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INITIAL ASSESSMENT STUDY OF MARINE CORPS AIR STATION, EL TORO, CALIFORNIA

NEESA 13-074

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY
Port Hueneme, California

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INITIAL ASSESSMENT STUDY
MARINE CORPS AIR STATION
EL TORO, CALIFORNIA

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NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY

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NAVY ASSESSMENT AND CONTROL
OF INSTALLATION POLLUTANTS (NACIP) DEPARTMENT
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NEPSS

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FOREWORD

The Department of the Navy developed the Navy Assessment and Control of Installation Pollutants (NACIP) program to identify and control environmental contamination from past use and disposal of hazardous substances at Navy and Marine Corps installations. The NACIP program is part of the Department of Defense Installation Restoration Program, and is similar to the Environmental Protection Agency's "Superfund" program authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

In the first phase of the NACIP program, a team of engineers and scientists conducts an Initial Assessment Study (IAS). The IAS team collects and evaluates evidence of contamination that may pose a potential threat to human health or to the environment. The IAS includes a review of archival and activity records, interviews with activity personnel, and an on-site survey of the activity. This report documents the findings of an IAS at the Marine Corps Air Station (MCAS) El Toro, California.

ıfirmation Studies under the NACIP program were recommended ..or nine sites at MCAS El Toro, Western Division, Naval Facilities Engineering Command (WESTNAVFACENGCOM), will assist MCAS El Toro in implementing the recommendations.

Questions regarding this report should be referred to the Naval Energy and Environmental Support Activity, Code 112N at AUTOVON 360-3351, FTS 799-3351, or commercial (805) 982-3351. Questions concerning confirmation work or other follow-on efforts should be referred to WESTNAVFACENGCOM Code 1141, at AUTOVON 958-5461, or commercial (619) 696-5461.

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EXECUTIVE SUMMARY

This report presents the results of an Initial Assessment Study (IAS) conducted at the Marine Corps Air Station (MCAS) El Toro, California. The purpose of an IAS is to identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous materials operations.

Surface water and ground water are possible pathways for migration of possible contamination at MCAS El Toro. Three washes--Bee Canyon, Aqua Chinon, and Borrego Canyon--drain surface runoff from or near several past disposal sites. These washes eventually empty into the Upper Newport Bay Ecological Reserve, located 9 miles southwest of the station. Contamination could potentially affect the shallow ground water zone which occurs 37 to 92 feet below the station. Contamination of the deeper regional water supply aquifer (the middle aquifer), is not likely for the majority of the station due to the extensive clay strata underlying the majority of the station. However, deep regional water supply aquifer contamination may occur along the bottoms of natural canyons and washes, from vertical seepage, due to a thinner layer of, or absence of, clay strata. Specific receptors include humans, and the 12 species of animals and two species of plants at the Upper Newport Bay Ecological Reserve considered Rare, Endangered, or Threatened. The humans, animals and plants are potentially threatened by direct exposure to contaminants, or indirect exposure through the food chain.

Based on information from historical records, aerial photographs, field inspections, and personnel interviews, a total of 17 potentially contaminated sites were identified at MCAS El Toro. Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors.

The study concludes that, while none of the sites pose an immediate threat to human health or to the environment, nine warrant further investigation under the Navy Assessment and Control of Installation Pollutants (NACIP) program to assess potential long-term impacts. A Confirmation Study, involving sampling and monitoring of the nine sites, is recommended to confirm or deny the presence of the suspected contamination and to quantify the extent of any problems which may exist. The nine sites recommended for confirmation are listed below in order of priority:

Site 2 Magazine Road Landfill
Site 1 Explosive Ordnance Disposal Range
Site 3 Original Landfill

Site 11 Transformer Storage Area
Site 5 Perimeter Road Landfill
Site 17 Communication Station Landfill
Site 16 Crash Crew Pit No. 2
Site 9 Crash Crew Pit No. 1
Site 14 Battery Acid Disposal Area

The results of the Confirmation Study will be used to evaluate the necessity of conducting Remedial Measures or cleanup operations.

Remedial Measures are recommended for Site 4, Ferrocene Spill Area.

CHAPTER 1

INTRODUCTION

1.1 PROGRAM BACKGROUND. Past hazardous waste disposal methods, although acceptable at the time, have often caused unexpected long-term problems through release of hazardous pollutants into the soil and ground water. In response to a growing recognition of these problems, the U.S. Congress directed the U.S. Environmental Protection Agency (USEPA) to develop a comprehensive national program to manage past disposal sites. The program is outlined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of December 1980.

1.1.1 DOD Program. Department of Defense (DOD) efforts in this area preceded the nationwide CERCLA program. In 1975, the U.S. Army developed for DOD a pilot program to investigate past disposal sites at military installations. In 1980, DOD named this program the Installation Restoration Program and instructed the services to comply with program guidelines.

1.1.2 Navy Program. The Navy manages its part of the program, the Navy Assessment and Control of Installation Pollutants (NACIP), in three phases. Phase one, the Initial Assessment Study (IAS), identifies disposal sites and contaminated areas caused by past hazardous substance storage, handling, or disposal practices at naval activities. These sites are then individually evaluated with respect to their potential threat to human health or to the environment. Phase two, the Confirmation Study, verifies or characterizes the extent of contamination present and provides additional information regarding migration pathways. Phase three, the Remedial Measure, provides the required corrective measures to mitigate or eliminate confirmed problems.

1.2 AUTHORITY. The Chief of Naval Operations (CNO) and the Commandant of the Marine Corps (CMC) initiated the NACIP program in OPNAVNOTE 6240 of 11 September 1980, and MCO 6280.1 of 30 January 1981. These were superseded by OPNAVINST 5090.1 of 26 May 1983 and MCO P11000.8B of 9 December 1983. Naval Facilities Engineering Command (NAVFACENGCOM), manages the program within the existing structure of the Naval Environmental Protection Support Service (NEPSS), which is administered by the Naval Energy and Environmental Support Activity (NEESA). NEESA conducts the program's first phase, the IAS, in coordination with NAVFACENGCOM Engineering Field Divisions (EFDs). Activities are selected for an IAS by CNO, based on recommendations by NAVFACENGCOM, the EFDs, and NEESA. Approval of the Marine Corps Air Station (MCAS) El Toro, California for an IAS is contained in CNO letter ser 451/4U383534 of 26 March 1984.

1.3 SCOPE

1.3.1 Past Operations. The NACIP program focuses attention on past hazardous substance storage use and disposal practices on Navy property. Current practices are regularly surveyed for conformity to state and federal regulations and, therefore, are not included in the scope of the NACIP program. The IAS addresses operational nonhazardous disposal and storage areas only if they were hazardous waste disposal or storage areas in the past. Current operations are investigated solely to determine what types and quantities of chemicals or other materials were used and what disposal methods were practiced.

1.3.2 Results. If necessary, an IAS recommends Remedial Measures to be performed by the activity or EFD, or recommends Confirmation Studies to be administered by the EFD under the NACIP program. Based on these recommendations, NAVFACENGCOM schedules Confirmation Studies for those sites which have been determined by scientific and engineering judgment to be potential hazards to human health or to the environment.

1.4 INITIAL ASSESSMENT STUDY

1.4.1 Records Search. The IAS begins with an investigation of activity records followed by a records search at various government agencies including EFDs, national and regional archives and records centers, and U.S. Geological Survey offices. In this integral step, study team members review records to assimilate information about the activity's past missions, industrial processes, waste disposal records, and known environmental contamination. Examples of records include activity master plans and histories, environmental impact statements, cadastral records, and aerial photographs. Appendix A lists the agencies contacted during this study.

1.4.2 On-site Survey. After the records search, the study team conducts an on-site survey to complete documentation of past operations and disposal practices and to identify potentially-contaminated areas. With the assistance of an activity point-of-contact, the team inspects the activity during ground and aerial tours, and interviews long-term employees and retirees. The on-site survey for MCAS El Toro was conducted from 11 to 15 March, 1985; information in this report is current as of those dates.

Information obtained from interviews is verified by data from other sources or from corroborating interviews before inclusion in the report. If information for certain sites is conflicting or inadequate, the team may collect samples for clarification.

1.4.3 Confirmation Study Ranking System. With information collected during the study, team members evaluate each site for its potential hazard to human health or to the environment. A two-step Confirmation Study Ranking System (CSRS) developed at NEESA is used to systematically evaluate the relative severity of potential problems. The two steps of the CSRS are a flowchart and a numerical ranking model. The first step is a flowchart based on type of waste, containment, and hydrogeology. This step eliminates innocuous sites from further consideration. If the flowchart indicates that a site poses a potential threat to human health or to the environment, the second step, the model, is applied. This model assigns a numerical score from 0 to 100 to each site. The score reflects the characteristics of the waste, the potential migration pathways from the site, and possible contaminant receptors on and off the activity.

1.4.4 Site Ranking. After scoring a site, engineering judgment is applied to determine the need for a Confirmation Study or for immediate Remedial Measure. At sites recommended for further work, CSRS scores are used to rank the sites in a prioritized list for scheduling projects. For a more detailed description, refer to NEESA 20.2-042, Confirmation Study Ranking System.

1.4.5 Confirmation Study Criteria. A Confirmation Study is recommended for sites at which (1) sufficient evidence exists to indicate the presence of contamination and (2) the contamination poses a potential threat to human health or to the environment.

1.5 CONFIRMATION STUDY. Generally, the EFD conducts the Confirmation Study in two phases--verification and characterization. In the verification phase, short-term analytical testing and monitoring determines whether specific toxic and hazardous materials, identified in the IAS, are present in concentrations considered to be hazardous. Normally, the IAS recommends verification phase sampling and monitoring. The design of the characterization phase usually depends on results from the verification phase. If required, a characterization phase, using longer-term testing and monitoring, provides more detailed information concerning the horizontal and vertical distribution of contamination migrating from sites, as well as site hydrogeology. If sites require Remedial Measures or additional monitoring programs, the Confirmation Study recommendations include the necessary planning information for the work, such as design parameters.

1.6 IAS REPORT CONTENTS. In this report, the significant findings and conclusions from the IAS are presented in Chapter 2. Recommendations are presented in Chapter 3. Chapter 4 describes general activity information, history, biology, and physical features. Chapters 5 through 8 trace the use of chemicals and hazardous materials from storage and transfer, through manufacturing and operations, to waste processing and disposal. The latter chapters provide detailed documentation to support the findings and conclusions in Chapter 2. Appendix B provides the meanings of the acronyms used in this report.

CHAPTER 2. SIGNIFICANT FINDINGS AND CONCLUSIONS

2.1 INTRODUCTION. This chapter summarizes the significant findings and conclusions of the Initial Assessment Study (IAS) regarding characteristics of the disposal and spill sites identified at the Marine Corps Air Station (MCAS) El Toro, California. First, aspects of local geology, hydrogeology, surface drainage, and biology are discussed with regard to potental contaminant migration pathways and potential contaminant receptors. Next, significant findings for sites recommended for confirmation studies are summarized and conclusions are presented. Finally, sites not recommended for confirmation are discussed.

2.1.1. Hydrogeology and Migration Potential. The location of MCAS El Toro is shown on Figure 2-1. Soils beneath the majority of the station are well-drained silty clay loams and fine sandy loams with moderate infiltration rates. Soils beneath the current MCAS El Toro family housing area are excessively well drained loamy sands with a high infiltration rate. Soils along the canyons to the north of the station are generally well drained river wash, gravelly loams, fine sandy loams and clay loams with moderate to high infiltration rates.

Beneath these soils lie alluvial deposits of up to 200 feet in thickness, which consist of unconsolidated silt and clay with discontinuous lenses of sand and gravel. Shallow marine or lagoonal deposits lie beneath the alluvial deposits and consist of sand, gravel, silt, and clay with interbedded limestone lenses. The shallow marine deposits are up to 550 feet in thickness. Beneath the shallow marine deposits lie consolidated sedimentary rocks considered to be the local bedrock. Igneous and metamorphic rocks comprise the basement rocks which lie at a depth of between 4,000 and 5,000 feet below the ground surface in the MCAS El Toro area.

Two main aquifer zones lie beneath the station: a shallow and upper aquifer system, and a middle aquifer system. The shallow and upper aquifer system is variable in thickness, though generally less than 200 feet, and contains numerous small perched water tables and a few zones which are under semi-confined conditions. Ground water from this aquifer is not used as a supply source in the MCAS El Toro area.

The middle aquifer, separated from the shallow and upper aquifer system by a sequence of silts and clays 50 to 150 feet thick, is between 0 to 550 feet thick in the MCAS El Toro area.

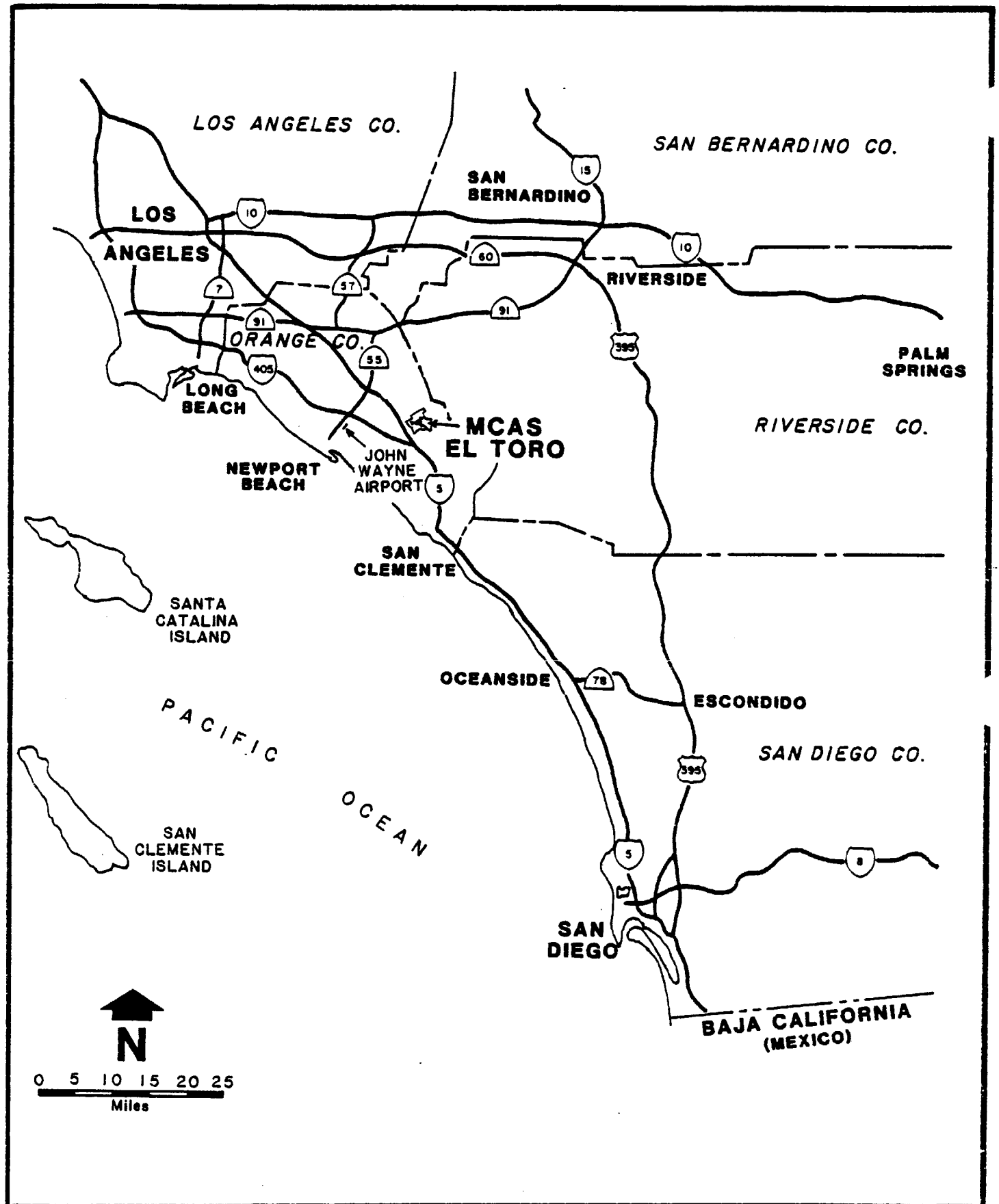

Figure 2-1. Location Map of Marine Corps Air Station, El Toro

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

This middle aquifer system is absent in the recharge areas along the base of the surrounding hills especially in the canyons north of the station.

Where the alluvial deposits are thin and lie directly on bedrock, recharge to the lower water-bearing layers through down-basin migration is possible. These thin areas include the base of hills and the canyons north of the station where the alluvial fans are composed of a coarser fraction of material and are thinner, thus allowing a higher rate of infiltration for potential contaminants to enter the lower ground water system. The depth to ground water in these areas ranges from 37 to 92 feet. However, in the majority of the station area, ground water depths for the aquifer system are greater than 200 feet. Typically, as beneath MCAS El Toro, the upper 100 feet of the alluvial deposits contain 60 feet of clay strata which acts as an incomplete confining zone for the lower water-bearing layers and helps restrict further vertical migration of potential contaminants. However, some vertical migration will occur at the discontinuous zones, and at any leaking, abandoned wells.

Ground water flow is thus a potential pathway of contaminant migration. The station obtains drinking-water supplies from the Irvine Ranch Water District which operates deep wells into the middle aquifer system and purchases water from imported and surface reservoir sources. These wells lie 2 to 2-1/2 miles west, and downgradient of the station. Within a one mile radius of the station, ground water is produced only by the Irvine Company and is used only for agricultural purposes. Contaminants from MCAS El Toro are able to migrate to the wells. (See Chapter 4 for details of ground water and well systems.)

Surface-water drainage is also a potential pathway of contaminant migration. Rainfall and excess irrigation water runs off into storm drainage channels. MCAS El Toro storm-water and facility drains also empty into these drainage channels. In some areas local surface gradients flow into adjacent agricultural lands prior to reaching the drainage channels. The drainage channels ultimately flow into San Diego Creek and then Newport Bay. Contaminants from MCAS El Toro could enter the drainage channels and ultimately the Newport Bay. (See Section 4.5.1 for climatology discussion.)

2.1.2. Potential Contaminant Receptors. MCAS El Toro is situated in a semiurban agricultural area of Southern California. The majority of the land immediately adjacent to the station is used to raise oranges and other agricultural crops. The University of California has an agricultural field station directly north of the station. A small industrial complex across Borrego Canyon Wash adjoins the station boundary to the southeast, next to the MCAS golf course. The city of East Irvine is located immediately adjacent to the northwest margin of the station.

Potential human receptors occur through direct or indirect contact. Contaminants present in drainage ditches could migrate into Bee Canyon, Agua Chinon or Borrego Canyon Wash which are not restricted to direct human exposure outside of the station. Indirect human exposure is likely to occur through consumption of agricultural goods produced on lands within and immediately surrounding the station where surface migration of contaminants has occurred.

Nine miles southwest and down drainage from the station lies the Upper Newport Bay Ecological Reserve. This reserve encompasses 752 acres of coastal wetlands set aside for wildlife and contains twelve species of animals and two plants classified by the State of California as either Rare or Endangered (Wilcox, No date). Drainage from the installation is likely to reach the reserve by way of Bee Canyon, Agua Chinon Wash, and Borrego Canyon, via the San Diego Creek. A 300-acre duck pond area is located along San Diego Creek between Newport Bay and the station. Surface drainage from the station enters San Diego Creek and birds from this pond area would experience direct and indirect contact with possible contaminants if they enter San Diego Creek or the Ecological Reserve of Upper Newport Bay. Also, the California least tern (Endangered) and California black-tailed gnat catcher (Candidate 2) are reported to nest about 5 to 8 miles southwest of MCAS El Toro. These species could feed on, or use for nesting, materials along San Diego Creek, or in the reserve and contact possible contaminants.

2.2 CONFIRMATION STUDY SITES. Of the seventeen disposal spill sites identified as MCAS El Toro, nine are recommended for Confirmation Studies. Table 2-1 summarizes the findings of the disposal and spill sites. Plate 1, Appendix F shows the locations of these sites. Unless otherwise stated, the final disposition of excavated soils could not be determined. Reference Chapter 8 for more details of the respective site operations. Where the broad category of "solvents" is used, reference Appendix E for more details.

2.2.1. Site 1, Explosive Ordnance Disposal Range. Site 1 is located along Magazine Road in the West Fork of Borrego Canyon Wash approximately 200 yards north of the new detonation shack. Site 1 is located at an elevation of 700 feet, approximately 300 feet higher than the station and about 1-1/2 miles upstream of the nearest agricultural-use lands along Borrego Canyon Wash. The disposal range consists of two 100-foot diameter pits in which 55-gallon drums containing sulfur trioxide chlorosulfonic acid (FS smoke) were buried in each pit in 1982. One pit lies west of the road and one lies east. After burial, these drums were ruptured by using C-4 explosives. It is estimated that approximately 750 gallons of sulfur trioxide chlorosulfonic acid was not destroyed by combustion during the explosion in each pit, for a total of 1,500 gallons at the site. Yet, these estimates may be high, since sulfur trioxide chlorosulfonic acid readily volatilizes and reacts easily with water. (See Section 8.2 for further site details.)

Table 2-1 Summary of Disposal and Spill Sites at MCAS El Toro, California

Site number	Site name	Map coordinates	Period of operation	Types of materials disposed	Comments
SITES RECOMMENDED FOR CONFIRMATION STUDIES					
74-1	Explosive Ordinance Disposal Range	D-14/ E-14	1982	Sulfur trioxide chlorosulfonic acid	
74-2	Magazine Road Landfill	L-16/17	Late 1960s to 1980	Inert solid waste, municipal solid waste, transformers, lead batteries, household refuse, hydraulic fluid, waste fuel, waste crankcase oil, lead-based paint residue, and scrap metal.	Up to 1,000,000 cubic yards total material. PCBs present, and lead elevated. Lies in recharge area on sand and gravel deposit with approximately 30 feet to bedrock.
74-3	Original Landfill	M-10/11	1943-1955	Municipal solid wastes, scrap metal, incinerator ash, construction debris, paint residues, unspecified oily wastes, industrial solvents, hydraulic fluid and engine coolants.	Trenches exposed during construction in area. In a high-density population area of station. Unknown solvents and solid wastes.
74-5	Perimeter Road Landfill	O-14	1955 to late 1960s	Municipal solid waste, scrap metal, unspecified fuels, solvents, paint residues, unspecified oily wastes.	Located in sandy soil. Unknown oily wastes and paint residues. Near farm fields and major surface drainage wash.
74-9	Crash Crew Pit No. 1	T-6/ S-7	1965 to 1971	Leaded aviation gasoline (AVGAS) JP-5, crankcase oil.	Located in sandy soil. Large quantity percolated into soils.
74-11	Transformer Storage Area	T-7	1968 to 1983	Transformer fluid.	PCBs present.
74-14	Battery Acid Disposal Area	S-4	1977 to 1983	Vehicle battery acid, lubrication oil and paint residues.	Lead, paint residue, and acid disposed of near a high traffic area
74-16	Crash Crew Pit No. 2	P-6	1972 to present	JP-5, leaded aviation gas, hydraulic fluid, crankcase oil, napalm, white phosphorus, and magnesium phosphate.	Large volume of fuel allowed to percolate to soil.
74-17	Communication Station Landfill	L-14	1981 to 1983	Cooking grease, oil and fuels from sumps. Rubble and municipal debris.	1,000-gallon vacuum truck repeatedly emptied at site. Sandy soils against small mountain range.

Table 2-1 Summary of Disposal and Spill Sites at MCAS El Toro, California (continued)

Site number	Site name	Map coordinates	Period of operation	Types of materials disposed	Comments
SITES NOT RECOMMENDED FOR CONFIRMATION STUDIES					
74-6	Drop Tank Drainage Area, No. 1	R-11	1960-1983	JP-5, lubrication oil.	Small quantities. Little staining visible.
74-7	Drop Tank Drainage Area, No. 2	S/T-9	1969-1983	JP-5, lubrication oil.	Materials spread over large area. No visible staining.
74-8	DPDO Storage Yard	U-9	1984	Transformer fluid.	Contaminated soil has been removed.
74-10	Petroleum Disposal Area	T-7	1952 to Mid 1960s	Crankcase oil, anti-freeze, hydraulic and transmission fluids, motor fuel, and solvents.	Ninety percent comprised of lube oil. Sprayed over large area so significant evaporation took place. Over 50 percent of original disposal area has been removed.
74-12	Sludge Drying Beds	U-6	1943-1972	Wastewater sludges.	Based on typical concentrations of heavy metals for municipal sludges from city sources.
74-13	Oil Change Area	S-4	1977-1983	Crankcase oil.	Removal of contaminated soil underway.
74-15	Suspended Fuel Tanks	S-4	1979 to 1984	Diesel fuel.	Removal of contaminated soil underway. Small quantities of material.
SITES RECOMMENDED FOR REMEDIAL MEASURES					
74-4	Ferrocene Spill	N-10	1983	Ferrocene	Biodegradable. Not soluble in water.

Some sulfur trioxide chlorosulfonic acid may remain in the pits as a result of the insufficient addition of water by rainfall or containment in unexploded drums. The pH of the soils at the site will be decreased as a result of sulfuric acid formation.

In addition, it was reported that low-level radioactive waste may have been disposed of in the EOD range. Although no information could be obtained concerning the location of this site within the EOD range or the specific material disposed of, the possibility of its existence there should be recognized.

The soils at the site are sand and gravel which are conducive to percolation and migration of contaminants. Contaminants from the site may migrate to the agricultural-use lands at the base of the canyon or be carried further downstream to the upper Newport Bay Ecological Reserve. Because of the low annual net precipitation rate at the station, migration of these materials will be slow and would most likely occur during periods of heavy rainfall, further diluting the concentration levels of the contaminants which are migrating. This site poses a potential threat to human health through direct contact at the site and indirect food chain consumption, and to the environment from the indirect affects on the rare or endangered species present in the upper Newport Bay Ecological Reserve which feed at the station.

Based on the type and characteristic of the waste disposed of, the high potential for surface migration and the presence of potential receptors of contamination, Site 1 is recommended for a Confirmation Study.

2.2.2. Site 2, Magazine Road Landfill. Site 2 consists of a 22 acre landfill that lies along Borrego Canyon Wash adjacent to Building 1752. From the late 1960s until 1980 all solid wastes generated at the station, plus those from MCAS Tustin, were disposed of in this landfill. Some liquid wastes (as described below) were also deposited in the landfill. The landfill is situated in an old borrow pit which was backfilled in a series of lifts. Based on the overall dimensions, it is estimated a total volume of 800,000 to 1,000,000 cubic yards of material were placed in this landfill. Unlike earlier landfills, the majority of wastes placed in this landfill were not burned for volume reduction.

Wastes disposed of in the landfill reportedly include inert solid wastes such as construction debris, concrete, and asphalt; municipal solid waste, lead-batteries, scrap metal, household refuse, waste crankcase oil, hydraulic fluid, fuels, lead-based paint residue, solvents and possibly transformers. Individual quantities, and the actual makeup of these "categories" of wastes listed above, could not be determined, though reportedly almost any type of waste generated on station may have been disposed of at the landfill. (See Section 8.3 for further site details.)

Transformers containing PCB, lead-batteries, lead-based paint residue, and solvents are of concern. PCBs are carcinogenic, lead-batteries, and lead-based paint residue would raise the level of lead and lower the pH of the soils at the landfill. Solvents are likely to include commonly used aromatic or chlorinated solvents, based on known types of solvents used in industry at the time.

Site 2 is located in an abandoned borrow pit between two naturally-occurring intermittent streams which are the main tributaries to Borrego Canyon Wash. Bedrock is approximately 50 feet deep in this area. Based on the limits of the borrow pit it is estimated that 25 to 30 feet of sand and gravel remain beneath the landfill. Ground water would flow along this bedrock/alluvium contact down the canyon and enter the shallow and upper aquifer system. Contaminants are likely to migrate from the site by entering the ground water and traveling down-basin into the middle aquifer system, or by entering the surface drainage system and traveling to San Diego Creek. The middle aquifer systems are used as an agricultural water supply. San Diego Creek eventually empties into the Upper Newport Bay Ecological Reserve. Therefore, this site poses a potential hazard to human health indirectly through the food chain, and to the environment as contaminants migrating from the site enter the surface waters nearby.

Because of the large quantities and types of materials reportedly, or likely to be present in the landfill, and the location of the landfill with respect to surface and local ground water systems of concern, a Confirmation Study is recommended.

2.2.3 Site 3, Original Landfill. Site 3 is the original station landfill located between Perimeter Road and North Marine Way along Agua Chinon Wash. The landfill consists of a series of trenches and pits located on a 20-acre tract which were used for waste disposal between 1943 and 1955. Three trenches, each approximately 200 to 400 feet long, 20 to 30 feet wide and 20 to 25 feet deep, and two pits (each covering about one acre, and 15 feet deep) lying west of Agua Chinon Wash and one pit (covering about 4 acres, and 15 to 25 feet deep) lying east of the wash, were used for disposal. A total volume of 163,500 to 243,000 cubic yards of waste material is estimated to be present in the trenches and pits. Reportedly, almost any type of waste generated on the station may have been disposed of in this landfill. The wastes are reportedly likely to include metals, solvents, paint residues, hydraulic fluids, coolants, construction debris, unspecified oily wastes, municipal solid waste, and various inert solid wastes. The exact composition and quantities of the wastes could not be determined. Prior to burial, all wastes were burned to reduce volume. (See Section 8.4 for further site details.)

Of the materials likely to be disposed of, solvents, paint residues, and oily wastes are potentially hazardous. Aromatic and chlorinated solvents are toxic. Chlorinated solvents are not biodegradable. Paint residues are likely to include paint strippers, composed of methylene chloride and methanol, and lead. Methylene chloride is moderately toxic and an experimental carcinogen (Sax, 1979). Methanol is biodegradable. Lead is bioaccumulative and will increase the lead content of the soil. Oily wastes from various metal, paint and vehicle maintenance shops may contain heavy metals considered to be hazardous. The complete nature of the materials disposed of in the trenches and pits is not known and hazardous materials other than those suspected may have also been placed in the original landfill area due to the non-control of disposal operations.

The site is bisected by the Aqua Chinon Wash composed of sand and gravel. The sand and gravel deposits at the site are conducive to percolation and migration of contaminants. Once contaminants enter the shallow ground water table, estimated to be approximately 100 feet below the ground surface, they would tend to migrate south-westward in the Irvine subbasin. Contaminants entering the middle ground water aquifer systems are likely to enter agricultural supply wells, indirectly affecting the human food chain. Contaminants can also percolate towards Agua Chinon Wash and flow through surface drainages to San Diego Creek, ultimately impacting the rare or endangered species present at the upper Newport Bay Ecological Reserve.

Based on the volume and types of waste reportedly disposed of, the potential for migration of contaminants, and the presence of receptors, Site 3 is recommended for a Confirmation Study.

2.2.4. Site 5, Perimeter Road Landfill. The Perimeter Road Landfill, in operation from 1955 to the late 1960's, is located directly adjacent to Perimeter Road and just north of the station golf course. The site consists of three separate trenches which are 60 feet wide, 20 to 25 feet deep and have a combined length of 1,200 feet. Reportedly almost any type of waste generated on the station may have been disposed of in this landfill. The wastes reportedly included burnable trash, municipal solid waste, fuels, oils, solvents, cleaning fluids, scrap metals, paint residues, and other materials. The exact composition and quantities of the wastes could not be determined. Prior to burial the wastes were burned to reduce volume. The total estimated volume for all trenches is between 50,000 to 60,000 cubic yards. (See Section 8.6 for further site details.)

Solvents, paint residue, and oily wastes as well as fuel have hazardous constituents. Aromatic and chlorinated solvents, likely to be present, are toxic and carcinogenic. Chlorinated solvents are not biodegradable. Paint residues are likely to include paint

strippers composed of methylene chloride, methanol, and lead. Methylene chloride is moderately toxic and an experimental carcinogen (Sax, 1979); methanol is biodegradable. Lead is bioaccumulative and will increase the level of lead in the soil. Oily wastes may contain heavy metals if the origin of the material is from metal, paint, and vehicle maintenance shops. Fuels are hazardous in the State of California. The complete nature of the materials disposed of at this site is unknown and other hazardous materials may also have been placed in this landfill due to the non-control of disposal operations.

Site 5 is located on level ground adjacent to nearby farm fields and the station golf course. The farm fields are currently being used, and the golf course is frequented by many of the station residents. Borrego Canyon Wash is approximately 800 feet to the southeast and empties into San Diego Creek. San Diego Creek enters the upper Newport Bay Ecological Reserve approximately 10 miles downstream from the site. The sandy soil at site 5 is conducive to contaminant percolation and migration of contaminants. Clay in the upper zone will tend to retard downward migration but, once contaminants enter the shallow ground water table, estimated to be approximately 100 feet below the ground surface, they will tend to migrate southward in the Irvine subbasin or they may enter Borrego Canyon Wash through subsurface pathways. The shallow and upper aquifer system in the vicinity of the station is not used for ground water supplies. However, the shallow and upper aquifer system is known to recharge the middle aquifer system down-basin. The middle aquifer is used for agricultural water supplies, thus posing an indirect threat to human health through the food chain. If contaminants enter the surface drainage system and proceed downstream to the Upper Newport Bay Ecological Reserve, Rare and Endangered species would be affected.

Based on known and suspected types of materials present at the landfill, the potential for migration potential and the presence of receptors, Site 5 is recommended for a Confirmation Study.

2.2.5. Site 9, Crash Crew Pit No. 1. Site 9 is located on the western edge of the aircraft matting north of Building 1601. From 1965 to 1971 a 50 foot diameter unlined pit, approximately 3 to 4 feet deep, was used for crash crew training. An estimated 8,170 gallons of AVGAS, 4,080 gallons of JP-5 fuel, and 120 gallons of crankcase oil percolated into the surrounding soils. (See Section 8.10 for further site details.)

Elevated levels of lead as well as oil and grease would be expected in these soils. The pit lies in sandy soils and migration of contaminants into the shallow and upper aquifer system are possible. These contaminants could travel down-basin, entering the middle aquifer systems which are an agricultural water supply source. Since the shallow water table in this area is approximately 100

feet below the ground surface, and the presence of 60 feet of discontinuous clay within this 100 feet, contaminants migrating from the site have probably not reached the local water table. However, this site does pose an indirect potential threat to human health and the environment through the food chain if contamination reaches the middle aquifer. Based on the nature and large volume of material which was disposed of in a small area, this site is recommended for a Confirmation Study.

2.2.6. Site 11, Transformer Storage Area. Site 11 is located behind Building 369 and consists of a 30 by 30 foot concrete pad on which transformers were stored. From 1968 to 1983, 50 to 75 transformers were stored here. Of these transformers, six containing PCBs were documented to have leaked. A maximum of 60 gallons of PCB-contaminated fluid were spilled in this area, and flowed onto the surrounding soil. The soil contaminated by these fluids was not removed; however, the transformers were disposed of off-station by contract in 1983. (See Section 8.12 for further site details.)

The site lies on the north edge of the facilities management area. Surface runoff from the site would flow along the adjacent roadway and enter the storm drain system just south of Building 369. The potential for human contact with this runoff and with the contaminated soil in the storage yard exists. This site is a potential threat to human health, and a Confirmation Study is recommended.

2.2.7. Site 14, Battery Acid Disposal Area. Site 14 is located along the edge of the asphalt pavement south of Building 245. From 1977 to 1983, battery acids, oily wastes, and paint wastes were disposed of on the soil along the pavement edge. An estimated total of 210 gallons of material was disposed of at this site. (See Section 8.15 for further site details.)

Battery acid disposed of at Site 14 would decrease the pH of the soil and increase the lead content. Lead is moderately toxic and bioaccumulative. Paint wastes disposed of at the site are likely to include paint strippers composed of methylene chloride and methanol. Methylene chloride is moderately toxic and an experimental carcinogen. However, methanol is biodegradable.

Site 14 lies within 150 feet of an area used for recreational activities by station personnel. The site is uphill of and connected to an asphalt parking lot used for food vending and car washing. Sandy soils at the site would allow contaminants to percolate downward. Because the site lies on the bank of a nearby drainage ditch the majority of the contaminants percolating through the soil are likely to migrate into the ditch. Further surface migration, to San Diego Creek, and ultimately to the Upper Newport Bay Ecological Reserve aproximately eight miles away, is likely.

Because of the nature of the wastes, the potential threat to human health and to the environment, a Confirmation Study is recommended.

2.2.8. Site 16, Crash Crew Pit No. 2. Site 16 is located directly west of Building 399 in the north central area of the aircraft runways. From 1972 to the present this area has been used as a training area for crash crew fire fighting.

A 50 to 60 foot unlined pit, approximately 3 feet in depth, is used to burn material during practice sessions. A second unlined pit, which is 12 by 35 feet and 4 to 5 feet in depth, is used as a holding basin for residues drained from the larger pit after a burning exercise. It is estimated that a total of approximately 27,400 gallons of JP-5, AVGAS, hydraulic fluid, and crankcase oil have percolated into the underlying soils at Site 16. The vast majority (an estimated 95 percent) of this volume is comprised of JP-5 fuel. Since 1982 only JP-5 has been used in the pits. (See Section 8.17 for further site details.)

Site 16 lies in an area of sandy soil which would allow percolation and migration of oil and fuel into the shallow and upper aquifer system. Although contaminant migration to the shallow water table is not suspected due to the approximate depth of this system (100 feet below ground surface), and the presence of 60 feet of discontinuous clay within the 100 feet, contaminants could migrate down basin and enter the middle aquifers used for agricultural water supplies. Fuel and oil are hazardous in the State of California. These contaminants pose a potential threat to human health indirectly through the food chain. A Confirmation Study is recommended for this site.

2.2.9. Site 17, Communication Station Landfill. Site 17 consists of approximately 26 acres in the shape of an "L" adjacent to Buildings 394 and 573. From 1981 to 1983 the site was used as a discharge point for the 1,000 gallon vacuum truck. The truck was driven up to the area and emptied to the ground. The majority of liquid waste emptied from the truck was cooking grease. Oils and fuels from sumps were also disposed of to the ground at the site. Reportedly, the site has also been used by "midnight dumpers" for rubble and municipal debris (i.e., couches, washing machines, etc.), and almost any type of waste generated on station between 1981 and 1983 may have been disposed of at this site (i.e. empty drums, etc.).

Site 17 is now covered with cut from a nearby hill that was leveled due to airport clearance criteria. The area is an open field against a small mountain range. The soils are sandy, supporting brush vegetation, birds, and squirrels. Ground water is at an estimated depth of 150 feet below ground surface. The nearest housing is 750 yards away.

2.3 REMEDIAL MEASURE SITE. One of the seventeen sites is recommended for a Remedial Measure. It is discussed below.

2.3.1. Site 4, Ferrocene Spill Area. Site 4 is located in a road ditch just south of Building 658. In 1983, a 500-gallon tank containing a maximum of 5-gallons of ferrocene and a hydrocarbon carrier, was filled with water and overflowed onto the asphalt paving and into the nearby dirt drainage ditch. Vegetation along the ditch is stressed; however, no stressed vegetation is present near the nearby storm drain. The material spilled on the asphalt was cleaned with absorbent material; however, the material in the nearby drainage ditch soil was not removed. (See Section 8.4 for further site details.)

Ferrocene is biodegradable and is not soluble in water. It is toxic and an equivocal tumorigenic agent (Sax, 1979). The soils at the site are sandy and would allow percolation of contaminants. This site lies along a roadway which services the nearby tank farm only. A moderate threat to direct human exposure exists to workers in the area if the soil in the ditch is disturbed.

Since the quantities of material are small, biodegradable, and not soluble in water, migration of the materials will be minimal and a confirmation study is not recommended. Due to the potential for human exposure, Remedial Measures for the site are recommended as outlined in Chapter 3.

2.4 NON-CONFIRMATION STUDY SITES. Seven of the seventeen potentially contaminated sites are not recommended for Confirmation Studies or Remedial Measures. Significant findings for these sites are summarized in Table 2-1.

2.4.1. Site 6, Drop Tank Drainage Area No. 1. Site 6 lies southwest of buildings 710, 747, and 458, along the edge of the asphalt paved apron. Between 1969 and 1983 JP-5 fuel from aircraft drop tanks were rinsed with soap and water and drained onto the soil surrounding the apron. An estimated total of 1,400 gallons of JP-5 fuel were disposed of here. Additionally, assuming a one gallon per month leakage rate, a total of about 300 gallons of waste lubricating oil leaked from storage drums onto the unpaved portions of this site. No staining or stressed vegetation is present at the site. (See Section 8.7 for further site details.)

JP-5 fuel and lubricating oil are hazardous in California. Based on the small quantities, and the nature of the materials, considering the ultraviolet and bio-degradation that would have occurred, and the location, the site poses no threat to human health or to the environment. No Confirmation Study is recommended for Site 6.

2.4.2. Site 7, Drop Tank Drainage Area No. 2. Site 7 has two areas: 16,000 square feet between the runway and the apron north of Building 295, and 60,000 square feet east of buildings 295 and 296.

In the area north of Building 295, 6,700 gallons total of JP-5 and waste lubricating oil were disposed of on the soil for dust control from 1969 to 1983. On the ground east of buildings 295 and 296, an estimated total volume of 14,760 gallons of JP-5 and lubricating oil were spread as a means of dust control between 1972 and 1983. Additionally, a one-time spill of 2,000 gallons of JP-5 fuel occurred in 1982 in the area east of buildings 295 and 296. Currently, a portion of this area has been paved with concrete. (See Section 8.8 for further site details.)

Contamination at this site appears to be minimal since the wastes were applied over a base of disturbed soil as a means of dust control, thus, biodegradation of the fuels and oils are anticipated to have occurred. Further, in the area north of Building 295, no staining or stressed vegetation was visible. This is consistent with the volume of material reportedly disposed of at this location. The shallow ground water table in this area is estimated to be greater than 100 feet and the depth of migration of this material is minimal based on the site inspection.

Because of the volume, type, and method of application of the materials, this site does not pose a threat to human health or the environment and no Confirmation Study is recommended.

2.4.3. Site 8, DPDO Storage Area. Site 8 is located at the southwest corner of the intersection of Perimeter Road and "R" Street along the southern edge of the station. In 1984 a spill of several gallons of transformer fluid containing PCB's occurred adjacent to ramp 633. The contaminated soil was excavated to a depth of one foot and removed for disposal off-station. (See Section 8.9 for further site details.)

Since the contaminated soils were removed, no threat to human health or to the environment exists, and a Confirmation Study is not recommended.

2.4.4. Site 10, Petroleum Disposal Area. Site 10 lies between buildings 297, 369, and 435. From 1952 through the mid-1960s, an original area of 960,000 square feet was used to dispose of an estimated 52,000 gallons of petroleum wastes by spraying on a monthly basis for dust control. During recent construction, two areas totaling 480,000 square feet had contaminated soil removed to an approximate depth of two feet. As a result, a 480,000 square feet contaminated area of the site was left. The soil in this area was mixed with cement and aircraft matting was placed over the area. (See Section 8.11 for further site details.)

The petroleum wastes disposed of in the area predominantly originated in the Heavy Duty Maintenance Shop, and consisted of 90 percent spent lubricating oil, with the remaining 10 percent consisting of hydraulic fluid, transmission fluid, motor fuel, and antifreeze. Since aircraft hydraulic fluid previously contained PCB's, it is possible that some PCB-contaminated oils were disposed

of at the site. These materials were used for dust control and exposed to the air by spraying; thus most of the solvents would evaporate, and the hydrocarbons and antifreeze would biodegrade readily. Some spent lubricating oils may have penetrated the sandy soils at the site, but migration vertically would be limited by biodegradation as well.

Due to the disposal method and volumes of contaminated materials remaining, this site does not pose a threat to human health or to the environment; therefore, a Confirmation Study is not recommended.

2.4.5. Site 12, Sludge Drying Beds. Site 12 is located between Perimeter Road and Plant Road, west of Building 493. Between 1943 and 1972 MCAS El Toro operated a secondary wastewater treatment plant in which the sludge was dewatered in drying beds. Reportedly, 880 cubic yards of sludge was plowed under at this location. Reportedly, no electroplating operations occurred at the station except for a few years during the 1940s. It is suspected that sludges from this treatment plant are representative of municipal sludges derived from a city source and contain typical concentrations of heavy metals, the wastes of concern in this type of sludge. (See Section 8.13 for further site details.)

Based on typical concentrations of heavy metals in city sludges, this site poses no potential hazard to human health or to the environment. Therefore, no Confirmation Study is recommended.

2.4.6. Site 13, Oil Change Area. Site 13 is located northeast of Building 244 and is an area of approximately 1/4 acre. From 1977 until 1983, approximately 7,000 gallons of heavy equipment waste crankcase oil was disposed of on the soil in this area. The contaminated soil has been scraped into a pile for removal. (See Section 8.14 for further site details.)

No releases of hazardous constituents are suspected to have occurred here and removal of this material is underway. This site poses no threat to human health or to the environment and no Confirmation Study is recommended.

2.4.7. Site 15, Suspended Fuel Tanks. Site 15 is located northeast of Building 31. From 1979 to mid-1984 a total of more than 500 gallons of diesel fuel spilled to the ground beneath two elevated 500-gallon diesel fuel tanks. The tanks have been removed but the soil is stained for a 750 square foot area. (See Section 8.16 for further site details.)

Diesel fuel is hazardous in California. However, based on the small quantities and the nature of the material, and the ultraviolet and bio-degradation which is taking place, the site presents no potential threat to human health or to the environment. Therefore, no Confirmation Study is recommended.

CHAPTER 3. RECOMMENDATONS

3.1 INTRODUCTION. Recommended courses of action are provided for the potentially contaminated sites identified at MCAS El Toro. Nine sites pose a potential threat to human health or to the environment. Therefore, confirmation studies, Phase II of the Navy Assessment and Control of Installation Pollutants (NACIP) programs are recommended for Site 1, Explosive Ordnance Disposal Range; Site 2, Magazine Road Landfill; Site 3, Original Landfill; Site 5, Perimeter Road Landfill; Site 9, Crash Crew Pit No. 1; Site 11, Transformer Storage Area; Site 14, Battery Acid Disposal Area; Site 16, Crash Crew Pit No. 2; and Site 17, Communication Station Landfill. The Confirmation Study Ranking System (CSRS) is used to systematically evaluate the severity of potential problems at these sites. The remaining sites are not recommended for confirmation studies. However, a Remedial Measure is recommended for Site 4, Ferrocene Spill Area.

The results of the CSRS and a summary of the recommendation actions for the sites recommended for confirmation studies are listed in Table 3-1. These first sampling recommendations are designed to verify the presence of contamination. Depending on results of the recommended actions for verification, a characterization of the extent of the contamination at the sites may be required. The design of the characterization phase will depend on results from the verification phase.

3.2 CONFIRMATION STUDY RECOMMENDATIONS:

3.2.1 Site 1, Explosive Ordnance Disposal Range.

Type of Samples:	Soil (0 to 3 feet depth)
Frequency of Sampling:	Once
Number of Samples:	Four
Testing Parameters:	pH, radium isotopes

Remarks:

Soil samples locations should be downslope from the pits in low areas as shown in Figure 3-1. All holes should be advanced with a posthole digger and all samples should be collected continuously with a hand operated bucket auger. The ten samples collected are to be composited to four, per Figure 3-1. Further recommendations on the need for shallow ground water monitoring wells must be considered on the basis of the results from the verification samples.

