Final Environmental Assessment for Landfill Drainage Improvements Vandenberg Air Force Base, California

April 7, 2003

30 CES/CEVPP
806 13th Street, Suite 116
Vandenberg Air Force Base, California 93437

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
07 APR 2003		**00-00-2003 to 00-00-2003**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Final Environmental Assessment for Landfill Drainage Improvements Vandenberg Air Force Base, California	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Tetra Tech Inc,4213 State Street, Suite 100,Santa Barbara,CA,93110**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**265**	

FINDING OF NO SIGNIFICANT IMPACT
ENVIRONMENTAL ASSESSMENT FOR
LANDFILL DRAINAGE IMPROVEMENTS
VANDENBERG AIR FORCE BASE, CALIFORNIA

INTRODUCTION

The U.S. Air Force proposes to complete drainage improvements on the Vandenberg Air Force Base (AFB) landfill in Santa Barbara County, California. This Environmental Assessment (EA) provides analysis of potential impacts associated with the proposed improvements. The National Environmental Policy Act (NEPA) and the implementing regulations issued by the Council on Environmental Quality (CEQ) require the lead agency to prepare an EA for federal actions not qualifying for categorical exclusion and that would not require an environmental impact statement. The U.S. Air Force is the lead agency for NEPA compliance on this proposed project. This EA has been prepared in accordance with the NEPA of 1969, as amended, 42 U.S. Code (U.S.C.) 4321 *et seq.;* the CEQ regulations implementing NEPA, 40 Code of Federal Regulations (CFR) 1500–1508; and Air Force Instruction (AFI) 32-7061, Environmental Impact Analysis Process, dated July 6, 1999, and in 32 CFR Part 989.

Drainage improvements to the landfill are needed to divert off-site storm water. The U.S. Air Force has prepared this Environmental Assessment to evaluate the potential environmental consequences of the Proposed Action, three alternatives (Alternatives 1, 2, and 3), and the No-Action Alternative on local and regional resources. Alternatives eliminated from further study are also discussed.

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The proposed drainage improvements would divert storm water runoff around the landfill and would be designed to accommodate the water flow during a 100-year storm. A Proposed Action and three alternatives were considered and are presented in this EA. A No-Action Alternative, in which no drainage improvements would be made, is also presented.

The Proposed Action involves installation of an underground storm drain using a trenching method that re-routes storm water away from the landfill generally in a southwest to northeast direction. Alternatives 1 and 2 follow a different route, generally in a southwest to southeast direction. Alternative 3 follows a similar route as the Proposed Action but would employ a jack and bore method for installation of the storm drain under railroad tracks and roads.

SUMMARY OF THE ANTICIPATED ENVIRONMENTAL IMPACTS

This EA evaluates the potential effects of the Proposed Action, Alternatives 1, 2, and 3, and the No-Action Alternative with respect to the following issue areas: water resources, geology and soils, biological resources, cultural resources, pollution prevention, solid waste management, hazardous materials/waste management, air quality, health and safety, land use and visual resources, noise, utilities, transportation/circulation, environmental justice, and cumulative impacts. Because all federal, state, local, and Air Force rules and regulations would be followed under the construction and operation phases of the proposed project and best management practices would be used, the Proposed Action and Alternatives 1, 2, and 3 would either have no impact or a less than significant impact on these resources according to the EA.

As discussed in the EA, cumulative impacts would be the same for the Proposed Action and Alternatives 1, 2, and 3. Cumulative impacts to solid waste, traffic, and air quality could occur if the proposed project were to coincide with other proposed construction projects in the vicinity. Implementing best management practices for solid waste, transportation/circulation, and air quality for the proposed project results in no cumulative impacts. In addition, the short-term nature of the proposed project and the scattered locations of the other construction projects throughout the base also result in no cumulative impacts.

Under the No-Action Alternative there would be no construction and landfill drainage improvements would not be made. Erosion and threat of generating leachate at the landfill would continue.

REGULATORY APPROVALS

An application for a Section 404 permit for impacts to jurisdictional waters of the United States has been submitted to the United States Army Corps of Engineers for the proposed project. In addition, an application for a Section 401 Water Quality Certification and a NPDES General Permit for Storm Water Discharges Associated with Construction Activities has been submitted to the California Regional Water Quality Control Board. All conditions of each permit will be adhered to for the proposed project. Coordination with the California Regional Water Quality Control Board has also been initiated for excavation in Installation Restoration Program Site 3. Finally, coordination with the County of Santa Barbara for proposed alterations within the landfill boundary is underway.

Because the proposed project would result in *de minimus* pollutant emissions and would not be regionally significant, it is exempt from further conformity requirements in accordance with conformity requirements set forth in 40 CFR (b), (c), Section 176 (c) (4) of the CAA, and Santa Barbara County Air Pollution Control District Rule 702, General Conformity. Because it was determined that the proposed project is unlikely to affect a federally listed or proposed listed species or its critical habitat, including the California red-legged frog and southwestern willow flycatcher, Section 7 consultation or conference with the United States Fish and Wildlife Service is not necessary. Finally, there are no documented cultural resources in the proposed project area, therefore, consultation with the State Preservation Officer (SHPO) pursuant to Section 106 of the National Historic Preservation Act (NHPA) is not necessary. However, in the event that previously undocumented cultural resources are discovered during construction activities, coordination with the SHPO in compliance with Section 106 of the NHPA will be conducted.

FINDINGS AND CONCLUSIONS

Following a review of the EA, I find that the proposed Landfill Drainage Improvements will not result in significant environmental impacts. Based upon the information contained within this assessment, a Finding of No Significant Impact is made. The preparation of an environmental impact statement is not required for this action.

The Draft EA for Landfill Drainage Improvements was available for public review for 30 days from 20 January 2003 to 19 February 2003. No public comments were received on the Draft EA. A copy of the Final EA is available at the following location:

Vandenberg Air Force Base
30 CES/CEV Environmental Management Office
806 13th Street, Suite 116
Vandenberg Air Force Base, California 93437-5242

FINDING OF NO PRACTICABLE ALTERNATIVE

Implementation of the Proposed Action will conform to Executive Order 11990 which requires federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Implementation of the Proposed Action will also conform to Executive Order 11988 which requires federal agencies to take actions to reduce the risk of flood loss, to minimize the impacts of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

Wetlands would be directly impacted by construction of the Proposed Action. Due to the topography and hydrology in and near the landfill, no other viable design for the landfill drainage improvements project exists without impacting wetlands. The landfill drainage diversion pipeline placement is constrained by Pine Canyon Road, development north and south of the road (including the landfill south of the road), and the vernal wetlands on the north. It cannot avoid the topographic depression (at sampling station [SS]-3) or wetland areas associated with SS-8, SS-9, and SS-10 without impacting the landfill and other developed areas or the vernal wetlands.

Routes and construction methods for the Proposed Action have been designed to minimize the area of direct impacts on wetlands to the maximum extent possible. In addition, an analysis of alternatives to the Proposed Action is contained in the EA. Alternatives 1, 2, and 3 were determined to have the same direct impacts on jurisdictional waters of the United States or wetlands due to the same constraints of the storm drain alignment that apply to the Proposed Action.

Finally, the Proposed Action would not impact a FEMA-delineated floodplain.

Pursuant to Executive Orders 11990 and 11988, the authority delegated by SAFO 780-1, and 32 CFR Part 989, and taking the submitted information into account, I find that there is no practicable alternative to this action and the Proposed Action includes all practical measures to minimize harm to the environment.

Robert C Hinson

ROBERT C. HINSON
Lieutenant General, USAF
Vice Commander

MAY 2 9 2003

ERRATUM

1. Draft Finding of No Significant Impact, page 1, paragraph 1, last sentence. Delete the last sentence and replace with: "The EA for Landfill Drainage Improvements will be available for public review on 20 January 2003. The public comment period will be for 30 days beginning on 20 January 2003."

This page intentionally left blank.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED

TABLE OF CONTENTS (CONTINUED

TABLE OF CONTENTS (CONTINUED

TABLE OF CONTENTS (CONTINUED

TABLE OF CONTENTS (CONTINUED

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)

This page intentionally left blank.

1 BACKGROUND

1.0 BACKGROUND

This environmental assessment (EA) provides analysis of potential impacts associated with the proposed landfill drainage improvements at Vandenberg Air Force Base (AFB) in Santa Barbara County, California.

The National Environmental Policy Act (NEPA) and the implementing regulations issued by the Council on Environmental Quality (CEQ) require the lead agency to prepare an EA for federal actions not qualifying for categorical exclusion and that would not require an environmental impact statement. The U.S. Air Force is the lead agency for NEPA compliance on this proposed project.

This EA has been prepared in accordance with the NEPA of 1969, as amended, 42 U.S. Code (U.S.C.) 4321 *et seq.;* the CEQ regulations implementing NEPA, 40 Code of Federal Regulations (CFR) 1500–1508; and Air Force Instruction (AFI) 32-7061, Environmental Impact Analysis Process, dated July 6, 1999, as coded in 32 CFR Part 989.

1.1 PROJECT LOCATION

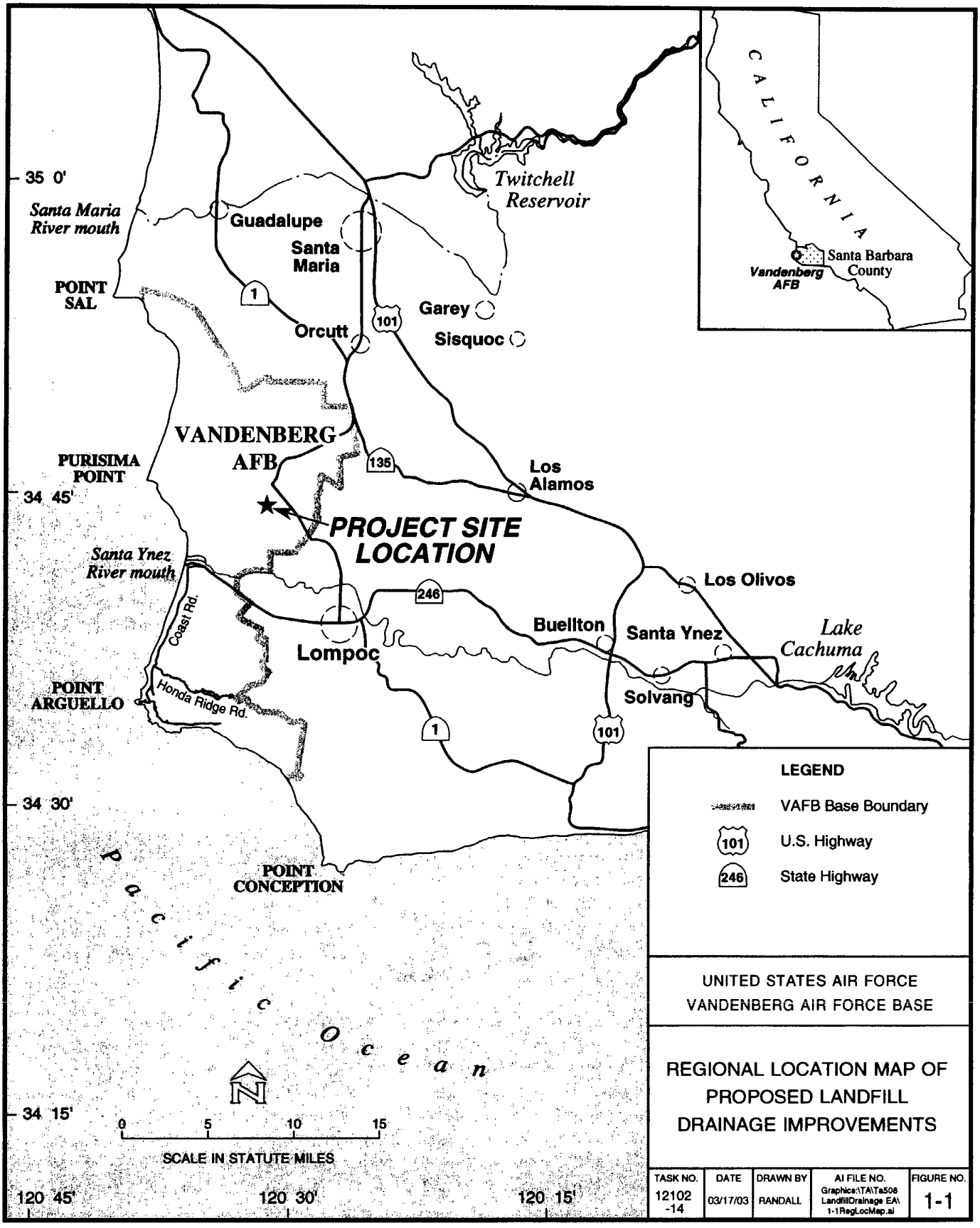
Vandenberg AFB is located on the south-central coast of California, approximately halfway between San Diego and San Francisco (Figure 1-1). The base covers approximately 99,100 acres in western Santa Barbara County and is headquarters for the 30th Space Wing. The Air Force's primary missions at Vandenberg AFB are to launch and track satellites in space, test and evaluate America's intercontinental ballistic missile systems, and support aircraft operations in the western range. As a nonmilitary facet of operations, Vandenberg AFB is also committed to promoting commercial space launch ventures.

The proposed project is located near the Vandenberg AFB Sanitary Landfill (landfill), on North Base. The landfill is just southeast of the intersection of Washington and New Mexico Avenues, southwest of Pine Canyon Road (Figure 1-2).

1.2 PURPOSE AND NEED

Vandenberg AFB must comply with federal and state regulations regarding landfill controls. Regulatory requirements for landfill controls are documented in 40 CFR Part 258, Subtitle D and California Code of Regulations (CCR) Title 27, Article 4. Source control corrective actions, consisting of upgrades and/or repairs to the existing drainage system, must be implemented at the Vandenberg AFB landfill to facilitate compliance with State of California Water Quality Protection Standards. Storm water discharges associated with landfill activities have been permitted since 1993 under the California State Water Resources Control Board (SWRCB) Water Quality Order No. 97-03-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000001 Waste Discharge Requirement (WDR) for Storm Water Associated with Industrial Activities (General Permit).

Improvements to the landfill drainage system are necessary to divert off-site storm water runoff away from the landfill area to avoid contact with buried waste and generating excess leachate; prevent erosion; ensure integrity of roads, structures, and gas monitoring and control systems; and prevent safety hazards. Leachate is generated when water percolates through buried waste, and it may contain potentially harmful materials. Source control structures include a series of swales, concrete channels, and culverts. In accordance with the General Permit, storm water discharge is analyzed for pH, total suspended solids (TSS), oil and grease (in lieu of total organic carbon), specific conductance, and iron. Of these analytes, TSS levels have consistently exceeded state guidelines. In addition, four Installation Restoration Program


CALIFORNIA
Santa Barbara County
Vandenberg AFB
35 0'
Santa Maria River mouth
Guadalupe
Santa Maria
Twitchell Reservoir
POINT SAL
Garey
Orcutt
Sisquoc
VANDENBERG AFB
PURISIMA POINT
34 45'
Los Alamos
PROJECT SITE LOCATION
Santa Ynez River mouth
Los Olivos
Coast Rd.
Buellton
Santa Ynez
Lake Cachuma
Lompoc
POINT ARGUELLO
Honda Ridge Rd.
Solvang
34 30'
POINT CONCEPTION
Pacific Ocean
34 15'
0 5 10 15
SCALE IN STATUTE MILES
120 45'
120 30'
120 15'
LEGEND
VAFB Base Boundary
U.S. Highway
State Highway
UNITED STATES AIR FORCE
VANDENBERG AIR FORCE BASE
REGIONAL LOCATION MAP OF PROPOSED LANDFILL DRAINAGE IMPROVEMENTS
TASK NO. 12102 -14
DATE 03/17/03
DRAWN BY RANDALL
AI FILE NO. Graphics\TA\Ta508 LandfillDrainage EA\ 1-1RegLocMap.ai
FIGURE NO. 1-1

LEGEND

- CONTOUR LINES, 4 METER INTERVALS (MSL, NAD83)
- RAILROAD
- PAVED ROADS AND PARKING
- UNPAVED ROADS AND TRAILS
- DRAINAGE
- 6601 BUILDINGS
- LANDFILL BOUNDARY
- SUBTITLE "D" BOUNDARY

400 0 400 800 FEET

Base map from 30th CES CECB Base Planning, April 2000

LOCAL VICINITY MAP FOR THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AT VANDENBERG AFB

TASK NO	DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
12102 -14	03/17/03	Vance Hoyt RANDALL	VAFB	Graphics\TA\12102\9 1-2 VicinityMap.ai	1-2

This page intentionally left blank.

(IRP) sites are located near the landfill. Results of quarterly landfill groundwater monitoring have historically shown statistically significant levels of contamination in the groundwater. Installing a new drainage system would also divert storm water runoff away from the IRP sites, thus slowing the spread of contaminated water. The drainage improvements would divert storm water runoff around the landfill and would be designed to accommodate the water flow during a 100-year storm.

1.3 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

In accordance with AFI 32-7061 and CEQ regulations, potential environmental impacts are discussed in proportion to their significance. The level of analysis was determined by the amount of information that would be required for the decision-makers to make an informed choice. Consequently, different levels of detail are presented for the resource areas discussed in this EA.

This EA presents analyses and descriptions of the potential environmental impacts resulting from the proposed project and identifies all required environmental permits. As appropriate, the environmental consequences of the action are described in terms of regional or site-specific effects.

Chapter 2.0 of this EA describes the Proposed Action and Alternatives. In addition to providing project information, this section describes the general site setting of the Proposed Action and discusses the No-Action Alternative.

Chapter 3.0 provides regional and site-specific information related to water resources, geology and soils, biological resources, cultural resources, pollution prevention, solid waste management, hazardous materials/waste management, air quality, health and safety, land use, visual resources, noise, utilities, and environmental justice. Impacts to socioeconomics are not discussed in this EA because these resource areas would not be affected on a short- or long-term basis. The regional information in this section provides the context for site-specific information on resources that would potentially be affected by the Proposed Action or Alternatives.

Chapter 4.0 addresses the potential effects of proposed project on each of the resource areas analyzed. Possible impacts of project activities are analyzed, the significance of each impact is identified for each resource area, and mitigation measures are provided if necessary. Mitigation measures are designed to ensure that none of the potential effects of the Proposed Action or Alternatives would cause significant impacts to the environment.

Chapter 5.0 presents a list of applicable federal, state, local, and Air Force regulations requiring compliance prior to implementing the Proposed Action.

Chapters 6.0 through 9.0 identify report references, persons and agencies contacted, preparers of this EA, and acronyms and abbreviations, respectively.

Appendix A is the Natural Resources Survey, and Appendix B is the Air Quality Conformity Analysis.

This page intentionally left blank.

2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter describes activities associated with the proposed construction of drainage improvements near the Vandenberg AFB landfill. Each project description includes requirements for construction, related equipment, schedule, and workforce. Activities associated with the Proposed Action, Alternatives 1, 2, and 3, alternatives eliminated from detailed study, and the No-Action Alternative are discussed in this chapter.

2.1 PROPOSED ACTION

The Proposed Action would consist of installing approximately 5,300 linear feet of underground high density polyethylene (HDPE) storm drain pipe. The HDPE would range from 24 to 60 inches in diameter and each piece would be approximately 20 feet long. Several lateral connection lines would be installed along the proposed route that would connect to and plug existing corrugated metal pipe (CMP) storm drains. The storm drains that will be tied in to the lateral connection lines are described in Section 3.12 and shown on Figure 3-4 (Utilities Map).

The storm water drain would be routed just outside the landfill, parallel with New Mexico Avenue (Utah Avenue), and then turn southeast to parallel Pine Canyon Road. The storm drain would then turn northeast and would be trenched across Pine Canyon Road using an open cut with slurry. The storm drain would be routed east of existing power lines and several vernal pools. Storm water would finally be discharged into an intermittent tributary leading to Upper Lake in Lake Canyon, northeast of the landfill (Figure 2-1). The outlet occurs in upland vegetation just above the tributary. A channel of riprap would be constructed at the outflow point. Photographs of the outflow point are provided in Appendix A, Attachment 7.

A 24-inch diameter reinforced concrete outlet pipe would be installed over the existing 36-inch diameter outlet pipe at Lower Lake to provide discharge capacity sufficient to prevent flooding of Lake Canyon in the event of a 100-year storm. Routine maintenance of the outlet structures of all of the lakes in Lake Canyon would be conducted, including clearing of clogged vegetation from the inlet and discharge areas with hand tools. Such maintenance would minimize inundation and prevent flooding. All construction work to install a new outlet pipe at Lower Lake would be conducted from the existing road and would involve the use of a track excavator, track gradual, dozer, and rubber tire loader. In addition to biological monitoring during construction, pre-construction surveys for the California red-legged frog and southwestern willow flycatcher will be conducted near the outlet structure of Lower Lake to ensure that they would not be impacted by construction of the Lower Lake outlet. Finally, construction and maintenance of the Lower Lake outlet will be conducted outside the nesting season of the southwestern willow flycatcher between 15 May and 30 August.

Under the Proposed Action, a trench approximately 5,300 feet long would be excavated, the excavation would be lined with clean sand and shored, HDPE pipe would be laid in the trench, and the excavation would be backfilled. Native material excavated from the trench would be used where possible. To create a continuous downward slope toward the pipe outlet, the trench would be excavated to depths ranging from 5 to 30 feet below the existing grade, possibly requiring removal of bedrock with heavy equipment.

Deep sections of the trench would be widened, sloped at the sides, and shored during construction to prevent collapse. The trench would be completely backfilled and the original grade would be restored. The trench width would range from 8 feet to 30 feet. Excavation spoils would be stored temporarily alongside the trench. If excavation through Installation Restoration Program (IRP) 3 is done during the rainy season (beginning in October), excavated soils would be containerized and sampled immediately

after excavation rather than stored alongside the trench. The total path of disturbance would range from 80 feet wide to 100 feet wide. The total volume of excavated soil for the culverts would be approximately 74,080 cubic yards. Approximately 11.6 acres of land would be disturbed.

A topographic depression (fill area) where the storm drain would pass under Pine Canyon Road would be filled to raise surface elevation. The sides of the fill area would be sloped at a two percent grade toward a catch basin, which would collect runoff from the fill area and channel it into the drain pipe. Approximately 25,000 cubic yards of fill material would be taken from a borrow site southeast of the California Street–Utah Avenue intersection to use for additional fill in the depressed area near where the pipeline crosses under Pine Canyon Road.

2.1.1 Construction Requirements

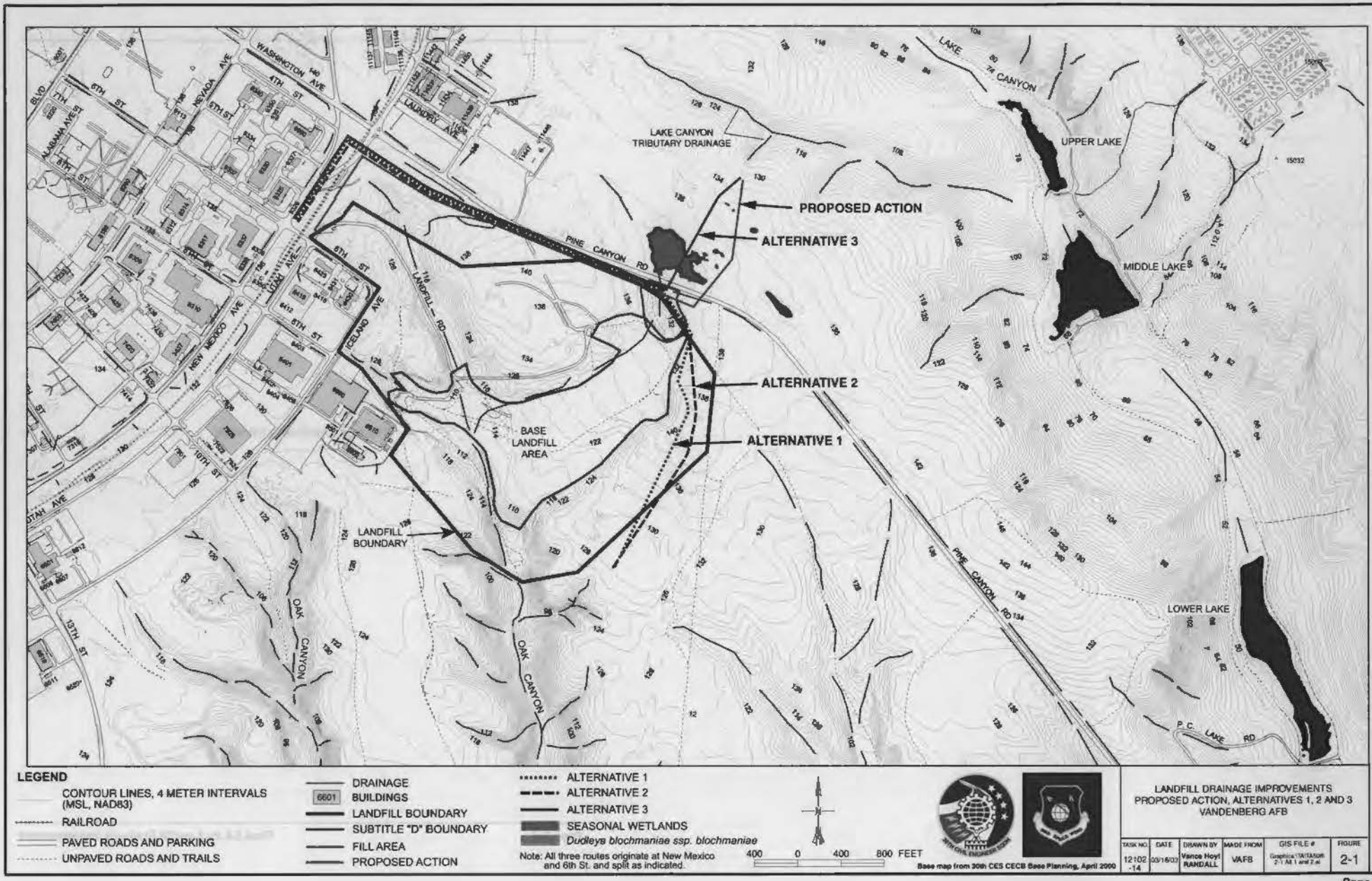
Construction activities would be confined to the area around the landfill as indicated in Figure 2-1. The construction staging area would be located less than 1 mile from the construction site and the construction site boundaries on a previously disturbed area.

An excavator would be used for digging trenches for the HDPE pipes. Excavated areas where groundwater is encountered would be dewatered prior to pipe installation. The depth of trenching and excavation would vary depending on the elevation of surface soil. The greatest depth of excavation for the Proposed Action would be approximately 30 feet.

Excavated material would be used as backfill. Extra material would be hauled off base for reuse or proper disposal or, if clean, brought to the landfill and used as daily cover.

The entire length of the pipe would be encased with 6 inches of sand and re-covered with soil. Water trucks would be used to control dust after fill and grading were complete. Groundwater has been located along portions of the alignment. In areas where groundwater is contacted, anti-seep collars or rings would be constructed around the pipeline to prevent groundwater diversion and allow natural flow.

Within the area of IRP Site 3 (see sections 3.7 and 4.7), anti-seep collars or rings would be constructed at about 1 per 100 linear feet to prevent spread of contaminated water. The anti-seep rings would be constructed at the site using a ready-mix truck and a concrete pump. Disturbance through IRP Site 3 would be minimized by restricting the trench depth to 5 to 10 feet below the existing grade and the disturbance width to 80 feet.


LAKE CANYON TRIBUTARY DRAINAGE
PROPOSED ACTION
ALTERNATIVE 3
ALTERNATIVE 2
ALTERNATIVE 1
BASE LANDFILL AREA
LANDFILL BOUNDARY
UPPER LAKE
MIDDLE LAKE
LOWER LAKE
LAKE CANYON
PINE CANYON RD
LANDFILL RD
OAK CANYON
P.C. LAKE RD
WASHINGTON AVE
NEVADA AVE
ALABAMA AVE
UTAH AVE
NEW MEXICO AVE
ICELAND AVE
LAUNDRY AVE
4TH ST
5TH ST
6TH ST
8TH ST
10TH ST
13TH ST
LEGEND
CONTOUR LINES, 4 METER INTERVALS (MSL, NAD83)
RAILROAD
PAVED ROADS AND PARKING
UNPAVED ROADS AND TRAILS
DRAINAGE
6601 BUILDINGS
LANDFILL BOUNDARY
SUBTITLE "D" BOUNDARY
FILL AREA
PROPOSED ACTION
ALTERNATIVE 1
ALTERNATIVE 2
ALTERNATIVE 3
SEASONAL WETLANDS
Dudleys blochmaniae ssp. blochmaniae
Note: All three routes originate at New Mexico and 6th St. and split as indicated.
400 0 400 800 FEET
Base map from 30th CES CECB Base Planning, April 2000
LANDFILL DRAINAGE IMPROVEMENTS
PROPOSED ACTION, ALTERNATIVES 1, 2 AND 3
VANDENBERG AFB
TASK NO. 12102-14
DATE 03/16/03
DRAWN BY Vance Hoyt RANDALL
MADE FROM VAFB
GIS FILE # Graphics\TAT\TASK6 2-1 Alt 1 and 2.ai
FIGURE 2-1

This page intentionally left blank.

2.1.2 Projected Equipment Needs

Several types of heavy equipment would be used throughout the construction period. However, not all equipment would be operated simultaneously. The estimated amount of time each piece of equipment would operate during construction is listed in Appendix B, Section 2.6. The following heavy-duty vehicles would be used to complete this project (numbers in parentheses represent the quantities needed):

- Excavator (2)
- Dozer (4)
- Backhoe/Skip loader (2)
- Ready mix truck
- Flatbed truck (2)
- End dump truck (30)
- Motor grader (2)
- Track gradual (1)
- Rubber tire loader (4)
- Sheeps foot (2)
- Concrete pump
- Water truck (2)
- Pick up truck (4)
- Scraper (4)
- Horizontal boring/jacking machine

2.1.3 Construction Schedule and Workforce

Installing the proposed storm drain is anticipated to take 4 to 5 months and require a maximum daily workforce of 30 people. The average number of personnel is estimated to be 5 per day. Construction would begin during the dry season (mid-May) of 2003.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

This section contains descriptions of the project alternatives considered in addition to the Proposed Action.

2.2.1 Alternative 1

Alternative 1 consists of installing approximately 6,500 linear feet of underground reinforced concrete pipe (RCP) storm drain. The RCP would range from 48 to 66 inches in diameter and each piece would be approximately 6 to 8 feet long. As with the Proposed Action, lateral connection lines would be installed along the proposed route to connect the line with existing CMP storm drains.

The storm water drain would begin near the intersection of 6th Street and New Mexico Avenue (Utah Avenue). The storm water drain would be routed between the railroad tracks and New Mexico Avenue starting near the intersection of New Mexico Avenue (Utah Avenue) and 6th Street, then turn southeast and cross under a portion of New Mexico Avenue and the railroad tracks near Washington Avenue (Pine Canyon Road), and run parallel to Pine Canyon Road. The drain would follow Pine Canyon Road southeast, then turn south approximately 3,000 feet from the Utah Avenue and Pine Canyon Road intersection. It would follow the landfill boundary to discharge runoff into the hilly area south of the landfill and disperse runoff in Oak Canyon (Figure 2-1).

Traditional trenching and excavation would be used along the entire route, except for areas with roads and railroad tracks (Figure 2-1). A jack and bore construction method would be used to install the storm drain pipe under roads and railroad crossings. Boring pits would be excavated on both sides of each of the two roads and the railroad tracks. Boring pits would be a maximum of 20 to 30 feet deep. The bottom width would be between 10 and 20 feet, and the top width would be between 75 and 100 feet.

Alternative 1 would require significantly deeper cutting for pipeline installation than Alternative 2. The greatest depth of excavation would be approximately 37.5 feet and the total volume of excavated soil for the culverts would be approximately 88,452 cubic yards. Approximately 12.5 acres of land would be disturbed. Construction of Alternative 1 would take 6 months.

As in the Proposed Action, a channel of riprap and an energy dissipater would be installed at the outflow point. Where the pipeline alignment turns south, the topographic depression (see section 2.1 Proposed Action) would be filled to raise the surface elevation. This area would require approximately 25,000 cubic yards of fill material.

2.2.2 Alternative 2

Alternative 2 would be the same as Alternative 1 except the alignment would continue slightly further east (and then south) to avoid the depth of excavation required under Alternative 1 (Figure 2-1). The Alternative 2 drain would also discharge into the hilly area south of the landfill and disperse in Oak Canyon. A channel of riprap would be constructed at the outflow point. The greatest depth of excavation would be approximately 35.5 feet and the total volume of excavated soil for the culverts would be approximately 87,118 cubic yards. Approximately 12.5 acres of land would be disturbed. Construction of Alternative 2 would take 6 months.

2.2.3 Alternative 3

Alternative 3 would be similar to both the Proposed Action and Alternatives 1 and 2 except for slight deviations in the route and construction methods. As in Alternatives 1 and 2, the storm water drain would be routed between the railroad tracks and New Mexico Avenue near the intersection of New Mexico Avenue (Utah Avenue) and 6th Street, cross under a portion of New Mexico Avenue and the railroad tracks near Washington Avenue (Pine Canyon Road) and parallel Pine Canyon Road. As in the Proposed Action, the storm drain would then go northeast, crossing under Pine Canyon Road. Alternative 3 would require jack and boring rather than trenching, as in the Proposed Action.

After crossing under Pine Canyon Road, the pipeline would lead to Lake Canyon, under a significant concentration of vernal pools. Storm water would finally be discharged into the same outlet point as the Proposed Action. As under the Proposed Action, a channel of rip-rap would be installed at the outflow point at the tributary to Lake Canyon.

Traditional trenching and excavation would be used along the entire route, except for areas with roads and railroad tracks and vernal pools (i.e., seasonal wetlands) (Figure 2-1). A jack and bore construction method would be used to install the storm drainpipe under roads, railroad crossings, and the vernal pool area. Boring pits would be excavated on both sides of each of the two roads, the railroad tracks, and vernal pool area. Boring pits would be a maximum of 20 to 30 feet deep. The bottom width would be between 10 and 20 feet, and the top width would be between 75 and 100 feet.

In total, the excavated area would be approximately 4,900 to 5,000 feet long and 50 feet wide. The greatest depth of excavation would be 30 feet. The total volume of excavated soil would be approximately 63,000 cubic yards. Approximately 9 acres would be disturbed. Construction of Alternative 3 is anticipated to take 6 months.

As under the Proposed Action, the topographic depression (fill area) located on the south side of Pine Canyon Road, where the storm drain would pass under the road, would be filled to raise the surface elevation and change the direction of storm water flow away from the landfill.

2.2.4 No-Action Alternative

The No-Action Alternative would consist of not installing the storm drain system and allowing storm water runoff to continue flowing through the landfill. No landfill drainage improvements would be made. Erosion and the threat of generating leachate at the landfill would continue and TSS levels would remain high at the landfill toe.

2.3 ALTERNATIVE ELIMINATED FROM DETAILED STUDY

2.3.1 Alternative 4

Alternative 4 would follow the same route as Alternative 3. As under Alternative 3, Alternative 4 would require installing the storm drain using a combination of traditional trenching and jack and boring construction methods. However, Alternative 4 would only rely on the jack and boring method for the portion of the storm drain route beginning on the north side of Pine Canyon Road and extending to the discharge point into Lake Canyon. No trenching would occur along this portion of the route. This alternative was eliminated from further study because it would be cost prohibitive.

This page intentionally left blank.

3 AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions at the proposed project area in relation to each of the resource areas addressed in this EA. Each of the following sections provides general regional information related to the environment at Vandenberg AFB and site-specific information related directly to the project location, construction activities, and potentially sensitive environmental resources.

3.1 WATER RESOURCES

3.1.1 Regional Setting

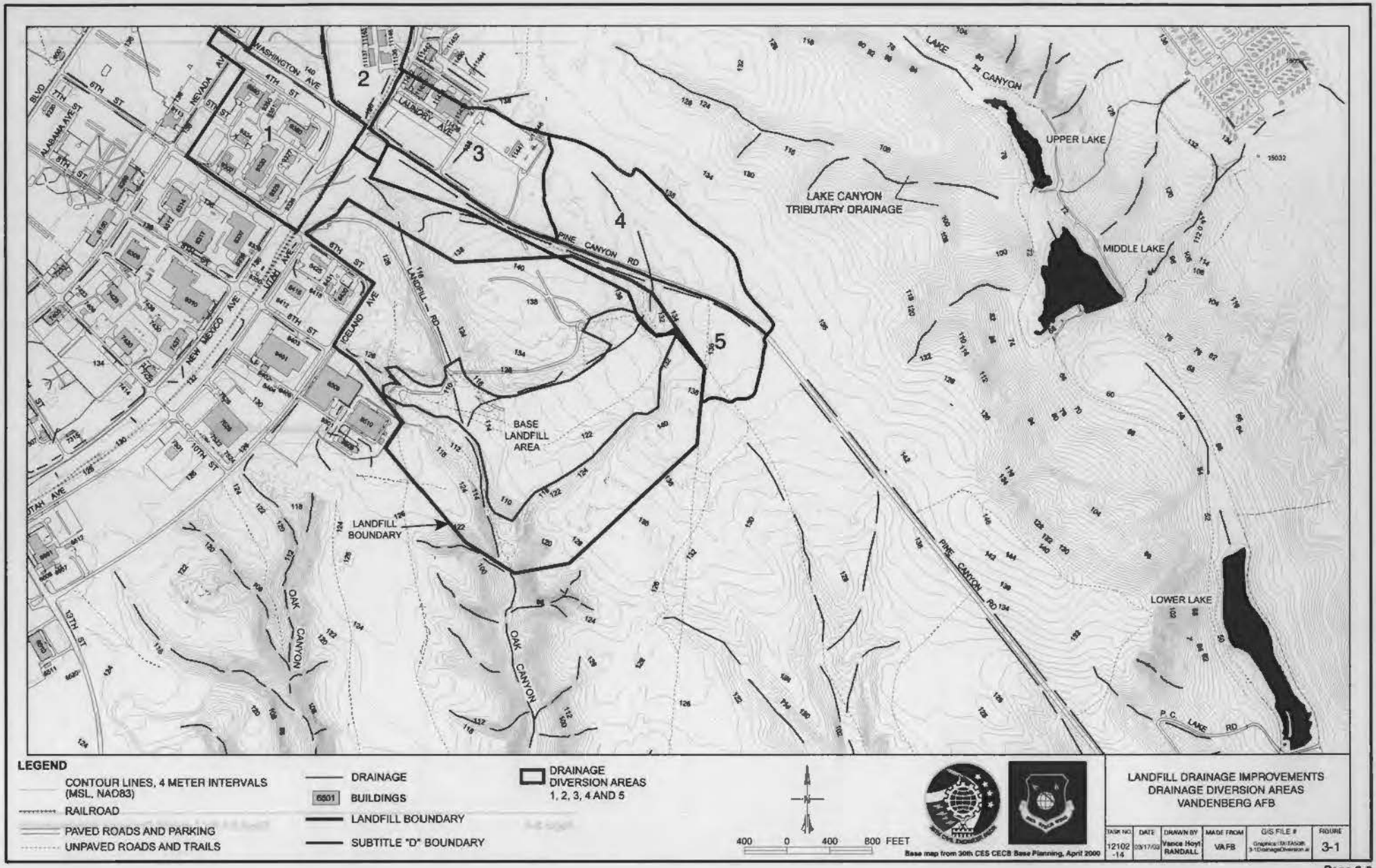
Vandenberg AFB encompasses portions of two major drainage basins: San Antonio Creek basin, and the Santa Ynez River basin. Five minor drainage basins, associated with smaller creeks, and several ponds are contained within base boundaries. The drainage divide between the San Antonio Creek basin and the Santa Ynez River basin occurs in the southern portion of Burton Mesa. San Antonio Creek, located on North Base (the area generally north of the Santa Ynez River), drains an area of approximately 135 square miles and flows westward to discharge into a lagoon impounded behind the coastal dunes on North Base. The Santa Ynez River drains an area of approximately 900 square miles, flows westward, and discharges into the Pacific Ocean. Bradbury Dam, located at Lake Cachuma, limits the wet season flow of the Santa Ynez River. Withdrawal of water for agricultural irrigation from both drainage basins affects the flow volume of San Antonio Creek and the Santa Ynez River. High discharge and flooding may occur in the Santa Ynez River from November through April, and there may be very little or no discharge occurring in the drier months. The presence of high levels of total dissolved solids, sulfates, chlorides, and iron causes poor water quality in San Antonio Creek and the Santa Ynez River (U.S. Air Force 1987).

