse	N/A	70 *	07/31/91	N/P
80280	02/23/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/13/88	N/P
80290	02/22/88	60	20	40	Bentonite Grout	Refuse	60	N/A	08/22/88	N/P
90010	02/16/88	60	20	40	Bentonite Grout	Refuse	60	N/A	08/31/88	N/P
90020	02/16/88	60	20	40	Bentonite Grout	Refuse	56 **	N/A	09/02/88	N/P
90030	02/12/88	60	20	40	Bentonite Grout	Refuse	57 **	N/A	09/13/88	N/P
90040	02/12/88	60	20	40	Bentonite Grout	Refuse	57 **	N/A	09/06/89	N/P
90050	02/12/88	60	20	40	Bentonite Grout	Refuse	45 **	N/A	10/26/88	N/P
90060	02/24/88	60	20	40	Bentonite Grout	Refuse	60	N/A	09/13/88	N/P
90070	02/23/88	60	20	40	Bentonite Grout	Refuse	60	N/A	09/13/88	N/P
90075	02/23/88	60	20	40	Bentonite Grout	Refuse	57 **	N/A	09/13/88	N/P
90080	02/22/88	60	20	40	Bentonite Grout	Refuse	50 **	N/A	08/23/88	N/P
90085	02/22/88	60	20	40	Bentonite Grout	Refuse	58 **	N/A	09/13/88	N/P
90087	04/01/91	105	56	49	N/A	Refuse	N/A	53 *	08/01/91	N/P
90090	02/22/88	60	20	40	Bentonite Grout	Refuse	50 **	N/A	08/23/88	N/P
90100	02/22/88	60	20	40	Bentonite Grout	Refuse	55 **	N/A	09/29/88	N/P
90105	04/01/91	105	56	49	N/A	Refuse	N/A	54 *	08/01/91	N/P
90110	02/22/88	60	20	40	Bentonite Grout	Refuse	22 **	N/A	09/29/88	N/P

N/A - not available

N/P - not applicable

* - water was pumped out

** - recent depth is less than original depth; probably due to well casing damage caused by settlemet



TYPICAL DESIGN OF AN EXISTING ACTIVE TRENCH

FIGURE 1.3-7

southwestern boundary. Details of an existing passive trench design are shown in Figure 1.3-8. Design details of the gas collection trenches at the PVLF are also contained in Table 1.3-3.

As noted above, the Sanitation Districts do not have any plans for a gas system expansion in the near future. The Sanitation Districts will inform DTSC when any new gas collection trenches are scheduled to be installed. Any new active trenches installed in the future at the PVLF will have a one foot bentonite clay seal or a hypalon sheet (or equivalent) will be placed across the top of the trench to act as a seal.

Gas-to-Energy Facility

The landfill gas collected from the gas collection wells and the active trenches is combusted in a landfill gas-to-energy facility located in the northern corner of the main site facing Hawthorne Boulevard. The location of the gas-to-energy facility is shown on Exhibit 1.3-6. The facility began operation in December 1988. The collected landfill gas is combusted in two landfill gas-fired boilers to produce steam which in turn produces electricity through a steam turbine. The generated electricity is sold to Southern California Edison for use in the local power grid network. At present, the net power output from the facility is 9 Megawatts (MW) which supports the average daily usage of 19,000 homes. The power production from the gas-to-energy facility is expected to decrease with time due to a decrease in the amount of landfill gas generated from this closed landfill site.

For a period of three years, from January 1984 to December 1987, the Sanitation Districts operated a gas turbine electrical generation facility at the current location of the recycling center. Approximately 1 MW of electricity, which was produced by the gas turbine facility from a portion of the collected landfill gas, was sold to Southern California Edison. The new gas-to-energy facility has replaced the gas turbine facility. From 1974 to 1985, a portion of the landfill gas flow was treated in a landfill gas recovery-treatment plant operated by Getty Synthetic Fuels, Inc. (now GSF Energy, Inc.). The treated gas was sold to the Southern California Gas Company. The Getty plant ceased operations on July 1, 1985. The plant was located in the northern corner of the main site which is now the location of the gas-to-energy facility.

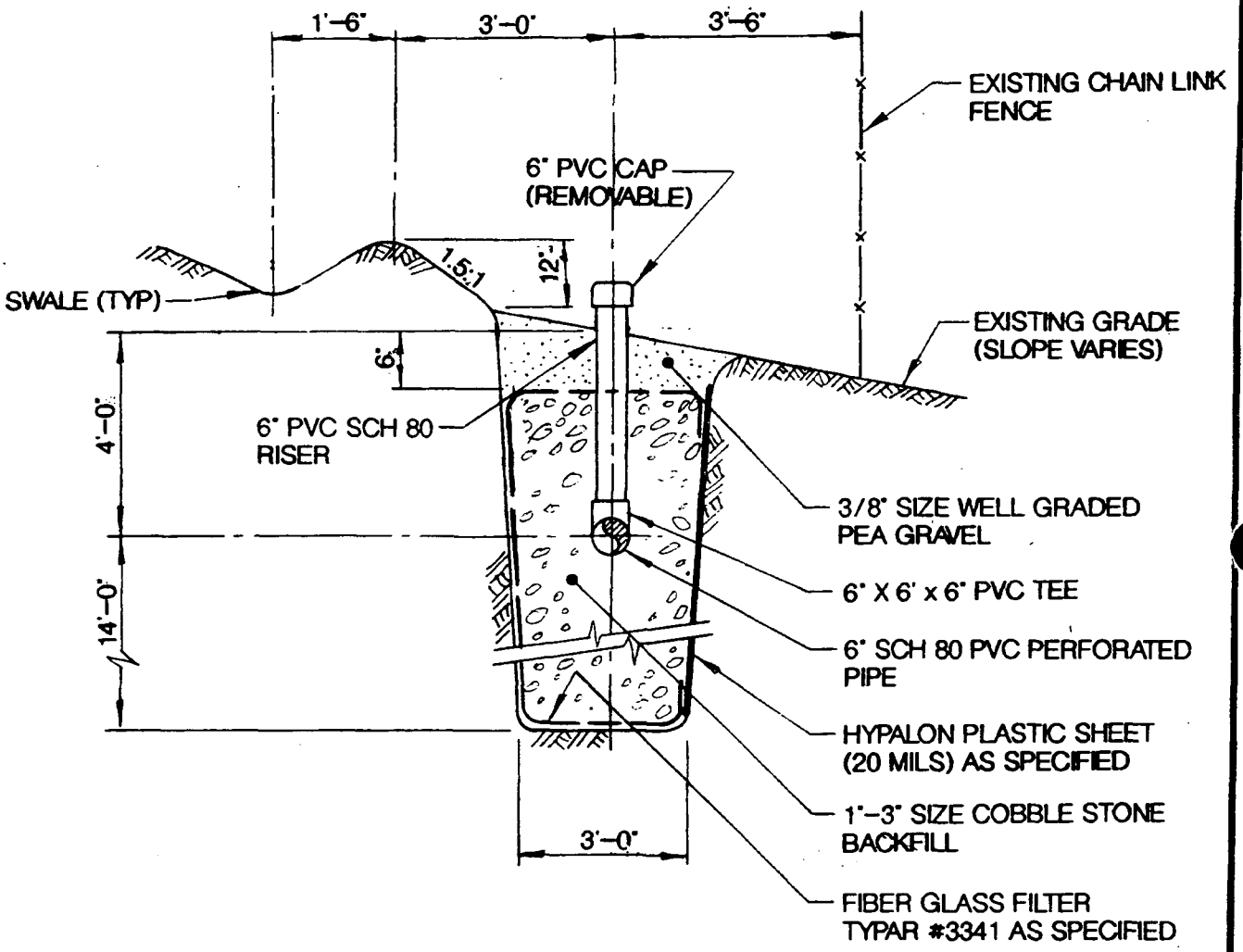


FIGURE 1.3-8

TYPICAL DESIGN OF A PASSIVE TRENCH

Flare Stations

There are two existing landfill gas flare stations located on the main site as shown on Exhibit 1.3-6. They serve as backup disposal facilities for the collected landfill gas when the gas-to-energy facility is being maintained. Flare station No. 2 is located adjacent to the gas-to-energy facility and consists of six flares. Flare station No. 3 consists of seven flares and is located off Crenshaw Boulevard. Flare station No. 1, which consisted of two flares, permanently ceased operations in January 1986. Each of the thirteen flares are eight feet in diameter and sixteen feet in height and can burn approximately 1,500 cfm of landfill gas.