Table 3-1. Summary of Confirmation Study Recommendations at MCAS El Toro--Study Number 74

Site number	Site name	CSRS score[a]	Number of wells	Number and type of samples	Frequency of sampling	Analyzed parameters[b]
74-1	Explosive Ordnance Disposal Range	15	0	4-soil (auger 0-3 feet)	Once	pH and radium isotopes
74-2	Magazine Road Landfill	20	3	3-soil from borings 4-soil from surface 4-water from surface[c] 12-ground water from wells[c]	Once Once Once Quarterly for 1 year	Soil-PCBs, purgeable organics, lead and pH Soil-PCBs, purgeable organics, organic and total lead, pH, TOX, and TOC. Surface water-same as soil plus specific conductance Ground water same as suface water plus water level
74-3	Original Landfill	13	4	4-soil from borings 16-ground water from wells	Once Quarterly for 1 year	Soil-purgeable and base/neutral/acid extractable organics, 13 metals, pH, total phenol, TOX, TOC, and total cyanide Ground water-same as soil plus specific conductance and water level
74-5	Perimeter Road Landfill	11	4	4-soil from borings 16-ground water from wells	Once Quarterly for 1 year	Soil-purgeable and base/neutral/acid extractable organics, 13 metals, pH, total phenol and total cyanide, TOX and TOC Ground water-same as soil plus specific conductance and water level
74-9	Crash Crew Pit No. 1	7	0	10-5 soil borings (vertical)two samples per hole	Once	Lead, total recoverable oil and grease, TOX, TOC, priority pollutant purgeable organics
74-11	Transformer Storage Area	11	0	4-soil (0-1.0 feet)	Once	PCBs
74-14	Battery Acid Disposal Area	6	0	4-soil (0-1.0 feet)	Once	Purgeable organics, lead, pH, total phenols and TOC
74-16	Crash Crew Pit No. 2	9	0	10-5 soil borings two samples per hole	Once	Lead, total recoverable oil and grease, TOX, TOC, and priority pollutant purgeable organics
74-17	Communication Station Landfill	11	3	3-soil from borings 4-soil from surface 4-water from surface[c] 12-ground water from wells[c]	Once Once Once Quarterly for 1 year	Soil-PCBs, purgeable organics, lead, and pH Soil-PCBs, purgeable organics, organic and total lead, pH, TOX, and TOC Surface water-same as soil plus specific conductance Ground water-same as surface water plus water level

[a]CSRS--Confirmation Study Ranking System.
[b]Oil and Grease--Total recoverable EPA Method No. 9070. Purgeable Organics--Priority Pollutant EPA Method No. 8240. Extractable Organics--Priority Pollutant EPA Method No. 8270. PCBs--PCBs and Pesticides EPA Method No. 8080.
[c]If water is present, samples will be collected.

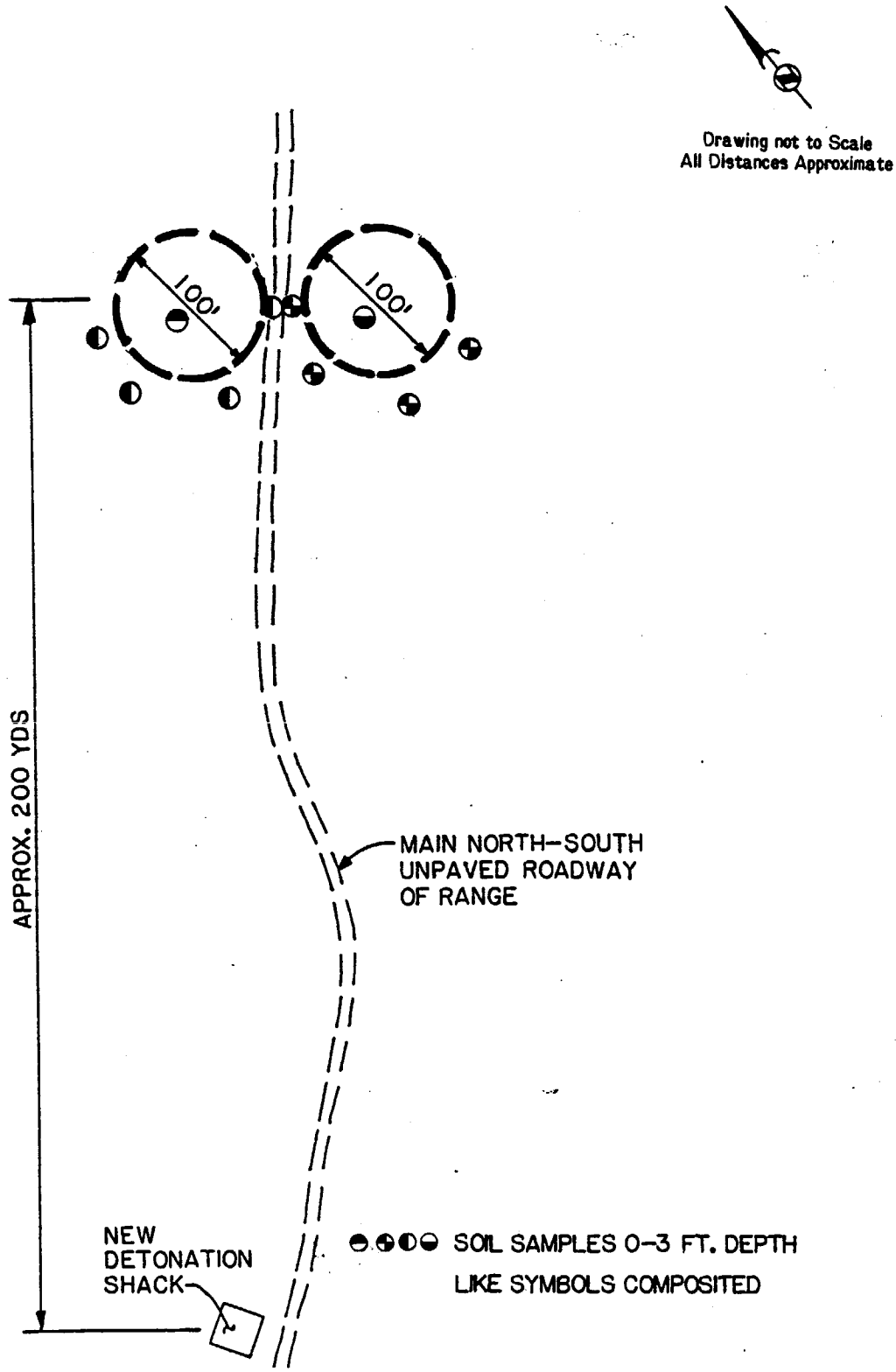

Figure 3-1. Sample Plan for Site 1

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

3.2.2. Site 2, Magazine Road Landfill.

Type of Samples:	Ground water Surface water Surface Soil (Trench Samples)
Frequency of Sampling:	Soil--Once Surface water--Once (In rainy season) Ground water--Quarterly for one year
Number of Samples:	Soil-Wells-3 -Surface-4 Surface water-4 Ground water-12 (3 for each quarter)
Testing Parameters:	Soil-Polychlorinated biphenyls (PCB), priority pollutant purgeable organics, organic and total lead, total organic halogens (TOX), total organic carbon (TOC), and pH. Groundwater and surface water-PCB, priority pollutant purgeable organics, organic and total lead, pH, specific conductance, TOX, TOC and water level (for ground water samples only).

Remarks:

Three wells are recommended; two below the landfill and one upgradient of the landfill (see figure 3-2). These wells should be drilled to a depth of approximately 50 feet or until bedrock is encountered, whichever occurs first. A hollow-stem auger drilling method should be used for the installation of the well and if no water is encountered during drilling, the bottom of the screen should be set at the bedrock/alluvium interface. The well soil samples should be collected on approximately 5- to 15-foot centers, depending on determination of soil contamination, which will be based on visual appearance and the use of air-monitoring equipment (such as an organic vapor analyzer) in the field. (The air-monitoring equipment is used to determine if there is contamination, even though not visible.) If several zones of contamination are encountered in each hole, a composite sample should be made in the laboratory so that only a total of three soil samples will be analyzed; one per well.

The four surface soil samples should be collected from a depth of 0 to 6 inches along a trench in the nearby surface drainage ditches. If water is present, it should also be sampled and analyzed for the same basic parameters as the ground water samples, with the exception of water level.

3.2.3. Site 3, Original Landfill

Type of Samples:	Soil Ground water

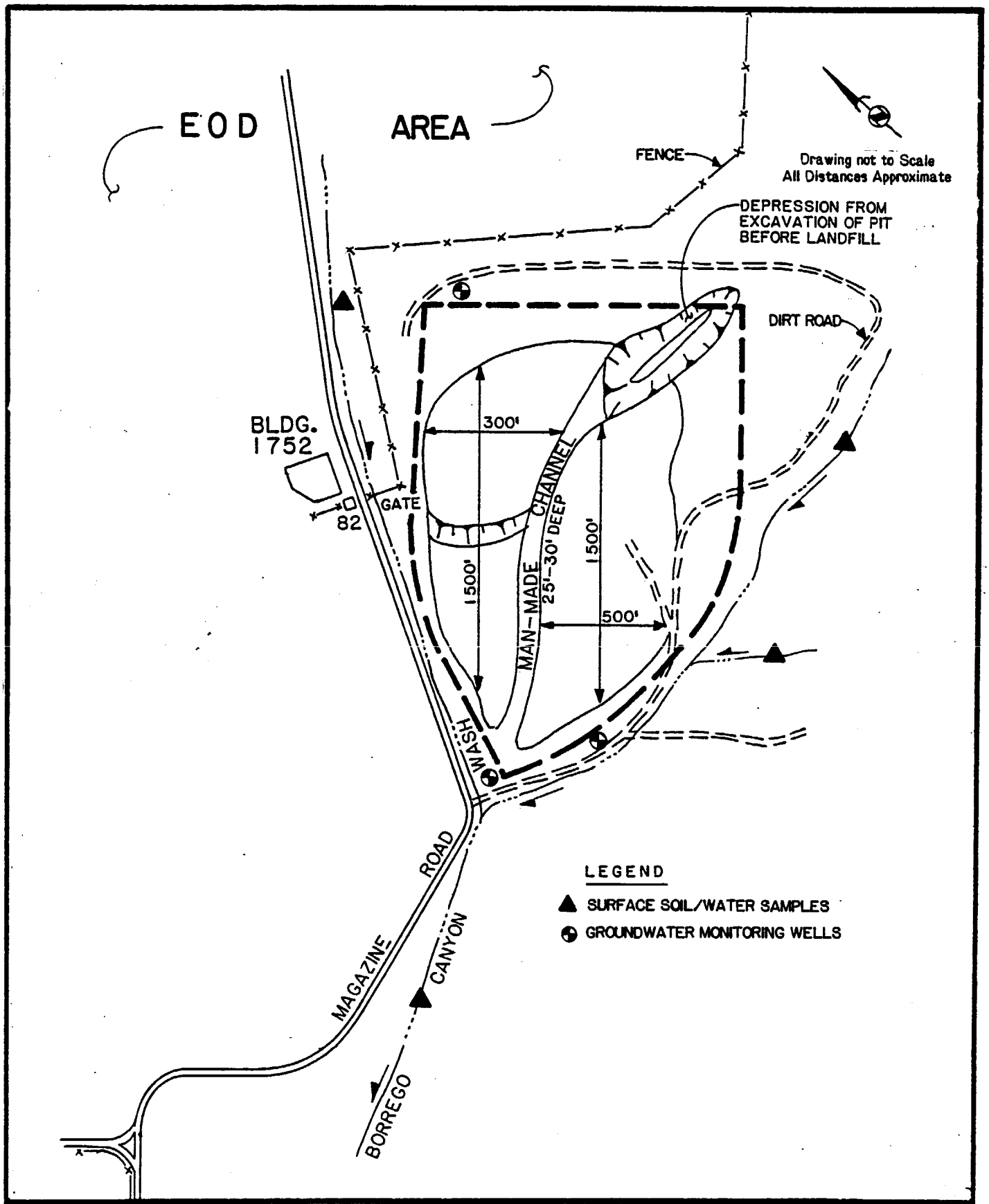

Figure 3-2. Sample Plan for Site 2

INITIAL ASSESSMENT STUDY
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Frequency of Sampling:	Soil-Once Ground water-Quarterly for one year
Number of Samples:	Soil-4 Ground water-16 (4 for each quarter)
Testing Parameters:	Soil-Priority pollutant purgeable and base/neutral/acid extractable organics, 13 priority pollutant metals, pH, TOX, TOC, and total cyanide. Ground water-Same as for soil plus specific conductance and water level.

Remarks:

Four wells are recommended; three below the landfill area and one upgradient of the landfill as shown in Figure 3-3. These wells will be drilled to a depth of approximately 100 feet or until a substantial clay layer (one which would be confining) is encountered which is below the anticipated bottom elevation of the trenches (i.e., 30 feet below the ground surface), which ever occurs first. The well soil samples should be collected on approximately 5- to 15-foot centers, depending on determination of soil contamination, which will be based on visual appearance and the use of air-monitoring equipment (such as an organic vapor analyzer) in the field. (Use the air-monitoring equipment to determine if there is contamination, even though not visible.) If several zones of contamination are encountered in each hole, a composite sample should be made in the laboratory for each hole so that only a total of four soil samples will be analyzed, one per well. In the event that a perched water table exists at the site which yields insufficient quantities of ground water for sampling, further well installations below this horizon may be necessary.

3.2.4. Site 5, Perimeter Road Landfill.

Type of Samples:	Soil Ground Water
Frequency of Sampling:	Soil-Once Ground Water-Quarterly for one year
Number of Samples:	Soil-4 Ground Water-16 (4 for each quarter)
Testing Parameters:	Soil-Priority pollutant purgeable and base/neutral/acid extractable organics, 13 priority pollutant metals, pH, TOX, TOC and total cyanide. Ground water-Same as for soil, plus specific conductance and water level.

Remarks:

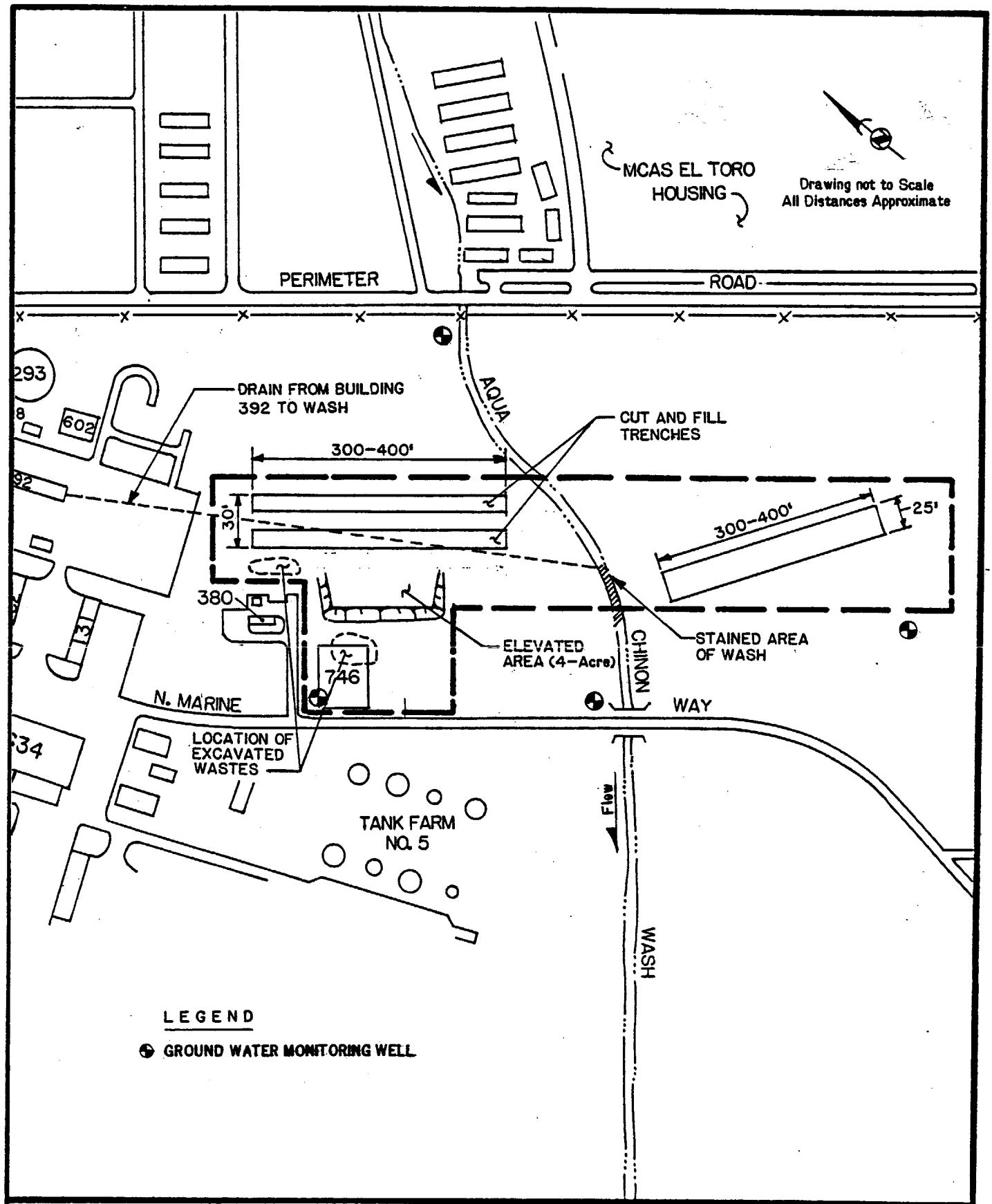

Figure 3-3. Sample Plan for Site 3

INITIAL ASSESSMENT STUDY
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Four wells are recommended; three on the sides of landfill area and one upgradient of the landfill as shown in Figure 3-4. These wells will be drilled to a depth of approximately 100 feet or until a substantial clay layer (one which would be confining) is encountered which is below the anticipated bottom elevation of the trenches (i.e., 30 feet below the ground surface). Soil samples should be collected on approximately 5- to 15-foot centers, depending on determination of soil contamination, which will be based on visual appearance and the use of air-monitoring equipment (such as an organic vapor analyzer) in the field. (Use the air monitoring equipment to determine if there is contamination, even though not visible.) If several zones of contamination are encountered in each hole, a composite sample should be made in the laboratory for each hole so that only a total of four soil samples will be analyzed, one per well. In the event that a perched water table exists at the site, which yields insufficient quantities of ground water for sampling, further well installations below this horizon may be necessary.

3.2.5. Site 9, Crash Crew Pit.No. 1

Type of Samples:	Soil Borings (Vertical, 10 feet deep)
Frequency of Sampling:	Once
Number of Samples:	Ten (maximum)
Testing Parameters:	Organic and total lead, total recoverable oil and grease, TOC, TOX, and priority pollutant purgeable organics.

Remarks:

Five vertical borings up to 10 feet in depth should be drilled as shown in Figure 3-5. Continuous soil samples should be collected and up to two samples per boring can be analyzed. Screen the samples in the field based on visual appearance and the use of air-monitoring equipment to determine how many samples should be taken and how many composites (1 or 2) should be made. (Use the air monitoring equipment as per previous sections of this chapter.) Any contaminated samples should be sent to the laboratory for compositing and in all borings the last sample taken in a boring should be segregated for analyses to substantiate the extent of potential migration. All borings should be backfilled with soil.

3.2.6. Site 11, Transformer Storage Area.

Type of Samples:	Soil (0 to 1.0 feet in depth)
Frequency of Sampling:	Once

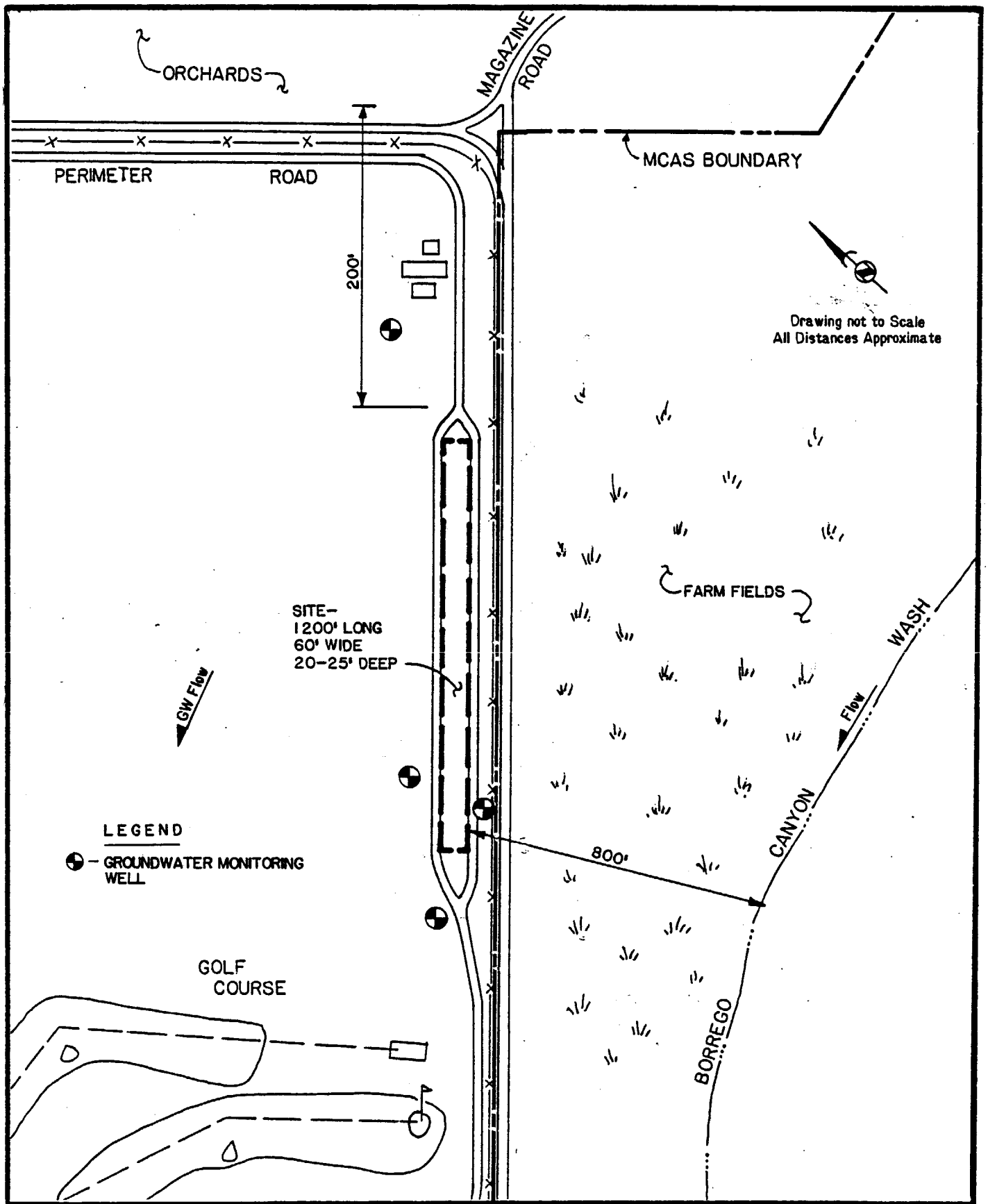

Figure 3-4. Sample Plan for Site 5

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

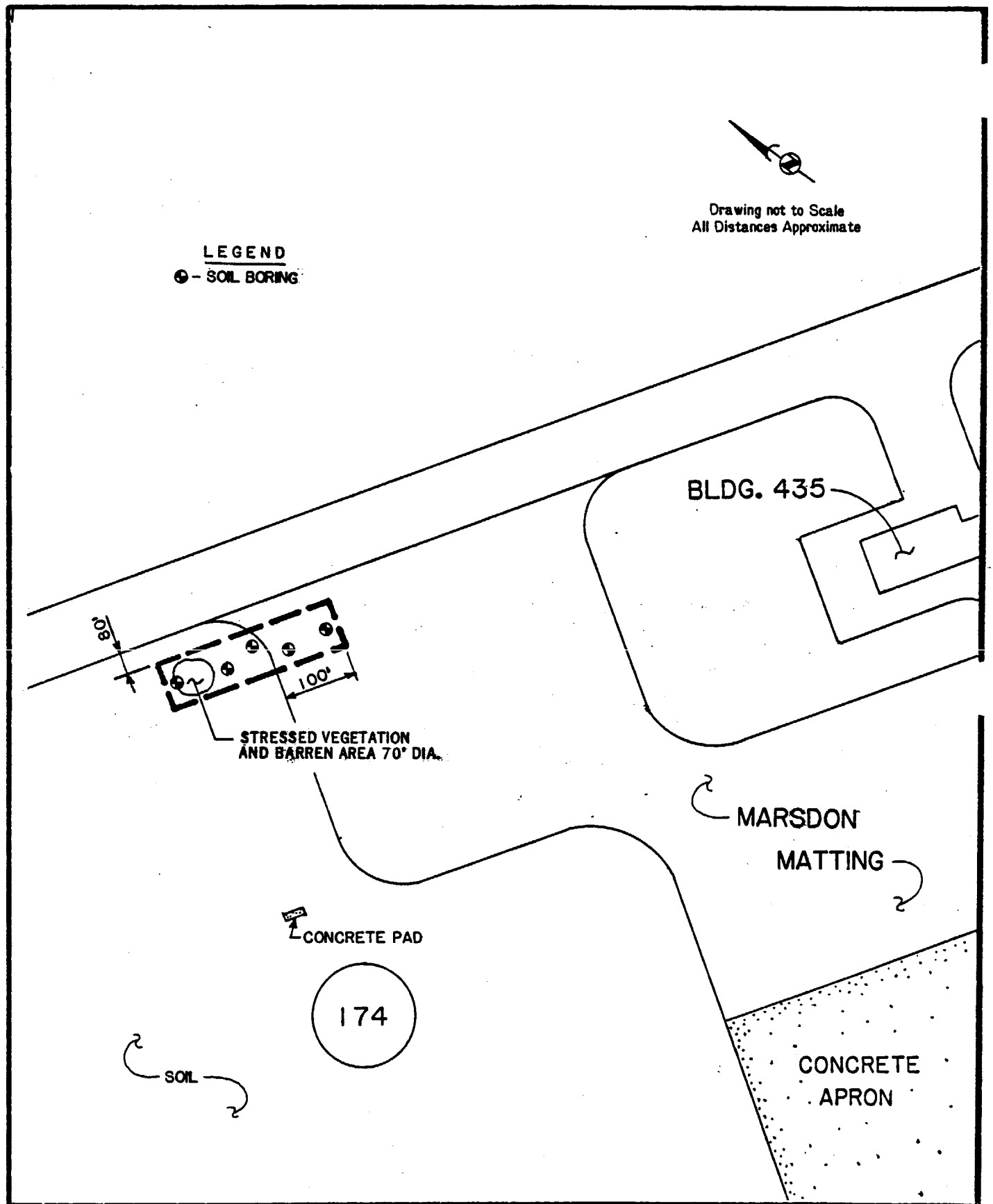

Figure 3-5. Sample Plan for Site 9

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

Number of Samples: 4

Testing Parameters: PCB

Remarks:

Soil samples should be collected from seven locations as shown on Figure 3-6. All samples should be collected with a 6-inch bucket auger and composited in the laboratory as shown.

3.2.7. Site 14, Battery Acid Disposal Area.

Type of Samples: Soil (0 to 1.0 feet in depth)

Frequency of Sampling: Once

Number of Samples: 4

Testing Parameters: Priority pollutant purgeable organics, total and organic lead, total phenols, TOC, and pH.

Remarks:

Soil samples should be collected from eight locations as shown on Figure 3-7. All samples should be collected with a 6-inch bucket auger and composited in the laboratory as shown.

3.2.8. Site 16, Crash Crew Pit.No. 2

Type of Samples: Soil Borings (vertical, 10 feet deep; slant, 20 feet deep)

Frequency of Sampling: Once

Number of Samples: 10 (maximum)

Testing Parameters: Total and organic lead, total recoverable oil and grease, TOX, TOC, and priority pollutant purgeable organics.

Remarks:

Three slant borings at the large pit area and two vertical borings at the smaller pit area as shown in Figure 3-8. Soil samples should be collected on 5 foot centers and up to 2 composited samples per boring can be sent for analyses.

The samples should be screened in the field based on visual appearance and air-monitoring equipment used to determine how many samples should be taken and how many composites (1 or 2) should be made.

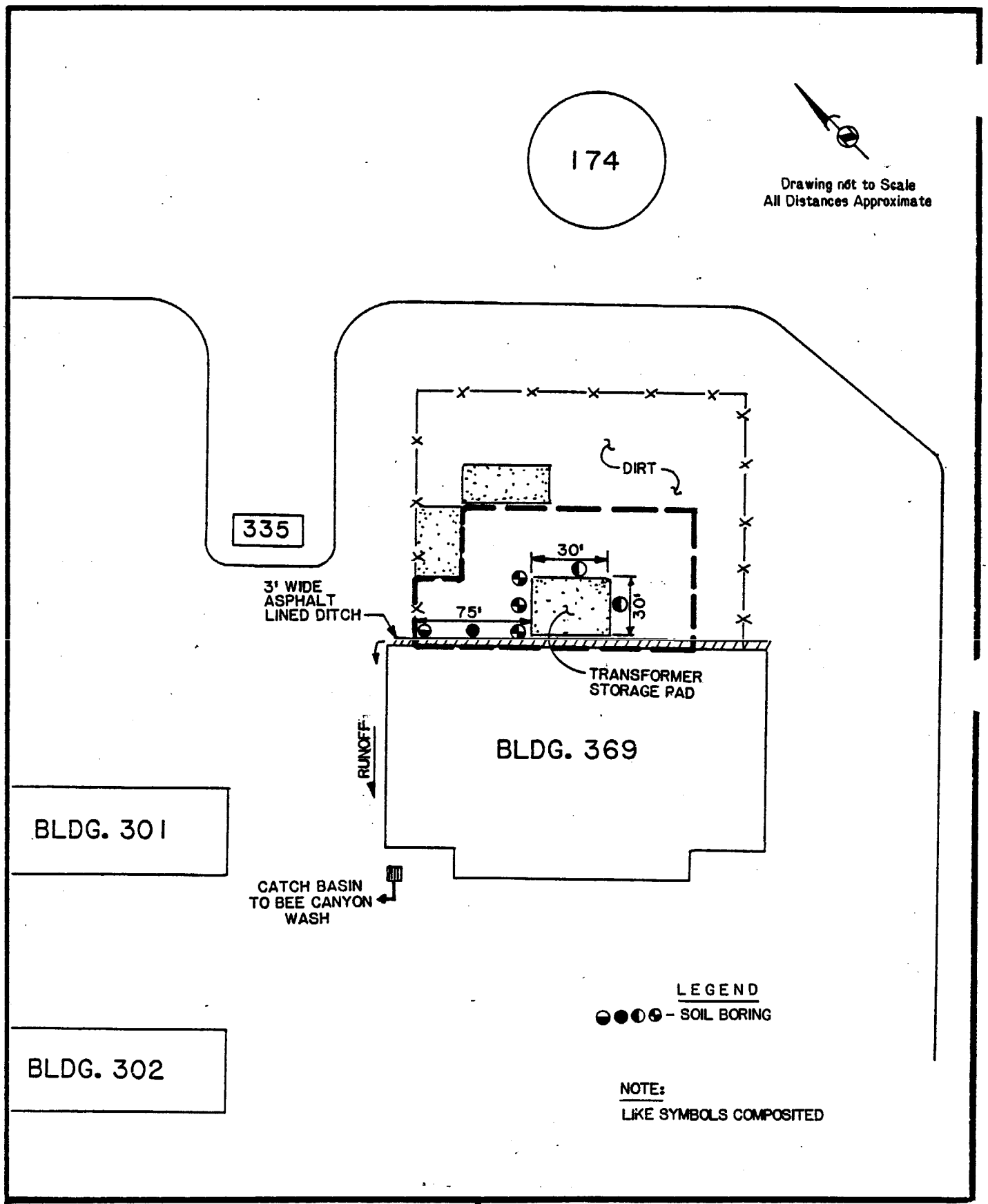

Figure 3-6. Sample Plan for Site 11

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

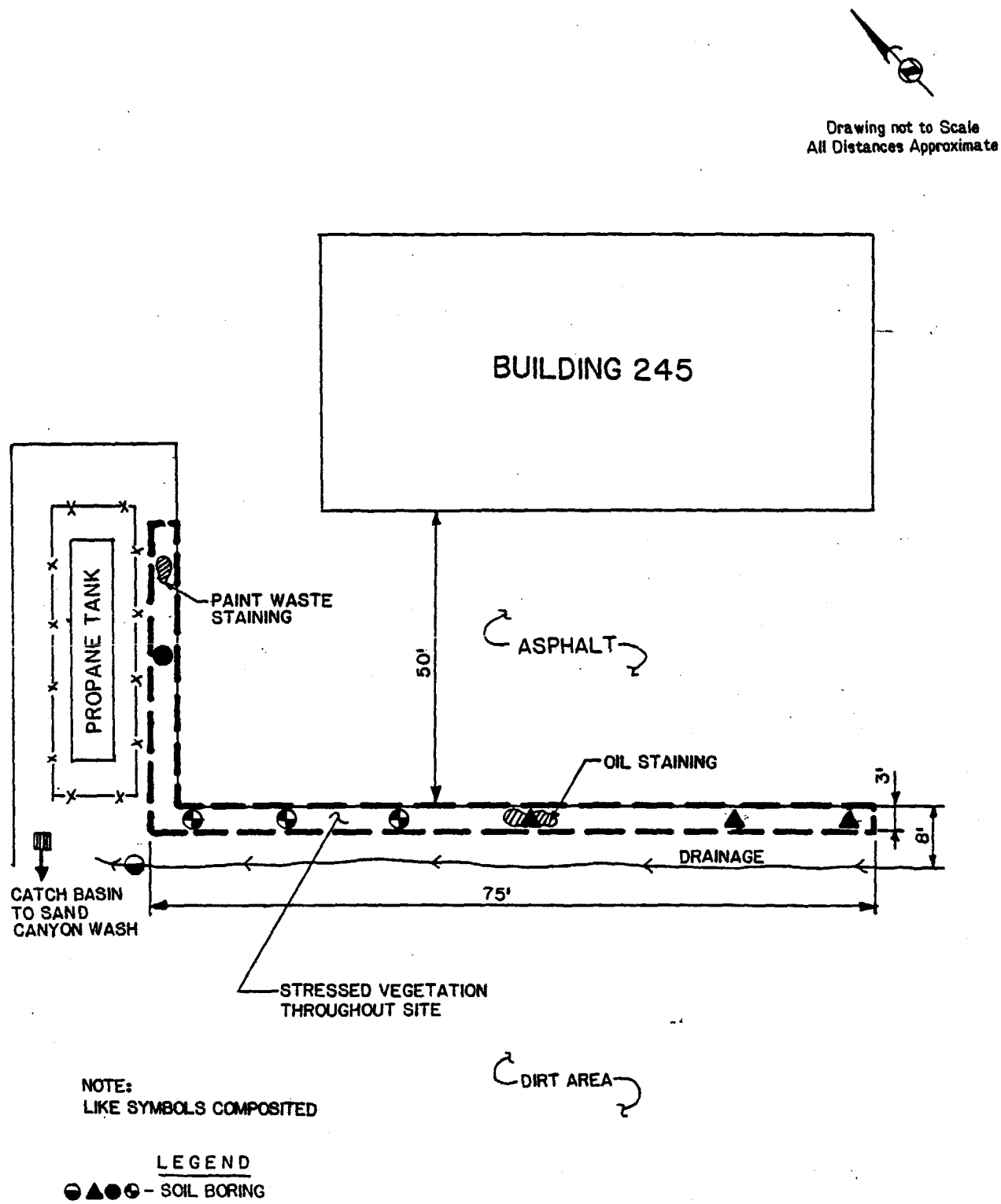

Figure 3-7. Sample Plan for Site 14

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

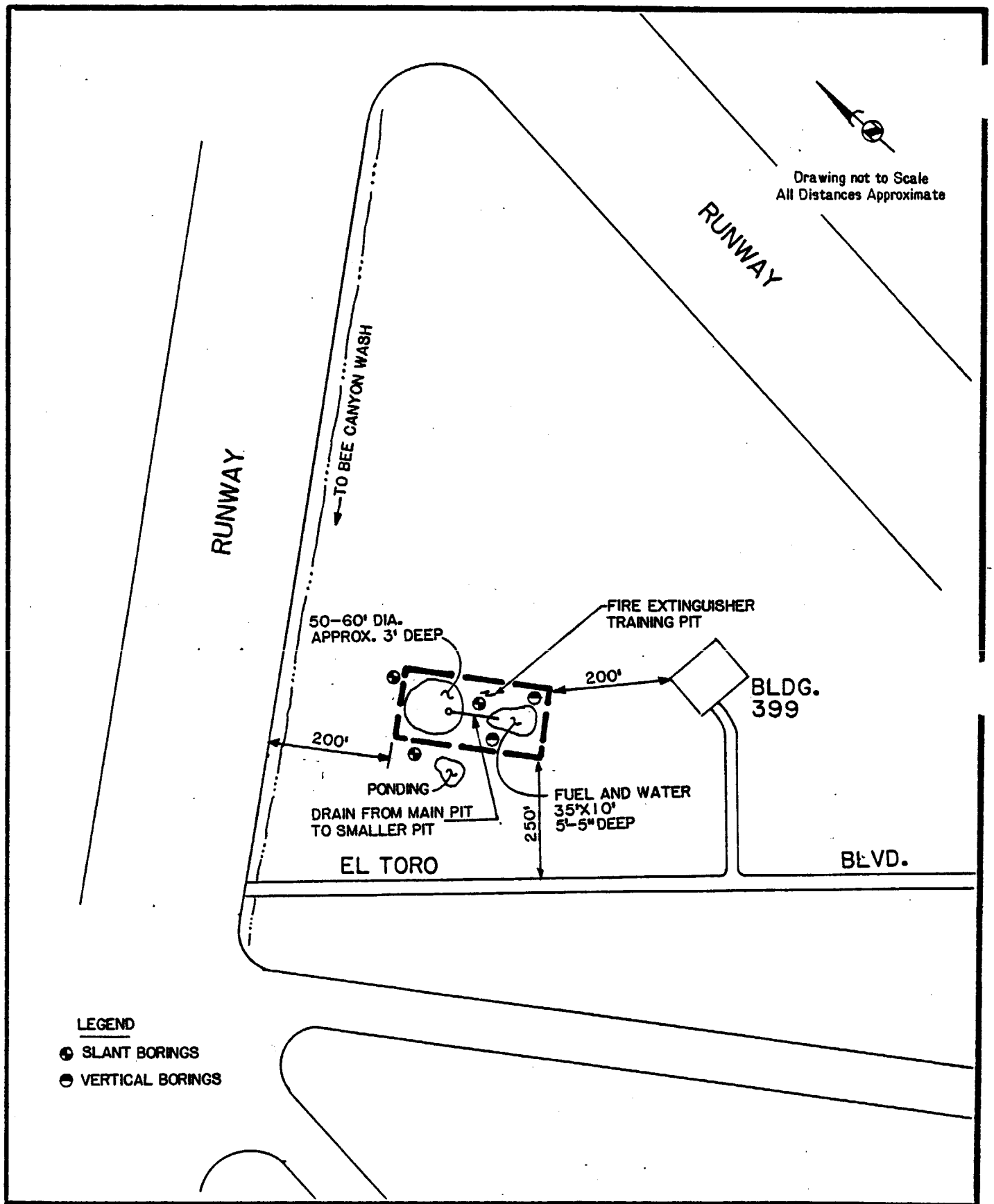

Figure 3-8. Sample Plan for Site 16

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

(Use the air monitoring equipment as per previous sections of this chapter.) Any contaminated samples should be sent to the laboratory for compositing and in all borings the last sample taken in a boring should be segregated for analyses to substantiate the extent of potential migration. All borings should be backfilled with dirt.

3.2.9. Site 17, Communication Station Landfill

Type of Samples:	Ground water Surface water Surface soil (Trench samples)
Frequency of Sampling:	Surface water--Once (in rainy season) Ground water--Quarterly for one year Soil--Once
Number of Samples:	Soil-wells-3 -surface-4 Surface water-4 Ground water-12 (3 for each quarter)
Testing Parameters:	Soil-Polychlorinated biphenyls (PCB), priority pollutant purgeable organics, organic and total lead, total organic halogens (TOX), total organic carbon (TOC), and pH. Ground water and surface water-PCB, priority pollutant purgeable organics, organic and total lead, pH, specific conductance, TOX, TOC, and water level (for ground water samples only).

Remarks:

Three wells are recommended; two on the southern/downgradient border of the landfill and one on the northern/ upgradient border (see Figure 3-9). These wells should be drilled to a depth of approximately 50 feet or until bedrock is encountered, whichever occurs first. A hollow-stem auger drilling method should be used for the installation of the well and if no water is encountered during drilling, the bottom of the screen should be set at the bedrock/alluvium interface. The well soil samples should be collected at approximately 5- to 15-foot intervals. depending on determination of soil contamination, which will be based on visual appearance and the use of air-monitoring equipment (such as an organic vapor analyzer) in the field. (The air-monitoring equipment is used to determine if there is contamination, even though not visible). If several zones of contamination are encountered in each hole, a composite sample should be made in the laboratory so that only a total of three soil samples will be analyzed, one per well.

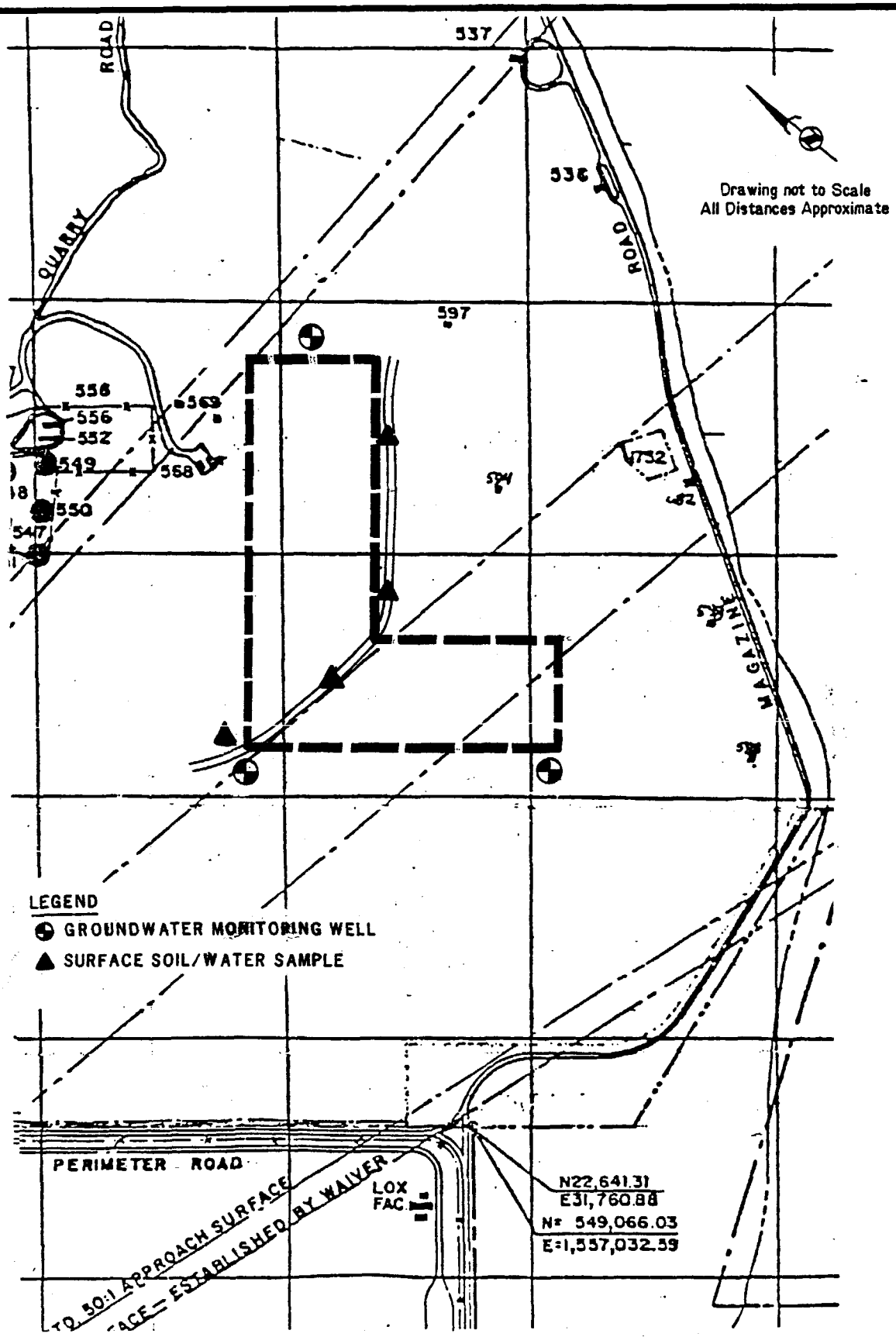

Figure 3-9. Sample Plan for Site 17

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
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The four surface soil samples should be collected from a depth of 0 to 6 inches along a trench in the nearby surface drainage ditches. If water is present, it should be sampled and analyzed for the same basic parameters as the ground water samples, with the exception of water level.

3.3. REMEDIAL MEASURE RECOMMENDATIONS. The following site, though it does not warrant a Confirmation Study, warrants a Remedial Measure.

3.3.1. Site 4, Ferrocene Spill Area. It is recommended that the banks of the drainage ditch immediately south of Building 658 that constitutes the site be scraped free of contaminated soils and that a 1- to 4-foot depth of soil be removed from the ditch. The limits of this soil removal should be based on the stained area and stressed vegetation visible in the road ditch. This material should be disposed of in an appropriate disposal area.

CHAPTER 4. BACKGROUND

4.1 GENERAL INFORMATION. The Marine Corps Air Station (MCAS) El Toro is located in Orange County in Southern California (Figure 4-1). Specifically, the station is situated approximately 8 miles southeast of the City of Santa Ana (the county seat) and 12 miles north-northeast of the City of Laguna Beach on the Pacific Coast (Figure 4-2). The Marine Corps Air Station (MCAS) Tustin is 4 miles to the northwest.

The mission of MCAS El Toro is to maintain and operate facilities and provide services and material to support the operation of aviation activities and units of the operating forces of the Marine Corps, Navy, and other activities as designated by the Commandant of the Marine Corps, in coordination with the Chief of Naval Operations (Naval Facilities Engineering Command, 1983).

4.1.1 Command. MCAS El Toro is under command authority of the Commander Marine Corps Air Bases, Western Area (COMCABWEST).

4.1.2 Organization. MCAS El Toro is one of four air stations operated by COMCABWEST. (The other three are located at Tustin and Camp Pendleton, California, and Yuma, Arizona.) Figure 4-3 presents the organization chart of MCAS, El Toro.

4.1.3 Tenants. The principal tenant of MCAS El Toro is the Third Marine Aircraft Wing. An organization chart for the Third Marine Aircraft Wing is provided on Figure 4-4.

4.1.4 Adjacent Land Use. MCAS El Toro is situated in a semi-urban agricultural area of Southern California. To the north, south, and east, the majority of the land immediately adjacent to the station is used to raise oranges and other agricultultural crops. The University of California has an agricultural field station directly north of the station. A nursery raising fruit trees is just northeast of the base. A small industrial complex across Borrego Canyon Wash adjoins the station boundary to the southeast, next to the MCAS golf course. The city of East Irvine is located immediately adjacent to the northwest margin of the station.

The area around MCAS El Toro is becoming rapidly urbanized. Until 8 to 12 years ago, agricultural lands surrounded the station. Since then urbanization has brought physical development near. However, continuing efforts by the U.S. Marine Corps to work closely with city and county legislators have resulted in establishing generally realistic land use compatibility policies around the station in noise and aircraft hazard zones (NAVFACENGCOM, 1982).