3.1.2 Site Setting

The project site is located on Burton Mesa above Oak Canyon, which trends generally north-south, to the north and northeast of the landfill (Figure 2-1). The Proposed Action and Alternative 3 would intercept an intermittent drainage from approximately 175 upgradient acres to the north, east, and west of the landfill and redirect it to discharge into Upper Lake of Lake Canyon rather than into the landfill and Oak Canyon (Penfield and Smith 1999). Alternatives 1 and 2 would also prevent drainage from the same upgradient area from entering the landfill, but would divert drainage to an area south of the landfill. The Proposed Action and alternatives would divert drainage from 46.7 percent of the current landfill watershed area (Penfield and Smith 1999). The five watershed areas to be diverted are shown on Figure 3-1.

There are two surface water bodies located within the storm drain alignment, an intermittent tributary drainage to the Lake Canyon stream, and the Oak Canyon drainage. Under the Proposed Action and Alternative 3, runoff diverted from the landfill would be released to the Lake Canyon tributary drainage (Figure 2-1), where it would then flow to Lake Canyon. The main body of the Lake Canyon stream is dammed to create three connected lakes. These lakes were formed artificially and do not occur in a natural, FEMA-delineated floodplain. The dams have outlet structures that regulate the amount of water released from the lakes (Penfield and Smith 1999). Vegetation currently obstructs the intake and outflow structures at the three lakes and the outlet structure of Lower Lake where the Lake Canyon stream crosses under Pine Canyon Lake Road near Pine Canyon Gate (Penfield and Smith 2000b). Under Alternatives 1 and 2, diverted runoff would discharge to the slopes of Oak Canyon, which contains an intermittent stream that forms a tributary to the Santa Ynez River at a point approximately 6 miles from the Pacific Ocean (U.S. Air Force 1997a).

This page intentionally left blank.


1
2
3
4
5
WASHINGTON AVE
4TH ST
LAUNDRY AVE
NEVADA AVE
ALABAMA AVE
6TH ST
8TH ST
NEW MEXICO AVE
ICELAND AVE
10TH ST
13TH ST
UTAH AVE
LANDFILL RD
PINE CANYON RD
BASE LANDFILL AREA
LANDFILL BOUNDARY
OAK CANYON
LAKE CANYON
LAKE CANYON TRIBUTARY DRAINAGE
UPPER LAKE
MIDDLE LAKE
LOWER LAKE
P.C. LAKE RD
LEGEND
CONTOUR LINES, 4 METER INTERVALS (MSL, NAD83)
RAILROAD
PAVED ROADS AND PARKING
UNPAVED ROADS AND TRAILS
DRAINAGE
6501 BUILDINGS
LANDFILL BOUNDARY
SUBTITLE "D" BOUNDARY
DRAINAGE DIVERSION AREAS 1, 2, 3, 4 AND 5
400 0 400 800 FEET
Base map from 30th CES CECB Base Planning, April 2000
LANDFILL DRAINAGE IMPROVEMENTS
DRAINAGE DIVERSION AREAS
VANDENBERG AFB
TASK NO. 12102 -14
DATE 03/17/00
DRAWN BY Vance Hoyt RANDALL
MADE FROM VAFB
GIS FILE # Graphics\DATA\GIS\3-1\DrainageDiversion.ai
FIGURE 3-1

This page intentionally left blank.

Surface water entering the landfill drains from urbanized and undeveloped areas to the north, east, and west of the landfill. Surface water enters the landfill via outfalls from storm drains in the Vandenberg AFB cantonment area on Burton Mesa and from natural drainage (U.S. Air Force 1997b). The landfill's drainage area is approximately 430 acres and includes regions outside the landfill boundary (U.S. Air Force 1997b). The active portion of the Vandenberg AFB landfill occupies the northernmost portion of the northeast branch of Oak Canyon. Burton Mesa surrounds the landfill, ranging in elevation from about 420 to 450 feet above mean sea level (msl).

Naturally occurring ephemeral drainages enter the landfill in three general locations. All three drainages originate outside the landfill boundary. The drainages are located northeast of the landfill from the Lake Canyon area, at the northernmost portion of the landfill east of the entrance road, and at the western portion of the site above the existing wash rack area.

Surface water that enters the landfill is controlled to prevent contact with buried waste and minimize erosion. A system of surface channels and buried culverts directs surface water runoff and run-on (U.S. Air Force 1999a). The landfill's drainage structures include a gunnite-lined configuration of storm water conveyances that flow into and within the landfill boundary. The landfill is also graded so that storm water is directed away from the active fill areas. The landfill surface is covered with an interim cover that is a minimum of 1 foot thick and slopes to disperse runoff away from the landfill (U.S. Air Force 1999a).

All of the drainage through the landfill converges at the southernmost portion of the Subtitle D footprint, which is the permitted fill area for buried waste (Figure 2-1). The drainage exits the landfill via a 64-inch-diameter corrugated pipe that discharges into Oak Canyon, a deeply incised creek bed (U.S. Air Force 1997b). Drainage from Oak Canyon flows southward to discharge into the Santa Ynez River, approximately 2.4 miles away.

Surface water in Oak Canyon beyond the discharge point consists of the main drainage and several smaller, tributary drainages. The main drainage is a historical natural drainage. Historical natural drainage patterns and wetland swales existed in this part of Vandenberg AFB before the base facilities were developed. However, excavation, filling, and diversion have disrupted these natural drainage patterns. The presence of the landfill at the head of Oak Canyon has also altered the natural drainage pattern of Oak Canyon. Portions of the drainages at the head of Oak Canyon, upstream of the landfill, have been delineated as wetlands, waters of the United States, and atypical wetlands (U.S. Air Force 1997c). Atypical wetlands are defined as wetland types and/or conditions that may make application of indicators of one or more of the three wetland parameters (hydrophytic vegetation, hydric soils, wetland hydrology) difficult, at least at certain times of the year (Environmental Laboratory 1987).

The flow of water in Oak Canyon depends on the seasonal influx of rainwater. Flow is abundant during the rainy season but diminishes to a trickle during the remainder of the year (U.S. Air Force 1997d, 1998a, 1998b, 1999b, 1999c, 2000a, 2000b). Table 3-1 summarizes the peak discharge rates for water entering Oak Canyon from the entire watershed (existing conditions) and when runoff from 46.7 percent of the watershed area is diverted (Proposed Action, Alternatives 1, 2, and 3).

3.1.2.1 Surface Water Quality

Surface water at the landfill is monitored quarterly from five monitoring points located upstream and downstream from the landfill and twice each rainy season in accordance with WDR 94-26 and in compliance with the NPDES General Permit No. CAS000001 (General Permit) for discharges of storm water associated with industrial activities. Requirements for compliance are described in the Vandenberg AFB Storm Water Pollution Prevention Plan (SWPPP) (U.S. Air Force 1999a). Samples from the quarterly

Table 3-1
Peak Discharge Rates for Surface Water Run-on/Runoff from Landfill Watershed to Oak Canyon (cubic feet per second)

	2-year Storm	10-year Storm	25-year Storm	100-year Storm
Existing conditions	170	388	525	662
Proposed Action, Alternatives 1, 2, and 3	91	207	280	353

Source: U.S. Air Force 1997a.

monitoring points are analyzed for pH, sulfate, nitrate as nitrogen, metals, and volatile organic compounds (VOCs). The wet season samples are collected twice per season after storm events. These samples are collected at the main outfall into Oak Canyon and are analyzed for pH, TSS, oil and grease (in lieu of total organic carbon), specific conductance, and iron. The analysis results have shown high levels of TSS in the Oak Canyon outfall. A complete account of landfill surface water monitoring results can be found in the Vandenberg AFB Annual Detection Monitoring Reports (U.S. Air Force 1996a, 1997b, 1998a, 1999c, 2000a) and in the Annual Storm Water Reports (U.S. Air Force 1997d, 1997e, 1998e, 1999c, 2000b).

3.1.2.2 NPDES Permit

In 1972, the Federal Water Pollution Control Act (also referred to as the Clean Water Act [CWA]) was amended to provide that the discharge of pollutants to waters of the United States from any point source is effectively prohibited unless the discharge is in compliance with the NPDES program. The 1987 amendments to the CWA added Section 402(p) which establishes a framework for regulating municipal, selected industrial, and construction storm water discharges under the NPDES Program. On November 16, 1990, the United States Environmental Protection Agency (U.S. EPA) published final regulations that establish storm water permit application requirements for specified categories of industries. The regulations require a NPDES permit for discharge of storm water associated with industrial activity either directly to surface waters or indirectly through municipal separate storm sewers. In California, these regulations are implemented through the Statewide General Permit No. CAS000001, regulated by the SWRCB. Storm water discharges associated with Vandenberg AFB landfill activities are covered under the Statewide General Permit.

Storm water discharges associated with construction projects are required to comply with SWRCB regulations under the General Permit for storm water discharges associated with construction activities, No. CAS000002. This General Permit applies to construction projects that disturb more than 5 acres. Coverage under the General Permit would, therefore, be required for the Proposed Action, Alternative 1, Alternative 2, or Alternative 3. The General Permit requires construction contractors to prepare a SWPPP, and perform monitoring and reporting.

3.1.2.3 Waste Discharge Requirements 94-26

Groundwater and surface water monitoring at the landfill are regulated by WDR 94-26 issued on June 3, 1994, by the California Regional Water Quality Control Board (RWQCB). The WDR incorporates all criteria applicable to solid waste disposal sites, particularly criteria established in 27 CCR and criteria

established in 40 CFR Parts 257 and 258 (known as Subtitle D), promulgated October 9, 1991. The Vandenberg AFB Annual and Quarterly Detection Monitoring Reports address requirements of WDR 94-26 including, but not limited to, groundwater quality at detection monitoring wells, groundwater flow and direction at the landfill, surface water quality at the five detection monitoring points, leachate monitoring and control systems, and run-on/runoff control facilities.

3.1.2.4 Groundwater

Groundwater on Burton Mesa generally occurs as small lenses of water perched on low-permeability layers in the thin sediment layer overlying bedrock; in thin, linear zones in paleochannels eroded in the bedrock; or in bedrock fractures (U.S. Air Force 2002). According to information obtained from subsurface investigations of IRP Site 3 (located in the northern portion of the project area) most of the groundwater zones have historically ranged from 3 feet below ground surface (bgs) in monitoring well 3-MW-5 to approximately 54 feet bgs in well 3-MW-12D. The substantial variability in groundwater elevations on the mesa results from infiltrating groundwater being intercepted by discontinuous clay layers and cemented sand stringers within the alluvium (U.S. Air Force, in preparation). Because of multiple discontinuous clay layers at various depths, very little groundwater reaches the bedrock/surficial-sediment contact. Results obtained during one remedial investigation at Site 3 indicate that a continuous piezometric surface is not present and direction cannot be reliably calculated (Jacobs Engineering Group, Inc. [JEG] 1997; U.S. Air Force 2002). The cantonment area underground storm drain system is the primary source of groundwater recharge to Site 3 (JEG 1994a). Groundwater at Site 3 is monitored quarterly (Tetra Tech Inc. 2000).

Geotechnical borings were drilled at eight points along the proposed storm drain alignment in March 2000. Groundwater was encountered in three of the borings, all of which are within IRP Site 3 or the adjacent area to the southeast. No groundwater was encountered in the other five borings. Though free groundwater was not encountered in the other five borings, several very moist to near saturated zones were found at variable depths. Water levels fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, and climatic conditions as well as other factors (S/G Testing Laboratories [S/G] 2000). Groundwater throughout the entire project area may not be limited to the locations of the three geotechnical borings where groundwater was found.

There is no published information, and no geotechnical borings were done, along the pipeline alignment draining into Oak Canyon where Alternatives 1 and 2 would discharge. Groundwater in these areas is assumed to follow the general Burton Mesa pattern of discontinuous lenses of shallow perched groundwater.

Groundwater beneath the landfill occurs in alluvial sediments in Oak Canyon, and in the bedrock below. The water-bearing unit in the Oak Canyon alluvial fill underlies the bottom of the landfilled materials at depths of 5 to 30 feet bgs. Groundwater flow in the alluvial fill generally appears to follow the canyon contours and is likely affected by localized topography of the bedrock. Source areas for recharge of this water-bearing unit appear to be primarily from surface water/groundwater drainage at the northwestern edge of Oak Canyon, upgradient of the landfill. The bedrock aquifer in the upper Monterey Formation underlies the landfill at approximately 50 feet bgs. In 1983, the Air Force installed a groundwater extraction system to dewater the landfill, lower the groundwater table, and prevent the interaction of buried waste and water and the formation of leachate (U.S. Air Force 1999a).

3.2 GEOLOGY AND SOILS

3.2.1 Regional Geologic Setting

Vandenberg AFB is located in the Santa Maria Basin, a wedge-shaped lowland area bounded on the northeast by the San Raphael Mountains of the Southern Coast Ranges, on the south by the Santa Ynez Mountains of the Western Transverse Ranges, and on the west by the Pacific Ocean (Hunt 1993). The Southern Coast Ranges, located north of the Santa Ynez River, comprise northwest-southeast trending faults and folds of the earth's crust that appear as elongate valleys and ranges on the surface. The Western Transverse Ranges are located south of the Santa Ynez River and comprise east-west trending valleys and ranges (Norris and Webb 1990). Major geomorphic features of the Santa Maria Basin on Vandenberg AFB include the Casmalia and Purisima Hills, San Antonio Terrace, Barka Slough, Lompoc Valley, Burton Mesa, and beaches, rocky headlands, and points.

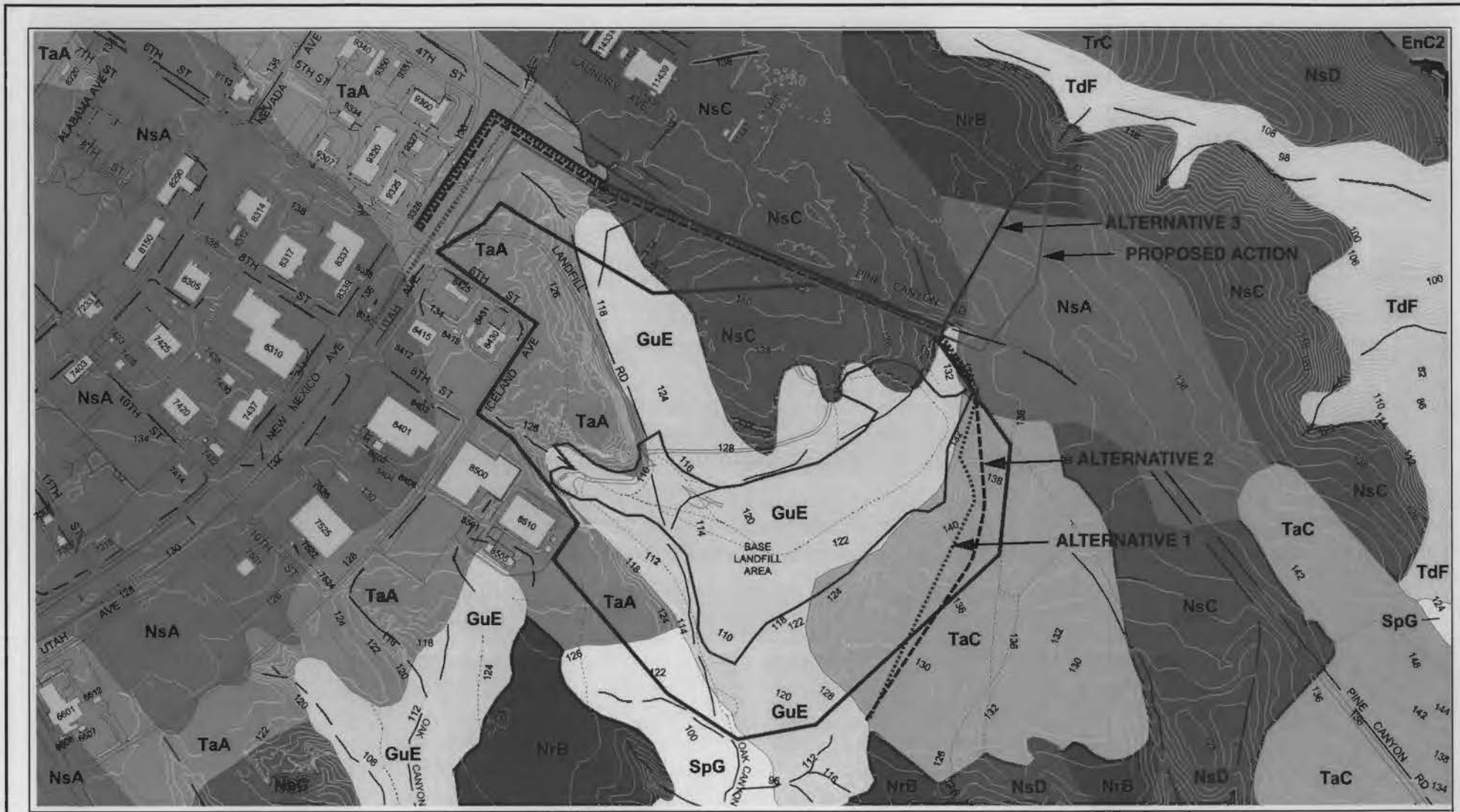
The base is underlain predominantly by marine sedimentary rocks of Late Mesozoic and Cenozoic age. The basal unit underlying the entire area is the Franciscan Assemblage of Mesozoic age (Dibblee 1950), which consists of marine sedimentary, metamorphic, and igneous rocks (Dibblee 1988).

3.2.2 Local Geologic Setting

The project area is located on the edge of Burton Mesa, a wide erosional platform that rises approximately 300 feet above the San Antonio Creek floodplain to the north, and about 400 feet above the Santa Ynez River floodplain to the south. Bedrock near the project location consists of the Monterey and Sisquoc Formations. The Monterey Formation consists of siliceous shale, diatomite, and chert, and is exposed on most of the walls of Oak Canyon. The Sisquoc Formation consists of light gray diatomaceous claystone and shale, and is exposed in the eastern branch of Oak Canyon (Dibblee 1988). The bedrock is conformably overlain by approximately 15 to 45 feet of unconsolidated sediments known as Orcutt Sand. In the project area, the Orcutt Sand consists of fine, wind-deposited sands with high clay content, interspersed with clays (U.S. Air Force, in preparation). The elevation of the first segment of the Proposed Action and Alternatives 1, 2, and 3 is 448 feet above msl. The topography over the remainder of the project routes is varied, sloping upward to the southeast along Pine Canyon Road, then downward on either side of Pine Canyon Road. The ground surface elevation at the outlet of the Proposed Action and Alternative 3 is 427 feet above msl. The surface elevations at the outlets of both Alternatives 1 and 2 are approximately 422 feet above msl.

3.2.3 Soils

The U.S. Soil Conservation Service (Shipman 1972) identified and mapped the soils included in the project areas as sand, sandy clay, loamy sand, and clay soils. The Tangair-Narlon complex (soil mapping unit) are the predominant soils occurring on Burton Mesa and in the project area. Figure 3-2 is a map of the distribution of surficial soil types; the soil types are also listed in Table 3-2. A brief description of the soil types found along the project route follows.



LEGEND

- CONTOUR LINES 4 METER INTERVALS (MSL, NAD83)
- RAILROAD
- PAVED ROADS AND PARKING
- UNPAVED ROADS AND TRAILS
- DRAINAGE
- 6501 BUILDING
- LANDFILL BOUNDARY
- SUBTITLE "D" BOUNDARY
- PROPOSED ACTION
- ALTERNATIVE 1
- ALTERNATIVE 2
- ALTERNATIVE 3

SOIL LEGEND

EnC2	Elder Shaly loam	SpG	Sedimentary rock land
GuE	Gullied land	TaA	Tangair sand
NrB	Narlon sand	TaC	Tangair sand
NsA	Narlon loamy sand	TdF	Terrace escarpment, loamy
NsC	Narlon loamy sand	TrC	Tierra loam
NsD	Narlon loamy sand		

Note: All three routes originate at New Mexico and 6th St. and split as indicated.

300 0 300 600 FEET

Base map from 30th CES CECB Base Planning, April 2000

LANDFILL DRAINAGE IMPROVEMENTS
GEOLOGY AND SOILS
VANDENBERG AFB

TASK NO.	DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
12102 -14	03/18/03	Vance Hoyt RANDALL	VAFB	Graphics:\TA\TA508\ 3-2Geology.ai	3-2

This page intentionally left blank.

Table 3-2
Surficial Soil Types in Project Vicinity

U.S. Soil Conservation Service Map Symbol	Description
EnC2	Elder shaly loam, 2 to 9 percent slopes
GuE	Gullied land
NrB	Narlon sand, 0 to 5 percent slopes
NsA	Narlon loamy sand, 0 to 2 percent slopes
NsC	Narlon loamy sand, 2 to 9 percent slopes
NsD	Narlon loamy sand, 9 to 15 percent slopes
SpG	Sedimentary rock land
TaA	Tangair sand 0 to 2 percent slopes
TaC	Tangair sand 2 to 9 percent slopes
TdF	Terrace escarpment, loamy
TrC	Tierra loam

Tangair-Narlon Complex

The Tangair-Narlon association consists of nearly level to gently sloping, somewhat poorly to moderately well drained sands, and loamy sands on terraces. The soils of the Tangair-Narlon complex formed in marine terraces, and generally have a slope of 0 to 15 percent.

Tangair soils have a surface layer of light gray sand. The subsoil is a loamy sand with iron concretions, which overlies white sand. Tangair soils are somewhat poorly drained. The surface sands are highly permeable, but a layer of slowly permeable material lies at depths of 50 to 60 inches. A perched water table sometimes forms above this material immediately after a period of rain or irrigation. The shrink-swell potential for the Tangair soils is low. Surface runoff on the Tangair soils of 0 to 2 percent slopes is very slow to slow, and the hazard of erosion by water is none to slight. However, the hazard of soil blowing is high. Tangair soils with 0 to 2 percent slopes are found along the first segment of the project route for the Proposed Action and all alternatives, in the area south of New Mexico Avenue. On Tangair soils of 2 to 9 percent slopes, surface runoff is slow to medium, and the erosion hazard is slight to moderate (Shipman 1972). Tangair soils with 2 to 9 percent slopes are found along the last segment of Alternatives 1 and 2, in the area south of the landfill.

Narlon soils consist of moderately well-drained soils that have a loamy sand surface layer and a clay subsoil. The surface and subsurface layers are loamy sands about 32 inches thick. The subsoil is clay and sandy clay to a depth of 60 inches or more. Sandy marine sediments and diatomaceous shale underlie the subsoil. The permeability of the Narlon soils is very slow. A perched water table often forms above the clay after a heavy rain or irrigation. The sandy Narlon soils have a low shrink-swell potential, while the clay Narlon soils have a high shrink-swell potential. On Narlon soils with 0 to 2 percent slopes, surface runoff is very slow, and the erosion hazard is none to slight (Shipman 1972). The hazard of soil blowing is moderate. Narlon soils with 0 to 2 percent slopes are found along the last segment of the Proposed Action and Alternative 3 route, north of Pine Canyon Road. On Narlon soils with 2 to 9 percent slopes, surface runoff is slow to medium and the erosion hazard is moderate. Narlon soils with 2 to 9 percent slopes are found on the middle portion of the project route for the Proposed Action and Alternatives, along Pine Canyon Road.

3.2.4 Seismicity

The project site is located in a seismically active region of central California. Burton Mesa is generally bounded by the Hosgri fault to the west, the Lion's Head fault zone to the north-northwest, and the Santa Ynez fault zone to the east-southeast. The generally east-west trending Los Alamos Baseline fault zone is located east of the project site (Alterman *et al.* 1994). Earthquakes on one of the above fault zones or more distant regional faults could produce strong ground shaking at the project site.

The Lion's Head fault is about 8.5 miles north of the project area. It is a northwest-southeast trending fault that is oriented roughly parallel to the coastline. The Lion's Head fault may be an extension of the Baseline/Los Alamos Fault system, which extends from Lake Cachuma to the San Antonio Valley. The Lion's Head and the Baseline/Los Alamos faults are considered to be active (International Conference of Building Officials 1997; Woodward-Clyde Consultants [Woodward-Clyde] 1985). Another active fault, the Pacifico Fault, crosses the southern tip of Vandenberg AFB at Jalama Beach County Park, approximately 15 miles south of the project location. Other known active faults in Santa Barbara County include the Big Pine, Graveyard-Turkey Trap, Mesa, More Ranch, Nacimiento, Santa Cruz Island, Santa Rosa Island, and Santa Ynez faults. Movement of any of these known active faults would potentially affect the project area, as would activity along the regional San Andreas fault system (U.S. Air Force 1987; U.S. Army Corps of Engineers [USACE] 1988).

In Santa Barbara County, the recurrence interval for major earthquakes (magnitudes 5.2 to 7.0 on the Richter scale) is wide ranging, from every 14 to 115 years. Although Vandenberg AFB is located in an area subject to earthquakes, the base has not reported damage to its structures from earthquakes (U.S. Air Force 1987).

3.2.5 Geologic Hazards

Potential structural damage, landslides, tsunamis, surface fault ruptures, and liquefaction are related to regional earthquake activity. Due to the gently sloping topography of the project area, landslides are not considered a potential hazard. Tsunamis are unusually large and destructive waves caused by undersea earthquakes. In the event of a tsunami reaching the coast of Vandenberg AFB, it is likely the project location would not be affected due to the elevation and distance of Burton Mesa from the ocean (approximately 400 feet and 4.5 miles, respectively). The potential for tsunamis is considered low. The potential for surface fault rupture on Vandenberg AFB is generally considered to be low. There are no known active or potentially active faults in the project area. However, because the Lion's Head fault is an active fault, the potential exists for movement along this fault to cause seismic disturbance of the project site. At present, there are no known areas on Vandenberg AFB where liquefaction has occurred (U.S. Air Force 1987). Liquefaction is the sudden loss in shear strength because of a rapid increase in soil pore water pressures resulting from cyclic loading during a seismic event. There may be a potential liquefaction hazard on the portions of the project route where perched water tables overlie clay.

3.3 BIOLOGICAL RESOURCES

3.3.1 Regional Setting

Vandenberg AFB is located in a transitional ecological region that lies at the northern and southern distributional limits of many species, and contains diverse biological resources of considerable importance. The base provides habitat for many federal- and state-listed threatened, endangered, candidate, and special concern plant and animal species. Fourteen major vegetation and habitat types have been described and mapped on the base (U.S. Air Force 1996b). Among these vegetation types, the

major communities found in the project area are coast live oak woodland, willow woodland, Burton Mesa chaparral, coastal sage scrub, freshwater marsh, and nonnative grassland. Small areas of vernal freshwater marsh wetlands also occur.

3.3.2 Methods

For this project, biological field surveys were conducted on foot along the drainage alignment routes and in tributaries below the storm drain outlets. Surveys also were carried out in the three lakes in Lake Canyon, in the northern section of Oak Canyon, and the area in the northern part of the landfill where storm water currently flows in unlined drainages. The areas surveyed extended 90 meters on each side of the centerline of the proposed storm drain, and included a 15-meter-wide corridor around the lakes in Lake Canyon and the Oak Canyon drainage downstream of the landfill to its first confluence with a tributary. The routes for Alternatives 1, 2, and 3 were surveyed during primary surveys conducted in April and May 2000; supplemental surveys were conducted for the Proposed Action in April 2002 (Attachment 1, Figure 1). Dominant plant species and vegetation types were identified, and wildlife was observed by sight, sound, tracks, or other sign. The potential occurrence of other species was examined by identifying the documented or known habitat preferences of species.

Surveys for special-status species potentially occurring in the area were conducted concurrently with the biological field surveys. Field surveys for the federally threatened California red-legged frog (*Rana aurora draytonii*) were carried out in the three lakes in Lake Canyon. Targeted surveys for this species were scheduled, following U.S. Fish and Wildlife Service (USFWS) protocol, to commence after May 1; two daytime and two nighttime surveys were conducted. Protocol surveys for listed bird species were not required, although they were included in the list of special-status target species to be surveyed. Bird surveys were timed to occur during the breeding season of many species.

Surveys for jurisdictional waters of the United States and wetlands were conducted along the drainage alignment routes and in tributaries below the storm drain outlets. Field surveys also were carried out in the section of Oak Canyon downstream of the landfill. Waters of the United States and wetlands in these parts of the project area were investigated in April 2000. Wetlands in additional areas were surveyed in April 2002 (Appendix A, Figure 1). Wetland resources in the landfill were surveyed and delineated in 1997 (U.S. Air Force 1997c), therefore, that area was not resurveyed for the current project. The USACE is responsible for determining jurisdictional boundaries of waters of the United States and wetlands for regulatory and permitting purposes under Section 404 of the CWA. The jurisdictional limit of waters of the United States is identified by the extent of the ordinary high water mark. For delineating wetlands, the USACE has developed a field method using a "three parameter test" that considers hydrophytic vegetation, wetland hydrology, and hydric soils. Under the USACE definition, an area is considered a wetland only if indicators of all three parameters are present, except for wetland types designated as "problem areas" or conditions considered to be significantly disturbed or "atypical" (Environmental Laboratory 1987). Complete documentation for the biological and wetland surveys performed for this EA has been provided in a separate Natural Resources Survey Report (Appendix A).

3.3.3 Special-Status Biological Resources

Among the plant communities found in the project survey areas, willow woodland, Burton Mesa chaparral (Central Coast maritime chaparral), and freshwater marsh are designated sensitive by the California Department of Fish and Game (CDFG). The CDFG ranks Central Coast arroyo willow riparian forest (willow woodland) as S3.2 (threatened). Riparian systems are important due to their high biological productivity and value for providing food and cover for wildlife, particularly avifauna. In the project area, this community occurs in the northern part of the landfill, along the tributary leading from

the Proposed Action and Alternative 3 outlet into Lake Canyon, and in Lake Canyon. Central Coast maritime chaparral has the state rank of S2.2 (restricted, threatened). It is a regionally declining plant community, and much of its remaining acreage in California occurs on the base, where it also has reduced in area considerably over the years. Many regionally endemic species and special-status plants are found in this type of chaparral on Vandenberg AFB. In the project area, Burton Mesa chaparral occurs as the dominant plant community along the Alternative 1 and 2 routes east of the landfill, and also is found on the upper slopes of Oak Canyon. Freshwater marsh has a CDFG rank of S2.1 (restricted, very threatened). In the project area, freshwater marshes occur in Lake Canyon; small patches of this community are found in the landfill and in the upstream part of the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon. A unique variant of this habitat occurs in shallow depressions, flats, or swales scattered in grasslands, coastal scrub, or chaparral on the Burton Mesa. Small areas of this type of wetland occur scattered along the routes north of the landfill, and in the southern part of the Proposed Action and Alternative 3 route, north of Pine Canyon Road.

Eight special-status plant species were observed during field surveys in the project area: sand mesa or shagbark manzanita (*Arctostaphylos rudis*, California Native Plant Society [CNPS] List 1B); dune larkspur (*Delphinium parryi* ssp. *blochmaniae*, CNPS List 1B); Blochman's dudleya (*Dudleya blochmaniae* ssp. *blochmaniae*, CNPS List 1B); black-flowered figwort (*Scrophularia atrata*, CNPS List 1B); La Purisima manzanita (*Arctostaphylos purissima*, CNPS List 1B); San Luis Obispo wallflower (*Erysimum capitatum* ssp. *lompocense*, CNPS List 4); and California spineflower (*Mucronea californica*, CNPS List 4).

Sand mesa manzanita was observed in Burton Mesa chaparral along the Alternative 1 and 2 routes east of the landfill and on the upper slopes of Oak Canyon. It also is scattered on the slopes of the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon, and around the Upper Lake in Lake Canyon. Dune larkspur was found on the western slopes of the Upper Lake in Lake Canyon (two small populations with about 30 plants each). Blochman's dudleya was found in the southern part of the Proposed Action and Alternative 3 route and north of Pine Canyon Road (one population with about 700 to 1,000 plants). Black-flowered figwort was found along the eastern shore of the Upper Lake (about 500 plants), the western shore of the Lower Lake (about 200 scattered plants), and in Oak Canyon (two small populations with about 10 to 20 plants each).

La Purisima manzanita is the dominant species in the Burton Mesa chaparral found in the project area. It also occurs scattered in different locations along the Proposed Action route, near its outlet and on the slopes of the tributary leading from the outlet into Lake Canyon, and around the Upper and Lower Lakes of Lake Canyon. San Luis Obispo wallflower was found in coastal scrub on the slopes of the lower part of the tributary leading into Lake Canyon from the Proposed Action and Alternative 3 outlet, and on slopes near the Middle Lake. California spineflower was found on the western slopes of the Upper Lake in Lake Canyon. Round woolly marbles was observed in scattered locations in vernal wetland or mesic areas along all routes.

Special-status wildlife species observed during field surveys in or near the project area were California red-legged frog (*Rana aurora draytonii*, federally listed as threatened [FT]); southwestern pond turtle (*Clemmys marmorata pallida*, federal species of concern [FS]); and Bell's sage sparrow (*Amphispiza belli belli*, FS). Sightings of the California red-legged frog during field surveys for this project are the only known occurrences in this area, even though the lakes have been repeatedly surveyed for this species. The western least bittern (*Ixobrychus exilis hesperis*, FS) and the California horned lizard (*Phrynosoma coronatum frontale*, FS) have been recorded near the project area, but were not observed in the current surveys.

Two adult California red-legged frogs were observed in a small marsh on the east side of the road at the northeast corner of the Lower Lake in Lake Canyon. Two sightings of lone male individuals of the southwestern pond turtle were made in each of the three lakes in Lake Canyon. An individual Bell's sage sparrow was heard singing during the current field surveys, but appeared to be outside the project area, west of Oak Canyon.

Within the project area, potential habitat exists for the federally endangered southwestern willow flycatcher (*Empidonax traillii extimus*) in the willow woodland of Lake Canyon. Suitable habitat is found in areas that have a mixture of closed and open canopy vegetation, and where standing water is present. This migratory bird species occurs on Vandenberg AFB from May to August, breeding from mid-May to mid-July; if present in the project area, it should have been observable during the current field surveys. It was not observed, however, and has been sighted in undisturbed riparian willow woodland only in two locations along the Santa Ynez River within 3 miles of the ocean.

3.3.4 Biological Survey Results

3.3.4.1 Proposed Action

Mowed annual introduced grasses and ruderal vegetation, including the exotic species iceplant (*Carpobrotus edulis*) and veldt grass (*Ehrharta calycina*), are found at the start of the Proposed Action route along New Mexico Avenue. Scattered native perennial needlegrasses (*Nassella* spp.) also occur. Patches of arroyo willow are found along the northern part of the landfill. As the route continues southeast along Pine Canyon Road, coastal sage scrub species become more prevalent, and grade into chaparral with scattered coast live oaks.

A topographic depression (location of sampling station [SS]-3) exists where the Proposed Action and Alternative 3 routes diverge from the Alternative 1 and 2 routes. This disturbed area near the road has relatively diverse vegetation, with annual grasses, ruderal species, and coastal sage scrub with coyote brush, California sagebrush, and goldenbush (*Isocoma menziesii* var. *menziesii*). In addition, there are three patches each of coast live oak and arroyo willow. The exotic species iceplant also is present in this area. Lower parts of the depression have hedge nettle (*Stachys bullata*), western ragweed (*Ambrosia psilostachya*), and rushes (*Juncus* spp.) in the understory.

Northeast of Pine Canyon Road, the Proposed Action route crosses an area of nonnative grassland with scattered native perennial needlegrasses. The northern part of the Proposed Action route near the outlet has coastal sage scrub vegetation dominated by coyote brush, California sagebrush, western poison oak, California coffeeberry (*Rhamnus californica* ssp. *californica*), and pitcher sage (*Salvia spathacea*); annual grasses are found in the understory. The special-status species La Purisima manzanita is found scattered near the outlet area.

Within the survey area for the Proposed Action route, sign was noted for the mammal species mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), and pocket gopher (*Thomomys bottae*). Along New Mexico Road and Pine Canyon Road, 17 bird species were observed. The most common species were house finch (*Carpodacus mexicanus*), spotted towhee (*Pipilo maculatus*), California towhee (*Pipilo crissalis*), and bushtit (*Psaltriparus minimus*). In the section north of Pine Canyon Road, other common species were wrentit (*Chamaea fasciata*) and western meadowlark (*Sturnella neglecta*). A pair of white-tailed kites (*Elanus caeruleus*) and a great egret (*Casmerodius albus*) were observed hunting in the grassland. Herpetofauna observed on the Proposed Action route included the western fence lizard (*Sceloporus occidentalis*) and Pacific treefrog (*Hyla regilla*).

3.3.4.2 Alternative 1

The Alternative 1 route along Utah Avenue and Pine Canyon Road would be similar to the Proposed Action route. Observed plant and animal species are the same for this section of Alternative 1 and for the topographic depression where the routes diverge. South of the topographic depression at the northeast corner of the landfill, the Alternative 1 route would run near the fence of the Subtitle D boundary, the active fill area at the landfill (Figure 1). In this area, activities within the landfill have created a berm which appears to have dammed surface water runoff. Ponding has occurred in this disturbed area, and wetland species are present, including brown-headed rush (*Juncus phaeocephalus* var. *phaeocephalus*), broad-leaved cattail (*Typha latifolia*), and creeping spikerush (*Eleocharis macrostachya*); saplings of arroyo willow (*Salix lasiolepis*) suggest that ponding may have occurred relatively recently. This area is surrounded by coyote brush (*Baccharis pilularis*) and coast live oaks. The invasive exotic species pampas grass (*Cortaderia jubata*) also is present.