1.3.4.1.3 Landfill Gas Monitoring System

To ascertain that off site gas migration is not occurring and to assess the effectiveness of the gas collection system, an extensive landfill gas monitoring probe system has been installed around the entire perimeter of the PVLF in accordance with the California Integrated Waste Management Board (CIWMB) postclosure regulations. The current probe monitoring system was installed in 1980 after the PVLF reached its final design capacity and closed. The boundary probe monitoring system at the PVLF includes a total of 256 probes: 63 around the South Coast Botanic Garden, 155 on the perimeter of the main site, and 38 around Ernie Howlett Park as shown in Exhibit 1.3-8.

The spacing and depth of the probes were determined based on local geologic conditions, surrounding land uses, and the distance to neighboring residences. Spacing and depth are selected to conform to applicable regulations and to provide adequate coverage to detect landfill gas migration that may result in gas emissions off site. Table 1.3-4 shows the spacing and depths of the boundary probes at the PVLF.

Site geologic conditions which affect gas migration, and therefore probe spacing and depth, include permeability, bedrock structure, degree of induration, degree of weathering, and depth to the zone of saturation. Landfill gas will preferentially migrate through higher permeability materials, so probes are often placed in unconsolidated materials rather than bedrock. Bedrock that is relatively impermeable and is not fractured or weathered is not likely to be conducive to gas

TABLE 1.3-4

SPACING AND DEPTHS OF EXISTING BOUNDARY PROBES

PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

Locations	Number of Probes	Spacing (feet)	Depth (feet)
Main Site			
Northeast boundary	64	50	40
Along Crenshaw Blvd.	30	100	10
Southwest boundary	50	50	10
Along Hawthorne Blvd.	11	150	10
South Coast Botanic Garden			
Northeast boundary	16	100	20
Along Rolling Hills Road	11	150	10
Southwest boundary	22	150	10
Along Crenshaw Blvd.	14	150	15
Ernie Howlett Park			
Northeast boundary	6	90-130	10-15
Along Hawthorne Blvd.	12	150	10-15
Southwest boundary	13	70-170	10-15
North boundary	7	80-180	10-15

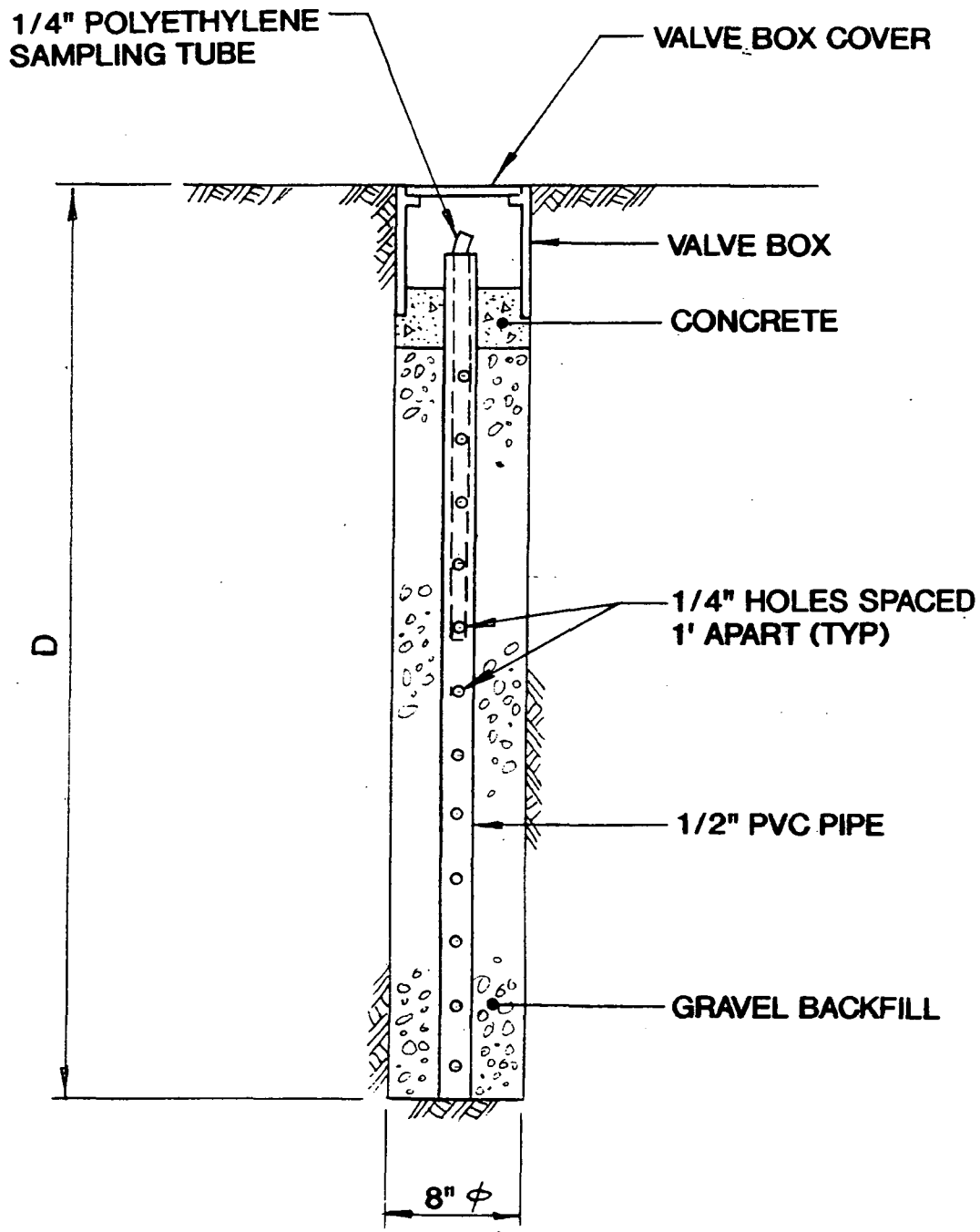
migration. However, if fracturing or weathering is present in bedrock, probes may be placed in bedrock or spaced more closely since these features may provide a migration pathway for gas. Ground water effectively prevents bulk migration of landfill gas, since the available pore spaces are saturated with water.

The maximum allowed probe spacing is 1,000 feet. This distance has been set by CIWMB. Probes may be spaced closer together to facilitate early identification of gas migration. This may be desirable when the surrounding land use is primarily residential, particularly if residences are located near the landfill boundary and setbacks between the property boundary and the fill area are minimal.

At the PVLF, the maximum probe spacing is 180 feet, while in some areas probes are less than 50 feet apart. Boundary probes have been installed at this density due to the residential nature of the surrounding area and the relatively small setback of ten feet between the property boundary and fill areas in some locations. The probes are typically aligned halfway between the gas extraction wells. Therefore, they monitor the areas that experience the least amount of influence from the gas collection system and are the most likely pathways for gas migration.

There are no specific maximum or minimum allowable probe depths. Typically, probe depths will be determined at the time of installation by the geologist or be predetermined by other localized conditions. In the situation where nearby residences are at a lower elevation that the landfill surface, as is the case along the northeast boundary of the main site, the Sanitation Districts typically install probes to a depth of ten feet below the adjacent land surface elevation where residences are located. Since the adjoining residential lots along this boundary consist of a slope down to flat terrain 30 feet below the landfill level, probes in this area are 40 feet deep to ensure that the monitored depth is at least ten feet deeper than the ground level of nearby houses. Otherwise, probes at the PVLF are typically ten feet deep because of the impermeable nature of the bedrock and the relatively shallow unconsolidated zone.