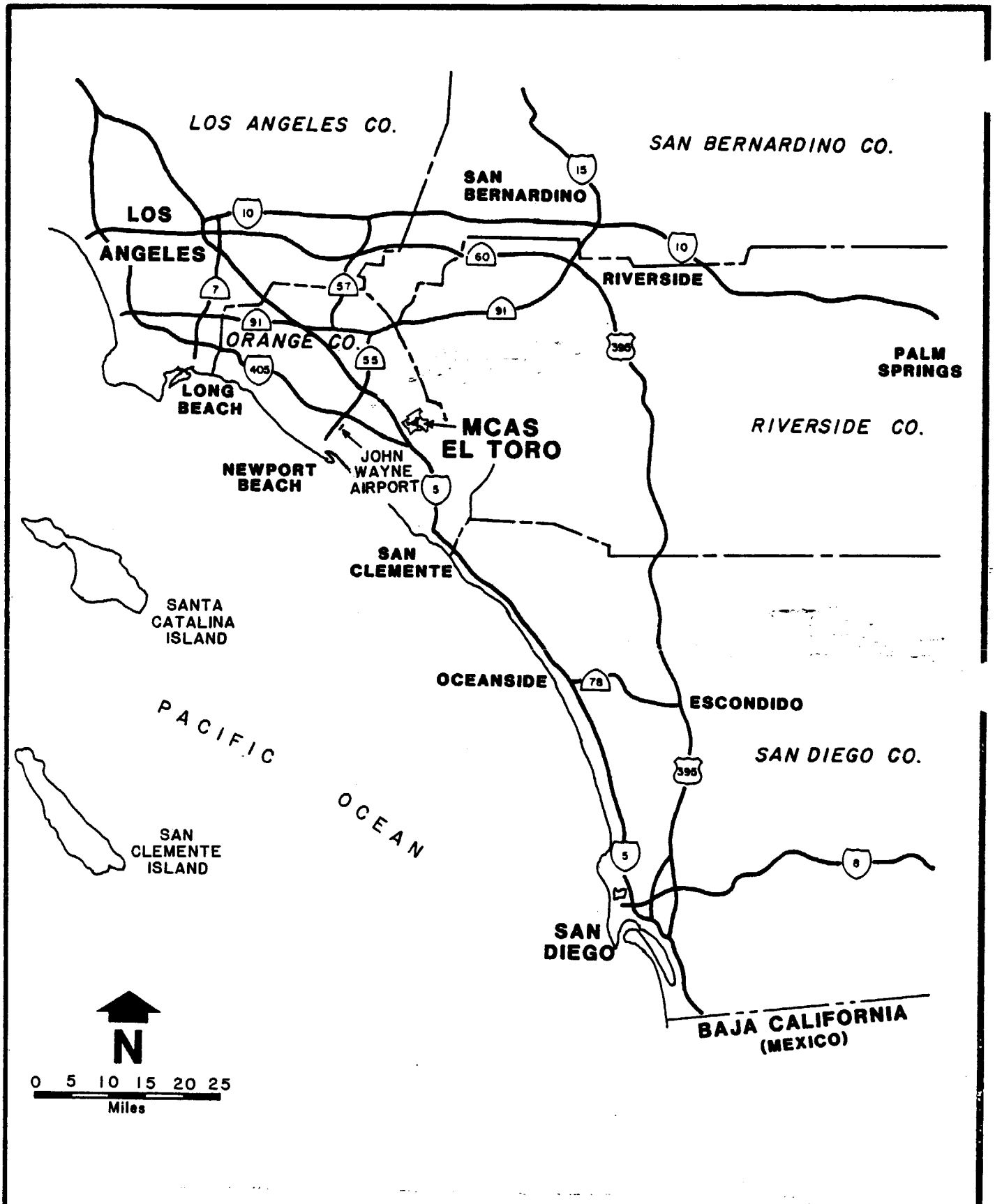


Figure 4-1. Location Map of Marine Corps Air Station, El Toro

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

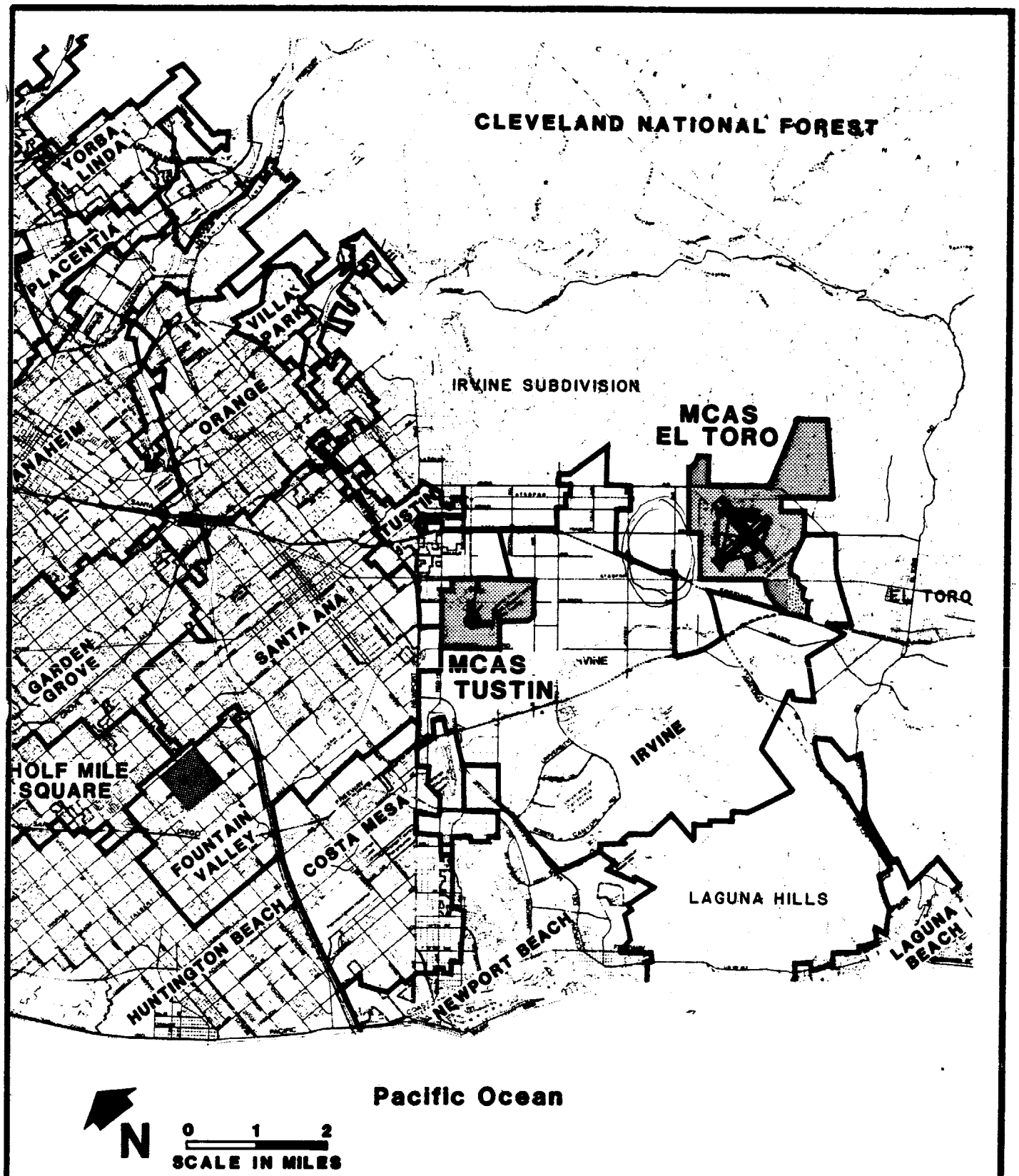
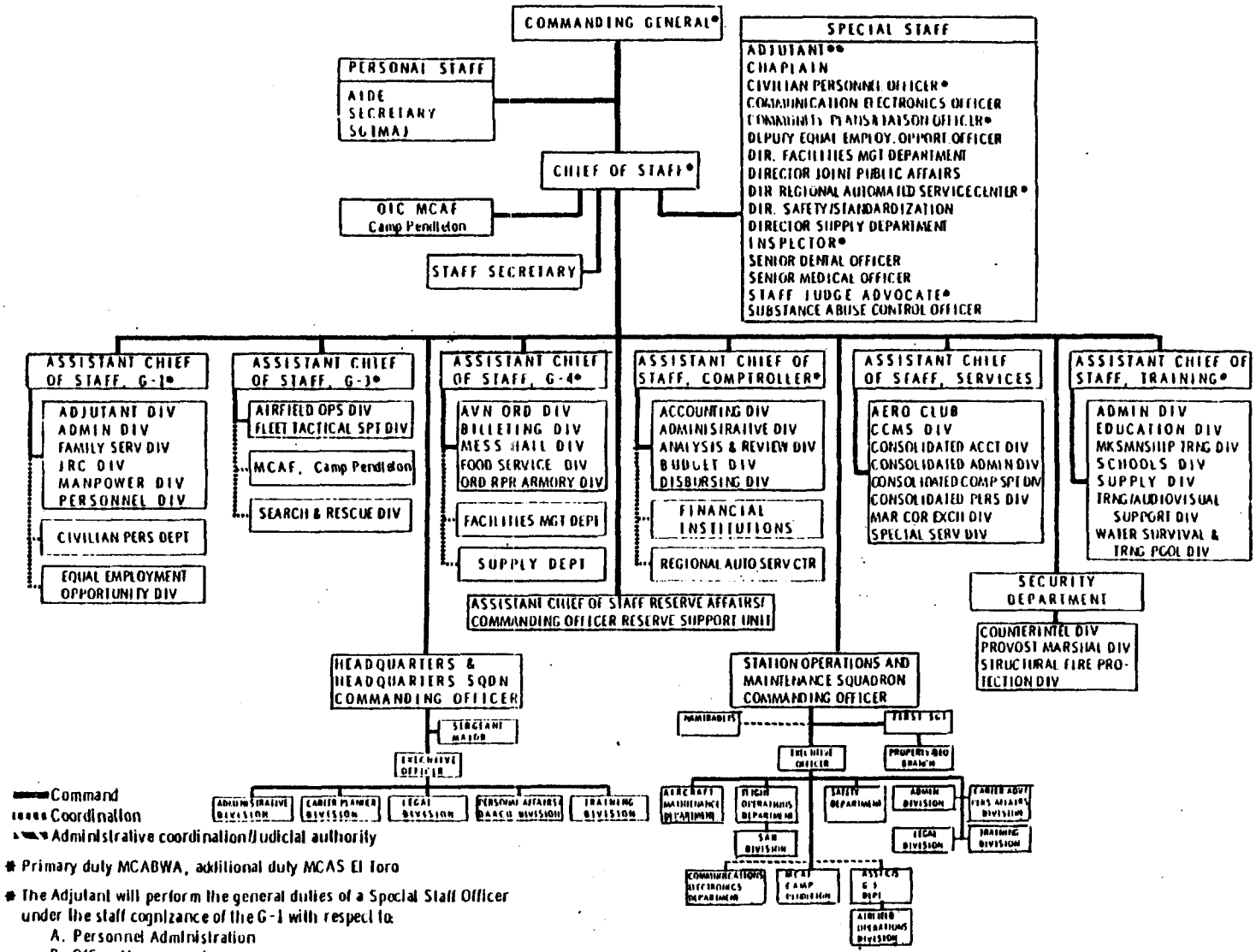


Figure 4-2. Vicinity Map of Marine Corps Air Station, El Toro

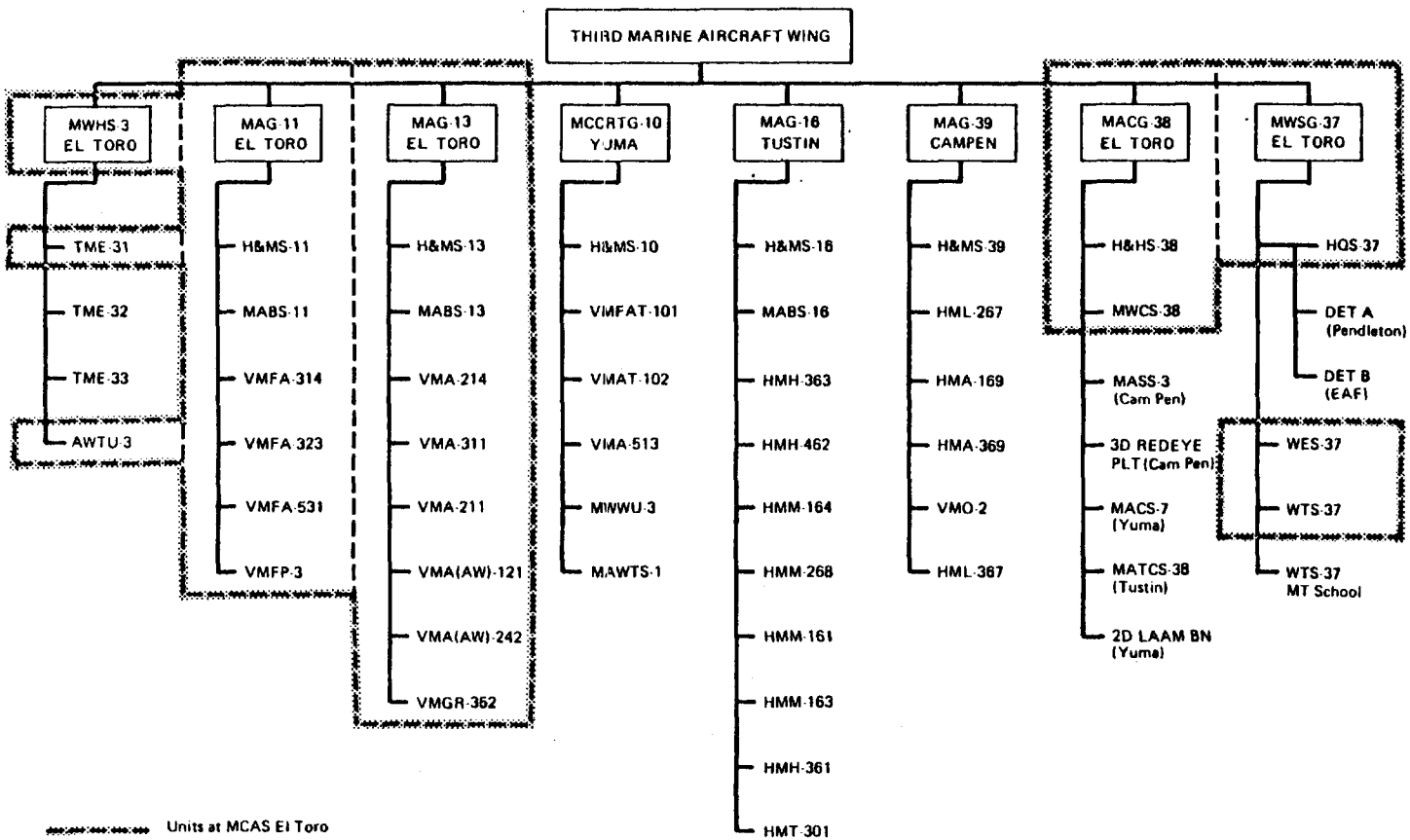
INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

Figure 4-3. Organization Chart for Marine Corps Air Station, El Toro



INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

Figure 4-4. Organization Chart for Third Marine Aircraft Wing



INITIAL ASSESSMENT STUDY
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Currently, the Atchison, Topeka, and Santa Fe Railroad runs right along the southwest boundary of MCAS El Toro. A low density residential area occurs just outside of the southeast border which also lines the Marine Memorial Golf Course. Residential areas of El Toro begin three quarters of a mile from the southeast border of the base. The main residential areas of the Irvine Community are located about 1-1/2 miles from the northwest border. The land north and northeast of the base, comprised of the Santa Ana Mountains and the San Joaquin Hills, is open and remains virtually undeveloped.

4.2 HISTORY. MCAS El Toro was originally commissioned in 1943 on an area of 2,319 acres. The station has grown to a present-day area of 4,698 acres.

4.2.1 Record of Real Estate Acquisition. The land was purchased from James Irvine II by condemnation proceedings. Real estate acquisitions are listed chronologically:

Date	Action
27 October 1942	2318.833 acres acquired under the authority of an Act of Congress, approved March 27, 1942.
1 July 1945	21.512 acres acquired under the authority of an Act of Congress, approved February 24, 1942.
9 January 1952	160.7343 acres acquired by a Grant Deed from El Toro Development Company, Inc.
13 August 1953	1403.42 acres acquired pursuant to a Declaration of Taking filed in the United States District Court for the Southern District of California.
16 April 1956	17.908 acres acquired pursuant to a Declaration of Taking filed in the United States District Court for the Southern District of California.
1976	730 acres acquired by exchange.

4.2.2 Historical Evolution. The historical evolution of MCAS El Toro is outlined below:

Date	Event
July 1942	Construction of MCAS El Toro began on land acquired in fee simple through condemnation from the Irvine Ranch Corporation.

Date	Event
17 March 1943	The base was commissioned as a fleet operational training facility for Marine Corps pilots.
February 1944	El Toro was designated as a major supply point for the other Marine Air Stations in the district.
1950	El Toro was selected for development as a master jet air station and permanent center for Marine aviation on the West Coast to support the operations and combat readiness of Fleet Marine Forces, Pacific.

4.3 LEGAL ACTIONS. Any past legal actions concerning hazardous or toxic wastes or other environmental issues would have been investigated through the Staff Judge Advocate's office at MCAS El Toro. No court cases concerning hazardous waste or other environmental issues have ever been brought to the attention of the Staff Judge Advocate.

4.4 BIOLOGICAL FEATURES.

4.4.1 Flora. Ninety percent of the native flora of MCAS El Toro has been cleared for agricultural purposes, construction, and paving. Seventy percent of the existing natural habitat consists of grassland, while the other 30 percent is comprised of sage-scrub communities.

4.4.1.1 Grassland Community. Seasonal rainfall of 12 inches per year on grassland results in a semidesert grassland community. Three types of plants have adapted to this region: annuals, succulents, and desert shrubs. Annuals have adapted by growing only in areas with adequate moisture. Succulents avoid drying out by storing water. Desert shrubs have adapted to lengthy dry periods with many branches and with thick small leaves that shed during droughts (MCAS El Toro, 1984). Table 4-1 shows the flora and fauna of the grassland community.

4.4.1.2 Sage-Scrub Community. The sage-scrub community consists of shrubs under 3 feet high, with the predominant species being the coastal California sagebrush. Buckwheat, also abundant in this community, thrives on the dry hillsides and other stable terrain (MCAS El Toro, 1984). Table 4-2 lists the flora and fauna of the sage-scrub community.

4.4.2 Fauna. Because so much of the natural vegetation at MCAS El Toro has been cleared, it can be assumed the native fauna population has greatly declined. Native fauna at the station include various birds, rodents, small game animals, and large and small predators. The most abundant are described below.

Table 4-1 Flora and Fauna of the Grassland Community
MCAS El Toro

Common Names	Technical Names
Plants:	
Johnson grass	Sorghum halepense
Spear grass	Stipa speciosa
Beard grass	Andropogon saccharoides
Cactus	Opuntia occidentailis
Brome grass	Bromus mollis & rubens
Golden-top grass	Lamarckia aurea
Wild oat	Avena fatua
Slender wild coat	Avena barbata
Yellow mustard	Brassica campestris
Filaree	Erodium moschatum
Wild pansy	Viola penduncalata
Wild onion	Allium haematochiton
Buckwheat	Eriogonum fasciculatum
Shooting star	Dodecatheon clevelandii
Wild barley	Hardeum murinum
Peppergrass	Lepidium nitidum
Hyacinth	Brodiaea pulchella
Buttercup	Ranunculus californicus
Chocolate lily	Fritillaria biflora
California sagebrush	Artemisia californica
California poppy	Eschscholtzia californica
Amphibians & Reptiles:	
California toad	Bufo boreas halophilus
San Diegan gopher snake	Pituophis melanoleucus
California king snake	Lampropeltis getulus californice
Striped racer	Coluber lateralis
Ring-necked snake	Diadophis amabilis
Horned lizard	Phrynosoma blainvillii
Western fence lizard	Sceloporus occidentalis
Side-blotched lizard	Uta stansburiana
Pacific rattlesnake	Crotalus viridis

(continued...)

Table 4-1 (continued...)

Common Names	Technical Names
Birds:	
Meadowlark	Sturnella neglecta
Horned lark	Otocaris alpestris actia
Lark sparrow	hondestes grammacus strigat
Grasshopper sparrow	Ammodramus savannarum bimaculatus
Rufous-crowned sparrow	Aimophila ruficeps
Shrike	Lanius ludovicionus gambeli
Mourning dove	Zenaidura macroura marginell
Copper hawk	Accipiter cooperii
Marsh hawk	Circus hudsonius
Red-tailed hawk	Buteo borealis calurus
Red-shouldered hawk	Buteo lineatus elegans
Turkey vulture	Cathortes aura septentrionali
Barn owl	Tyto alba pratincola
Golden eagle	Aquila chrysaetos canadensis
White tailed kite	Elanus leucurus majusculus
Roadrunner	Geococcyx californianus
California quail	Lophortyx californ cus
Mockingbird	Mimus polyglattus
Mammals:	
Southern California meadow mouse	Microhus californicus sanciidiegi
Long tailed harvest mouse	Reithrodontomys megalotis longicaudus
California pocket mouse	Perognathus californicus
Deer mouse	Peromyscus maniculatus
Grapeland pocket mouse	Thomomys bottae palescens
San Diego wood rat	Neotoma fuscipes macrotis
Desert wood rat	Neotoma lepida
California ground squirrel	Citellis beecheyi
San Diego jackrabbit	Lepus californicus bennettii
California valley coyote	Canis latrans ochropus

Table 4-2 Flora and Fauna of the Sage-scrub Community
MCAS El Toro

Common Names	Technical Names
Plants:	
Melic grass	Melica frutescens
Soap plant	Chlorogalum pomeridianum
Slender wild oat	Avena barbata
Wild oat	Avena fatua
Buckwheat	Eriogonum fasciculatum
Wild onion	Allium haematochiton
Golden star	Bloomeria crocea
Hedge mustard	Sisymbrium officinale
Fileree	Erodium moschatum
Laurel sumac	Rhus laurina
Purple sage	Salvia leucophylla
Black sage	Salvia mellifera
White sage	Salvia apiana
California sagebrush	Artemisia californica
Deerweed	Lotus scoparius
Lemondade berry	Rhus integrifolia
Live forever	Dudleye stolonifera
Wild rose	Rosa californica
Reptiles:	
Brown-shouldered lizard	Uta stansburiana hesperis
San Diego horned lizard	Phrynosoma coronoatum blainvillii
Gopher snake	Pituophis melanoleucus
Worm snake	Leptotyphlops humilis humilis
Blue-tailed skink	Eumeces skiltonianus
California king snake	Lampropeltis getulus californica
Boyle's king snake	Lampropeltis getulus boylii
Black-headed snake	Tantilla planiceps
Rosy boa	Lichanura roseofusca roseofusca
Speckled rattlesnake	Crotalus Mitchelli pyrrhus
Red diamond rattlesnake	Crotalus ruber
Western fence swift	Sceloporus occidentalis
Pacific rattlesnake	Crotalus viridis

(continued...)

Table 4-2 (continued...)

Common Names	Technical Names
Birds:	
Meadowlark	Sturnella neglecta
Black-chinned sparrow	Spizella atrougularis cana
Gambel sparrow	Zonotrichia leucophrys gambelii
Lincoln sparrow	Melospiza lincolnii lincolnii
Lark sparrow	Chandestes grammacus strigatus
Bell sparrow/sage sparrow	Amphispiza belli belli
Shrike	Lanius ludovicianus gambeli
Red-tail hawk	Buteo borealis calurus
Common nighthawk	Chordeiles minor
Copper hawk	Accipiter cooperii
California quail	Lophortyx Californicus
Mourning dove	Zenaidura macroura marqinella
Roadrunner	Geococcyx californianus
Barn owl	Tyto alba pratincola
Dusky poorwill	Phalaenoptilus nuttalii californicus
Anna's hummingbird	Calypte anna
Cassin kingsbird	Tyrannus vociferans
Brown towhee	Pipilo maculatus megalonyx
Black phoebe	Sayornis nigricans nigricans
Say phoebe	Sayornis saya saya
Hermit thrush	Hylocicala guttata guttata
Audubon warbler	Pendroica auduboni audoboni
California thrasher	Toxostoma redivivum redivivum
Mockingbird	Mimus polyglottus
Mammals:	
Dulzura white footed mouse	Peromyscus eremicus fraterculus
Gambel white footed mouse	Peromyscus maniculatus gambeli
Short-eared pocket mouse	Perognathus fallax fallax
Long-tailed harvest mouse	Reithrodontomys megalotis longicaudus
Southern California meadow mouse	Microtus californicus sanctidiegi
California pocket mouse	Perognatnus californicus
California mouse	Peromyscus californicus insignis
Pocket gopher	Thomomys battae
Gambel kangaroo rat	Dipodomys agilis agilis
California ground squirrel	Citellis beecheyi
Pacific pallid bat	Antrozous pallidus pacificus
California spotted skunk	Spilogale gracilis phoenox
Southern California striped skunkMephitis	Mephitis mephitis holzneri
San Diego jackrabbit	Lepus californicus bennettii
San Diego cottontail	Sylvilagus audubonii sanciidiegi
Ashy brush rabbit	Sylvilagus bachmani cinerascens
California valley coyote	Canis lotrans ochropus
California gray fox	Urocyon cinereoargenteus

4.4.2.1 Birds. The California quail is a year-round resident of MCAS El Toro and can be found throughout parts of the station where natural vegetation still exists. The base provides a good quail habitat in most respects, though slightly deficient in available water; thus, the quail population is abundant (MCAS El Toro, 1984).

Mourning dove is also found throughout the station. The population size varies daily because this bird is a transitory species. Some nesting occurs, although the extent is unknown. The doves use the base mostly as a feeding and resting area (MCAS El Toro, 1984).

The burrowing owl is also found at MCAS El Toro. This species is a bird of prey and not abundant in the local area. Suitable habitats are available for breeding and foraging. Owls have been seen to nest at the station (MCAS El Toro, 1984).

The white tailed kite is found at the station. This species is also a bird of prey. The kite population was declining in California, but it has recently increased in number. The kite has not been observed to nest at the station (MCAS El Toro, 1984; and California Department of Fish and Game, 1985).

4.4.2.2 Small Game Animals. Cottontail rabbit, another abundant species at this Marine Corps base, is the primary small game animal. The habitat for rabbits ranges from good to excellent (MCAS El Toro, 1984).

4.4.2.3 Predators. The large transient predators are the coyote, bobcat, and gray fox. The natural vegetative areas of the base are not large enough to support large resident populations. Small predators such as opossums and skunks are scattered throughout the base (MCAS El Toro, 1984).

4.4.2.4 Rodents. The rodents in this area are the California ground squirrel and the pocket gopher. Operations to control the rodent population are currently being conducted (MCAS El Toro, 1984).

4.4.2.5 Other Fauna. A list of fauna in the region of the base can be found in Tables 4-1 (grassland community) and 4-2 (sage-scrub community).

4.4.3 Rare, Threatened, and Endangered Species. The Endangered Species Act of 1973 (Public Law 93-02050), as amended, provides that all federal agencies shall carry out programs for the conservation of listed Endangered and Threatened species. Federal agencies must ensure that actions authorized, funded, or carried out by them will not jeopardize the continued existence of any Endangered or Threatened species or result in the destruction or adverse modification of critical habitats as determined by the Secretary of the Interior (OPNAVINST 5090.1, 1983).

The list of Endangered and Threatened animal and plant species is published in the Federal Register 50 CFR 17.11-17.12. The official State of California listing of Endangered and Rare animals is contained in California Administrative Code, Title 14, Section 670.5 (State of California, 1983). The California Native Plant Protection Act of 1978 assigns primary responsibility to the State Department of Fish and Game for determining California plants to be listed as Endangered or Rare. As of 20 November 1979, the State of California had listed 75 Endangered and 40 Rare plants. The Department of Fish and Game uses the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California as their species-of-concern list (California Native Plant Society, 1980).

A species is Endangered when its prospects of survival and reproduction are in immediate jeopardy. A species is Threatened or Rare when, although not immediately facing extinction, it is in such small numbers throughout its ranges that it may become Endangered if its present environmental conditions deteriorate. "Candidate 2" means that the species cited has met the criteria required for inclusion as a threatened species, but has not yet been officially listed.

A computer search of the Natural Diversity Data Base (NDDB) by the California Department of Fish and Game was conducted for El Toro, California. The NDDB lists Rare, Endangered, and Threatened animals and plants officially recognized by federal and California law. As of 13 March 1985, no plants or animals were listed for El Toro. However, two species of animals were listed for the Tustin area, in the immediate vicinity of the Upper Newport Bay Ecological Reserve. One was listed as Endangered and one was listed as Possibly-threatened (Candidate 2).

4.4.3.1 Rare or Endangered Species Associated with the Upper Newport Bay Ecological Reserve. The Upper Newport Bay Ecological Reserve was established in 1975 for the purpose of preserving and enhancing a saltwater marsh ecosystem and the various forms of life that are dependent upon this habitat. Three washes--Bee Canyon, Agua Chinon, and Borrego Canyon--drain the station via San Diego Creek to the Ecological Reserve.

Eight species classified by the State of California as either rare or endangered are dependent on Upper Newport Bay (Wilcox). The bay is the year-round home for two endangered birds: the light-footed clapper rail (*Railus longirostris levipes*) and the Belding's savannah sparrow (*Passerculus sandwichensis belding*).

Four other rare or endangered birds visit the bay: the California least tern (*Sterna antillarum browni*), the California brown pelican (*Pelicanus occidentalis californicus*), the American peregrine falcon (*Falco peregrinus anatum*) and the rare California black rail

(Laterallus jamaicensis obsoletus). Two plants are similarly classified, the Endangered salt marsh bird's-beak (Cordy-lanthus maritimus maritimus) and the Rare Laguna live forever (Dudleya stolenifera).

4.4.3.2 Endangered Species. The California least tern (Sterna antillarum browni) is classified endangered by both federal and state codes and has been reported to nest in the immediate vicinity of the Upper Newport Bay Ecological Reserve. The least tern is a small (8-1/2-to 9-1/2-inch) white bird with gray mantle, black cap, and a white forehead. It breeds world wide along ocean coasts and in broad river valleys in mud, sand and gravel beaches. It arrives at northern breeding areas near the reserve between mid-April and mid-May and leaves between mid-July and October (Reilly, 1968). The tern consumes small fish--such as anchovy, top smelt, shiner perch, or killigish (California Department of Fish and Game, no date)--as well as crustaceans, worms, and mollusks (Reilly, 1968). Due to loss of habitat, human disturbance, and animal predation in nesting areas, the least tern has been declared endangered (California Department of Fish and Game, no date.)

4.4.3.3 Possibly-threatened Species. The California black-tailed gnatcatcher (Polioptila melanura california) is listed federally as a candidate 2 species and has no listing for California status. This bird has been spotted in the immediate vicinity of the Upper Newport Bay Ecological Reserve. The black-tailed gnatcatcher is 4-1/2 inches long with black cap and tail, dark gray back and wings, and white belly. It is a resident of Southern California, Arizona, New Mexico, Texas, and Northern Mexico. It lives in arid and semiarid scrub, mesquite, and sage with no seasonal movements. The gnatcatcher feeds on insects of all kinds, spiders, other small invertebrates, and small amounts of seeds and berries (Reilly, 1968).

4.4.3.4 Impacts of Hazardous Waste Disposal, Endangered, or Possibly-Threatened Species. Hazardous wastes disposed of at MCAS El Toro may affect the above described birds from bioaccumulation of toxic substances through the food chain (that is, contamination of worms, insects, and other small invertebrates which the birds eat).

4.4.3.5 300 Acre Duck Pond Area. A series of marsh-like wildlife refuges (associated with the University of California at Irvine, and with an area of approximately 300 acres) are located immediately adjacent to San Diego Creek, about 8 miles southwest of MCAS El Toro. Much of the wildlife seen at MCAS El Toro and at the Upper Newport Bay Ecological Reserve also use this wildlife refuge, most notably the cottontail rabbit, many common rodents and birds. The possibly threatened California Black-Tailed Gnatcatcher and the endangered California least tern may also use this refuge.

4.5 PHYSICAL FEATURES. This section describes the physical features of the MCAS El Toro area and its vicinity.

4.5.1 Climatology. The climate at MCAS El Toro is typical of the Southern California Coastal Region. There are two seasons, a cool moist winter and a mild dry summer. Early morning light fogs and low clouds are common in the late spring and early summer. Summer temperatures usually do not exceed 100 degrees F. Nights are generally cool throughout the year. Winter temperatures seldom drop below freezing, with 37 degrees F being the approximate low.

The average annual precipitation for MCAS El Toro is approximately 12 inches per year and occurs mostly during the winter. Annual rainfall data for Orange County are tabulated in Table 4-3. Dry, damaging winds, locally known as the "Santa Anas", occur for short periods during the late fall or early winter. The combined effect of dry air, strong gusty winds, and unprotected soil occasionally produces clouds of dust (Master Plan, 1982).

4.5.2 Topography. MCAS El Toro is located on an alluvial plain known as the Tustin plain at the foot of the Santa Ana Mountains. With the exception of the eastern corner (which is mountainous), the station is flat, sloping gently from east to west.

The mountains rise sharply north and east of the station with the highest peak reaching 6,698 feet above sea level, 10 miles east of the station. To the south, the coastal hills (Lomas de Santiago) rise gradually to a height of 1,170 feet within 6 miles of the station. The land to the west is characterized by gently rolling hills, and to the northwest, the land is relatively level (Master Plan, 1982). Figure 4-5 shows the topography of the station.

4.5.3 Geology. MCAS El Toro lies on the Tustin plain, the southernmost extension of the central plain of the Los Angeles basin (see Figure 4-6). The Tustin plain results from the alluvial fan formed by Santiago Creek and other smaller fans derived from the southern part of the Santa Ana Mountains (California Department of Water Resources, 1967). In the area of MCAS El Toro, Holocene (Recent) alluvial fan material is underlain by a large volume of unconsolidated to semiconsolidated Pleistocene stream terraces, older alluvium, and lagoonal or shallow marine sedimentary units.

The underlying Tertiary rocks are comprised of consolidated marine deposits which lie on the basement rocks of Jurassic age igneous and metamorphic rocks. Table 4-4 shows the general stratigraphy in the area of MCAS El Toro, and Figure 4-7 shows the surficial geology of the area.

Table 4-3. Historical Annual Rainfall for Orange County, California

Year	Inches	Percent of average[a]	Year	Inches	Percent of average
1931	7.95	66	1956	13.05	102
1932	11.93	93	1957	8.42	66
1933	6.33	50	1958	21.68	170
1934	9.10	71	1959	6.34	50
1935	17.69	139	1960	10.20	80
1936	8.89	70			
1937	22.93	180	1961	3.56	28
1938	17.58	138	1962	13.52	106
1939	15.29	120	1963	5.88	46
1940	16.16	127	1964	10.21	80
			1965	10.41	82
1941	32.14	252	1966	12.78	100
1942	12.55	98	1967	15.41	121
1943	15.56	122	1968	9.42	74
1944	16.68	131	1969	19.71	154
1945	14.96	117	1970	9.01	71
1946	9.49	73			
1947	11.82	93	1971	8.60	67
1948	7.52	59	1972	4.88	38
1949	8.14	64	1973	16.30	128
1950	9.12	71	1974	11.46	90
			1975	12.08	95
1951	7.55	59	1976	7.18	56
1952	22.97	180	1977	10.42	82
1953	9.66	76	1978	28.52	223
1954	11.23	88	1979	18.47	145
1955	10.74	84	1980	21.20	166
			1981	8.76	69

Source: Data from Orange County Environmental Management Agency, Station 121, Santa Ana, which is centrally located midway between the coast and the Santa Ana mountains. The rainfall received at the station is representative of that received over Orange County. Station is operated and observed by Orange County Environmental Management Agency. (Orange County Water District, 1981).

[a]Using an average of 12.77 inches per year.

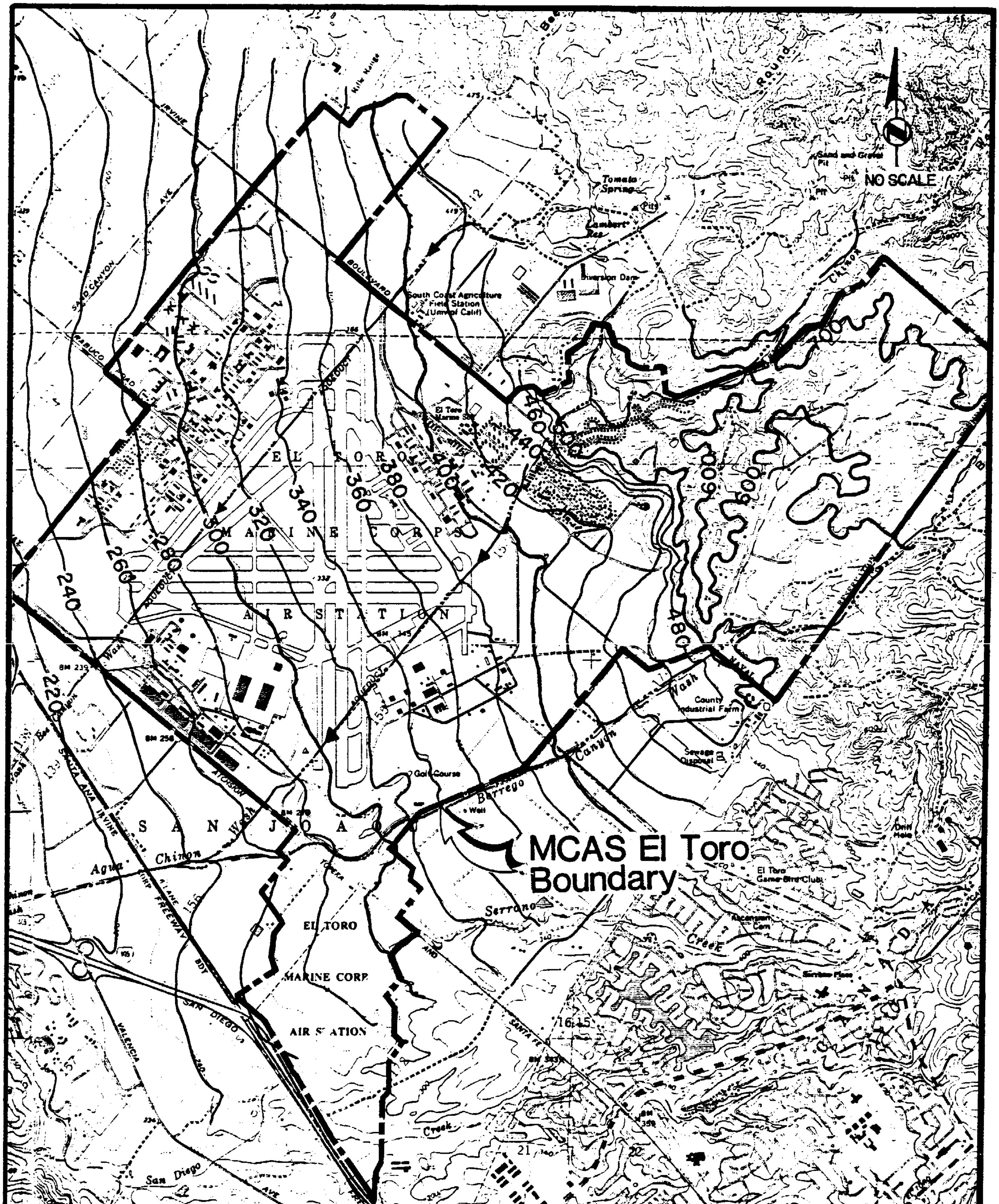
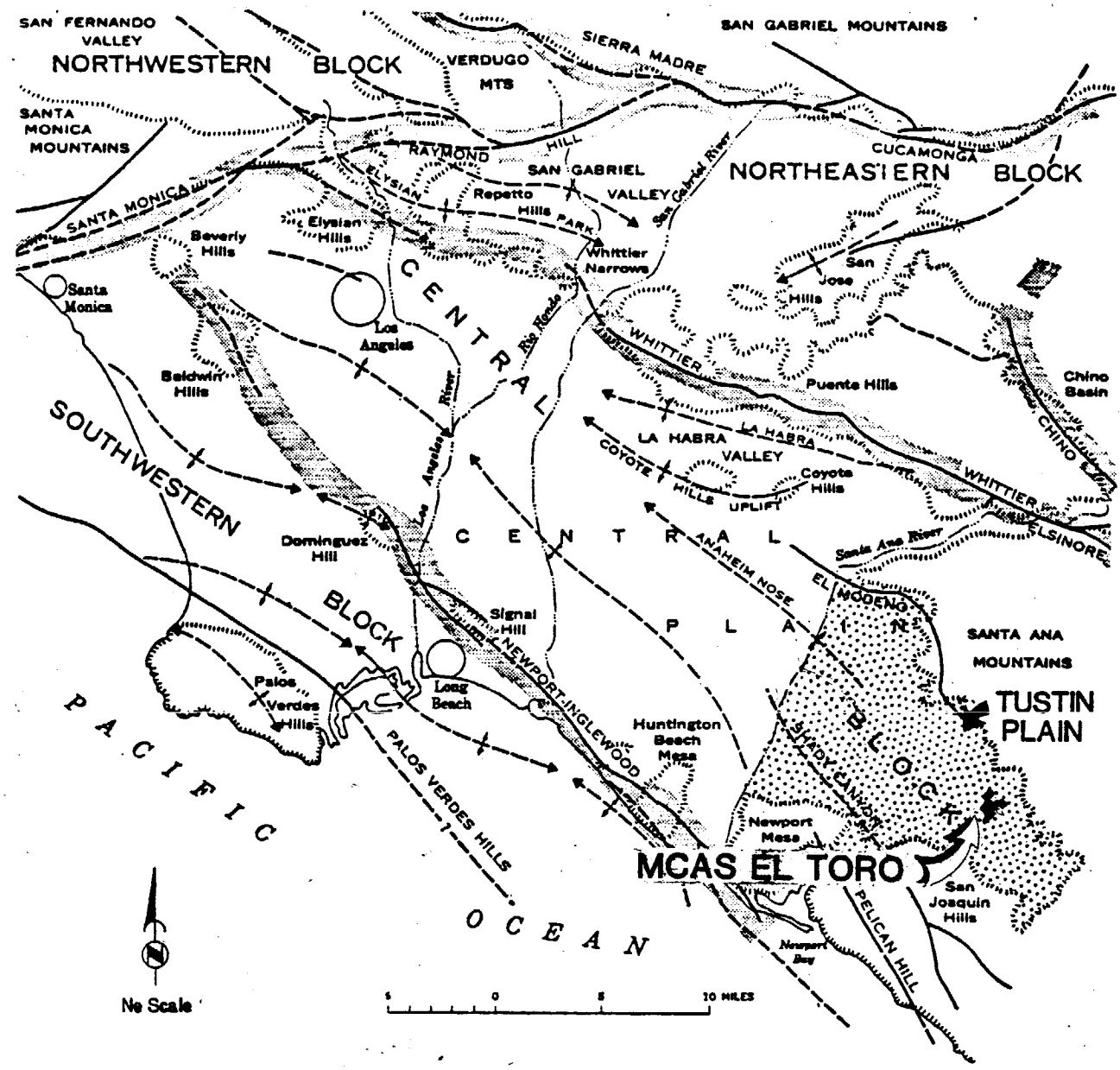


Figure 4-5. Topographic Map and Surface Drainage of MCAS, El Toro

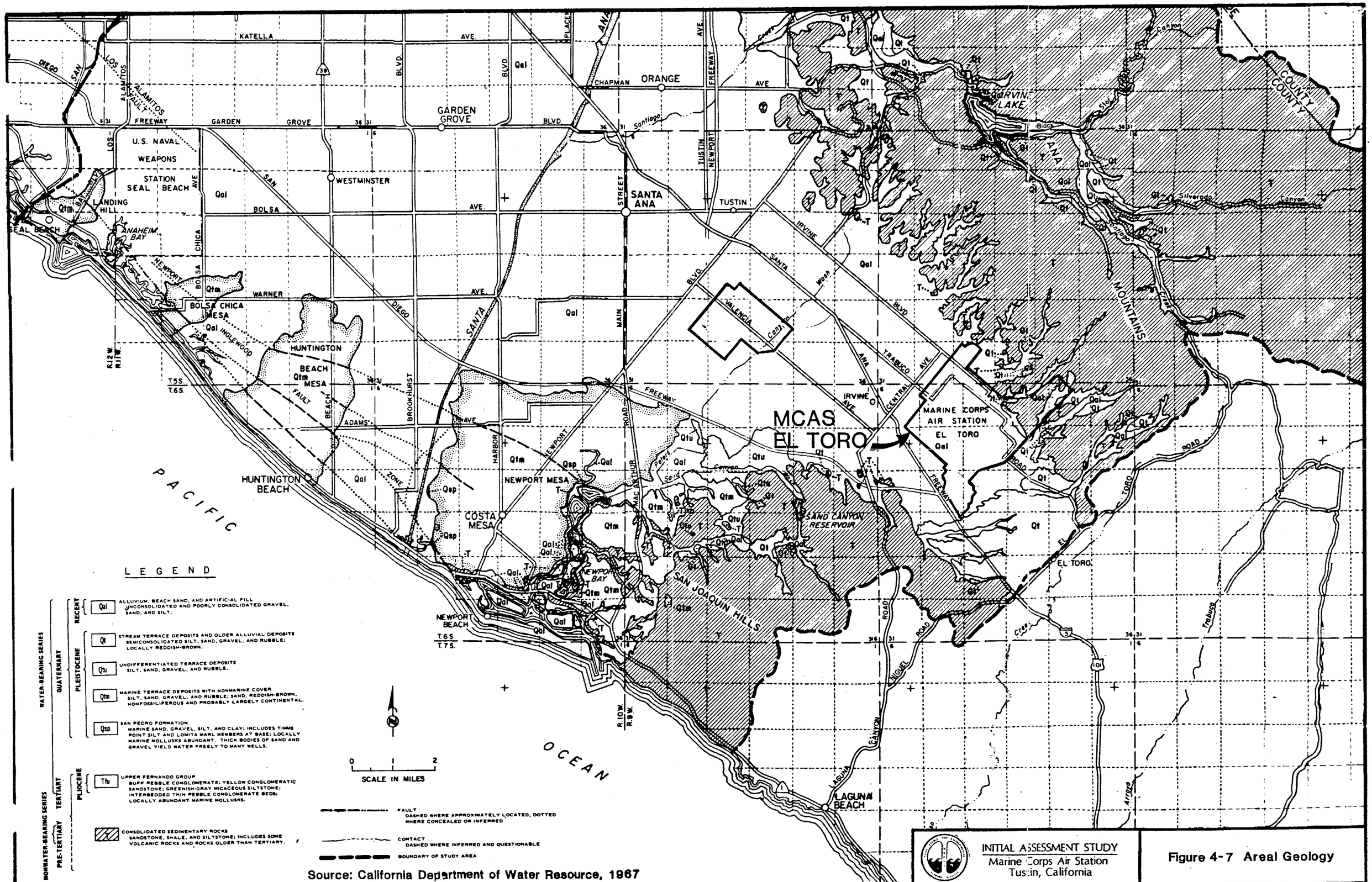
INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California



Source: Yerkes and Others, 1965

Figure 4-6. Key to Physiographic and Major Structural Features

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California



Source: California Department of Water Resource, 1967

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
Tustin, California

Figure 4-7 Areal Geology

Table 4-4 Generalized Geological Column

System	Series	Formation	Estimated thickness, feet	Physical characteristics	Groundwater conditions
Quaternary	Holocene	Alluvium local	Zero to 200	Predominantly silt and clay with occasional lenses of sand and gravel, fluvial in origin. Pleistocene deposits are generally redish brown and semiconsolidated. Terrace deposits are quite thin and occur along valley walls.	Perched and semi-perched aquifers. Poor quality of water. Not used. Can act as direct recharge to several large surface drainage channels.
	Pleistocene	Stream terrace and older alluvium (Unconformity)			Separate from shallow zone by extensive clay to silty clay lens. Semiconfined aquifers. Recharge from forebay areas through precipitation. Poor quality for water, generally not used.
Tertiary	Pliocene	San Pedro Formation (Unconformity)	100 to 750	Semiconsolidated sand and gravel, silts and clays with limestone interbeds of lagoonal or shallow marine origin.	Production zone for Irvine Subbasin for agricultural needs. Separated from upper aquifer system by clay and silt layers. Hydraulic connection with upper aquifer system exists. Water quality good. Confined aquifer in pressure area.
Pretertiary	Paloceneto Miocene	-	Between 3,000-4,000	Alternative siltstones, shale, sandstone with some schist-bearing conglomerate.	Generally, nonwater bearing.
Cretaceous to Jurassiac	-	-	-	Basement rock of igneous and metasedimentary units. Includes igneous rocks of quartz and granodiorite composition; possibly volcanic rocks.	Impervious nonwater bearing.