Continuing south, the Alternative 1 route would enter an area with relatively dense Burton Mesa chaparral. The special-status species La Purisima manzanita is the dominant species in the chaparral, particularly in the northern part of this section. Sand mesa manzanita is more prevalent in the southern part. Round woolly marbles (*Psilocarphus tenellus* var. *globiferus*) was observed in scattered locations in disturbed mesic areas along the Alternative 1 route.

The southern part of the route has more disturbed chaparral. The area near the outlet has been used in the past as a wastewater disposal area; it is surrounded by a fence, and a sprinkler system is present within the enclosure. Species observed in the enclosure include coyote brush, chamise, black sage (*Salvia mellifera*), and La Purisima manzanita. Vegetation here has been degraded by the invasion of pampas grass and iceplant. Leachate from the wastewater system apparently has damaged some of the native shrubs.

South of the area where the three routes diverge, sign was noted along the Alternative 1 route for mule deer and coyote. The number of bird species observed was 26. The most common species were Bewick's wren (*Thryomanes bewickii*), wrentit (*Chamaea fasciata*), bushtit (*Psaltriparus minimus*), spotted towhee (*Pipilo erythrophthalmus clementae*), and California towhee (*Pipilo crissalis*). An individual of the special-status species Bell's sage sparrow (*Amphispiza belli belli*, FS) was heard singing within earshot of the outlet of Alternative 1, but appeared to be outside the project area, west of Oak Canyon. Herpetofauna observed on the Alternative 1 route included the southern alligator lizard (*Gerrhonotus multicarinata*), western fence lizard (*Sceloporus occidentalis*), and Pacific treefrog.

3.3.4.3 Alternative 2

The Alternative 2 route along Utah Avenue and Pine Canyon Road would be similar to the Alternative 1 route. After the divergence of the Proposed Action and Alternative 3 routes, the Alternative 2 route would be the same as Alternative 1 in the topographic depression at the northeast corner of the landfill. Observed plant and animal species are the same for this section of Alternative 2 as for the previously described routes. After the topographic depression, Alternative 2 would continue southward east of Alternative 1.

For the most part, plant and animal species are the same for Alternatives 2 and 1. Alternative 2, however, would bypass the disturbed wet area near the fence of the Subtitle D boundary. The chaparral present along Alternative 2 also is dense, and is less disturbed than that found along Alternative 1. Species composition is similar, but more chamise is present in the chaparral. The outlet for Alternative 2 would be in the same location as that for Alternative 1.

3.3.4.4 Alternative 3

The Alternative 3 route would be similar to the Alternative 1 and Alternative 2 routes until the crossing of Pine Canyon Road. Northeast of Pine Canyon Road, the Alternative 3 route would cross an area of nonnative grassland with numerous scattered vernal wetland swales dominated by brown-headed rush (*Juncus phaeocephalus* var. *phaeocephalus*). The special-status species Blochman's dudleya was found in the southern part of this area, near swales containing the vernal pool plant coyote-thistle (*Eryngium armatum*). Round woolly marbles was observed in scattered locations in vernal wetland or mesic areas on the Alternative 3 route, along and northeast of Pine Canyon Road. Scattered native perennial needlegrasses also occur in the nonnative grassland.

3.3.4.5 Existing Drainages Within the Landfill

Existing drainages within the landfill are within the survey area of the Proposed Project and are included in the analysis. Storm water runoff from the cantonment area and the mesa north of the landfill currently is directed through culverts into several unlined drainages within the landfill. The main drainage is a historical natural drainage, and is mapped as an intermittent stream in the soil survey for the region (U.S. Air Force 1997d; U.S. Department of Agriculture 1972). The slopes of the drainage have coastal sage scrub, chaparral including the special-status species La Purisima manzanita, and ruderal species. Within the drainage at lower elevations, willow woodland is found, along with two small freshwater marsh areas. Arroyo willow dominates the overstory, and the understory and marshy areas have western poison oak, broad-leaved cattail, western goldenrod (*Euthamia occidentalis*), clustered field sedge (*Carex praegracilis*), and various species of rushes.

In the landfill area, sign was noted for mule deer and coyote. The number of bird species observed was 23. The most common birds were European starling (*Sturnus vulgaris*), song sparrow (*Melospiza melodia*), wrentit, spotted towhee, and Wilson's warbler (*Wilsonia pusilla*); an individual yellow warbler (*Dendroica petechia*) was heard singing. Pools of water in the landfill drainage had larvae of Pacific treefrogs; no other herpetofauna were observed.

3.3.4.6 Lake Canyon

The outlet for the Proposed Action and Alternative 3 occurs in upland vegetation above a draw leading to a tributary to Lake Canyon. The draw has scattered vegetation, including coyote brush, California sagebrush, toyon (*Heteromeles arbutifolia*), coast live oak, and bracken fern (*Pteridium aquilinum* var. *pubescens*). A marsh with brown-headed rush and basket rush (*Juncus textilis*) occurs upstream of the main tributary drainage leading to Lake Canyon. This drainage is occupied with willow woodland in the upper part, and coast live oak woodland in the lower part near the lakes. The oak woodland has mature trees, and also contains several large black cottonwoods (*Populus balsamifera* ssp. *trichocarpa*). The understory is dominated by western poison oak and California blackberry (*Rubus ursinus*). The slopes of the tributary drainage above the trees are covered with diverse chaparral and coastal sage scrub species, including chamise (*Adenostoma fasciculatum*), black sage, spiny redberry (*Rhamnus crocea*), California monkey-flower (*Mimulus aurantiacus*), chaparral mallow (*Malacothamnus fasciculatus*), golden yarrow (*Eriophyllum confertiflorum* var. *confertiflorum*), California broom (*Lotus scoparius* var. *scoparius*), and California-aster (*Lessingia filaginifolia* var. *filaginifolia*).

The three lakes in Lake Canyon have open water with freshwater marsh vegetation at the edges dominated by California bulrush (*Scirpus californicus*), tule (*Scirpus acutus* var. *occidentalis*), and broad-leaved cattail. Mesic areas along the shorelines have willow woodland dominated by arroyo willow. Associated species in the willow woodland included sedges (*Carex barbarae*, *C. harfordii*), hoary nettle

(*Urtica dioica* ssp. *holosericea*), basket rush, western poison oak, California blackberry, western goldenrod (*Euthamia occidentalis*), hedge nettle (*Stachys bullata*), mugwort (*Artemisia douglasiana*), gooseberry (*Ribes divaricatum*), California rose (*Rosa californica*), wax myrtle (*Myrica californica*), branching phacelia (*Phacelia ramosissima* var. *montereyensis*), and nightshade (*Solanum xanti*).

The special-status species sand mesa manzanita was observed scattered on the slopes of the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon, and around the Upper Lake in Lake Canyon. Dune larkspur was found on the western slopes of the Upper Lake in Lake Canyon (two small populations with about 30 plants each). Black-flowered figwort was found along the eastern shore of the Upper Lake (about 500 plants) and the western shore of the Lower Lake (about 200 scattered plants). La Purisima manzanita occurs scattered in different locations on the slopes of the tributary leading from the outlet of the Proposed Action and Alternative 3 into Lake Canyon, and around the Upper and Lower Lakes of Lake Canyon. San Luis Obispo wallflower was found in coastal scrub on the slopes of the lower part of the tributary leading into Lake Canyon from the Proposed Action and Alternative 3 outlet and on slopes near the Middle Lake. California spineflower was found on the western slopes of the Upper Lake in Lake Canyon.

In the Lake Canyon survey area, sign was noted for mule deer and coyote. The number of bird species recorded was relatively high, with 29 species noted at the Upper Lake, 41 at the Middle Lake, and 45 at the Lower Lake. Birds common at all three lakes included Bewick's wren, marsh wren (*Cistothorus palustris*), Wilson's warbler, and song sparrow. Bushtit, wrentit, orange-crowned warbler (*Vermivora celata*), and spotted towhee were more abundant at the Upper and Middle Lakes, compared to the Lower Lake. The common yellowthroat (*Geothlypis trichas*) was more abundant at the Middle and Lower Lakes, compared to the Upper Lake. The American goldfinch (*Carduelis tristis*) was common at the Middle Lake, but was not recorded at the other two lakes. The house finch (*Carpodacus mexicanus*) was present at the Lower Lake, but not at the other two lakes. Waterfowl observations included ruddy duck (*Oxyura jamaicensis*) at all three lakes, and mallard (*Anas platyrhynchos*) at the Upper and Lower Lakes. Other species of note included yellow warbler (*Dendroica petechia*), recorded at the Upper and Lower Lakes, and yellow-breasted chat (*Icteria virens*) at the Middle and Lower Lakes. Additional noteworthy observations included Cassin's vireo (*Vireo cassinii*), black-throated gray warbler (*Dendroica nigrescens*), and Townsend's warbler (*Dendroica townsendi*) at the Middle Lake, and the white-tailed kite (*Elanus caeruleus*), spotted sandpiper (*Actitis macularia*), great blue heron (*Ardea herodias*), and black-crowned night heron (*Nycticorax nycticorax*) at the Lower Lake. A hairy woodpecker (*Picoides villosus*) nest cavity with vocal fledglings and a house finch (*Carpodacus mexicanus*) nest also were seen at the Lower Lake.

Two adults of the federally threatened species California red-legged frog were seen in a small marsh on the east side of the road at the northeast corner of the Lower Lake. The observations were made from within 2 meters, and the frogs were positively identified by their dorsolateral folds and the lack of a clearly defined tympanum. Two sightings of lone male individuals of the special-status species southwestern pond turtle were made in each of the three lakes in Lake Canyon. They were seen basking on mats of bulrushes and tule. Numerous observations of western fence lizard, Pacific treefrog, and bullfrog (*Rana catesbeiana*) also were made at all three lakes.

3.3.4.7 Oak Canyon

The outlet for Alternatives 1 and 2 would be located in an upland area about 200 to 300 feet upslope of a small tributary canyon to Oak Canyon. The tributary canyon has steep, rocky slopes, and the drainage is occupied by oak woodland, with chaparral species present on the upper slopes. Coast live oak dominates the overstory, and species present in the understory include western poison oak, hedge, and California

blackberry. These species also are present in the main drainage of Oak Canyon, along with scattered arroyo willow. No ponds or freshwater marshes were observed in Oak Canyon.

The special-status species sand mesa manzanita was observed in Burton Mesa chaparral on the upper slopes of Oak Canyon, with La Purisima manzanita. Black-flowered figwort was found in the tributary canyon and in the main drainage of Oak Canyon (two small populations with about 10 to 20 plants each).

Twenty-four bird species were observed in Oak Canyon. The most common birds were bushtit, wrentit, Bewick's wren, orange-crowned warbler, Wilson's warbler, and spotted towhee. A northern rough-winged swallow (*Stelgidopteryx serripennis*) was seen on a nest 6 feet up the canyon bank. Herpetofauna noted included a dead bullfrog; the eggs and tadpoles of Pacific treefrog also were seen.

3.3.5 Waters of the United States and Wetlands

3.3.5.1 Proposed Action

Along the Proposed Action route, wetland surveys were carried out at fourteen sampling stations, SS-3 through SS-10 and SS-12 through SS-17. Station SS-3 was located in the topographic depression along Pine Canyon Road, and stations SS-4 through SS-6 and SS-12 through SS-17 were established in the area of vernal swales north of Pine Canyon Road. Station SS-7 was located in the upstream part of the tributary leading from the Proposed Action outlet to Lake Canyon, station SS-8 was established in a patch of willow woodland in the northeastern part of the landfill, and stations SS-9 and SS-10 in vernal swales near Pine Canyon Road in the same area.

Atypical situations were observed at two stations, SS-3 and SS-10. Positive indicators for hydrophytic vegetation were found at all stations except SS-3, where a mixture of plant communities and species is present and at SS-13 and SS-15, which were placed in upland areas to investigate a potential realignment of the Proposed Action. Wetland hydrology and hydric soils indicators were noted during the surveys at all stations, except stations SS-13 and SS-15. The area where station SS-3 was located is in a historical natural drainage tributary to Oak Canyon. Drainage patterns have been modified here by flow being directed through culverts, and fill has occurred downstream of the station. Although this topographic depression has been subject to hydrology modifications and soil disturbance, the station was determined to be in USACE waters of the United States because of its location in a tributary to Oak Canyon. Stations SS-4 through SS-6, SS-9, SS-10, SS-12, SS-14, SS-16, and SS-17, were determined to occur in vernal wetlands, and stations SS-7 and SS-8 were in willow woodland wetlands. Station SS-10 had field indicators for all three wetland parameters, but may not qualify as a wetland because the wetland has been created artificially and is not located within or associated with Waters of the United States or navigable waters. Surface runoff from the mesa north of Pine Canyon Road has been obstructed by the road and directed through a culvert; the wetland likely has been created by outflow from the culvert. While SS-10 may not qualify as a jurisdictional wetland, it may qualify as an "isolated wetland" under Executive Order (EO) 11990 as the road that creates this wetland is a permanent feature that has become "naturalized". This road stabilizes the hydrologic character of this area.

3.3.5.2 Alternative 1

Along the Alternative 1 route, wetland surveys were carried out at five sampling stations, SS-3 and SS-8 through SS-11. Station SS-3 is waters of the United States. Stations SS-8, SS-9, and SS-10 are wetlands; again, station SS-8 was established in a patch of willow woodland in the northeastern part of the landfill, and stations SS-9 and SS-10 in vernal swales near Pine Canyon Road in the same area.

Atypical situations were observed at two stations, SS-3 and SS-10. Positive indicators for hydrophytic vegetation were found at all stations except SS-3, where a mixture of plant communities and species is present. Wetland hydrology and hydric soils indicators were noted during the surveys at all stations.

In addition to stations SS-3 and SS-10, an atypical situation also was observed at station SS-11. This station was located in a ponded area at the northeast corner of the landfill where the Alternative 1 route would run near the fence of the Subtitle D boundary. Station SS-11 had positive indicators of hydrophytic vegetation, wetland hydrology, and hydric soils, and therefore was determined to be an atypical wetland. It is atypical since the inundated area present here likely has been created artificially by surface runoff being dammed by a berm within the landfill. With implementation of the project, it is likely that the man-made hydrologic condition at this location will cease to exist due to diversion of storm water flows from the landfill. Therefore, it would not qualify as a jurisdictional wetland or "isolated wetland" protected under Section 404 of the Clean Water Act or EO 11990.

3.3.5.3 Alternative 2

The Alternative 2 route along Utah Avenue and Pine Canyon Road would be similar to the Alternative 1 route. After the divergence of the Proposed Action and Alternative 3 routes, the Alternative 2 route would be the same as Alternative 1 in the topographic depression at the northeast corner of the landfill. After the topographic depression, Alternative 2 would continue southward east of Alternative 1; no potential wetland areas were noted in this section and therefore, no sampling stations were established.

Wetland sampling stations and wetland resources are the same for Alternative 2 as for Alternative 1, with the exception of station SS-11, which is not on the Alternative 2 route, since this alternative would bypass the disturbed wet area near the fence of the Subtitle D boundary. With respect to the other stations located on the Alternative 2 route, station SS-3 is in USACE waters of the United States, and stations SS-8 through SS-10 are in wetlands.

3.3.5.4 Alternative 3

Since Alternative 3 follows a route similar to the one for the Proposed Action, waters of the United States and wetlands found within this route are identical to those found along the route of the Proposed Action.

3.3.5.5 Existing Drainages Within the Landfill

Existing drainages within the landfill are within 50 meters around the project area and are included in the survey for the proposed project. Storm water runoff from the cantonment area and the mesa north of the landfill currently is directed through culverts into several unlined drainages within the landfill. The main drainage is a historical natural drainage, and is mapped as an intermittent stream in the soil survey for the region (U.S. Air Force 1997b; U.S. Department of Agriculture 1972). Jurisdictional wetland resources in the landfill drainage were surveyed and delineated in 1997 (U.S. Air Force 1997c), therefore, the landfill area was not resurveyed for the current project. Details regarding sampling stations and observed wetland parameters are provided in the 1997 report.

3.3.5.6 Lake Canyon

For this project, wetland surveys were not required at the three lakes in Lake Canyon. All three lakes are man-made impoundments, but they occur within the natural drainage of Lake Canyon, a tributary leading into the Santa Ynez River. This tributary is mapped as a blue-line stream on the U.S. Geological Survey (USGS) topographic map. Blue-line streams and their tributaries generally are considered to be USACE

jurisdictional waters of the United States. In addition, impoundments of waters of the United States, otherwise defined as waters, are themselves also considered jurisdictional waters. Therefore, all three lakes in Lake Canyon are jurisdictional resources.

3.3.5.7 Oak Canyon

Wetland surveys in Oak Canyon were carried out at two sampling stations, SS-1 and SS-2, located in riparian coast live oak woodland. Station SS-1 was established in the tributary to Oak Canyon found below the outlet of the Alternative 1 and 2 routes, and SS-2 was located just below the confluence of this tributary and the drainage leading south of the landfill. The hydrophytic vegetation criterion was not met at the two sampling stations. Wetland hydrology was indicated at both stations by the presence of a watercourse with flowing water. Inundation was observed at SS-1, and free water in the soil pit at SS-2. Hydric soils could not be confirmed at either station. The soil was too rocky to dig at SS-1, and soil colors could not be determined for the variable riverwash sand at SS-2. Both stations were determined to qualify as USACE jurisdictional waters of the United States.

3.4 CULTURAL RESOURCES

3.4.1 Cultural Setting

The following summary of prehistory and ethnohistory is modified from Lebow and Moratto (1999). The historic overview derives primarily from Palmer (1999).

3.4.1.1 Prehistory

The prehistory of California's central coast spans the entire Holocene and may extend back to late Pleistocene times. In the Santa Barbara Channel region, a fluted Clovis point found on the surface of a coastal site suggests use of the area possibly as early as 11,000–12,000 years ago (Erlandson *et al.* 1987), while a site on San Miguel Island has yielded a radiocarbon date of 10,300 B.P. (Erlandson 1991). Recent calibrations suggest that terminal Pleistocene radiocarbon dates are about 2,000 years too recent (Fiedel 1999:95) and thus these early sites may be even older. In San Luis Obispo County, excavations at CA-SLO-2 in Diablo Canyon revealed an occupation older than 9,000 years (Greenwood 1972; Moratto 1984) and investigations at CA-SLO-1797 indicate initial occupations as early as 10,300 B.P. (Fitzgerald 1998). Occupations on Vandenberg AFB occurred by at least 9,000 years ago, based on radiocarbon dates from CA-SBA-931 at the mouth of the Santa Ynez River (Glassow 1990, 1996).

Moratto (1984) refers to these early occupations as Paleocoastal. Population densities were probably low; judging from the limited number of sites dated to this period. Diagnostic tools associated with this time period have not been identified, although similarities with the San Dieguito Complex in southern California (Wallace 1978; Warren 1967) have been suggested (Erlandson 1994). Cultural assemblages have few of the grinding implements common to subsequent periods. These sites are characterized by a strong maritime orientation and an apparent reliance on shellfish. Occupants are thought to have lived in small groups that had a relatively egalitarian social organization and a forager-type land-use strategy (Erlandson 1994; Glassow 1996; Greenwood 1972; Moratto 1984).

Site densities throughout the central coast are higher during the subsequent periods, suggesting increased population size and possibly better site preservation. Sites dating between about 8,000 and 6,500 years ago often have relatively high densities of manos and milling slabs that are typically associated with processing seeds. These milling stones are diagnostic of this period.

Early scholars associated sites of this age with inland knolls and terraces (e.g., Rogers 1929), but subsequent investigations revealed that coastal environments were also used (e.g., Glassow *et al.* 1988). Well-developed middens at many sites suggest a more sedentary and stable settlement system (Breschini *et al.* 1983). Glassow (1990, 1996) infers that occupants of Vandenberg AFB during this time were sedentary and had begun using a collector-type (i.e., logistically mobile) land-use strategy.

Population densities appear to have decreased substantially between 6500 and 5000 B.P. throughout the region, and little is known about this period. It is possible that arid conditions associated with the Altithermal degraded the environment to the point that only low population densities were possible (Glassow 1996; Glassow and Wilcoxon 1988).

After 5000 B.P., population densities increased to pre-6500 B.P. levels as conditions became cooler and more moist. Between 5000 and 3000 B.P., mortars and pestles became increasingly common throughout the region, suggesting intensified use of acorns (Basgall 1987), although these implements may have been associated with processing pulpy roots or tubers (Glassow 1997). Increased logistical organization is suggested in this area (Jones *et al.* 1994; Jones and Waugh 1995). Proportions of obsidian (indicating exchange with other regions) increased after about 5000 B.P., particularly in San Luis Obispo County (Jones *et al.* 1994; Jones and Waugh 1995).

Cultural complexity appears to have increased around 3,000–2,500 B.P. Based on mortuary data from the Santa Barbara area, King (1981, 1990) suggests a substantial change in social organization and political complexity about 3,000 years ago. According to King, high-status positions became hereditary and individuals began to accumulate wealth and control exchange systems. Arnold (1991, 1992) proposes that this evolutionary step in socioeconomic complexity occurred around 700–800 years ago.

The period between 2,500 and 800 years ago is marked by increased cultural complexity and technological innovation. Fishing and sea mammal hunting became increasingly important, corresponding to development of the *tomol* (a plank canoe), single-piece shell fishhooks, and harpoons (Glassow 1996; King 1990). The bow and arrow also was introduced during this period (Glenn 1990, 1991). Sites in San Luis Obispo County suggest that use of terrestrial mammals remained high. Proportions of imported obsidian continued to increase during this period (Jones *et al.* 1994).

Arnold (1992) proposes that the complex Chumash sociopolitical system known at historic contact evolved substantially during a brief period between A.D. 1150 and 1300. Arnold infers that decreased marine productivity caused by elevated sea-surface temperatures resulted in subsistence stress that allowed an elite population to control critical resources, labor, and key technologies, resulting in hierarchical social organization and a monetary system. Although the issue of elevated sea-surface temperatures has been questioned (e.g., Kennett 1998) and the inference of marine degradation and subsistence stress has been challenged (e.g., Raab *et al.* 1995; Raab and Larson 1997), the full emergence of Chumash cultural complexity around this time is generally accepted.

On Vandenberg AFB and in the Santa Barbara Channel region, population densities reached peak levels between 700 years ago and historic contact (Glassow 1990, 1996). Higher numbers of *Olivella* shell beads reflect increased exchange between the Channel Islands, the Santa Barbara mainland, and Vandenberg AFB. Increased subsistence diversity is apparent. In San Luis Obispo County, the settlement system appears to have changed substantially after 700 B.P. as residential bases along the coast were abandoned in favor of habitation sites farther inland.

The Vandenberg AFB landfill is located on the edge of the Santa Lucia and Oak canyon watersheds. Lebow and Moratto's (1999) study of spatio-temporal site distribution patterns on Vandenberg AFB

revealed that these basins have a site density of 12.3 sites/1,000 acres, lower than the overall average density of 14.0 sites/1,000 acres on north base. However, in these basins the density of quarry sites is relatively high and the density of chipping station locations is the highest on the base. Conversely, village sites are absent and densities of residential site types are among the lowest on the base. This pattern indicates that the Santa Lucia and Oak canyons were primarily used for toolstone procurement and lithic reduction.

3.4.1.2 Ethnohistory

People living in the Vandenberg AFB area prior to historic contact are grouped with the Purisimeño Chumash (Greenwood 1978; King 1984; Landberg 1965), one of several linguistically related members of the Chumash culture. Their social organization, traditions, cosmology, and material culture are described by Blackburn (1975), Grant (1978a, 1978b, 1978c, 1978d), Greenwood (1978), Hudson *et al.* (1977), Hudson and Blackburn (1982, 1985, 1986), Hudson and Underhay (1978), Johnson (1988), and Landberg (1965).

Accounts of early explorers in the Santa Barbara Channel area indicate that the Chumash people lived in large, densely populated villages with well-built structures (e.g., Bolton 1926, 1931; Engelhardt 1933; Fages 1937; Moriarity and Keistman 1968; Simpson 1939; Teggart 1911; Wagner 1929). With a total Chumash-speaking population estimated at 18,500 (Cook 1976) and employing a maritime economy, the Chumash had a culture that "was as elaborate as that of any hunter-gatherer society on earth" (Moratto 1984:118). Leadership was hereditary and chiefs exercised control over more than one village, reflecting a simple chiefdom social organization. The Chumash engaged in craft specialization and maintained exchange systems (Arnold 1992; Johnson 1988).

Relatively little is known about the Chumash in the Vandenberg region. Explorers noted that villages were smaller and lacked the formal structure found in the channel area (Greenwood 1978:520). Approximately 22 villages were used by the Purisimeño Chumash at historic contact, with populations between 30 and 200 per village (Glassow 1996:13–14). About five ethnohistoric villages are identified by King (1984) on Vandenberg AFB, along with another five villages in the general vicinity.

Contact with early Euroamerican explorers, beginning with the maritime voyages of Cabrillo in A.D. 1542–1543, undoubtedly had an effect on the Chumash culture. The effect may have been profound. Erlandson and Bartoy (1995, 1996) and Preston (1996) convincingly argue that Old World diseases substantially impacted Chumash populations more than 200 years before Spanish occupation began in the 1770s.

Unquestionably, drastic changes to Chumash lifeways resulted from the Spanish occupation that began with the Portolá expedition in A.D. 1769. The first mission in Chumash territory was established in San Luis Obispo in 1772, followed in short order by San Buenaventura (1782), Santa Barbara (1786), and La Purísima Concepción, established in 1787 in the present location of Lompòc. The Santa Ynez Mission was established in 1804. Eventually, nearly the entire Chumash population was under the mission system (Grant 1978a). During the 1830s, the missions were secularized in an attempt to turn the mission centers into pueblos and make the Indians into Mexican citizens.

3.4.1.3 History

Vandenberg AFB history is divided into the Mission, Rancho, Anglo-Mexican, Americanization, Regional Culture, and Suburban periods (Palmer 1999). The Mission Period began with the early Spanish explorers and continued until 1820. Established in 1787, Mission La Purísima encompassed the area

between Gaviota and Guadalupe. Farming and ranching were the primary economic activities at the Mission, which was responsible for supplying the Santa Barbara Presidio with food supplies. In addition to livestock, crops such as wheat, barley, corn, peas, and beans were grown at Mission La Purísima. Agricultural activities primarily occurred along the major streams such as San Antonio Creek and the Santa Ynez River (Palmer 1999:1–7).

The Rancho Period of Vandenberg AFB history began in 1820 and continued until 1845 (Palmer 1999:7). Following secularization in 1834, the Alta California government granted former mission lands to Mexican citizens as ranchos. The Vandenberg AFB landfill lies within Rancho Jesus Maria, which originally encompassed 42,184 acres and was granted to Lucas, Antonio, and Jose Olivera in 1837. Rancho Jesus Maria included lands from just south of Shuman Canyon (northern boundary) to the Santa Ynez River (southern boundary), and from the Pacific Ocean to a few kilometers east of San Antonio Terrace and Burton Mesa on the east (Tetra Tech Inc. 1988). By 1839, Antonio and Jose Olivera had sold their part of the land grant to Jose Valenzuela, who, in 1847, sold a one-third share to Don Pedro Carrillo and a one-third share to Lewis T. Burton. Cattle ranching was the primary economic activity during the Rancho Period; in the 1840s cattle were so abundant that only the hides had any value. Fishing and trapping became important economic activities during this period (Palmer 1999:7–13).

The Bear Flag Revolt and the Mexican War marked the beginning of the Anglo-Mexican Period (1845–1880). Cattle ranching continued to flourish during the early part of this period, with as many as 500,000 cattle in Santa Barbara County during the 1850s. However, severe droughts during the 1860s decimated cattle herds and less than 5,000 cattle remained in the entire county. The combination of drought and change in government from Mexican to the United States caused substantial changes in land ownership. By 1851, approximately 42 percent of the land grants were owned by non-Mexicans; by 1864, after a few years of drought, 90 percent of the southern California ranchos were mortgaged. The various shares in Rancho Jesus Maria changed hands, with Lewis Burton steadily increasing his holdings until he owned the entire rancho in 1853. His son, Ben Burton, inherited all of Rancho Jesus Maria upon the death of Lewis in 1879. Sheep ranching and grain farming replaced the old rancho system during this period. Dairy farming became an important economic activity, particularly as Swiss-Italians immigrated into the area. Early roads were established during the 1860s and 1870s to obtain supplies that were surfed in at Point Sal. Although the amount of farming increased substantially, it still remained a limited activity due in large part to the difficulty of shipping to markets but also due to climatic fluctuations and lack of water. Lompoc was established during this period by the Lompoc Temperance Colony. Population growth and the associated demand for a means of sending and receiving supplies led to construction of the Lompoc Landing on Rancho Jesus Maria land donated by Lewis Burton. At one time, Lompoc Landing had a hotel, a restaurant, warehouses, and a machine shop (Palmer 1999:14–44).

Increased population densities characterize the Americanization Period (1880–1915). The railroad reached the area in the late 1890s, providing a more efficient means of shipping and receiving goods and supplies, which in turn increased economic activity. A branch line connected Lompoc with Surf in 1899. The wharf system was largely abandoned by 1901 as the railroad was completed between San Francisco and Los Angeles. Ranching continued and agriculture increased, particularly with development of steam-powered threshers. Row crops became increasingly common; sugar beets were one of the most economically important crops. Union Sugar Company established an operation in the San Antonio Creek valley and had a substantial influence on economic growth in the region. Dairy farming also increased, and the population of the Italian-Swiss ethnic community continued to grow. Oil exploration began in earnest during this period. Union Oil began to purchase Rancho Jesus Maria property in 1903; they ultimately obtained subsurface rights to 120,000 acres in the area. Ben Burton leased the former Rancho Jesus Maria for grazing and farming during the early part of the Americanization Period. However, by 1900 the rancho was divided into four parcels and sold. These four parcels were further subdivided by

1906. Edwin Marshall formed the Jesus Maria Rancho Corporation in December 1906; by the 1920s the Marshall Ranch encompassed 52,000 acres and prospered by raising cattle and beets. An elaborate system of line camps and other facilities supported the ranch operations (Palmer 1999:45–84).

Ranching and farming continued to dominate the area economy during the early part of The Period of Regional Culture (1915–1945). Cattle ranching reached its pinnacle during this period, particularly on the former Rancho Jesus Maria. Grain was raised on coastal terraces, and Union Sugar purchased farm land in the San Antonio Valley for agricultural purposes. The addition of paved roads greatly facilitated access to markets. However, dairy farming suffered as it became difficult to compete with the more profitable sugar beets and other row crops planted on the fertile valley bottoms. In 1933, the Marshall family moved to the Olivera adobe, and expanded and modernized the building. A wooden-framed guest house was added in 1935 and a dude operation known as Marshallia Ranch began. The ranch was sold to Frank Long upon the death of Edwin Marshall in 1937. All ranching, farming, and dairy farming in the Vandenberg AFB area was substantially reduced when Camp Cooke was established in 1941. This army training facility was built on approximately 90,000 acres along the coast, and included the area of Rancho Jesus Maria. At its peak, Camp Cooke included more than 36,000 personnel. The Cantonment Area headquarters were established on Burton Mesa, immediately north of the current Vandenberg AFB landfill. Camp Cooke was deactivated at the end of World War II (Palmer 1999:85–117).

The Suburban Period (1945–1965) began with the end of World War II. After Camp Cooke was deactivated, the Army continued the historic tradition and leased much of the area for ranching and farming. Oil drilling reached its peak during this period. Union Oil drilled a number of wells on the San Antonio Terrace, and the Jesus Maria No. 4 produced commercial quantities of oil. Most of the Suburban Period is characterized by military use of the area. Camp Cooke was reactivated in 1950 for training during the Korean War, and the current landfill vicinity was used for grenade practice, range estimation, and bayonet practice. Camp Cooke was put into caretaker status from 1953 to 1956. The Cantonment Area became so overgrown that sheep were used to manage the vegetation and reduce the fire hazard. In November of 1956, the army transferred 64,000 acres of North Camp Cooke to the Air Force, and it was renamed the Cooke Air Force Base (Palmer 1999:118–125). In 1958 the base had its first missile launch, the Thor, and was renamed Vandenberg AFB. The southern section of the current base was transferred to the Air Force from Army and Navy control in 1964 (Vandenberg AFB 1992). Post-transfer use of both North and South Vandenberg AFB has related primarily to the construction and operation of missile launch and support facilities. Specific activities include management of the launch, testing, and evaluation of ballistic missile and space systems for the Department of Defense (DOD), and operation of the Western Range (Science Applications International Corporation 1995; Vandenberg AFB 1992).

3.4.2 Existing Resources

An archaeological site record and literature search was completed for the Proposed Action and Alternatives 1, 2, and 3. All alternatives were examined during the basewide archaeological inventory (Carbone and Mason 1998), and thus no pedestrian survey was completed specifically for the Landfill Drainage Improvement project.

3.4.3 Archival Research

Archival research was completed at the Central Coast Information Center, University of California, Santa Barbara (UCSB), and at 30th Civil Engineer Squadron/Environmental Management Flight, Cultural Resources (30 CES/CEVPC), Vandenberg AFB, California. This effort included a review of literature, archaeological base maps, and cultural resource records. Information was collected for previous archaeological studies within 1.0 mile of the project's Area of Potential Effects (APE) and for

archaeological sites within 0.25 miles of the APE for each alternative. The Statement of Work defines the APE for each alternative as 90 meters on either side of the centerline. In addition, the Statement of Work indicates that boundary testing may be necessary at sites within 100 meters of the APE. Maps consulted at 30 CES/CEVPC include Vandenberg AFB A-3 series (46 map set), the Base Comprehensive Plan Geographic Information Systems, and USGS topographic maps. Maps resulting from Palmer's (1999) study of historic resources were also consulted. Earle and Johnson (1999) was consulted for information on areas of potential concern to Native Americans. USGS topographic maps with plotted site locations were consulted at UCSB.

3.4.3.1 Proposed Action

Archival research indicates that 23 cultural resource studies have been completed within 1.0 mile of the Proposed Action route (Table 3-3). Six archaeological sites are recorded within 0.25 mile of the APE (Table 3-4). However, no sites are within the Proposed Action APE, and no sites are within 100 meters of the APE.

3.4.3.2 Alternative 1

Nineteen cultural resource studies have been completed within 1.0 mile of Alternative 1 (Table 3-3). Nine archaeological sites are within 0.25 mile of Alternative 1; one site, CA-SBA-1049, is within 100 meters of the APE (Table 3-4). No sites are within the APE for Alternative 1. Site location maps at 30 CES/CEVPC indicate that CA-SBA-1049 is within the Alternative 1 APE. However, the site is incorrectly plotted on those maps. This error was first identified during a recent assessment of site condition (Lebow 1999). At that time, no cultural materials were found at the site's plotted location, but a site meeting the description of CA-SBA-1049 was found east of the site's plotted location and was assumed to be the site's correct location. The site's plotted location was examined again for the current project, and no evidence of a site was found. Larry Spanne, the current Base Historic Preservation Officer who recorded CA-SBA-1049 in 1972, was consulted concerning the site's correct location. Spanne was able to verify that the plotted location is incorrect and that the site to the east is the actual site location. Thus, CA-SBA-1049 is actually at the edge of the 100-meter zone around the APE.

3.4.3.3 Alternative 2

For cultural resources purposes, Alternative 2 is very similar to Alternative 1. Nineteen cultural resources studies have been completed within 1.0 mile of Alternative 2 (Table 3-3), and nine archaeological sites have been recorded within 0.25 mile of the APE. Although no sites are within the APE, one site (CA-SBA-1049) is within 100 meters. The discussion of CA-SBA-1049 relative to Alternative 1 also applies to Alternative 2.

3.4.3.4 Alternative 3

For cultural resource purposes, Alternative 3 is very similar to the Proposed Action. No sites are within the Alternative 3 APE, and no sites are within 100 meters of the APE.

Table 3-3
Archaeological Studies Within 1.0 Mile of Each Alternative

Reference (in chronological order)	Vandenberg AFB Reference No.	UCSB Reference No.	Proposed Action and Alt. 3	Alt. 1	Alt. 2
Spanne 1979a	1979-04	V-13b	X	X	X
Spanne 1979b	1979-05	V-12	X	X	X
Craig 1980	1980-13	None	X	X	X
Westec Services Inc. 1981	1981-04	V-16	X	X	X
Neff 1982	1982-05	V-9	X	X	X
Westec Services, Inc. 1982	1982-10	V-17	X	X	X
Westec Services, Inc. 1983	1983-02	V-19	X	X	X
Chambers Consultants and Planners 1984	1984-26	V-176	X	X	X
Westec Services, Inc. 1984	1984-02	V-20	X	X	X
Westec Services, Inc. 1984	None	V-24	X		
Waldron 1988	None	E-945	X		
Bergin 1989	1989-12	V-115	X	X	X
Gard *et al.* 1990	1990-10	None	X	X	X
Jaffke 1990	1990-04	V-122	X	X	X
U.S. Air Force 1990	None	V-133	X	X	X
Gibson 1992	1992-03	V-140	X	X	X
Osland 1993	None	V-248	X	X	X
SAIC 1994	1994-03	E-1706	X	X	X
SAIC 1994	1994-06	V-209	X	X	X
Price *et al.* 1996	1996-03	V-146	X		
Wilcoxon and Haley 1996	1996-07	V-164	X	X	X
Clark 1997	1997-01	V-159	X		
Carbone and Mason 1998	1998-03	None	X	X	X

Table 3-4
Archaeological Sites Within 0.25 Mile of the Project Area

Site	Proposed Action and Alternative 3			Alternative 1			Alternative 2			Site Description
	Within 0.25 Mile	Within 100 m of APE	In APE	Within 0.25 Mile	Within 100 m of APE	In APE	Within 0.25 Mile	Within 100 m of APE	In APE	
SBA-1049					X			X		Recorded by Spanne in 1972, this site is a chert quarry with a low-density scatter of lithic debitage and hammerstones within a 300-foot-diameter area.
SBA-2376	X									Recorded in 1990, this small (210 square meters) site includes four flakes.
SBA-2377	X									Recorded in 1990, the site is comprised of eight flakes and a possible groundstone in an area of 150 square meters.
SBA-2554	X			X			X			Now buried under the landfill, this site was recorded from memory by Gibson and Spanne. It was a low-density scatter of lithic artifacts near a spring.
SBA-3168				X			X			Recorded in 1995 during the basewide survey, this site coincides with a man-made berm and contains chert outcrops as well as flakes and a biface fragment.
SBA-3169				X			X			Recorded in 1995 during the basewide survey, the site is a small (50 square meters) chipping station containing eight flaked stone artifacts and a hammerstone.
SBA-3170				X			X			Encompassing only 19 square meters, this site includes four cores and 16 flakes surrounding a small chert boulder. It was recorded in 1995.
SBA-3182				X			X			This site includes one flake, two hammerstones, and one flake tool in 25 square meters. It was recorded in 1995.
SBA-3188				X			X			Recorded in 1995, this site is described as "dozens of flakes representing all stages of reduction." It covers 70 square meters.
SBA-3247	X									This site is a low-density lithic scatter, comprised of 15 flakes in an area of 3,318 square meters. It was recorded in 1995.
SBA-3248	X			X			X			Recorded in 1995, this site is a low-density scatter of 16 flakes in an area of 198 square meters.
SBA-3561H	X			X			X			This site is historic masonry associated with drainage in the Cantonment Area. It was recorded in 1999.