A typical probe design for existing installed probes is shown on Figure 1.3-9. The probe consists of a polyethylene sampling tube and a one-half inch diameter polyvinyl chloride (PVC) casing. The casings extend to the design probe depth for all probes except those along the



TYPICAL DESIGN OF AN EXISTING GAS MONITORING PROBE

FIGURE 1.3-9

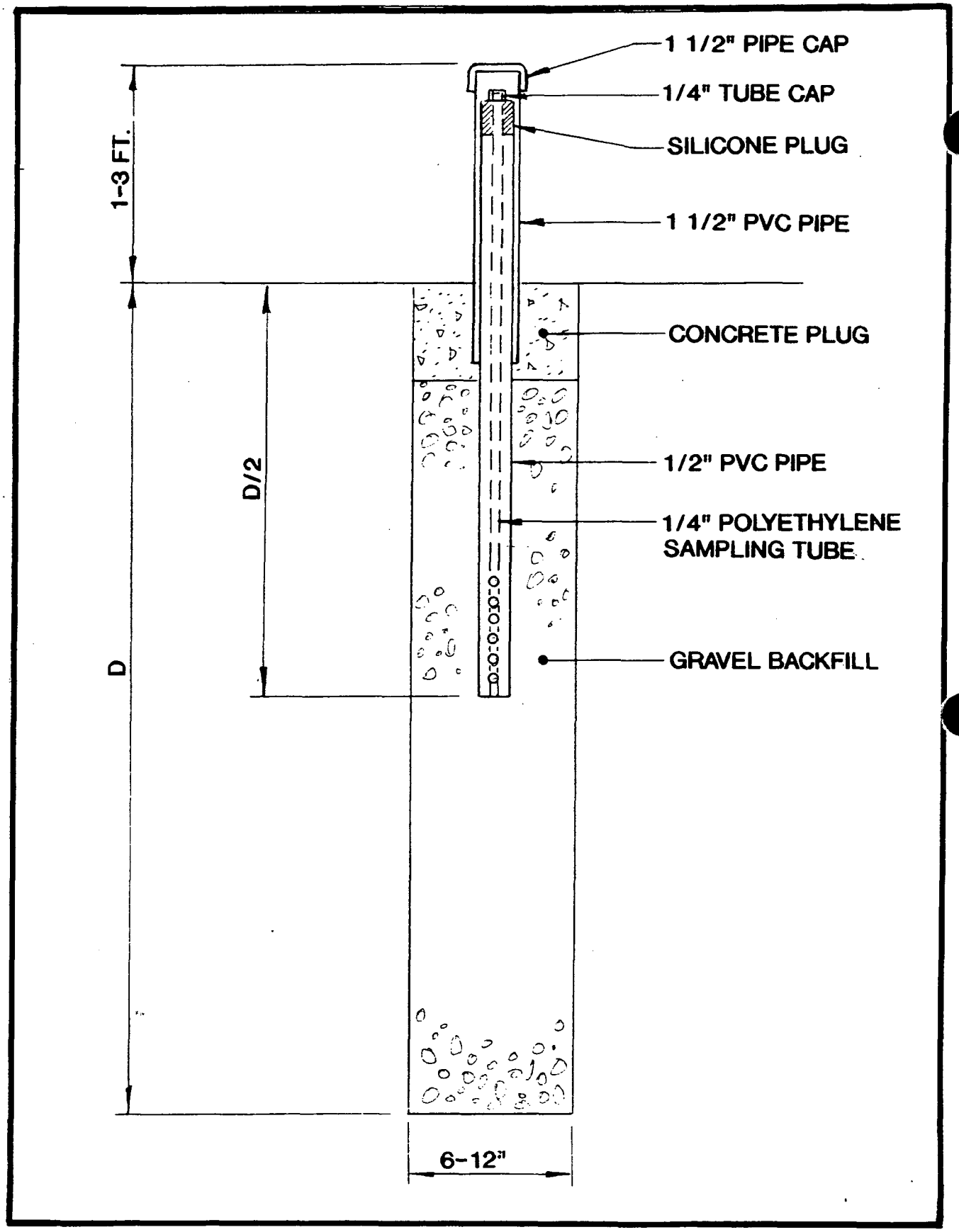
northeastern boundary. The northeastern boundary probes, which are the deepest probes at 40 feet, extend one half of the design depth as shown in Figure 1.3-10. The casing typically extends one to three feet above the ground surface for convenient sampling. Shorter extensions and irrigation valve boxes are used where necessary to protect the top of the casing from damage. The buried portion is perforated along its entire length from one foot below the ground surface. The perforations consist of 1/4-inch holes spaced about six inches apart. The sampling tube is 1/4-inch in diameter and extends to one half of the probe depth. Any new probes installed in the future at the PVLF will have a six inch bentonite clay seal or a hypalon sheet (or equivalent) will be placed across the probe bore at about one foot beneath the ground surface to act as a seal.

Routine monitoring of boundary probes is conducted at the PVLF on at least a monthly basis. Probes located closer to residences are monitored more frequently. The results of the monthly boundary probe monitoring are reported to the Los Angeles County Department of Health Services (DHS); this reporting procedure has been ongoing since the closure of the PVLF. This report includes the gas levels detected at each probe and any remedial actions taken or planned to eliminate gas migration when gas is detected at a probe.

When methane is detected at a probe, actions are taken to eliminate methane from the area. Daily monitoring is performed until no methane is detected for seven business days. Actions that may be taken to eliminate methane from the area include valve adjustments on nearby gas wells to increase their flow rate, dewatering gas wells and draining piping, increasing the vacuum on gas wells in the area, and installing additional gas wells.

1.3.4.2 Surface Water

The purpose of the surface water controls is to adequately divert rainfall runoff away from the site to prevent ponding over the waste-filled areas of the PVLF and control the potential for cover erosion. This reduces water infiltration into the soil cover and any potential leachate generation. Leachate is moisture that has contacted waste in the landfill and could potentially transport contamination from the waste into the ground water. Currently, several water management plans are in place to reduce any water infiltration at the site. The grading at the site is designed to prevent off site surface water from running onto the site. Any off site surface water that may possibly



TYPICAL DESIGN OF AN EXISTING DEEP GAS MONITORING PROBE

FIGURE 1.3-10

run onto the site is diverted using berms or underground storm drains. The grading at the landfill site is also designed to prevent any ponding of rainfall runoff. The grading along with the current drainage network directs any runoff away from the waste-filled areas of the PVLF. Because of surface settlement on the landfill, the grading and surface controls must frequently be monitored and maintained to ensure that no ponding on the landfill site occurs.

The Sanitation Districts also maintain a vegetative cover on the landfill to prevent the loss of soil cover to surface runoff water. This prevents contamination in the surface water and sediment in two ways. First, the soil cover is the barrier that exists between the waste in the PVLF and runoff water. A vegetative cover reduces the erosion of the soil cover, thereby maintaining the soil barrier and preventing any exposure of the waste. Secondly, the vegetative cover reduces the erosion of the soil, thereby reducing the amount of sediment and dissolved constituents in the runoff. The Sanitation Districts currently maintain a vegetative cover at the main site on the PVLF which consists mainly of grass on the level areas and pampas grass, oleanders, shrubs, trees, ice plants, and other ground cover plant species on the sloping areas.

1.3.4.3 Ground Water and Liquids Collection Systems

Both ground water protection and monitoring systems are currently in existence at the PVLF. The ground water protection systems focus on liquids collection, treatment, and disposal. The purpose of these liquids systems is twofold; first, to minimize liquids contact with the landfill contents, and secondly to remove any liquids that have come in contact with the landfill contents.

There are three components to the ground water protection system and two components of the ground water monitoring system. The ground water protection system consists of the subsurface barrier, the underdrain collection sumps, and the condensate system, which are summarized in Sections 1.3.4.3.1 through 1.3.4.3.3. The ground water monitoring system consists of 52 saturated zone monitoring wells, and nine lysimeters. Sections 1.3.4.3.4 and 1.3.4.3.5 summarize the status of the monitoring systems.

1.3.4.3.1 Subsurface Barrier System

The Sanitation Districts installed a subsurface cement bentonite barrier system in 1986 in the northern corner of the main site along Hawthorne Boulevard. The barrier system prevents contaminated ground water on site from migrating off site. The barrier system consists of three components; the barrier itself, upgradient ground water extraction wells, and downgradient ground water monitoring wells.