Source: Compiled from Camp Dresser & McKee Inc., 1984; Banks and Others, 1984; California Department of Water Resources, 1967; Poland and Piper, 1956; Yerkes and Others, 1965; and Singer, 1973.

4.5.3.1 Stratigraphy. MCAS El Toro lies on alluvial deposits of Holocene Age. The Holocene alluvial deposits are underlain by older alluvial deposits of Pleistocene Age. The Holocene alluvium and the upper Pleistocene stream terrace and older alluvial deposits are composed of silt and clay with occasional lenses of sand and gravel. The estimated total thickness of the two units is variable and less than 200 feet in the MCAS El Toro area. The terrace deposits are thin and occur only along the previous margins of the basin. The upper Pleistocene deposits are generally reddish brown in color and are semiconsolidated. Both the terrace deposits and, in places, the upper Pleistocene deposits lie directly on bedrock along the upper reaches (headwaters) of the existing streams, as is likely beneath MCAS El Toro.

The lower Pleistocene San Pedro Formation is composed of semi-consolidated sand and gravel deposits with silts, clays, and interbedded limestones. Total thickness of the San Pedro Formation is between 100 and 750 feet in the MCAS El Toro area (Table 4-4), and likely does not exist beneath MCAS El Toro. The San Pedro Formation is of lagoonal or shallow marine origin.

The consolidated rocks of pre-Tertiary Age are comprised of sandstone, siltstone, shale, and some conglomerate lenses. These rocks, considered to be the local bedrock, have a maximum thickness of between 3,000 to 4,000 feet in the MCAS El Toro area (Yerkes and others, 1965).

Basement rocks are composed of metasedimentary, metavolcanic, and igneous rocks of quartz diorite or granodiorite composition. These rock units are believed to be of Cretaceous to Jurassic Age and may belong to the Franciscan Formation (Poland and Piper, 1956). A regional unconformity exists between these basement rocks and the overlying sedimentary bedrock.

4.5.3.2 Structural Geology. MCAS El Toro lies on the south-eastern margin of the northwest-trending Los Angeles Basin (see Figure 4-6). The central block of the Los Angeles Basin, 30 miles to the northwest, is characterized by a northwest-trending, doubly plunging synclinal trough, 31,000 feet deep. This trough is bounded by the Santa Ana Mountains on the east and the San Joaquin Hills on the west; both ranges were formed by uplift during Quaternary Time. South of MCAS El Toro, three northwest-trending fault zones exist: Shady Canyon, Pelican Hill, and the Newport-Inglewood Faults. The Shady Canyon Fault lies approximately 2 miles southwest of MCAS El Toro and was active only during pre-middle Miocene time (Yerkes and others, 1965). Relative movement on the Shady Canyon Fault has been upward to the east with the downthrow block to the west (Miller and Tan, 1976).

The Pelican Hill Fault, approximately 5 miles southwest of MCAS El Toro, is a right-lateral strike-slip fault which displaces early Miocene and late Pliocene rocks. The Pelican Hill Fault is a probable branch of the Newport-Inglewood Fault zone (Miller and Tan, 1976). The Newport-Inglewood Fault is a right-lateral strike-slip fault which displaces lower Pliocene rocks and lies approximately 9 miles southwest of MCAS El Toro. The Pelican Hill and Shady Canyon Faults do not appear to be active fault zones; however, the Newport-Inglewood Fault zone is believed to be responsible for the 1933 Long Beach earthquake (Yerkes and others, 1965).

4.5.3.3 Geologic Hazards. MCAS El Toro is in a seismically active area of Southern California. Historic earthquakes potentially damaging to structures are known to have occurred with magnitudes between 4.7 and 8.0 as shown in Table 4-5. The faults most likely to have generated these earthquakes are the San Andreas (30 miles north), the Elsinore-Whittier (13 miles north), and the Newport-Inglewood (9 miles southwest) (Miller and Tan, 1976). MCAS El Toro lies on dense soil with a deep groundwater table. The predominant potential seismic hazard is ground motion. Ground breakage or failure is not expected to be a problem. The possibility of liquefaction is expected to be remote (Naval Facilities Engineering Command, 1983).

4.5.4 Soils. The U.S. Department of Agriculture Soil Conservation Service (Wachtell, 1978) identified four major soil types at MCAS El Toro. They include the Sorrento loam, the San Emigdio fine sandy loam, the Metz loamy sand, and the Myford sandy loam. River wash soils are also noted in the USDASCS reports.

4.5.4.1 Sorrento Loam. The Sorrento loams are derived from the large alluvial fans and floodplains at the station. Sorrento soils have a grayish brown loam, underlain by a grayish brown, light brown gray and pale gray silty clay loam. The loams are moderately alkaline and calcareous throughout with a pH between 6.1 to 8.4. These soils possess a moderate to low shrink-swell potential, a permeability of 0.2 to 2.0 in/hr, an available water capacity of 0.16 to 0.21 in/in, and a moderate infiltration rate (Watchell, 1978). Runoff is slow and the erosion hazard for these soils is slight.

The Sorrento loam covers the majority of the central station area at MCAS El Toro and can also be found along the upper reaches of Borrego Canyon wash.

4.5.4.2 San Emigdio Fine Sandy Loam. The San Emigdio fine sandy loams are also derived from alluvial fan materials and floodplain materials. These soils are found north of the main runway area at the station and also along the upper reaches of Borrego Canyon

Table 4-5. Earthquakes That Were Potentially Damaging to Structures, El Toro Area

Date	Approximate area of origin	Modified Mercalli intensity near origin	Magnitude Richter reference
1769 July 28	Not known but noted by Portola expedition near mouth of Santa Ana Canyon	?	?
1812 December 8	Not known, but severely damaged Missions San Juan Capistrano and Santa Ynez	IX-X	7[a]
1857 January 9	Port Tejon region	X-XI	8.0[a]
1892 February	Baja California, Mexico	?	7.0[a]
1893 April 4	Newhall	VIII-IX	?
1899 December 25	San Jacinto-Hemet	IX	7.0[a]
1918 April 21	San Jacinto-Hemet	IX	7.0[a]
1923	San Bernardino	?	6.0[a]
1933 March 10	Long Beach (offshore)	IX	6.3[a]
1938 May 31	Santa Ana Mountains (Upper Trabuco Canyon)	VI	5.5
1956 January 3	Riverside County (Glen Ivy)	VI	4.7

Source: Miller and Tan, 1976.

[a]Estimated.

wash. The San Emigdio loams are well drained, light brownish gray to very pale to pale brown in color and have a low shrink-swell potential. The available water capacity of these soils ranges from 0.12 to 0.17 in/in and the general pH is 7.9 to 8.4. The Emigdio loams are rapidly permeable (2.0 to 6.0 in/hr) and have a moderate infiltration rate (Wachtell, 1978).

4.5.4.3 Metz Loamy Sand. The Metz loamy sand is derived from large alluvial fans and floodplain deposits which lie in the area between the MCAS El Toro family housing units and North Marine Highway. These soils are pale brown to brown to very pale brown in color and are excessively drained. They have a low shrink-swell potential, a pH between 6.6 and 8.4, a high permeability (2.0 to 20 in/hr), and an available water capacity of 0.07 to 0.11 in/in.

4.5.4.4 Myford Sandy Loam. The Myford sandy loam is formed on the broad marine terrace deposits which lie in the area of the present-day golf course along Borrego Canyon wash. These soils are pale brown to pinkish gray in color and have a permanently high water table. The Myford loams have a high shrink-swell potential, an available water capacity of 0.02 to 0.14 in/in, a pH of 5.1 to 8.4, a slow permeability (0.06 to 6.0 in/hr), and a very slow infiltration rate (Watchell, 1978).

4.5.4.5 River Wash Soils and Miscellaneous Canyon Soils. River wash soils which are generally stratified sandy, cobbly, and bouldery have developed along Borrego Canyon wash. These soils have a slow infiltration rate and a rapid runoff hazard.

Balcom clay loams, Capistrano sandy loams, and Soper gravelly loams are found in insolated patches along the upper reaches of the major canyons north of the station. These soils range in pH from medium acidity (Capistrano loams) to moderate alkaline. The clayey loams are slowly permeable (0.2 to 0.6 in/hr), and the gravels are rapidly permeable 2.0 to 6.0 in/hr (Watchell, 1978). These canyon soils have a moderate to low shrink-swell potential and range from reddish brown to yellowish red in color.

4.5.5 Surface-Water Hydrology. Surface runoff of excess precipitation leaves MCAS El Toro in two ways: through the underground storm drainage system or through open ditches and channels. Figure 4-5 shows the interrelation between these two systems, as well as the main drainage ditches at the station.

4.5.5.1 Direction of Surface-Water Flow. In general, surface-water flow is to the south and southwest, away from the station. Three major channels receive runoff from the station--Bee Canyon wash, Agua Chinon wash, and Borrego Canyon wash. Bee Canyon wash transects the station on the northwestern side and empties directly into San Diego Creek. Borrego Canyon wash lies along the southern and

southeastern perimeter of the station and empties into Agua Chinon wash just outside of the southern station boundary. Agua Chinon wash transects the central portion of the station and flows into San Diego Creek approximately 1,500 feet upstream from Bee Canyon wash. Agua Chinon and Bee Canyon wash merge with San Diego Creek approximately 6,000 feet southwest of MCAS El Toro. San Diego Creek empties into Newport Bay approximately 9 miles southwest of the station.

4.5.5.2 Volume of Surface-Water Flow. A stream gauge approximately 1-1/2 miles southwest of the station, at the intersection of San Diego Creek and Sand Canyon Avenue, has a total annual historical flow of 31,300 cubic decameters (8.3 billion gallons) (Orange County Environmental Management Agency, 1982).

4.5.5.3 Surface-Water Quality. The quality of surface water in San Diego Creek approximately 9 miles downstream from MCAS El Toro is shown in Table 4-6. The water is high in calcium, sodium, bicarbonate, sulfate, chloride, total hardness, and total dissolved solids. This sample does not directly indicate the quality of the runoff water leaving the station, but it is representative of the receiving waters for station runoff. Permitted discharges from industrial sources include the Canada filter plant which enters Serrano Creek, a tributary to San Diego Creek, south-east of the station (Banks and others, 1984). Additional discharges from water reclamation plants also enter San Diego Creek upstream from the station.

4.5.6 Ground Water Hydrology. MCAS El Toro lies in the Irvine ground water subbasin, a subbasin of the Los Angeles ground water basin (or Coastal Plain basin) as described by Banks and others (1984) and shown on Figure 4-8. The Irvine ground water subbasin also lies adjacent to and southeast of the Orange County ground water basin. Within the Irvine subbasin, three major water-bearing strata have been recognized. Table 4-7 summarizes the various aquifer zones as described in the available literature. This classification of the aquifers is based on depth of the water-bearing strata and lithologic correlation with the existing geological formations.

4.5.6.1 Horizontal Extent of Aquifers. The transition between sedimentary units of the Irvine subbasin and the main ground water basin of Orange County is poorly defined. Aquifer zones generally have a greater areal extent and thickness in the main Orange County basin than in the Irvine subbasin (Banks and others, 1984). The Irvine subbasin area aquifers have lower permeabilities than the equivalent zones of the main basin and aquifer correlation between the two basins is difficult (Banks and others, 1984).

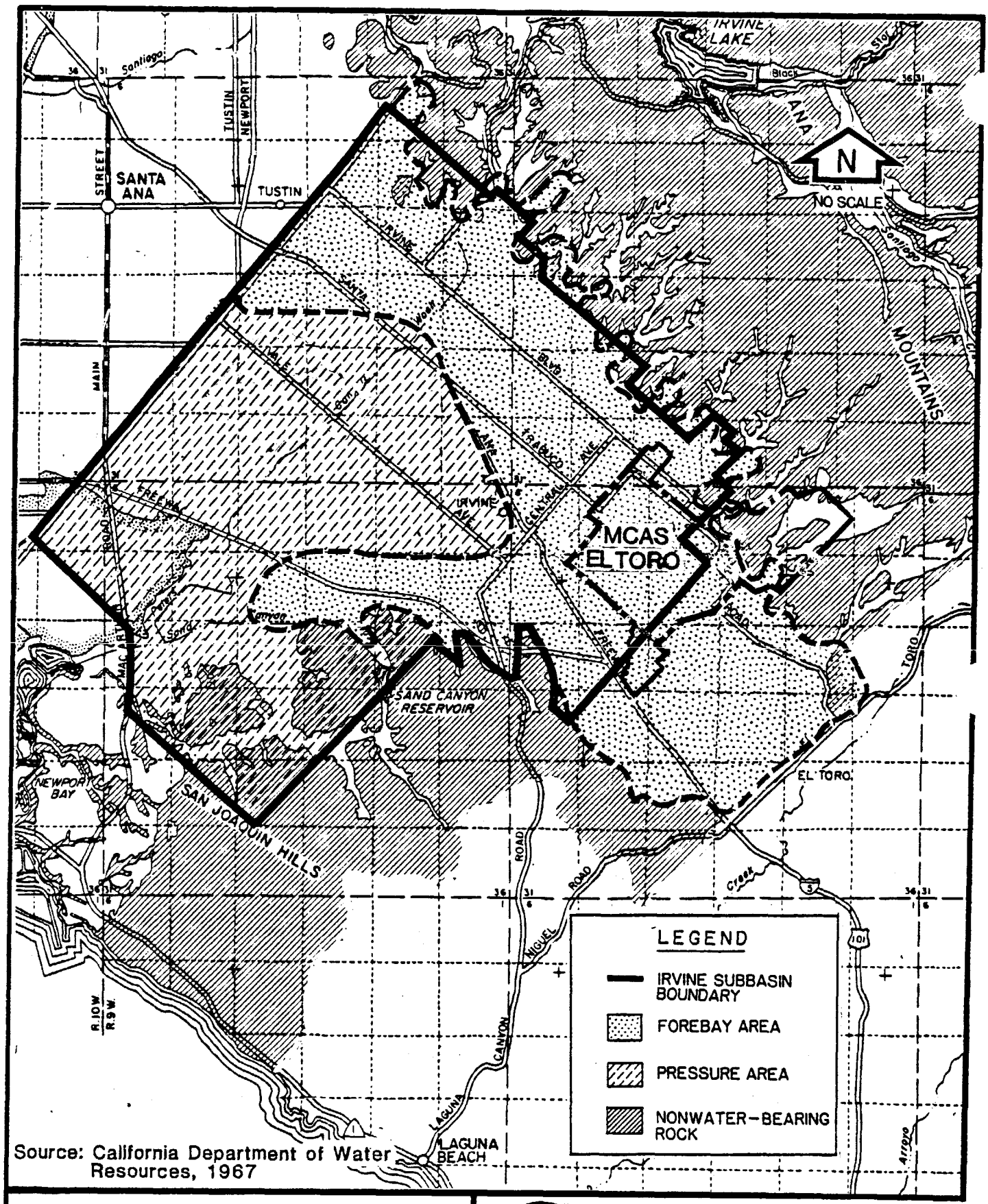
4.5.6.2 Vertical Extent of Aquifers. A section (up to 750 feet) of unconsolidated to semiconsolidated sedimentary units comprise the water-bearing zones in the vicinity of MCAS El Toro. These

Table 4-6. Surface-Water Quality

Constituents	Value[a]
Calcium	183
Magnesium	77
Sodium	286
Potassium	12
Bicarbonate	206
Sulfate	713
Chloride	135
Nitrate (as N)	1.6
Manganese	-
Iron	0.02
Boron	0.5
Silica	27
Fluoride	-
pH (units)	7.8
Temperature (degrees C)	-
Total Hardness (as $CaCO_c$)	1,780
Electrical Conductivity (micromhos per centimeter at 26 degrees C)	-

Source: Banks and Others, 1984.

[a]Concentrations of chemical constituents are expressed as milligram per liter (mg/l) except when stated otherwise. Grab sample at San Diego Creek between Jamboree and MacArthur Boulevard on June 2, 1983.



Source: California Department of Water Resources, 1967

Figure 4-8. Hydrogeological Basin Boundary

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Table 4-7 Correlation of Geologic Formations With Aquifer Systems

Formation name[a]	Coastal plain[b]	This report		Aquifer system designations				CA DWR report[d]	
				CDM report[c]		Banks report[b]			
	Name	Name	Depth	Name	Depth	Name	Location	Name	Thickness
Recent Alluvium	Talbert	Shallow and upper aquifer system	Variable <200 feet	Perched zone	<10 feet	Semi-perched	50-foot depth		
Stream terrace deposits and older Alluvium	Alpha Beta Lambda			Shallow zone	Bottom depth at 300 feet maximum	Shallow	50- to 100-foot depth	Upper aquifer system	800 - 1,100 feet
San Pedro Formation	Omicron Rho Main	Middle aquifer system	100 to 750	Deep zone	Bottom depth at 950 feet	Principal aquifer zone	From depth of 200 feet down base	Middle aquifer system Main	50 - 1,600 feet
Fernando Group (Pico Formation equivalent)		Lower aquifer system	Believed to be absent	(Not included in report)		Lower aquifer system	Depth to top 1,300 to 1,900 feet	Lower aquifer system	350 - 500 feet

[a]See Table 4-4 for description of rock types.
[b]Banks and others, 1984.
[c]Camp Dresser & McKee Inc., Consulting Engineers, 1984.
[d]California Department of Water Resources, 1967.

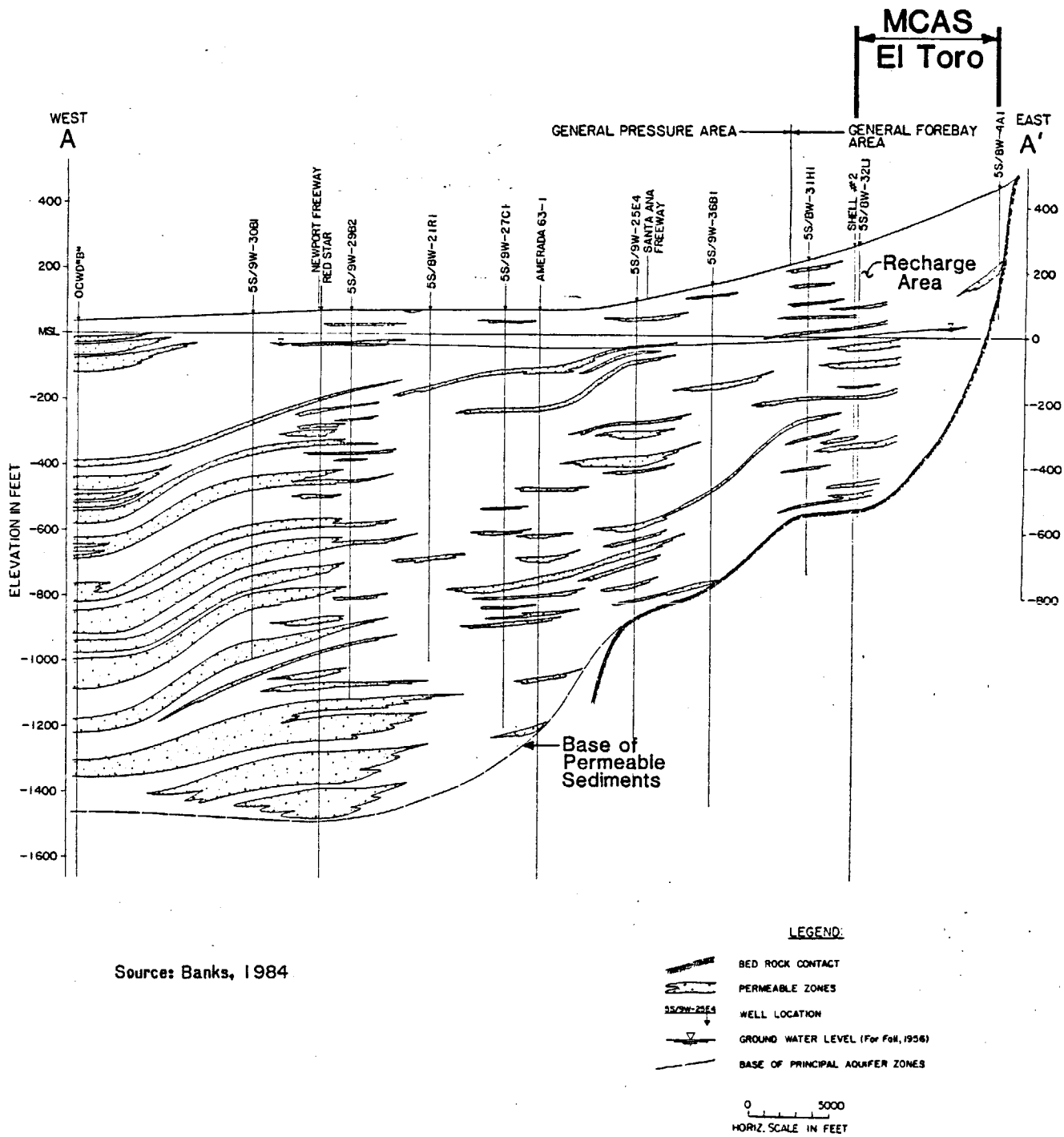
permeable sedimentary units comprise the two major aquifer systems of the Irvine subbasin and consist of discontinuous lenses of permeable materials surrounded by less permeable clays and silts which were deposited in a large synclinal trough (see Figure 4-9). The line of cross section is located on Figure 4-10. Beneath the base of the permeable strata lies the more consolidated, bedrock aquifer system and eventually the basement rocks at a depth of 4,000 to 5,000 feet below the surface (Yerkes and others, 1965).

4.5.6.3 Ground Water Recharge. Within the Irvine subbasin, areas of thick silt and clay deposits effectively divide much of the principal aquifer system into confined and unconfined zones. Banks and others (1984), describe a forebay area, where recharge occurs from the shallow unconfined zones to the lower confined zones through down-basin migration of ground water. A pressure area defined by wells under confined conditions was also identified. Both areas are shown on Figure 4-8. The contact between the forebay and pressure areas varies seasonally and yearly according to the amount of ground water withdrawal and recharge (Banks and others, 1984). MCAS El Toro lies within the forebay area, and percolation of groundwater in this area would act as a recharge for the middle aquifer system down-basin from the station. Recharge for down-basin aquifers would also occur in areas along the edges of the Irvine subbasin where thin deposits of permeable alluvium material are present in stream canyons.

4.5.6.4 Characteristics of the Shallow and Upper Aquifer System. In the vicinity of MCAS El Toro, shallow perched or semiperched aquifers are present to a maximum depth of approximately 200 feet (Singer, 1973). This upper aquifer system is composed of Holocene and Upper Pleistocene alluvial and stream terrace deposits. Recharge to this system is through precipitation and artificial recharge from irrigation (Banks and others, 1984).

4.5.6.5 Characteristics of the Middle Aquifer. The next lower aquifer, the middle aquifer system, is separated from the upper aquifer system by extensive clay and silt layers. This aquifer system ranges from a depth of approximately 100 to 750 feet below MCAS El Toro. The middle aquifer system comprises the lower Pleistocene San Pedro Formation and is the main water-production zone for the Irvine subbasin. Recharge for this aquifer system appears to be from percolation in the forebay area of the Tustin plain (Camp Dresser & McKee, Inc., 1984).

4.5.6.6 Characteristics of the Lower Aquifer. Beneath the middle aquifer system lies the consolidated sedimentary rocks which comprise the lower aquifer system of the main coastal ground water basin. In the area of MCAS El Toro, these rock units are generally nonwater-bearing based on well logs reviewed by Banks and others (1984). These rock units are exposed in hills surrounding the station and are believed to be approximately 3,000 to 4,000 feet in thickness (Yerkes and others, 1965).



Source: Banks, 1984

Figure 4-9. Generalized Hydrogeologic Profile A-A' (Irvine Area)

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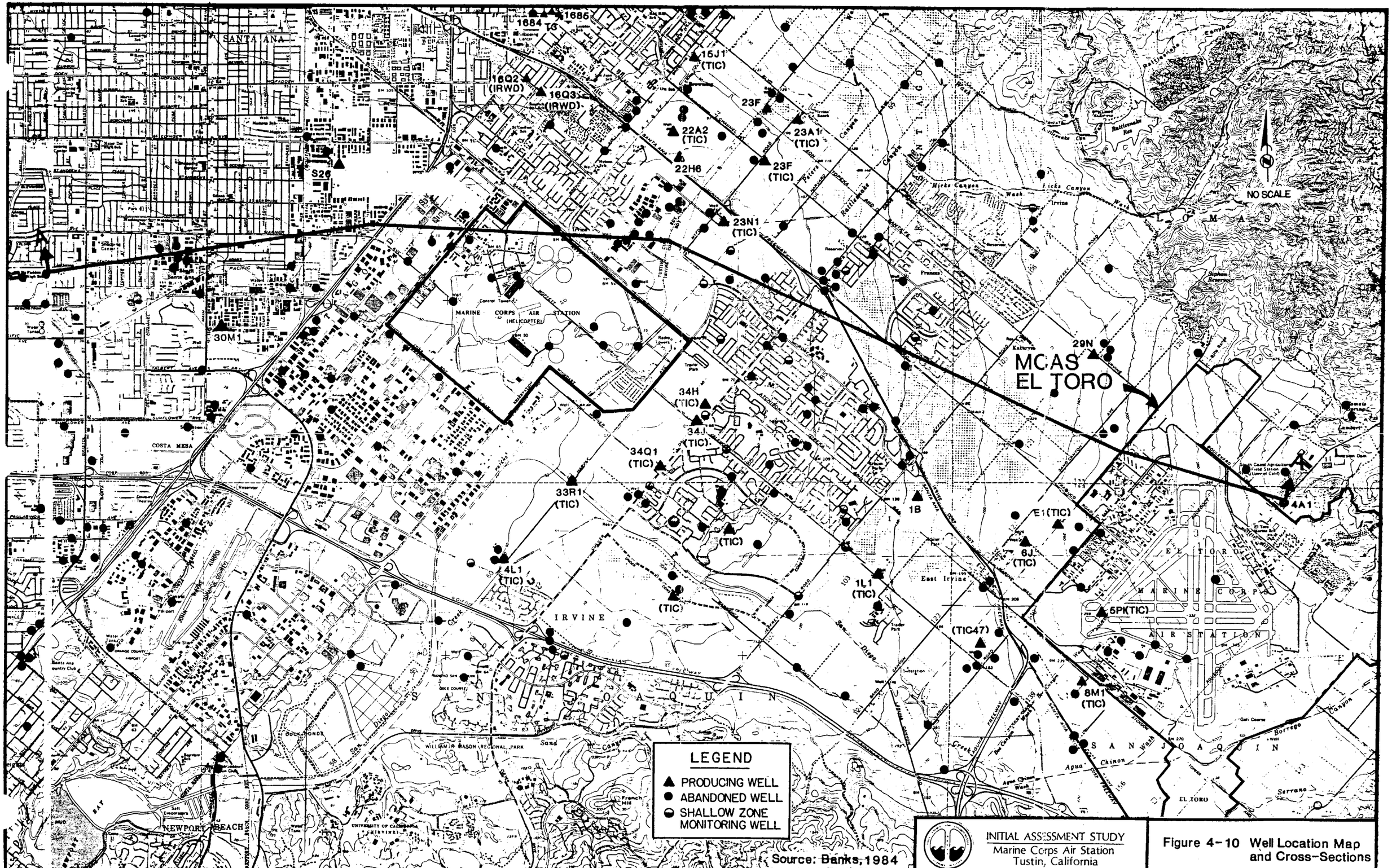

Source: Banks, 1984

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Figure 4-10 Well Location Map and Cross-Sections

4.5.6.7 Ground Water Movement. Extensive hydrological studies of the shallow zone and the upper aquifer system as well as the middle aquifer system have been conducted in the MCAS El Toro area. Banks and others (1984) include part of the upper aquifer system (below the 200-foot depth) and all of the middle aquifer system into the "principal aquifer zone." The "principal aquifer zone" includes interbedded sands and gravels which occur at depths below 200 feet in the MCAS El Toro area.

Most of the production of ground water in the Irvine subbasin is from sand and gravel beds below 300 feet in depth (Camp Dresser & McKee, Inc., 1984). The ground water elevations of the wells that produce from the "principal aquifer zone" have been contoured and are presented on Figure 4-11. The general direction of ground water flow in the "principal aquifer zone" is to the southwest. Ground water flow from beneath MCAS El Toro flows somewhat west/northwest for a short distance until it "turns the corner," a mile or so west of the station, around the nonwater-bearing rock and then flows southwest toward Newport Bay (see Figure 4-8).

In the majority of the station area groundwater depths in the "principal aquifer zone" are between 140 to 160 feet. Based on an average porosity of 40 percent and the data shown in Table 4-8, an average flow rate of 14 feet per year is calculated for the "principal aquifer zone" (Banks and others, 1984). This relatively low-flow rate is typical of aquifers with low transmissivity values.

Shallow-zone aquifers have been studied in some detail by Singer (1973) and Radzevich (1984). The location of ground water monitoring wells into the shallow and upper aquifer system is shown on Figure 4-12. Table 4-9 shows the depth of test drilling, the level of water encountered, and the type of material present in borings placed in the shallow and upper aquifer system at Agua Chinon and Borrego Canyon wash. The shallow zone aquifer is comprised of several thin, discontinuous near-surface sand and gravel lenses separated by impermeable layers. These lenses act as unconfined aquifers in some areas and may become semiconfined as the lense becomes deeper in the depositional trough (see Figure 4-13). In the canyons to the north of the station, the thickness of these deposits vary from 37 to 92 feet, and water was encountered in greater than 50 percent of the holes.

Upward vertical leakage within the shallow and upper aquifer system has been suggested for the main Irvine Subbasin area as a result of surface restriction of infiltrating waters with high piezometric conditions in some areas (Camp Dresser & McKee, Inc., 1984). Current data suggest the perched and semiperched water tables of the shallow and upper aquifer systems may be in hydraulic continuity. It is important to note, however, that little hydraulic continuity exists between the bottom portion of the upper aquifer and the middle aquifer from which the majority of the groundwater production occurs (Camp Dresser & McKee, Inc., 1984).

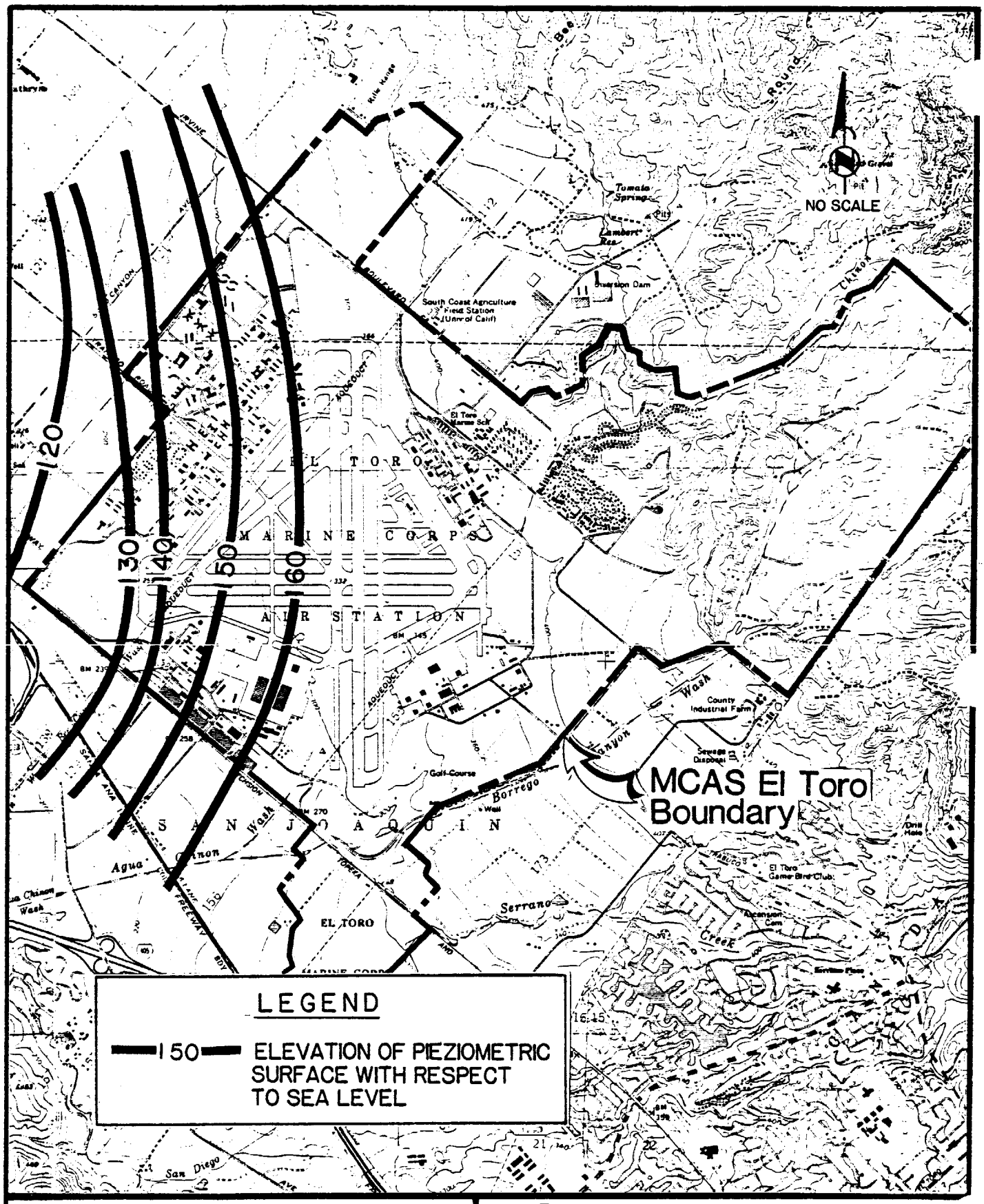

Figure 4-11. Ground-Water Elevations, "Principal Aquifer Zone"

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Table 4-8

Estimated Rates of Groundwater Flow in the "Principal Aquifer Zone" Near MCAS El Toro

Year[a]	Hydraulic gradient[b], 10^{-3} ft/ft	Flow rate[c] ft/yr
1969-70	2.4	7
1970-71	5.0	15
1971-72	NA	NA
1972-73	5.8	18
1973-74	NA	NA
1974-75	6.3	19
1975-76	4.7	14
1976-77	3.0	9
1977-78	7.0	21
1978-79	3.3	10
1979-80	3.9	12
1980-81	6.3	19
1981-82	2.6	8
Average	4.6	14

Source: Banks and others, 1984.

[a]As of November 1 of each year.

[b]Assume an average aquifer thickness of 1,000 feet and a transmissivity of 50,000 gpd/feet.

[c]Represents actual velocity of groundwater flow (V_p).

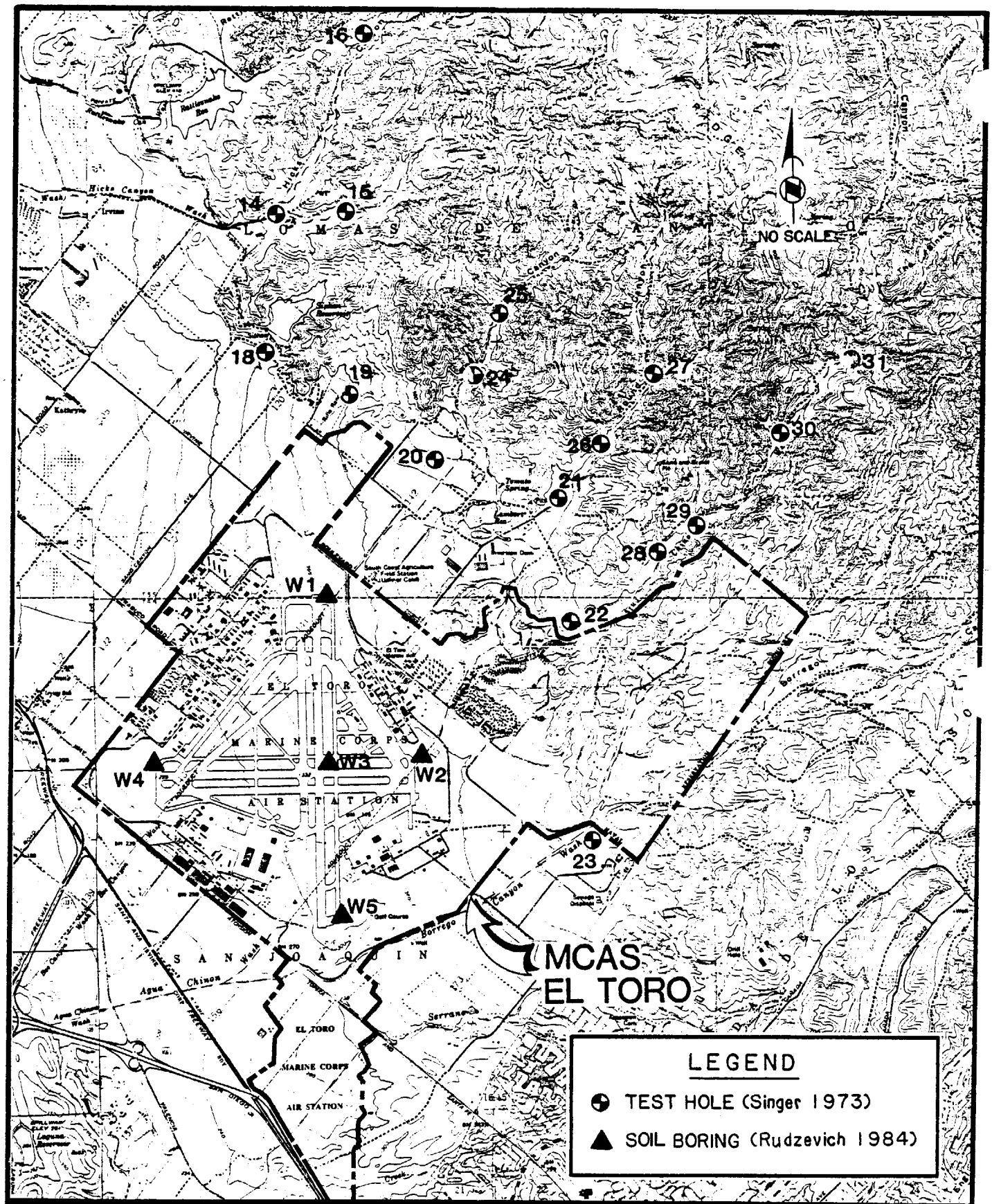

Figure 4-12. Location of Test Borings Placed in the Shallow and Upper Aquifer System

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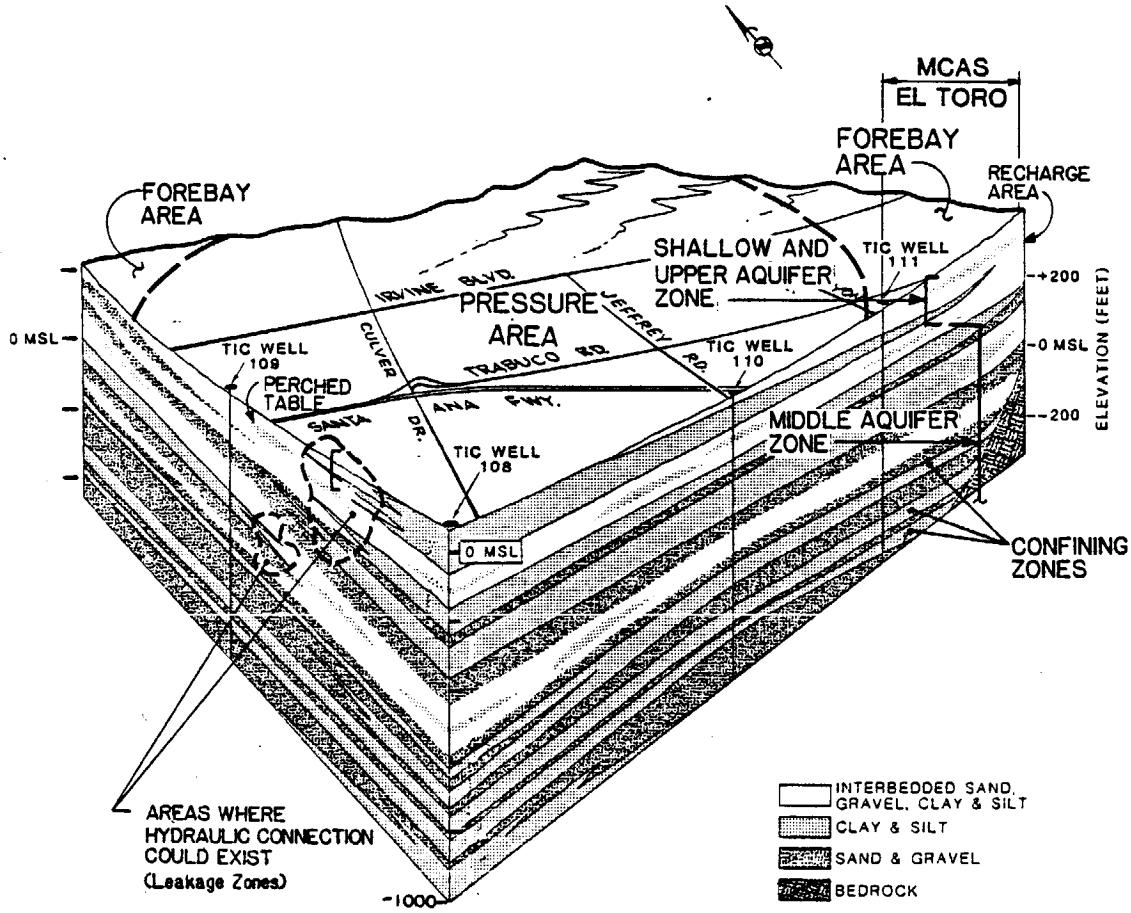

Source: Camp Dresser & McKee, Inc., 1984

Figure 4-13. Isometric Cross-Section, Irvine Subbasin

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Marine Corps Air Station
El Toro, California

Table 4-9

Test Hole Data for Borings Placed in the Shallow and Upper Aquifer System (Sites are shown in Figure 4-12)

Auger hole number	Depth drilled (feet below land surface)	Water level (feet below land surface)	Hole bottomed in	Predominant material
14	62	44	Conglomerate	Silt
15	36	None	Claystone	Sand and gravel to 22 feet
16	30	None	Siltstone	Siltstone
18	42	12	Sandstone	Clay and silt
19	55	None	Conglomerate	Sand and silt
20	90	72	Sandy clay	Clay
21	77	None	Clay	Clay
22	97	37	Silt and sand	Silt and sand
23	52	None	Clay	Sand above clay
24	107	50	Conglomerate	Sand
25	47	None	Claystone	Claystone
26	37	None	Siltstone	Siltstone
27	42	37	Sand and silt	Sand
28	42	27	Clay	Sand and gravel
29	92	27	Sand and silt	Sand and silt
30	37	None	Sandstone	Silt and sand
31	52	27	Clay	Clay
W-1	30	None	Sand	Silty sand
W-2	30	None	Sand	Silty sand
W-3	30	None	Sand	Sand
W-4	30	None	Silty sand	Silty sand
W-5	30	None	Silty sand	Silty sand

Sources: Singer (1973) and Rudzevich (1984)

4.5.6.8 Ground Water Quality. Water quality of the shallow and upper aquifer zone ranges widely beneath the MCAS El Toro area, with some total dissolved solids (TDS) concentrations greater than 7,000 mg/l (milligrams per liter). The dominant cation is sodium, with sulfate and chloride the predominant anions. Total hardness ranged from 560 to 1,000 mg/l (Banks and others, 1984). Ground water quality of the middle aquifer system is usually calcium-bicarbonate with low sulfate concentrations and TDS values of 400 to 1,200 mg/l (California Department of Water Resources, 1967).

In general, ground water in the MCAS El Toro area has sodium and calcium as the prevalent cations, and bicarbonate or sulfate as the dominant anions (California Department of Water Resources, 1967). The water is hard, with 400 to 1,200 mg/l TDS levels. This water is considered to be a Class 2 irrigation source (California Department of Water Resources, 1967).

4.5.6.9 Ground Water Use. Ground water use within a one mile radius of MCAS El Toro is used for agricultural purposes only. Figure 4-10 shows the location of known wells within the area of MCAS El Toro with the exception of the more recent shallow wells shown on Figure 4-12. The majority of the wells shown within a 1-mile radius of MCAS El Toro are not currently utilized as production wells. Eight deep producing wells are utilized for agricultural supplies. Well usage for drinking water supplies begins with wells located 2 to 2-1/2 miles west of the station.

4.5.6.10 Local Water-Supply Sources. Water supplies for all purposes at MCAS El Toro are purchased from the Irvine Ranch Water District (IRWD). The IRWD obtains water from four sources: surface reservoirs, wells, imported water, and reclaimed water (Banks and others, 1984). The local surface sources for IRWD include:

- Irvine Lake (5.7 miles north of the station).
- Rattlesnake Reservoir (1.7 miles north of the station).
- Siphon Reservoir (1.5 miles north of the station).
- Lambert Reservoir (1.1 miles northeast of the station).
- Sand Canyon Reservoir (3.1 miles southwest of the station). (Possibly a direct receiver of MCAS El Toro runoff.)
- Laguna Reservoir (1.7 miles south of the station). (Possibly a direct receiver of MCAS El Toro runoff.)
- Big Peter's Canyon Reservoir (6.1 miles northeast of the station).

All ground water wells used by IRWD are shown on Figure 4-10. A new well field is being developed 6 to 6-1/2 miles northwest of the station. It has been estimated that 1.9 percent of the volume of water used at MCAS El Toro is from ground water sources (Orange County Water District, 1984).

Imported water is obtained from the Metropolitan Water District of Orange County. Reclaimed water is obtained from IRWD's Michelson Water Reclamation Plant, 4.5 miles west of the station.

4.5.7 Surface Water Contamination Events. A storm drain pipe from the building 392 area discharges directly into Agua Chinon wash approximately 600 feet south of Perimeter Road. Agua Chinon wash at this point is stained and contains stressed vegetation downstream to at least the culvert at North Marine Way. Agua Chinon wash empties into San Diego Creek and eventually upper Newport Bay.

4.6 CONTAMINANT MIGRATION POTENTIAL. Materials disposed of on the surface of the ground at MCAS El Toro can migrate to usable water supplies in two ways: surface runoff and subsurface percolation.

4.6.1 Surface Runoff. Materials migrating by surface runoff could enter storm sewer drainages, swales, ditches, and unlined channels which lie on and adjacent to the station. Contaminants can be carried downstream to San Diego Creek and eventually to Newport Bay, 9 miles southwest of the station. Generally, these conditions would occur during storm events or in areas where runoff is artificially induced, such as in irrigated farm fields.

4.6.2 Subsurface Percolation. Subsurface percolation of materials disposed of at the station can migrate vertically and reach shallow aquifer zones. This shallow and upper aquifer system, a series of perched or semiperched aquifers, either empties into nearby surface drainages or migrates downward into other areas of the deeper aquifer systems. During periods of falling water levels, a low permeability layer, which is above the current water table, may no longer act as a confining layer, and may allow downward migration (California Department of Water Resources, 1967).

4.6.3 Contamination Potential. As the majority of MCAS El Toro lies on the Tustin Plain, surface contaminants migrating to the subsurface may enter the shallow and upper aquifer system and travel down-basin, thus entering agricultural supply wells. However, it is unlikely that these contaminants will enter the middle aquifer system, due to extensive impermeable beds lying beneath the majority of the station. Migration of these contaminants to the middle aquifer system would in general be possible only along well casings and in abandoned wells, but there is no evidence of this at this time.