3.5 POLLUTION PREVENTION

The Pollution Prevention Act (PPA) was enacted in 1990 to refocus the national approach to environmental protection. Previous legislation had emphasized pollution control (treatment and disposal) and a multi-media approach (separate legislation for air, water, and other impacted media). The PPA turned the focus of environmental protection toward pollution prevention (P2), which emphasizes source reduction and recycling to reduce impacts to all media (U.S. Air Force 1996c).

The Air Force has developed a P2 Program to implement the requirements of the Resource Conservation and Recovery Act (RCRA) and Hazardous and Solid Waste Amendments, as well as the PPA. The PPA calls for waste reduction at the source whenever feasible; this is the foundation of the Air Force's program. The P2 program at Vandenberg AFB consists of various policies aimed at achieving 30th Space Wing goals and objectives for reducing pollution through revised practices, procedures, and operational requirements. In addition, Vandenberg AFB operates under the conditions of a Pollution Prevention Plan.

The P2 hierarchy of waste management includes the following:

- Source reduction to prevent the creation of waste;
- Recycling of waste or used material that cannot be prevented at the source;
- Treatment of waste, in an environmentally safe manner, that cannot be prevented or recycled; and
- Environmentally compliant disposal, only as a last resort.

The Air Force has established specific goals for selected P2 program components:

- Ozone depleting chemicals;
- Environmental Protection Agency 17 industrial toxic project chemicals;
- Hazardous waste;
- Municipal solid waste;
- Environmentally preferred products;
- Energy conservation;
- Water conservation;
- Emergency Planning Community Right-to-know Act (EPCRA)/Toxic Release Inventory chemical releases; and
- Pesticide management.

Responsibility and guidance for achieving the 30th Space Wing P2 Program goals is provided in the Pollution Prevention Management Plan, which applies to Vandenberg AFB and remote facilities. Its purpose is to provide sufficient guidance and direction for a comprehensive and unified approach to P2 management and operations on Vandenberg AFB and remote facilities under the cognizance of 30th Space Wing. This plan is also intended to ensure compliance with applicable federal, state, and local regulations.

The P2 program includes waste generation, material acquisition, handling and use of materials, production and operational activities, process management, waste management, and disposal. It is a cradle-to-grave approach, wherein there is an accounting of what enters, what is used, and what leaves Vandenberg AFB.

3.6 SOLID WASTE MANAGEMENT

Solid waste management methods in place at Vandenberg AFB include a sanitary landfill, refuse and recycling collection, recycling outreach programs, construction and demolition debris management and a household hazardous materials exchange program.

The *Solid Waste Management Plan* 32-7042 (U.S. Air Force 1997g), describes the solid waste management programs at Vandenberg AFB, and must be followed by the applicable units and agencies generating, reusing, recycling, and disposing of solid wastes. The procedures described in the Solid Waste Management Plan apply to all Vandenberg AFB solid waste generators and handlers.

The Vandenberg AFB Class III Landfill currently occupies 172 acres with a Subtitle D footprint of 46 acres. The Subtitle D footprint is the active fill area at the landfill and is regulated by 40 CFR Part 258, Subtitle D. The base landfill is operating pursuant to Solid Waste Facility Permit #42-AA-0012 issued to the Air Force on 15 November 1994, by the Santa Barbara County Environmental Health Services Department (U.S. Air Force 1997f). The permit currently allows the Vandenberg AFB landfill to accept a daily maximum of 400 tons of waste. The landfill is also operating following WDR Order No. 94-26 issued by the RWQCB on June 3, 1994. The average daily volume of solid waste received at the landfill is 30 to 60 tons.

In 1998, DOD and U.S. Air Force Headquarters issued a municipal solid waste diversion goal that requires installations to maintain 40 percent diversion of recyclable materials through 2005. Since 1995, Vandenberg AFB has gradually increased the amount of waste diverted from the landfill, as shown in Table 3-5.

Table 3-5
Waste Disposal and Diversion at Vandenberg AFB Landfill

Year	Waste Generated (tons)	Waste Diverted (tons)	Waste Disposed of (tons)
2001	33,489	25,759	7,729
2000	37,399	27,139	10,260
1999	57,519	45,367	12,152
1998	44,577	31,299	13,277
1997	41,345	18,323	23,022
1996	59,986	32,191	27,795
1995	57,923	33,336	24,587

Note: Waste Disposed of = Waste Generated – Waste Diverted.
Source: U.S. Air Force 2002b

The capacity of the disposal area, as listed in the Solid Waste Facility Permit, is 2.464 million cubic yards. The estimated closure date for the landfill is 2034 if the disposal rate remains consistent with 1997 disposal rates. However, if accepted waste decreases 25 percent then the estimated closure date will be 2084, which is the closure date given in the Solid Waste Facility Permit. This estimate was calculated in 1997 and does not take into account current disposal information. The remaining landfill capacity is being calculated based on a March 2002 survey and a new closure date will be determined based on these calculations. These calculations are being developed as part of the updated Fill Sequencing Plan scheduled to be completed in September 2002 (U.S. Air Force 2002b).

The landfill accepts municipal and commercial solid waste (U.S. Air Force 1997f). Construction debris, green waste, used tires, and recyclables, including scrap metal, concrete, and asphalt, are segregated and diverted for reclamation. Construction debris such as concrete and asphalt generated by Base personnel is taken to Washington Street rubble yard and the landfill respectively, for recycling. Contractors are not

allowed access to the base landfill, and are required to take this material off base for recycling. Special wastes, such as nonfriable asbestos and dead animals, are disposed of in separately designated sites. The base landfill is prohibited from accepting any designated liquid wastes, including grease, sewage sludge, septic tank pumping, burning waste, hot ashes, and untreated medical waste. Recyclable material collected by the Refuse and Recycling contractor is taken off base to a local materials recovery facility. Waste material, recyclable or otherwise, generated by base contractors is taken off base for disposal unless coordinated with 30 CES/CEVC.

3.7 HAZARDOUS MATERIALS/WASTE MANAGEMENT

Hazardous materials are those substances defined as hazardous by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601–9675), the Solid Waste Disposal Act as amended by RCRA (42 U.S.C. 6901–6992), and Title 22 of the CCR. In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, would present substantial danger to public health and welfare or to the environment when released into the environment. Executive Order 12088, under the authority of U.S. EPA, ensures that necessary actions are taken for the prevention, management, and abatement of environmental pollution from hazardous materials or hazardous waste caused by federal facility activities.

3.7.1 Hazardous Materials Management

Vandenberg AFB uses numerous hazardous materials in support of its mission. These materials range from highly explosive and toxic rocket fuels to more common and less toxic materials like latex paint. Vandenberg AFB's Hazmart Pharmacy manages hazardous materials purchased from offbase suppliers for Air Force organizations. The Hazmart inventories hazardous materials and provides a printed copy of the Material Safety Data Sheet before releasing hazardous materials to the user. By providing handling and use information, Vandenberg AFB is attempting to control the potential misuse of hazardous materials and minimize waste.

Executive Order 12856, signed on 4 August 1993, requires that federal facilities comply with Sections 301 through 312 of EPCRA. EPCRA was established in Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986. EPCRA added significant public notification and reporting requirements to CERCLA, especially in terms of toxic chemical release reporting.

3.7.2 Hazardous Waste Management

Vandenberg AFB generates approximately 600–1,000 tons of hazardous waste each year and is classified as a large quantity generator. Management of hazardous waste at Vandenberg AFB must comply with RCRA Subtitle C (40 CFR Part 261) regulations administered by U.S. EPA, unless otherwise exempted through CERCLA actions. Hazardous wastes at Vandenberg AFB are also regulated by the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) under the California Health and Safety Code, Sections 25100 through 67188 and Title 22 of the CCR. These regulations specify requirements for wastes that would be handled, stored, transported, disposed of, or recycled.

The Vandenberg AFB *Hazardous Waste Management Plan* (U.S. Air Force 1998c) outlines the procedures to be followed for hazardous waste management and disposal. Implementation of the Hazmart and other P2 programs has reduced the amount of hazardous wastes generated on base.

3.7.3 Installation Restoration Program

In response to CERCLA and SARA requirements, the DOD established the Defense Environmental Restoration Program (DERP). DERP funding is used to clean up past disposal and spill sites on federal military installations nationwide. Hazardous release investigations conducted under the IRP are DERP-funded actions. These investigations have identified the following:

- IRP sites, where proof exists of hazardous material releases to the environment;
- Areas of Concern (AOCs), where potential hazardous materials releases are suspected; and
- Areas of Interest (AOIs), defined as areas with the potential for use and/or presence of a hazardous substance.

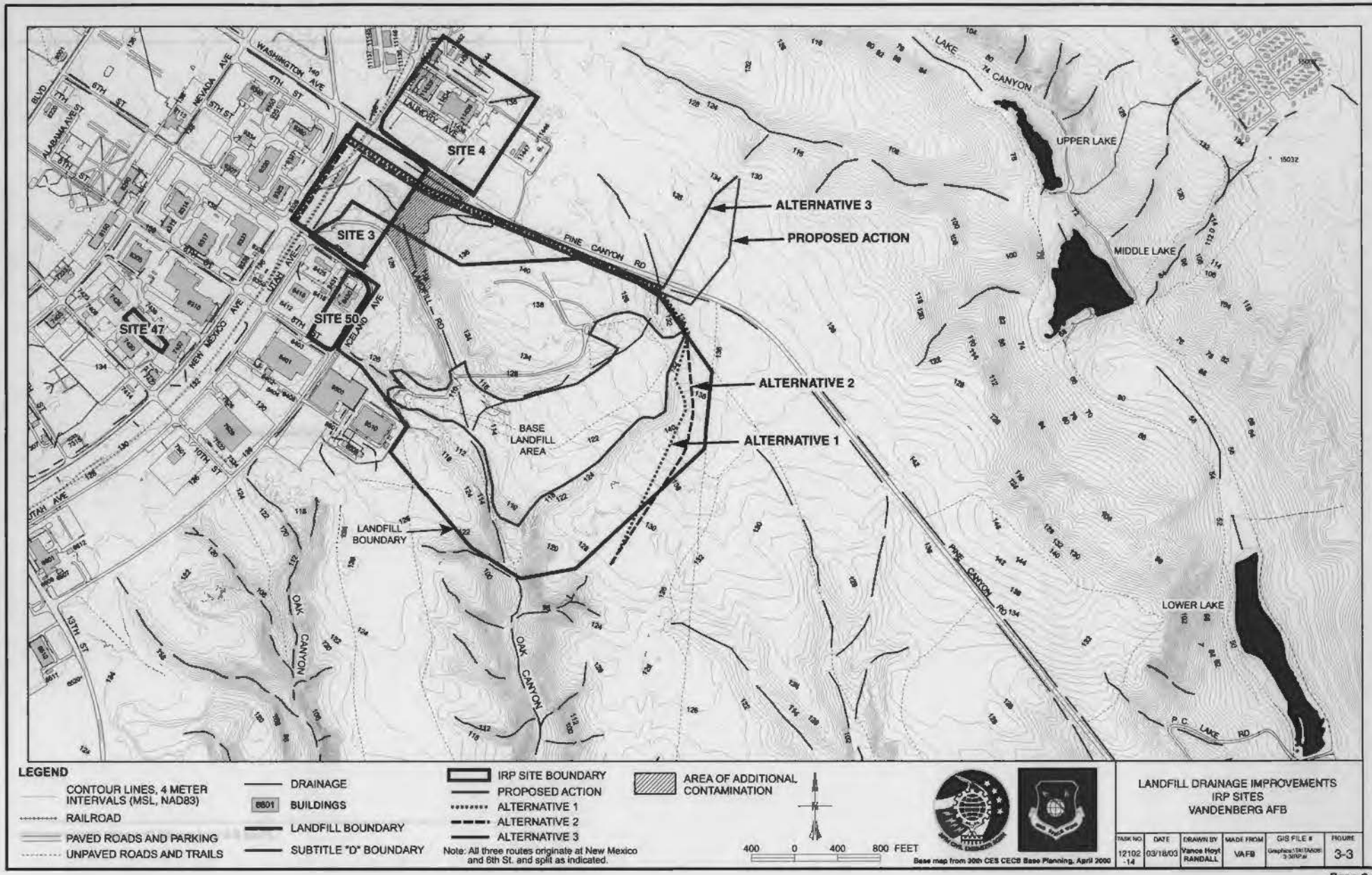
Chemicals of potential concern (COPCs) are hazardous materials or wastes that may be associated with past site activities. They differ from site to site and depend upon activities in the area.

3.7.3.1 IRP Sites

There are four IRP sites (Sites 3, 4, 50, and 47) within a 2,000-foot radius of the project route for the Proposed Action and alternatives. Figure 3-3 shows the location of the IRP sites in relation to the project routes.

Site 3 is located at the northern end of the project route for the Proposed Action and alternatives. Site 3, the old Railroad Pumping Station, consisted of six aboveground fuel storage tanks, two underground fuel storage tanks, and a pumping facility. Diesel fuel was reportedly stored in all the tanks, which have been removed from the site (U.S. Air Force 1999e). All structures and equipment associated with the pumping station have also been removed except the old railway siding. The site boundaries are illustrated on Figure 3-3. A remedial investigation (RI) is being conducted to assess the extent of contamination at Site 3. The scope of the RI was recently expanded to include assessment of potential source areas from surrounding upgradient areas (U.S. Air Force 1999f). A feasibility study will be conducted to determine an appropriate remediation strategy.

Several COPCs have been detected in soil and groundwater samples from Site 3. In 1997, zones of soil and groundwater contamination were identified on Burton Mesa above the landfill, and at three locations in the upper portion of Oak Canyon (JEG 1997). Data from the landfill quarterly groundwater monitoring program (U.S. Air Force 1999b) and expanded RI sampling indicate that soil and groundwater contamination on Burton Mesa may extend southeastward beyond the current Site 3 boundary (Tetra Tech Inc. 2000: Figure 3-3). Soil COPCs include total petroleum hydrocarbons (TPH), trichloroethene (TCE), diesel, gasoline components, polynuclear aromatic hydrocarbons (PAHs) hexavalent chromium and other metals. Groundwater COPCs include TCE, perchloroethene (PCE), 1,4-dichlorobenzene, other VOCs, gasoline components, and diesel. To date, five zones of groundwater contamination have been identified at Site 3. The groundwater zones are not connected. Remediation of both soil and groundwater contamination at Site 3 is projected to begin in 2004 following completion of the remedial investigation and determination of risk to humans and ecological receptors, and completion of the feasibility study.


SITE 4
SITE 3
SITE 47
SITE 50
ALTERNATIVE 3
PROPOSED ACTION
ALTERNATIVE 2
ALTERNATIVE 1
BASE LANDFILL AREA
LANDFILL BOUNDARY
PINE CANYON RD
LAKE CANYON
UPPER LAKE
MIDDLE LAKE
LOWER LAKE
OAK CANYON
P.C. LAKE RD
WASHINGTON AVE
NEVADA AVE
ALABAMA AVE
UTAH AVE
NEW MEXICO AVE
ICELAND AVE
LAUNCH COMPLEX RD
4TH ST
5TH ST
6TH ST
10TH ST
13TH ST
LEGEND
CONTOUR LINES, 4 METER INTERVALS (MSL, NAD83)
RAILROAD
PAVED ROADS AND PARKING
UNPAVED ROADS AND TRAILS
DRAINAGE
6801 BUILDINGS
LANDFILL BOUNDARY
SUBTITLE "D" BOUNDARY
IRP SITE BOUNDARY
PROPOSED ACTION
ALTERNATIVE 1
ALTERNATIVE 2
ALTERNATIVE 3
Note: All three routes originate at New Mexico and 6th St. and split as indicated.
AREA OF ADDITIONAL CONTAMINATION
400 0 400 800 FEET
Base map from 30th CES CECB Base Planning, April 2000
LANDFILL DRAINAGE IMPROVEMENTS
IRP SITES
VANDENBERG AFB
TASK NO. 12102 -14
DATE 03/18/03
DRAWN BY Vance Hoyt RANDALL
MADE FROM VAFB
GIS FILE # Graphics\TASKS\03-3IRP.ai
FIGURE 3-3

This page intentionally left blank.

Site 4, the Laundry Site, is located across Pine Canyon Road to the east of the first portion of the project route for the Proposed Action and alternatives. The Site 4 boundaries are shown on Figure 3-3. Between 1941 and 1967, a large scale laundry operated at Site 4. The facility included a boiler house, three 10,000-gallon diesel fuel underground storage tanks (USTs), and a pump system for the tanks. In 1957 the tanks were excavated and disposed of. The location of the former USTs, investigated under the Vandenberg AFB Basewide Underground Storage Tank program, is known as Site 46. Low levels of three VOCs (TCE, toluene, and PCE) were detected during a soil gas survey conducted at Site 4 in 1992 (U.S. Air Force 1999b). Five former heating oil USTs were recently discovered and removed at Site 4 (U.S. Air Force 1999b). Contaminated soil surrounding the USTs was analyzed, excavated, and taken to the Bioremediation Area on Vandenberg AFB for processing (U.S. Air Force 1999d). No further action was recommended for Site 4, which has since been closed (Cal/EPA DTSC 1999).

Site 50, the Bionetics Building, is located approximately 700 feet south of the first segment of the project route for the Proposed Action and alternatives. The site boundaries are shown on Figure 3-3. Site 50 consists of Building 8430 and outbuildings 8431 and 8432 (U.S. Air Force 1999d). Beginning in 1965, Building 8430 was a component cleaning shop. The outbuildings were used for support activities including chemical storage. An elongated TCE plume with subsidiary 1,2-dichloroethene (DCE) is present in groundwater beneath Site 50. However, the source of these VOCs is believed to be Building 8337 (AOI 292), a former missile maintenance facility which is upgradient of Site 50 (U.S. Air Force 1999d). There are continuing remedial investigation activities at Site 50 (U.S. Air Force 2000c).

Site 47, the former concrete wash pad, was used for steam cleaning vehicles and paint removal. The site is located about 1,800 feet southwest of the first segment of the project route for the Proposed Action and alternatives. Environmental investigations were performed to assess the impacts of past site activities. A soil gas survey was conducted to assess the presence of VOCs, which were not detected (JEG 1996). Sediment samples collected from the wash pad drain area contained barium, cadmium, total chromium, copper, lead, nickel, silver, and zinc above their respective Background Threshold Values (JEG 1997). The sediment samples also contained the semivolatile organic compounds 4-methylphenol and bis(2-ethyl hexyl)pthalate. In 1995, an interim remedial action was performed and this sediment was removed from the wash pad and the drain was sealed. A human health risk assessment conducted for the site after the interim remedial action indicated that the compounds detected in soil remaining at the site do not pose a risk to human health (JEG 1996). In addition, the qualitative ecological risk assessment indicated that ecological receptors are unlikely to use the site. Based on the information presented during the RI, both the DTSC and the RWQCB concurred with the No Further Action Recommendation and the site was closed in May 1997 (DTSC 1999).

3.7.3.2 Areas of Concern

There are 11 AOCs within a 2,000-foot radius of the project route for the Proposed Action and alternatives. The Landfill is adjacent to the south and west of the project route, and is downgradient from the project location. There are no other AOCs on or adjacent to the project route. No other AOCs within 2,000 feet of the route are downgradient from the project route. Information about AOCs within 2,000 feet of the project route is summarized in Table 3-6.

3.7.3.3 Areas of Interest

There are 22 AOIs within a 2,000-foot radius of the project route for the Proposed Action and alternatives. There are no AOIs on or adjacent to the project route. No AOIs within 2,000 feet of the route are downgradient from the project route. Information about AOIs within 2,000 feet of the project route is summarized in Table 3-7.

Table 3-6
AOCs Within 2,000 feet of the Landfill Drainage Improvement Project Route

AOC Number	Building Number	Chemicals of Potential Concern (COPCs)	Approximate Distance and Direction from Project Site	Status
166	Base Landfill	Former kitchen grease pit, landfill leachate[1]	Adjacent to south and west of route	Active Class III sanitary landfill.
62	8425	Chlorinated solvents, diesel, PCBs[1]	200 feet south	Included with IRP Site 50 investigations.
100	8428	Diesel fuel, oil[1]	300 feet southwest	Included with IRP Site 50 investigations.
101	9350	TCE in subsurface soil[3]	1,000 feet northwest	Investigated under Work Request Nos. 9 and 10. No further action recommended.
147	8401	Metals in subsurface soil[2]	1,000 feet south	Investigated under SSI (Supplemental Site Inspection). No further action recommended.
156	8314	TCE and 1-2 dichlorobenzene in building sumps potentially connected to groundwater[3]	1,200 feet northwest	Investigated under Work Request Nos. 9 and 10. Included with IRP Site 50 investigations.
99	8305	Lead, metals in soil[3]	1,600 feet southwest	Investigated under Work Request Nos. 9 and 10. Additional investigation recommended.
165	11219	Potential former UST site[1]	1,600 feet north	Investigated by Vandenberg AFB Environmental Compliance.
77	7425	Potential former UST site[1]	1,750 feet northwest	Investigated by Vandenberg AFB Environmental Compliance.
54	8195	PCBs in surface soil[2]	1,800 feet west	Investigated under Work Request Nos. 9 and 10. No further action recommended.
123	10713	Oil and chlorinated solvents[1]	2,000 feet northwest	Recommended for review by Vandenberg AFB Environmental Management.

Notes: Information summarized from: Installation Restoration Program Vandenberg AFB, Supplemental Preliminary Assessment Final Report (U.S. Air Force 1995); Draft Technical Report. Work Request No. 09 (U.S. Air Force 1997f); Final Supplemental Site Inspection Report (U.S. Air Force 1998d); Final Technical Report. Work Request No.10 (U.S. Air Force 1998e); and Vandenberg AFB IRP Remedial Action Project Managers. Meeting Minutes, 09 March (U.S. Air Force 2000c).

1 - COPCs as identified during Preliminary Assessment records search and reconnaissance
2 - COPCs detected in site samples during Supplemental Site Inspection
3 - COPCs detected in site samples during Work Request No. 09
PCB - polychlorinated biphenyl
TCE - trichloroethene
UST - underground storage tank

Table 3-7
AOIs Within 2,000 feet of the Landfill Drainage Improvement Project Route

AOI Number	Building Number	Basis of AOI Determination	Approximate Distance and Direction from Project Route	Preliminary Assessment Recommendation
297	9325	Paints, solvents, sandblast grit	300 feet northwest	Review by Vandenberg AFB Environmental Management
298	9327	Paints, solvents	400 feet northwest	Review by Vandenberg AFB Environmental Management
604	9360	Asbestos, hazardous materials storage	400 feet northwest	Asbestos managed under Vandenberg AFB Asbestos Abatement Program. Hazardous materials to be reviewed by Vandenberg AFB Environmental Compliance.
295	8415	Solvents, depleted uranium, PCBs	500 feet southwest	Refer to Vandenberg AFB PCB Management Program.
296	9320	Metals, acids, solvents	500 feet northwest	No further action.
292	8337	Spray paints, UST	600 feet west	UST investigated under IRP OU 6
293	8339	Solvents, UST	700 feet southwest	UST investigated under IRP OU 6
246	9351	Motor oil, transmission fluid	800 feet northwest	No further action.
498	9307	Diesel UST, asbestos, PCBs	800 feet northwest	UST investigated under IRP OU6. Asbestos managed under Vandenberg AFB Asbestos Abatement Program. Refer PCBs to Vandenberg AFB PCB Management Program.
261	8341	PCBs	900 feet southwest	Refer to Vandenberg AFB PCB Management Program.
260	8317	Oils, solvents, PCBs	1,000 feet southwest	Refer to Vandenberg AFB PCB Management Program.
31	9340	Chlorinated solvents, corrosive liquids	1,200 feet northwest	Review by Vandenberg AFB Environmental Management.
596	8308	Diesel UST, unknown 55-gallon container	1,200 feet southwest	UST investigated under IRP OU 6. Refer unknown container to Vandenberg AFB Environmental Management.
602	9310	PCBs, former grease pit	1,200 feet northwest	Refer PCBs to Vandenberg AFB PCB Management Program. Vandenberg AFB Environmental Compliance to review grease pit.
534	11154	Heating oil, PCBs	1,300 feet north	Refer to Vandenberg AFB PCB Management Program.
544	11477	Diesel and gasoline USTs	1,300 feet northeast	USTs investigated under IRP OU 6
533	11156	Heating oil	1,400 feet north	No further action.
597	8312	Tetrachloroethene	1,400 feet southwest	No further action
289	7438	Sandblast grit	1,500 feet southwest	Review by Vandenberg AFB Environmental Management
287	7430	Oil, PCBs	1,600 feet southwest	Refer to Vandenberg AFB PCB Management Program.
535	11162	Unknown hazardous materials storage	1,700 feet north	No further action.

Notes: Information summarized from: Installation Restoration Program Vandenberg AFB, Supplemental Preliminary Assessment Final Report (U.S. Air Force 1995).
OU - Operable Unit
PCB - polychlorinated biphenyl
UST - underground storage tank

3.7.4 Hazardous Materials/Waste Transport

The transport of hazardous materials and waste is regulated by the Department of Transportation (DOT). Anyone transporting hazardous materials or waste must obtain U.S. EPA identification numbers as transporters. The U.S. EPA has incorporated DOT's regulations (49 CFR) into its regulatory scheme, and has added other requirements such as record keeping and cleanup of spills (LaGrega *et al.* 1994). Transporters of hazardous materials and waste at Vandenberg AFB are regulated by the aforementioned laws and are DOT certified transporters.

The DOT regulates transportation of hazardous material through the Hazardous Materials Transportation Law (49 U.S.C.). Transporters of hazardous materials must have a safety permit issued by the Secretary of Transportation and the permit must be kept in the vehicle (49 U.S.C. Section 5109). Each state and local jurisdiction is required to have designations of specific highway routes over which hazardous material may or may not be transported (49 U.S.C. Section 5112(a)(2)). Vandenberg AFB follows the California Department of Transportation (Caltrans) requirements for traveling with hazardous materials on State Highway 1, which runs through part of the eastern edge of Vandenberg AFB.

3.8 AIR QUALITY

3.8.1 Regional and Site Specific Air Quality Setting

Air quality within the Santa Barbara Air Basin is affected by the concentrations of various pollutants in the atmosphere. The amount of pollutants in the atmosphere is affected by the interaction of three factors: the physical characteristics of the air basin, the prevailing meteorological conditions within the air basin, and the amount of pollution emitted into the atmosphere. The interrelationship of these three factors determines the measurable concentration of pollutants in the atmosphere.

The portion of the Santa Barbara Air Basin that would be affected by emissions from the Proposed Action generally includes Vandenberg AFB and the surrounding portions of Santa Barbara County north of the Santa Ynez Mountains.

3.8.2 Regional Climate and Meteorology

The climate at Vandenberg AFB is Mediterranean, or dry summer subtropical. The weather is cool and wet from November through April and warm and dry from May through October. The Pacific Ocean, which borders Vandenberg AFB on the west and south, has a moderating effect on temperature fluctuations. The mean temperature ranges from 53 to 62 degrees Fahrenheit. Vandenberg AFB monthly temperature data for 1997, 1998, and 1999 are presented in Table 3-8.

Table 3-8
Temperature Means and Extremes
(degrees Fahrenheit)

Data	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1997													
Highest	70	75	82	72	78	67	73	90	91	90	93	72	**79.4**
Mean Max.	60	61	64	62	67	64	66	70	74	71	67	61	**65.6**
Mean Temp.	52	51	53	53	58	58	59	64	65	61	58	51	**56.9**
Mean Min.	44	41	42	43	49	51	54	57	56	50	48	40	**47.9**
Lowest	34	30	32	33	38	43	43	48	48	41	41	30	**38.4**
1998													
Highest	65	61	72	74	70	72	79	72	73	86	72	73	**72.4**
Mean Max.	60	58	61	58	62	64	66	68	68	68	60	59	**62.7**
Mean Temp.	52	52	53	53	56	58	60	62	61	57	52	48	**55.3**
Mean Min.	43	44	45	45	48	51	54	55	55	47	44	37	**47.3**
Lowest	30	37	37	37	41	46	46	50	46	39	32	21	**38.5**
1999													
Highest	75	68	64	79	68	64	81	70	84	93	81	77	**93.0**
Mean Max	61	60	57	59	60	60	66	65	66	70	66	66	**63.0**
Mean Temp	51	50	50	50	54	54	59	59	58	59	54	53	**54.3**
Mean Min	40	40	42	42	48	49	52	52	50	47	42	40	**45.3**
Lowest	32	32	32	32	37	43	46	45	43	39	34	32	**32.0**

Source: Viray 2000.

Average annual rainfall for Vandenberg AFB ranges from 11 to 13 inches, most of which falls between November and April. There are usually 40 to 50 days per year with measurable precipitation (i.e., greater than 0.01 inch). Coastal areas, including Vandenberg AFB, experience approximately 30 days per year with 0.10 to 0.49 inch of rain and 10 to 15 days with 0.50 inch or more rain. Vandenberg AFB monthly and seasonal precipitation data for 1997, 1998, and 1999 are presented in Table 3-9.

Table 3-9
Average Monthly and Annual Precipitation
(in inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Season
1997	4.66	0.11	0.00	0.06	0.01	0.01	0.16	0.00	0.19	<0.01	3.47	3.59	**12.3**
1998	4.36	14.49	4.25	3.15	2.30	0.03	0.06	<0.01	0.40	0.23	3.44	0.67	**33.4**
1999	1.93	2.29	9.00	2.01	0.00	0.03	0.15	0.02	0.00	0.05	0.18	0.12	**15.8**

Source: Viray 2000.

Vandenberg AFB lies within the zone of mid-latitude prevailing westerlies from approximately November to April. During the rest of the year, the semi-permanent Eastern Pacific subtropical high-pressure cell creates a northwesterly to westerly flow direction. Locally, winds are usually light during the nighttime hours, reaching speeds of approximately 12 miles per hour by the afternoon. Winds at Vandenberg AFB most often are northwesterly on the North Base and north to northeasterly on the South Base. The strongest winds are associated with rainy season storms.

Vandenberg AFB experiences early morning and afternoon temperature inversions about 87 to 96 percent of the time. The inversion acts as a lid and restricts the vertical dispersion of pollutants, thus increasing

local pollutant concentrations. Pollutants can be "trapped" in the inversion layer until heat lifts the layer or strong surface winds disperse the pollutants.

The principal meteorological conditions that control dispersion are winds and turbulence (or mixing ability) of the atmosphere. The wind direction determines which locations would be affected by a given source. The wind speed, along with the degree of turbulence, controls the volume of air available for pollutant dilution. Atmospheric stability is a measure of the mixing ability of the atmosphere and, therefore, its ability to disperse pollutants. Greater turbulence and mixing are possible as the atmosphere becomes less stable, and thus pollutant dispersion increases. In general, stable conditions occur most frequently during the nighttime and early morning hours.

3.8.3 Existing Air Quality

The Clean Air Act required the U.S. EPA to establish ambient ceilings for certain criteria pollutants. Subsequently, the U.S. EPA promulgated regulations that set National Ambient Air Quality Standards (NAAQS). Two classes of standards were established: primary and secondary. Primary standards prescribe the maximum permissible concentration in the ambient air required to protect public health. Secondary standards specify levels of air quality required to protect public welfare, including materials, soils, vegetation, and wildlife, from any known or anticipated adverse effects. The criteria pollutants for which the NAAQS have been established include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, particulate matter 2.5 microns or less in diameter ($PM_{2.5}$), particulate matter 10 microns or less in diameter (PM_{10}), and lead.

California has also established its own air quality standards, known as the California Ambient Air Quality Standards (CAAQS). The CAAQS are generally more stringent than the NAAQS and have incorporated additional standards for sulfates, hydrogen sulfide, and visibility-reducing particulate matter. The NAAQS and CAAQS are presented in Table 3-10.

The U.S. EPA classifies air quality within each Air Quality Control Region with regard to its attainment of federal primary and secondary NAAQS. According to U.S. EPA guidelines, an area with air quality better than the NAAQS for a specific pollutant is designated attainment for that pollutant. Any area not meeting ambient air quality standards is classified nonattainment. When there is a lack of data for the U.S. EPA to define an area, the area is designated unclassified and treated as an attainment area until proven otherwise. Pollutant concentrations within the Santa Barbara Air Basin atmosphere are assessed relative to the federal and state ambient air quality standards.

The Santa Barbara County Air Pollution Control District (SBCAPCD) is required to monitor air pollutant levels to ensure federal and state ambient air quality standards are met. If ambient air quality standards are not met, SBCAPCD must develop a plan to meet them. If air quality in Santa Barbara County exceeds government standards, the area is classified as an "attainment" area. If regional air quality contains pollutant levels violating these standards, the area is classified as a "nonattainment" area.

Santa Barbara County is in attainment for all standards except the state ozone standard and the state standard for PM_{10}. The SBCAPCD is currently filing a request with the EPA to be redesignated as attainment for the federal 1-hour ozone standard based on recently collected ambient air quality monitoring data. Santa Barbara County is still technically considered non-attainment for the federal 1-hour ozone standard until such time as the request for designation as attainment has been granted The following text addresses Santa Barbara County's air quality nonattainment for these two pollutants and the environmental and source factors contributing to this nonattainment status.

Table 3-10
National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]	National Standards[2]	
			Primary[3]	Secondary[4]
Ozone (O_3)	1-Hour	0.09 ppm (180 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	Same as Primary Standard
	8-Hour	-	0.08 ppm	-
Carbon monoxide (CO)	8-Hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	-
	1-Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	-
Nitrogen dioxide (NO_2)	Annual	-	0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard
	1-Hour	0.25 ppm (470 $\mu g/m^3$)	-	-
Sulfur dioxide (SO_2)	Annual	-	0.03 ppm (80 $\mu g/m^3$)	-
	24-Hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	-
	3-Hour	-	-	0.5 ppm (1,300 $\mu g/m^3$)
	1-Hour	0.25 ppm (655 $\mu g/m^3$)	-	-
Suspended particulate matter at 2.5 microns ($PM_{2.5}$)	Annual	No separate state standard	15 $\mu g/m^3$	-
	24-Hour	No separate state standard	65 $\mu g/m^3$	-
Suspended particulate matter at 10 microns (PM_{10})	Annual	30 $\mu g/m^3$ Geometeric	50 $\mu g/m^3$ Arithmatic	Same as Primary Standard
	24-Hour	50 $\mu g/m^3$	150 $\mu g/m^3$	-
Sulfates	24-Hour	25 $\mu g/m^3$	-	-
Lead	30-Day	1.5 $\mu g/m^3$	-	-
	Quarterly	-	1.5 $\mu g/m^3$	Same as Primary Standard
Hydrogen sulfide	1-Hour	0.03 ppm (42 $\mu g/m^3$)	-	-
Visibility reducing particles[5]	8-Hour (10 a.m. to 6 p.m.)	Insufficient amount to produce an extinction coefficient of 0.23 per km due to particles when the relative humidity is less than 70%.	-	-

Notes:
1 - California standards for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, PM_{10}, and visibility reducing particles are not to be exceeded. The standards for sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded.
2 - National standards other than O_3 and those based on annual averages are not to be exceeded more than once a year. The O_3 standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one.
3 - National Primary Standards: The level of air quality necessary, with an adequate margin of safety, to protect the public health.
4 - National Secondary Standards: The level of air quality necessary to protect the public welfare from any known or anticipated adverse effects from a pollutant.
5 - This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70%.

3.8.3.1 Ozone Nonattainment

Ozone is not produced directly by any pollutant source. Instead, it is formed by a reaction between oxides of nitrogen, and VOCs in the presence of sunlight. A reduction in ozone is dependent on a reduction in oxides of nitrogen and VOC emissions. Significant reduction in these emissions can be achieved through reducing the number of vehicle trips. Reduction of these pollutants has the added benefit of reducing the concentration of entrained $PM_{2.5}$ and PM_{10} emissions. Reduction of PM_{10} emissions is important because Santa Barbara County is currently in violation of the state standard for PM_{10}.

Ozone concentrations are generally highest during the summer months and coincide with atmospheric inversions. At their maximum, ozone concentrations tend to be regionally distributed. This is due to the homogeneous dispersion of the precursor emissions in the atmosphere. Hence, when an inversion occurs, the mixing of the precursor pollutants is within a much smaller volume of air. In 2001, Santa Barbara County reported 2 days during which the NAAQS standard was exceeded at various monitoring stations throughout the county; however, the more stringent CAAQS standard was exceeded on 15 days.

Santa Barbara County's air quality has historically violated both CAAQS and NAAQS for ozone. The severity of the ozone violation for the County is classified as "serious" by the federal government. The degree to which Santa Barbara County is in nonattainment for ozone is dependent on the "design value" concentration. The design value represents the fourth highest 1-hour observed concentration during a 3-year period at any individual monitoring station. Santa Barbara County is in serious nonattainment as a result of missing the December 31, 1996, deadline to meet the federal ozone standard, regardless of the overall trend of improved air quality of the Santa Barbara Region. However, the Santa Barbara County has met the federal 1-hour and 8-hour ozone standards based on air quality data from 1999 to 2001. As stated above, Santa Barbara County is currently in the process of applying for federal redesignation as attainment.

3.8.3.2 PM_{10} Nonattainment

Particulate matter 10 microns or less in diameter is produced either by direct emission of particulates from a source or by formation of aerosols as a result of chemical reactions in the atmosphere involving precursor pollutants. The sources of PM_{10} can also be categorized as natural (geogenic) or resulting from human activity (anthropogenic). The largest source of PM_{10} emissions in the county is entrained paved road dust. Other sources of PM_{10} emissions include dust from construction and demolition, agricultural activities, entrained road dust from unpaved roads, natural dust, and particulate matter released during combustion.

As previously mentioned, Santa Barbara County exceeds the state 24-hour and annual standards for PM_{10}. Exceedances of the annual standard predominantly occur at the downtown Santa Maria monitoring station. Exceedances of the 24-hour standard are more widespread across the county, although they do not occur as frequently.

3.8.3.3 Baseline Air Quality

The SBCAPCD developed a 2001 Maintenance Plan, which has been approved by the SBCAPCD Board of Directors. Parts of the 2001 Maintenance Plan are still waiting for state and federal approval. The 2001 Maintenance Plan demonstrates maintenance of the federal 1-hour ozone standard out to year 2015 based on projections of the 1999 baseline emissions inventory. Short-term and cumulative emissions for this 2003 construction project are compared to the 2005 baseline emissions inventory as projected in the SBCPCD 2001 Maintenance Plan.

In addition, the SBCAPCD and Vandenberg AFB Memorandum of Agreement outlines the administration of SBCAPCD regulations at Vandenberg AFB. The agreement between SBCAPCD and Vandenberg AFB was renegotiated and finalized on June 5, 1998. The agreement states that Vandenberg AFB is designated as a single stationary source.

3.9 HEALTH AND SAFETY

All construction activities, facility operations, and maintenance on Vandenberg AFB are subject to the requirements of the federal Occupational Health and Safety Administration (OSHA), Air Force Occupational Safety and Health (AFOSH) regulations, other recognized standards, and applicable Air Force regulations or instructions.