A low hydraulic conductivity (10^{-7} cm/sec) cement-bentonite cutoff wall is a physical barrier that impedes ground water flow. Eleven extraction wells (two are inactive) upgradient of the barrier are available to maintain the hydraulic gradient across the barrier to be towards the landfill further impeding the flow of ground water. The volume of ground water that is collected from each extraction well is monitored weekly, and the total volume extracted from a composite of extraction wells is monitored daily. For 1993, the extraction wells removed approximately 14,300 gallons of ground water per day. This ground water is combined with other liquids collected from multiple sources at the PVLF. The Sanitation Districts treat the extracted ground water using an air stripper, when necessary, prior to its disposal to the sanitary sewer in accordance with an existing Industrial Waste permit (Number 11561). The water is then treated at the Joint Water Pollution Control Plant in Carson. The off gases from the air stripper are piped to the PVLF gas-to-energy facility where they are combusted in the landfill gas fired boilers. Fourteen monitoring wells downgradient of the barrier monitor its competency. Seven of the barrier monitoring wells are screened in the alluvium (wells M01A through M07A) and seven are screened in the upper bedrock (wells M01B through M07B).

1.3.4.3.2 Underdrain Collection Sumps

There are two underdrain collection sumps located at the PVLF which are hydraulically connected to the subsurface. The first is Sump 7, which receives liquids from a french drain collection system beneath the northeast portion of the main site (Parcel 6). The volume of ground water that is collected from Sump 7 is monitored daily. During 1993, Sump 7 collected approximately 500 gallons of water per day. This water is combined with liquids from multiple sources at the PVLF prior to being discharged into a sewer line under Industrial Waste Discharge Permit Number 11561. The water

quality requirements set forth under this discharge permit are discussed in Section 1.3.4.3.1 and the permit is included in Appendix E.14. This water is then treated at the Joint Water Pollution Control Plant in Carson.

The other underdrain collection sump is the Parcel 4 Sump (Sump P4) which collects water from an underdrain beneath Ernie Howlett Park. The Sanitation Districts installed this underdrain in 1969 to collect alluvial water flowing in the canyon where Parcel 4 (now Ernie Howlett Park) was to be filled. The volume of ground water that is collected from Sump P4 is monitored daily. For 1993, Sump P4 collected approximately 5,000 gallons of water per day. This water is discharged into a sewer line under Industrial Waste Discharge Permit Number 10995. A copy of this waste discharge permit is also given in Appendix E.14. Composite samples of this water are collected and analyzed on a monthly basis. The chemical analysis results of the water samples must meet the specifications set forth by Industrial Waste Discharge Permit Number 10995. Table 1.3-5 compares the wastewater discharge requirements with the water quality results for the effluent taken at sampling point P4 prior to entering the sewer. The table shows that for 1993, all of the concentrations of the P4 effluent were below the maximum concentrations allowed by the permit. This water flows to the Joint Water Pollution Control Plant in Carson where it is treated.

1.3.4.3.3 Condensate Collection System

As previously discussed, the PVLF has an extensive landfill gas control system. This system collects landfill gas from gas wells and active gas trenches and transports this gas to the gas-to-energy plant via a headerline system. Once the landfill gas reaches the gas-to-energy plant, it is combusted in a boiler, which generates steam that is converted to electrical power through a turbine. Because of pressure and temperature variations that occur in the headerline system, some of the gases (mainly water vapor) condense forming liquid condensate. This condensate is collected at the PVLF in the condensate collection system. Exhibit 2.1-1 shows the existing landfill gas wells and gas headerline system at the PVLF. The majority of the gas wells are located on the main site with a lesser number located at the South Coast Botanic Garden. There are no gas wells located at the Ernie Howlett Park. A system of condensate lines, sumps, tanks, and pumps are used to collect the condensate that forms in the gas headerlines and pump it to the main holding tank located on the main site. This condensate is combined with liquids from multiple sources at the PVLF prior to being

TABLE 1.3-5

COMPARISON OF WASTEWATER DISCHARGE REQUIREMENTS AND WATER QUALITY RESULTS FOR THE EFFLUENT AT SAMPLING POINT P4

PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

CONSTITUENT	UNITS	MAXIMUM CONCENTRATION	1993 RANGE FOR P4 EFFLUENT
CONVENTIONAL POLLUTANTS			
DISSOLVED SULFIDES	MG/L	0.1	ND
HEAVY METALS AND CYANIDES			
ARSENIC	MG/L	3	0.02 - 0.204
CADMIUM	MG/L	0.69	ND
CHROMIUM	MG/L	2.77	ND - 0.03
COPPER	MG/L	3.37	0.06 - 0.03
LEAD	MG/L	0.69	ND
MERCURY	MG/L	2	ND - 0.0001
NICKEL	MG/L	3.98	0.06 - 0.60
SILVER	MG/L	0.43	ND - 0.014
ZINC	MG/L	2.61	ND - 0.09
CYANIDE (TOTAL)	MG/L	1.20	ND - 0.01
PRIORITY ORGANICS			
VOLATILE TOTAL TOXIC ORGANICS (PER EPA TEST METHODS 601 & 602)	MG/L	1.0	ND - 0.3597
SEMI-VOLATILE TOXIC ORGANICS (PER EPA TEST METHOD 625)	MG/L	1.0	ND
TOTAL IDENTIFIABLE CHLORINATED HYDROCARBONS (TICH)	UG/L	ESSENTIALLY NONE *	ND
OIL AND GREASE	MG/L	75	ND - 8.6

* - TYPICALLY LESS THAN 1 UG/L

discharged into a sewer line under Industrial Waste Discharge Permit Number 11561. This water is then treated at the Joint Water Pollution Control Plant in Carson. The volume of condensate from the headerlines of the gas system is monitored at several locations on a daily basis. For 1993, the condensate system collected approximately 9,900 gallons of liquids from the gas headerlines per day.

In addition to collecting condensate from the gas headerlines, the condensate collection system also collects condensate from gas wells located on the northeast boundary of the PVLF. Currently, there are 37 gas wells located the on the northeast boundary that have dedicated pumps to automatically control the level of condensate in these gas wells. The locations of these 37 gas wells are shown in Exhibit 1.2-2. If the condensate is not periodically pumped out of these wells, the flow of landfill gas to the wells is greatly reduced. The condensate from the gas wells is collected and pumped to the same holding tank that stores the condensate from the gas headerlines. The volume of condensate is monitored on a weekly basis. For 1994, the volume of condensate from all 37 gas wells with dedicated pumps was approximately 1,100 gallons of liquids per day. The 1994 condensate extraction rates for the gas wells with dedicated pumps are listed in Table 1.3-6.

As previously discussed, the condensate from the gas headerlines and the gas wells is combined with liquids from multiple sources at the PVLF prior to being discharged into a sewer line. These other sources include the ground water from the extraction wells (discussed in Section 1.3.4.3.1), the leachate from Sump 7 (discussed in Section 1.3.4.3.2), and cooling water blowdown from the gas-to-energy plant. The water from these sources is discharged into a sewer line under Industrial Waste Discharge Permit Number 11561. Composite samples of this water are collected on a monthly basis from sampling point SB3 (just prior to entering the sewer) for chemical analysis. The chemical analysis results of the water samples must meet the specifications set forth by Industrial Waste Discharge Permit number 11561. Table 1.3-7 compares the wastewater discharge requirements with the water quality results for the effluent taken at sampling point SB3 prior to entering the sewer. The table shows that the analytical results of samples from SB3 for 1993 were below the maximum concentrations allowed by the permit. This water flows to the Joint Water Pollution Control Plant in Carson where it is treated.