There are some portions of MCAS El Toro which lie in direct recharge areas comprised of highly permeable material, such as along the bottoms of natural canyons and washes at the north end of the station. In these areas, contaminants migrating to the shallow and upper aquifer system are not as likely to be impeded by the impermeable beds beneath the station and may travel down-basin entering the lower aquifer system, thus entering the potable water wells located 2 to 2-1/2 miles southwest. The distances for this migration are large, and the low average transmisivity values and flow rates for the system suggest that movement of contaminants is limited.

CHAPTER 5. WASTE GENERATION

5.1 INTRODUCTION. This chapter describes major waste generators at Marine Corps Air Station (MCAS) El Toro and Third Marine Aircraft Wing El Toro. The chapter describes types of wastes and gives estimated rates of generation from the various sources. Past operations are described as completely as possible, while current operations are discussed only to enhance an understanding of past waste practices. The handling methods used by the waste generator are covered from the point waste was generated until its custody was transferred. Date of operations, types of wastes produced, estimated quantities and significant events are identified where known. Where the broad category of "solvents" is used, reference Appendix E for more details. Past operations concerned with waste handling, storage, transportation, waste processing, and disposal are described in subsequent chapters.

5.2 MARINE CORPS AIR STATION. Marine Corps Air Station (MCAS) El Toro has generated wastes from a variety of industrial operations since commissioning in 1943. This section describes the operations that have generated hazardous wastes on the station, excluding the Third Marine Air Wing (3d MAW). Third MAW operations are described in section 5.3. It is worth noting here that, reportedly, electroplating operations occurred on the station for a few years in the 1940s. However, the entity that performed this function and waste generation rates could not be determined.

5.2.1 Headquarters and Headquarters Squadron (H&HS). H&HS is a purely administrative entity of the MCAS El Toro and is primarily located in Building 1, though offices are scattered throughout the station. It falls under the direct command of the commanding general and oversees 5 divisions: administrative, career planning, legal, personnel and training. Responsibilities of H&HS include:

a. Accomplishing personnel administration and other related administrative functions in support of personnel assigned to Station General and Special Staff Departments, the Station Headquarters, and H&HS.

b. Exercising special and summary courts - martial, and non-judicial punishment authority over all assigned Navy and Marine Corps personnel in H&HS.

c. Assuming responsibility for overall supervision and coordination with Facilities Management, in the maintenance of billeting spaces assigned to H&HS personnel.

Because of its purely administrative function, H&HS has historically not generated hazardous wastes since its inception at the station's commissioning.

5.2.2 Station Operations and Maintenance Squadron (SOMS). SOMS coordinates, supervises, and manages Aircraft Maintenance, Flight Operations, and Safety Departments while conducting basic administrative functions over its own personnel. In the 1960s, SOMS was designated as the Station Operation and Engineering Squadron (SOES). At that time, SOMS and H&HS were the two main squadrons which comprised the station's aerial support. In the 1970s, SOMS and H&HS became a part of the Station. Then, in October 1982, a reorganization of the Station divided responsibilities once again between the two present squadrons, SOMS and H&HS, and this division still exists. The waste generating entities of SOMS are described in the following.

5.2.2.1 Aircraft Maintenance Department. The Aircraft Maintenance Department, located in buildings 288 and 289, has been the largest generator of hazardous wastes within SOMS. The Department provides maintenance on the Station's assigned aircraft, components, and associated support equipment, including periodic maintenance, inspections, servicing, disassembly, cleaning and examination, repair, modification, testing, assembly, replacement, and preservation (MCAS El Toro, 1984). All these operations have been conducted by the Department since the Station was commissioned.

Typical hazardous wastes generated by these operations include waste fuels (e.g., JP-5 and gasoline), solvents (PD-680 (Stoddard Solvent) was reportedly one), paint thinner, hydraulic fluids, and oils. Estimated quantities indicate that a total of less than 50 gallons per year of the above combined wastes were generated before the mid-1970s. Since the mid-1970's the quantity of combined wastes generated has risen steadily to about 450 gallons per year. Reportedly, the majority (about 90 percent) of wastes were used oils. In the past, the individual wastes were combined into common drums or bowsers. Facility maintenance (section 6.2) would then be called to pump out wastes or remove filled drums.

5.2.2.2 Airfield Operations. The principal activity of the Airfield Operations Division is the administration and management, and conducting of all airfield operations at MCAS El Toro. Airfield operation administration is located in the Air Freight and Passenger Terminal (Building No. 624), while airfield operations are controlled in the operations building (Building No. 372). The airfield operation administration does not generate hazardous waste, however, two branches within airfield operations do generate waste--the Crash Crew and the Joint EOD.

5.2.2.2.1 Crash Crew. The Crash Crew is responsible for extinguishing all fires on the airfield and runway caused by aircraft crashes. The crew practiced fire fighting techniques at various crash burn pits (sections 8.10 and 8.17) located across the airfield from 1965 to the present. (Other locations were reportedly used from the early 1950s to 1965, but the location(s) could not be determined.) Two to three drums of waste hydraulic fluid, AVGAS,

and waste oils were regularly burned at each fire. Three to four fires have been started at each training exercise and there have been three training exercises per month. Site 9, Crash Crew Pit No. 1, was used from 1965 to 1971, and Site 16, Crash Crew Pit No. 2, was used from 1972 to the present. Since 1982, only JP-5 has been used in the crash crew fires. (See sections 8.10 and 8.17 for further crash crew operation details.) All wastes burned have been generated by the various squadrons.

Reportedly, in addition to the above materials, four cannisters of napalm totaling 2,000 pounds, as well as occasionally white phosphorous and magnesium phosphate flares, were burned off over the nine-year period of 1972 to 1981.

5.2.2.2.2 Joint EOD. The EOD operations began on base after construction of the magazine at the northeast corner of the base, in approximately 1952 or 1953. Prior to that time munitions were stored in an area near Building 457. The EOD is responsible for disposal of explosives which are no longer useful. Ordnance which requires disposal is taken apart by the EOD and burned in lots of less than 25 pounds of explosive. This controlled detonation is done in an open air pit. Operations have continued in this manner since the construction of the facilities in the early 1950s. Frequencies and total quantities of waste generation could not be determined as records are not kept.

During the dismantling of the ordnance prior to its disposal, solvents such as acetone are used in very small quantities for cleaning of the casings and assorted components. The solvent wastes are then burned with the ordnance in the controlled detonations. Reportedly, most of the items disposed of in this manner are small arms munitions, explosives, and napalm, though, extended shelf life FS smoke (sulfur trioxide chlorosulfonic acid) has also been burned in these operations. Approximately 2 years ago about 20 55-gallon barrels of FS were buried above a small charge of C4 explosive, covered with soil, and then detonated. Reportedly, this FS smoke did not completely burn. (See Site 1, Explosive Ordnance Disposal Range, Section 8.2).

Two disposal sites were noted during the on-site survey. One was the location where the aforementioned FS smoke was buried. The other was approximately 50 yards to the east of that site in an exposure of 55 gallon barrels and other scrap. This exposure of scrap materials is the only indication of the second disposal site. Information on the second area could not be determined.

There is also, reportedly, a possible low-level radioactive material disposal site in the EOD range. However, no information was available on the location of this site or what materials it may contain.

5.2.3 Station Electronics and Maintenance Division. The station communication electronics maintenance division repairs air traffic control equipment, radar, mobile radios, and teletype equipment. Prior to 1980, this division was located in Building 138, where small amounts of carbon tetrachloride, trichloroethylene, and trichloroethane were used for cleaning (primarily the teletype equipment). Approximately two to three 55 gallon barrels of these solvents were used per year, though little disposal of these solvents occurred as the cleaning operation resulted in volatilization of most of the solvent. Any residual solvents collected in the bottom of the cleaning tanks was barrelled up in one of the empty drums and sent to an undetermined storage area reportedly near one of the hangars south of Building 730.

Since 1980, the operations have been located in Building 730. Due to the design of the building there is no ventilation for the use of volatile solvents, so cleaning of teletypes and other communication equipment is now done using biodegradable detergents. The spent detergents solutions are then disposed of in the sanitary sewer.

5.2.4 Naval Air Maintenance Training Detachment (NAMTD). The NAMTD at MCAS El Toro, established in 1961, is an aircraft maintenance training school located in Building 631. The NAMTD serves as a specialty satellite school to the main school located in Memphis, Tennessee. The NAMTD at MCAS El Toro provides lectures and academic coursework in the specialized areas of maintaining A4, F4, and C130 aircraft and CH43 and CG53 helicopters. By the academic nature of NAMTD, negligible amounts of hazardous wastes have been generated by this detachment.

5.2.5 Dental Clinic. Located in Building 439, the dental clinic is a branch of the Long Beach Naval Dental Center. The clinic provides dental service to all MCAS El Toro personnel and stationed marines. The dental clinic was built in 1959. Current operations have been in effect since then.

The potentially hazardous wastes generated by the dental clinic are X-ray developer and fixer and silver-mercury amalgam. The fixer is collected in 5-gallon plastic jugs over a 2- to-3 week period, after which time it is sent to MCB Camp Pendleton. About 100 gallons per year of these combined wastes are generated. Silver mercury scraps are placed in 5-gallon stainless steel containers with a mercury halide solution. One container of scraps is collected about every 6 months, when it is also sent to MCB Camp Pendleton. Thus, about 10 gallons per year is generated. Spills are mopped up from the tile floors with soapy water, ultimately being drained to the sewer system. There reportedly have been no spills since 1980 due to the use of capsules of premeasured amalgam, enough for one filling. Using premeasured amalgam reportedly eliminates scraps. Prior to 1980, jars of mercury were used.

5.2.6 Medical Clinic. The medical clinic, located in Building 439, is a branch of the Naval Regional Medical Center Long Beach. The clinic, which provides medical service to all personnel and marines at MCAS El Toro, was opened in 1959. Current waste disposal operations have been in effect since 1975 and most likely have been in effect since 1959.

The primary hazardous wastes generated are biological contaminants and X-ray fixer. Biological contaminants are placed in specially marked 5-gallon red contamination bags and rewrapped in similar bags two more times. They are then placed on a special cart and trucked to NRMC Long Beach daily for sterilization. About 20 gallons per month of waste fixer is generated. The waste fixer is collected in 5-gallon plastic jugs and then shipped to NRMC Long Beach. About 5 gallons in spills occur every two months. Spills are mopped up, and ultimately drained to the sewer system.

5.2.7 Golf Course. Located along the southern perimeter of MCAS El Toro, the golf course is used by military and civil service personnel and their dependents. The course has been in existence since the early 1950s.

The major types of hazardous wastes generated by golf course maintenance have been greens care products (such as pesticides), used golf cart batteries, and waste oils. The pesticides would be applied for greens care every 3 or 4 months, using between 1200 to 1500 gallons of solution. From the early 1950s until 1959, mixing of chemicals took place in a former maintenance area now overlain by Building 464, the present golf course club house. Since 1981, mixing has been done in an area outside of Building 1687 (the wash rack has been there since early 1985). The mixing area(s) used from 1959 to 1981 are unknown, though reportedly almost anywhere in golf course area was used. Until 1959, all pesticides were stored in the area now occupied by Building 464. Since 1959, all pesticides have been stored in Building 1687.

The typical method of disposal of the greens chemicals was to rinse the used chemical container with water and apply the waste solution to the golf greens. Table 5-1 lists the more hazardous chemicals which were used at the station in the past, but are no longer used. Used golf cart batteries have reportedly always been turned in to the supplier as part of the purchase of new batteries. This has been the practice ever since electric golf carts have been used, starting in the late 1950s or early 1960s. Electric carts are the only motorized type ever used. The quantity of used batteries turned in each year is unknown. Waste oil quantities have been relatively minor, and unknown, because electric golf carts simply do not require much oil.

Table 5-1. Used Pesticides Formerly at MCAS El Toro Golf Course and Pest and Weed Shop

Chemical	Type	Dates
Malathion	Insecticide	Used in 1973 - 1975
Kelthane	Insecticide	Used once in mid-1970s
Scott's Proturf	Fungicide	Used once in 1980 to 1982
Strychnine	Rodenticide	Stopped usage in 1973
DDT	Insecticide	Stopped usage in 1973
Retard-X	Herbicide	--

5.2.8 Auto Hobby Shop. Located in Building 626 and in operation since 1967, the Auto Hobby Shop provides the materials, equipment and facilities used by military personnel and their dependents at MCAS El Toro and MCAS Tustin to self-service their vehicles. Unless otherwise stated, the processes described below have occurred since the shops' inception.

The hobby shop has a 600-gallon waste oil tank located underground 10 feet from the northwest side of the building. The tank is emptied about every four months by a private contractor. The ground around the tank and leading to the building is saturated with oil. Two square feet of the building, in line to the tank and closest to the ground, are discolored black with the oil that has seeped under the floor.

The Auto Hobby Shop has three oil/water separators: one located just to the right of the front gate, another 25 feet east of the first, and the third in the southeast quadrant inside the compound. The water from all three separators drains into a ditch which runs along the road on the south side of building. Each separator has a 700-gallon capacity and the oil is emptied about once every three months by a contractor.

There are three 50-gallon solvent parts tanks. Most of the solvent is filtered and re-used. Any mud/solvent sludge in the tanks is disposed of to the separators. Very dirty solvent waste is sealed into a drum and picked up by Facilities Management (see section 6.2). Two drums are disposed of per year.

Kerosene was used to wash down the asphalt in the compound before 1976, but now it is only used to run the steam cleaner. The grounds are washed with bio-degradable soap, which is drained into the oil/water separators.

No battery work is done on the premises. From January 1983 to July 1984, a carbon-removing solution was used to soak engines in one of the parts tanks. The solution was then drummed and given to facilities maintenance for disposal. One trained person was responsible for washing the tank and channeling the effluent to the oil water separator.

5.2.9 Graphic Arts. This shop opened around 1970 in Building 443. It provides necessary materials and equipment for graphics art as a hobby to stationed marines. The amount and types of wastes produced now are the same as those produced in the past since operations have reportedly not changed since the start of the shop.

The waste generated includes enamel paint, rubber cement thinner, and fixers and developers. The enamel paint is water-based. If any empty aerosol cans need to be disposed of, they are thrown in the dumpster (removed by facility maintenance) at a rate of about one can per month. The quantity of enamel paint and rubber cement

thinner disposed of are unknown, but reportedly very small. Any disposal of these paints and thinners are to the sewer drain. Printing fixer is collected in a bucket at the rate of 2 gallons per month from the camera and 3 gallons per month from the typesetter. The fixer, along with the developer, is poured down the drain. The camera was obtained a year and a half ago and the typesetter was obtained less than a year ago.

The Graphic Arts shop also has a blueprinter which uses an anhydrous ammonia gas developing process. It has a filter which catches and vents the gas to the outside. The blueprinter was obtained 2-1/2 years ago, but has never been used. A 150-pound cylinder of anhydrous ammonia gas has been stored on the premises for the past 2-1/2 years.

5.2.10 Aero Club. The Aero Club is a recreational flying club available to MCAS El Toro personnel and other members. The club has maintained club-owned and club-leased aircraft at its own facility (Building No. 240) since its inception in the late 1950s or early 1960s.

The number of club aircraft has fluctuated and, therefore, the amount of wastes generated has fluctuated proportionately over the years. The hazardous wastes generated by the Aero Club are waste motor oils and old batteries. Table 5-2 summarizes the types and approximate quantities of these wastes. The waste oil was, and still is, collected and stored at the Aero Club facility in 55-gallon drums, prior to collection by a private contractor. Old batteries have always been sold back to the new battery private contractor.

5.2.11 Photographic Laboratory. The photographic laboratory has provided photographic services, including developing and printing, to the MCAS El Toro since 1944. The laboratory is located in Building 312. Information regarding the operation of the photographic laboratory is available for a period going back to the mid-1970s only. Since that time, all used fixer and developer solutions not containing silver have been disposed of in the sanitary drains. Solutions containing silver have been processed to recover the silver through an electrolysis process by an outside contractor. The MCAS Tustin Photography shop also contributes their silver-containing solutions to the photographic laboratory for silver recovery. The total wastes (with and without silver) are reportedly about 30 gallons per year.

5.2.12 Exchange Gasoline Station. The Marine Corps Exchange (MCX) gasoline station is managed out of Building 651 at MCAS El Toro. It provides motor fuel and auto servicing to its customers. The facility at this location opened in 1971. Previously, the station was located in Building 347, the Marine Corps Exchange warehouse. It is not known when this station began operation. A second supplemental station (Building 637) opened in 1968 by the back gate; however, this one does not provide auto service.

Table 5-2. Historical Waste Generation Rates of Aero Club, MCAS El Toro

Period	Wastes	Annual generation rate
Late 1950s or early 1960s	Waste oil Old batteries	50 gallons Intermittent
Late 1960s	Waste oil Old batteries	170 gallons 2-3 units
Mid-1970s	Waste oil Old batteries	340 gallons 3-6 units
Late 1970s	Waste oil Old batteries	460-510 gallons 5-9 units
Early 1980s	Waste oil Old batteries	340 gallons 3-6 units
Present	Waste oil Old batteries	600 gallons 6-10 units

The new MCX service station has housed four 12,000-gallon underground gasoline tanks, two 500-gallon underground oil tanks, and one 500-gallon underground waste oil tank since 1971. A private contractor drains the waste oil tank about once every 3 weeks. Information on where the waste oil was disposed of prior to 1971 was unavailable. Fuel levels in each of the four 12,000-gallon fuel tanks at the new station are checked regularly using a dip stick. The measurement in inches is converted to gallons using a conversion table. This value is then compared with the inventory and amount of gas pumped to determine whether or not there is a leak in a particular tank. This same procedure was used to check the fuel tanks at the old station and the supplemental station. So far, there have been no reported leaks or spills associated with the Exchange fuel tanks. The fuel and oil tanks at the old station were abandoned by filling them with sand.

About 110 gallons per month of solvents are used to wash parts. Also, 20 gallons per year of waste carburetor fluid and 120 gallons of waste automatic transmission fluid are produced. These generation rates for current operations are reportedly the same for past operations. All these wastes are disposed of in the waste oil tank. Solvent had also been used at the old station to wash the decks; but since the new station opened, a degreasing soap or a dry gravel absorbent with solvent has been used.

Suppliers from Santa Ana pick up old batteries with the acid still in them. They have been providing this service since 1966. Another private contractor picked up the batteries prior to 1966. No battery work other than recharging them has been done at the Exchange station.

5.2.13 Supply Department. The supply department at MCAS El Toro consists of two sections: the material management group and the fuel division.

5.2.13.1 Material Management Group. The material management group receives, stores, and distributes supplies for MCAS El Toro, MCLB Barstow, MCB Camp Pendleton, MCAS Tustin, and overseas. It is administered from Building 321.

The only wastes of concern produced are the leakage from stored chemical drums, and chemical supplies with expired shelf life. The drums are stored outside of Building 320. In 1964 about 1,000 drums were stored there; now, there are about 100 to 125 drums. Leaky drums received are returned to the supplier.

Supplies with expired shelf life are given over to Facilities Management. From the early 1970s to 1979, such supplies were disposed of in the Magazine Road Landfill (Site 2). From 1955 through the early 1970s, these wastes were disposed of to a dumpster and then taken to the Perimeter Road Landfill (Site 5).

5.2.13.2 Fuel Division. Based in Building 27, this department provides fuel for MCAS El Toro, MCAS Tustin, TAFDS, and the one gas station in the middle of C-pool. It also maintains the MCAS El Toro and MCAS Tustin fuel farms and tanks.

Normal spillage of small amounts of fuel onto the asphalt/concrete service occurs while gas is pumped at the C-pool station.

Tank farm sludges have always been taken off-base by a contractor. Waste oils have been put into a tank and handled by Facilities Management since 1981, whereas previously they were taken off-base by contractors. Approximately 40,000 to 45,000 gallons of waste oil is produced in a 9-month period. This rate has remained stable throughout the years.

Several incidents have occurred in the past. In 1984, an over-filled tank at fuel farm 5 spilled 1,100 to 1,200 gallons. The spill was pumped up by Facilities Management. Two to 3 years ago, a bladder tank in Area 37 spilled. The dirt under the fuel bladder was hauled away by TAFDS.

5.2.14 Defense Property Disposal Office (DPDO). The basic function of the DPDO is to transfer surplus military waste materials and components out of military custody, to civilian ownership. Disposal, therefore, refers to transfer or sale of property rather than buried or landfilling; the property handled has intended future uses and is not considered waste. However, surplus materials are and have been routinely stored by DPDO facilities.

DPDO at El Toro is in charge of property disposal at MCAS El Toro, MCAS Tustin, and other Navy and Marine installations in the region. Offices and facilities for DPDO are in a warehouse (Building 360) and storage yard complex along the southwest base perimeter near Gate No. 13. Surplus disposal functions were initiated at MCAS El Toro in the early 1940s under Marine Corps jurisdiction, and was called the "R and D Section." The current building facilities have been used continuously since that time. In 1973, the present civilian DPDO operation was initiated. DPDO has control over surplus materials. Examples of these include solvents, paints and batteries which have expired shelf lives.

Leaks or spills have reportedly occurred in the storage yard complex from stored containers and mechanical-electrical components, but there is little or no documentation regarding timing and volume. The greatest potential for environmental pollution may be associated with storage of solvents, paints, thinners and other substances, and leakage of PCB containing insulating oils from stored electrical transformers. Occurrences of minor leakage from containerized liquids, such as overtopping of open drums during rains, and leaks from imperfect or rusted pails and drums, were reported. The largest known leak of PCB-containing transformer oil occurred in 1984 in the former DPDO Storage Yard No. 1. The

spill area was subsequently excavated and soils removed for off-base disposal. (Reference section 8.9 for more details on DPDO storage yard operations and spills.)

5.2.15 Facilities Management Department (FMD). The function of Facilities Management is to maintain much of the plant and utilities for the base structures and facilities. FMD has always been located in the Public Works area (map grid U-7). FMD operations are conducted through several major divisions. For the purposes of this study, two divisions are considered potential pollutant sources: the Maintenance and Utilities Division, and the Motor Transport Division. The Maintenance and Utilities Division is further divided into four branches: Building Trades, Metal Trades, Electrical Trades and General Services. Motor Transport Division is divided into several maintenance branches. The branches consist of individual shops having specific functions.

5.2.15.1 Maintenance and Utilities. The function of the Maintenance and Utilities Division (MUD) of FMD is to maintain the physical plant and structures, and it is the operating entity under which several subordinate shop branches are operated. As such, MUD is an administrative activity and does not directly handle hazardous materials or wastes. Some shop branches within MUD, however, do handle hazardous substances. The MUD branches are Building Trades, Metal Trades, Electrical Trades and General Services. Each branch consists of several sections performing specific shop functions. Those handling hazardous substances are described in the following.

5.2.15.1.1 Metal Trades Branch. The Metal Trades Branch consists of three shops: Pipe Shop, Machine Shop, and Heat and Water Shop. All shops have been at their present locations, and have conducted their current operations, since the early years of station operation.

The Pipe Shop operates pipe cutting, threading, and other equipment, and has historically generated small amounts of cutting oils, hydraulic fluids, cleaning fluids and metal cuttings. The shop is located in Building 370. Small amounts of pipe cutting oils, metal cleaners/degreasers and hydraulic fluids have reportedly been generated at relatively constant levels since the shop's inception to present. The generating rate of these wastes (combined) has been about one to two gallons per month. The disposal procedure has been to incorporate the wastes into ordinary shop trash, for later disposal to one of the base landfills, now to an off-station landfill.

The Machine Shop (located in Building 370) currently generates, and has historically generated, the same types and volumes of wastes as the Pipe Shop, namely, small amounts of cutting oils, degreasers, and hydraulic fluids at a rate of one to two gallons per month. These waste generating operations have occurred since the shop's inception to the present.

The Heat and Water Shop is responsible for maintenance of heating and cooling equipment, and water delivery systems. This shop is located in Building 306. Prior to 1983, the principal wastes generated here have been chromate and boronitrate compounds (boiler blowdown from boiler plant maintenance) and asbestos removed from boilers and steamlines. The quantity of chromates and boronitrates generated is about 5 pounds per year at very dilute concentrations. The methods employed for disposal of chromate and boronitrate compounds was either to route them to the storm or sewage drains, by disposal to bare ground at the point of use, or through French drains located at boiler maintenance points in about twenty building locations. Asbestos waste was bagged at the point of generation and removed off-base by contract haulers.

5.2.15.1.2 Electrical Trades Branch. This shop includes three divisions; Electrical Conduits and High Voltage (ElecCon HiVolt), Refrigeration/Air Conditioning/Power (Ref/AC/Power), and the Emergency Service Center. All divisions are centered in Building 302. Only ElecCon HiVolt and Ref/AC/Power generate wastes.

Used oils from electric and diesel generators are taken to the Heavy Duty Shop (sections 5.2.15.2) by ElecCon HiVolt and disposed of in their waste oil tank. The Electrical Trades Branch produces about 6 gallons per year of waste oil.

Empty 30-pound freon cylinders from the Ref/AC/Power division are thrown into a dumpster. One cylinder per month is disposed of in the winter and 2-3 cylinders per day in the summer. Waste oil from the compressors is minimal. Compressors are not rebuilt; if a unit burns out, it is sent to salvage (DPDO) with the oil (1-2 qt) in it.

5.2.15.1.3 General Services. The General Services Branch at FMD consists of three separate shops: Grounds and Maintenance Shop, Pest and Weed Shop and Pavement Repair Shop. All three shops have been at their present location (Building 301) and have conducted their current operations since the early years of station operation.

The function of the Grounds and Maintenance Shop is to maintain lawns and grounds, and is not considered to be a hazardous waste generator since the required activities do not involve the use of chemicals other than fuels for lawn cutting equipment and other vehicles.

The Pest and Weed Shop is responsible for pest and weed control at MCAS El Toro and MCAS Tustin. Their area of responsibility includes all of the station areas except for outleased areas. Pesticides for control of gophers, ground squirrels, mice, rabbits and other rodents and weeds include Thurshan, Diazonan, Chlordane and Crovar. Methyl bromide has been used in the past as a rodenticide. Table 5-1 lists the more hazardous chemicals which were used at the station in the past, but are no longer used.

Nearly all these materials have been used in ground applications and therefore very little waste has been generated. Since the early 1970s, 1- and 5-gallon containers (pails), have typically been triple-rinsed, over the grounds where the chemicals were applied, and the containers taken to base landfills. A typical budget for these materials has been about $20,000 per year. Chemicals are currently stored in a bermed area in Building 493. Minor spills or drips have occurred while transferring chemicals to sprayers and other applicators. These are currently cleaned up with sorbents which are transferred to the hazardous materials disposal operation conducted by the Energy and Environmental Division of FMD. Infectious rodent cadavers are taken to the Medical Clinic (section 5.2.6) for inspection and disposal.

The Pavement Repair Section is responsible for roadway maintenance, as well as trash collection.

Trash collection has been conducted by this Section for the entire base area. Additional wastes have been transported to the various landfills by sundry military operations, contractors, and residents. Reportedly, "anything and everything" is probably buried in the on-station landfills historically operated by this Section (reference sections 8.3, 8.4, and 8.6). Currently, Pavement Repair operates several packer trucks to transfer wastes to a 40 cubic yard dumpster which is, in turn, taken off-site by a contractor for disposal at a nearby landfill. Past landfilling operations conducted on base by Pavement Repair have consisted of burn pits or trenches and non-burning sanitary landfilling.

5.2.15.2. Motor Transport Division. Although Motor Transport consists of the Light Duty Maintenance Shop (Building 298), the Heavy Duty Maintenance Shop (Building 1589), and Operations and Control, only the first two shops produce potentially hazardous wastes. The division as a whole provides vehicle maintenance and repair for the station.

5.2.15.2.1 The Heavy Duty Maintenance Shop produces waste crankcase oils and waste solvents. A common practice prior to 1952 through the mid 1960s was to spray the waste oil and solvent over the station roads and surrounding area for dust control. This waste was collected from the Heavy Duty Maintenance shop, the Light Duty Maintenance Shop, MAG 13, MSWG 37, and all other motor stations. A total of about 4,000 gallons per year was used in this manner.

The oil from diesel generators is changed once per year by fuel maintenance. This oil is then put into 55-gallon drums, taken by truck to Heavy Duty Maintenance, and put into either one of two 500-gallon above ground waste oil tanks located at either end of Building 1589. These tanks are drained, as required, by Facilities Maintenance (section 6.2). Five 55-gallon drums are filled by emptying one generator; there are 14 generator sites, thus a total of 3,850 gallons per year are generated.

Various dry cleaning solvents have been used in the parts dip tank, averaging about 75 gallons per year. From 1952 through the mid 1960s, this solvent was used to wash the cement decks once per week (144 gallons per year) and the lube racks daily (240 gallons per year). The rinsings were washed to the storm sewers.

Up until 1974, the Heavy Duty Maintenance Shop had a 20 by 20 by 60-foot waterfall paint booth. Sludges from the booth were allowed to drain onto the compound, or were disposed of in dumpsters.

5.2.15.2.2 The Light Duty Maintenance shop has a hot tank cleaner which uses 16 lbs per year of a toxic, caustic lye soap. The hot tank cleaner has been in use since 1982. Also, since 1982, Light Duty Maintenance has had a steam rack with an oil/water separator.

The cleared water discharges to the sanitary sewer, and the oil is sent to the shop's 500-gallon waste oil tank (above ground). Prior to 1982, wastes from steam cleaning went to the storm drain. The 500-gallon waste oil tank has always been pumped out by Facilities Maintenance monthly, for a total of about 6,000 gallons of waste oil per year.

The shop has always had a 30-gallon parts dip tank. The solvent has been changed every six weeks. Through the mid 1960s, this solvent was used to clean the cement decks (about 720 gallons per year). There were two dip tanks, but one was disposed of in October 1984 due to a leak resulting from corrosion, although it had been obtained only two years before.

Since approximately 1952, a battery locker has been located in the west end of Building 298. Battery acid has been neutralized with baking soda and poured down a floor drain before sending the old battery to DPDO. The amount of acid drained has been about 140 gallons per year. The cement around the drain has eroded away several inches.

5.3 MARINE AIR WING (3d MAW). The Third Marine Air Wing was formed at the time of the inception of MCAS El Toro in 1943. The 3d MAW has generated wastes from several squadron operations since then. This section describes the operations that have generated hazardous wastes. Wastes handling methods are described between the time the waste was generated and the time its custody was transferred. Pertinent data, including types of wastes generated, estimated quantities produced, operation periods, and significant events are identified where known. Unless otherwise stated, all operations have occured since the mid to late 1940s.

5.3.1 Aviation Ordnance. The aviation ordnance group is a tenant of the MCAS El Toro base and is responsible for issuing ordnance. Potentially unstable ordnance is either turned over to the EOD for burning or is returned to Indian Head, Maryland for evaluation of the service life of the particular piece of equipment. The aviation ordnance group does not by itself generate any hazardous wastes.

5.3.2 Wing Communication Electronics Maintenance. The communication electronics maintenance for the wing consists of first and second echelon maintenance only. This consists of removal and replacement of individual component assemblies. Sub-assemblies which are repairable are either repaired in house or shipped back through the station supply for repair at another facility. The communication electronics maintenance group work primarily on mobile radios and portable telephone units.

The wastes generated include small electronic components such as capacitors, resistors, and transistors. Also, trash such as cables, and connectors are generated. Any sub-assemblies or printed circuit boards which are deemed not repairable are turned over to DPDO for disposal. Any batteries used in the equipment which are no longer serviceable are turned back through the station supply, and not disposed of.

5.3.3 Marine Wing Support Group 37. MWSG 37 consists of three different groups which perform maintenance functions. These groups include Headquarters Squadron 37, Wing Transport Squadron 37, and Wing Engineer Squadron 37.

5.3.3.1 Headquarters Squadron 37. The Headquarters Squadron 37 is primarily concerned with the TAFDS (Tacticle Air Fuel Dispensing System) and the Aircraft Recovery. The squadron provides fuel service to aircraft and air field construction. Both of these groups (TAFDS and Aircraft Recovery) obtain their equipment from the Wing Transport Squadron 37.

The Aircraft Recovery group maintains aircraft arresting gear. They perform maintenance of this equipment which primarily consists of changing the oils and coolants in the arresting gear. Prior to 1982, Aircraft Recovery waste oils and coolants were taken by the crash crew for fire training but since then the materials are disposed of in various waste oil tanks.

At MCAS El Toro, Aircraft Recovery also aids in cleanup of the fuel spills along the flight line. The spills that Aircraft Recovery assists in cleaning up are primarily spillage or leakage from the vent pipes on aircraft fuel tanks. Spills were washed down with water and/or detergent until approximately 3 years ago. Currently, Speedi-Dri absorbant is used to contain the spilled fuel. The Speedi-Dri is disposed of in 55-gallon barrels which are then handled by Facilities Management. The minimal residue which is left on the pavement is then washed down.

The TAFDS Group is responsible for fueling aircraft. They maintain two fuel farms, one located west of the Mag 11 area (map quadrant Q10), and the other northwest of the 37 group area (map quadrant T7). At both locations are a number of 20,000-gallon bladder tanks. The bladder tanks act as interim storage for refueling operations, and are filled by the station. Fueling vehicles, obtained from Wing Transport Squadron 37, are used to

take fuel from the bladder tanks and deliver it to the aircraft along the flight lines. These fueling systems are designed for a tacticle environment and reportedly, spills do occur, as is evidenced by a 500 to 600 gallon spill that occured in the bladder area approximately one year ago (Q10 quadrangle of Plate 1).

Some spillage also occurs in the fueling and defueling operations. The aircraft are generally fueled at night, thus during the daytime, as the fuel in the aircraft warms up, it can expand sufficiently to overflow the tank vents on the aircraft if the tanks were completely topped off the previous evening. It is estimated that no more than a few gallons leak from each aircraft under these circumstances.

Another cause of leakage is during defueling of aircraft. Defueling is done when it is found that fuel in the aircraft tanks is contaminated with water and/or sediment. A defueling truck will remove the fuel, and take it to the fuel farm for testing. Most can be reprocessed and reused. However, between 300 and 500 gallons of fuel per month is contaminated to such a degree that it requires disposal. This fuel is barrelled in 55 gallon drums and handled for disposal by the Facilities Management (section 6.2).

5.3.3.2 Wing Transport Squadron 37. There are currently two operating entities under the WTS 37 Squadron. These are the refueler washrack operation, located on Plate 1 map quadrants U9 and U10 (near Building 672), and the refueler maintenance operation, located at Plate 1 map quadrants P12 and P13 (near Building 673).

The refueler washrack operations have consisted of preparing tanks, trailers, and trucks for repair, or general cleaning of the equipment. Prior to submitting empty fuel tanks to repair, the tanks are emptied of all fuel residuals to an underground storage tank, with some of this contaminated fuel going to the crash crew. When the underground storage tank is filled, it is emptied by Facilities Management. Oil and coolant drained from the trucks are stored separately in above ground 400 gallon bowsers or 55-gallon barrels. These are emptied by Facilities Management when filled (section 6.2).

The refueler washrack operation has a steam cleaning area. This area is currently drained to an oil water separator, where the cleaned water drains into the sanitary sewer system. Prior to six months ago, vehicles and tank trailers were regularly steamed down off the rack, which resulted in large quantities of detergent solution, containing suspended oil and sediment, to be washed off the pad (near Building 672) onto bare soil. Approximately 1 year ago, about 200 gallons of JP-5 was spilled and bypassed the oil water separator. The fuel eventually ended up in the Irvine Ranch Water District Sewage Treatment Plant.

Vehicle Maintenance for WTS 37 is currently conducted in a yard at Plate 1 map quadrants P12 and P13. Maintenance at this yard consists primarily of second echelon maintenance, which involves

changing fuel, fluids, and occasional tune ups. Any further maintenance is handled separately by a different entity. The waste generated by the vehicle repair consists of small amounts of perchloroethylene solvent, neutralized battery acid, contaminated fuel, waste crankcase oil, waste ethylene, and contaminated hydraulic fluid. This area also has a steam cleaner which drains to a water separator, where the cleaned water drains to the sanitary sewer. In this area all pavement runoff goes through the drains to the oil/water separator. The solvent used for cleaning carburetors and other vehicle components evaporates, and thus is not a waste. Cleaning sludges and waste solvents are combined with contaminated fuel, oil, coolant, and hydraulic fluids. These are then disposed of in 400-gallon bowsers and/or 55-gallon barrels. Neutralized battery acid is discharged to the sanitary sewer.

There is a POL storage area at this facility which handles waste oils from maintenance operations. Reportedly, this area also handles all of the waste oils from training operations conducted at Twentynine Palms and Yuma. The WTS 37 Group performs training off base, and during these missions all waste fluids are drummed and brought back to the MCAS El Toro for storage at this POL area. These waste oils are collected by Facilities Management (section 6.2).

5.3.3.3 Wing Engineer Squadron (WES) 37. The WES 37 Squadron generates wastes from maintenance of vehicles and equipment. The WES 37 maintains heavy equipment such as cranes, tractors, front end loaders and dozers, and utilities such as power generation equipment, plumbing equipment and refrigeration equipment. The heavy equipment maintenance was formally located in Building 31 at map quadrant S4 until approximately 1977. At that time it was moved over to Building 244 in quadrant S5.

The maintenance of heavy equipment primarily consists of draining oils and fuels, and changing tires and batteries. The heavy equipment shop generates approximately 1,000 gallons of waste oil annually. This has, until approximately 1983, been disposed of directly to the ground, first behind Building 31 and more recently behind, or north of, Building 244. Reportedly, battery acid was drained directly to the ground south of Building 244. The oil change area and the battery acid drainage area are discussed in sections 8.14 (Site 13, Oil Change Area) and 8.15 (Site 14, Battery Acid Disposal Area), respectively. The waste oil is no longer discharged to the ground. The waste oil for the heavy equipment maintenance is stored behind Building 244 in a large tank which is emptied when full by Facilities Management (section 6.2).

The utilities shop of WES 37 maintains power generation equipment, potable water treatment equipment, and refrigeration equipment. Waste generated by this shop consists of water treatment waste such as diatomaceous earth combined with ferric chloride flocculant, batteries and neutralized battery acid, waste oil, waste motor

fuel, empty paint cans, and paint thinner. The utility shop operates out of Building 31. Currently all wastes are drummed or barrelled and are removed by Facilities Management (section 6.2). Up until approximately mid 1984 all waste paint thinner, fuel, and waste oil were combined and disposed of in bowsers or 55 gallon barrels. Since then, these wastes are no longer combined, but are stored separately in bowsers or 55 gallon barrels at the same location. The utility shop has operated in Building 31 since 1977, however, there are currently no personnel active in this group who have knowledge of the previous location of the operation. Waste generation from the utility shop is minor, consisting of a total accumulation of two or three barrels of the above mentioned waste materials per month.

5.3.4 Third Force Field Support Group Detachment B. The third FFSG is headquartered out of Camp Pendleton. Detachment B is a detached unit of that group stationed at MCAS El Toro and has been operating since the station's inception. Detachment B performs heavy maintenance on equipment for Marine Wing Support Group 37 and other groups on MCAS El Toro. Detachment B provides engine overhauls, transmission overhauls, body work, and other similar functions for equipment and motor vehicles in an area located at the northeast corner of map quadrant U8. The waste generated by this shop consists of waste oils, contaminated fuel, contaminated hydraulic fluid, contaminated coolant, epoxy based body filler, and neutralized battery acid. Formally there was a painting shop at this facility, however, it was moved to MCAS Tustin in approximately 1978 (information on waste operations was unavailable).

Waste oil, hydraulic fluid and coolant from this operation are stored in two 400-gallon bowsers behind Building 388. These are drained approximately every 2 to 3 months by Facilities Management. There is a steam cleaner at this facility, located next to Building 760. The water drain from this steam cleaner (clear water, as the cleaner contains a water separator) is discharged to the sanitary sewer. Approximately three 55-gallon barrels of solvent, predominately methylene chloride , are used for parts cleaning each year. The waste solvent is stored in barrels near the waste oil bowsers. Approximately 30 to 40 batteries per year are drained into a barrel and neutralized with baking soda. The neutralized battery acid is poured down a floor drain in the battery shop (Building 383), which discharges to the sanitary sewer. On the east side of Building 655 is a 500-gallon buried oil sump. This sump is emptied once per month. Currently, any waste oils or fuels which are spilled to the ground are immediately cleaned up with Speedi-Dri absorbent, to prevent eroding of the asphalt concrete pavement in the area. All the spent absorbent is disposed of in trash dumpsters. Prior to the late 1970s, spills would have been rinsed to the storm drains. As the equipment maintained by Detachment B is used solely for training purposes, there are rarely more than a dozen or so vehicles being worked on in this area at any one time.

5.3.5 Marine Air Group (MAG) 11. MAG-11 is an essentially self-sufficient organization that maintains capability to operate and maintain all assigned aircraft. MAG-11 is composed of the following six squadrons and, unless otherwise stated, waste operations for the groups are reportedly the same since that group's inception:

H&MS-11
MABS-11
VMFA-314
VMFA-323
VMFA-531
VMFP-3

5.3.5.1 H&MS-11. Headquarters and Maintenance Squadron 11 (H&MS-11 or HAMS-11) is responsible for all intermediate maintenance on aircraft of squadrons assigned to the MAG. H&MS-11 also reworks, checks, and tests selected aircraft components and test equipment. It provides base storage and distribution of Class V and V(A) materials to support units, and provides a liquid oxygen manufacturing unit as appropriate.

The H&MS-11 paint shop has been in existence since the late 1960s and has been located at Building 634. This paint shop is the principal generator of hazardous waste in H&MS-11. Surfaces are prepared for painting by removing old paint with various solvents/strippers. An average 2-1/2 gallons per month of stripper is used. The stripped paint is scraped off and collected in 55-gallon drums for ultimate disposal off-station by a private contractor. Less than one drum of stripper residue is collected every 3 months. After a surface is painted, excess paint is collected and stored in 55-gallon drums. One barrel of excess paint is collected every 3 months and disposed of off-station by a private contractor. Paint booth scrubber liquid waste from the scrubber unit drains to the sanitary sewer two times per month. Residual sludge from the scrubber (several gallons) is shoveled into trash dumpsters twice a month.

5.3.5.2 MABS-11 The Marine Air Base Squadron (MABS-11) provides air base facilities and services for the Marine Aircraft Group. MABS-11 does not generate any waste.

5.3.5.3 VMFA-314, VMFA-323, and VMFA-531 The Marine Fighter/Attack Squadrons (VMFA-314, VMFA-323, and VMFA-531) have dual missions of intercepting and destroying enemy aircraft under all-weather conditions and attacking and destroying surface targets under visual conditions. Each squadron is responsible for its own maintenance and service. The squadrons have been at various locations at MCAS El Toro throughout their existence. Only their current locations could be determined. Due to the nature of these squadrons (mobile, move from base to base) little past waste disposal information is available. Past waste (prior to the early 1980s) was probably disposed of to the ground, or stored in drums and picked up by Facilities Maintenance.

VFMA-314 began operation in 1952 and is currently located at Building 605. The principal wastes generated include oil, hydraulic fluid, JP-5, solvents (such as PD-680), paint thinner, and paint stripper. A washdown separator was installed in the summer of 1984. Wastes are currently disposed of off-station, by a private contractor.

VMFA-323 has been in operation since 1946 and is currently located at Building 115. A variety of wastes has been generated, including hydraulic fluid, oil, and solvent. Some of the fuels and oil (of which the quantities are unknown) have been disposed of on the Tarmac. Other than these spills, all waste is disposed of off-station, by a private contractor.

VMFA-531 started in 1968 and is currently located at Building 115. JP-5, oil, hydraulic fluid, and methyl ethyl benzene are the only wastes generated. All wastes are disposed of off-station, by a private contractor.

5.3.5.4 VMFP-3 The Marine Tactical Reconnaissance Squadron (VMFP-3) is a photo reconnaissance squadron responsible for training and operational missions throughout the world. VMFP-3 has been in existence since 1950 and is currently located at Building 114. The types of wastes generated are the same as the other squadrons of MAG 11. All waste materials are hauled off-station for disposal, by a private contractor.

5.3.6 Marine Air Group (MAG) 13. MAG-13 is comprised of seven squadrons:

- Marine Aerial Refueler Transport Squadron (VMGR) 352
- Marine All Weather Attack Squadron (VMA) 121
- VMA-211
- VMA-214
- VMA-242
- VMA-311
- Headquarters and Maintenance Squadron (H&MS) 13

The squadrons operations are described in the following:

5.3.6.1 VMGR-352. VMGR-352's mission is to provide:

(1) Aerial refueling of Marine Corps tactical aircraft

(2) Air delivery of combat cargo and emergency re-supply to air drops between supply bases and small combat fields in the objective area

(3) Aerial transport of personnel, equipment and supplies

(4) The long-range direct delivery of high priority material and personnel to alleviate an emergency combat situation, if other means of suitable air transportation are not readily available

Presently, VMGR-352, which is located in Building 297, consists of twelve C130 re-fueler aircraft. A summary of the waste generation of this squadron is contained in Table 5-3.

5.3.6.2 VMA-121, VMA-211, VMA-214, VMA-242 and VMA-311. The purpose of the VMA squadrons is to attack and destroy surface targets, lay smoke screens, drop flares, and conduct aerial spraying and visual observation under night or day conditions. Presently, VMA-211 (Buildings 453 and 461), VMA-214 (Building 454 and 462) and VMA-311 fly A4 fighters while VMA-121 and VMA-242 (Building 455) fly A6 fighters. Table 5-3 summarizes these squadrons' waste generation operations.

5.3.6.3 H&MS-13. The mission of the H&MS-13 is to provide the logistic and administrative support for squadrons and other units attached to MAG-13. H&MS-13 consists of a headquarters branch and an aircraft maintenance branch. The headquarters branch is administrative, by nature, and thus does not generate hazardous wastes. The aircraft maintenance branch (Building 371) is capable of providing intermediate maintenance to all aircraft squadrons in MAG-13. As a result of this function, a significant quantity of hazardous waste is produced. Table 5-3 contains a summary of the waste generation operations of H&MS-13.

5.3.6.4 Ground Support Equipment. In addition to the 7 squadrons, another major hazardous waste generator within MAG-13 is the Ground Support Equipment (GSE) unit, located in Building 673. GSE maintains and operates equipment necessary for the towing and transportation of aircraft. Table 5-3 also summarizes the waste generation characteristics of GSE.

5.3.7 Marine Air Control Group (MACG)-38. The primary mission of MACG-38 is to provide tactical communication support for the Third Marine Air Wing. Though MACG-38 consists of eight squadrons, its maintenance squadron H&MS-38, located in Building 22, is the only squadron in the group generating significant quantities of material over the years since the groups inception in the early years of the station. The wastes generated by H&MS-38 include old batteries, neutralized acid, antifreeze, brake fluid, diesel oil, gasoline, and oil. The waste generation rates are not known, but due to shop size and type, are taken as comparable to the "non-utility waste" generation rates of WES-37 (section 5.3.3.3).

5.4 MISCELLANEOUS. It has been reported that a Plating Facility operated at the station for several years during the 1940s. No information concerning the size or location of the plating shop could be obtained. Typically, plating shops generate a waste which contains heavy metals and discharge to the sanitary sewer system. However, due to the lack of available information the type and quantity of waste and the point of disposal cannot be identified.