Relevant health and safety requirements include industrial hygiene and ground safety. Industrial hygiene is the joint responsibility of Bioenvironmental Engineering, 30 Space Wing (SW) Safety, and contractor safety departments. Responsibilities include monitoring of exposure to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations. Ground safety includes protection from hazardous situations and hazardous materials. If personal protective equipment must be used, 30 SW Safety requires a general description of the commodity in use, the hazardous qualities of the material, and data showing compliance with allowable limits for workplace exposures, workplace emergencies, and public exposures.

Many areas on Vandenberg AFB were used as ordnance training ranges. Consequently, there are remnants of unexploded ordnance (UXO) in recognized areas of the base. Unexploded ordnance from these areas may be detonated by only a slight movement, resulting in an explosion, burning, or release of smoke. Special precautions need to be taken in known areas of Vandenberg AFB that were used as practice ranges for artillery firing, referred to as Explosive Ordnance Disposal (EOD) Zones.

3.9.1 Site Health and Safety

The project area has the following known health and safety issues: the route for the Proposed Action and alternatives includes IRP Site 3 and the adjacent area to the east, where zones of contaminated soil and groundwater have been encountered over the course of several investigations. Soil COPCs include TPH, TCE, diesel, gasoline components, PAHs, hexavalent chromium, and other metals. Groundwater COPCs include TCE, PCE,1,4-dichlorobenzene, other VOCs, gasoline components, and diesel. All of the COPCs present a potential dermal exposure hazard to site workers. The VOCs, TCE, PCE, gasoline components, and diesel also present potential inhalation and explosive hazards. The route of the Proposed Action and Alternative 3 north of Pine Canyon Road includes the approximate vicinity of a Camp Cooke hand grenade training course (USACE 1953). The project area includes buried utility lines.

3.10 LAND USE/VISUAL RESOURCES

3.10.1 Land Use

3.10.1.1 General Land Use Setting

Vandenberg AFB covers approximately 99,100 acres in Santa Barbara County and is physically divided into two parts by the Santa Ynez River and Ocean Avenue. These two areas of Vandenberg AFB are commonly referred to as North Base and South Base. Much of Vandenberg AFB is open space set aside as security or safety buffer zones. The open space, when topography and natural resource management

allows, is frequently outleased to the United States Penitentiary for cattle grazing or farming. Approximately 23,000 acres of rangeland is outleased for grazing activities, with about 25 percent of the available rangeland unutilized each year (U.S. Air Force 1997g). The rangeland on base is divided into six grazing management units. In addition, about 1,100 acres of land are available for dryland farming (U.S. Air Force 1997g).

Space launch, missile test, telemetry, and tracking facilities are located throughout the base. Several space launch complexes, launch facilities, launch support complexes, and a California Commercial Spaceport on base provide for military and commercial launches, which take place on a regular basis. These facilities support the primary mission of Vandenberg AFB. A total of 20 space launches and 10 ballistic missile launches per year are estimated through 2001 (U.S. Air Force 1997g).

A developed cantonment area is located on North Base and includes various administrative, industrial, commercial, and residential land uses. The cantonment area is concentrated between California Boulevard and New Mexico Avenue to the east, Ocean View Avenue and Airfield Road to the west, Lompoc-Casmalia Road to the north, and 13th Street to the south. Development and land use at Vandenberg AFB is managed by 30 CES/CECB, Base Planning.

3.10.1.2 Regional and Community Setting

Vandenberg AFB is located in northern Santa Barbara County, near the cities of Lompoc and Santa Maria. The dominant land feature of Vandenberg AFB is the natural environment. Open space accounts for 90 percent of the total land area of 98,000 acres (Vandenberg AFB 2000). The mostly rural atmosphere of Vandenberg AFB is attributed to the open space needs for public safety during base operations. Many civilian employees live in the surrounding communities; the base plays a role in the livelihood of many people in this area. Table 3-11 lists the land use categories on the base.

3.10.1.3 Land Use Plans and Policies

The Vandenberg AFB General Plan (Vandenberg AFB 2000) is the primary planning document for land use; it outlines development goals and constraints for the base. The main objectives of the plan are to eliminate inefficient land use, reduce future siting conflicts, avoid incompatible future development, reduce or eliminate unnecessary project expenditures, and protect the environmental resources of Vandenberg AFB.

Table 3-11
Vandenberg AFB Land Use Categories

Administrative	Industrial
AETC	Launch Operations
Agriculture/Grazing	Medical
Airfield	Open Space
Community (Commercial and Service)	Outdoor Recreation
Housing (Accompanied and Unaccompanied)	Water/Coastal

Source: Vandenberg AFB 2000.

3.10.1.4 Site Setting

Site setting should be compatible with existing land use and the natural limitations of the area. The proposed project site is located on North Base, which consists of mostly open space. Land use on North Base, south of San Antonio Creek, is characterized by the urbanized main administrative area. Nearby facilities and their uses are summarized in Table 3-12.

The project site is located on Burton Mesa above Oak Canyon, to the north and northeast of the landfill. Access to the landfill is from Landfill Road, through Utah Avenue and 6th Street. The cantonment area is located northeast and northwest of the proposed project area. Lake Canyon lakes are located to the east, and southwest of the proposed project is open space.

3.10.2 Visual Resources

Visual resources are areas that are considered valuable due to their aesthetic attributes and the desirability of maintaining those attributes.

3.10.2.1 Regional Setting

Visual resources at Vandenberg AFB include natural and man-made features. The environment at Vandenberg AFB incorporates a number of diverse visual elements. The base encompasses 35 miles of coastline, including rocky headlands, coastal bluffs, and sandy beaches. A large dune complex, rolling hills, erosional valleys, and a broad sweeping mesa are found on North Base while the Transverse Range is a major mountain feature on South Base. Man-made elements are scattered throughout the base. Space and missile launch complexes are located near the coast, and radar towers, telemetry stations, and supporting utilities are distributed widely.

3.10.2.2 Site Setting

The proposed project calls for installing an underground storm water drain around the landfill on north base, including areas along Pine Canyon Road. The surrounding area northeast and northwest is developed and includes various administrative, industrial, commercial, and residential land uses. The surrounding area to the southeast is open space. The landfill lies southwest of the proposed project area.

3.11 NOISE

Noise is often defined as "unwanted sound." Depending on its intensity, it has the potential to disrupt sleep, interfere with speech communication, or even damage hearing. Noise is generated by a variety of interior and exterior sources. Exterior noise sources can be mobile or stationary, such as motor vehicles, aircraft, construction work, industrial processes, various human activities, and miscellaneous operations such as emergency vehicles and air conditioning units.

Sound waves, traveling outward from a source, exert a sound pressure, which is commonly assigned a "sound pressure level," measured in decibels (dB - a logarithmic measure of the ratio between sound pressure and the approximate threshold of human hearing). Environmental noise is usually measured in A-weighted decibels (dBA); the A-weighting describes a correction for variations in the typical human ear's frequency response at commonly encountered noise levels. In general, a fluctuation in sound of 1 dBA is noticeable only under laboratory conditions. A change of 3 dBA is just noticeable in field conditions,

Table 3-12
Facilities in the Project Area Vicinity

Building Number	Facility Use	Approx. Distance From Project Site (feet)
8337	Missile assembly/processing/storage/office space	2,100
8338	Hazardous materials storage shed	2,000
8339	Base supply / Administration	2,100
8350	Storage for special fuels	2,100
8412	Traffic check house	1,950
8415	Re-entry vehicles / Missile building services	1,650
8418	Missile surface / shipment	1,575
8425	Civil engineering shop	1,425
8430	Research equipment storage	1,350
8431	Storage shed	1,500
9320	Missile lab / testing	1,950
9325	Office space/equipment research lab/testing	1,650
9327	Logistics services building / offices	1,650
9360	Office space / storage	1,500
11432	Civil engineering administration	1,200
11433	Civil engineering administration	750
11434	Base engineering shop / administration space	1,050
11438	Civil engineering shop	900
11439	Main base civil engineering shop / office	900
11447	Civil engineering storage shed	600
11446	Storage shed	900

Source: Welch 2000.

a 5 dBA change is clearly noticeable, and a 10 dBA change is perceptually twice (or half) as loud. For example, a noise level of 70 dBA sounds approximately twice as loud as 60 dBA and four times as loud as 50 dBA.

Because environmental noise levels typically fluctuate over time, different types of noise descriptors are used to account for their variability. These descriptors include L_{eq} (which is the time-averaged equivalent noise level) and L_{DN} (day-night noise level; a 24-hour average noise assessment with "penalty" decibels added to the quieter nighttime levels). The L_{DN} descriptor is typically used in assessing vehicular traffic noise and aircraft noise. The Community Noise Equivalent Level (CNEL) is similar to the L_{DN}, but the adjustment factors are slightly different for different time periods. In most instances, however, CNEL is approximately equal to L_{DN}, and the two descriptors can be considered equivalent and interchangeable within this report. Both measurements are weighted averages with penalty decibels added for noises occurring during the quieter evening and nighttime hours.

Outdoor noise levels below an L_{DN} of 65 dBA are recommended for residential and educational land uses (Departments of the Air Force, Army, and Navy 1978). The OSHA recommends noise levels below 90 dBA for an 8-hour continuous noise exposure, and a 24-hour average noise level below 70 dBA for members of the general public. Higher noise levels are permitted for progressively shorter noise exposures; for example, noise levels as high as 115 dBA are permitted for only 15 minutes or less.

3.11.1 Regional Noise Setting

Existing noise levels on Vandenberg AFB are generally at or below an L_{DN} of 65 dBA, which is the generally accepted limit for outdoor noise levels in residential areas (Departments of the Air Force, Army and Navy 1978; U.S. Department of Housing and Urban Development 1978). Typical sources of noise include automobiles, trucks, and trains, with the higher noise levels occurring near transportation routes and industrial facilities. Aircraft and helicopter flights and rocket launches are less-frequent sources of noise. Typically, during launch activities and low-level aircraft flights, L_{DN} increases to between 48 and 67 dBA. The present noise levels have been considered acceptable in previous environmental assessments (Halliburton 1993).

3.11.2 Site Noise Setting

The proposed location for the storm water drainage system is on North Base near the landfill and south of the cantonment area. Lake Canyon lakes are located to the east of the proposed project and open space lies to the southwest. The cantonment area is the closest known sensitive noise receptor. Table 3-12 in Section 3.10.1.4 lists facilities in the project vicinity and describes facility use and distance from the proposed project area.

3.12 UTILITIES

Electricity is provided to Vandenberg AFB by Pacific Gas and Electric. The utility supplies 70 kilovolts of power to the Main Base service meters at Substation A (Halliburton 1993). Communication utilities include both copper and fiber-optic systems. Other utilities on base include natural gas, water, sanitary sewer, and storm drainage systems.

Electrical, natural gas, water supply, sanitary sewer, and storm drainage systems are all located in the portion of the project route that lies between 6th Street and Pine Canyon Road. There are also overhead electric lines along the northern part of Pine Canyon Road, and near the outlet for the Proposed Action and Alternative 3 (Figure 3-4). The presence of utilities in the project area was determined from available maps provided by 30 CES/CECB. However, these maps should be confirmed at the time of construction through Exterior Electric, 30th Communication Squadron Cable Maintenance, and Comprehensive Planning. The lines' availability and activity should also be confirmed.

The Proposed Action and alternatives do not require use of utilities. However, underground storm drainage pipes that pass beneath New Mexico Avenue in the project area will be connected to the drainage diversion (Figure 3-4).

3.13 TRANSPORTATION/CIRCULATION

3.13.1 Regional Traffic Setting

The existing roadway system at Vandenberg AFB is a combination of freeway facility, arterial, and local roads. Characteristics of freeway facility roads include controlled access, high speeds, and large volume capacity. State Route 1 is a freeway facility road located on base property, outside the secured area. Caltrans is responsible for maintaining State Route 1. Arterial roads are characterized by large volume capacity, divided roads, and limited access to adjacent land uses. The only arterial road within Vandenberg AFB is a short portion of California Boulevard near the Santa Maria Gate. Local roads are characterized by two lanes and low speeds. The remaining roads in the cantonment area are local roads. Because of Vandenberg AFB's large size, rural highways, which are roadways not normally designated in

the classification of roadways on military bases, are also found. The rural highway is a two-lane, high-speed road, which serves relatively low traffic volumes compared with urbanized areas. Its function is to provide quick and safe access to the more distant parts of the base. All Vandenberg AFB roads operate at an acceptable level of service.

3.13.2 Site Traffic Setting

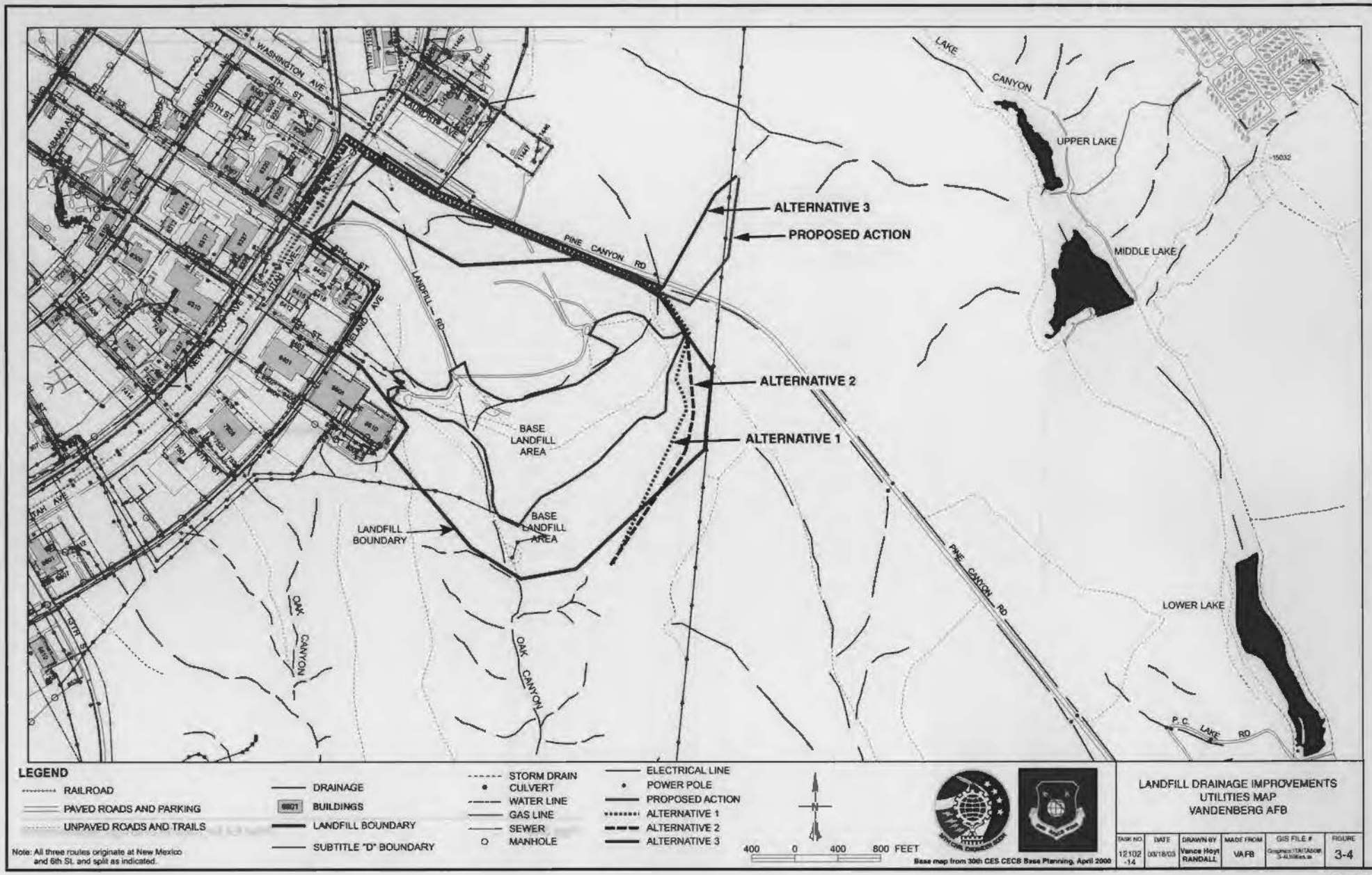
The proposed landfill drainage improvement project would follow New Mexico Road from 6th Street and turn south to follow Pine Canyon Road. New Mexico and Pine Canyon Roads are heavily traveled areas especially during the peak hours of 7:00 a.m. to 9:00 a.m. and 3:00 p.m. to 5:00 p.m.

3.14 ENVIRONMENTAL JUSTICE

Executive Order (EO) 12898, Environmental Justice was issued by the President on February 11, 1994. Objectives of the EO, as it pertains to this EIS, include development of federal agency implementation strategies, identification of minority and low-income populations where proposed federal actions have disproportionately high and adverse human health and environmental effects, and participation of minority and low-income populations. Accompanying EO 12898 was a Presidential Transmittal Memorandum that referenced existing federal status and regulations to be used in conjunction with EO 12898. The memorandum addressed the use of the policies and procedures of the NEPA. Specifically, the memorandum indicates that, "Each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions including effects on minority communities and low-income communities, when such analysis is required by the NEPA 42 U.S.C. Section 4321, et seq." Although an environmental justice analysis is not mandated by NEPA or by AFI 32-7061, DOD has directed that NEPA will be used as the primary approach to implement the provision of the EO.

The 2000 Census of Population and Housing reports numbers of minority residents. Minority populations included in the census are identified as Black or African American, American Indian and Alaskan Native, Asian, Native Hawaiian/Other Pacific Islander, Hispanic, or Other.

The potential economic and environmental impacts resulting from the construction and operation of the landfill drainage improvement project at Vandenberg AFB would occur primarily within Santa Barbara County, California, which is designated as the region of influence for environmental justice. Based upon the 2000 Census of Population and Housing, Santa Barbara County had a population of 399,347 persons. Of this total, 172,264 persons, or 43.14 percent, were minority (U.S. Bureau of the Census 2000).


ALTERNATIVE 3
PROPOSED ACTION
ALTERNATIVE 2
ALTERNATIVE 1
BASE LANDFILL AREA
BASE LANDFILL AREA
LANDFILL BOUNDARY
LANDFILL RD
PINE CANYON RD
PINE CANYON RD
OAK CANYON
OAK CANYON
LAKE CANYON
UPPER LAKE
MIDDLE LAKE
LOWER LAKE
P.C. LAKE RD
WASHINGTON AVE
41TH ST
NEBRASKA AVE
ALABAMA AVE
IDAHO AVE
UTAH AVE
IRELAND AVE
LAUNDRY AVE
15032
LEGEND
RAILROAD
PAVED ROADS AND PARKING
UNPAVED ROADS AND TRAILS
DRAINAGE
BUILDINGS
LANDFILL BOUNDARY
SUBTITLE "D" BOUNDARY
STORM DRAIN
CULVERT
WATER LINE
GAS LINE
SEWER
MANHOLE
ELECTRICAL LINE
POWER POLE
PROPOSED ACTION
ALTERNATIVE 1
ALTERNATIVE 2
ALTERNATIVE 3
Note: All three routes originate at New Mexico and 6th St. and split as indicated.
400 0 400 800 FEET
Base map from 30th CES CECB Base Planning, April 2000
LANDFILL DRAINAGE IMPROVEMENTS
UTILITIES MAP
VANDENBERG AFB
TASK NO. 12102 -14
DATE 03/18/03
DRAWN BY Vance Hoyt RANDALL
MADE FROM VAFB
GIS FILE #
FIGURE 3-4

This page intentionally left blank.

4 ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

This section presents the results of analyzing the environmental effects associated with the Proposed Action, Alternatives 1, 2, and 3, and the No-Action Alternative. Changes to the natural and human environments that would result from the Proposed Action were evaluated relative to the existing environmental conditions described in Chapter 3 and against threshold values for significance described for each resource area. Required and recommended mitigation measures are provided to reduce potential impacts resulting from the Proposed Action.

The term "significant impact" and its application to the Proposed Action are used as defined in the CEQ regulations, 40 CFR, Part 1508, Section 1508.27, *Significantly:* "Significantly, as used in NEPA, requires considerations of both context and intensity."

Context "means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the Proposed Action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than the world as a whole. Both short- and long-term effects are relevant."

Intensity "refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

- Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance that the effect will be beneficial.
- The degree to which the Proposed Action affects public health or safety.
- Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
- The degree to which the effects on the quality of the human environment are likely to be highly controversial.
- The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
- The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in, or eligible for listing in the National Register of Historic Places

(NRHP) or may cause loss or destruction of significant scientific, cultural, or historical resources.

- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

- Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment."

4.1 WATER RESOURCES

Impacts to water resources are divided into surface and ground water and are discussed for construction and operation of the proposed storm drain.

4.1.1 Proposed Action

4.1.1.1 Surface Water

The Proposed Action would not cause significant impacts to surface waters. Diverted runoff from the Proposed Action would enter an intermittent tributary leading to Upper Lake in Lake Canyon first, then flow downstream to the middle and lower lakes. The Upper Lake, Middle Lake, and Pine Canyon Gate outflow structures are all large enough to accommodate the increased volume of water that would result from a 100-year storm (the maximum design flow for the project) (Penfield and Smith 1999, 2000b). The Lower Lake outlet structure could not discharge this volume quickly enough to prevent the water level in the lake from rising to within 0.12 foot of the top of the dam (Penfield and Smith 2000b); this could cause flooding in Lake Canyon. A 24-inch diameter reinforced concrete outlet pipe would be installed over the existing 36-inch diameter outlet pipe at Lower Lake to provide discharge capacity sufficient to prevent flooding in the event of a 100-year storm. Routine maintenance of the outlet structures of the lakes in Lake Canyon will be conducted, including clearing of clogged vegetation from the inlet and discharge areas. Such maintenance would minimize inundation and prevent flooding. The proposed construction site for the Proposed Action is not located within a 100-year floodplain or tidal flood hazard. Lake Canyon drainage is also not within a FEMA-delineated floodplain.

Impacts to jurisdictional waters of the United States and wetlands are discussed in section 4.3, Biological Resources. Section 404 permitting would be required for the Proposed Action. In addition, a Finding of No Practicable Alternative (FONPA) was prepared for the project. A NPDES, California Statewide General Permit for storm water discharges associated with construction activities will be obtained for the construction phase of the project. Compliance with the requirements of the General Permit would minimize erosion and negative impacts to surface water quality during construction by implementing best management practices. Construction would be confined to the dry season to reduce or eliminate the potential for erosion caused by the construction activities. The Proposed Action would not increase erosion in the project area and is specially designed to minimize erosion. The diverted runoff would be contained within drain pipes and flow onto a grouted riprap channel that extends to a stable discharge point (Penfield and Smith 1999).

Because there is more runoff from pavement and buildings than from vegetated, undeveloped land, under the existing conditions Oak Canyon currently receives more runoff than it did before the cantonment area was constructed. Reducing the volume of runoff to Oak Canyon would return the drainage to a more

natural condition. By reducing the volume of water discharged into Oak Canyon from the landfill, the Proposed Action would also serve to reduce erosion in Oak Canyon.

The Proposed Action would not cause significant impacts to surface water quality. Compliance with the NPDES permit and limiting construction to the dry season would reduce or eliminate the potential for impacts to surface water quality during the construction phase. The drainage diversion would intercept storm water runoff from the cantonment area upgradient of the landfill, before it entered the landfill. Diverting runoff away from the landfill would prevent it from contacting waste and carrying contaminants into Oak Canyon. Lake Canyon currently receives storm water from developed/paved areas. Storm water diverted into Lake Canyon would originate from developed/paved areas, and areas where vegetation is well established. Runoff from these areas will not increase the sediment load to Lake Canyon.

A Notice of Intent will be submitted for coverage under the Statewide General Permit. Under the General Permit, a SWPPP will be developed for the construction of the drainage diversion. Compliance with the General Permit and the SWPPP will minimize impacts to storm water quality resulting from the construction phase through implementation of best management practices and regular observations. In addition, the project must be in compliance with the basewide SWPPP scheduled to be completed in March 2003. Best management practices applicable to the proposed construction project would include erosion control and standard spill prevention measures including drip pans and equipment parking areas, proper storage of construction materials, and disposal of wastes. Construction vehicle maintenance would not be performed at the site.

Depending on site conditions, watering construction areas for dust control would require up to 5,000 gallons per acre over the course of the project. The Vandenberg AFB water supply system capacity is 7.5 million gallons per day. Therefore, watering areas for dust control would not significantly affect the Vandenberg AFB water supply system.

Potential contaminants that would enter storm water during construction include excess sediments generated during excavation, air particulates, and accidental spills from vehicles.

During site reconnaissance conducted for the proposed project, an existing underground storm drain pipe planned for connection to the drainage diversion was found to be connected to roof vents on two buildings in the cantonment area west of New Mexico Avenue, Buildings 9320 and 9334 (Penfield and Smith 2000a). The Air Force is investigating these buildings to determine their connections to the drain pipe. All inlets to the drain pipe within the buildings would be located and sealed prior to the construction of the Proposed Action.

4.1.1.2 Groundwater

Groundwater will be encountered along the Proposed Action project alignment. Zones of soil or groundwater contamination within IRP Site 3 and the adjacent area to the southeast were found during IRP investigations (Figure 3-3). However, the investigation of the area adjacent to the southeast of Site 3 is limited to a single monitoring well and two soil borings at culvert outfalls along the south side of Pine Canyon Road (U.S. Air Force 1999f). Geotechnical borings drilled along the project route encountered groundwater at three locations within IRP Site 3 and the adjacent area to the southeast. Excavations for the pipeline will encounter groundwater at these three locations, and where the project route comes close to locations of groundwater encountered during IRP investigations.

The SWPPP will include sampling, analysis, and discharge of groundwater from the IRP Site 3 area. No groundwater from the IRP Site 3 work area will be released or removed from the site without analytical

results to determine its proper disposition. All groundwater encountered during excavation at IRP Site 3 and the adjacent area to the east will be captured, containerized, sampled, analyzed, and disposed of according to analytical results. If the groundwater is deemed nonhazardous, it can be treated at the base Industrial Wastewater Treatment Plant; otherwise it must be disposed of properly as hazardous waste.

The locations of geotechnical borings that encountered groundwater are given in the report of the geotechnical investigation (S/G 2000). The locations of IRP borings that encountered groundwater are given in the following documents: JEG 1994b, 1994c, 1995, and 1997; Tetra Tech 2000; and U.S. Air Force 1999f. In areas where trenching is used, the pipeline trench will create a new route for groundwater migration, allowing contaminated groundwater to migrate beyond IRP Site 3, and allowing uncontaminated groundwater to migrate into contaminated soil. A slurry wall will be constructed in the IRP Site 3 work area to prevent migration of groundwater. In addition, anti-seep collars or rings will be constructed at about 1 per 100 linear feet to eliminate impacts to groundwater. Diverting drainage away from IRP Site 3 will ultimately reduce groundwater recharge to the contaminated areas. The contractor will coordinate with 30 CES/CEVR prior to and during all activities involving excavation or groundwater at IRP Site 3 and other contaminated areas.

The Proposed Action would not impact groundwater quantity or quality over the project route outside of IRP Site 3 and the adjacent area to the southeast. The thin, discontinuous zones of perched groundwater on Burton Mesa are not considered a reliable groundwater resource (JEG 1997). Therefore, removing a portion of the recharge to these zones of perched groundwater would not have a significant impact. Some portions of the trench will be excavated to depths of 30 feet, and continuous groundwater may be encountered there. In addition, continuous groundwater may be encountered in areas where a jack and bore construction method is used. Areas with continuous groundwater would be dewatered during the construction phase of the project. The SWPPP will include proper procedures for discharge of groundwater pumped from the trench outside of IRP Site 3. Best management practices of the project design and required in the SWPPP would be carried out to reduce or eliminate impact to groundwater over the portion of the project route that lies outside of IRP Site 3 and the adjacent area.

By diverting surface drainage away from Oak Canyon, the Proposed Action would reduce groundwater recharge to the alluvial sediments beneath the landfill. Reducing recharge to this area would aid in the efforts to dewater the landfill, lower the groundwater table, and prevent the interaction of buried waste and water and the formation of leachate. Reducing the flow of surface water into the landfill would also reduce erosion of the underlying shale, and reduce the amount of sediment carried out of the landfill and into Oak Canyon. Water quality in Oak Canyon would improve due to a decreased TSS load in the water from the landfill.

4.1.2 Alternative 1

Alternative 1 would follow a project route similar to the one for the Proposed Action, up to the project fill area adjacent to Pine Canyon Road. Alternative 1 then would turn southward to discharge diverted runoff into the hilly area south of the landfill. This area was formerly used as a spray discharge field for groundwater pumped from the landfill groundwater extraction system (U.S. Air Force 1999a). Additional surface drainage to this area would not be expected to cause flooding or erosion in the discharge area, or to adversely affect surface or groundwater quality. The diverted runoff would be contained within drain pipes and flow out onto a grouted riprap channel that extends to a stable discharge point (Penfield and Smith 1999). Compliance with the requirements of the General Permit would prevent erosion and negative impacts to surface water quality during construction. A Notice of Intent would be submitted for the construction phase of the project.

Impacts to jurisdictional waters of the United States and wetlands are discussed in section 4.3, Biological Resources. Section 404 permitting would be required for Alternative 1. In addition, a FONPA was prepared for the project.

Under Alternative 1, surface water would be diverted around the landfill and into Oak Canyon. Therefore, area recharge would be reduced, which would aid in the efforts to dewater the landfill, lower groundwater tables within the landfill, and prevent the interaction of buried waste and water and the formation of leachate. Alternative 1 would also reduce erosion in Oak Canyon, thus improving water quality. However, the impacts to groundwater in the IRP Site 3 portion of the route for Alternative 1 would be the same as for the Proposed Action. There would be no potential for flooding under Alternative 1.

4.1.3 Alternative 2

Alternative 2 would follow the same project route as the Alternative 1, diverge slightly to the east, then rejoin the Alternative 1 route to end at the same discharge point. Due to the very small difference in the routes, all the impacts to surface water and groundwater for Alternative 2 would be the same as those for Alternative 1. There would be no potential for flooding under Alternative 2.

4.1.4 Alternative 3

Alternative 3 would follow a route similar to the Proposed Action, but would require jack and bore methods underneath vernal pool areas. Boring may mean encountering groundwater more frequently, however, these areas would be dewatered during the construction phase of the proposed project, thus impacts would be less than significant. In the operational phase of the proposed project, Alternative 3 would have the same impacts on surface water and groundwater as the Proposed Action.

4.1.5 No-Action Alternative

Under the No-Action Alternative, there would be no diversion of drainage away from the landfill and Oak Canyon. Existing surface water and groundwater conditions and quality would be unchanged and would continue to erode the site and pass through the fill area. However, there would be no excavation through the zone of contamination at IRP Site 3, which would preclude the potential for disturbing existing site conditions. There would also be no potential for flooding in Pine Canyon.

4.1.6 Mitigation Measures

No significant impacts to water resources have been identified, therefore no mitigation measures will be required. However, all federal, state, local, and Air Force rules and regulations will be followed to ensure there are no impacts to water resources.

4.2 GEOLOGY AND SOILS

4.2.1 Proposed Action

The Proposed Action would not increase the likelihood of, or cause, earthquake damage in the project area because the excavation would not be extensive. The project route would not pass through steep slopes subject to landslides or failure. The two percent slopes to be created in the fill area would not be steep enough to pose a risk of landslide or failure. There are no buildings along the project route, thus there would be no impacts to building foundations. Use of HDPE pipe in the trench and proper boring,

backfill, compaction, and slope shoring techniques would ensure that the filled trench did not subside or collapse. Geologic impacts would be less than significant.

The Proposed Action would not result in a loss of soil for agriculture or habitat, aesthetic value from a unique landform, mineral resources, or cause severe erosion or sedimentation. The Proposed Action would involve excavating contaminated soil at IRP Site 3 and the adjacent area to the east. Approximately 2,518 cubic yards of soil would be excavated from IRP Site 3. Excavated soil from IRP Site 3 would be segregated and properly stockpiled immediately adjacent to the trench. All soil excavated from IRP Site 3 and the adjacent area to the east would be sampled and characterized in an analytical laboratory for proper disposal methods pursuant to the Porter-Cologne Act (also see Section 4.7, Hazardous Materials, Hazardous Waste Management). Although not planned, if excavation through IRP Site 3 is done during the rainy season (beginning in October), excavated soils would be containerized and sampled immediately after excavation rather stored alongside the trench. No contaminated or suspect contaminated soil from the IRP Site 3 area or the adjacent area to the east would be backfilled or removed from the site without analytical results to determine its proper method of disposal. Soil that met appropriate regulatory guidelines/maximum contaminant levels would be used as backfill in the IRP Site 3 area only. IRP Site 3 soil that met designated levels for landfill disposal would be taken to the Vandenberg AFB landfill or another permitted sanitary landfill. Soil that exceeded designated levels would be properly disposed of as hazardous waste.

Compliance with all federal, state, local, and Air Force rules and regulations pertaining to the handling, storage, treatment, and disposal of hazardous materials and waste and implementing best management practices would reduce impacts caused by excavating contaminated soil to less than significant levels. Where possible, the existing soil would be retained for use as backfill. Clean fill would be used to supplement the natural material as needed. The area to be excavated and backfilled does not encompass any unique landforms or known mineral resources. Approximately 77,080 cubic yards of soil would be excavated under the Proposed Action. The Proposed Action would reduce erosion of soil and bedrock in the landfill and in Oak Canyon.

4.2.2 Alternative 1

The impacts to geology and soils for Alternative 1 would be greater than for the Proposed Action. The route of Alternative 1 would be slightly longer through IRP Site 3 than the Proposed Action. Approximately 9,462 cubic yards of soil would be excavated within IRP Site 3 under Alternative 1, as opposed to approximately 2,518 cubic yards under the Proposed Action. In addition, the total volume of excavated soil under Alternative 1 (approximately 88,452 cubic yards) would be greater than under the Proposed Action (approximately 77,080 cubic yards).

4.2.3 Alternative 2

The impacts to geology and soils for Alternative 2 would be slightly less than for Alternative 1 but greater than for the Proposed Action. Approximately 87,112 cubic yards of soil total would be excavated under Alternative 2 as opposed to approximately 88,452 cubic yards under Alternative 1 and 77,080 cubic yards under the Proposed Action.

4.2.4 Alternative 3

The impacts to geology and soils for Alternative 3 would be similar to the Proposed Action. A total of approximately 63,000 cubic yards of soil would be excavated under Alternative 3 as opposed to 77,080 cubic yards under the Proposed Action. However, more soil (approximately 9,462 cubic yards) would be

excavated within IRP Site 3 under Alternative 3 than under the Proposed Action (approximately 2,518 cubic yards).

4.2.5 No-Action Alternative

Under the No-Action Alternative, the contaminated soil at IRP Site 3 and the adjacent area to the east would remain undisturbed. No grading or excavation would take place over the project route as a whole, thus there would be no potential for erosion resulting from the construction activities. Erosion would continue at the landfill and in Oak Canyon.

4.2.6 Mitigation Measures

No significant geological impacts have been identified and therefore no mitigation measures will be required. However, best management practices will be implemented to prevent soil erosion.

4.3 BIOLOGICAL RESOURCES

4.3.1 Proposed Action

4.3.1.1 Biological Resources

No impacts to listed threatened or endangered plant species would occur from implementing the Proposed Action within the direct construction zone. The most important botanical resources identified along and near the Proposed Action route are the special-status species Blochman's dudleya, and La Purisima manzanita, as well as seasonal freshwater marshes. Blochman's dudleya is known to occur on the base from only two other locations; the other two species, although more widespread on the base, are relatively rare. Vernal marshes are ranked sensitive (very threatened) by the CDFG. To prevent impacts to special-status plant species and vernal marshes, the Proposed Action storm drain alignment will be constructed to avoid the environmentally sensitive areas where they occur.

The tributary below the Proposed Action outlet that leads to Lake Canyon, and the three Lake Canyon lakes, could be affected indirectly by increased storm water runoff resulting from implementing the Proposed Action. However, replacement of the outlet structure for Lower Lake and continued maintenance of the intakes and outlets of the other Lake Canyon lakes would prevent flooding of Lake Canyon due to excess runoff from the landfill. Therefore, it is unlikely that upland special-status plant species found along the slopes of the tributary and Upper Lake would be affected by increased runoff. In addition, it is unlikely that the sensitive freshwater marsh and willow woodland (very threatened and threatened, respectively) would be affected by increased runoff from the landfill.

No impacts to listed threatened and endangered wildlife species, or to any species of concern, would occur due to implementation of the Proposed Action within the direct construction zone, due to the fact that special-status species are not expected to occur within or near the direct construction zone. The closest known locations of special-status species to the direct construction zone would be in Lower Lake near the replacement of the outlet structure. Observations of the southwestern pond turtle and California red-legged frog have been made in Lower Lake, however, these observations were at the other side of the lake from the outlet structure. Potential habitat for the southwestern willow flycatcher exists at the Lower Lake outlet, however, the species has not been observed there during past surveys. Biological monitoring during construction will also ensure that special-status species are not impacted during construction. In addition to biological monitoring during construction, pre-construction surveys for the California red-legged frog and southwestern willow flycatcher will be conducted in the immediate area of the Lower

Lake outlet to ensure that they would not be impacted by construction of the Lower Lake outlet. Finally, construction and maintenance of the Lower Lake outlet will be conducted outside the nesting season of the southwestern willow flycatcher between 15 May and 30 August.

Since there will be relatively extensive trenching and excavation, and removal of vegetation, there would, however, be adverse impacts to other wildlife species not considered special-status and their habitats, particularly to birds protected under the Migratory Bird Treaty Act (MBTA). There is the potential for adverse impacts to bird species, both directly and indirectly due to disturbance-related nest abandonment, if project implementation takes place during their nesting season (15 April to 30 August). However, such potential impacts, although adverse, would not be significant because they would be limited and localized. Some other wildlife, such as small mammals and non-listed herpetofauna (e.g., Pacific treefrog), may be impacted directly by excavation. These impacts also would be localized and temporary, and most wildlife species that might occur within the disturbance zone likely would be able to move to suitable habitats away from the impact area. In addition, the area of impact would be revegetated to restore wildlife habitat.

As stated above, the tributary below the Proposed Action outlet that leads to Lake Canyon, and the three Lake Canyon lakes, would be affected indirectly by increased storm water runoff. Changes in hydrology, such as increases in water levels or waterflow, and sedimentation or turbidity, potentially could have indirect adverse impacts on the habitat quality for the California red-legged frog, observed at the Lower Lake. However, based upon the Water Resources impact analysis for this project, surface water quality and water levels would not be affected adversely by the Proposed Action. Additional runoff should not add a large sediment load or other contaminants to Lake Canyon. In addition, replacement of the outlet structure for Lower Lake and continued maintenance of the intakes and outlets of the other Lake Canyon Lakes would prevent flooding of Lake Canyon due to excess runoff from the landfill. Therefore, impacts to the California red-legged frog and its habitat would not be considered significant.

In conclusion, implementation of appropriate best management practices, pre-construction surveys, and biological monitoring during construction would reduce potential adverse impacts to vegetation and wildlife under the Proposed Action to less than significant levels.