Before discharge to the sanitary sewer, the liquids collected from the various sources at the PVLF can be treated. The Sanitation Districts operate two air strippers at the PVLF. One

TABLE 1.3-6

CONDENSATE EXTRACTION RATES FOR THE GAS WELLS WITH DEDICATED PUMPS FOR 1994

PALOS VERDES LANDFILL - REMEDIAL INVESTIGATION REPORT

GAS WELL	CONDENSATE EXTRACTION RATE (GALLONS/DAY)
00330	1.55
00342	4.52
00345	8.57
00347	2.32
00350	5.72
00370	4.87
00390	3.22
00400	4.66
00410	2.86
00423	10.09
00432	11.12
00435	3.81
00445	7.74
00451	9.02
00455	6.38
00458	55.62
00460	0
00470	24.11
00471	11.27
00472	16.92
00473	13.27
00474	3.7
00476	8.91
00477	13.69
00478	16.17
00479	0.55
00480	45.05
00510	10.22
00550	9.76
00554	0.29
00555	6.86
00560	0.97
00562	1.87
00564	0.75
00570	1.6
00580	25.61
00610	319.2
TOTAL	672.84

TAB13_6.XLS

TABLE 1.3-7

COMPARISON OF WASTEWATER DISCHARGE REQUIREMENTS AND WATER QUALITY RESULTS FOR THE EFFLUENT AT SAMPLING POINT SB3

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CONSTITUENT	UNITS	MAXIMUM CONCENTRATION	1993 RANGE FOR SB3 EFFLUENT
CONVENTIONAL POLLUTANTS			
DISSOLVED SULFIDES	MG/L	0.1	ND
HEAVY METALS AND CYANIDES			
ARSENIC	MG/L	3	0.019 - 0.041
CADMIUM	MG/L	0.69	ND - 0.01
CHROMIUM	MG/L	2.77	ND - 0.16
COPPER	MG/L	3.37	0.06 - 0.16
LEAD	MG/L	0.69	ND
MERCURY	MG/L	2	ND - 0.0007
NICKEL	MG/L	3.98	0.06 - 0.21
SILVER	MG/L	0.43	ND - 0.01
ZINC	MG/L	2.61	ND - 0.09
CYANIDE (TOTAL)	MG/L	1.20	ND
PRIORITY ORGANICS			
VOLATILE TOTAL TOXIC ORGANICS (PER EPA TEST METHODS 601 & 602)	MG/L	1.0	0.0021 - 0.0565
SEMI-VOLATILE TOXIC ORGANICS (PER EPA TEST METHOD 625)	MG/L	1.0	ND - 0.295
TOTAL IDENTIFIABLE CHLORINATED HYDROCARBONS (TICH)	UG/L	ESSENTIALLY NONE *	0.01 - 0.65
OIL AND GREASE	MG/L	75	7 - 51.5

* - TYPICALLY LESS THAN 1 UG/L

air stripper is located on the east side of the main site near Flare Station 3. This air stripper is used to treat headerline condensate that is collected in the Flare Station 3 holding tank. Another air stripper is located on the north corner of the main site near the gas-to-energy facility. This air stripper is used to treat headerline condensate, ground water from the extraction wells, and leachate from Sump 7 that is collected in the Flare Station 2 holding tank. The air strippers are operated intermittently. The off gases from both air strippers are piped to the PVLF gas-to-energy facility where they are combusted in the landfill gas fired boilers.

The volume of water entering the sewer under Waste Discharge Permit Number 11561 is monitored daily. Based on a material balance, the volumes of water from the various sources can be calculated. For 1993, the volumes of water entering the sewer included approximately 9,900 gallons per day of condensate from the gas headerlines; 1,100 gallons per day of condensate from gas wells; 14,300 gallons per day of ground water from the extraction wells; 500 gallons per day of leachate from Sump 7; and 27,500 gallons per day of cooling water blowdown from the gas-to-energy plant.

1.3.4.3.4 Saturated Zone Monitoring Wells

Canyon alluvium and fill is capable of transmitting ground water. A review of aerial photographs taken over the history of the site shows abundant growth of vegetation along the original canyon bottoms which supports the hypothesis that saturated zones were present in canyon bottoms. The Sanitation Districts found additional supportive evidence during the construction of the subsurface barrier along Hawthorne Boulevard where canyon waters were found toward the center of the original canyon flowing through the alluvium and/or fill. Therefore, the majority of site monitoring concentrates on alluvial flow. In addition, ground water in the bedrock could be a possible conduit for off site migration of contaminants. Upgradient and under the PVLF, the bedrock consists predominantly of the shale and mudstone of the Monterey Formation which are not considered to be capable of storing and transmitting significant amounts of ground water. The relatively small amount of ground water flow from this bedrock is believed to be through the weathered and fractured portions of the bedrock in the uppermost horizons. The Sanitation Districts installed monitoring wells into the bedrock below the site to investigate the presence and quality of ground water in the bedrock.

The saturated zone monitoring wells are discussed below. The monitoring wells are categorized into upgradient wells which monitor the background water quality and downgradient wells which detect any potential contaminants which may be leaving, or have left, the landfill site. The monitoring wells are also grouped into wells located on site and off site of the PVLF.

On Site Upgradient Monitoring Wells

The on site upgradient monitoring wells include wells M41A, M42A, M45A, M47B, and M48A. These wells are installed in the alluvium and bedrock to characterize the quality of the ground water entering upgradient of the site. Monitoring wells M41A and M42A are located on the southwestern edge of the South Coast Botanic Garden. Monitoring well M45A is located on the southwestern edge of the main site. Monitoring wells M47B and M48A are located on the southwestern edge of Ernie Howlett Park.

M46A is also an on site upgradient monitoring well for the PVLF, but it is also downgradient of the Hawthorne Canyon Landfill (HCLF) adjacent to the PVLF. Therefore, since the water quality at this well may represent landfill impacted ground water, M46A has not been included as an upgradient monitoring location in any summaries or calculations. The small off site canyon formerly known as Hawthorne Canyon, was filled in the late 1960s by the Sanitation Districts under agreements with and the City of Rolling Hills Estates and the owners of the property at that time. Fill operations were conducted in accordance with the conditions of a permit obtained from the Regional Water Quality Control Board. The site was filled with municipal waste originating from the City of Los Angeles.

Off Site Upgradient Monitoring Wells

Several of the upgradient monitoring wells are located off site of the PVLF. Wells in this group include M54B (RFB20), M55B (RFB21), M56B (RFB24), M57B (RFB25), M58B (RFB26), M59B (RFB27), M60B (RFB29), M61B (RFB31), and M62B (RFBL3). These wells are installed in the bedrock to monitor the presence and quality of the background ground water.

On Site Downgradient Monitoring Wells

The on site downgradient monitoring wells include the South Coast Botanic Garden monitoring wells, northeast boundary bedrock monitoring wells, Ernie Howlett Park monitoring wells, and main site monitoring wells.

The South Coast Botanic Garden monitoring wells are located on the downgradient side of this area and monitor the alluvial drainages for indications of landfill effects. These wells are designated M38A, M39A, M40A, and M43A.

The northeast boundary bedrock monitoring wells are located along the northeast boundary of the main site. The Sanitation Districts installed five bedrock monitoring wells to investigate the presence and quality of ground water in the bedrock. These locations are designated as monitoring wells M30B, M32B, M33B, M34B, and M35B. At three locations an initial boring was drilled to the first fracture zone below the base of the landfill or to 50 feet below the bottom of the landfill, whichever came first. A well was completed with screening on the bottom 20 feet in each of the initial boreholes. A second adjacent boring was drilled to the appearance of the first water in the bedrock based on review of the initial boring data by a California Registered Geologist (RG). If the bedrock did not yield free water, a second boring was not drilled. This was the case with proposed well pair M30B and M31B. Therefore boring M31B was not drilled, and well M31B was not installed.

The Ernie Howlett Park monitoring wells include seven monitoring wells located on the downgradient side of Parcel 4. These wells are designated P4-6, P4-7, P4-8, P4-9, P410, P411, and P412. The Sanitation Districts installed these seven monitoring wells during exploratory drilling at Ernie Howlett Park. Although twelve exploratory borings were made, bedrock was encountered at or near the ground surface in borings 1 through 5. No water was found in these borings and wells were not installed. The Sanitation Districts provided further information regarding the installation and monitoring of the Ernie Howlett Park wells in a letter dated June 16, 1986, to the RWQCB. The sampling plan outlined in the SSAP includes two of these wells, P4-6 and P410. The other Ernie Howlett Park wells are not included because they provide redundant data.