Table 5-3. MCAS El Toro, MAG-13 Hazardous Waste Generation

Name of shop and location	Period of operation	Types of wastes	Annual generation rate	Treatment/ disposal means
Marine Aerial Refueler Transport Squadron (VMGR) 352 Building 297	Pre-1971 - present	Waste fuel	24,000 gallons	Drums to Crash Crew Burn Pits (Sites 9 and 16), Drains
		Waste oil and hydraulic fluids	1,200-1,400 gallons	
		Paints	60 - 120 gallons	
		Contaminated rags	6,000-8,400 pounds	Dumpsters to landfill (Sites 2, 3, and 5)
Marine All-weather Attack Squadrons (VMA) 121, 211, 214, 242, 311 (each squadron) Buildings 453, 454, 455, 461, and 462	Pre-1970-1976	Waste oils, fuel, detergents	600 gallons	Spillage to ground (Site 6, partial)
		Waste oils, fuel, detergents	500-1,000 gallons	Drums/crash burn (Sites 9 and 16)
	1976 - Present	Fuel samples and waste oils	500-6,000 gallons	Drums/crash burn (Sites 9 and 16)
Headquarters and Maintenance Squadron (H&MS) 13 Building 22	Pre-1981 - 1984	Paints	60 - 120 gallons	Drums/landfill
		Hydraulic fluids	360 gallons	(Sites 2, 3, and 5)
		Dry cleaning solvents	240 - 360 gallons	
		Acids (hydrofluoric and nitric)	300 gallons	Neutralized with sodium bicarbonate to storm drain
		Paint Stripper	600 - 800 gallons	Drums/landfill (Sites 2, 3, and 5)
Ground Support Equipment (GSE) Building 673	1977 - Present	Oil	3,000 gallons	1. Bowser/recycled
		JP-5, diesel	600 gallons	
		Hydraulic fluid	720 gallons	2. Dust suppression
		Transmission fluid	240 gallons	
		Gasoline	180 gallons	Neutralize/to sanitary drain
		Battery acid	360 - 480 units	
		Batteries		
	Pre-1970 - 1977	Oil	2,200 gallons	
		JP-5, diesel	450 gallons	1. Bowser/pumped out recycled by contract
		Hydraulic fluid	540 gallons	
		Gasoline	180 gallons	2. Dust suppression
		Battery acid	130 gallons	Neutralize/to sanitary drain
		Batteries	270 - 360 units	

CHAPTER 6. MATERIALS HANDLING, STORAGE AND TRANSPORTATION

6.1 GENERAL. This chapter describes past operations involving handling, storage, and transportation of hazardous materials and wastes. Operations discussed include materials and waste transportation, Defense Property Disposal Office, scrap and salvage yards, ordnance storage, above ground and below ground storage tanks, service station, and pesticide storage.

6.2 INDUSTRIAL

6.2.1 Materials and Waste Transportation. Materials and waste transportation at MCAS El Toro has been handled by General Services Branch, Facilities Management Department. The Pavement Repair Section has handled trash collection, and Pest and Weed Section has handled waste oil transportation.

Trash collection has evolved over the years due to the use of different disposal sites, use of contract refuse collectors, and changes in station population and generation rates. However, the basic operation has remained essentially unchanged--collection of trash by packer trucks and transportation to landfill sites for burning and/or burial. From 1943 until 1955, burnable trash was routinely transported to incinerators and the residues hauled to the Original Landfill (Site 3, see section 8.4). After the incinerators were closed in 1955, trash was transported to the Perimeter Road Landfill (Site 5, see section 8.6), where it was burned and buried in place. Eventually, open burning was eliminated in the late 1960s and trash was then hauled to the Magazine Road Landfill (Site 2, see section 8.3) where it was buried. This landfill was used until 1980 and also included wastes transported from MCAS Tustin (late-1960s to mid-1970s). Since 1980, trash has been collected by a private contractor and disposed of in an off-station sanitary landfill.

Waste oil collection and transportation has always been and is currently conducted by Pest and Weed Section. Prior to 1984, waste oil was handled by the Supply Fuels Division. A vacuum truck periodically collects waste oils from various collection points at El Toro and Tustin, as currently directed by the Energy/Environmental Division. These points vary from underground tanks or sumps to above ground tanks or drums. Several waste oil collection points are not serviced by Pest and Weed Section. An example would be the Auto Hobby Shop at Tustin, which employs a contract waste hauler/ recycler for removal of wastes. Prior to the late 1970s, some of the oil collected by the Supply Fuels Division was sold to private off-station contractors while some was spread over dirt roads or

parking lots as a method of dust control (see Site 10, Petroleum Disposal Area, section 8.11, and Site 7, Drop Tank Drainage Area No. 2, section 8.8, as known examples). Since the late 1970s, all waste oils collected have been sold to off-station private contractors.

6.2.2 Defense Property Disposal Office The DPDO has handled surplus property at MCAS El Toro, MCAS Tustin, and several nearby naval locations since the early years of El Toro operations. Much of the surplus material is not handled by direct physical custody, but is disposed administratively for public sale through Barstow DPDO.

From the start of the base until approximately 1982, some potentially hazardous materials were received for storage at DPDO El Toro prior to public sale. Materials included leaking containers and electrical transformers. Materials stored at DPDO El Toro yards have been stacked in uncovered and unlined yards adjacent to the DPDO office/ warehouse at Building 319. The yard consists of a graded, gravelled surface which shows the soil staining typical of industrial storage yards. (See section 8.9 for more details on DPDO storage yards.) Currently, no hazardous materials are stored or transported by DPDO El Toro. Hazardous materials, such as extended shelf-life paints and batteries, are handled by the Energy and Environmental Division.

6.2.3 Scrap and Salvage Yards. Scrap and salvage storage yards are scattered throughout MCAS El Toro. Generally, these are small areas adjacent to various shops throughout the base which may be used for temporary storage of unused and/or abandoned equipment and materials. Those areas determined to have possibly stored hazardous wastes are discussed in Chapter 8. The principal scrap storage areas have always been the DPDO yards adjacent to Building 319 (see section 8.9) where much of the scrap generated on base is stored prior to eventual public sale.

6.2.4 POL Storage Aboveground. Various shops at MCAS El Toro store their waste oils in aboveground tanks or 55-gallon drums prior to collection by Facilities Maintenance (section 6.2.1). Examples are the Aero Club (section 5.2.10), which uses 55-gallon drums, and the Light and Heavy Duty Maintenance Shops (section 5.2.15.2) which use one and two 500-gallon tanks, respectively.

The TAFDS stores fuel in 1,000-gallon bladder tanks on the south side of the runway. Spills have reportedly occurred at this location (see Section 5.3.3.1).

6.2.5 POL Storage, Underground. For a complete listing of inactive and abandoned underground storage tanks, see Appendix C (SCS Engineers, 1979).

The auto hobby shop has a 600-gallon underground waste oil tank located on the northwest side of Building 626. It is unknown when the tank was installed, although it probably was in 1967 when the hobby shop was built. Other POL tanks include the Fuel Farm and the MCX Service Stations, sections 5.2.13.2 and 5.2.12 respectively.

6.2.5.1 MCX Service Station. The original Marine Corps Exchange (MCX) service station, located next to the MCX warehouse (Building 347) on the north corner of North 5th Street and F Street, was abandoned in 1971. The current station is located at Building 651, on the west corner of C Street and North 4th Street. All related pumps and fuel lines at the old station have been removed. It is unknown whether special procedures for abandoning storage tanks were conducted for the three fuel tanks.

The new MCX service station has four 12,000-gallon fuel tanks, two 500-gallon underground new oil tanks, and one 500-gallon underground waste oil tank. Reportedly, there have been no known spills or leaks at either the old or new MCX stations.

6.2.6 Supply Center Storage. The Supply Center Storage Warehouse has been located at Building 320 since 1945. Chemical supply drums are stored in two designated areas outside of Building 320--one adjacent to the building and the other next to the parking lot across the street. The former area is fenced in; the latter area is open dirt. Approximately 1,000 drums were stored in these two areas in 1964; as of March 1985, there were 100 to 125 drums.

6.2.7 Pesticide Storage. Pesticides have been primarily handled by the Pest and Weed Section. The Pest and Weed Section is in the General Services Branch of the Maintenance and Utilities Division within the Facilities Management Department. Other station activities may have used minor amounts of pesticides occasionally.

Pesticide storage, both past and present, has been in 1- or 5-gallon pails for liquid pesticides and similar-sized containers for dry or powdered materials. The Pest and Weed Section has stored these containers in a designated area within Building 493, stacked on shelves or on the floor, since the section was started in the early years of the station. The storage area is curbed or bermed to contain potential spills. Additional pesticides are temporarily stored in the applicating equipment (such as sprayers) prior to and following applications. The Golf Course has stored pesticides in Building 1687 and, prior to 1959, in the area now occupied by Building 464. For further details on pesticide usage by the Pest and Weed Section and the Golf Course, see sections 5.2.15.1.3 and 5.2.7 respectively.

6.3 ORDNANCE STORAGE. Prior to 1952, all ordnance was stored in the ammunition bunkers, located adjacent to El Toro Boulevard (Map Quadrangle P-11). After 1952, the Explosive Ordnance Disposal (EOD) area magazines for ordnance storage were constructed along Magazine Road. There are a number of storage bunkers located along this road (see Map Quadrangle K15, J15, and I14).

Recalled ordnance is eliminated by burning. This is done by the EOD unit. In some cases, ordnance is shipped back to Indian Head, Maryland, for evaluation. Thus, the disposition of recalled ordnance depends entirely on its condition. It is handled by EOD only if it is considered unstable.

CHAPTER 7. WASTE PROCESSING

7.1 GENERAL. This chapter presents information on past waste processing operations at Marine Corps Air Station (MCAS) El Toro. These operations consist of: sewage treatment, incinerators, and other waste processing (oil and grease separators). The location of the waste processing facilities are shown on Figure 7-1 (excluding the oil/grease separators).

7.2 SEWAGE TREATMENT PLANT. The sewage treatment plant was originally constructed in 1943 and expanded in the 1960s. The treatment plant received and treated domestic wastewater from 1943 to 1972. In September 1972, all of the station's wastewater was diverted to the Irvine Ranch Water District for treatment. The treatment facilities, including operations buildings, unit processes and sludge drying beds, were abandoned in-place in 1972. The facility buildings and unit processes were demolished when funds became available in the late 1970s; the drying beds, however, remain in-place. The drying beds are described in detail in section 8.13, Site 12, Sludge Drying Beds.

The treatment plant, located off Plant Road, was designed to treat an average dry weather flow of 1.4 million gallons per day (mgd); actual flows averaged 1.0 mgd. After pumping from a wet well, influent flow was split and then treated by parallel trickling filter plants. Figure 7-2 is a process flow schematic showing the sewage treatment plant. Treatment at the plant consisted of primary clarification/digestion, trickling filtration, and secondary clarification. Secondary effluent from both plants was combined and disinfected in a chlorine contact tank. A portion of the chlorinated effluent was pumped to a storage tank and used for golf course irrigation. Sludge from the digester was dried in the aforementioned sludge beds, and the dried sludge still remains in the beds. The remaining effluent was discharged into San Diego Creek.

7.3 INCINERATOR. An incinerator was operated from shortly after the station was established in 1943 until about 1955. Aerial photographs indicate the structure was dismantled between 1963 and 1967. The location of the former incinerator is in map grid M-10. No trace of the original structure remains.

Trash or municipal solid waste-type refuse was burned to reduce volume and the ash was disposed of in the Original Landfill (Site 3, see section 8.4). The volume of waste processed through the incinerator is not known, but is believed to be most or all the trash generated by station housing and other activities during the period of incinerator operation.

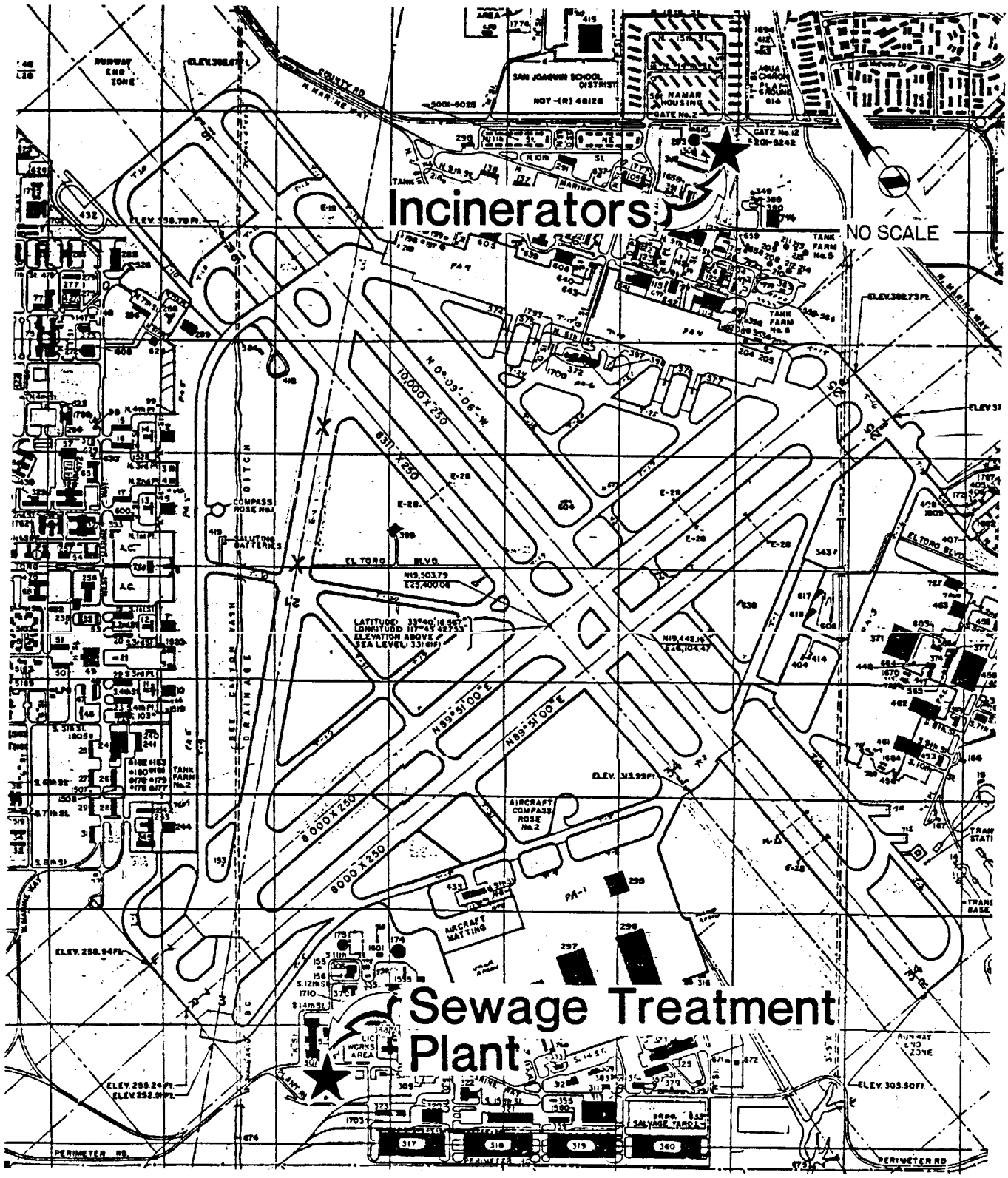

Figure 7-1 Location of Waste Processing Operations

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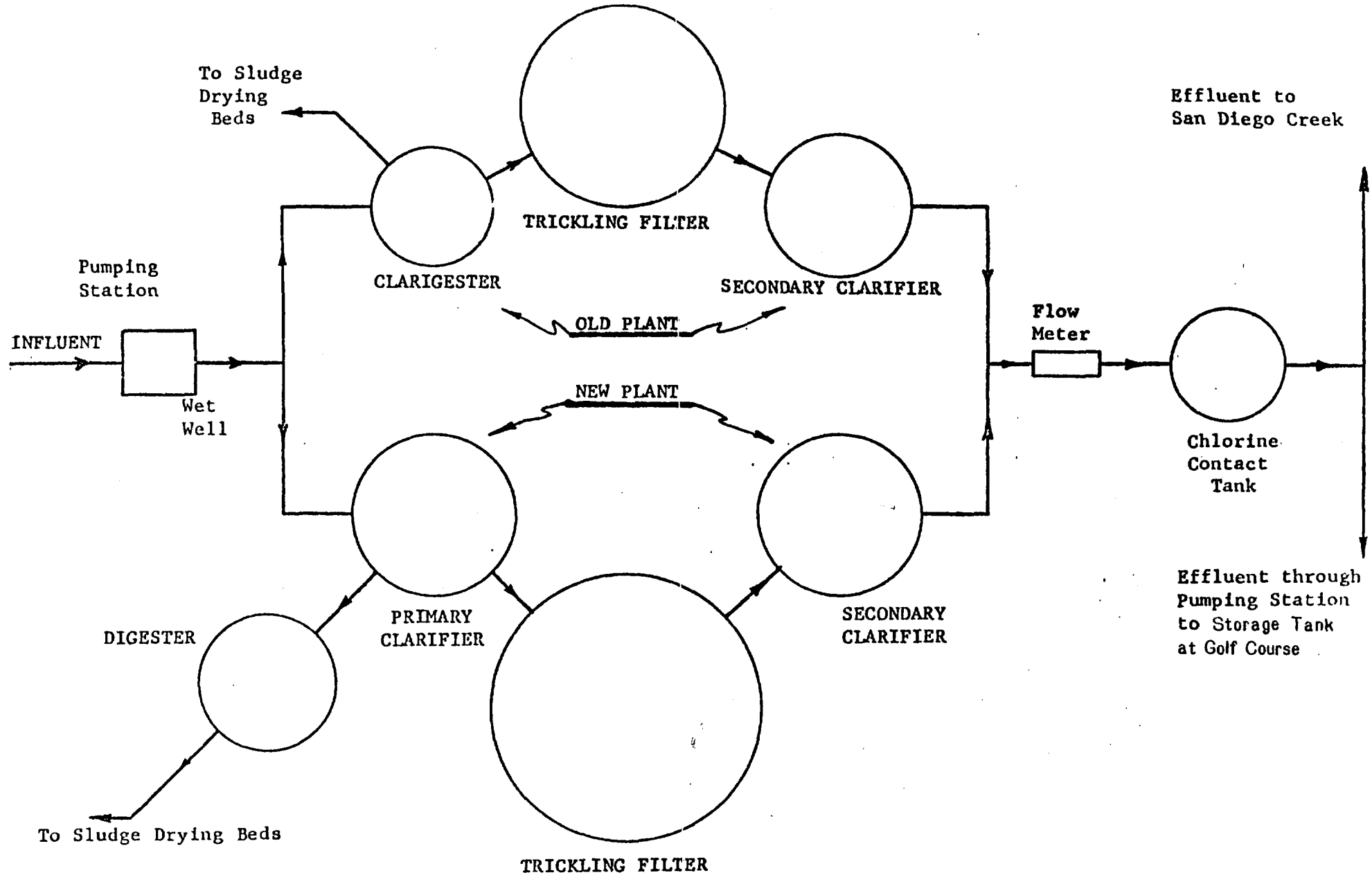

Figure 7-2 Sewage Treatment Plant Process Flow Schematic

7.4 OIL/WASTE SEPARATORS. Oil/water separators are used at various locations within MCAS El Toro for the primary separation of oil from water prior to discharge of the water to the sewer drain system. The separator units also serve as oil storage. A total of 18 oil/water separators are found at the following locations at MCAS El Toro:

1. South of Hangar 10, Building 766
2. Adjacent to Building 240
3. Next to Building 244, Building 765
4. North of Building 1589
5. South of Building 298
6. East of C-Pool Entrance Gate
7. Near Building 655
8. South Side of Building 388, Building 760
9. East Side of Building 392, Building 764
10. East of Hangar 114, Building 763
11. Southeast Corner of Building 673
12. Southwest Side of Hangar 297 (has no control switch)
13. South Side of Building 390
14. By Hangar 461, Building 761
15. Building 671
16. Hangar 462
17. Building 706
18. Hangar 605

CHAPTER 8. DISPOSAL SITES AND POTENTIALLY CONTAMINATED AREAS

8.1 GENERAL. Sixteen potentially contaminated areas were identified at MCAS El Toro during this study. Information presented was compiled from on-site examinations, interviews, and records review. Table 8-1 summarizes the information collected on these sites. Plate 1 shows the location of all identified sites. Where the broad category of "solvents" is used, reference Appendix E for more details.

8.2 SITE 1, EXPLOSIVE ORDNANCE DISPOSAL RANGE. Site 1 consists of two disposal areas located on either side of the main north-south unpaved roadway running through the EOD range. The EOD range is located at Plate 1 map coordinates D-14, E-14. The disposal areas lie approximately 200 yards north of the new detonation shack, and are shown on Figure 8-1. Both areas are small, no more than 100 feet in diameter.

The site lying to the west of the roadway contains approximately twenty 55-gallon drums that contained sulfur trioxide chlorosulfonic acid (FS-Smoke). In 1982, these drums were buried with a small charge of C-4 explosive, covered with soil and detonated. Reportedly, not all of the FS-Smoke was burned in that explosion. This is a reasonable assumption as sulfur trioxide chlorosulfonic acid is a liquid at ambient temperatures. FS-Smoke does volatilize though, and reacts with water. Thus it is reasonable to assume that more than 25 percent of the material was destroyed by this destruction method, and that 75 percent or about 750 gallons, or less, remained after detonation.

The site located east of the roadway is evidenced by barren soil and the presence of portions of exploded 55-gallon drums, half buried at the surface. It is not known how much FS-Smoke was disposed of at this location. Assuming attempts were made to destroy a similar quantity of sulfur trioxide chlorosulfonic acid at this location, approximately 750 gallons, or less, of material remained after detonation.

There is also, reportedly, a possible low-level radioactive material disposal site in the EOD range. No information concerning the location of this site or what material it contained could be obtained.

8.3 SITE 2, MAGAZINE ROAD LANDFILL. Site 2 is located adjacent to Building 1752 along Borrego Canyon Wash and is shown on Figure 8-2. Disposal operations were initiated in the late 1960s following closure of the Perimeter Road Landfill (Site 5), and ceased about 1980.

The landfill is approximately 22 acres in size and lies between the two main tributaries of Borrego Canyon Wash. Initially, the area between the two tributaries was excavated for sand and gravel

Table 8-1. Past Disposal Sites at MCAS El Toro

Number	Site	Location	Period	Wastes	Quantities	Sources
74-1	Explosive ordnance disposal range	D/E-14	1982	Sulfur trioxide chlorosulfonic acid	2,000 gallons	3d MAW
74-2	Magazine Road landfill	L-16/17	Late 1960s-1980	Inert solid waste, municipal solid waste, unspecified industrial wastes, lead batteries, transformers, household refuse, hydraulic fluid, unspecified waste fuels, crankcase oil, lead based paint residue and scrap metal	800,000 to 1,000,000 cubic yards	FMD, base contractors, and station personnel
74-3	Original landfill	M-10/11	1943-1955	Municipal solid wastes, scrap metal, incinerator ash, construction debris, paint residues, unspecified oily wastes, industrial solvents, hydraulic fluid and engine coolants	163,500 to 243,000 cubic yards	Station housing, FMD and station squadrons
74-4	Ferrocene spill area	N-10	1983	Ferrocene	5 gallons	MAG-11 test cell
74-5	Perimeter Road landfill	O-14	1955-late 1960s	Municipal solid waste, unspecified fuels, solvents and cleaning fluids, scrap metals, paint residues and unspecified oily wastes	50,000 to 60,000 cubic yards	Station housing and FMD
74-6	Drop tank drainage area No. 1	R-11	pre 1960-1983	JP-5 and lubrication oils	1,676 gallons	MAG-13
74-7	Drop tank drainage area No. 2	S/T-9	pre 1969-1983	JP-5 and lubrication oils	21,800 gallons	MAGs
74-8	DPDO storage yard	U-9	1984	Transformer fluid	< 5 gallons	DPDO
74-9	Crash Crew Pit No. 1	T-6/S-7	pre 1965-1971	Leaded AVGAS, JP-5 and crankcase oil	12,370 gallons	Squadrons
74-10	Petroleum disposal area	T-7	1952-mid 1960s	Crankcase oil, antifreeze, hydraulic and transmission fluids, motor fuel and solvent	52,000 gallons	HD maint. shop, LD maint.shop, MWSG-37, MAG-13, MAG-11
74-11	Transformer storage area	T-7	pre 1968-1983	Transformer fluid	60 gallons	Station
74-12	Sludge drying beds	U-6	1943-1972	Wastewater sludges	880 cubic yards	Sewage treatment plant
74-13	Oil change area	S-4	pre 1977-1983	Crankcase oil	7,000 gallons	WES-37

Table 8-1. Past Disposal Sites at MCAS El Toro (continued...)

Number	Site	Location	Period	Wastes	Quantities	Sources
74-14	Battery acid disposal area	S-4	pre 1977-1983	Vehicle battery acid, lubrication oil, paint residue	210 gallons	WES-37
74-15	Suspended fuel tanks	S-4	pre 1979-1984	Diesel fuel	> 500 gallons	WES-37
74-16	Crash Crew Pit No. 2	P-6	1972-present	JP-5, AVGAS, hydraulic fluid, crankcase oil, white phosphorus, magnesium phosphate, and napalm	27,360 gallons	Squadrons, 3d MAW
74-17	Communication Station Landfill	L-14	1981-1983	Cooking grease, oils, fuels, municipal debris	36,000 gallons	Mess Hall, various sumps

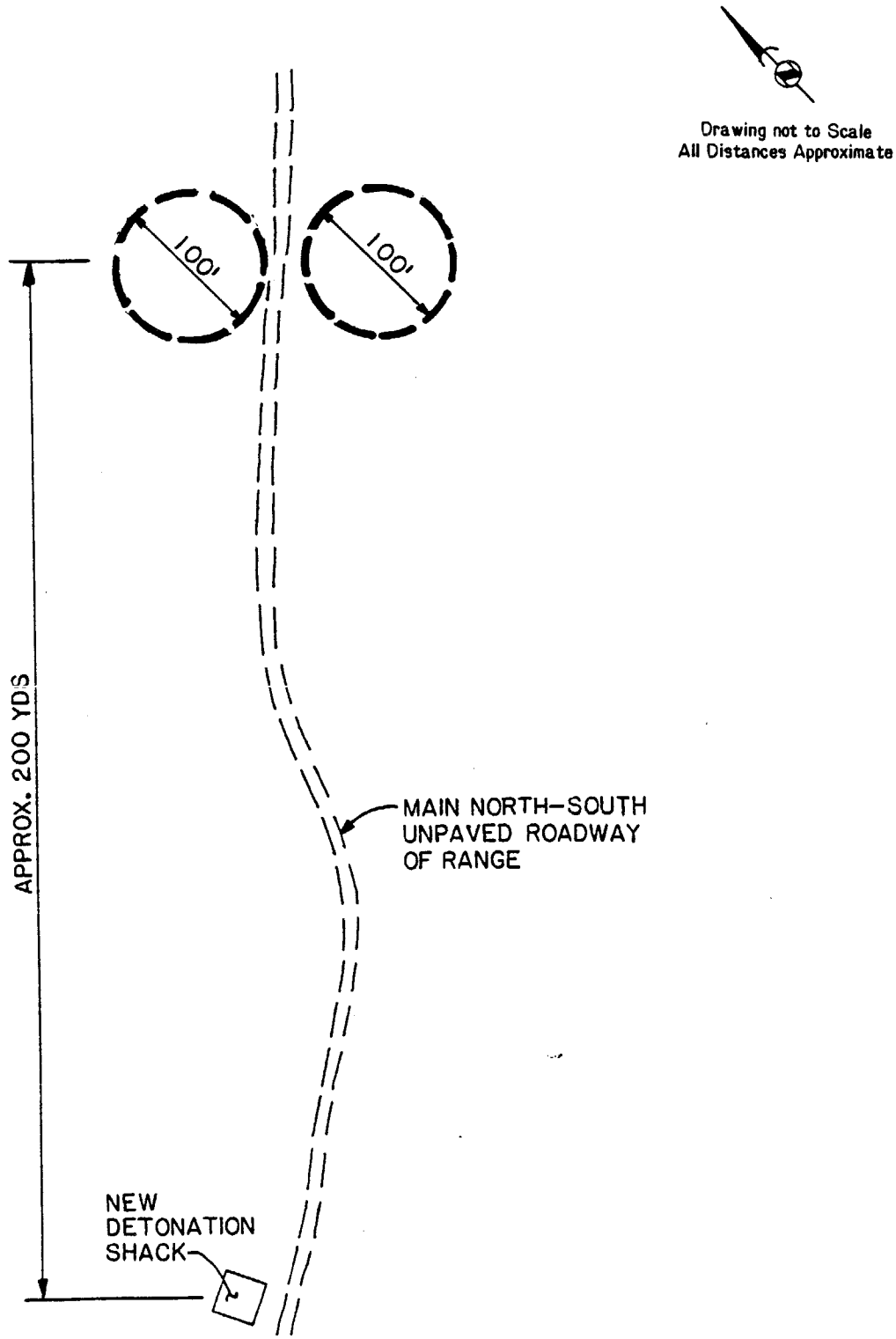

Figure 8-1. Site 1, Explosive Ordnance Disposal Range

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El Toro, California

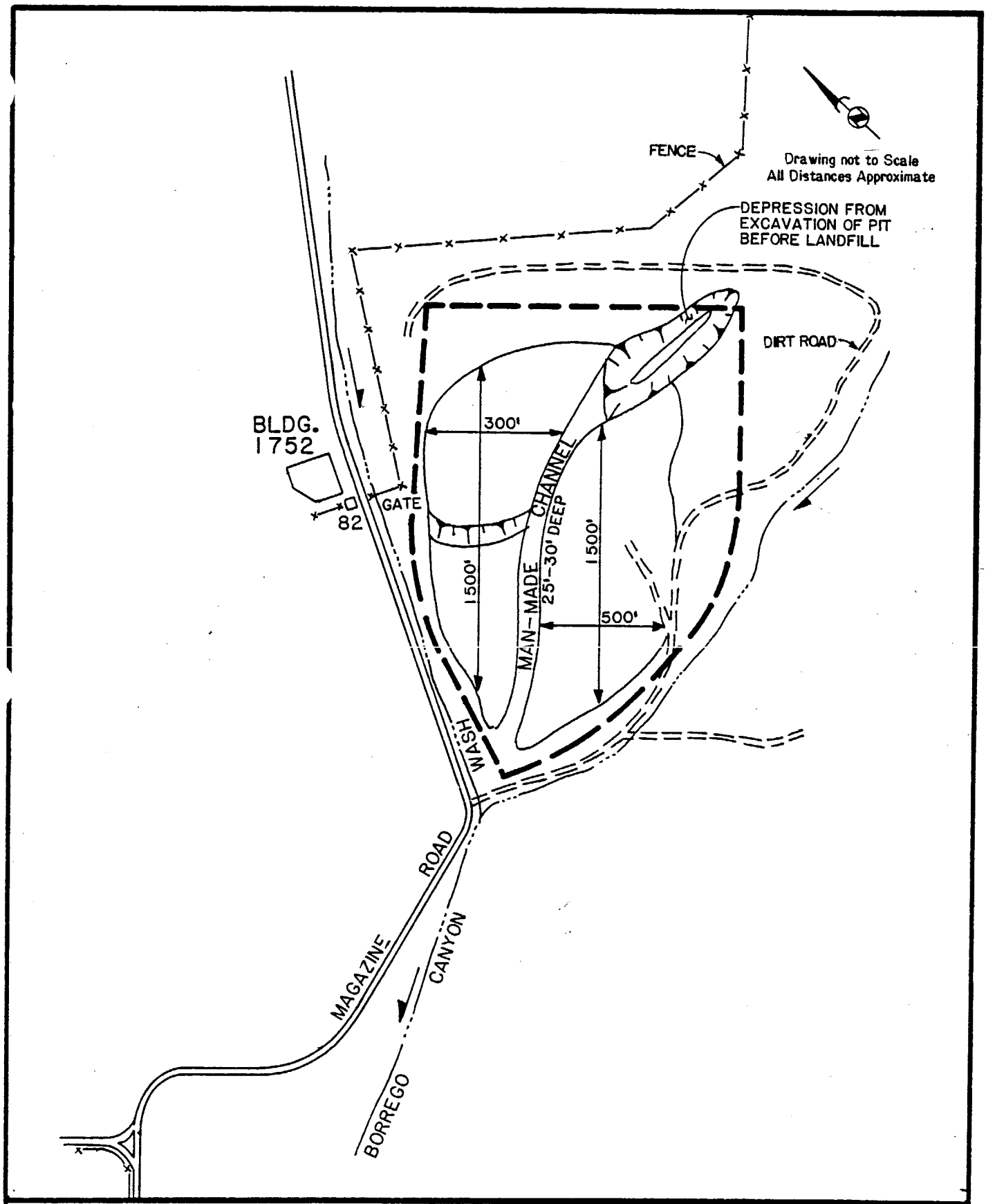

Figure 8-2. Site 2, Magazine Road Landfill

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supplies required at the station. Each area was then backfilled with waste materials and a channel was formed down the center of the area as a result of the backfilling practices. East of the man-made channel the landfill cell is approximately 1,500 feet by 500 feet. West of the man-made channel the landfill has two cells, an upper cell that is 300 feet wide and a lower cell that is 200 feet wide. The length of the two cells combined is approximately 1,500 feet.

The depth of the landfill varies, but is estimated to average between 25 to 30 feet, when height above Magazine Road, rise in slope up the canyon, and depth of the tributary streams are considered.

Reportedly, bedrock was never reached during excavation and a relatively flat bottom to the borrow pit excavation is assumed. Based on the above dimensions, the assumptions concerning the shape of the borrow pit and the estimated average depth, an estimated maximum volume of wastes of 800,000 to 1,000,000 cubic yards is calculated for the landfill. This volume does include some cover soil used in the landfill. Additionally, no burning of material was permitted during the active period of disposal, so no volume reduction is assumed.

Wastes reportedly consist of inert solid wastes such as construction debris, surplus soils, broken concrete, and asphalt delivered to the site by the Facilities Management Department from various construction areas at MCAS EL Toro and MCAS Tustin. However, the site was known to have been used as a disposal area over the years by base contractors, station personnel, and others. These wastes reportedly include automotive batteries, municipal solid waste including small amounts of scrap metals, household refuse, waste motor oil, hydraulic fluid, fuels, lead-based paint residue and containers, solvents, and possibly transformer fluids. Individual quantities, and the actual makeup of these "categories" of wastes listed above, could not be determined, though reportedly almost any type of waste generated on station may have been disposed of at the landfill.

8.4 SITE 3, ORIGINAL LANDFILL. Site 3 contains a number of separate pits or trenches, all within Plate 1 map coordinates M-10 and M-11, adjacent to an unlined flood control channel (Aqua Chinon Wash). During construction of the Flight Simulator building (Building 746) and a nearby parking/office area, buried wastes were uncovered, indicating that a number of disposal pits are located over a wide area.

One possible disposal pit or covered trench is observable as an elevated pad as presented on Figure 8-3. This particular area covers approximately four acres and is reported to contain wastes to a depth of approximately 15 to 25 feet. The estimated volume of

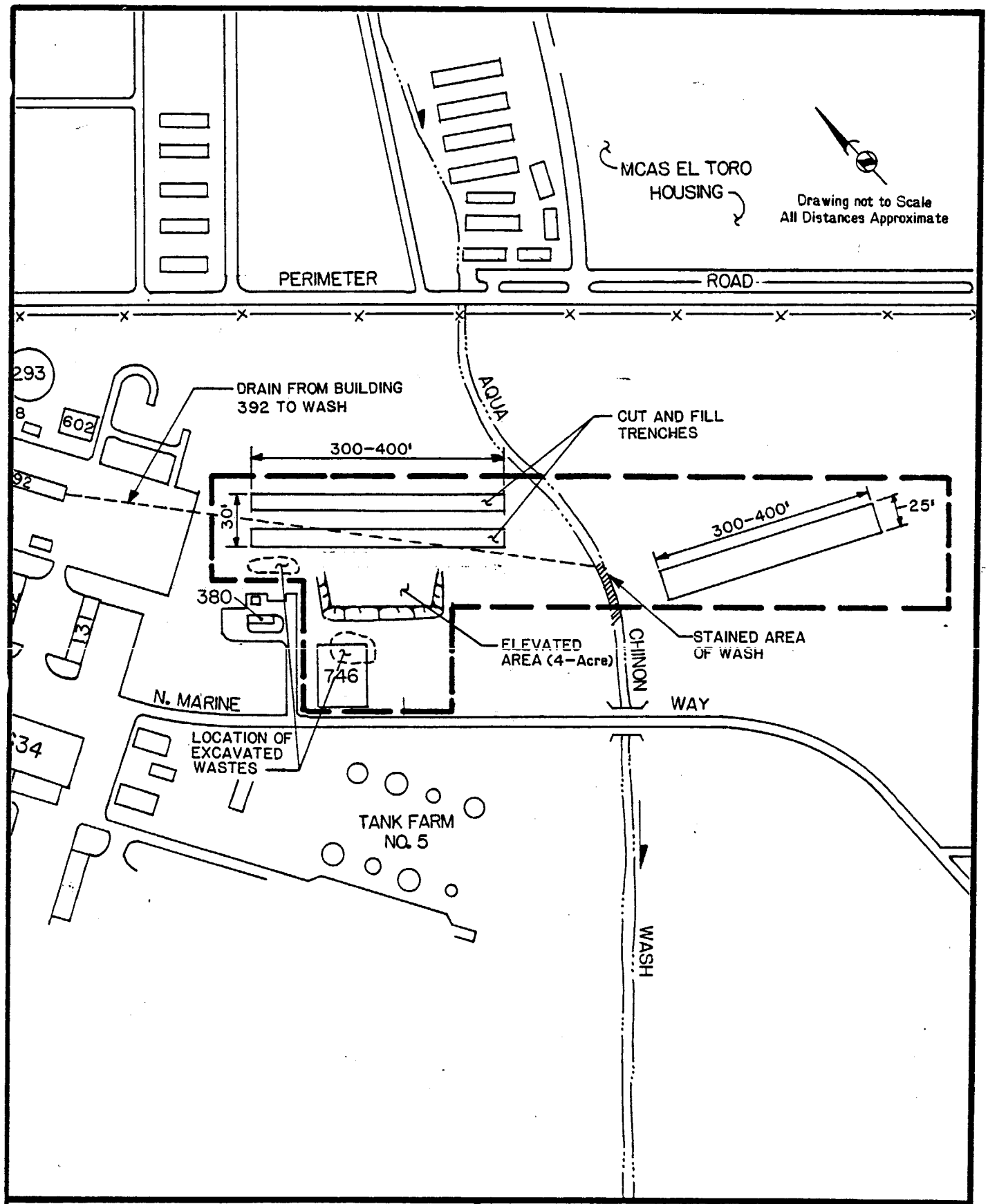

Figure 8-3. Site 3, Original Landfill

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the pit is between 100,000 and 160,000 cubic yards. Three additional trenches, each approximately 300 to 400 feet long, 20 to 30 feet wide and 20 to 25 feet deep, are reported to be located as shown on Figure 8-3. Each would contain between 4,500 and 11,000 cubic yards. Two disposal pits, uncovered during excavation for Building 746 and a parking area due north of Building 380, had reported depths of 15 feet. Assuming each is one acre in size, these two pits account for another 50,000 cubic yards of waste material. The total volume of wastes in the six identified disposal areas of this site (shown on Figure 8-3) is estimated to be between 163,500 and 243,000 cubic yards.

Disposal operations at the site began about 1943, shortly after the station was established. Pits or trenches were excavated and virtually every type of waste generated on the station reportedly may have been disposed of in this landfill. The wastes reportedly are likely to include metals, solvents, paint residues, hydraulic fluids, coolants, construction debris, oily wastes, municipal solid wastes, and various inert solid wastes. The exact composition and quantities of the wastes could not be determined. The majority of the buried wastes probably consist of ash and other combustion residues from a nearby incinerator in which most combustible solid wastes were incinerated prior to burial in the landfill (see Section 7.3). The disposal area ceased operation about 1955 when the incinerator operation was suspended and the Perimeter Road Landfill (Site 5) was activated.

8.5 SITE 4, FERROCENE SPILL AREA. In August 1983, personnel washing a 500-gallon tank flushed a maximum of 5 gallons of a ferrocene and hydrocarbon carrier solution to the ground in the area south and east of Building 658 at Plate 1 map coordinates N-10. The site is presented on Figure 8-4. The tank was essentially empty. It had not been in use for 6 months and had been vented to the atmosphere for that length of time. Personnel were filling the tank with water to wash and remove any residue, prior to permanently abandoning the tank and having it removed from the area. During rinsing, the tank overflowed. The rinse water spilled to the asphalt paving, and then into the nearby dirt drainage ditch in its approach to a nearby storm drain. Presently, the grass in the contact area is visibly stressed. The spill probably did not reach the storm drain itself, as liquids tend to pool just north of the drain, where the vegetation is stressed. Additionally, the vegetation is not stressed in any way in the 10-foot long area between the storm drain and the stressed area itself. Personnel cleaned the spill from the asphalt paved area with a dry, absorbent material. The disposition of this material is not known.

As ferrocene is a solid at ambient temperatures, and insoluble in water, it likely would have been dissolved in a hydrocarbon carrier. Thus, the residual contents of the tank, estimated to be a maximum of 5 gallons of ferrocene and a hydrocarbon carrier, would constitute the spill volume at Site 4.

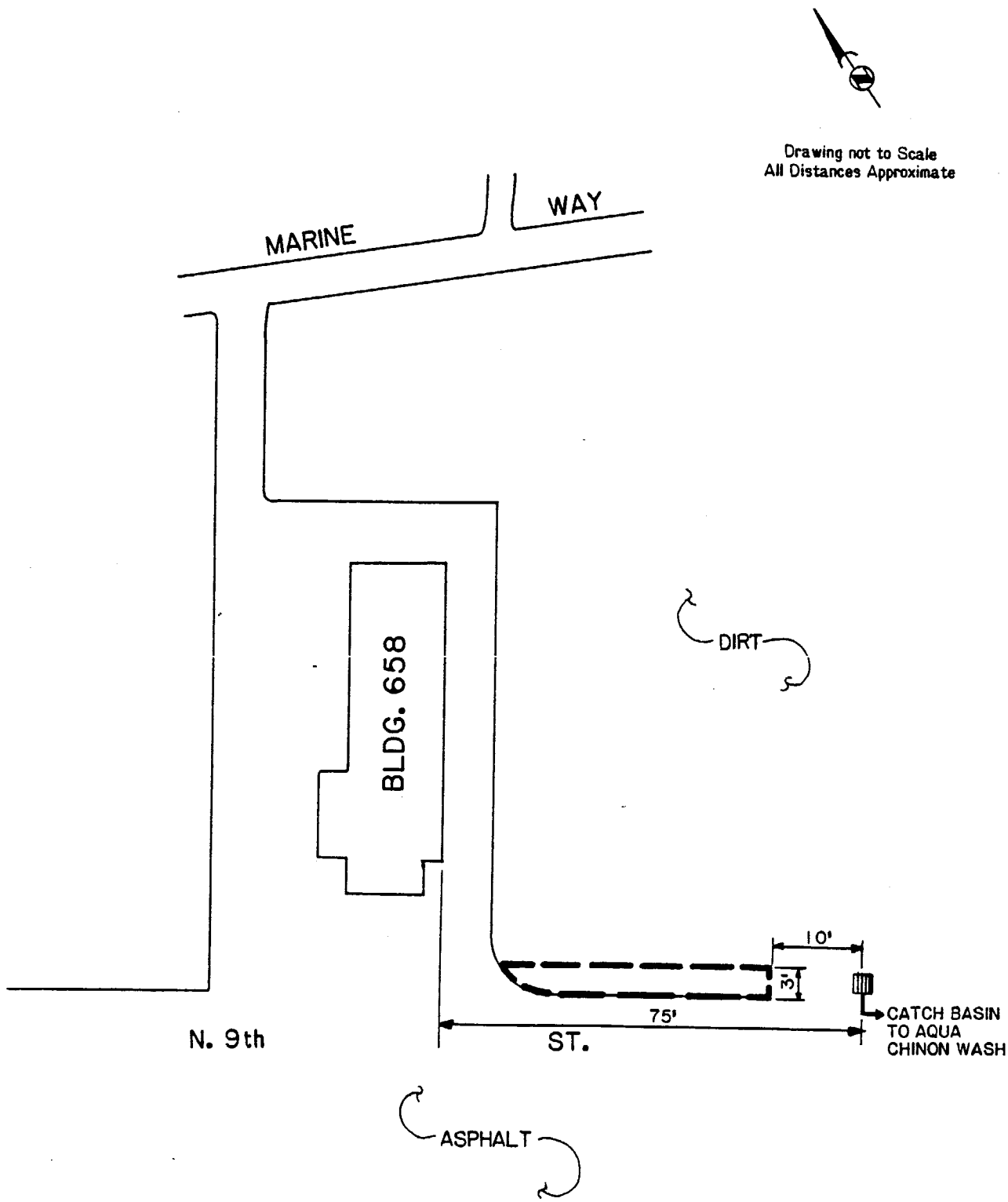

Figure 8-4. Site 4, Ferrocene Spill Area

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8.6 SITE 5, PERIMETER ROAD LANDFILL. Site 5 is located adjacent to the station perimeter north of Gate No. 3, at Plate 1 map coordinates 0-14. The site is shown on Figure 8-5. The site consists of trench type cut-and-fill burn pits probably containing three separate trenches. The main disposal area, based on review of aerial photographs, ground surveys and personnel interviews, includes an area about 1,200 feet long, 60 feet wide and 20 feet deep. Thus the total volume, including wastes and cover soils, is about 50,000 to 60,000 cubic yards.

Site 5 was activated in about 1955 when operations at the Original Landfill (Site 3) were phased out. Operations at Site 5 continued until the late 1960s when Magazine Road Landfill (Site 2) was opened. Wastes disposed of included burnable trash, municipal solid waste, unspecified fuels, oils, and solvents, cleaning fluids, scrap metals, paint residues and other materials. The exact compositon and quantities of the wastes could not be determined, though reportedly almost any type of waste generated on the station may have been disposed of at this landfill.

The mode of operation consisted of trench excavation, placement and burning of wastes in the trench, followed by burial. Recurring settlement or consolidation of wastes, possibly due to continuing underground fires, has required periodic applications of additional cover soil over the trenches to maintain drainage and avoid ponding. Vegetation above the trench areas appears stressed.

8.7 SITE 6, DROP TANK DRAINAGE AREA NO. 1. Site 6 is a 70-foot by 20-foot grass area located along the southwest edge of the concrete apron just south of Building 1684. This site is located at Plate 1 map coordinates R-11 and is shown on Figure 8-6. Reportedly, between 1969 and 1983, aircraft drop tanks were emptied and the remnants of JP-5 fuel were washed out. Drop tanks are external fuel tanks that are detachable from aircraft. The fuel was washed from the tanks with water and detergent. An estimated 50 gallons per month of JP-5 fuel was disposed of at Site 6 from before 1969 until 1983 as a result of this practice. The total quantity of JP-5 fuel disposed of at this site is 1,400 gallons.

Portions of this unpaved site were reportedly used for storing oil drums. Spills and leakages occurred from time-to-time. Disposal of waste lubrication oils resulting from maintenance operations reportedly took place in this area also. This practice reportedly began after the construction of the hangars and concrete aprons in 1960, and was not discontinued until 1983. The quantity of oil disposed of could not be determined. However, assuming one gallon of disposal per month, the total quantity would have been about 300 gallons.