4.3.1.2 Waters of the United States and Wetlands

Since the Proposed Action would avoid areas where vernal pools are located, impacts to vernal wetland swales would not occur. However, there would be fill in jurisdictional waters of the United States in the topographic depression where sampling station SS-3 was located. Also wetland areas (represented by sampling stations SS-8, SS-9, and SS-10) along the route of the Proposed Action likely would be impacted directly by construction. Due to the topography and hydrology in and near the landfill, construction of the storm drain through the topographic depression and impacts to this area are unavoidable; therefore, coordination with the USACE through the Section 404 permitting process will be required. Similarly, impacts to wetlands protected under Executive Order 11990 near sampling stations SS-8, SS-9 and SS-10 would also be unavoidable due to the topography and hydrology of the landfill. Because jurisdictional waters of the United States and wetlands will be revegetated after construction, less than significant impacts to these resources are anticipated. Any conditions of the Section 404 permit will also be implemented. Since wetlands would be impacted by construction of the Proposed Action, a Finding of No Practicable Alternative (FONPA) has been prepared to document that all practical measures are being taken to minimize destruction or modification of these resources.

Implementation of the Proposed Action would involve diverting storm water runoff from one drainage basin (the landfill and Oak Canyon) to another (Lake Canyon). Water flow would be increased in Lake

Canyon, and peak 100-year flow rates are estimated to increase by as much as 30 to 70 percent. Conversely, water flow would be reduced in Oak Canyon. This diversion would be considered a significant change to conditions in these drainage areas, which comprise jurisdictional waters and wetland resources. Initial examination of flow rates and the capacities of the Lake Canyon lakes suggest that the Lower Lake appears to have insufficient capacity to handle peak 100-year flow rates. Replacement of the outlet structure for Lower Lake and continued maintenance of the intakes and outlets of the other Lake Canyon Lakes, however, would prevent flooding of Lake Canyon due to excess runoff from the landfill. Therefore, impacts to these jurisdictional waters and wetland resources are not anticipated to be significant. Since replacement of the outlet structure for Lower Lake would be conducted from the existing road and the new culvert would be placed on top of the existing culvert, and routine maintenance of intakes and outlets of the other lakes is permissible under USACE regulations, an individual Section 404 permit for these activities would not be required.

4.3.2 Alternative 1

4.3.2.1 Biological Resources

No impacts to listed threatened or endangered plant species would occur from implementation of Alternative 1 within the direct construction zone. However, impacts would occur to certain special-status (threatened) plant species. The most important botanical resource identified along the Alternative 1 route is the plant community Burton Mesa chaparral, designated as sensitive (threatened) by the CDFG. Two dominant species in this community are special-status species: sand mesa or shagbark manzanita and La Purisima manzanita. Impacts to Burton Mesa chaparral and its constituent species, including the manzanitas, and consequent habitat loss or degradation as a result of implementation of Alternative 1, would be unavoidable and considered significant without mitigation. However, the proposed storm drain alignment for Alternative 1 would be modified to avoid sensitive plant species.

No impacts to listed threatened and endangered wildlife species, or to any species of concern, would occur due to implementation of Alternative 1 within the direct construction zone. Since there will be relatively extensive trenching and excavation, and removal of vegetation, there would be adverse impacts to non-listed wildlife species and habitats, particularly to birds protected under the MBTA. There is the potential for adverse impacts to these bird species, both directly and indirectly due to disturbance-related nest abandonment, if project implementation takes place during their nesting season. However, such impacts, although adverse, would not be significant, because they would be limited and localized. The impacts potentially could be most significant for the special-status species Bell's sage sparrow, recorded in the vicinity of Oak Canyon, but this species was not recorded in the impact area. Furthermore, the Burton Mesa chaparral found here is not ideal habitat because it is relatively dense and has not been burned recently. Some other wildlife, such as small mammals and non-listed herpetofauna, may be impacted directly by excavation. These impacts also would be localized and temporary, and most wildlife species that might occur within the disturbance zone likely would be able to move to suitable habitats away from the impact area. The area of impact would be revegetated to restore wildlife habitat. In addition, implementation of appropriate best management practices and biological monitoring during construction would reduce potential adverse impacts to wildlife under the Alternative 1 to less than significant levels.

4.3.2.2 Waters of the United States and Wetlands

There would be fill in jurisdictional waters of the United States in the topographic depression where sampling station SS-3 was located. Also wetland areas (represented by sampling stations SS-8, SS-9, and SS-10) along Alternative 1 likely would be impacted directly by construction. Due to the topography and

hydrology in and near the landfill, construction of the storm drain through the topographic depression and impacts to this area are unavoidable; therefore, coordination with the USACE through the Section 404 permitting process will be required. Similarly, impacts to wetlands protected under Executive Order 11990 near sampling stations SS-8, SS-9, and SS-10would also be unavoidable due to the topography and hydrology of the landfill. Because jurisdictional waters of the United States and wetlands will be revegetated after construction, less than significant impacts to these resources are anticipated. Any conditions of the Section 404 permit will also be implemented. Since wetlands would be impacted by construction of the Proposed Action, a Finding of No Practicable Alternative (FONPA) has been prepared to document that all practical measures are being taken to minimize destruction or modification of these resources.

Under Alternative 1, surface water would be diverted around the landfill and into the floodplain within Oak Canyon. The outlet area was formerly used as a spray discharge field for groundwater pumped from the groundwater extraction system. Therefore, additional surface drainage to this area would not be expected to cause flooding or erosion in the discharge area. Additionally, in contrast to the Proposed Action, no impacts would occur to Lake Canyon.

4.3.3 Alternative 2

4.3.3.1 Biological Resources

Impacts to biological resources under Alternative 2 would be the same as for Alternative 1. The same plant communities, species, and wildlife would be affected.

4.3.3.2 Waters of the United States and Wetlands

Impacts to jurisdictional waters of the United States and wetlands under Alternative 2 would be identical to those for Alternative 1. Therefore, impacts would be less than significant.

4.3.4 Alternative 3

4.3.4.1 Biological Resources

Since Alternative 3 follows a similar route as the Proposed Action, impacts to biological resources generated by Alternative 3 would be similar to those generated by the Proposed Action. Both alternatives avoid direct impacts to the vernal pools and sensitive species located north of Pine Canyon Road. However, since Alternative 3 would bore underneath the vernal pools, removal of vegetation in this area would be less than the removal that would be required for the Proposed Action, even though nonnative grassland is the dominant habitat under the Proposed Action. Therefore, Alternative 3 would generate fewer impacts to wildlife species and habitats in this area, including birds protected under the MBTA. Any impacts on wildlife species and habitats would be temporary, occurring only during construction, and would be less than significant. Biological monitoring and revegetation would occur as described for the Proposed Action, although Alternative 3 would require less revegetation, since less native vegetation would be removed. Since the outfall for Alternative 3 would be identical to the outfall used for the Proposed Action, impacts to Lake Canyon, the three canyon lakes, and the California red-legged frog and would be identical to those described for the Proposed Action. Under Alternative 3, implementation of best management practices would occur under as described for the Proposed Action.

4.3.4.2 Waters of the United States and Wetlands

Alternative 3 would bore under vernal pools located northeast of Pine Canyon Road. Therefore, no impacts to vernal pools located in this area would be generated by Alternative 3. However, as described for the Proposed Action, fill in jurisdictional waters of the United States in the topographic depression where sampling station SS-3 is located and wetlands where sampling stations SS-8, SS-9, and SS-10 are located would occur under Alternative 3, thus generating impacts to jurisdictional waters of the United States and wetlands. Impacts generated by Alternative 3 on storm water runoff, water flow rates, and the capacities of the Lake Canyon lakes would be identical to those generated by the Proposed Action.

4.3.5 Project Impacts Common to the Proposed Action and the Three Alternatives

Under the Proposed Action and Alternatives, storm water from the base that currently is routed through the landfill would be diverted. This diversion would result in the permanent loss of the source of water that currently supports willow woodland habitat, small marshes, and pools in the northern part of the landfill. No listed threatened or endangered or other special-status plant and animal species were found in this area, therefore, no impacts to these species are anticipated from project implementation. There would be adverse impacts to the marsh and woodland habitats, both of which are ranked by the CDFG as sensitive communities (very threatened and threatened, respectively). The marsh likely would dry up and revert to upland ruderal or scrub vegetation. The willows may persist for a longer period, but the understory would change. Habitat values therefore would change in this area. These impacts are not likely to be significant because the affected habitats are small in extent, species diversity is relatively low compared to other parts of the project area, and no special-status species occur.

Under the Proposed Action and Alternatives, the topographic depression at the northeast corner of the landfill just south of Pine Canyon Avenue also would be affected similarly from project implementation. No listed threatened or endangered or other special-status plant and animal species were found in this area, therefore, no impacts to these species are anticipated from project implementation. Small patches of arroyo willow and coast live oak are present in this depression and would be lost from filling the area. However, the affected habitats are small in extent, no special-status species occur, and the area previously has been disturbed and is invaded by introduced species, including iceplant.

Introducing fill into the topographic depression, where USACE jurisdictional waters of the United States are present, would constitute jurisdictional impacts, and would require coordination with the USACE. Section 404 permitting would be required.

Wetlands at SS-3, SS-8, SS-9 and SS-10 would be impacted by construction of the Proposed Action and Alternatives 1, 2, and 3. It is not possible to avoid these impacts because the pipeline placement is constrained by Pine Canyon Road and development north and south of the road, including the landfill to the south of the road. No other viable design for the storm water system exists without impacting wetlands. Therefore, a FONPA was prepared for the project.

4.3.6 No-Action Alternative

4.3.6.1 Biological Resources

Under the No-Action Alternative, no impacts would occur to biological resources directly from project implementation. Potential risk to ecological receptors due to exposure to contaminants in the soil and groundwater from the landfill are currently under investigation during preparation of remedial investigations for the nearby IRP sites.

4.3.6.2 Waters of the United States and Wetlands

Under the No-Action Alternative, no impacts would occur to jurisdictional waters of the United States or wetlands.

4.3.7 Mitigation Measures

No significant impacts would occur to listed or proposed listed plant and bird species, therefore, no species-specific mitigation measures are required for these species. If the Proposed Action or Alternative 3 were implemented, routine maintenance of the outlet structures of the lakes in Lake Canyon would be conducted, including clearing of clogged vegetation from the inlet and discharge areas, and the outlet structure for Lower Lake would be replaced. Such maintenance would minimize potentially adverse impacts from inundation to shoreline habitats and species, including the special-status plant black-flowered figwort.

Implementation of either Alternative 1 or 2 would cause adverse and significant direct impacts to the sensitive community Burton Mesa chaparral and its constituent special-status plant species. To reduce these impacts and the fragmentation of chaparral habitat, the routes could be modified to the maximum extent possible, to follow the fence of the Subtitle D boundary (the active fill area at the landfill) in the northern part, and areas that previously have been disturbed or cleared in the southern part (Appendix A, Attachment 1, Figure 4). This route would not avoid all impacts to chaparral or reduce them to a level of insignificance, but would reduce the extent of habitat impacted and the scope of future required restorations. Realignment of the Alternative 1 and/or 2 pipeline route to avoid Burton Mesa chaparral and its constituent species may reduce impacts to less than significant. However, realignment of the Alternative 1 and/or 2 pipeline route would constitute a significant change in Alternative 1 and/or 2 and would require separate analysis and documentation.

4.4 CULTURAL RESOURCES

4.4.1 Proposed Action

The route of the Proposed Action has previously been surveyed, and archival research indicates that no archaeological sites are within the APE. Furthermore, no archaeological sites are within 100 meters of the APE. Therefore, no impacts to cultural resources would be expected as a result of the Proposed Action. No archaeological or Native American monitoring would be required, as the nearest site to the APE, CA-SBA-3248, is approximately 125 meters from the edge of the APE. An examination CA-SBA-3248 revealed that it does not extend into the APE.

The Proposed Action will comply with Section 106 of the National Historic Preservation Act (NHPA) and with AFI 32-7065. In the event that previously undocumented cultural resources are discovered during construction activities, the 36 CFR 800 regulations of Section 106 of the NHPA would be followed.

4.4.2 Alternative 1

The route for Alternative 1 has previously been surveyed, and archival research indicates that no sites are within the APE. CA-SBA-1049 is approximately 100 meters from the edge of the APE. Both the APE and the site were examined, but most of the intervening area is within a former landfill groundwater spray disposal area where access is prohibited. The site is associated with chert outcrops at the canyon edge,

and it is unlikely that site boundaries extend to the APE, well away from the chert outcrops. Thus, it is unlikely that CA-SBA-1049 would be directly impacted by construction associated with Alternative 1.

Although direct impacts are unlikely, indirect impacts from Alternative 1 as currently planned would be possible. The outlet for Alternative 1 is midslope, with riprap at the mouth to impede the flow of water. The expectation is that the water would spread out from the outlet and dissipate as sheet flow (Steward 2000). However, erosion would be possible. CA-SBA-1049 is downslope from the Alternative 1 outlet and may be impacted by erosion, particularly if the natural channel just south of the site expanded due to the increased volume of water. If Alternative 1 is selected as the preferred alternative it may be necessary to channel the water to the canyon edge or even to the canyon bottom in order to prevent erosion (Steward 2000). Construction of a channel might impact CA-SBA-1049.

Under Alternative 1, CA-SBA-1049 may be indirectly impacted by erosion or directly impacted by the construction of a channel intended to reduce erosion. Prior to implementation of Alternative 1, the boundaries at CA-SBA-1049 would be defined by subsurface probing to determine if the site extends into the area likely to be affected by erosion or by construction of a channel. If CA-SBA-1049 is found to extend into the area likely to be affected by erosion or construction of a channel, site significance should be evaluated relative to the NRHP, as required under Section 106 of the NHPA and its implementing regulations (36 CFR 800).

4.4.3 Alternative 2

Alternatives 1 and 2 are nearly identical in terms of cultural resources. The Alternative 2 route has previously been surveyed, and archival research indicates that no sites are within the APE. CA-SBA-1049 is approximately 100 meters from the edge of the APE. The site and the APE were examined, but access is prohibited in the intervening area due to the former landfill groundwater disposal system. The site is a prehistoric quarry associated with chert outcrops at the canyon edge, and it is unlikely that site boundaries extend to the APE, well away from the canyon edge. Thus, it is unlikely that CA-SBA-1049 would be directly impacted by construction activities associated with Alternative 2.

Indirect impacts to CA-SBA-1049 would be possible if Alternative 2 was selected as the preferred alternative. As with Alternative 1, the outlet for Alternative 2 is midslope, with rip rap at the mouth to impede the flow of water. It is anticipated that water would spread out from the outlet and dissipate as sheet flow (Steward 2000). However, erosion is possible, particularly as the surface water gathers speed at the canyon edge. CA-SBA-1049 is downslope from the outlet of Alternative 2, at the canyon edge, and may be impacted by erosion. If Alternative 2 is selected as the preferred alternative it may be necessary to channel the water to the canyon edge or even to the canyon bottom in order to prevent erosion (Steward 2000). Construction of a channel may impact CA-SBA-1049.

Under Alternative 2, CA-SBA-1049 may be indirectly impacted by erosion or directly impacted by the construction of a channel intended to reduce erosion. Prior to implementation of Alternative 2, the boundaries at CA-SBA-1049 would be defined by subsurface probing to determine if the site extends into the area likely to be affected by erosion or by construction of a channel. If CA-SBA-1049 is found to extend into the area likely to be affected by erosion or construction of a channel, site significance should be evaluated relative to the NRHP, per Section 106 of the NHPA and its implementing regulations (36 CFR 800).

4.4.4 Alternative 3

The route of Alternative 3 has previously been surveyed, and archival research indicates that no archaeological sites are within the APE. Furthermore, no archaeological sites are within 100 meters of the APE. As described for the Proposed Action, there would be no impacts to cultural resources. No archaeological or Native American monitoring would be required, and Alternative 3 would comply with Section 106 of the NHPA. In the event that previously undocumented cultural resources are discovered during construction activities, the 36 CFR 800 regulations of Section 106 of the NHPA would be followed.

4.4.5 No-Action Alternative

Under the No-Action Alternative there would be no improvements made to the landfill drainage, therefore there would be no impacts to cultural resources.

4.4.6 Mitigation Measures

No impacts to cultural resources are anticipated and no mitigation measures are required.

4.5 POLLUTION PREVENTION

4.5.1 Proposed Action

It is anticipated that minimal amounts of wastes would be generated during the Proposed Action and, hence, P2 impacts would be minimal. Adherence to the 30th Space Wing PPMP would ensure that wastes generated from the Proposed Action would be minimized through source reduction and recycling. The types of pollution that would be generated during the Proposed Action are discussed in Section 4.4 (Solid Waste), Section 4.5 (Hazardous Waste), and Section 4.7 (Air Quality). Environmentally preferable products would be purchased when feasible, and wastes generated on-site would be reused or recycled when feasible.

4.5.2 Alternative 1

Pollution prevention efforts during construction of Alternative 1 would be similar to the Proposed Action. Therefore, the project would have a less than significant impact to P2.

4.5.3 Alternative 2

Pollution prevention efforts during construction of Alternative 2 would be similar to the Proposed Action. Therefore, the project would have a less than significant impact to P2.

4.5.4 Alternative 3

Pollution prevention efforts during construction of Alternative 3 would be similar to the Proposed Action. Therefore, the project would have a less than significant impact to P2.

4.5.5 No-Action Alternative

Under the No-Action Alternative, P2 impacts would not occur.

4.5.6 Mitigation Measures

No significant impacts to P2 have been identified, therefore no mitigation measures are required.

4.6 SOLID WASTE MANAGEMENT

4.6.1 Proposed Action

Solid waste generated during construction of the storm drain would include concrete rubble, and scrap metal. Excavated soil that could not be used as fill material would be considered solid waste. Miscellaneous waste generated by personnel on-site would also be considered solid waste.

The alignment of the Proposed Action would pass through an area previously used for demolition debris disposal. The exact extent and composition of the material is unknown. The project specifications would include provisions for disposal of asbestos and other harmful materials, if encountered. Excavated concrete rubble and rocky soils would be taken off-base for reuse, recycling, or proper disposal. Scrap metal and HDPE would be recycled off-base. Clean soil excavated as part of the Proposed Action, if not used as fill material, would be used as daily cover at the landfill.

Solid waste generated by the construction of the storm drain would not generate sufficient waste to pose an impact on the base landfill. Therefore, the project would have less than significant impacts on solid waste management.

4.6.2 Alternative 1

Solid waste generation during the construction of Alternative 1 would be similar to the Proposed Action. Therefore, the project would have a less than significant impact on solid waste management.

4.6.3 Alternative 2

Solid waste generation during the construction of Alternative 2 would be similar to the Proposed Action. Therefore, the project would have a less than significant impact on solid waste management.

4.6.4 Alternative 3

Solid waste generation during the construction of Alternative 3 would be similar to the Proposed Action. Therefore, the project would have a less than significant impact on solid waste management.

4.6.5 No-Action Alternative

Under the No-Action Alternative, the storm drain would not be constructed; therefore, no trenching and excavation would occur, no HDPE would be necessary, and no other construction site waste would be generated. Therefore, there would be no impacts on solid waste.

4.6.6 Mitigation Measures

No significant impacts to solid waste have been identified, therefore no mitigation measures are required.

4.7 HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT

4.7.1 Proposed Action

Hazardous materials generated under the Proposed Action would be motor oil, ethylene glycol, gasoline, diesel fuel, hydraulic fluids, and lubricants through accidental release from construction equipment and vehicles. Compliance with federal and state regulations and the Vandenberg AFB Hazardous Waste Management Plan would ensure that there are no significant hazardous materials/waste management impacts and ensure that all equipment is maintained properly and free of leaks during operation and all necessary repairs are carried out in controlled paved areas to minimize the risk of accidental spillage. Guidelines for the disposal of hazardous wastes are identified in the Hazardous Waste Management Plan.

The project route for the Proposed Action would include zones of known contaminated soil and groundwater (Figure 3-3). These areas would be encountered during portions of the trench excavation and boring activities. The excavation work in the these areas would increase the potential for exposure to hazardous materials, increase the likelihood of a hazardous material release to the environment, and generate significant volumes of soil and water requiring disposal as hazardous waste. If all applicable federal, state, local, and Air Force rules and regulations were followed, completion of the Proposed Action would not result in a significant impact on hazardous materials/hazardous waste.

Excavation of the trench and boring activities and the subsequent installation of the drainage diversion pipe through known areas of contamination could potentially affect future IRP investigations and remedial activities. The potential impacts include altering the natural pattern of groundwater occurrence at the site, altering the permeability of the soils at the site due to the sand placed around the pipe, and creating an obstacle to investigation and remediation design and excavation/construction. However, the soil and groundwater sampling and analysis associated with the proposed project would assist the IRP effort to delineate and quantify contamination at IRP Site 3. Disposal of contaminated soil and groundwater encountered during the course of the project would also contribute to the IRP remediation effort. In the long term, diverting surface water runoff from the upgradient areas would reduce groundwater recharge to IRP Site 3, and possibly reduce the volume of groundwater requiring remediation. All soil excavated from IRP Site 3 and the adjacent area to the east will be sampled and characterized in an analytical laboratory for proper disposal methods pursuant to the Porter-Cologne Act. Excavation spoils would be stored temporarily alongside the trench. Although not planned, if excavation through IRP Site 3 is done during the rainy season (starting in October), excavated soils would be containerized and sampled immediately upon excavation. No contaminated or suspect contaminated soil from the IRP Site 3 area or the adjacent area to the east will be backfilled or removed from the site without analytical results to determine its proper method of disposal. Soil that meets appropriate regulatory guidelines/maximum contaminant levels will be used as backfill in the IRP Site 3 area only. IRP Site 3 soil that meets designated levels for landfill disposal will be taken to the Vandenberg AFB landfill or another permitted sanitary landfill. Soil that exceeds designated levels will be properly disposed of as hazardous waste.

The contractor will coordinate with 30 CES/CEVR prior to and during all excavation activities. In addition, 30 CES/CEVR will be provided copies of all sampling analysis.

4.7.2 Alternative 1

The impacts to hazardous materials/hazardous waste management for Alternative 1 would be slightly larger than for the Proposed Action due to the larger volume of excavated soil from IRP Site 3 (see section 4.2 Geology and Soils).

4.7.3 Alternative 2

The impacts to hazardous materials/hazardous waste management for Alternative 2 would be slightly larger than for the Proposed Action due to the larger volume of excavated soil from IRP Site 3 (see section 4.2 Geology and Soils).

4.7.4 Alternative 3

The impacts to hazardous materials/hazardous waste management for Alternative 3 would be slightly larger than for the Proposed Action due to the larger volume of excavated soil from IRP Site 3 (see section 4.2 Geology and Soils).

4.7.5 No-Action Alternative

The No-Action Alternative would create no additional hazardous materials or a need for waste management; therefore, no impacts would occur. Under the No-Action Alternative, there would be no excavation through IRP Site 3, no disturbance of contaminated soil and groundwater and no impact to future remediation activities.

4.7.6 Mitigation Measures

No significant impacts to hazardous materials and waste have been identified, therefore no mitigation measures are required. All federal, state, local, and Air Force rules and regulations pertaining to hazardous waste handling, treatment, storage, and disposal will be followed to prevent impacts from excavation through contaminated areas.

4.8 AIR QUALITY

4.8.1 Proposed Action

The assumptions and calculations used in assessing impacts of the Proposed Action on air quality are presented in Appendix B. Although no significant impacts would be anticipated for the Proposed Action, standard SBCAPCD recommended mitigation measures for PM_{10} are included in this document to reduce PM_{10} impact in Santa Barbara County areas of nonattainment and protect regional air quality.

4.8.2 Proposed Action Pollutant-Emitting Activities

The pollutant emitting activities, sources of emissions, and resulting pollutants that would occur under the Proposed Action are listed in Table 4-1.

4.8.2.1 Proposed Action Construction Activities

Construction activities, which include excavation, compact, backfill, and construction would be confined to the proposed site. In order to determine a worst-case scenario for air quality, the construction activities are estimated to be complete in 1 year.

Several types of heavy equipment would be used throughout the construction phase of the project. During construction, it is assumed that not all equipment would operate simultaneously.

Table 4-1
Proposed Action Emission Activity, Source, and Potential Pollutant from Emission Activity

Emission Activity	Source	Potential Pollutant
Construction	Excavation; Compact and backfill; and Concrete use	NO_x; SO_x; PM_{10}; CO; and ROC
Mobile Source[1]	Construction vehicles	NO_x; SO_x; PM_{10}; CO; and ROC
Site Preparation[2] (Fugitive Dust)	Workers' vehicles; Construction vehicles; Wind erosion; and Dirt piling or material handling	PM_{10}

Notes: 1 - Emissions from mobile sources include exhaust emissions from mobile equipment and motor vehicles during construction and site preparation.
2 - Emissions from site preparation are from entrained vehicle emissions, wind erosion, dirt piling, and material handling.

During storm drain pipe installation for the Proposed Action and Alternatives, a section of the proposed project would involve trenching through the IRP Site 3, which is contaminated with volatile and non-volatile hydrocarbons and various metals. During trenching, soil excavation and piling, and ground disturbance activities at IRP Site 3, the volatile hydrocarbons in the contaminated soil would potentially volatilize and result in fugitive hydrocarbon emissions. Resulting emissions during all construction activities, including those that pass through IRP Site 3, are presented in Appendix B, Table B-5.

4.8.2.2 Mobile Source

Mobile source emissions include mobile equipment traveling on-site and off-site, and construction work force travel. Emission calculations and technical assumptions for the mobile source are presented in Appendix B, Table B-6.

4.8.2.3 Site Preparation

For the Proposed Action, resulting emissions from site preparation are generated from wind erosion, dirt piling, material handling, and entrained PM_{10} emissions from passenger vehicle and truck travel. Site preparation emissions are calculated and presented in Appendix B, Table B-7.

4.8.3 General Air Quality

The SBCAPCD rules and regulations applicable to this project are listed in Table 4-2. It is important to note that stationary source equipment, if not exempted by SBCAPCD Rule 202, would require a Permit to Operate prior to operational activities. Typical equipment requiring a permit includes, but is not limited to, internal combustion engines and equipment (generators and compressors).

Table 4-2
SBCAPCD Air Quality Compliance Rules Applicable to Proposed Project

Rule 101	Compliance by Existing Installations: Conflicts
Rule 201	Permits Required
Rule 202	Exemptions to Rule 201
Rule 205	Standards for Granting Applications
Rule 206	Conditional Approval of Authority to Construct or Permit to Operate
Rule 210	Fees
Rule 301	Circumvention
Rule 302	Visible Emissions
Rule 303	Nuisance
Rule 304	Particulate Matter – Northern Zone
Rule 309	Specific Contaminants
Rule 311	Sulfur Content of Fuels
Rule 333	Control of Emissions from Reciprocating Internal Combustion Engines
Rule 702	General Conformity[1]
Rule 1001	National Emission Standards for Hazardous Air Pollutants

Note: 1 - General Conformity is addressed within this EA.

4.8.4 Project Emissions and General Air Quality Compliance

4.8.4.1 Construction Emissions

The Proposed Action would disturb the smallest area. In comparison, Alternative 1 represents the worst-case scenario because it would disturb the largest area and require the greatest number of construction operating hours and mobile source vehicle miles traveled. Therefore, Alternative 1 was used for estimating the total project emissions and for the conformity determination. Total estimated emissions for the proposed project are summarized in Table 4-3.

Table 4-3
Total Annual Emissions for Proposed Project
(tons per year)

Oxides of Nitrogen	Oxides of Sulfur	Carbon Monoxide	PM_{10}	VOC
7.22	0.61	6.47	24.32	2.23

Notes: PM_{10} – particulate matter 10 microns or less in diameter.
VOC – volatile organic compound.

The proposed project emissions would not be expected to exceed the SBCAPCD significant threshold of 25 tons per year for any pollutant other than carbon monoxide, in a 12-month period (SBCAPCD Rule 202, F.3). SBCAPCD does not set a limit for carbon monoxide emissions. Therefore, impacts from the proposed project are considered insignificant to the region's air quality.

4.8.4.2 Long-term/Operational Air Quality Impacts

The proposed project is a short-term construction project that would not contribute to any long-term/operational air impacts; therefore, the proposed project's long-term/operational air quality impact is considered insignificant to the region's air quality.

4.8.5 Conformity Analysis

A formal air conformity applicability analysis is required for the proposed project to ensure that the Proposed Action would be in compliance with the implementation of the CAA and the SBCAPCD Rule 702, General Conformity. For Santa Barbara County, the federal regulations require that the total annual emissions of ozone precursors (oxides of nitrogen and VOCs) associated with the proposed project should not exceed the *de minimis* level of 50 tons per year.

A detailed air conformity analysis that includes the regulatory summary and a detailed description of the estimation of criteria pollutant emissions associated directly and indirectly with the worst case scenario, Alternative 1, of the proposed project activities is provided in Appendix B. Results from this study indicate that the total direct and indirect emissions from the construction and operation of the proposed project at Vandenberg AFB would not exceed federal *de minimis* conformity threshold values for ozone precursors. In addition, annual emission for each criteria pollutant from Alternative 1 would be well below 10 percent of the SBCAPCD 1996 Base Year Annual Emission Inventory level for each criteria pollutant. Therefore, Alternative 1 is deemed *de minimis* and not regionally significant, and is exempt from further conformity requirements, in accordance with conformity requirements set forth in 40 CFR (b), (c), Section 176 (c) (4) of the CAA, and SBCAPCD Rule 702 *General Conformity*. Furthermore, since the potential air quality impacts from Alternative 1 are the worst case scenario and deemed *de minimis* and regionally insignificant, the Proposed Action, Alternative 2, and Alternative 3 are likewise deemed *de minimis,* regionally insignificant, and exempt from further conformity analysis.

4.8.6 No-Action Alternative

Under the No-Action Alternative, there would be no landfill drainage improvements, therefore, there would be no air quality impacts associated with the No-Action Alternative.

4.8.7 Mitigation Measures

No significant impacts to air quality have been identified for the proposed project, therefore no mitigation measures are required. However, standard best management practices to reduce PM_{10} emissions to avoid potentially significant air quality impacts, including the effect of residual impacts, are described below. A 50-percent reduction in fugitive dust would be achieved through proper implementation of the following practices.

- During operation, water trucks or sprinkler systems will be used to keep all areas of vehicle movement damp enough to prevent dust from leaving the site. At a minimum, this mitigation will include wetting down such areas in the late morning and after work is complete for the day. Increased watering frequency will take place whenever the wind speed exceeds 15 miles per hour. This practice will also ensure compliance with SBCAPCD Rule 302 Visible Emissions.

- Vehicle speed on the disturbed area will be no more than 15 miles per hour.

- Any imported, exported, and stockpiled fill material will be covered. All trucks transporting material will be tarped from the point of origin.

- The contractor's foreman will be responsible for implementing and monitoring the mitigation measures. The mitigation measures will also be noted on the grading and plans.

4.9 HEALTH AND SAFETY

4.9.1 Proposed Action

Health and safety concerns intrinsic to excavation and construction activities include potential trench collapse, hazardous/low-oxygen atmospheres resulting from the confined-space conditions in the trench, injuries caused by falling into the trench, and the hazards of operating heavy equipment. These potential hazards would be present throughout the project as a whole. The engineering planners would ensure that the construction contractor complies with the Occupational Safety and Health Act (OSHA), AFOSH regulations, the USACE Safety and Health Requirements Manual (EM 385-1-1), and other recognized standards for operations that involve excavation and construction. Restricted public access to the proposed construction site would be ensured through use of signs and fencing.

In addition to the health and safety concerns associated with excavation and construction, the Proposed Action includes work in IRP Site 3 and the adjacent area to the southeast. Contaminated soil and groundwater will be encountered during the trench excavation in these areas. Workers involved with the excavation and construction activities in these areas would be exposed to the COPCs at the site. Volatile organic compounds such as TCE and PCE in the soil and groundwater would diffuse into the air when exposed by excavation, and pose a potential inhalation and/or explosive hazard. The vapors would concentrate within the confined space of the trench. These potential hazards would be present at Site 3 and the adjacent area to the southeast. Workers involved with excavation and construction activities within Site 3 will have successfully completed Hazardous Waste Workers' Operations Level Health and Safety (HAZWOPER) training, satisfying the OSHA Hazardous Waste Operations and Emergency Response Standards.

The engineering planner would also ensure that the construction contractor provides for the health and safety of workers and all subcontractors who would be exposed to their operations or services. Contractors generally must submit a health and safety plan to the base and appoint a formally trained individual to act as safety officer. The appointed individual would be the point of contact on all problems involving job site safety. The project health and safety plan would include the following elements: site worker health and safety training and certification; air monitoring program with a direct-reading organic vapor analyzer and an explosivity meter, respiratory protection program, personal protective equipment and action levels for personal protective equipment upgrades. The project health and safety plan would be developed with the participation of the IRP program. During performance of work, the contractor must comply with all provisions and procedures prescribed for the control and safety of construction team personnel and visitors to the job site. Compliance with regulations would ensure that no health and safety impacts result from implementing the Proposed Action.

The route of the Proposed Action north of Pine Canyon Road includes the approximate vicinity of a Camp Cooke hand grenade training course (USACE 1953). Unexploded ordnance potentially remaining in this area may be detonated by only a slight movement, resulting in an explosion, burning, or release of smoke. Special precautions need to be taken in this area. Before construction can begin, an Air Force Form 35 must be completed, which requires the consultation and approval of the Vandenberg AFB EOD

office. All excavation and construction contractors and workers must comply with EOD recommendations for site safety. If an item suspected to be UXO is discovered anywhere on the project route, the following steps should be taken: do not disturb the item, mark the location with anything available, notify the safety officer, and direct the EOD team to it.

The locations of buried utility lines in the project area would be identified by base utilities personnel involved in reviewing and approving the Air Force Form 35 required for all construction projects. If necessary, the project alignment would be changed to avoid buried lines. No excavation would be done near buried utility lines.

If noise levels exceed 90 dBA L_{eq} continuously for an 8-hour work period, employers will provide "feasible administrative or engineering controls" to reduce noise levels to below 90 dBA L_{eq}. If such controls are not feasible, the regulations state that "personal protective equipment shall be provided and used to reduce sound levels."

If workplace noise levels exceed a time-averaged limit of 85 dBA L_{eq} continuously for an 8-hour work period, employers will administer a continuing, effective hearing conservation program, including monitoring sound levels, implementing an audiometric testing program, and providing hearing protectors, as described in the Occupational Safety and Health Administration regulations.

All aspects of implementing the Proposed Action would comply with the Occupational Safety and Health Act, AFOSH regulations, the U.S. Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1), and other recognized standards.

4.9.2 Alternative 1

The health and safety concerns associated with excavation, construction, and hazardous materials/waste would be the same for Alternative 1 as for the Proposed Action. Although the alignment for Alternative 1 does not pass through a historical ordnance use area, an Air Force Form 35 including review by Vandenberg AFB EOD personnel would be required. All excavation and construction contractors and workers must comply with EOD recommendations for site safety. If an item suspected to be UXO is discovered anywhere on the project route, the following steps should be taken: do not disturb the item, mark the location with anything available, notify the safety officer, and direct the EOD team to it.

4.9.3 Alternative 2

The health and safety concerns for Alternative 2 would be the same as those for Alternative 1 as for the Proposed Action.

4.9.4 Alternative 3

The health and safety concerns associated with excavation, construction, and hazardous materials/waste would be the same for Alternative 3 as for the Proposed Action. Since Alternative 3 would follow a route similar to the Proposed Action, it would also include the approximate vicinity of a Camp Cooke hand grenade training course located north of Pine Canyon Road (USACE 1953). As a result, the special precautions described for the Proposed Action must also be taken for Alternative 3 in this area. Before construction can begin, an Air Force Form 35 must be completed, which requires the consultation and approval of the Vandenberg AFB EOD office. All excavation and construction contractors and workers must comply with EOD recommendations for site safety. If an item suspected to be UXO is discovered

anywhere on the project route, the following steps should be taken: do not disturb the item, mark the location with anything available, notify the safety officer, and direct the EOD team to it.

4.9.5 No-Action Alternative

Under the No-Action Alternative landfill drainage improvements would not be made and storm water runoff would continue to flow through the landfill. If water continued to flow through the landfill, health and safety hazards caused by potentially exposed waste and the generation of leachate would continue to exist.

4.9.6 Mitigation Measures

With appropriate regulatory compliance, the project would have no impacts on public or worker health and safety. Therefore, no mitigation measures would be required.

4.10 LAND USE/VISUAL RESOURCES

4.10.1 Proposed Action

4.10.1.1 Land Use

The Proposed Action would not conflict with, disrupt, or divide established land uses or land use configurations, or represent a substantial change in existing land uses. Therefore, no significant impacts to land use would occur due to the Proposed Action.

4.10.1.2 Visual Resources

Visual resources would be temporarily impacted during construction of the proposed storm drain from the on-site storage and use of construction equipment. However, the Proposed Action, once completed, would not interfere with existing scenic views, block visibility, or produce light and glare inconsistent with existing area uses. Therefore, no significant impacts to visual resources would occur due to the Proposed Action.

4.10.2 Alternative 1

4.10.2.1 Land Use

Alternative 1 would not conflict with, disrupt, or divide established land uses or land use configurations, or represent a substantial change in existing land uses. Therefore, no significant impacts to land use would occur due to Alternative 1.

4.10.2.2 Visual Resources

Impacts on visual resources would be the same for Alternative 1 as for the Proposed Action. Therefore, no significant impacts to visual resources would occur due to Alternative 1.

4.10.3 Alternative 2

4.10.3.1 Land Use

Alternative 2 would not conflict with, disrupt, or divide established land uses or land use configurations, or represent a substantial change in existing land uses. Therefore, no significant impacts to land use would occur due to Alternative 2.

4.10.3.2 Visual Resources

Impacts on visual resources would be the same for Alternative 2 as for the Proposed Action. Therefore, no significant impacts to visual resources would occur due to Alternative 2.

4.10.4 Alternative 3

4.10.4.1 Land Use

Alternative 3 would not conflict with, disrupt, or divide established land uses or land use configurations, or represent a substantial change in existing land uses. Therefore, no significant impacts to land use would occur due to Alternative 3.

4.10.4.2 Visual Resources

Impacts on visual resources would be the same for Alternative 3 as for the Proposed Action. Therefore, no significant impacts to visual resources would occur under Alternative 3.

4.10.5 No-Action Alternative

Under the No-Action Alternative, no landfill drainage improvements would be made and there would be no construction. Therefore, there would be no impacts to land uses or visual resources.

4.10.6 Mitigation Measures

There would be no significant land use or visual impacts under the Proposed Action. Therefore, no mitigation measures would be required.

4.11 NOISE

4.11.1 Proposed Action

The Proposed Action would temporarily raise the ambient noise levels in the project area. There are sensitive noise receptors in the project vicinity. The project area is bordered on one side by the 30 CES, Engineering Complex, which contain personnel on a daily basis, and Lake Canyon. On the opposite side, the project site is bordered by the landfill and continuing vegetation. The buildings closest to the project area are approximately 600 and 750 feet away, respectively. Due to the distance between the project area and these buildings, and the short-term nature of the project, no significant noise impacts would occur as a result of the Proposed Action. Heavy machinery operates at the landfill daily and would contribute to the noise level during construction, however these noise levels would not be significant.