The main site monitoring wells include M44A, and M53B (RFB16). Monitoring wells M44A and M53B (RFB16) are located on the southeast side of the main site adjacent to Crenshaw Boulevard. Prior to development of the PVLF, the previous site owners conducted mining and quarrying operations at the site. Monitoring well M44A is located in an old quarry area that was backfilled with mine tailings. Monitoring well M44A is partially completed in the zone that corresponds to these mine tailing. Monitoring well M53B (RFB16) is partially completed in the alluvium and partially in the bedrock.

Off Site Downgradient Monitoring Wells

This designation includes off site downgradient wells near Hawthorne Boulevard, off site downgradient wells near Crenshaw Boulevard, and off site downgradient wells to the northeast of the PVLF between Hawthorne and Crenshaw Boulevards. The off site downgradient wells near Hawthorne Boulevard include PV-3, M23A, M24A, M25A, M26A, M49A, M50B (RFB3), M51B (RFB4), M63B (AB2), and M64B (AB1a). Wells PV-3, M23A, M24A, M25A, M49A, M51B (RFB4), M63B (AB2), and M64B (AB1a) monitor the downgradient confluence area of the northerly extension of the Agua Negra Canyon (the major canyon beneath the main site) and a lesser, related canyon where Ernie Howlett Park was filled. Wells M26A and M50B (RFB3) are located in the West Coast Basin and monitor the aquifer downgradient of the location where the canyons meet the Palos Verdes fault zone.

The off site downgradient wells near Crenshaw Boulevard include M36A, M37A, M52B (RFB13), M69B (AB6), and M70B (AB7). Wells M36A, M37A, and M69B (AB6) monitor the downgradient area of the northerly extension of the Agua Magna Canyon (the major canyon beneath the South Coast Botanic Garden). Well M70B (AB7) monitors the downgradient area of a small unnamed canyon that eventually also joins the northerly extension of the Agua Magna Canyon. Well M52B (RFB13) is located in the West Coast Basin and monitors the aquifer downgradient of the location where the canyon meets the Palos Verdes fault zone.

The off site downgradient wells to the northeast of the PVLF between Hawthorne and Crenshaw Boulevards include M65B (AB3), M66B (AB4), M67B (AB8), and M68B (AB9). Wells M65B (AB3) and M66B (AB4) monitor the bedrock ground water zone immediately downgradient

of the PVLF. Wells M67B (AB8) and M68B (AB9) are screened in the West Coast Basin and monitor the aquifer immediately to the northeast of the Palos Verdes fault zone.

1.3.4.3.5 Lysimeters

The Sanitation Districts installed nine vadose zone lysimeters to monitor the vadose zone both upgradient and downgradient of the landfill. Lysimeters L2 through L6 monitor the vadose zone on the downgradient edge of the landfill site. Lysimeter L1 monitors the vadose zone on the upgradient edge of the main site. Lysimeters L7 (RFBL1) through L9 (RFBL3) monitor the vadose zone upgradient of the landfill. L7 (RFBL1) monitors the vadose zone in the Valmonte Diatomite member of the Monterey Formation, L8 (RFBL2) monitors the vadose zone in the Altamira Shale member of the Monterey Formation, and L9 (RFBL3) monitors the vadose zone in the Malaga Mudstone member of the Monterey Formation.

1.3.5 Previous Investigations

The Sanitation Districts have commissioned numerous technical studies to investigate site background conditions and potential migration pathways on and surrounding the PVLF site. This section of the RI Report will briefly discuss the principal studies which have been used in the development of the remedial investigation.

1.3.5.1 Air

In 1984, the California legislature passed and the governor signed AB 3525 (Calderon). This bill set forth gas and ambient air testing requirements at disposal sites in California. In September 1986, the governor signed Health and Safety Code (HSC) Section 41805.5 which modified AB 3525. HSC Section 41805.5 defines an inactive disposal site as one which has not received solid waste since January 1, 1984. The PVLF meets this definition of an inactive site. In accordance with the requirements of HSC Section 41805.5, the Sanitation Districts submitted a completed screening questionnaire to the local air pollution control officer (the South Coast Air Quality Management District [SCAQMD]) in November 1986.

Based on the information included in the questionnaire, the SCAQMD decided that studies of landfill gas characterization, off site gas migration, integrated surface gas, and specified air contaminants in the ambient air adjacent to the solid waste disposal site were required. These items were documented in the Solid Waste Air Quality Assessment Test (SWAQAT) Report (Sanitation Districts, 1987). The SCAQMD also directed the Sanitation Districts to follow the guidelines developed by the California State Air Resources Board (ARB) in implementing the HSC Section 41805.5 study. A formal SWAQAT proposal for the PVLF was submitted to the SCAQMD on November 5, 1987. The proposed testing procedures for gas stream characterization and gas migration were approved on November 13, 1987, with the landfill gas tests starting on November 18, 1987. The ambient air testing program received verbal approval November 17, 1987, by SCAQMD. This was confirmed in writing on November 19, 1987. The meteorological survey began on November 24, 1987, followed by the ambient air monitoring which started on November 29, 1987.

The Sanitation Districts completed the monitoring and submitted the results to the SCAQMD on December 31, 1987. The monitoring program was performed in accordance with the ARB guidelines as directed.

The SWAQAT Report (Sanitation Districts, 1987) summarizes the results of the ambient air testing, the landfill gas characterization testing, the integrated surface gas analyses, and the off site gas migration testing per HSC Section 41805.5 requirements. The ARB specified air contaminants detected in the downwind ambient air samples were within the ranges of background levels found in the Los Angeles Basin and were no different from those found in upwind samples. It was concluded that the landfill does not affect the local air quality. Landfill gas samples were taken from the header lines going into Flare Stations No. 2 and No. 3 on two separate days. Integrated surface gas was collected from a 50,000 square foot grid at the center of the disposal site on two separate days. The off site gas migration testing indicated that landfill gas was not identified at the perimeter of the landfill.

1.3.5.2 Geologic

A geologic investigation is one whose sole purpose is to define the geologic conditions of a particular study area. The ultimate goal of such investigations is to determine the geologic history

of the study area which portrays a sequence of natural events responsible for the formation of the stratigraphy, geologic structure, and paleontology of the study area. Although the Sanitation Districts have not conducted an investigation solely for the purpose of defining the site geologic conditions, several investigations have provided information on the site geology of the PVLF as a portion of the work scope. All studies used in the development of this report are referenced in Section 8.0; however, three of these studies are significant to the understanding of the site geology and ultimately to the development of the remedial investigation. The major purposes of these studies are outlined below.

1) Robert Stone Associates, January 27, 1975, Geologic and Soils Engineering Study, Proposed Class I Landfill, Crenshaw Boulevard, Los Angeles County, California. The Sanitation Districts commissioned this study to investigate the feasibility of expanding the PVLF as a Class I facility into the Parcel 6 area (located at the northeastern section of the main site). Thirty exploratory boreholes were drilled within Parcel 6 to define depth to bedrock, characterize the bedrock structure, determine the depth to ground water, and to perform hydraulic conductivity tests in selected boreholes. Detailed geologic maps and cross sections of Parcel 6 were constructed as a part of this field investigation.

2) Kleinfelder, June 1988, Report of Monitoring Well Completion and Hydrogeologic Conditions, Palos Verdes Landfill, Palos Verdes, California. The Sanitation Districts commissioned this study to fulfill the requirements of the Water Quality Solid Waste Assessment Test (SWAT) program. As a part of this SWAT program, 23 ground water monitoring wells were installed around the PVLF. The exploratory borehole for each monitoring well was logged to determine the geologic unit monitored by each well.

3) Herzog Associates, January 29, 1991, Palos Verdes Landfill Hydrogeological Investigation Phases I and II, Los Angeles County, California. The Sanitation Districts commissioned this investigation to fulfill the bulk of the requirements of the geologic and hydrogeologic portions of the remedial investigation, under which site geology, hydrogeology, and ground water quality were investigated. A total of 43 exploratory boreholes were drilled to define the geologic and hydrogeologic conditions immediately surrounding the PVLF. Exploratory boreholes were logged by RGs according to the most current stratigraphic nomenclature for the regional geologic units.