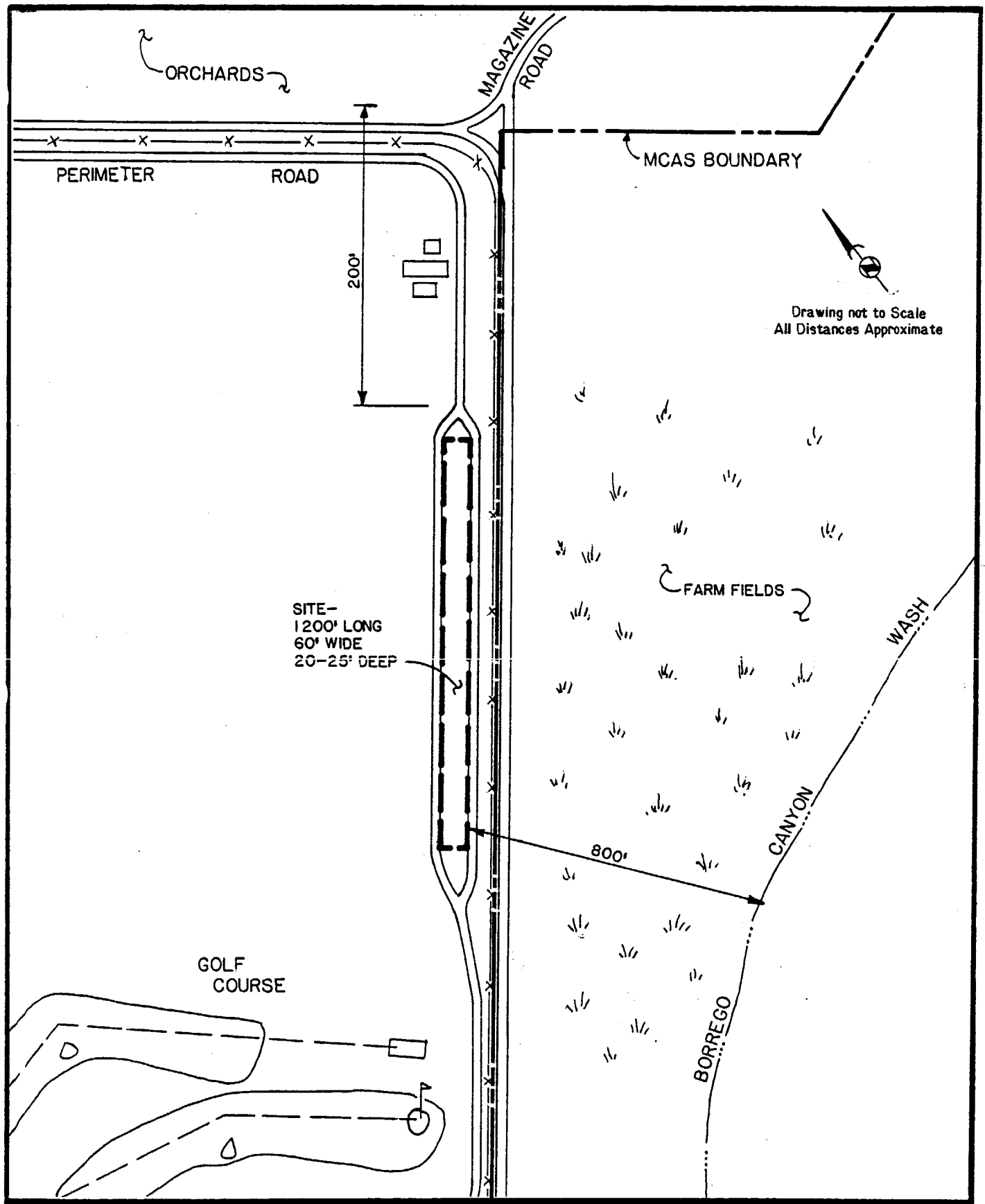

Figure 8-5. Site 5, Perimeter Road Landfill

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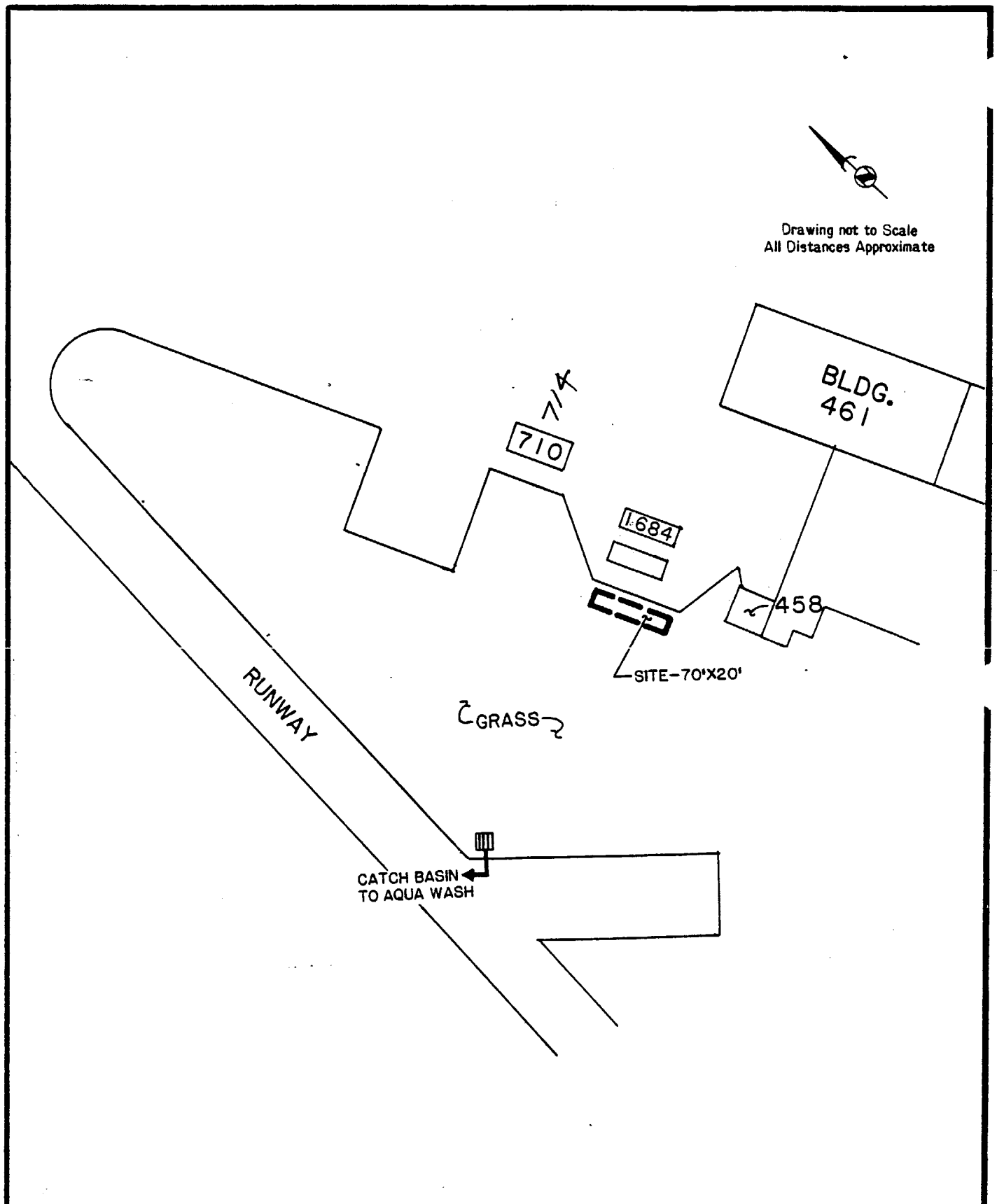

Figure 8-6. Site 6, Drop Tank Drainage Area No. 1

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At the time of the on-site visit in mid-February 1985, most of Site 6 was covered with grass and clovers. A portion of the site is currently used for waste lubrication oil drum storage. Although there were some very small local patches at the site where no vegetation exists, no evidence of stressed vegetation was apparent.

8.8 SITE 7, DROP TANK DRAINAGE AREA NO. 2. Site 7 spans the area north and east of the concrete aprons serving hangars 295 and 296, along the interface between the apron and unpaved grassy areas. The site is located at Plate 1 map coordinates S,T-9, and is actually two areas as shown on Figure 8-7.

From 1969 to 1983, aircraft drop tanks were drained of residual JP-5 in the first area north of Hangar 295. This is an area 800 feet long by 20 feet wide along the edge of the pavement. The MAGs occupying Hangar 295 would empty and flush out the drop tanks with water and detergent. Test samples of JP-5 fuel and lubrication oils generated during routine maintenance were also disposed of in this area. Reportedly the area was saturated with JP-5 fuel and lubrication oil in the early 1980s. Assuming a 50:50 ratio of the two and an average total disposal rate of 40 gallons per month of petroleum products, 3,360 gallons of lubrication oil and 3,360 gallons of JP-5 were disposed of in this area of the site.

East of Hangar 296 is the second area, approximately 1,200 feet long and 50 feet wide, bordering the concrete apron area. In this area drop tanks were drained and flushed of residual JP-5 and waste lubrication oil was disposed of. The sources of both of these wastes were the MAGs located in hangars 296, 297 and 295.

Reportedly this area was used to a lesser extent for drop tank rinsing than the area north of Hangar 295. It is assumed that the disposal rate of JP-5 to this area of the site was roughly half that disposed of in the area north of Hangar 295. Thus, it is assumed that JP-5 was disposed of to this area at the rate of 10 gallons per month from 1969 to 1983. Thus, a maximum quantity of 1,680 gallons of JP-5 was disposed in this area.

From 1972 to 1978, much of the area of the site east of Hangar 296 served as a dirt parking lot. Throughout this period, waste lubrication oils generated by the MAGs located in the hangars were applied to the dirt parking lot as a means of dust control. Between 200 and 300 gallons of waste lubrication oil per month was applied to the area in 1972 for suppressing dust. In the mid-1970s, the application rate declined to about 200 gallons per year, rising again in the late 1970s to a disposal rate of 200 gallons per month. Presently, much of this area is paved over with concrete.

In 1982, 2,000 gallons of JP-5 spilled from a 4,000-gallon fueler truck when a valve on the truck broke. The JP-5 spilled from the truck to the concrete pad in an area east of Hangar 296 known as Pad-4. The JP-5 was immediately washed with water from the concrete pad onto the surrounding soils to the east of the Hangar 296 area.

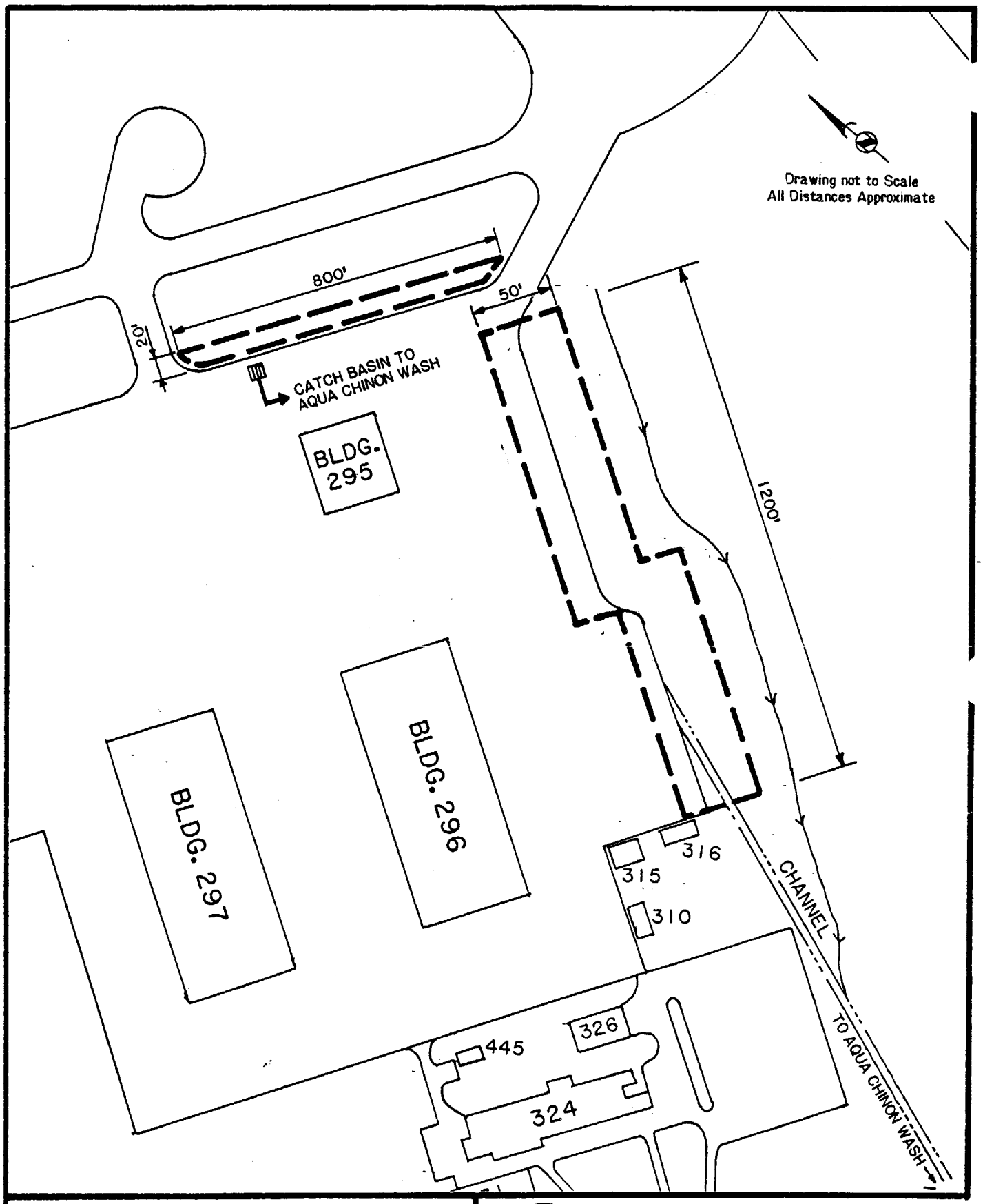

Figure 8-7. Site 7, Drop Tank Drainage Area No. 2

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A summary of waste disposal to site 7 is presented in Table 8-2. This table describes the source of the wastes, the generation rate and an estimated disposal quantity. A maximum of 6,720 gallons of wastes were disposed of in the area north of Hangar 295, and a maximum of 15,080 gallons of waste are estimated to have been disposed of in the area east of Hangar 296.

8.9 SITE 8, DPDO STORAGE YARD. The DPDO storage yard is located at Plate 1 map coordinates U-9 along the southwestern station perimeter. The site is located within the storage yard as shown on Figure 8-8. Operated by the Defense Property Disposal Office, the yard has served as a storage area for various scrap and salvage materials since the early years of El Toro operations. These materials include mechanical and electrical components, and containerized liquids, from MCAS El Toro and MCAS Tustin. Since the mid-1970s, the storage yard has been a graded gravel pad elevated several feet above the surrounding street culverts.

A PCB spill occurred in the yard in 1984, resulting from a leaking electrical console, releasing an undetermined amount, but reportedly several gallons, of PCB-containing insulating oil. The spill occurred in a small area near the east end of the yard. The spill was subsequently cleaned up by excavation to about one foot depth and removal of several cubic yards (about 10,000 pounds) of potentially contaminated soils. The excavated soils were trucked to an approved off-station disposal facility by a hazardous waste contractor.

8.10 SITE 9, CRASH CREW PIT NO. 1. Site 9 is located at Plate 1 map coordinates T-6 and S-7 and is presented on Figure 8-9. An area of stressed vegetation 70 feet in diameter to the west of the aircraft matting was reportedly the location of the original crash crew pit. However, review of aerial photographs from 1965 to 1971 would place the site 50 feet to 100 feet to the east in the area of the aircraft matting.

The site was used from 1965 to 1971 as a practice training area for the crash crew to extinguish fires. The crash crew pit was approximately 50 feet in diameter and 3 to 4 feet deep. Three to four months per year were suitable for practice burns from an air quality standpoint, and during those months trainings were held four times per week. Between 100 and 500 gallons of waste fuel was applied to the pit per training. The waste fuel was applied after the pit was first covered with a layer of water. The floating fuel was ignited, and then the crash crew practiced putting out the fire using water and other fire fighting chemicals. This procedure was then repeated 10 to 20 times on a training day. Reportedly, water-contaminated AVGAS and JP-5 were the two wastes mainly used for training; reportedly some waste crankcase oil was also burned, but this was identified as a small quantity. The AVGAS would have been used from 1965 until 1969, and JP-5 would have been used from 1969 to 1971. All the wastes used were reportedly generated by the

Table 8-2. Wastes Disposed of to Site 7, Drop Tank Drainage Area No. 2, MCAS El Toro

Disposal area within site	Waste	Source	Time period	Estimated disposal rate, gallons per month[a]	Estimated disposal quantity, gallons
North of Hangar 295	Lubrication oil	MAGs	pre 1969-1983	20	3,360
	JP-5	MAGs	pre 1969-1983	20	3,360
	Subtotal				6,720
East of Hangar 296	Lubrication oil	MAGs	pre 1972	300	3,600
	Lubrication oil	MAGs	pre 1973	200	2,400
	Lubrication oil	MAGs	pre 1974-1976	200[b]	600
	Lubrication oil	MAGs	pre 1977-1978	200	4,800
	JP-5	MAGs	1982	2,000[c]	2,000
	JP-5	MAGs	pre 1969-1983	10[d]	1,680
	Subtotal				15,080
	Total				21,800

[a]Except as noted.

[b]Gallons per year.

[c]One time spill incident.

[d]Assuming one-half of the disposal rate as to the area North of Hangar 295.

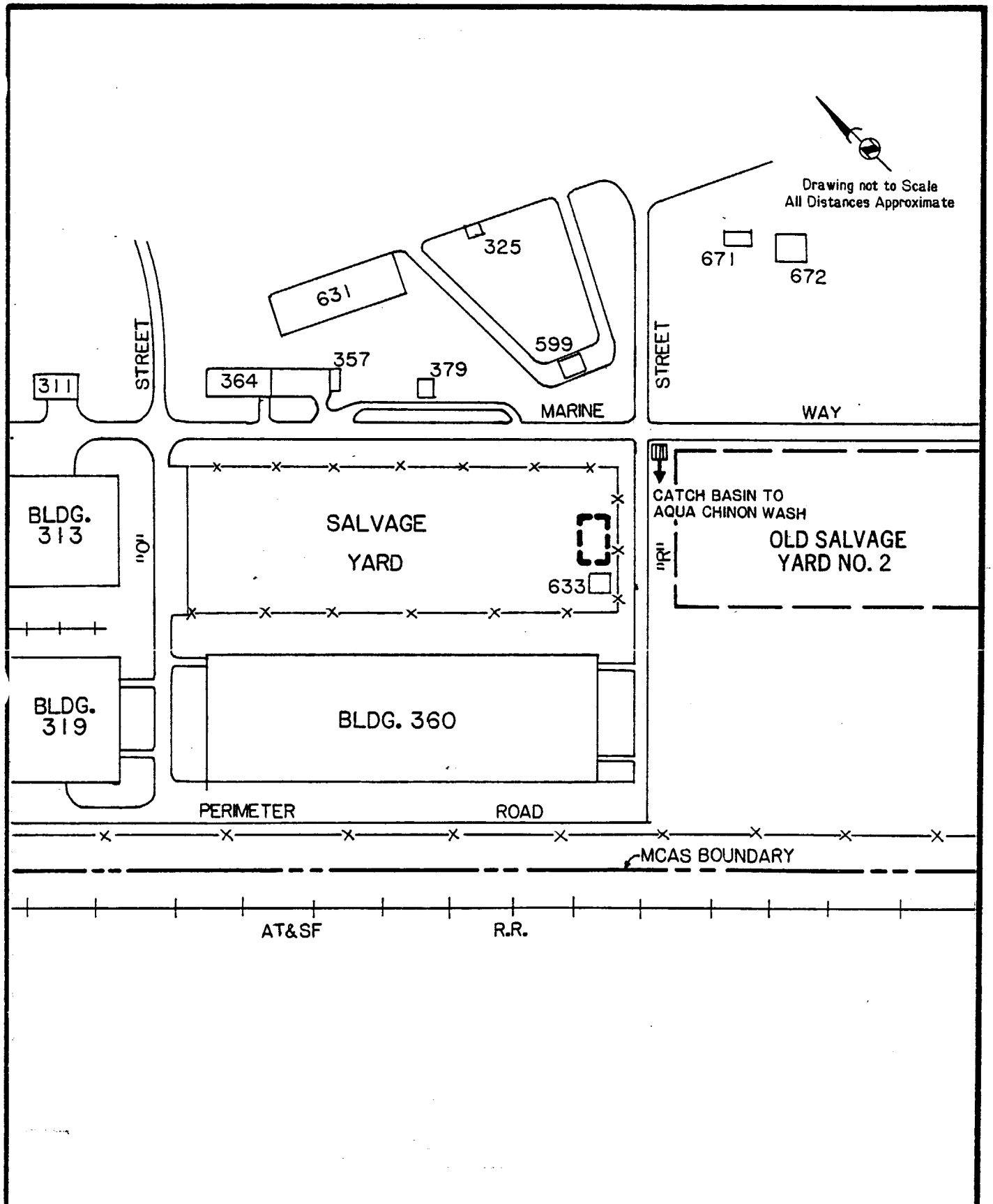

Figure 8-8. Site 8, DPDO Storage Yard

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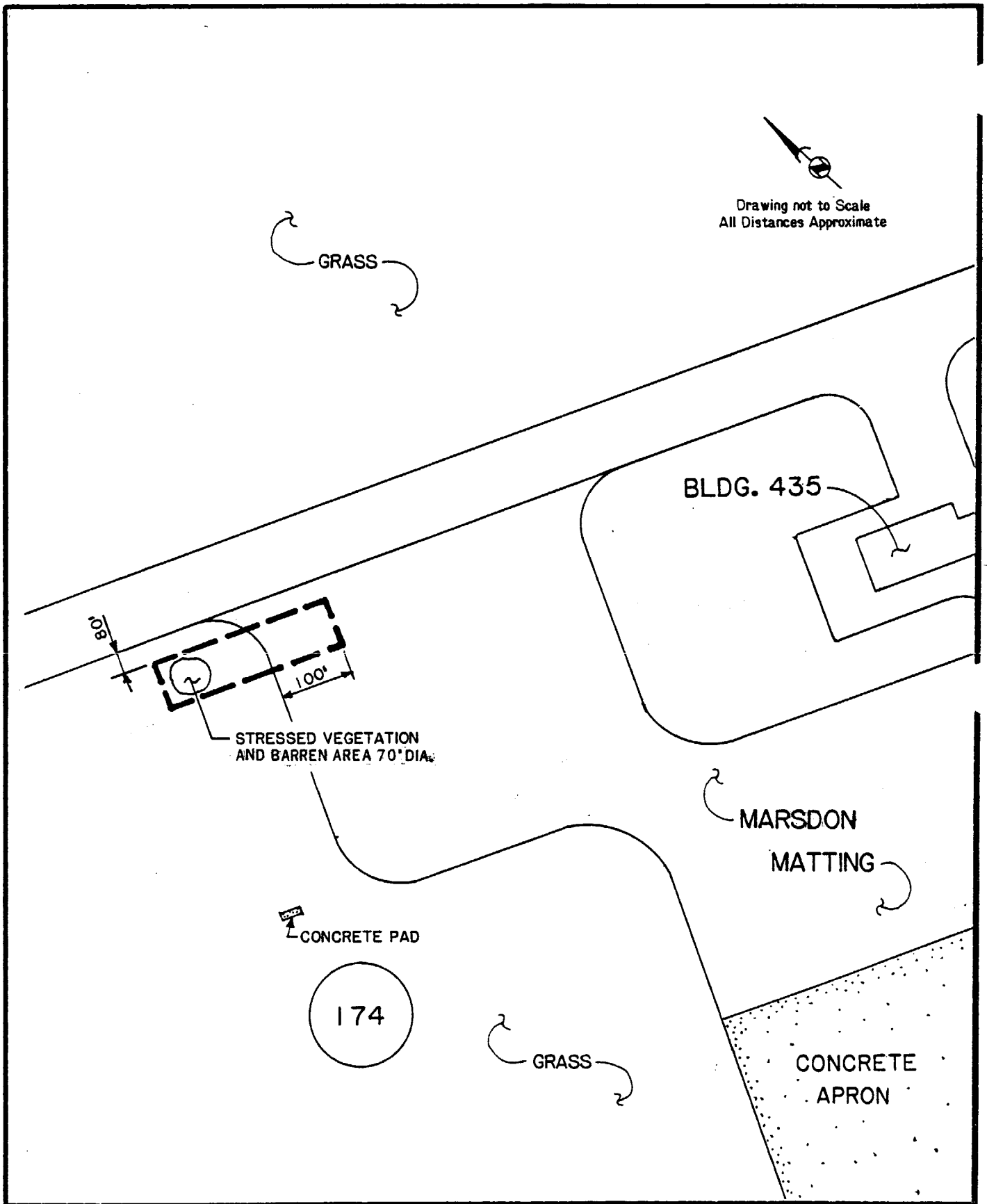

Figure 8-9. Crash Crew Pit No. 1

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squadrons on the station. Based on this information, 123,700 gallons of wastes are estimated to have been applied to the pit during its operating period. Assuming that 1 percent of this quantity was waste crankcase oil, the wastes applied to the pit consisted of 81,700 gallons of AVGAS, 40,800 gallons of JP-5 and 1,200 gallons of crankcase oil.

Reportedly wastes were never allowed to sit in the crash crew pit between training periods. Wastes were only applied to the pit at the time of training and were burned off during the training itself. Assuming that 90 percent of the wastes were consumed in the fire itself, 10 percent of the waste applied to the pit would have percolated into the soil underlying the area. Based on this assumption, 12,370 gallons of waste percolated to the ground consisting of 8,170 gallons of leaded aviation gas, 4,080 gallons of JP-5 and 120 gallons of crankcase oil.

8.11 SITE 10, PETROLEUM DISPOSAL AREA. Site 10 is an area approximately 800 feet by 1200 feet located at Plate 1 map coordinates T-7, and shown on Figure 8-10. Waste crankcase oil, antifreeze, hydraulic and transmission fluids, motor fuel, and solvents were collected in two 500-gallon tanks kept at the Heavy Duty Maintenance Shop, Building 1589. When a tank was filled, a spray bar was attached to the tank, which was then placed on a truck. The contents were sprayed over the disposal area to control dust. This method of disposal was in operation from 1952 through the mid-1960s. Sources of the wastes, which were 90 percent crankcase oil, were: 1) primarily the Heavy Duty Maintenance Shop, 2) the Light Duty Maintenance Shop, 3) MWSG-37, 4) MAG-13, and 5) MAG-11. The 500-gallon tanks were emptied once every three months over a period of about 13 years. Thus, the total amount of wastes disposed of at this site is estimated to be a maximum of 52,000 gallons.

In 1971, a concrete parking apron for aircraft was constructed. It comprised an area approximately 600 feet by 800-feet. All soil to a depth of about two feet was removed (disposition unknown) and replaced with steel reinforced concrete. The remaining site area would be a maximum of 600 feet by 800 feet with a proportional waste volume of 26,000 gallons disposed of to this area of the 52,000 gallons disposed of to the site overall.

In 1967, the Crash Crew barn (Building 435) was built at the north end of the disposal area. Soil may have been excavated from an area as large as 200 feet by 300 feet during construction of this building. In 1973, metal aircraft matting was installed throughout a 300-foot by 800-foot area between the Crash Crew barn at the northern end of the site and the concrete apron at the southern end of the site. However, none of the soil in this area was removed as part of the improvement. Instead, the soil was mixed with a dry cement, and then wet prior to installation of the aircraft matting. Thus, the estimated quantity of waste disposed to the site is 52,000 gallons, half of which was probably removed as part of the process of installing the concrete apron and the Crash Crew barn.

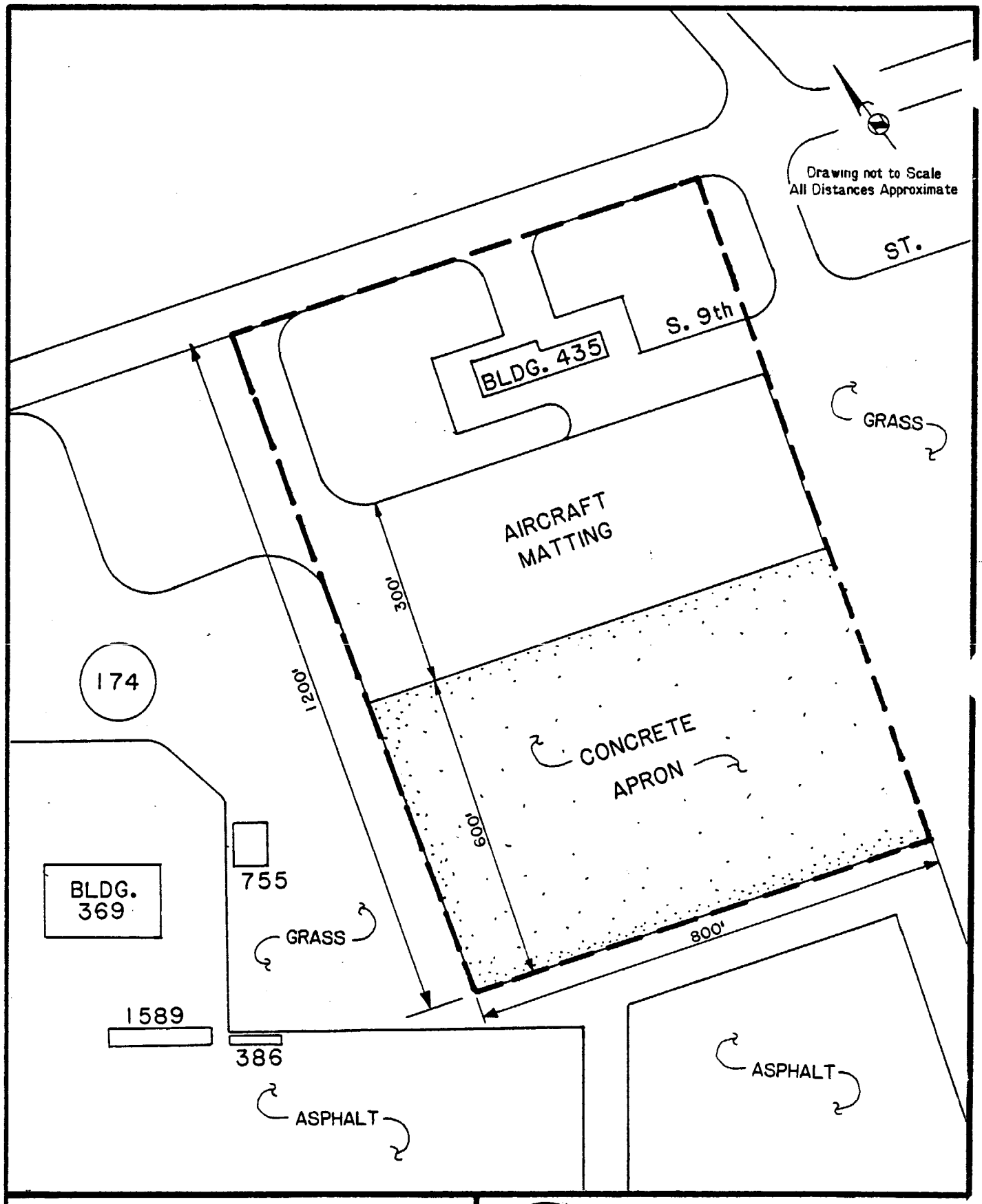

Figure 8-10. Site 10, Petroleum Disposal Area

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8.12 SITE 11, TRANSFORMER STORAGE AREA. Between 1968 and 1983, about 50 to 75 transformers from around the base were stored on a 30 feet by 30-feet concrete slab behind Building 369, as shown on Figure 8-11. The transformers were always stored on the concrete slab, except for one day every six weeks when they were moved onto the dirt surrounding the cement slab so that the cement could be cleared of debris. Forty to sixty of the transformers were outdated. Between 12 and 19 were found to contain polychlorinated biphenyls (PCBs) after all transformers were tested in the early 1970s. Warning tags were placed on those transformers with PCBs. Over the period of use of this storage area, five transformers leaked and one spilled. Assuming a capacity of about 10 gallons per transformer, a maximum of 60 gallons of PCB contaminated fluid spilled in this area. The spills were not cleaned up. In 1980, Facilities Management arranged to have a private contractor remove and dispose of the transformers from this site.

8.13 SITE 12, SLUDGE DRYING BEDS. Between 1943 and 1972, the MCAS El Toro operated a secondary wastewater treatment plant. Sludges from this wastewater treatment plant were dewatered using sludge drying beds. The site is shown on Figure 8-12. In September 1972, when the plant was closed, reportedly no special actions were taken with regard to disposal of the final sludges generated by the wastewater treatment plant. Reportedly, the sludges may have been abandoned in place and eventually plowed under. Based on a 1959 aerial photograph, the sludge drying beds appear to cover an area 210 feet by 135 feet. Assuming a bed thickness of 10 inches, the total volume of sludges would be about 880 cubic yards. The primary concern for sludges would be their toxic metals content. Using available data on typical concentrations of heavy metals in municipal sewage sludges (Southern California Coastal Research Project, 1979 to 1980 and 1981 to 1982), and assuming the sludge drying beds were fully loaded when covered in place, a "ball park" estimate of metals content that would be expected in the 880 cubic yards of sludge is listed in Table 8-3.

Use of data on typical heavy metal concentration of municipal sewage sludges is considered applicable as the station is basically comparable to a municipality. Typical municipalities have industrial dischargers, including plating shops, to their sewer systems. Though MCAS El Toro had a relatively high quantity of industrial wastewater dischargers to its system, it had only one plating shop for a short period of time due to the relatively low level echelon maintenance performed on station. A plating shop would be the only substantial discharger of heavy metals. Reportedly, a plating shop did exist on the station for several years in the 1940s. No information with respect to the size or location of the plating shop was available. However, assuming it was only a source of heavy metal discharge into the system for several years out of the 29-year life of the plant, it is considered appropriate to use the municipal sludge data in this analysis.

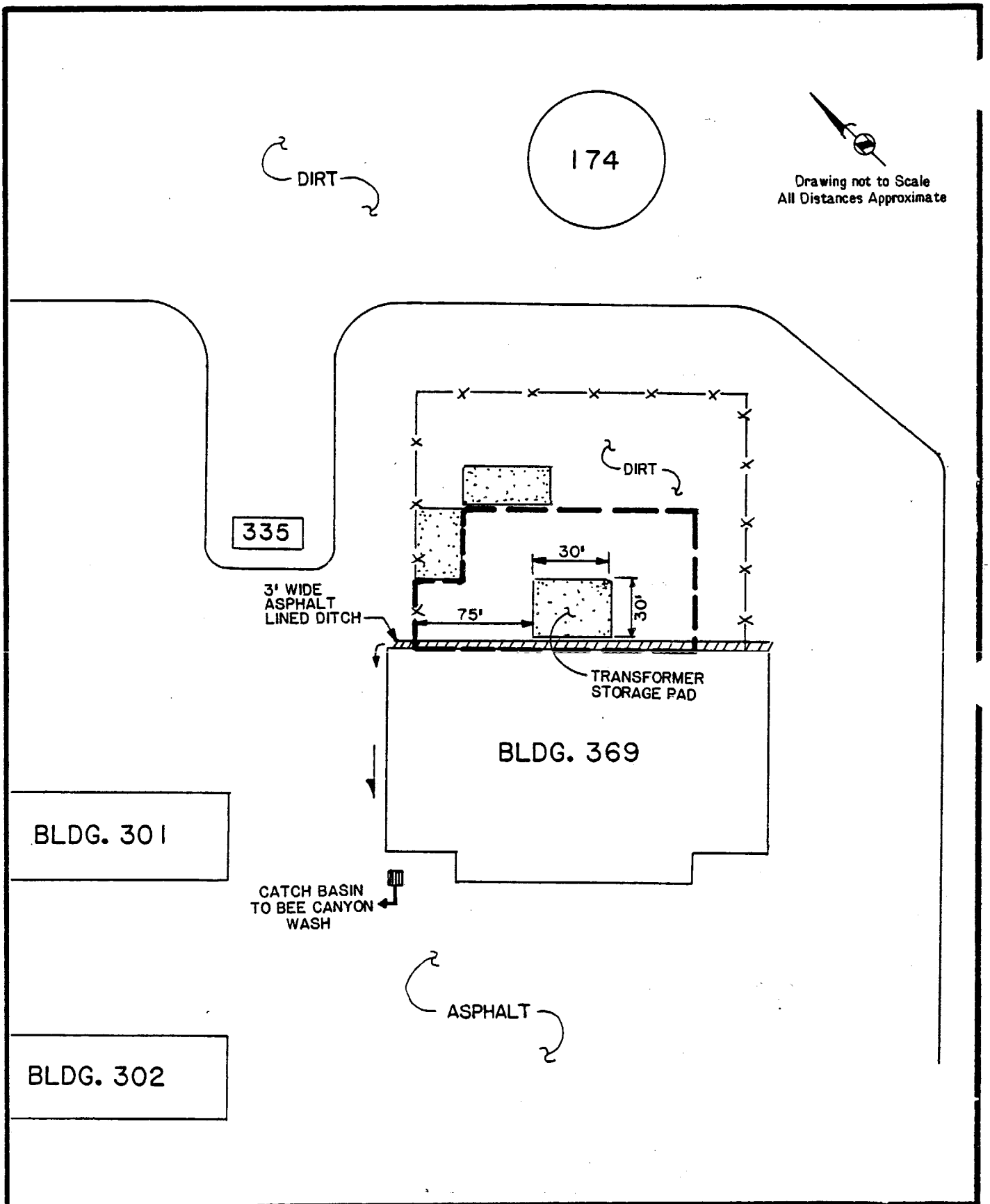

Figure 8-11. Site 11, Transformer Storage Area

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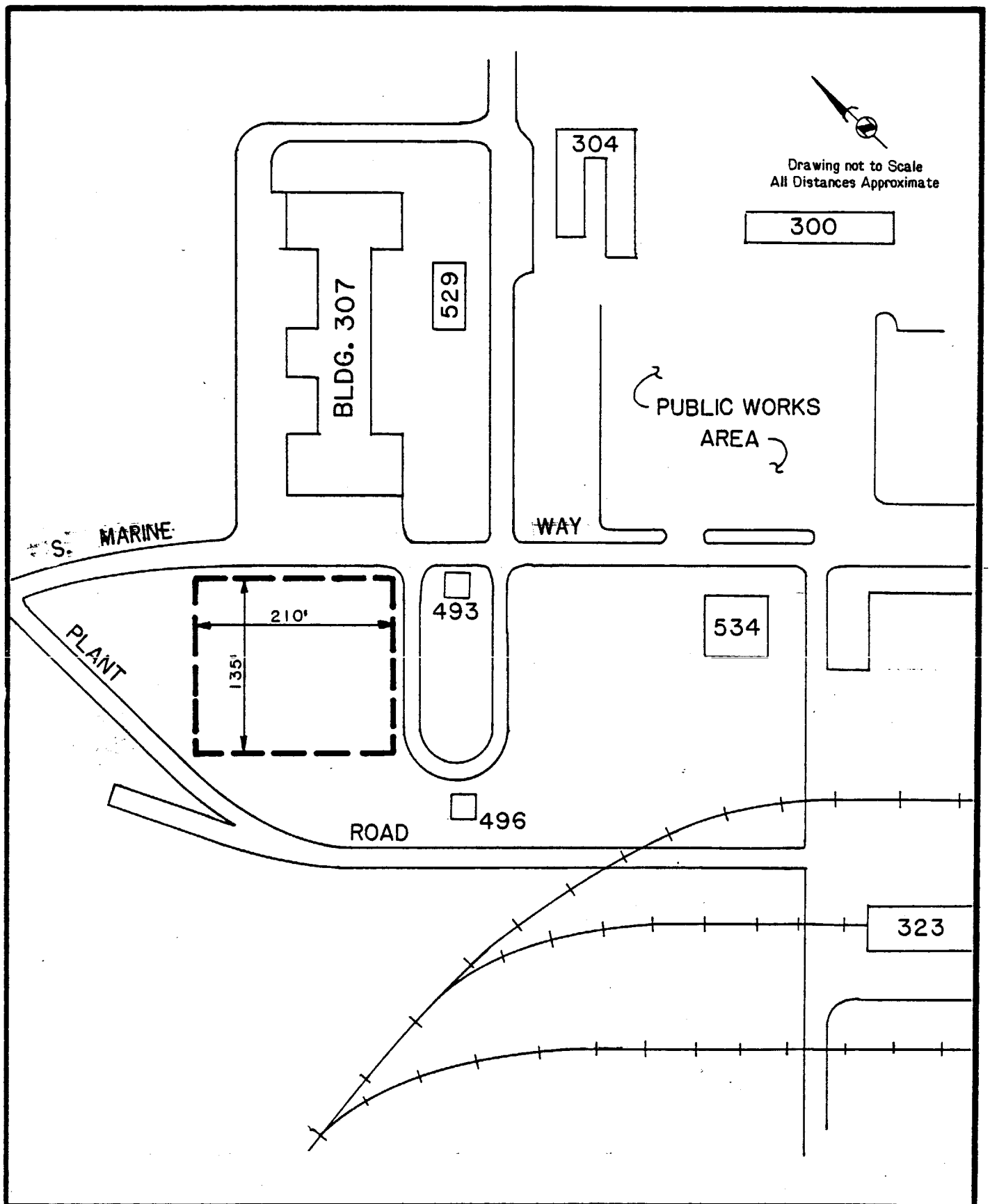

Figure 8-12. Site 12, Sludge Drying Beds

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Table 8-3. Estimate of Metals in Closed Sludge Drying Beds at MCAS El Toro

Heavy metals	Quantity, lbs
Silver (Ag)	1.0
Arsenic (As)	0.3
Cadmium (Cd)	1.4
Chromium (Cr)	6.9
Copper (Ca)	15.0
Mercury (Hg)	0.08
Nickel (Ni)	5.2
Lead (Pb)	6.0
Selenium (Se)	0.3
Zinc (Zn)	26.0
Total	62.18

8.14 SITE 13, OIL CHANGE AREA. Site 13 is located northeast of Building 244 at Plate 1 map coordinates S-5, and was used for draining crankcase oil directly to the soil from heavy equipment maintained by WES-37. This practice occurred from prior to 1977 until 1983. The site is approximately 1/4 acre in size and is shown on Figure 8-13. Approximately 1,000 gallons of oil were changed annually in the vehicles, yielding an estimated 7,000 gallons disposed of. The contaminated soil has been partially scraped up and piled at the north end of the area. There is still some evidence of oily residue on the soil.

8.15 SITE 14, BATTERY ACID DISPOSAL AREA. The heavy equipment maintenance shop of WES-37 used the edge of a paved area south of Building 245, at Plate 1 map coordinates S-4, about 50 feet long and 2 to 3 feet wide, for emptying batteries directly to the soil. Site 14 is shown on Figure 8-14. As the squadron moved heavy equipment maintenance from Building 31 to this area in 1977, this practice would have occurred at most between 1977 and 1983. The soil along the edge of the asphalt concrete pavement is stained with oil and supports only minimal native grass growth. It appears that the oily residue is from washdown of the pavement. Small patches of paint residue are visible at the western edge of the site. Quantities of materials are unknown, however, the heavy equipment shop supports approximately 30 vehicles.

Assuming the acid was drained from the batteries once per year, and each battery held one gallon of acid, perhaps as much as 30 gallons per year,totalling 210 gallons, of battery acid (possibly neutralized) could have been disposed of at this site. Surface drainage from this soil area drains to a ditch immediately south of the disposal site. There is no evidence of stressed vegetation or oil staining downslope of the area or along the ditch.

8.16 SITE 15, SUSPENDED FUEL TANKS. Site 15 was occupied by two elevated, 500 gallon diesel fuel tanks and is shown on Figure 8-15. Interviewees reported that from early 1979 to mid-1984 more than 500 gallons of diesel fuel spilled to the ground beneath these tanks. WES-37 of 3d MAW was the source of the diesel fuel. Reportedly the fueling hoses and nozzles were constantly leaking. The leakage was evidenced by heavy staining of the soil beneath these tanks, whose operation ceased in mid-1984. The tanks were subsequently removed from the site.

8.17 SITE 16, CRASH CREW PIT NO 2. Site 16 is located at Plate 1 map coordinates P-6, and is presented on Figure 8-16. This site has been used since 1972 as a practice training area for the Crash Crew to extinguish fires. The Crash Crew Pit is approximately 50 to 60 feet in diameter and 3 feet deep. An underground drain pipe connects the main pit with an adjacent pit located approximately 40 feet away. This second pit is rectangular in shape, 12 feet by 35 feet in surface area and 4 to 5 feet deep.