Construction activities would take place during the daytime, no earlier than 7:00 a.m. and no later than 7:00 p.m., otherwise the nighttime decibel penalties would be incurred when calculating the L_{DN}/CNEL values. Typical noise levels for heavy construction equipment are shown in Table 4-4.

Table 4-4
Noise Levels of Heavy Construction Equipment

Equipment Item	Maximum Noise Level (dBA) at 15 meters (50 feet)
Saws	72–82
Dump truck	84–87
Front end loader (1.5 cubic yards)	77–82

Note: dBA - A-weighted decibels.
Source: Beranek 1988.

Regulations issued by OSHA limit noise exposure in the workplace ("Control of Noise Exposure," Article 105, Title 8 California Administrative Code). If workplace noise levels exceed a time-averaged limit of 85 dBA L_{eq} continuously for an 8-hour work period, employers must administer a continuing, effective hearing conservation program, including monitoring sound levels, implementing an audiometric testing program, and providing hearing protectors, as described in the OSHA regulations.

Once constructed, the proposed storm drain alignment would be underground and would not constitute a noise impact on surrounding buildings. Therefore, operation phase noise from the Proposed Action would be less than significant.

4.11.2 Alternative 1

Impacts from noise would be larger under Alternative 1 than the Proposed Action due to the greater use of the jack and bore method to drill underneath roads and railroads. However, no significant impacts from noise would occur due to Alternative 1.

4.11.3 Alternative 2

Impacts from noise would be larger under Alternative 2 than the Proposed Action due to the greater use of the jack and bore method to drill underneath roads and railroads. However, no significant impacts from noise would occur due to Alternative 2.

4.11.4 Alternative 3

Impacts from noise would be larger under Alternative 3 than the Proposed Action due to the use of the jack and bore method to drill underneath roads and railroads. However, no significant impacts from noise would occur due to Alternative 3.

4.11.5 No-Action Alternative

Under the No-Action Alternative, no landfill drainage improvements would be made. Therefore, there would be no noise impacts due to construction.

4.11.6 Mitigation Measures

No significant impacts to noise were identified for the proposed project, therefore no mitigation measures are required. Construction noise impacts can be minimized by maintaining the equipment, mufflers, and other machinery according to manufacturers' recommendations. Construction will be limited to daytime hours, meaning no earlier than 7:00 a.m. and no later than 7:00 p.m., otherwise the nighttime decibel penalties are incurred when calculating L_{dn}/CNEL values.

If noise levels exceed 90 dBA L_{eq} continuously for an 8-hour work period, employers are required to provide "feasible administrative or engineering controls" to mitigate noise levels to below 90 dBA L_{eq}. If such controls are not feasible, the regulations state that "personal protective equipment shall be provided and used to reduce sound levels."

4.12 UTILITIES

4.12.1 Proposed Action

The Proposed Action would not impact utilities beyond connecting some of the existing storm drain lines in the project area to the new drainage diversion.

To insure that none of the existing utility lines are disturbed, the procedures outlined below would need to be followed. In addition, all the necessary safety precautions should be taken to ensure worker safety. Facility blueprints should be used to estimate the location of utilities. Prior to any construction, an Air Force Form 35 (digging permit) would be needed for each project site. This permit would require the notification and approval of the base Utilities Shops and 30 Communications Squadron for the proposed project alignment. Upon notification, these divisions would flag the location of the utility lines in the project area. The 30th Communications Squadron follows the same process in identifying telephone and fiber optic lines. The Exterior Electric shop would be consulted for the identification and location flagging of underground electric lines in the project area. Once the appropriate divisions have been notified and all of the utilities are identified, the permit to authorize excavation could be obtained.

4.12.2 Alternative 1

The impacts to utilities would be similar to those from the Proposed Action. Therefore, there would be no significant impacts to utilities due to Alternative 1.

4.12.3 Alternative 2

The impacts to utilities would be similar to those from the Proposed Action. Therefore, there would be no significant impacts to utilities due to Alternative 2.

4.12.4 Alternative 3

The impacts to utilities would be similar to those from the Proposed Action. Therefore, there would be no significant impacts to utilities due to Alternative 3.

4.12.5 No-Action Alternative

Under the No-Action Alternative, no landfill drainage improvements would be made. Therefore there would be no impacts to utilities.

4.12.6 Mitigation Measures

Since the Air Force Form 35 is automatically required, no impacts to utilities have been identified, and no mitigation measures would be required.

4.13 TRANSPORTATION/CIRCULATION

4.13.1 Proposed Action

The storm drain alignment for the Proposed Action would cross Pine Canyon Road using an open cut with slurry. This process would not effect traffic on Pine Canyon Road, however, and no road closures would be expected. Therefore, impacts to traffic would be less than significant.

4.13.2 Alternative 1

The storm drain alignment for Alternative 1 would cross under the road on the west side of the New Mexico and Utah Street intersection. A horizontal jacking machine would be used to "jack" the storm drain pipe under the road. This process would not effect traffic on New Mexico Road, and no road closures would be expected. Therefore, impacts to traffic would be less than significant.

4.13.3 Alternative 2

Construction of Alternative 2 would have similar traffic impacts as Alternative 1. Therefore, impacts to traffic would be less than significant.

4.13.4 Alternative 3

The storm drain alignment for Alternative 3 would cross under the road on the west side of the New Mexico and Utah Street intersection. Construction activities would then be limited to the roadside of Pine Canyon Road, then cross under Pine Canyon Road to connect with existing storm drains leading to the lakes in Lake Canyon. A horizontal jacking machine would be used to "jack" the storm drain pipe under the road. This process would not effect traffic on New Mexico or Pine Canyon Roads, and no road closures would be expected. Therefore, impacts to traffic would be less than significant.

4.13.5 No-Action Alternative

Under the No-Action Alternative, no landfill drainage improvements would be made, no construction would occur, and a storm drain would not be jacked under the road near the landfill. Therefore, there would be no impacts to traffic from the No-Action Alternative.

4.13.6 Mitigation Measures

Impacts to traffic would be less than significant. Therefore, no mitigation measures would be required.

4.14 ENVIRONMENTAL JUSTICE

4.14.1 Proposed Action

No minority or low-income populations are located in the project area, or would be affected in any way by the Proposed Action. Therefore, the Proposed Action would not have any high health or environmental effects on minorities, low-income populations, or communities.

4.14.2 Alternative 1

The impacts to environmental justice would be the same as for the Proposed Action.

4.14.3 Alternative 2

The impacts to environmental justice would be the same as for the Proposed Action.

4.14.4 Alternative 3

The impacts to environmental justice would be the same as for the Proposed Action.

4.14.5 No-Action Alternative

No environmental justice impacts would occur under the No-Action Alternative.

4.14.6 Mitigation Measures

Because there would be no environmental justice impacts, no mitigation measures would be required.

4.15 CUMULATIVE IMPACTS

4.15.1 Proposed Action

Major projects currently under construction as well as reasonably foreseeable projects on North Vandenberg AFB include the basewide demolition project, military family housing, several proposed road repair projects, and the 13th Street bridge retrofit project. The Basewide Demolition Program on Vandenberg AFB is a project to demolish 82 facilities that have outlived their usefulness due to their abandonment or state of repair (U.S. Air Force 1988). The Military Family Housing Project consists of 14 phases to replace 1,781 housing units in the Military Family Housing Area along Lompoc-Casmalia Road. The proposed road repair projects on Vandenberg AFB will be staggered according to project-specific mitigation and the 13th Street bridge retrofit project will start in late spring or early summer of 2003.

Cumulative impacts to solid waste, traffic, and air quality would potentially occur if the Proposed Action were to coincide with other proposed construction projects in the vicinity.

A cumulative impact to solid waste would occur if the Proposed Action and the other proposed projects in the vicinity together greatly increased the waste (including construction/demolition debris), disposed of in the Vandenberg AFB Landfill or increased the amounts generated beyond available waste management capacities. However, base projects are required to follow the Vandenberg AFB Solid Waste Management

Plan to reduce impacts to solid waste management. Therefore, cumulative impacts would not be considered significant.

Cumulative impacts to traffic could occur if the Proposed Action was implemented concurrently with other proposed construction projects on base. Since the traffic on the base is usually minimal, this impact will not be significant. Staggering of the construction schedule would further ensure that these impacts would remain minimal.

A cumulative impact to air quality would occur if the Proposed Action and the other proposed construction projects collectively were to increase the air contaminants beyond significance thresholds set by applicable regulations. Dust from construction activities may also be a factor in determining a significant impact. Although no significant impacts would be anticipated for the proposed project, standard mitigation measures to reduce PM_{10} emissions to avoid potentially significant air quality impacts, including the effect of residual impacts, are described in Section 4.8.6. If all proposed projects follow necessary federal, state, local, and Air Force rules and regulations and implement best management practices, cumulative impacts to air quality would not occur.

4.15.2 Alternative 1

Cumulative impacts generated under Alternative 1 would be the same as those generated under the Proposed Action. Therefore, cumulative impacts to solid waste, traffic, and air quality would potentially occur if Alternative 1 coincided with other proposed construction projects in the vicinity. However, as described for the Proposed Action, cumulative impacts generated by Alternative 1 would be less than significant.

4.15.3 Alternative 2

Cumulative impacts generated under Alternative 2 would be the same as those generated under the Proposed Action. Therefore, cumulative impacts to solid waste, traffic, and air quality would potentially occur if Alternative 2 coincided with other proposed construction projects in the vicinity. However, as described for the Proposed Action, cumulative impacts generated by Alternative 2 would be less than significant.

4.15.4 Alternative 3

Cumulative impacts generated under Alternative 3 would be the same as those generated under the Proposed Action. Therefore, cumulative impacts to solid waste, traffic, and air quality would potentially occur if Alternative 3 coincided with other proposed construction projects in the vicinity. However, as described for the Proposed Action, cumulative impacts generated by Alternative 3 would be less than significant.

4.15.5 No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. Therefore, there would be no cumulative impacts.

4.15.6 Mitigation Measures

No cumulative impacts were identified for the proposed project, therefore no mitigation measures are required.

This page intentionally left blank.

5 APPLICABLE REGULATIONS AND AGENCY COORDINATION

5.0 APPLICABLE REGULATIONS AND AGENCY COORDINATION

This section provides a list of the federal, state, local, and Air Force regulations with which Vandenberg AFB must comply prior to and during construction and operation of the Proposed Action.

5.1 FEDERAL REGULATIONS

The *NEPA* (Public Law 91-190, 42 U.S.C. 4321-4347 as amended) requires federal agencies to analyze the potential environmental impacts of major federal actions and alternatives and to use these analyses as a decision-making tool on whether and how to proceed with a Proposed Action.

The *Clean Air Act* (40 CFR Part 50) states that all applicable state and national ambient air quality standards must be maintained during the operation of any emission source. The NAAQS include both primary and secondary standards for various pollutants. Primary standards are mandated by the CAA to protect public health, while secondary standards are intended to protect the public welfare from adverse impacts of pollution, such as materials soiling, vegetation damage, and visibility impairment.

The *Clean Air Act Amendments* of 1990 established new federal nonattainment classifications, new emission control requirements, and new compliance dates for areas in nonattainment. The nonattainment classifications are based on a design day value. The design day value is the fourth highest pollutant concentration recorded in a 3-year period. The requirements and compliance dates are based on the nonattainment classification.

The *Clean Air Act Amendments* generally require ozone nonattainment areas to demonstrate a reduction in VOC emissions by 15 percent for the first 6 years (by November 15, 1996), and 3 percent annually thereafter, until attainment is reached. This plan to reach attainment is included in a State Implementation Plan (SIP) and shows current emission inventories and control measures that will lead to a reduction in future emissions.

The *Clean Water Act* (33 U.S.C. 1251 *et seq.*) prohibits the discharge of pollutants from a point source into navigable waters of the United States, except in compliance with a NPDES (40 CFR Part 122) permit. The navigable waters of the United States are considered to encompass any body of water whose use, degradation, or destruction will affect interstate or foreign commerce.

Section 402 of the *Clean Water Act* requires that the U.S. EPA establish regulations for issuing permits for storm water discharges associated with industrial activity. A NPDES permit is required if activities involve the disturbance of more than 5 acres of land. A Notice of Intent must be submitted to the RWQCB by Vandenberg AFB and a SWPPP must be developed. After May 2002, NPDES regulations will change to include all construction projects of 1 to 5 acres (Fabry 1999).

Section 404 of the *Clean Water Act* establishes a program to regulate the discharge of dredged and fill materials into waters of the United States, including wetlands. Activities in waters of the United States that are regulated under this program include fills for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. U.S. EPA and the USACE jointly administer the program. In addition, the USFWS, the National Marine Fisheries Service, and state resource agencies have important advisory roles.

The *RCRA* of 1974 (42 U.S.C. 6901 *et seq.)* was designed to control the handling and disposal of hazardous substances by responsible parties. Hazardous waste, as defined by RCRA, is a "waste that may cause or significantly contribute to serious illness or death, or that poses a substantial threat to human health or the environment when improperly disposed." The treatment, storage, and disposal of solid waste (both hazardous and nonhazardous) are regulated under the *Solid Waste Disposal Act* as amended by RCRA and the Hazardous Solid Waste Amendments of 1984.

The *SARA* of 1986, Title III: *EPCRA* establishes standards for community right-to-know programs and requires the reporting of releases of certain toxic chemicals. The local planning committee, comprising government, news media, industry, environmental organizations, and medical representatives, receives the right-to-know information from facilities. Facilities with Standard Industrial Classification codes between 20 and 39 that manufacture, process, or otherwise use listed toxic chemicals, must report a release of these toxic chemicals to the environment, in greater than reportable quantities, on a Form R.

Executive Order 11990 May 24, 1977. This Executive Order requires federal agencies to take actions to minimize the destruction, loss, or degradation of Wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

Executive Order 12856. Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements (1993). This Executive Order requires federal agencies to develop comprehensive P2 strategies and to attempt reduction of their emissions of toxic chemicals or toxic pollutants by 50 percent by 1999.

CFR 29 Section 1910.120. Requires 40-hour hazardous materials response training.

The *NHPA* (16 U.S.C. 470 *et seq.)* is the key federal law establishing the foundation and framework for historic preservation in the United States. The Act authorizes the Secretary of the Interior to expand and maintain an National Register of Historic Places. In addition, it establishes an Advisory Council on Historic Preservation as an independent federal entity, requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council an opportunity to comment upon any undertaking that may affect properties listed or eligible for listing in the National Register, and makes the heads of all federal agencies responsible for the preservation of historic properties owned or controlled by them.

Archaeological and Historic Preservation Act (16 U.S.C. 469a *et seq.*). The act is directed toward preserving historic and archaeological data that would otherwise be lost as a result of federal construction or other federally licensed or assisted activities. The act authorizes the Department of the Interior to undertake recovery, protection, and preservation of archaeological or historic data.

American Indian Religious Freedom Act (42 U.S.C. 1996). On and after August 11, 1978, it shall be the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

The *Endangered Species Act* of 1973 declares the intention of the Congress to conserve threatened and endangered species and the ecosystems on which those species depend. The act requires that federal agencies, in consultation with the USFWS and the National Marine Fisheries Service, use their authorities in furtherance of its purposes by carrying out programs for the conservation of endangered or threatened species.

Section 7 of the *Endangered Species Act* (16 U.S.C. 1536) contains provisions that require federal agencies to consult with the Secretary of Interior and to take necessary actions to ensure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of endangered species and threatened species. Federal agencies must ensure that actions taken will not result in the destruction or modification of the habitat of endangered species.

5.2 STATE OF CALIFORNIA REGULATIONS

The *California Clean Air Act* of 1988 develops and implements a program to attain the CAAQS for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10}, lead, sulfates, hydrogen sulfide, and vinyl chloride. Similar to the federal nonattainment rating system, the state ozone nonattainment rating system is based on the design day concentration. Attainment is reached when the design day concentration falls below 0.09 part per million.

Santa Barbara County is considered a serious nonattainment area and the SBCAPCD is required to implement new emission control measures. These control measures include an indirect and area source control program, application of Reasonably Available Control Technology to existing stationary sources, a modification to the permitting program to achieve no net increase of emissions from new or modified stationary sources that have the potential to emit at least 25 tons per year of nonattainment pollutants or their precursors, and consideration of reasonable transportation control measures. Vandenberg AFB is required to comply with the SBCAPCD rules and regulations.

The federal *Clean Air Act, 40 CFR Part 51,* gives state and local agencies the authority to establish air quality rules and regulations. Rules adopted by the local air pollution control districts and accepted by the Air Resources Board are included in the SIP. When approved by the U.S. EPA, these rules become federally enforceable. The SBCAPCD, having received the necessary approvals, regulates stationary sources of air pollution in the county.

The *California Integrated Waste Management Act* of 1989 specifies waste reduction mandates for municipal solid waste facilities. The Vandenberg AFB Class III Landfill must reduce the amount of solid waste received by 50 percent in the year 2000 from a baseline waste generation survey conducted in 1990. Construction and demolition debris accounted for nearly 50 percent of the total landfilled waste stream in calendar year 1995.

The *California Hazardous Waste Control Law* imposes obligations on facilities that generate hazardous waste. This law applies to federal facilities insofar as the law requires permitting, inspections, and monitoring. State waste disposal standards, reporting duties, and submission to state inspections are required of federal facilities.

The *Porter-Cologne Water Quality Control Act* protects all waters of the state for the use and enjoyment of the people of California and declares that the protection of water resources be administered by the regional water quality control boards with statewide coordination managed by the State Water Resources Control Board.

California Administrative Code, Sections 66001 through 67181, contains California's hazardous materials regulations.

5.3 FEDERAL, STATE, AND COUNTY REGULATORY PERMITS REQUIRED

The following coordination, approval, and permits will be required for the Proposed Action and Alternatives 1, 2, and 3.

- The proposed construction activity would involve disturbance of more than 5 acres, and therefore would be subject to NPDES permit requirements;
- Coordination with USACE for Section 404 permit consultation;
- Coordination with the California RWQCB for Section 401 permit consultation, and for excavation in IRP Site 3;
- Coordination with the U.S. Fish and Wildlife Service for informal Section 7 consultation;
- In the event that previously undocumented cultural resources are discovered during construction activities, coordination with the State Historic Preservation Officer in compliance with Section 106 of the NHPA; and
- Coordination with the County of Santa Barbara for alterations proposed within the landfill boundary.

5.4 AIR FORCE INSTRUCTIONS, APPROVALS, AND REVIEWS

The following approvals, reviews, and other actions will be conducted by Vandenberg AFB prior to implementing the Proposed Action and Alternatives 1, 2, and 3:

- Completion of Air Force Form 813, Air Force Form 35, and field clearance of the work site for natural and cultural resources, underground utilities, and ordnance prior to commencement of construction; and
- Signature and approval from HQ AFSPC (Air Force Space Command) for a FONPA for impacts to wetlands from the proposed project.

6 REFERENCES

6.0 REFERENCES

Alterman, I., *et al.* (ed.)
1994 Seismotectonics of the Central California Coast Ranges, GSA Special Paper 292, Boulder, CO.

Arnold, Jeanne E.
1991 Transformation of a Regional Economy: Sociopolitical Evolution and the Production of Valuables in Southern California. *American Antiquity* 56:953–962.

Arnold, Jeanne E.
1992 Complex Hunter-Gatherer-Fishers of Prehistoric California: Chiefs, Specialists, and Maritime Adaptations of the Channel Islands. *American Antiquity* 57:60–84.

Basgall, M.E.
1987 Resource Intensification Among Hunter-Gatherers: Acorn Economies in Prehistoric California. *Research in Economic Anthropology* 9:21–52.

Beranek, Leo
1988 *Noise and Vibration Control,* Revised Edition, Institute of Noise Control Engineering.

Blackburn, Thomas C.
1975 *December's Child: A Book of Chumash Oral Narratives.* University of California Press, Berkeley.

Bolton, H.E. (editor)
1926 Historical Memoirs of New California by Fray Francisco Palou, O.F.M., vol. 2. University of California Press, Berkeley.

Bolton, H.E. (editor)
1931 *Font's Complete Diary . . . 1775–1776.* University of California Press, Berkeley.

Breschini, Gary S., Trudy Haversat, and R. Paul Hampson
1983 A Cultural Resources Overview of the Coast and Coast-Valley Study Areas. Coyote Press, Salinas, California.

California Department of Finance
1999 http://www.dof.ca.gov.

California Department of Finance
1998 http://www.dof.ca.gov.

California Employment Development Department
1999 California Employment Development Department Labor Market Information. Updated December 14, 1998. http://www.calmis.ca.gov.

California Environmental Protection Agency Department of Toxic Substances Control (Cal/EPA DTSC)
1999 Letter to Vandenberg AFB dated 6 April 1999, subject: correction to letter clarifying list of closed sites.

Carbone, Larry A., and Roger D. Mason
1998 Phase I, II, and III Archaeological Surveys for Cultural Resources Inventory, Vandenberg Air Force Base, Santa Barbara County, California. Science Applications International Corporation and Chambers Group, Inc., Santa Barbara, California. Submitted to the Western Region Interagency Archeological Services Branch, National Park Service. Submitted in partial fulfillment of Contract 1443 CX 8000-92-010 for the U.S. Department of the Interior.

Departments of the Air Force, the Army, and the Navy
1978 Environmental Protection Planning in the Noise Environment.

Department of Toxic Substances Control
1999 Letter to 730th CES/CEVR (Mr. Jack Yamauchi) from the DTSC (Tizita Bekele) listing Vandenberg sites recommended for completion of preliminary endangerment assessment and/or no further action. 16 March.

Dibblee, T.W., Jr.
1950 Geology of Southwestern Santa Barbara County, California. California Division of Mines Bulletin 150.

Dibblee, T.W., Jr.
1988 Geologic Map of Lompoc and Surf Quadrangles, Santa Barbara County, California. Dibblee Geologic Foundation, Santa Barbara, California.

Earle, David D., and John R. Johnson
1999 Draft Technical Report: Chumash Ethnohistoric and Ethnographic Overview of Sacred and Traditional Sites, Vandenberg Air Force Base. Chambers Group. Submitted to the U.S. Department of the Interior, National Park Service, Western Region, Interagency Archaeological Services Branch. Contract 1443 CX 8000-92-010, Delivery Order CX 8006-92-010.

Engelhardt, Zephyrin
1933 *Mission San Luis Obispo in the Valley of the Bears.* Mission Santa Barbara, Santa Barbara, California.

Engineering Science, Inc.
1994 *Final Report of Waste Discharge, Vandenberg AFB Landfill Permitting Project. Pasadena, California.* May.

Environmental Laboratory
1987 *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1. United States Army Engineer Waterways Experimentation Station, Vicksburg, Mississippi.

Erlandson, Jon M.
1991 Early Maritime Adaptations on the Northern Channel Islands. In *Hunters and Gatherers of Early Holocene Coastal California*, edited by J.M. Erlandson and R. Colten, pp. 101–111. Perspectives in California Archaeology, vol. 1. Institute of Archaeology, University of California, Los Angeles.

Erlandson, Jon M.
1994 Early Hunter-Gatherers of the California Coast. Plenum, New York.

Erlandson, Jon M., and Kevin Bartoy
1995 Cabrillo, the Chumash, and Old World Diseases. *Journal of Great Basin Anthropology* 7:153–173.

Erlandson, Jon M., and Kevin Bartoy
1996 Protohistoric California: Paradise or Pandemic? *Proceedings of the Society for California Archaeology* 9:304–309.

Erlandson, Jon, T. Cooley, and R. Carrico
1987 A Fluted Projectile Point Fragment from the Southern California Coast: Chronology and Context at CA-SBA-1951. *Journal of California and Great Basin Anthropology* 9:120–128.

Fages, Pedro
1937 *A Historical, Political, and Natural Description of California by Pedro Fages, Soldier of Spain.* Translated by H.I. Priestly. University of California Press, Berkeley.

Fiedel, Stuart J.
1999 Older Than We Thought: Implications of Corrected Dates for Paleoindians. *American Antiquity* 64:95–115.

Fitzgerald, Richard T.
1998a The Ground stone Assemblage of the Cross Creek Site (CA-SLO-1797): A Reexamination of the Milling Stone Horizon in Central California. Paper presented at 32nd Annual Meeting of the Society for California Archaeology, San Diego. Fugro West, Inc.

Fitzgerald, Richard T.
1998b *Geotechnical Study, Honda Ridge Road Repairs, Vandenberg Air Force Base, Santa Barbara County, California.* Prepared for Penfield & Smith, Santa Barbara, California.

Glassow, Michael A.
1990 Archaeological Investigations on Vandenberg Air Force Base in Connection with the Development of Space Transportation System Facilities. Department of Anthropology, University of California, Santa Barbara. Submitted to USDI National Park Service, Western Region, Interagency Archaeological Services Branch, San Francisco, Contract No. CX-8099-2-0004.

Glassow, Michael A.
1996 *Purisimeño Chumash Prehistory: Maritime Adaptations Along the Southern California Coast.* Case Studies in Archaeology. Jeffrey Quilter, series editor. Harcourt Brace College Publishers, San Diego.

Glassow, Michael A.
1997 Middle Holocene Cultural Development in the Central Santa Barbara Channel Region. In *Archaeology of the California Coast During the Middle Holocene*, edited by J.M. Erlandson and M.A. Glassow, pp. 73–90. Perspectives in California Archaeology, vol. 4. Institute of Archaeology, University of California, Los Angeles.

Glassow, Michael, and Larry Wilcoxon
1988 Coastal Adaptations near Point Conception, California, with Particular Regard to Shellfish Exploitation. *American Antiquity* 53:36–51.

Glassow, Michael A., Larry Wilcoxon, and Jon M. Erlandson
1988 Cultural and Environmental Change during the Early Period of Santa Barbara Channel Prehistory. In *The Archaeology of Prehistoric Coastlines*, edited by G.N. Bailey and J.E. Parkington, pp. 64–77. Cambridge University Press, Cambridge.

Glenn, Brian
1990 Typological Analysis of Projectile Points. *In Archaeological Investigations on Vandenberg Air Force Base in Connection with the Development of Space Transportation System Facilities,* vol. 2, edited by Michael A. Glassow, pp. A4-1–A4-45. Department of Anthropology, University of California, Santa Barbara. Submitted to the National Park Service, Western Region, Interagency Archeological Services, Contract CX 8099-2-0004.

Glenn, Brian
1991 Typological Analysis of Projectile Points Recovered from Excavation on Vandenberg Air Force Base, Santa Barbara County, California. Unpublished Master's thesis, University of California, Santa Barbara.

Grant, Campbell
1978a Interior Chumash. In *California*, edited by Robert F. Heizer, pp. 530–534. Handbook of North American Indians, vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Grant, Campbell
1978b Chumash: Introduction. In *California*, edited by R.F. Heizer, pp. 505–508. Handbook of North American Indians, vol. 8, W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Grant, Campbell
1978c Island Chumash. In *California,* edited by R.F. Heizer, pp. 524–529. Handbook of North American Indians, vol. 8, W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Grant, Campbell
1978d Eastern Coastal Chumash. In *California,* edited by R.F. Heizer, pp. 509–519. Handbook of North American Indians, vol. 8, W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Greenwood, Roberta S.
1972 *9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California.* San Luis Obispo County Archaeological Society Occasional Paper No. 7.

Greenwood, Roberta S.
1978 Obispeño and Purisimeño Chumash. In *California*, edited by Robert F. Heizer, pp. 520–523. Handbook of North American Indians, vol. 8, W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Halliburton NUS Corporation (Halliburton)
1993 *Final Environmental Assessment for a Commercial Payload Processing Facility at Vandenberg Air Force Base, California.*

Hudson, D.T., and T.C. Blackburn
1982 *Food Procurement and Transportation.* The Material Culture of the Chumash Interaction Sphere, vol. I. Ballena Press Anthropological Papers No. 25. Ballena Press/Santa Barbara Museum of Natural History Cooperative Publication, Los Altos and Santa Barbara, California.

Hudson, D.T., and T.C. Blackburn
1985 *Clothing, Ornamentation, and Grooming.* The Material Culture of the Chumash Interaction Sphere, vol. III. Ballena Press Anthropological Papers No. 28. Menlo Park, California.

Hudson, D.T., and T.C. Blackburn
1986 *Ceremonial Paraphernalia, Games, and Amusement.* The Material Culture of the Chumash Interaction Sphere, vol. IV. Ballena Press Anthropological Papers No. 30. Menlo Park, California.

Hudson, D.T., T. Blackburn, R. Curletti, and J. Timbrook (editors)
1977 *The Eye of the Flute: Chumash Traditional History and Ritual*, as told by Fernando Librado Kitsepawit to John P. Harrington. Malki Museum Press, Banning.

Hudson, D.T., and E. Underhay
1978 *Crystals in the Sky: An Intellectual Odyssey Involving Chumash Astronomy, Cosmology, and Rock Art.* Ballena Press Anthropological Papers 10. Socorro, New Mexico.

Hunt, Lawrence E.
1993 *Origin, Maintenance and Land Use of Aeolian Sand Dunes of the Santa Maria Basin, California.* Prepared for the Nature Conservancy, San Luis Obispo, California.

International Conference of Building Officials
1997 Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada.

Jacobs Engineering Group, Inc. (JEG)
1994a Vandenberg AFB Installation Restoration Program Operable Units 1, 2, and 3 and Remedial Investigation Preliminary Draft Phase I Remedial Investigation Report. Operable Unit 1, Site 3. Pasadena, California. July.

Jacobs Engineering Group, Inc. (JEG)
1994b *Basewide Background Sampling Report.* Volumes I & II, Installation Restoration Program, Vandenberg AFB, California. Prepared by JEG, Pasadena, California.

Jacobs Engineering Group, Inc. (JEG)
1994c *Revisions to the Final Background Basewide Sampling Report,* Project Note No. 23, 11 August.

Jacobs Engineering Group, Inc. (JEG)
1995 Remedial Investigation Report Vol. II Operable Unit 1, Site 4.

Jacobs Engineering Group, Inc. (JEG)
1997 *Installation Restoration Program, Vandenberg AFB, Site 3 - Operable Unit 1 Focused Feasibility Study.* Pasadena, California.

Jameson, E.W., and H.J. Peeters
1988 *California Mammals.* University of California Press, Berkeley, California.

Johnson, John R.
1988 *Chumash Social Organization: An Ethnohistoric Perspective.* Ph.D. dissertation, Department of Anthropology, University of California, Santa Barbara.

Jones, Terry L., Kathleen Davis, Glenn Farris, Steven D. Grantham, Teresa W. Fung, and Betty Rivers
1994 *Towards a Prehistory of Morro Bay: Phase II Archaeological Investigations for the Highway 41 Widening Project, San Luis Obispo County, California.* Submitted to the California Department of Transportation, Environmental Branch, San Luis Obispo, California.

Jones, Terry L., and Georgie Waugh
1995 *Central California Coastal Prehistory: A View from Little Pico Creek.* Perspectives in California Archaeology, vol. 3. Institute of Archaeology, University of California, Los Angeles.

Kennett, Douglas J.
1998 *Behavioral Ecology and the Evolution of Hunter-Gatherer Societies on the Northern Channel Islands, California.* Ph.D. dissertation, Department of Anthropology, University of California, Santa Barbara.

Ken O'Brian and Associates
1966 Department of Air Force, Master Plan Storm Drainage System, Vandenberg AFB, California. Tab G-3, sheets 27, 28 and 33.

Kephart, B.
2002 Personal communication with Bea Kephart, Chief of the Installation Restoration Program, Vandenberg AFB, California. October 24.

King, Chester D.
1981 *The Evolution of Chumash Society: A Comparative Study of Artifacts Used in Social System Maintenance in the Santa Barbara Channel Region Before A.D. 1804.* Ph.D. dissertation, Department of Anthropology, University of California, Davis. University Microfilms, Ann Arbor, Michigan.

King, Chester D.
1984 *Ethnohistoric Background. In Archaeological Investigations on the San Antonio Terrace, Vandenberg Air Force Base, California, in Connection with MX Facilities Construction, pp.* I-1–I-54. Chambers Consultants and Planners, Stanton, California. Submitted to the U.S. Army Corps of Engineers, Los Angeles District, Contract No. DAC09-81-C-0048.

King, Chester D.
1990 *Evolution of Chumash Society: A Comparative Study of Artifacts Used for Social System Maintenance in the Santa Barbara Channel Region Before A.D. 1804.* Garland, New York.

LaGrega, Michael, Philip L. Buckingham, and Jeffrey C. Evans
1994 *Hazardous Waste Management.* McGraw Hill, Inc. New York.

Landberg, Leif
1965 *The Chumash Indians of Southern California.* Southwest Museum Papers No. 19. Los Angeles.

Lebow, Clayton G., and Michael J. Moratto
1999 *Draft Integrated Cultural Resources Management Plan, Vandenberg Air Force Base, Santa Barbara County, California, Vol. 5: Management of Prehistoric Archaeological Resources,* edited by Michael J. Moratto. Tetra Tech, Inc., Santa Barbara, California, and Applied EarthWorks, Inc., Fresno, California. Submitted to 30 CES/CEV, Vandenberg Air Force Base, California. USAF Contract No. F04684-95-C-0045, Work Request 14.

Moratto, Michael J.
1984 *California Archaeology.* Academic Press, New York and London (VAFBR-MORAT).

Moriarity, James R., and M. Keistman (translators)
1968 Cabrillo's Log 1542–1543: A Voyage of Discovery (a Summary by Juan Paez). *The Western Explorer* 5(2–3):1–20. Cabrillo Historical Association, San Diego, California.

Norris, R.M., and R.W. Webb
1990 *Geology of California, Second Edition.* John Wiley & Sons, Inc. New York.

Palmer, Kevin
1999 *Central Coast Continuum—From Ranchos to Rockets: A Contextual Historic Overview of Vandenberg Air Force Base, Santa Barbara County, California.* Prepared by Palmer Archaeology and Architecture Associates, Santa Barbara, California. Draft submitted to 30 CES/CEVPC, Vandenberg Air Force Base, California.

Penfield and Smith, Inc.
1999 Vandenberg AFB Facilities Improvement Program Design Analysis for the Concept (85 %) Study Submittal.

Penfield and Smith, Inc.
2000a *Vandenberg AFB Facilities Improvement Program Preliminary (30%) Design Submittal, Repair Landfill Drainage.* February.

Penfield and Smith, Inc.
2000b *Vandenberg AFB Facilities Improvement Program Preliminary Prefinal (85%) Design Submittal, Repair Landfill Drainage.* May.

Preston, William
1996 Serpent in Eden: Dispersal of Foreign Diseases into Pre-Mission California. *Journal of California and Great Basin Anthropology* 18(1):2–37.

Raab, L.M., K. Bradford, J.F. Porcasi, and W.J. Howard
1995 Return to Little Harbor, Santa Catalina Island, California: A Critique of the Marine Paleotemperature Model. *American Antiquity* 60:287–308.

Raab, L. Mark, and Daniel O. Larson
1997 Medieval Climatic Anomaly and Punctuated Cultural Evolution in Coastal Southern California. *American Antiquity* 62:319–336.

Rogers, David Banks
1929 *Prehistoric Man of the Santa Barbara Coast, California.* Santa Barbara Museum of Natural History, Special Publications No. 1.

Science Applications International Corporation
1990 *Installation Restoration Program Stage I, Site Characterization, Vandenberg AFB, California.* Final Report, Volume I.

Science Applications International Corporation
1995 *Final Environmental Assessment, Family Housing Management Office, Vandenberg Air Force Base, California.* Science Applications International Corporation, Santa Barbara, California. Prepared for the U.S. Air Force, Vandenberg Air Force Base, California.

S/G Testing Laboratories, Inc (S/G)
2000 *Department of Geotechnical Investigation, Proposed VAFB Landfill Storm Drain System, VAFB Project no. XUMU-01-1087B, Stations 00+00 to 54+00, Pine Canyon Road and New Mexico Avenue.* Vandenberg Air Force Base, California. April.

Shipman, G.E.
1972 *Soil Survey of Santa Barbara County, Northern Santa Barbara Area.* U.S. Department of Agriculture, Soil Conservation Service. Washington DC.

Simpson, Lesley B.
1939 *California in 1792: The Expedition of Longinos Martinez.* Huntington Library, San Marino, California.

Spear, Michael
1998 Personal communication. 30th Medical Squadron, Vandenberg AFB, California.

Steward, Craig
2000 Personal communication. Penfield and Smith, Inc., Santa Barbara, California.

Teggart, F.J. (editor)
1911 The Portolá Expedition of 1769–1770: Diary of Miguel Costansó. *Publications of the Academy of Pacific Coast History* 2(4):164–327.

Tetra Tech, Inc.
1988 *Historic Preservation Plan, San Antonio Terrace National Register District, Vandenberg Air Force Base, California.* Tetra Tech, Inc., San Bernardino, California. Prepared for United States Air Force AFRCE-BMS, Norton Air Force Base, California.

Tetra Tech, Inc.
2000 *Letter Report: Draft Supplemental Phase II Remedial Investigation Results, Installation Restoration Program, Site 3, Old Railroad Pumping Station, Operable Unit 1,* Vandenberg Air Force Base, California. June.

U.S. Air Force
1987 Mineral Resource Management Plan (Final), Potential Exploration, Development, and Production of the Oil and Gas. Vandenberg AFB, California.

U.S. Air Force

1988 *Environmental Assessment, Titan IV Space Launch Vehicle Modification and Operation, Vandenberg Air Force Base, California.* Department of the Air Force, Headquarters, Space Division, Los Angeles Air Force Station, California.

U.S. Air Force

1995 *Installation Restoration Program Vandenberg Air Force Base. Supplemental Preliminary Assessment Final Report.* Prepared by Tetra Tech, Inc. for 30 CES/CEV, Vandenberg AFB, California.

U.S. Air Force

1996a *Supplemental Detection Monitoring Landfill Third Quarter 1995.* Prepared by Tetra Tech, Inc. for 30 SW/ET, Vandenberg AFB, California. April.

U.S. Air Force

1996b *Integrated Natural Resources Management Plan.* Prepared by Tetra Tech, Inc. for 30 CES/CEV, Vandenberg Air Force Base, California.

U.S. Air Force

1996c *Pollution Prevention Management Plan, 30 Space Wing Plan 32-7080.* Vandenberg Air Force Base, California. 6 May.

U.S. Air Force

1997a *Final Groundwater Reclamation and Reuse Report, Vandenberg Air Force Base Sanitary Landfill.* Task Assignment No. 42. Prepared by Tetra Tech, Inc. for 30 CES/CEVCC. Santa Maria, California. September.

U.S. Air Force

1997b *Draft Stormwater Pollution Prevention Plan.* Prepared by Tetra Tech, Inc. for 30 CES/30 CEV. Vandenberg AFB, California.

U.S. Air Force

1997c *Vandenberg Air Force Base Sanitary Landfill Wetlands Delineation Report for Source Control Corrective Actions.* Work Request No. 12. Prepared by Tetra Tech, Inc. for 30 CES/CEV. Santa Maria, California. November.

U.S. Air Force

1997d *Vandenberg Air Force Base Annual Detection Monitoring Report.* Prepared by Tetra Tech, Inc. for 30 CES/CEV. Santa Maria, California. November.