1.3.5.3 Ground Water

Ground water monitoring of one form or another has been performed at or near the PVLF since 1964, when the permit conditions required monitoring of three existing off site wells located in the West Coast Basin Aquifer. In 1976, the permit conditions required the first installation of on site wells. The ground water monitoring system has since been expanded to include 66 ground water monitoring wells which have been installed by the Sanitation Districts at or around the site. This section will outline the ground water monitoring performed under permit conditions and ground water monitoring performed as part of ground water quality investigations at the landfill prior to the remedial investigation.

All ground water monitoring wells installed by the Sanitation Districts are identified on Exhibits 1.3-9 and 1.3-10.

1.3.5.3.1 Ground Water Monitoring Under Permit Conditions

Regional Water Quality Control Board (RWQCB) Resolution 64-10 specified semi-annual monitoring of state wells 4S/14W-28G1 and 4S/14W-27N1 and quarterly monitoring of state well 4S/14W-28J1. These wells were production wells located in the West Coast Basin Aquifer. Ground water monitoring results were transmitted to the RWQCB on a quarterly basis. Periodically, off site production wells were destroyed due to construction activities. Correspondence between the RWQCB and the Sanitation Districts confirmed the destruction of these wells and the monitoring requirements were changed appropriately. Monitoring of off site wells continued until 1976, when the installation of on site wells was required by RWQCB Order No. 76-106.

RWQCB Order 76-106 permitted the engineered Class I disposal area in Parcel 6 of the main site. The engineered Class I area included a "leachate collection sump" (Sump 7), five monitoring wells in the bedrock along the northeast boundary of the main site (MW1 through MW5), and one monitoring well in the alluvium downgradient of Parcel 6 (MW6). MW1 through MW5 were to be monitored on a quarterly basis, MW6 and off site state well 4S/14W-28G1 were to be monitored semi-annually, and Sump 7 was to monitored monthly. The monitoring results from these wells were transmitted to the RWQCB on a monthly basis. In 1991, monitoring wells MW1 through MW6 were

abandoned in accordance with all appropriate well abandonment regulations. Other, newer wells (M30B, M32B through M35B, and M07A) act as replacement wells in the monitoring requirements. The abandonment of MW1 through MW6 and substitution of their replacement wells in the monitoring requirements were approved by the RWQCB in a letter dated June 30, 1992.

1.3.5.3.2 Ground Water Monitoring Proposed Under Palos Verdes Landfill Closure Plan

A Draft Site Closure and Maintenance Report for the PVLF (Closure Report) was submitted by the Sanitation Districts to the RWQCB in March 1983. The Closure Report summarized the results of the ground water monitoring of wells MW1 through MW6 and Sump 7. The results indicated that the ground water beneath the landfill was of naturally poor quality due to the marine origin of the native sediments. There had been no indication of landfill related ground water contamination in the on site wells or in the off site basin wells. The Closure Report proposed an expansion of the monitoring system to include sixteen new ground water monitoring wells. The wells were designed to encircle the site and provide ground water monitoring in the alluvium downgradient of the site where most of the ground water flow was thought to be occurring. In addition, the construction of a subsurface barrier was proposed. The barrier was intended to limit the hydraulic connection between the engineered Class I area (Parcel 6) and the West Coast Basin Aquifer deposits located several hundred feet to the northeast. Approval of the this Closure Report was never received by the Sanitation Districts and consequently the ground water monitoring system portion of the plan as proposed was not implemented due to lack of regulatory approval.

1.3.5.3.3 Ground Water Monitoring Associated with the Installation of the Subsurface Barrier

In 1984, the Sanitation Districts drilled a number of borings as part of a foundation study for the gas-to-energy facility. During the drilling of these borings, an area of ground water containing elevated levels of VOCs was discovered in the northern corner of the main site. The discovery of this contaminated ground water led to a ground water quality and geologic investigation to determine the source of the VOC affected ground water and an expedited drilling program for alignment of the subsurface barrier. As a result of this investigation, 22 permanent ground water monitoring wells and a cement bentonite subsurface barrier were installed. Well PV-3, an off site monitoring well located at the downgradient confluence area of the canyons which underlay the main

site and Ernie Howlett Park was installed in January 1986. The subsurface barrier was installed in March 1986. Seven ground water monitoring wells were installed on the downgradient edge of Ernie Howlett Park in April 1986. Fourteen monitoring wells were installed downgradient of the subsurface barrier in June 1986. Other wells were installed but subsequently abandoned due to the construction of the PVLF gas-to-energy facility.

Complete information regarding the ground water investigation conducted during the installation of the subsurface barrier system was reported to the RWQCB in the Draft Remedial Action Plan (Sanitation Districts, 1986a) and Supplemental Draft Remedial Action Plan (Sanitation Districts, 1986b). These reports were submitted in January and April 1986, respectively.

The Sanitation Districts believe that process waters from the Getty Synthetic Fuels (GSF) facility contributed to the ground water contamination in this area. The Getty facility was operated in the northwestern corner of the main site near the existing gas-to-energy facility. From approximately March 1978 to May 1985, condensate and process waters generated from this facility were discharged to either of two liquid injection wells: RSF-1 or RSF-2. Injection well RSF-1 was located approximately 200 feet south of the present gas-to-energy facility. Records of RSF-1 indicate that it was approximately 110 feet deep, terminated in refuse deposits, and accepted roughly 2,200 gallons per day of liquids generated from the Getty facility. In November 1984, RSF-1 overflowed and all injection activities were moved to RSF-2, located approximately 50 feet east of the present gas-to-energy facility. According to the Sanitation Districts' records, RSF-2 was also roughly 110 feet deep, terminating in refuse, and also accepted approximately 2,200 gallons per day of condensate and process waters from the Getty facility. Liquid injection to RSF-2 terminated in May 1985.

1.3.5.3.4 Ground Water Detection and Monitoring Well Program Report and SWAT

The Sanitation Districts proposed to install an extensive network of ground water monitoring wells in the Closure Report and again in the Draft Remedial Action Plan. The monitoring well network plan was presented in the Draft Ground Water Detection and Monitoring Well Program Report. The network design was intended to provide information on ground water quality and on ground water flow patterns in the landfill area. This report was submitted to the RWQCB in July 1986. Twenty-three new monitoring wells (M23A through M26A, M30B, M32B through M35B, M36A

through M46A, M47B, M48A, and M49A) and six vadose zone lysimeters (L1 through L6) were to be located both off site and on site. The wells and lysimeters were installed during 1987 and 1988. Monitoring results from these monitoring wells are reported by the Sanitation Districts to the RWQCB in the Technical Reports for the PVLF which are submitted on a monthly basis. The Sanitation Districts initially intended to prepare a report which summarized the results of this investigation. However, due to the start of the remedial investigation process, the Sanitation Districts decided to incorporate the monitoring results into the comprehensive ground water assessment presented in this report.

Section 13273 of the California Water Code (CWC) required that a SWAT be conducted for numerous site throughout the state, including the PVLF. The SWAT proposal was submitted to the RWQCB on July 1, 1986. The ground water monitoring network proposed in the Ground Water Detection and Monitoring Well Program Report in addition to the in-place monitoring network at that time were proposed in the SWAT program proposal. The SWAT proposal was approved by the RWQCB on January 21, 1987. A SWAT report was submitted to the RWQCB on July 1, 1987.

1.3.5.4 Risk Assessment

In 1987, the Air Toxics Information and Assessment Act (AB 2588) established a statewide program for the inventory of air toxics emissions from individual facilities as well as requirements for potential risk assessment preparation and public notification of the risk assessment results. The AB 2588 program affected over 5,000 facilities in the South Coast Air Basin including the solid waste management facilities operated by the Sanitation Districts. The requirements of the program are multi-tiered. Essentially, a toxic inventory of emissions is prepared for individual sources within a facility. The details of the air toxics emissions inventory plan for PVLF are presented in Appendix 5 of the AALGCP. The inventory results are then subjected to a prioritization screening procedure developed by the SCAQMD. This procedure determines the facilities that must prepare a health risk assessment (HRA) of the reported emissions' impact on the local community. On June 6, 1991, five of the Sanitation Districts solid waste management facilities were notified to prepare and submit HRAs, including the PVLF.