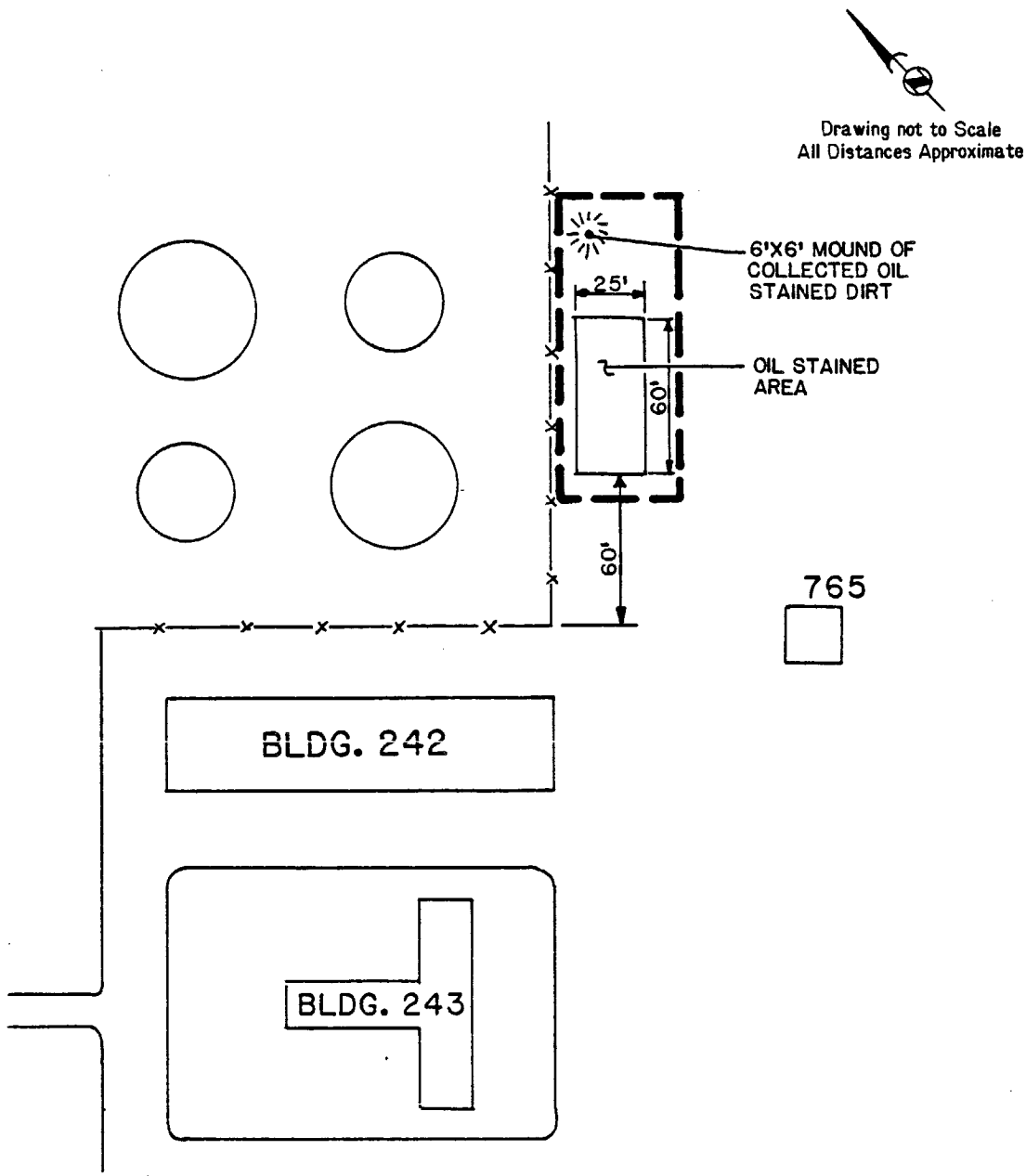

Figure 8-13. Site 13, Oil Change Area

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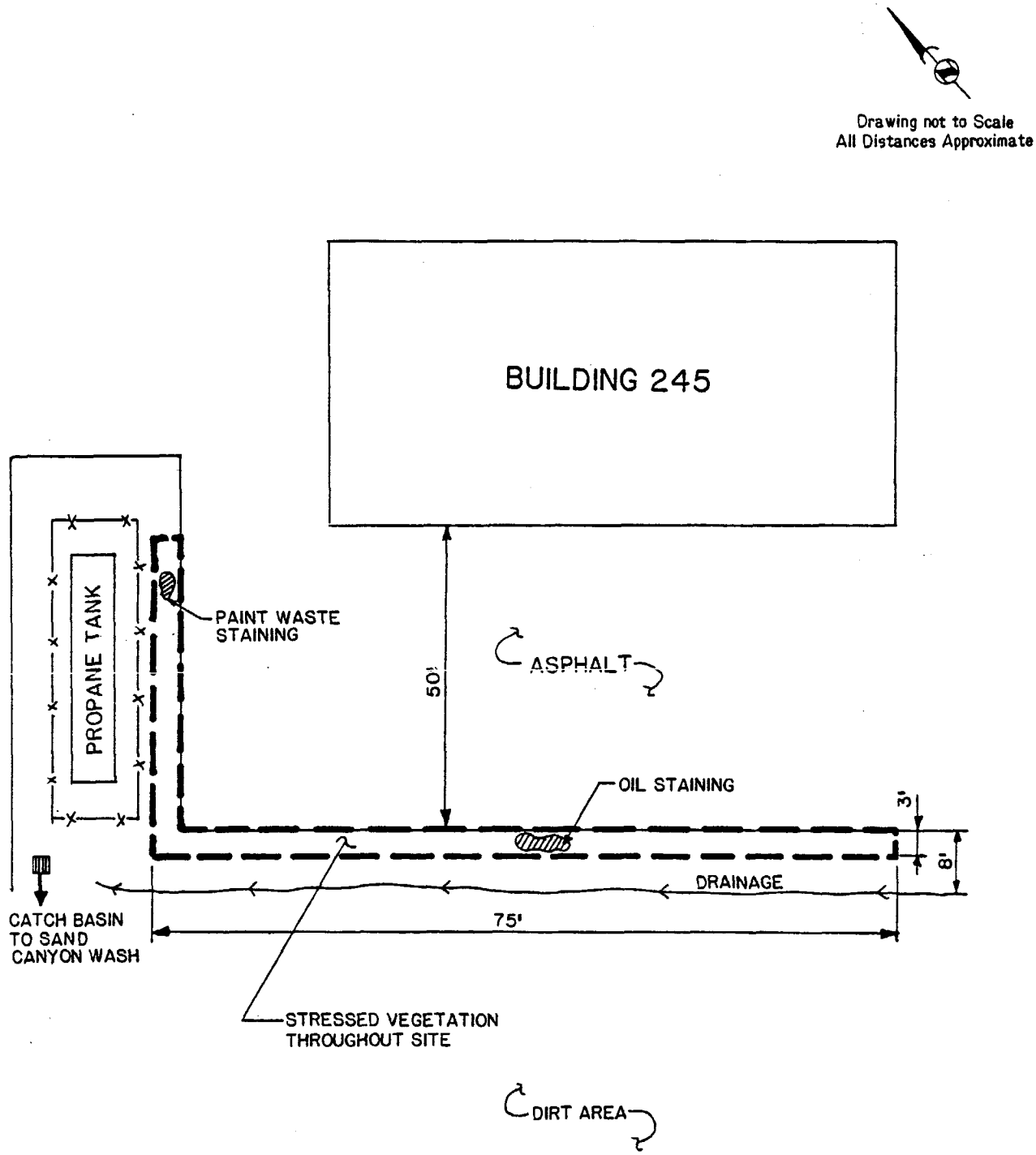

Figure 8-14. Site 14, Battery Acid Disposal Area

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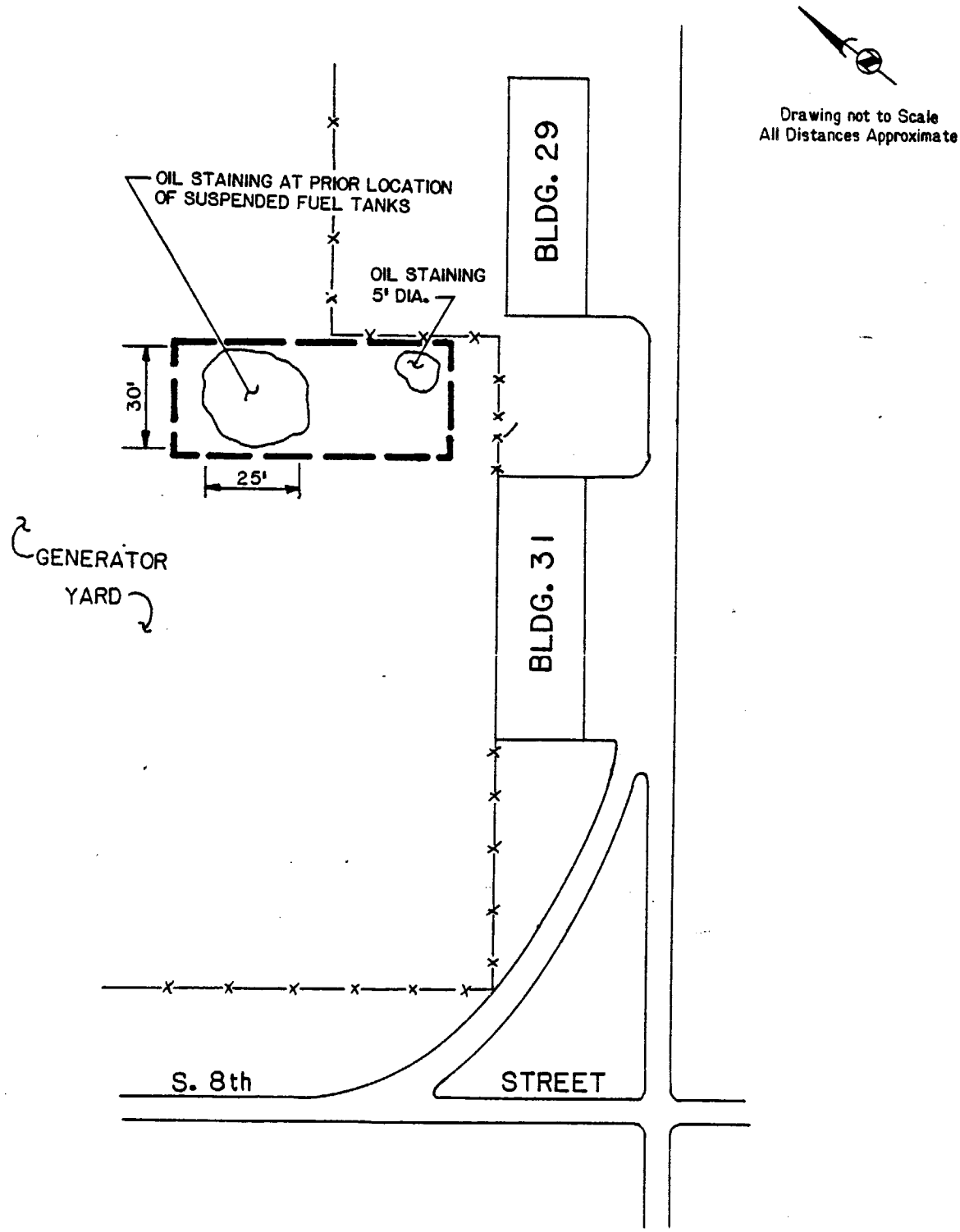

Figure 8-15. Site 15, Suspended Fuel Tanks

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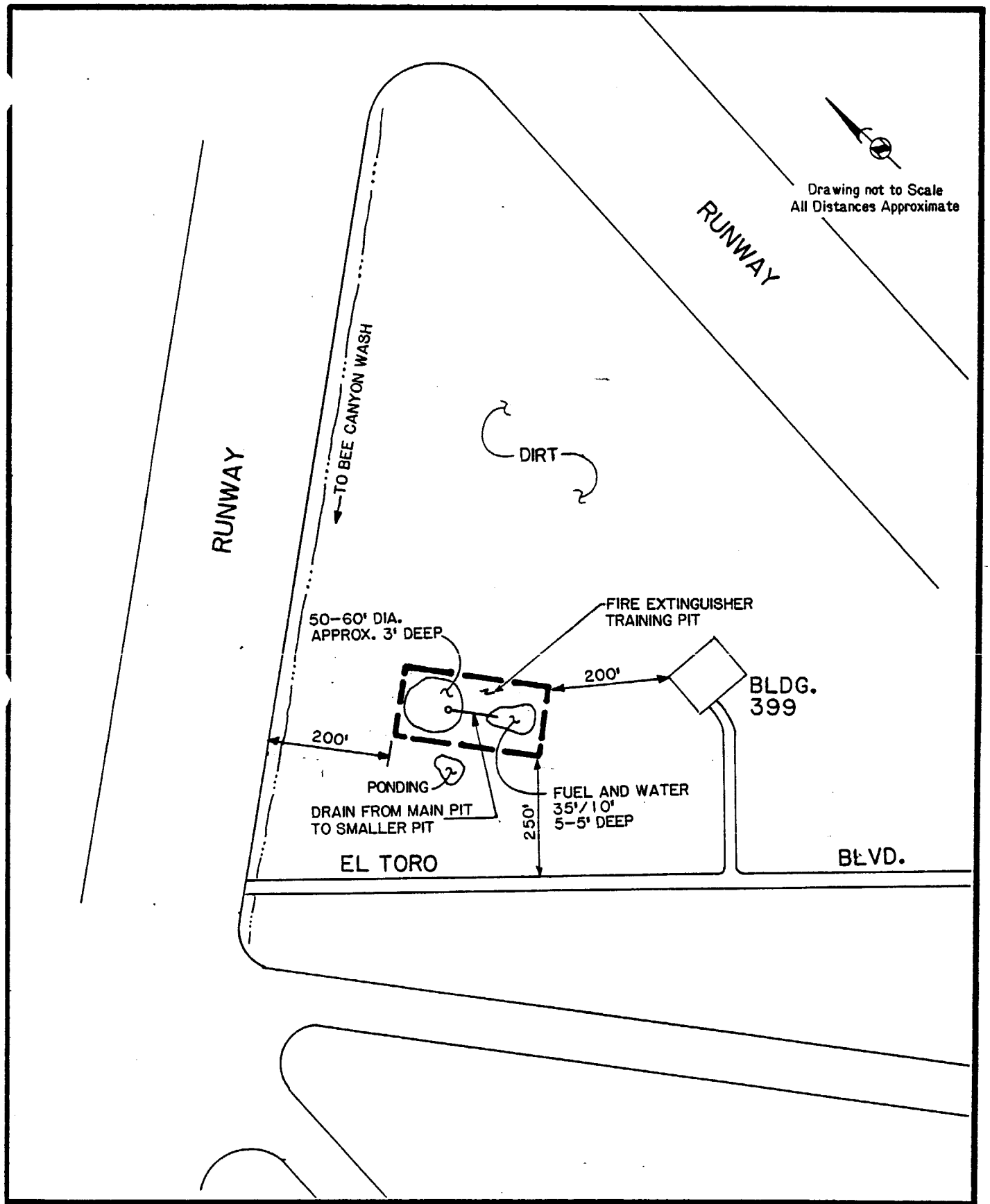

Figure 8-16. Crash Crew Pit No. 2

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A small third pit, 10 feet long and 3 feet wide and located adjacent to the second pit, is used for practicing the use of hand-held fire extinguishers. Three to four months per year were suitable for practice burns from an air quality standpoint. Wastes consisting of JP-5, leaded aviation gas, hydraulic fluid and crackcase oil were applied to the pit. See Section 8.10 for a discussion of how the training exercises were conducted at Site 9. The procedures were the same for Site 16, but multiple, as Site 16 had three pits. The waste JP-5, leaded aviation gas, and waste oils all came from the squadrons on the station. Since 1982, no wastes other than JP-5 have been used in the pits.

Reportedly during the 3 to 4 months per year that were suitable for burning, 5,000 gallons per month of JP-5, 220 to 330 gallons per month of a combination of hydraulic fluid and crankcase oil, and less than 10 gallons per month of leaded aviation gas were applied to the pit. Between 1972 and 1981, four cannisters of napalm, each weighing 500 pounds, were burned in the pit. Additionally, 50 pounds of white phosphorus and four 2-pound flares composed of magnesium phosphate were also burned in the pit. Reportedly the napalm, white phosphorus and magnesium phosphate were burned as a result of incidents involving aircraft at the station. Containers of these substances dropped off of the aircraft during unloading, damaging the containers. As a result, a decision was made to destroy the material at the Crash Crew Pit, rather than transport it to another location for disposal.

Once the training for the day was completed, the remaining liquids in the main pit, were drained by gravity from the main pit to the adjacent pit for storage. Typically, the major portion of the combustible liquids in the pit had been consumed by fire during the training, and it was the accumulated fire water that was drained to the adjacent pit. However, some wastes did remain in this water and would sit in the adjacent pit. Periodically, when these waste fuels accumulated on the surface of the water in the adjacent pit, personnel would ignite them to destroy them.

A summary of the wastes applied to Site 16, the current Crash Crew Pit, is presented in Table 8-4. The percolation information in the table is based on an assumption that 90 percent of the wastes applied to the site were consumed in the training fires, and that 10 percent of the wastes would have percolated into the soil underlying the area. Additionally, the relative proportion of the crankcase oil versus hydraulic fluid in the mixture of these two substances applied to the Crash Crew Pit could not be determined, a ratio of 20 percent hydraulic fluid to 80 percent crankcase oil was assumed. As napalm is a jelly-like substance, not amenable to percolation, and as the purpose of placing it in the Crash Crew Pit was to destroy it, it was assumed that the napalm was completely

Table 8-4. Wastes Applied to Site 16, Crash Crew Pit No. 2, MCAS El Toro

Waste	Source	Time period	Application rate to crash crew pit, gal per month	Estimated quantity applied to crash crew pit[a]	Estimated quantity percolated to soil[b]
JP-5	Station squadrons	1972-1985	5,000	260,000 gal	26,000 gal
Leaded aviation gas	Station squadrons	1972-1982	<10	400 gal	40 gal
Hydraulic fluid	Station squadrons	1972-1982	65	2,600 gal	260 gal
Crankcase oil	Station squadrons	1972-1982	265	10,600 gal	1,060 gal
Napalm	Station	1972-1981	-	2,000 lbs	0[c]
White phosphorus	Station	1972-1981	-	50 lbs	0[c]
Magnesium phosphate	Station	1972-1981	-	8 lbs	0[c]
Total					27,360

[a]Assumes 4 months per year are used for training.

[b]Assumes 10 percent of applied quantity percolates to underlying soil.

[c]Material is a solid or jelly-like, not amenable to percolation and is completely destroyed in the fire.

destroyed and none of it would have percolated into the soil. This same assumption applies to the white phosphorus and magnesium phosphate, which would have been completely consumed once ignited. It is estimated that 27,360 gallons of JP-5, leaded aviation gas, hydraulic fluid and crankcase oil percolated to the soil underlying Site 16.

8.18 SITE 17, COMMUNICATION STATION LANDFILL. Site 17 is comprised of an "L-shaped" area adjacent to Buildings 394 and 573, as shown on Figure 8-17. Between 1981 and 1983, a 1,000-gallon vacuum truck was repeatedly emptied on this site of approximately 26 acres.

The truck collected waste from several locations around the station. This waste material consisted primarily of cooking grease, but reportedly contained oils and fuels from sumps, as well. Due to airfield clearance criteria, the hill adjacent to the site had to be leveled. Site 17 was covered with the cut resulting from the leveling of this hill. In addition, the site was reportedly used to dispose of rubble and municipal debris (i.e., couches, washing machines, etc.) and other unknown types of wastes (i.e. empty drums, etc.). Reportedly almost any type of waste generated on station between 1981 and 1983 may have been disposed of at this landfill.

Although it was not possible to obtain information regarding the quantity of waste applied to this site, an estimate based on typical similar operations was made. Assuming that the vacuum truck was emptied only when full, and that the truck was filled once per month, then it is estimated that 36,000 gallons of grease, oil, and fuels were discharged to this site.

Site 17 is currently an open field against a small mountain range, with the nearest housing 750 yards away. The soils are sandy and the ground water level is estimated to be 150 feet below the ground surface. Brush vegetation, birds, and squirrels exist on this site.

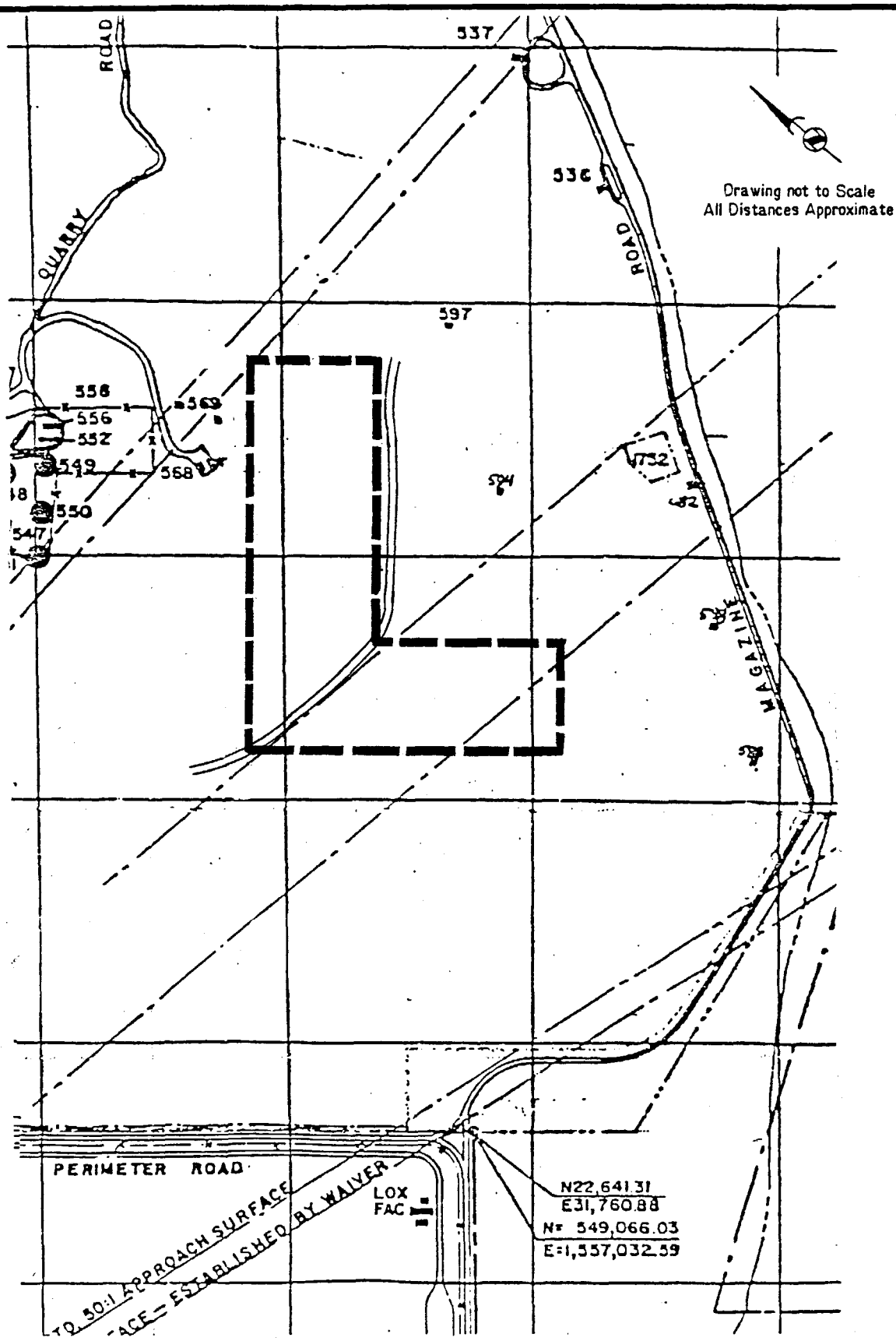

Figure 8-17. Communication Station Landfill

INITIAL ASSESSMENT STUDY
Marine Corps Air Station
El Toro, California

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APPENDIX A

AGENCIES CONTACTED DURING INITIAL ASSESSMENT STUDY

APPENDIX A

AGENCIES CONTACTED DURING INITIAL ASSESSMENT STUDY

1. California Department of Fish and Game, Long Beach, California

2. California Department of Health Services, Sacramento, California

3. Commandant of the Marine Corps, Rosslyn, Virginia

4. Defense Mapping Agency, Washington, D.C.

5. Department of Defense Explosives Safety Board, Dahlgren, Virginia

6. General Development Map Files, Port Hueneme, California

7. Marine Corps History Office, Navy Yard, Washington, D.C.

8. National Archives: Navy and Old Army Branch, and Still Pictures Branch, Washington, D.C.; Federal Archives and Records Centers at Suitland, Maryland, and San Bruno and Laguna Niguel, California; Cartographic Branch, Alexandria, Virginia

9. Naval Air Systems Command, Alexandria, Virginia

10. Naval Energy and Environmental Support Activity (NEESA), Port Hueneme, California

11. Naval Facilities Engineering Command (NAVFACENGCOM) Headquarters, Alexandria, Virginia

12. Naval Facilities Engineering Command, Western Division, San Bruno, California: Planning Branch, Geotechnical Branch, Maintenance Division, Facilities Planning Department, Real Estate Branch, and Natural Resources Management Branch

13. Naval Facilities Engineering Command, Western Division, San Diego, California: Environmental Engineering Branch

14. Naval Facility Record Drawing Film, Port Hueneme, California

15. Naval Sea System Command, SAFEORD File, Alexandria, Virginia

16. NAVFACENGCOM Command Historian, Naval Construction Battalion Center, Port Hueneme, California

17. Navy Historical Center, Operations Archives, Navy Yard, Washington, D. C.

18. Navy History Office, Navy Yard, Washington, D.C.

19. Ordnance Environmental Support Office, Naval Ordnance Station, Indian Head, Maryland

20. Photographs Curator, Navy Yard, Washington, D.C.

21. Radiological Affairs Support Office (RASO), Yorktown, Virginia

22. Regional Water Quality Control Board, Los Angeles, California

23. United States Environmental Protection Agency, Region IX, San Francisco, California

APPENDIX B

ACRONYMS

ACRONYMS

AUTOVON	Automatic Voice Network
AVGAS	Leaded Aviation Gasoline
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CNO	Chief of Naval Operations
CSRM	Confirmation STudy Ranking Model
CSRS	Confirmation Study Ranking System
DOD	Department of Defense
DPDO	Defense Property Disposal Office
EAF	Expeditionary Air Field
EOD	Explosive Ordinance Disposal
EPA	Environmental Protection Agency
FFSG	Force Field Support Group
FMD	Facilities Management Department
GSE	Ground Support Equipment
HAMS	Headquarters and Maintenance Squadron
H&HS	Headquarters and Headquarters Squadron
H&MS	Headquarters and Maintenance Squadron
MABS	Marine Air Base Squadron
MAG	Marine Air Group
MATCS	Marine Air Traffic Control Squadron
MAW	Marine Aircraft Wing
MCAS	Marine Corps Air Station

MCX	Marine Corps Exchange
MCC	Mobil Calibration Complex
MGD	Million Gallons per Day
MHHS	Marine Heavy Helicopter Squadron
MMHS	Marine Medium Helicopter Squadron
MSW	Municipal Solid Waste
MUD	Maintenance and Utilities Division
MWSG	Marine Wing Support Group
NACIP	Navy Assessment and Control of Installation Pollutants
NAS	Naval Air Station
NAVENENVSA	Naval Energy and Environmental Support Activity
NAVFACENGCOM	Naval Facilities Engineering Command
NBC	Nuclear, Biological, and Chemical
NCL	Naval Calibration Laboratory
NEESA	Naval Energy and Environmental Support Activity
PCB	Polychlorinated Biphenyls
POL	Petroleum, oils, and lubricants
TAFDS	Tacticle Air Fuel Dispensing System
USGS	United States Geological Survey
VMA	Marine All Weather Attack Squadrons
VMFA	Marine Fighter/Attack Squadron
VMFP	Marine Tactical Reconnaissance Squadron
VMGR	Marine Aerial Refueler Transport Squadron
WES	Wing Engineering Squadron
WTS	Wing Transport Squadron

APPENDIX C

UNDERGROUND POL STORAGE TANKS AT MCAS EL TORO, CALIFORNIA

UNDERGROUND POL STORAGE TANKS
AT MCAS EL TORO, CALIFORNIA

SPCC Key Map Quadrant*	Associated Building No.	Capacity (ga.)
O-3	347	8,000[a]
O-3	347	8,000[a]
O-3	347	8,000[a]
M-3	94	1,000
M-3	271	3,000
M-3	283	1,500
M-7	138	500
M-9	105	500
M-9	105	500
M-9	133	500
M-9	392	500
N-1	364	2,000
N-1	364	5,000
N-1	605	1,700
N-3	75	500
N-3	75	1,500
N-3	77	5,000
N-3	83	3,000
N-3	280	2,000
N-3	337	5,250
N-3	337	5,250
N-3	274	1,500
N-3	276	1,500
N-3	278	1,500
N-3	282	1,550
N-4	273	1,500
N-4	275	1,500
N-4	277	1,500
N-4	279	1,500
N-4	281	2,000
N-4	285	2,000
N-5	288	1,500
N-8	292	1,500
N-8	606	1,700
N-9	114A	560
N-9	114B	1,500
N-9	115A	560
N-9	115B	1,500
N-9	126	500
N-9	634	10,000
O-2	366	2,500
O-2	367	2,500
O-2	662	10,000
O-2	693	1,000

SPCC Key Map Quadrant*	Associated Building No.	Capacity (ga.)
O-3	66	3,000
O-4	14	500
O-4	98	1,400
O-4	256	200
O-4	264	2.000
O-4	268	1,500
O-4	272	1,500
O-8	372	2,500
P-2	439	500
P-3	1	1,000
P-3	58	3,510
P-3	59	2,600
P-3	60	2,000
P-3	63	500
P-3	258	2,000
P-3	258	2,000
P-3	260	2,600
P-3	262	5,200
P-3	262	5,200
P-3	329	2,600
P-4	13	500
P-4	54	500
P-4	54	2,000
P-4	57	3,000
P-4	56	500
P-4	257	2,000
P-4	327	2,600
P-4	328	2,600
P-5	6	500
P-12	405	1,240
P-12	406	1,240
P-12	442	550
P-12	443	1,000
P-13	390	500
Q-3	65	3,000
Q-3	65	3,000
Q-3	263	2,600
Q-4	12	500
Q-4	53	500
Q-11	463	2,000
Q-12	455	1,500
Q-11	374	42,000
Q-12	457	2,000
R-4	11	500
R-4	241	500
R-11	453	1,500
R-11	454	1,500
R-11	461	2,000
R-11	462	2,000
R-12	636	1,500

SPCC Key Map Quadrant*	Associated Building No.	Capacity (ga.)
S-3	32	500
S-3	33	500
S-3	38	500
S-3	248	500
S-3	249	1,500
S-3	250	1,500
S-3	251	2,000
S-3	375	10,000
S-4	243	1,500
S-7	435	1,000
T-6	304	500
T-6	335	500
U-6	529	1,000
U-7	275	275
U-7	322	1,000
U-8	318	275
U-8	319	275
U-8	388	500
O-4	--	10,000[b]
O-4	--	10,000[b]
U-9	1,782	--
U-9	1,783	--

[a]Storage item was MoGas.

[b]Storage item was JP-5.

*Refers to Plate 1 coordinates.

Note: MCAS El Toro Public Works Department records indicated that all inactive tanks were of underground steel construction.

Reference: SCS Engineers, 1979.

APPENDIX D

WELL LOGS

INVESTIGATION

South Coastal Basin

DIVISION OF WATER RESOURCES
DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

NUMBER C-1216c

WELL LOG

LOCAL DESIGNATION

Owner #1224

LOCATION 110' S.W. and 80' N.W. from east corner Locat on #134500

Lot 243'. 100' NW/o Central Ave; 100' SW/o Bryant

OWNER Irvine Co.

Commenced July 12 1928

DATE COMPLETED July 27, 1928

DIAMETER OF CASING 324'8" 8" casing
359'10" 12" casing Cased to 634'2"

DRILLED BY

SOURCE OF INFORMATION

INSPECTED WHILE DRILLING SEE FILE NO.

SURFACE ELEVATION 270' USGS Topo - El Toro Quad.

SKETCH

Publ. in Bull 40
Water Analysis.

DEPTH	ELEVATION OF BOTTOM OF STRATUM	MATERIAL	THICKNESS FEET	% VOIDS	ABSOLUTE VOIDS FEET	TOTAL VOIDS FEET
0- 3		Sandy soil				
3- 30		Sandy brown clay				
30- 32		Sandy brown clay and boulders				
32- 48		Sticky brown clay				
48- 74		Hard brown clay				
74- 77		Hard brown clay and boulders				
77- 89		Sandy brown clay				
89-105		Sticky brown clay				
105-118		Packed sand and few boulders				
118-139		Gravelly brown clay				
139-163		Hard brown clay				
163-166		Boulders				
166-186		Sandy brown clay				
186-190	↘	Sand (Little water)				
190-212		Hard brown clay				
212-230		Gravelly brown clay				
230-247		Brown clay few boulders				
247-259		Gravelly brown clay				
259-271		Tough brown clay hard				
271-275		Sand rock				
275-~~279~~ 280		Conglomerate				
280-287		Gravelly brown clay				
287-304		Tough brown clay				
304-307		Brown clay and boulders				
307-317		Hard sandy brown clay				
317-321		Sand rock				
321-323	↘	Coarse sand, (Water)				
323-332		Tough brown clay				
332-345		Tough brown clay				
345-359		Sandy brown clay				
359-367		Gravelly brown clay				
367-375		Hard brown clay				
375-379	↘	Sand and pine gravel (water)				

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LOG OBTAINED BY DATE

85418 3-31 8M

South Coastal

Basin

DIVISION OF WATER RESOURCES
DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

WELL LOG

NUMBER C-1216d-
Owner #1224

LOCAL DESIGNATION

DEPTH	ELEVATION OF BOTTOM OF STRATUM	MATERIAL	THICKNESS FEET	% VOIDS	ABSOLUTE VOIDS FEET	TOTAL VOIDS FEET
379-398		Sandy brown clay	~~Location #13450~~			
398-417		Tough brown clay				
417-431		Gravelly brown clay				
431-437		Packed sand (Coarse)				
437-449		Sticky brown clay				
449-458		Gravelly brown clay				
458-475		Sandy brown clay				
475-484		Sandy brown clay				
484-488		Sand and gravel (Water)				
488-497		Gravelly brown clay				
497-512		Sandy brown clay				
512-519		Tough brown clay				
519-528		Sandy brown clay				
528-540		Sand rock clay				
540-549		Tough brown clay				
549-560		Gravelly brown clay small bldrs				
560-568		Sticky brown clay				
568-575		Brown shale				
575-584		Sand rock				
584-596		Sand rock				
596-601		Sandy brown clay				
601-604		Sand (fine little water)				
604-611		Hard sandy brown clay				
611-623		Sand rock				
623-629		Sand				
629-634		Sandy brown clay				
634-642		Sandy brown clay				
642-655		Sticky brown clay				
655-670		Gravelly brown clay				
670-675		Packed sand (coarse)				
675-677		Decomposed granite				
677-685		Sandy brown clay				
685-695		Tough brown clay				
695-705		Sand rock				
705-717		Sand rock				
717-724		Tough dark blue shale				
724-730		Hard dark blue shale				
730-751		Tough dark blue shale				
751-760		Tough blue shale				
760-795		Sticky blue shale				
795-800		Hard sandy blue shale				
800-826		Hard dark blue shale				
826-830		Hard blue shale				

MICROFILMED

Perforated with Wills knife 8" casing perforated 540 to 475'. 450 to 429', 400' to 365'. 12" csg perforated 330 to 310'.
Water level 217' Flow 40" at 258'.

360 GPM

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Form 115 INVESTIGATION [redacted] SHEET 1

South Coastal Basin

DIVISION OF WATER RESOURCES
DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

NUMBER 0-1216b-

WELL LOG

LOCAL DESIGNATION

Owner #1170

LOCATION 50' N.E. and 100' S.E. from west corner of Lot 243. 46 mi NW/s central 100 NE/s Tredwo

Location #13440-

OWNER Irvine Co.

DATE COMPLETED

DIAMETER OF CASING 252"10" 20" Well cased to 1304'10" 1560'.

DRILLED BY

SOURCE OF INFORMATION

INSPECTED WHILE DRILLING SEE FILE NO.

SURFACE ELEVATION 222' tooo

SKETCH

Publ in Bull 40
Water Analysis

DEPTH	ELEVATION OF BOTTOM OF STRATUM	MATERIAL	THICKNESS FEET	% VOIDS	ABSOLUTE VOIDS FEET	TOTAL VOIDS FEET
0- 30		Soil, sand and clay				
30- 60		Clay, gravel and sand (hard)				
60- 90		Clay, tough				
90- 98		Gravel and sand				
98-125		Clay and sand				
125-130		Sand				
130-157		Clay, little sand rock				
147-150		Sand and gravel				
150-173		Clay				
173-180		Clay and gravel				
180-227		Sand rock and clay				
227-253		Sand and clay				
253-257		Sand and gravel, little water				
257-270		Sand and clay				
270-277		Clay MICROFILMED				
277-282		Clay and gravel				
282-290		Cement gravel				
290-292		Hard sand rock				
292-312		Sand rock and clay				
312-368		Clay and sand				
368-377		Cement gravel (hard				
377-393		Blue clay				
393-399		Cement gravel				
399-412		Clay				
412-421		Sand rock				
421-459		Clay				
459-471		Sand and clay				
471-496		Clay and gravel Very hard				
496-506		Sand rock				
506-532		Cement gravel (Hard) Very hard				
532-541		Clay, blue				
541-551		Cement gravel (Hard) Very hard				
551-557		Clay				

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D-3

LOG OBTAINED BY DATE

INVESTIGATION South Coastal Basin

DIVISION OF WATER RESOURCES
DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

SHEET

NUMBER C-1216b-
Owner #1170

WELL LOG

LOCAL DESIGNATION

DEPTH	ELEVATION OF BOTTOM OF STRATUM	MATERIAL	THICKNESS FEET	% VOIDS	ABSOLUTE VOIDS FEET	TOTAL VOIDS
557-561		Hard sand rock	Location #134			
561-577		Clay tough				
577-585		Sand rock				
585-596		Clay				
596-621		Cement gravel Very hard				
621-629		Clay				
629-634		Gumbo				
634-652 4		Sand rock				
652-662		Cement gravel				
662-668		Clay, blue shale formation				
668-674		Sand rock				
674-704		Cement gravel. Blue and whitish color very hard				
704-712		Clay, and sand rock				
712-732		Cement gravel				
732-755		Sand rock and little clay				
755-775		Clay				
775-784		Clay and gravel (Hard)				
784-792		Tough clay				
792-811		Sand rock and clay				
811-817		Cement gravel				
817-827		Sand rock, little sand				
827-865		Cement gravel and hard sand stone				
865-872		Gumbo of yellowish color				
872-903		Hard sand rock				
903-950		Whitish shale and decomposed granite (easy)				
950-965		Shale and boulders very hard				
965-1090		Hard shale and conglomerate in layers and decomposed granite				
1090-1130		Cement gravel (Big) and hard				
1130-1215		Shale and rock conglomerate fomration Little coal				
1215-1230		Granite boulders hard and little decomposed granite (Also quartz) water.				
1230-1310		Gumbo very tough and little sand rock in places				
1310-1345		Gumbo with sand stratas in places				
1345-1375		Clay and gravel				
1375-1425		Gumbo, very tough				
1425-1450		Conglomerate, very hard				
1450-1528		Gumbo, very tough dry				
1528-1543		Sand and clay				
1543-1603		Tough clay, gumbo formation				
1603-1624		Sand rock easy				
1624-1632		Cement formation and a little lime				
1632-1641		Shale				
1641-1660		Limerock, very very hard				

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MICROFILMED

APPENDIX E

COMMONLY USED SOLVENTS AND PAINT STRIPPERS

APPENDIX E

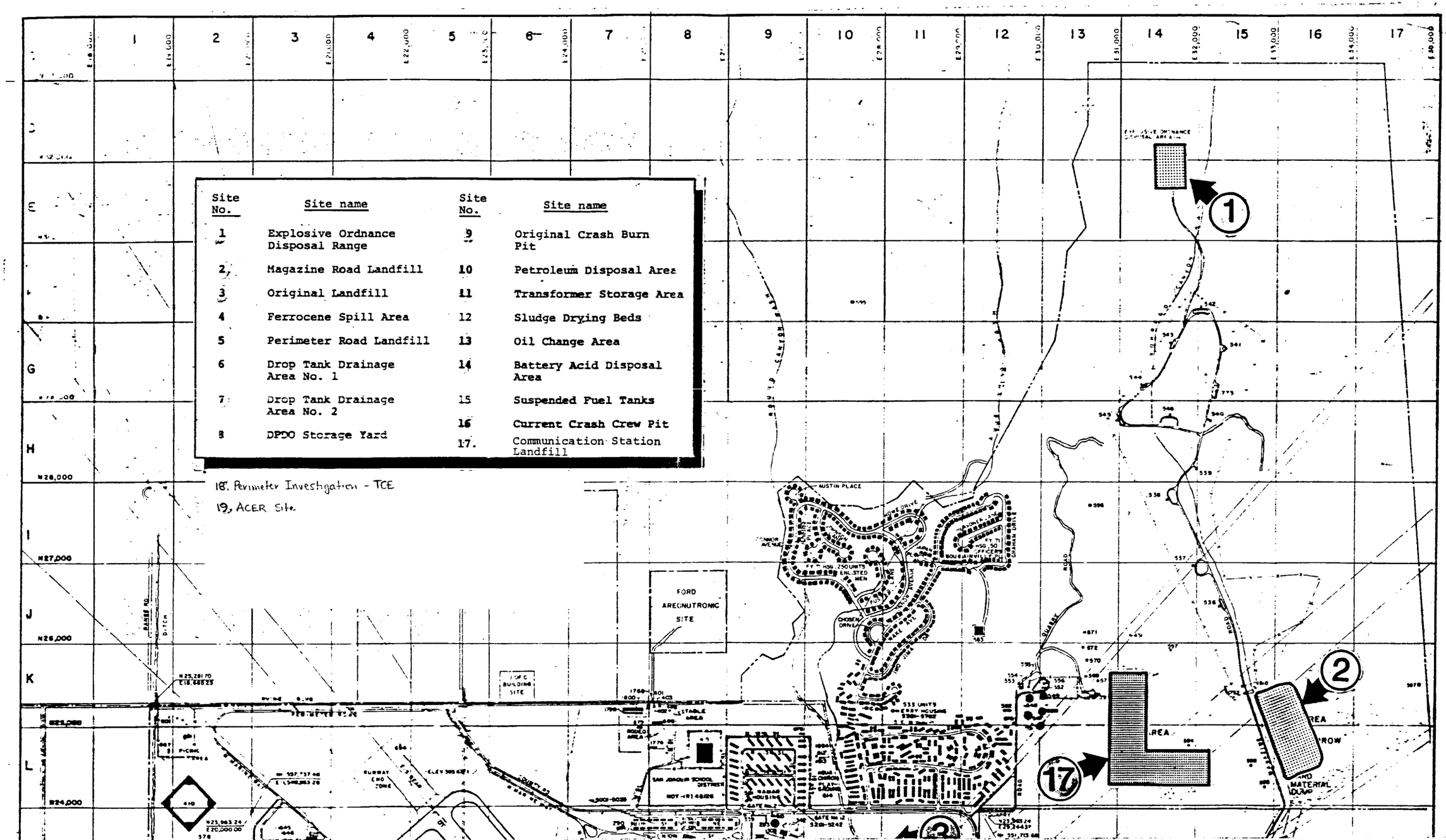
COMMONLY USED SOLVENTS AND PAINT STRIPPERS[a]

Chemical	Comments
Carbon Tetrachloride	Chlorinated hydrocarbon. Once used extensively in industry as a solvent, paint stripper, and dry cleaning agent. Common in industry in 1950s through 1970s. Carcinogen.
MEK	Methyl ethyl ketone. Currently commonly used general solvent and paint stripper. Reportedly used at MCAS Tustin and MCAS El Toro.
Isobutylalcohol	Commonly used in industry as a solvent, and sometimes paint stripper. Reportedly used at MCAS Tustin and MCAS Tl Toro.
Polyurethane thinners	General class of polyurethane paint strippers. Reportedly used at MCAS Tustin and MCAS El Toro.
Naptha	Petroleum distillate, similar to mineral spirits. Used as paint stripper and non-polar solvent. Reportedly used at MCAS Tustin and MCAS El Toro.
PD-680	Hydrocarbon petroleum distillate. Can contain as much as 15 percent aromatic hydrocarbons. Commonly used dry cleaning solvent in the past, not much now. Reportedly used at MCAS Tustin and MCAS El Toro. Also known as Stoddard Solvent.
Mineral Spirits	Hydrocarbon petroleum distillate. Very commonly used solvent and paint thinner. Reportedly used at MCAS Tustin and MCAS El Toro.
Freon	General class of hydrocarbons, can be chlorinated or fluorinated types. Used as a refrigerant, solvent, or degreaser. Common. Reportedly used at MCAS Tustin and MCAS El Toro.
TCE	Trichloroethylene. A chlorinated hydrocarbon solvent commonly used in industry until the latter 1970s. Declining use since, due to non-biodegradability and carcinogenicity.
TCA	Trichloroethane. A chlorianted hydrocarbon solvent. Commonly used in industry until the latter 1970s. Declining use since, due to non-biodegradability and carcinogenicity.
Methylene Chloride	Chlorinated hydrocarbon. Solvent commonly used in industry until the latter 1970s. Declining use since. due to non-biodegradability and carcinogenicity.
Acetone	Oxygenated hydrocarbon. Commonly used solvent used to date at MCAS Tustin and El Toro.
Benzene, Toluene, and Xylene	Aromatic hydrocarbons. Commonly used as solvents and paint strippers until the latter 1970s. Declining use since due to carcinogenicity. May be present in AVGAS as impurities. High probability of presence in AVGAS contaminated soils.

[a]These materials were either reportedly used at either MCAS Tustin or MCAS El Toro (as detailed in comments column) or were commonly used chemicals which have a high probability (due to its common industrial usage) of being present on the Marine bases with operations as are present on these two bases.

APPENDIX F

PLATE 1
HAZARDOUS WASTE DISPOSAL SITES



Site No.	Site name	Site No.	Site name
1	Explosive Ordnance Disposal Range	9	Original Crash Burn Pit
2	Magazine Road Landfill	10	Petroleum Disposal Area
3	Original Landfill	11	Transformer Storage Area
4	Ferrocene Spill Area	12	Sludge Drying Beds
5	Perimeter Road Landfill	13	Oil Change Area
6	Drop Tank Drainage Area No. 1	14	Battery Acid Disposal Area
7	Drop Tank Drainage Area No. 2	15	Suspended Fuel Tanks
8	DPDO Storage Yard	16	Current Crash Crew Pit
		17.	Communication Station Landfill

18. Perimeter Investigation - TCE

19. ACER Site

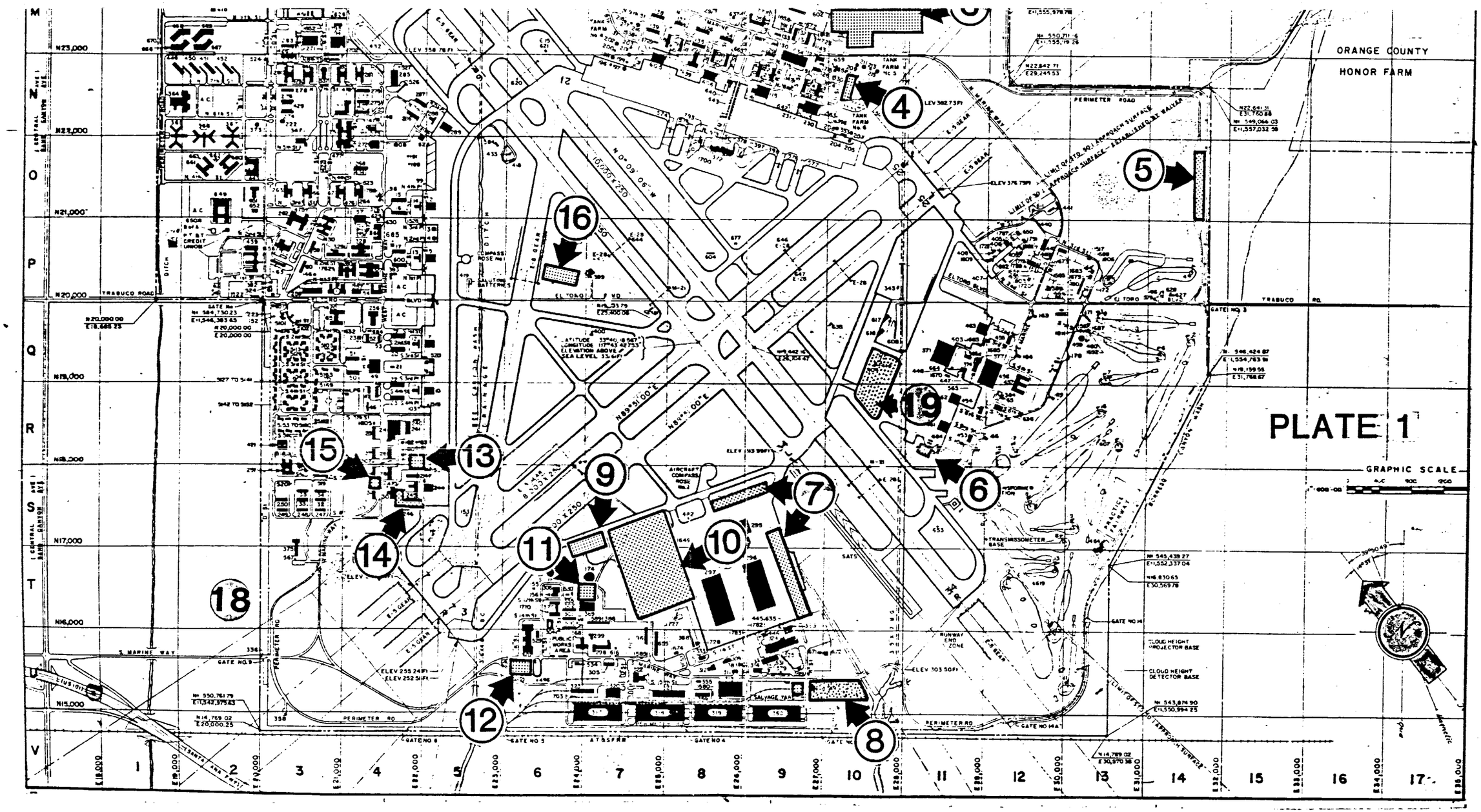


PLATE 1
ORANGE COUNTY
HONOR FARM
GRAPHIC SCALE
TRABUCO ROAD
PERIMETER ROAD
S. MARINE WAY
EL TORO BLVD
GATE NO. 3
GATE NO. 9
GATE NO. 14
GATE NO. 14A
GATE NO. 6
GATE NO. 5
GATE NO. 4
AIRCRAFT COMPASS ROSE
TRANSMISSOMETER BASE
CLOUD HEIGHT PROJECTOR BASE
CLOUD HEIGHT DETECTOR BASE
RUNWAY END ZONE
SALVAGE YARD
PUBLIC WORKS AREA
TANK FARM No. 5
TANK FARM No. 6
CENTRAL AVE
BARR AVE
EASTON AVE
N23,000
N22,000
N21,000
N20,000
N19,000
N18,000
N17,000
N16,000
N15,000
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