A health "risk assessment" is a procedure for determining the probability of excess cancer risk or non-cancer effects associated with a specific activity. The highly conservative assumptions used to prepare an HRA provide results that can be confidently referred to as an "upper level of risk"; the actual risk is very likely to be much lower. The approaches used to prepare the HRA for the PVLF were based upon procedures developed by the California Air Pollution Control Officers Association (CAPCOA) and SCAQMD.

The HRA addressed a total of seventeen substances on the AB 2588 list, all of which, except chlorine, are VOCs. Of the seventeen substances, eleven are considered carcinogenic and were evaluated for cancer risk, while all seventeen were evaluated for non-cancer health effects. For the purpose of quantifying emissions and later performing air dispersion modeling, emission sources were divided into three categories: 1) point sources (i.e. stacks); 2) mobile sources; and 3) landfill surface. Point source emissions were determined by actual field measurements (except for cooling tower emissions which were calculated). Mobile source emissions were calculated using emission factors published by the SCAQMD and EPA. Emissions of gas from the landfill surface were determined by a procedure developed by CARB.

Evaluation of human exposure requires consideration of emissions associated with the landfill operations along with the transport of those emissions through the atmosphere. The potential risks associated with these emissions are a function of the magnitude of exposure and toxicity of potency of the substances under review. An air dispersion modeling study was conducted to quantify the potential magnitude of exposure in the population surrounding the PVLF and the resultant exposure used as inputs to the risk assessment model. The risk model uses exposure information in conjunction with toxicity and potency data to generate a final risk value.

The risk assessment focused on two different exposure scenario calculations. The first exposure scenario calculation was for hypothetical maximum exposed individuals (MEI) in both a residential and employment area (thus, two MEI calculations were performed), and individuals exposed at sensitive receptors (i.e., day care centers, schools, hospitals). The MEI was assumed to have characteristics that maximize exposure (i.e., inhales the maximum level of toxics for 70 and 46 years, residential and employment/sensitive receptor locations, respectively). A second exposure scenario

calculation determined the cancer burden, or the number of excess cancers estimated in the population as a result of exposure to emissions associated with the landfill operations.

The risk assessment addressed both cancer and noncancer health impacts. The assessment of cancer risks requires adoption of the assumption that any exposure to a carcinogen, no matter how small, carries with it a finite risk of contracting cancer. Cancer risk is assumed to accumulate over an individual's lifetime as their cumulative exposure increases. For an individual carcinogenic substance, the total lifetime cancer risk is equal to the exposure (or "dose") multiplied by the potency of the carcinogen.

The analysis of the noncancer toxic endpoints of substances is conducted on the basis of a no-effect threshold exposure. In other words, for noncancer health effects, there exists a threshold of exposure which must be exceeded for any adverse health impact to occur. The risk assessment addressed the potential for chronic health impacts due to long-term exposure as well as health impacts that could occur from acute exposure. An additional noncancer impact, interactive health effects, was also determined by the calculation of a Hazard Index. The Hazard Index calculation is applied to groups of substances with a similar toxic endpoint or target organ.

The results of the quantitative cancer risk estimates indicated an incremental lifetime risk of 0.27 per million to the theoretical MEI in a residential area and 0.07 per million to the MEI in an employment area. The residential maximum impact is located approximately 62 meters to the east of the property line. The maximum employment impact is located on the property line of the South Coast Botanic Garden. The MEI risk at the residential site is based upon a 70 year, 24 hour per day exposure and at the employment site, a 46 year, 240 days per year, eight hours per day exposure. Both scenarios assume that 100 percent of the individual substances are absorbed through inhalation. An overall maximum receptor was determined which was higher than the locations of the residential and employment MEI; however, the location is in an unpopulated area and thus need not be considered. Risk was not calculated at sensitive receptors since all categories of maximum receptors were below one per million.

The substances contributing the greatest amount to the calculated risk were formaldehyde, benzene, and vinyl chloride. Formaldehyde emissions result from the mobile equipment

used in the day-to-day operation and maintenance of the landfill. The percent contribution to cancer risk from mobile equipment ranged from 32 to 48 percent depending upon the MEI category and location. Benzene can be attributed to mobile sources and the small amount of landfill surface gas emissions, and vinyl chloride can also be attributed to the small amount of landfill surface gas emissions. The percent contribution to cancer risk from landfill surface gas emissions ranged from 52 to 68 percent depending upon the MEI category and location.

The noncancer health effects assessment showed negligible impact to the local population from chronic (long-term) and acute (short-term) exposure to emissions associated with the PVLF when compared to background exposure to these substances and published acceptable exposure guidelines. The potential for interactive health impacts associated with exposure to multiple pollutants, as calculated by the Hazard Index, were, in most cases, several order of magnitudes below acceptable threshold values. For some endpoints in the calculation a Hazard Index value was calculated for the facility impact and background separately. The Hazard Index calculated for the background was 60 times higher than the index calculated for the facility. Overall, the maximum exposure to facility emissions was not found to produce a significant increase to existing levels of exposure.

The landfill gas production at the PVLF will decrease over time since this site has not accepted waste since 1980. Thus, the already low risk associated with the operation and maintenance of this site will continue to decrease over time.

1.4 REPORT ORGANIZATION

This report presents the results of the remedial investigation conducted at the PVLF from April 1990 through June 1994. In addition, the results of ground water monitoring performed prior to implementation of the SSAP (data from January 1986 through December 1990) were reviewed and included in the remedial investigation evaluation as appropriate. Ground water monitoring results for radioactivity analysis and for eight wells installed in December 1993 and January 1994 are included through December 1994.

The suggested remedial investigation report format from the appropriate EPA guidance document (U.S. EPA, 1988) was employed as the basis for the organization of this report. As recommended in the guidance document, this report focuses on the media of concern, or the potential migration pathways, and particularly on the integration of all field results and evaluations into a comprehensive overview of site characteristics. The body of the report is divided into eight sections presenting the investigation findings and interpretations, followed by six main appendices containing supporting data and reports.

Section 1.0, the introduction, summarizes the remedial investigation objective, purpose, scope, and approach. Information on the site location, history, area demography and land use, as well as existing environmental monitoring and control systems at the site and previous investigations performed in the area, are also included.

Section 2.0 outlines the study area field activities. The objectives and scope of the field studies for each of the potential migration pathways--air, surface water and sediment, soil, and ground water (including geologic and hydrogeologic investigations)--are detailed and discussed. The field methodologies for sample collection, laboratory analytical methodologies, statistical evaluation methodologies, and QA/QC are also described.

The results of the study area investigations are discussed and summarized in Section 3.0. The ambient air and landfill gas, surface water and sediment, geology, hydrogeology, soils, and ground water study results are included. All analyses performed to interpret the data collected, including geologic and hydrogeologic modeling, are detailed.

The nature and extent of contamination determined from the remedial investigation is portrayed in Section 4.0. The nature and extent of contamination by pathway is summarized, as well as across all pathways through the use of geologic cross sections augmented with chemical data from all media.

Section 5.0 summarizes the ground water contaminant transport modeling performed to estimate the dispersion of potential chemicals of concern from the landfill area to potential receptor points. This analysis was performed to provide input for the risk analysis.

In Section 6.0, the baseline risk assessment for the PVLF prepared by the Sanitation Districts' consultant, Dames & Moore, is presented. The available site characterization data, including modeled estimates of chemical concentrations in several media, were used to estimate the potential health and environmental risks posed by the site in the absence of remedial measures.

The conclusions drawn by the Sanitation Districts based on the results and analyses performed as part of the remedial investigation are contained in Section 7.0. Section 8.0 contains the references cited in the report.

The appendices are divided into six sections. Appendix A contains all analytical data collected during the remedial investigation, along with copies of the chains of custody. Appendix B consists of the QA/QC analyses and data for air, soil, and water samples collected during the investigation. Field data, consisting of boring logs, hydrographs, and field activities are attached in Appendix C. Technical memoranda on field/modeling activities are attached in Appendix D. Various supporting reports, including the hydrogeologic modeling and the contaminant transport modeling reports prepared by the Sanitation Districts' consultant Dames & Moore, Inc., are attached in Appendix E. Finally, Appendix F summarizes the community relations activities accompanying the remedial investigation.