U.S. Air Force

1997e *Supplemental Detection Monitoring Report Third Quarter 1996 Reporting Period.* Prepared by Tetra Tech, Inc. for 30 CES/CEVCC. April.

U.S. Air Force

1997f *Final Solid Waste Management Plan, 30 Space Wing Plan 32-7042.* Vandenberg Air Force Base, California.

U.S. Air Force
1997g *Final Integrated Natural Resources Management Plan.* Prepared by Tetra Tech, Inc. for 30 CES/CEV, Vandenberg Air Force Base, California.

U.S. Air Force
1998a *Vandenberg Air Force Base 1997 Annual Detection Monitoring Report.* Prepared by Tetra Tech, Inc. for 30 CES/CEVCC. Santa Maria, California. November.

U.S. Air Force
1998b *Storm Water Annual Report 1997–1998.* 30th Space Wing, Vandenberg Air Force Base, California

U.S. Air Force
1998c *Vandenberg Air Force Base Supplemental Detection Monitoring Report, First Quarter 1998 Reporting Period.* Prepared by Tetra Tech, Inc. for 30 CES/CEVCC. Santa Maria, California. October.

U.S. Air Force
1998c *Hazardous Waste Management Plan, 30 SW Plan 32-7043-A.* Prepared for 30 CES/CEV by Tetra Tech, Inc. July.

U.S. Air Force
1998d *Final Supplemental Site Inspection Report.* Prepared by Tetra Tech, Inc. for 30 CES/CEV, Vandenberg AFB, California.

U.S. Air Force
1998e *Final Technical Report. Work Request 10.* Prepared by Tetra Tech, Inc. for 30 CES/CEV, Vandenberg AFB, California.

U.S. Air Force
1999a *Preliminary Closure and Post Closure Maintenance Plan for Vandenberg AFB Sanitary Landfill.* Prepared by Tetra Tech, Inc. for 30 CES/30 CEVCC. Vandenberg AFB, California.

U.S. Air Force
1999b *Vandenberg Air Force Base 1998 Annual Detection Monitoring Report.* Prepared by Tetra Tech, Inc. for 30 CES/30 CEVCC. July.

U.S. Air Force
1999c *Storm Water Annual Report 1998–1999.* 30th Space Wing, Vandenberg AFB, California.

U.S. Air Force
1999d *Vandenberg AFB Supplemental Detection Monitoring Report Third Quarter 1998 Reporting Period.* April.

U.S. Air Force
1999e *Vandenberg Air Force Base 1998 Annual Detection Monitoring Report, July 1999.* Prepared by Tetra Tech, Inc. for 30 CES/CEVCC. Santa Maria, California.

U.S. Air Force
1999f *Installation Restoration Program Final Supplemental Phase II Remedial Work Plan Site 3, Old Railroad Pumping Station Operable Unit 1.* Prepared by Tetra Tech Inc. for 30 CES/CEV, Vandenberg AFB, California. November.

U.S. Air Force
1999g Vandenberg AFB Installation Restoration Program (IRP) Remedial Project Managers Meeting Minutes 02 December 1999.

U.S. Air Force
2000a *Vandenberg Air Force Base 1999 Annual Detection Monitoring Report.* Prepared by Tetra Tech, Inc. for 30 CES/CEVCC. July.

U.S. Air Force
2000b *Storm Water Annual Report 1999-2000.* 30th Space Wing, Vandenberg AFB, California.

U.S. Air Force
2000c Vandenberg AFB Installation Restoration Program (IRP) Remedial Project Managers Meeting Minutes 09 March 2000.

U.S. Air Force
2002 Basewide Groundwater Monitoring Program Report, Fall 2001. Installation Restoration Program (IRP) Site 3, Vandenberg Air Force Base, California. Prepared for the Department of the Air Force, HQ AFCEE/ERD, 3207 North Road, Brooks Air Force Base, Texas 78235-5523. March, 2002. Prepared by Tetra Tech, Inc.

U.S. Air Force
In preparation Supplemental Remedial Investigation Report, Installation Restoration Program Site 3 – Old Railroad Pumping Station, Operable Unit 1, Remedial Investigation/Feasibility Study (RI/FS). Preliminary Draft. Prepared for Headquarters Air Force Space Command, Peterson Air Force Base, Colorado 80914-5001. Prepared by Tetra Tech, Inc.

U.S. Army Corps of Engineers (COE)
1953 Drawing No. 22-245 Camp Cooke California Ranges and Training Facilities. Office of the Post Engineer, 13 April.

U.S. Army Corps of Engineers (COE)
1988 *Site Preparation Space Launch Complex 7 Vandenberg Air Force Base California Geotechnical Report.* 2 September

U.S. Bureau of the Census
2000 U.S. Census Bureau Home Page. http://www.census.gov.

U.S. Department of Agriculture
1972 Soil Survey of Northern Santa Barbara Area, California. Soil Conservation Service, Washington, D.C.

U.S. Department of Housing and Urban Development
1978 Environmental Criteria and Standards, Section 51.101.9.

Vandenberg Air Force Base (Vandenberg AFB)
1992 *Land Management Plan for Vandenberg Air Force Base, California, for Plan Period 1992 to 1997.* National Resources and Comprehensive Planning Division, Michael McElligott, Ecologist.

Vandenberg Air Force Base (Vandenberg AFB)
1996 *Environmental Assessment for the Range Standardization and Automation Fiber Optic Transmission System.*

Vandenberg Air Force Base (Vandenberg AFB)
1998 30th Space Wing Homepage, *www.30sw.vafb.af.mil,* Vandenberg AFB.

Vandenberg Air Force Base (Vandenberg AFB)
2000 *Vandenberg Air Force Base General Plan, Santa Barbara County, California.*

Viray, Captain Cynthia
2000 Personal communication. 30 WS/SYR Weather Squadron, Vandenberg AFB, California.

Wagner, Henry R.
1929 *Spanish Voyages to the Northwest Coast in the Sixteenth Century.* California Historical Society, San Francisco.

Warren, Claude N.
1967 The San Dieguito Complex: A Review and Hypothesis. *American Antiquity* 32:168–185.

Welch, Tom
2000 Vandenberg AFB, Real Estate Office, personal communication, 2000.

Woodward-Clyde Consultants (Woodward-Clyde)
1985 *Seismic Study - Launch Complex C, Vandenberg AFB.* Prepared for Space Transportation Systems Division, Rockwell International Corporation by Englekirk and Hart Consulting Engineers Inc. and Woodward-Clyde Consultants.

7 PERSONS AND AGENCIES CONTACTED

7.0 PERSONS AND AGENCIES CONTACTED

The following individuals were consulted during preparation of this EA:

Gillespie, Chris
Botanist, Vandenberg AFB, 30 CES/CEVPN, Vandenberg AFB, California

Johnson, Bert
Engineer, 30 CES/CECC, Vandenberg AFB, California

Kamei, Gary
Environmental Engineer, 30 CES/CEVCC, Vandenberg AFB, California

Kephart, Bea
Chief, Installation Restoration Program, 30 CES/CEVR, Vandenberg AFB, California

Lewis, Greg
Engineer, ACE Engineering, Inc., Lompoc, California

McElligott, Mike
Environmental Engineer, 30 CES/CEVCR, Vandenberg AFB, California

McNamara, Kevin
Senior Geologist, Tetra Tech, Inc., Santa Barbara, California

Osland, Karen
Environmental Planner, 30 CES/CEVPP, Vandenberg AFB, California

Read, Nancy
Wildlife Biologist, Vandenberg AFB, 30 CES/CEVPN, Vandenberg AFB, California

Santa Barbara County Air Pollution Control District
Santa Barbara, California

Spillman, Paul
Engineer, Penfield and Smith, Santa Barbara, California

Steward, Craig
Engineer, Penfield and Smith, Santa Barbara, California

Welch, Tom
Planner, Real Estate Office, Vandenberg AFB, California

Viray, Captain Cynthia
30 WS/SYR Weather Squadron, Vandenberg AFB, California

This page intentionally left blank.

8 LIST OF PREPARERS

8.0 LIST OF PREPARERS

Bach, Margaret, Staff Geologist Tetra Tech, Inc.
B.A., 1991, Geology, Mount Holyoke College
Years of Experience: 7

Bates, Michelle A., Biologist/Environmental Scientist, Tetra Tech, Inc.
B.S., 1997, Biology, Pepperdine University, Malibu
M.S., 2000, Environmental Science and Management, University of California, Santa Barbara
Years of Experience: 5

Eldridge, Jacqueline C., Publications Manager, Tetra Tech, Inc.
B.S., 1971, Biology, Fairleigh Dickinson University, Teaneck, New Jersey
M.S., 1978, Marine Science, Long Island University, Greenvale, New York
M.B.A., 1983, Business Administration, National University, Vista, California
Years of Experience: 25

Gale, Nathan, Scientist/Geographer, FL*x*
M.A., 1980, Geography, University of California, Santa Barbara
Ph.D., 1985, Geography, University of California, Santa Barbara
PWS, Certified Professional Wetland Scientist #1216, Society of Wetland Scientists
Years of Experience: 20

Green, Alice V., Project Scientist, Tetra Tech, Inc.
B.A., 1976, Biology (concentration Marine Biology), University of Pennsylvania, Philadelphia
M.S., 1978, Management (concentration Marine Resources Management), Texas A&M University, College Station
Years of Experience: 13

Hammond, Shari L., Environmental Scientist, Tetra Tech, Inc.
B.A., 1992, Environmental Studies, University of California, Santa Barbara
M.C.R.P., 1999, City and Regional Planning, California State Polytechnic University, San Luis Obispo
Years of Experience: 6

Ige, Geri K., Senior Graphic Designer, Tetra Tech, Inc.
Fine Arts, University of California, Irvine
Years of Experience: 23

Lebow, Clayton, Archeologist, Applied EarthWorks, Inc.
B.S., 1977, Forest Engineering, Oregon State University
M.A., 1982, Archaeology, Anthropology, and Cultural Geography, Oregon State University
Years of Experience: 18

Levinsohn, Justin A., Word Processor, Tetra Tech, Inc.
B.A., 2000, English Literature, University of California, Santa Barbara, California
Years of Experience: 1

Love, Diane, Geologist, Tetra Tech, Inc.
B.S., 1999, Geology, University of California, Santa Barbara
Years of Experience: 3

McGinnis, Christina E., Senior Environmental Planner, Tetra Tech, Inc.
B.A., 1991, History, University of California, Los Angeles
M.A., 1994, Urban Planning, University of Oregon, Eugene
Years of Experience: 8

Parikh, Anuja, Ecologist, FL*x*
B.S., 1979, Zoology and Geology, University of Bombay, India
M.S., 1981, Geography, University of Bombay, India
Ph.D., 1989, Plant Geography, University of California, Santa Barbara
PWS, Certified Professional Wetland Scientist #841, Society of Wetland Scientists
Years of Experience: 16

Perrell-Parsons, Francesca, Staff Hydrogeologist, Tetra Tech, Inc.
B.S., 1986 Geology, University of Idaho, Moscow, Idaho
M.S., 1990 Hydrology/Hydrogeology, University of Nevada, Reno, Nevada
Years of Experience: 15

Randall, Diane, Senior GIS Specialist, Tetra Tech, Inc.
Technical Certificate, Computer Programming, Sawyers College, Ventura, California
Technical Certificate, Program Management, Moorpark College, California
Years of Experience: 12

Steele, James, R.G., C.E.G., C.Hg., R.E.A., Engineering Geologist/Hydrogeologist, Tetra Tech, Inc.
B.A., Geological Sciences and Geography, University of California, Santa Barbara
Years of Experience: 12

Velazquez, Victor, Associate Engineer, Tetra Tech, Inc.
B.S., 1995, Chemical Engineering, University of California, Santa Barbara
Years of Experience: 5

Vianzon, Agnes, Intern Planning Assistant, Tetra Tech, Inc.
B.A., Environmental Studies, University of California, Santa Barbara
Years of Experience: 1

Warren, Shirley M., Word Processor III, Tetra Tech, Inc.
B.A. 1992, Environmental Studies, California State University Sacramento, California
Years of Experience: 8

Wellhausen, Nancy, Air Quality Specialist, Tetra Tech, Inc.
Chemical Engineering, University of California, Santa Barbara
Years of Experience: 10

Wilson, Michelle, Environmental Scientist, Tetra Tech, Inc.
B.A., 1993, Environmental Science (concentration in Biology), University of California, Berkeley
Minor: Resource Management
Years of Experience: 11

Yan, Michael, Associate Engineer, Tetra Tech, Inc.
B.S., 1998, Environmental Engineering, California State Polytechnic University, San Luis Obispo
Years of Experience: 3

This page intentionally left blank.

9 ACRONYMS AND ABBREVIATIONS

9.0 ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AOC	Area of Concern
AOI	Area of Interest
APE	Area of Potential Effects
bgs	below ground surface
CAAQS	California Ambient Air Quality Standards
Cal/EPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CAP	Clean Air Plan
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CECB	Base Planning Office
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CES	Civil Engineering Squadron
CEVPC	30th Space Wing Cultural Resources
CFR	Code of Federal Regulations
CMP	corrugated metal pipe
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
COPC	chemical of potential concern
CWA	Clean Water Act
dB	decibels
dBA	A-weighted decibels
DCE	1,2-dichloroethane
DERP	Defense Environmental Restoration Program
DOD	Department of Defense
DOT	Department of Transportation
DTSC	Department of Toxic Substances Control
EA	environmental assessment
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPCRA	Emergency Planning and Community Right-to-Know Act
FONPA	Finding of No Practicable Alternative
FS	federal species of concern
FT	federally listed as threatened
HDPE	high density polyethylene

IRP	Installation Restoration Program
JEG	Jacobs Engineering Group, Inc.
L_{DN}	day-night noise level
L_{eq}	time-average equivalent noise level
MBTA	Migratory Bird Treaty Act
msl	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
P2	pollution prevention
PAH	polyaromatic hydrocarbon
PCE	perchloroethene
$PM_{2.5}$	particulate matter 2.5 microns or less in diameter
PM_{10}	particulate matter 10 microns or less in diameter
PPA	Pollution Prevention Act
RCP	reinforced concrete pipe
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RWQCB	Regional Water Quality Control Board
S/G	S/G Testing Laboratories, Inc.
SARA	Superfund Amendments and Reauthorization Act
SBCAPCD	Santa Barbara County Air Pollution Control District
SIP	State Implementation Plan
SW	Space Wing
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCE	trichloroethene
TPH	total petroleum hydrocarbons
UCSB	University of California, Santa Barbara
U.S.C.	U.S. Code
U.S. EPA	U.S. Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

UST	underground fuel storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
WDR	Waste Discharge Requirement

This page intentionally left blank.

A NATURAL RESOURCES SURVEY REPORT

Appendix A

Natural Resources Survey Report

Environmental Assessment for Landfill Drainage Improvements Vandenberg Air Force Base, California

Revised March, 2003

Submitted To:

30 CES/CEVP
806 13th Street, Suite 116
Vandenberg Air Force Base, California 93437

Submitted By:

Tetra Tech, Inc.
4213 State Street, Suite 100
Santa Barbara, California 93110

Prepared By:

FL*x*
1215 Bajada
Santa Barbara, California 93109

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

ATTACHMENTS

1.0 INTRODUCTION

This natural resources survey report provides supporting documentation for an Environmental Assessment (EA) prepared for a project involving drainage system improvements at the landfill at Vandenberg AFB, California. The scope of this survey report includes vegetation and wildlife resources, as well as jurisdictional waters of the United States and wetlands protected under section 404 of the Clean Water Act (CWA) and Executive Order 11990.

The project includes a Proposed Action and three alternatives that would divert most off-site storm water through a storm drain around the current landfill area, and eliminate flow over and through the landfill. The purpose of the project is to minimize the potential for landfill leachate production. The storm drain would be constructed of high density polyethylene (HDPE) pipe and range in size from 24 to 60 inches in diameter. Installation would involve trenching, excavation, shoring, stockpiling, and backfilling of soil.

Under the Proposed Action, the storm water drain would be routed just outside the landfill, parallel with New Mexico Avenue (Utah Avenue), and then turn southeast to parallel Pine Canyon Road. The storm drain would then turn northeast and would be trenched across Pine Canyon Road using an open cut with slurry. The storm drain would be routed east of existing power lines and several vernal pools (see below). Storm water would finally be discharged into an intermittent tributary leading to Upper Lake in Lake Canyon, northeast of the landfill.

Alternatives 1 and 2 would start near the intersection of Utah Avenue and 6th Street, north of the entrance to the landfill. They would continue northeast along Utah Avenue, and then turn southeast along Pine Canyon Road. Near the northeast corner of the landfill, they would turn south towards Oak Canyon. Alternative 1 would run closer to the Subtitle D boundary, west of Alternative 2. Both alternatives would discharge storm water at the same outlet leading into a tributary to Oak Canyon, south of the landfill.

Alternative 3 would start near the intersection of Utah Avenue and 6th Street, north of the entrance to the landfill, continue northeast along Utah Avenue, and then turn southeast along Pine Canyon Road. Near the northeast corner of the landfill, the route would cross under Pine Canyon Road using a jack and bore method, and continue northeast towards Lake Canyon.

2.0 METHODS

2.1 BIOLOGICAL SURVEYS

For this project, biological field surveys were conducted on foot along the drainage alignment routes and in tributaries below the storm drain outlets. Surveys also were carried out in the three lakes in Lake Canyon, in the northern section of Oak Canyon, and the area in the northern part of the landfill where storm water currently flows in unlined drainages (Attachment 1, Figure 1). The areas surveyed extended 90 meters on each side of the centerline of proposed storm drain, and included a 15 meter wide corridor around the lakes in Lake Canyon and the Oak Canyon drainage downstream of the landfill to its first confluence with a tributary.

The routes for Alternatives 1, 2, and 3 were surveyed during primary surveys conducted in April and May 2000; supplemental surveys were conducted for the Proposed Action in April 2002 (Attachment 1, Figure 1). Dominant plant species and vegetation types were identified, and wildlife was observed by sight, sound, tracks, or other sign. The potential occurrence of other species was examined by identifying the documented or known habitat preferences of species. Many plant species can be observed or identified definitively only during their particular blooming periods, most of which vary during spring and summer.

The current botanical surveys were conducted at an appropriate time for most spring species, but not for all later blooming plants, and therefore, cannot be considered comprehensive. In addition, the seasonal nature of migration, wintering, and breeding behaviors in animal populations precludes observation of the full component of fauna in an area at a particular time. Wildlife species data, therefore, also cannot be considered comprehensive. However, bird surveys were timed to occur during the breeding season of many species. Targeted surveys for the federally threatened California red-legged frog (*Rana aurora draytonii*) were scheduled, following United States Fish and Wildlife Service (USFWS) protocol, to commence after May 1.

In this report, plant taxa nomenclature follows Hickman (1993). Species nomenclature for birds follows the American Ornithologist's Union (1983), and for other animals, sources include Stebbins (1985), Jones *et al.* (1986), Jameson and Peeters (1988), and Collins (1990).

2.2 SPECIAL-STATUS RESOURCES SURVEYS

Surveys for special-status species potentially occurring in the area were conducted concurrently with the biological field surveys. Under direction from the Air Force, field surveys for the California red-legged frog were carried out in the three lakes in Lake Canyon. Following USFWS protocol for this species, two daytime and two nighttime surveys were conducted. Protocol surveys for listed bird species were not required, although they were included in the list of special-status target species to be surveyed.

The available literature and maps of natural resources present at Vandenberg AFB also were consulted (U.S. Air Force 1996), including data updated in 1997 incorporating special-status species and sensitive habitat information from the California Natural Diversity Data Base (CNDDB) and the California Native Plant Society (CNPS).

The Endangered Species Act (ESA) of 1973, as amended (16 U.S. Code [U.S.C.] 1531 *et seq.*), requires the USFWS to identify species of wildlife and plants that are endangered (FE), threatened (FT), or proposed endangered (FPE), based on the best available information. Prior to 1996, species that were being considered for listing, and for which there was sufficient information on biological vulnerability, were known as Category 1 candidates. Category 2 candidates were those taxa for which information indicated that proposing to list them as endangered or threatened was appropriate, but for which sufficient data were lacking to support federal listing. In 1996, the USFWS issued a notice to present an updated list of plants and animals regarded as candidates for possible addition to the list of endangered and threatened species under the ESA (50 CFR Part 17). Under the revised list, only those species for which information is available to support a listing proposal are called "candidates" (FC). These were formerly known as Category 1 candidates. The USFWS renamed the list of species formerly known as Category 2 candidates as "species of concern" (FS). Although the USFWS no longer maintains this informal category, the Integrated Natural Resources Management Plan at Vandenberg AFB considers these species during planning as an approach to avoid the need for listing.

The California Department of Fish and Game (CDFG) ranks plant communities by evaluating their overall condition throughout their range (S-ranks 1 through 5) and their threat status (subranks .1 through .3). The S-rank S1 designates a very restricted community, S2 is restricted, S3 is somewhat restricted, S4 is apparently secure, and S5 is demonstrably secure. The subrank .1 designates a very threatened community, .2 is threatened, and .3 has no current known threats. S4 and S5 communities have no threat ranks. A state rank of S1.1 therefore designates a community with a very restricted occurrence (S1) and a very threatened status (.1). In this report, sensitive plant communities include those with some threat status: S1.1, S1.2, S2.1, S2.2, S3.1, and S3.2.

Plant species are listed sensitive by the CNPS (Skinner and Pavlik 1994) in five categories. List 1A species are presumed extinct in California; List 1B species are rare or endangered in California and elsewhere. List 2 species are rare or endangered in California but are more common elsewhere. List 3 species include those for which more information is needed. List 4 plants are those with limited distribution.

2.3 WETLAND SURVEYS

Surveys for jurisdictional waters of the United States and wetlands were conducted along the three drainage alignment routes and in tributaries below the storm drain outlets. Field surveys also were carried out in the section of Oak Canyon downstream of the landfill (Attachment 1, Figure 1). Waters of the United States and wetlands in these parts of the project area were investigated in April 2000. Wetlands in the area of a potential realignment of the Proposed Action were surveyed in April 2002. Wetland surveys were not required at the three lakes in Lake Canyon. Additionally, since wetland resources in the landfill were surveyed and delineated in 1997 (U.S. Air Force 1997), that area was not resurveyed for the current project.

The U.S. Army Corps of Engineers (USACE) is responsible for determining jurisdictional boundaries of waters of the United States and wetlands for regulatory and permitting purposes under Section 404 of the CWA. The jurisdictional limit of waters of the United States is identified by the extent of the ordinary high water mark. For delineating wetlands under Section 404 of the CWA, the USACE has developed a field method using a "three parameter test" that considers hydrophytic vegetation, wetland hydrology, and hydric soils. Under the USACE definition, an area is considered a wetland only if indicators of all three parameters are present, except for wetland types designated as "problem areas" or conditions considered to be significantly disturbed or "atypical" (Environmental Laboratory 1987). Wetlands located within or associated with waters of the United States or navigable waters are under the jurisdiction of the USACE. These jurisdictional wetlands and other wetlands are also protected by Executive Order 11990.

Seventeen sampling stations were established in potential waters or wetlands, and the USACE routine onsite method of wetland determination was used to confirm and document the presence or absence of wetland resources. A soil pit up to 14 inches deep was dug at each station, and field indicators for the three parameters of hydrophytic vegetation, wetland hydrology, and hydric soils were examined. Following USACE methodology, hydrophytic vegetation is indicated when more than 50 percent of the dominant species at a station are obligate wetland (OBL), facultative wetland (FACW), or facultative species (FAC; Reed 1988). Wetland hydrology typically is indicated when soils are inundated or saturated within 12 inches of the surface for at least 18 days during the growing season. Other wetland hydrology indicators include physical evidence of such conditions, indicated by the presence of water lines impressed on the bank, shelving, water marks or stains, drift lines (destruction or flattening of vegetation, litter and debris deposition), sediment deposits such as algal mats, and mudcracks. Hydric soils are indicated by the presence of one of the various indicators below the A horizon or 10 inches: a soil chroma of 2 or less in mottled soils, or 1 or less in unmottled soils (Munsell Color 1990); the presence of sulfidic material or odors; and the presence of organic material. In addition to field indicators, the soil series and subgroup were noted (U.S. Department of Agriculture 1972), as was inclusion of the soil on the 1992 List of Hydric Soils for Santa Barbara County.

Following the supplemental survey conducted in 2002, the boundaries of the vernal pools and swales in the complex north of Pine Canyon Road were marked with pin flags in the field. These data were then acquired using global positioning system (GPS) equipment and entered into the Vandenberg AFB geographic information system (GIS) database.

3.0 AFFECTED ENVIRONMENT

3.1 REGIONAL SETTING

Vandenberg AFB is located in a transitional ecological region that lies at the northern and southern distributional limits of many species, and contains diverse biological resources of considerable importance. The base provides habitat for many federal- and state-listed threatened, endangered, candidate, and special concern plant and animal species. Fourteen major vegetation and habitat types have been described and mapped on the base (U.S. Air Force 1996). Among these vegetation types, the major communities found in the project area are coast live oak woodland, willow woodland, Burton Mesa chaparral, coastal sage scrub, freshwater marsh, and nonnative grassland. Small areas of vernal freshwater marsh wetlands also occur.

The project area lies within the Burton Mesa geomorphic area or ecological management area (U.S. Air Force 1996), which occupies predominantly flat or gently sloping terrain. Natural and modified drainages as well as seasonally flooded pools are found in the area.

3.2 PLANT COMMUNITIES AND WILDLIFE HABITATS

3.2.1 Coast Live Oak Woodland

Coast live oak (*Quercus agrifolia* var. *agrifolia*) dominates Central Coast oak woodlands that occur away from the direct influence of the ocean in canyons, on north-facing slopes, and on sandy plains. Oak woodlands often grade into chaparral or coastal sage scrub upslope or under drier conditions; on higher areas subject to fog, they grade into tanbark oak forest. Coast live oaks are known to be long-lived, and are well-adapted to surviving fire. Annual grasses have replaced native perennial grasses once commonly associated with this community. On Vandenberg AFB, coast live oak woodlands occur mostly in the interior portions of North Base. In the project area, this community occurs along the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon, and in Oak Canyon.

Although coast live oak woodlands are not designated as sensitive (CDFG state rank S4), they are considered to be of primary aesthetic, cultural, and ecological importance in Santa Barbara County. Acorns of coast live oak are an important food source for a variety of wildlife; trees provide nesting sites for several bird species. The lack of oak seedling regeneration has been noted in many oak woodlands, particularly where annual grasses dominate the understory. The reproductive status of oak woodlands on the base is unclear, and the Vandenberg AFB Integrated Natural Resources Management Plan (U.S. Air Force 1996) has designated this community for protective management. Hoffmann's sanicle (*Sanicula hoffmannii*) is an endemic plant species associated with coast live oak woodlands; the federal species of concern black-flowered figwort (*Scrophularia atrata*) also is found in this community.

3.2.2 Willow Woodland

This community occurs along river courses, streambeds, and areas where the water table lies close to the surface of the ground. In most cases where riparian woodland is present, there is a very narrow transitional zone to other vegetation. On Vandenberg AFB, willow woodland is dominated by arroyo willow (*Salix lasiolepis*), both as a canopy and understory species. More uncommon canopy species in this community are wax myrtle (*Myrica californica*) and box elder (*Acer negundo* var. *californicum*). Understory species include California blackberry (*Rubus ursinus*), western poison oak (*Toxicodendron diversilobum*), gooseberry (*Ribes divaricatum*), and hoary nettle (*Urtica dioica* ssp. *holosericea*). Willow riparian woodland covers large areas on the base along San Antonio Creek and Santa Ynez River, and, to

a lesser degree, in the larger canyons such as along Shuman Creek, Bear Creek, and Cañada Honda Creek. In the project area, this community occurs in the northern part of the landfill, along the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon, and in Lake Canyon.

The CDFG ranks Central Coast arroyo willow riparian forest (Holland 1986; willow woodland in this report) as S3.2 (threatened). Riparian systems are important due to their high biological productivity and value for providing food and cover for wildlife, particularly avifauna. Throughout California, much riparian vegetation has been lost to agriculture and urban development; in the coastal region of Santa Barbara County, most of the remaining, relatively undisturbed riparian areas occur on Vandenberg AFB. Riparian willow woodlands provide habitat for black-flowered figwort. The federally endangered southwestern willow flycatcher (*Empidonax trailii extimus*) occurs in undisturbed riparian willow woodland of the Santa Ynez River. The California red-legged frog, also observed in this habitat, is a federally threatened species, and the southwestern pond turtle (*Clemmys marmorata pallida*) and the two-striped garter snake (*Thamnophis hammondii*) are reptile California Department of Fish and Game species of special concern.

3.2.3 Chaparral

Chaparral is a dense, evergreen, rigid, form of shrubby vegetation native to the coastal areas of California. It occurs on acidic substrates including stabilized sand, granite, and metamorphosed rock types. Under increased moisture conditions, it grades into Bishop pine or tanbark oak forest types, and under drier conditions, it frequently is replaced by coastal sage scrub. It's continued reproduction and survival is closely linked with fire (Holland 1986). Central Coast maritime chaparral, which includes Burton Mesa chaparral, occurs on well-drained, sandy substrates within the zone of summer coastal fog incursion. It is dominated by manzanitas (*Arctostaphylos* spp.), California lilacs (*Ceanothus* spp.), and chamise (*Adenostoma fasciculatum*). This community is restricted mostly to Vandenberg AFB and its vicinity, where it is widespread and variable, found on mesas and higher ridges. It occurs on parts of the Burton Mesa, San Antonio Terrace, Lompoc Terrace, South Base canyon slopes, and on some of the slopes of the lower Santa Ynez Mountains (U.S. Air Force 1996). In the project area, Burton Mesa chaparral occurs as the dominant plant community along the Alternative 1 and 2 routes east of the landfill, and also is found on the upper slopes of Oak Canyon.

Central Coast maritime chaparral is a sensitive community and has the state rank of S2.2 (threatened). It is a regionally declining plant community, and much of its remaining acreage in California occurs on the base, where it also has reduced in area considerably over the years. Many regionally endemic species and special-status plants are found in Central Coast maritime chaparral on Vandenberg AFB. Important special-status species are Lompoc yerba santa (*Eriodictyon capitatum*), manzanitas (*Arctostaphylos rudis*, *A. purissima*, *A. tomentosa* ssp. *eastwoodiana*), seaside bird's-beak (*Cordylanthus rigidus* ssp. *littoralis*), black-flowered figwort (*Scrophularia atrata*), and dune larkspur (*Delphinium parryi* ssp. *blochmaniae*). Bell's sage sparrow (*Amphispiza belli belli*) is partial to open chaparral, particularly to previously burned areas with dead snags that provide perches.

3.2.4 Coastal Sage Scrub

Coastal sage scrub often is referred to as soft chaparral, and unlike chaparral, it contains species that are mesophyllous and shallow-rooted, and often are entirely or partially drought-deciduous and summer-dormant. Plant growth is concentrated in winter and spring, when soil moisture is readily available. This community occurs on dry slopes and soils near the coast to the interior foothills in California, and frequently is associated with annual grasslands. It also occurs at the margins of dunes, chaparral, and woodlands. Coastal sage scrub is a diverse vegetation type dominated by the shrub California sagebrush

(*Artemisia californica*). In disturbed or more mesic areas, the dominant species may be coyote brush (*Baccharis pilularis*). In addition to these two dominants, associated shrub species in this vegetation type in the project area include dune buckwheat (*Eriogonum parvifolium*), California broom (*Lotus scoparius* var. *scoparius*), western poison oak, and black sage (*Salvia mellifera*). Many perennial and annual herbs also are found in this community. On Vandenberg AFB, coastal sage scrub is a variable community, and is found on South Base near Cañada Honda Creek and Bear Creek, and also in the northeastern part of the base. In the project area, coastal sage scrub is found north of the landfill along the three routes, in the northern part of the Proposed Action and Alternative 3 route and near the storm drain outlet, on the slopes of Lake Canyon, and the lower slopes of Oak Canyon.

Central (Lucian) coastal scrub (Holland 1986; coastal sage scrub in this report) is relatively widespread and is ranked by the CDFG as S3.3 (no current known threats), and therefore is not considered a sensitive community. It once was more abundant in California on flat terrain, before such areas were cleared for development. The straight-awned spineflower (*Chorizanthe rectispina*), seaside bird's-beak, dune larkspur, and black-flowered figwort also occur in this community.

3.2.5 Freshwater Marsh

Freshwater marsh is a heterogeneous plant community dominated by perennial herbs that occur in areas with water at or near the surface for the entire year. Soils are saturated to wet. Along larger streams and creeks, freshwater marshes often grade into or occur under a canopy of riparian woodland; along the coastline, they grade into salt marshes. In closed depressional swales, they grade into willow or oak woodland, and sometimes show sharp boundaries with upland scrub vegetation. Unlike other communities, the growth of species in freshwater marshes is greatest during the summer months. Dominant species include bulrushes (*Scirpus* spp.), cattails (*Typha* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp.). On Vandenberg AFB, the largest freshwater marsh occurs in Barka Slough. Smaller marshes are found along Santa Ynez River, creeks such as San Antonio Creek, and in the dune swale wetlands on San Antonio Terrace. In the project area, freshwater marshes occur in Lake Canyon; small patches of this community are found in the landfill and in the upstream part of the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon.

Coastal and valley freshwater marsh (Holland 1986; freshwater marsh in this report) is ranked by the CDFG as S2.1 (very threatened). The loss or replacement of freshwater marshes in California is a significant change; they provide habitat for many plant and wildlife species, including several special-status taxa. These include the federally endangered plant species Gambel's watercress (*Rorippa gambelii*). The California red-legged frog also inhabits freshwater marshes. The tricolored blackbird (*Agelaius tricolor*), the southwestern pond turtle, the two-striped garter snake, and the western spadefoot toad (*Spea hammondii*) are other species of concern found in this habitat.

3.2.6 Seasonal Freshwater Wetlands

A unique variant of freshwater marsh habitat occurs in shallow depressions, flats, or swales scattered in grasslands, coastal scrub, or chaparral on the Burton Mesa. These areas have similar topography and associated species as vernal pools dominated by non-persistent vegetation. Such seasonal wetlands are inundated for a short period during the year. They appear to be restricted in occurrence on Vandenberg AFB, but have not been well-mapped or studied. They are dominated by low-growing persistent brown-headed rush (*Juncus phaeocephalus* var. *phaeocephalus*) and cut-leaved plantain (*Plantago coronopus*). Small areas of this type of wetland occur scattered along the three routes north of the landfill, and in the southern part of the Proposed Action and Alternative 3 route, north of Pine Canyon Road.

3.2.7 Nonnative Grassland

This community is dominated by introduced annual and perennial grasses. Annual grasslands are found on varying slopes, aspects, and substrates, and species composition also is variable. Dominant species include bromes (*Bromus* spp.), wild oats (*Avena* spp.), and fescues (*Vulpia* spp.). At Vandenberg AFB, this community forms the resource base for grazing leases. The perennial exotic species veldt grass (*Ehrharta calycina*) and pampas grass (*Cortaderia jubata*) also often dominate grassland areas on the base, and have invaded and degraded many native scrub communities. Grasslands, both native and non-native, occupy a large areal extent on Vandenberg AFB. In the project area, nonnative grassland is found north of the landfill along the three routes and in the southern part of the Proposed Action and Alternative 3 route, north of Pine Canyon Road.

Non-native grassland (Holland 1986) is widespread in California and is ranked by the CDFG as S4 (no threat rank), and is not considered a sensitive community. However, several special-status species can be found in this habitat. These include plants such as the federally endangered Gaviota tarplant (*Hemizonia increscens* ssp. *villosa*), and animals such as western burrowing owl (*Speotyto cunicularia hypugea*) and grasshopper sparrow (*Ammodramus savannarum*).

3.2.8 Special-Status Plant Species

A list of rare plants that potentially could be present in the vicinity of the project area is provided in Attachment 2. Eight of these species were observed during field surveys in the project area: sand mesa or shagbark manzanita (*Arctostaphylos rudis*, CNPS List 1B); dune larkspur (CNPS List 1B); Blochman's dudleya (CNPS List 1B); black-flowered figwort (CNPS List 1B); La Purisima manzanita (*Arctostaphylos purissima*, CNPS List 1B); San Luis Obispo wallflower (*Erysimum capitatum* ssp. *lompocense*, CNPS List 4); and California spineflower (*Mucronea californica*, CNPS List 4).

The locations of these species in the project area are indicated in Attachment 1, Figure 2. La Purisima manzanita is the dominant species in the Burton Mesa chaparral found in the project area. It also occurs scattered in different locations along the Proposed Action and Alternative 3 route, near the outlet and on the slopes of the tributary leading from the outlet into Lake Canyon, and around the Upper and Lower Lakes of Lake Canyon. San Luis Obispo wallflower was found in coastal scrub on the slopes of the lower part of the tributary leading into Lake Canyon from the Proposed Action and Alternative 3 outlet, and on slopes near the Middle Lake. California spineflower was found on the western slopes of the Upper Lake in Lake Canyon. Round woolly marbles was observed in scattered locations in vernal wetland or mesic areas along all three routes. The plant species on CNPS list 1B are described in more detail below.

Sand Mesa Manzanita (*Arctostaphylos rudis*). This erect shrub in the family Ericaceae grows to 2 meters tall, and resprouts from a basal burl after fire. It has shreddy red-brown or gray bark, elliptic leaves, tomentose twigs, and finely puberulent branchlets. The spheric corolla is white to pink in color, and the species flowers from October to February. It has a restricted distribution and is endemic to the central coast of California from southern San Luis Obispo County to northern Santa Barbara County, occurring in sandy soils mainly on the Burton Mesa, and less extensively on the Nipomo Mesa. On the base, it occurs in Burton Mesa chaparral and in chaparral on Point Sal Ridge, Purisima Hills, San Antonio Terrace, Lompoc Canyon, and scattered in oak woodland and Bishop pine forest. It is less common than La Purisima manzanita. Sand mesa manzanita was observed in Burton Mesa chaparral along the Alternative 1 and 2 routes east of the landfill and on the upper slopes of Oak Canyon. It also is scattered on the slopes of the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon, and around the Upper Lake in Lake Canyon.

Dune Larkspur (*Delphinium parryi* ssp. *blochmaniae*). This perennial plant in the Ranunculaceae has a root less than 10 centimeters (cm) and no basal leaves in the flowering plant. Leaves and lower stems are curled-puberulent. Lower leaves have lobes less than 5 millimeters (mm) wide, and cauline leaves have 5 to 15 lobes. The blue-purple sepals generally are reflexed, with the lateral sepals 16 to 25 mm long, and the spur 11 to 16 mm. The lower petal blades are 7 to 10 mm and paler than the sepals. Dune larkspur has larger flowers than other subspecies in the taxon. It occurs associated with herbs and grasses in coastal chaparral, and in sand in dune vegetation, at elevations below 200 meters. It is found from San Luis Obispo to Ventura counties, and possibly is threatened by road maintenance and competition with weeds. On Vandenberg AFB, this plant has been recorded along Coast Road north of the boathouse, in Lake Canyon, and northwest of the airstrip. Dune larkspur was found on the western slopes of the Upper Lake in Lake Canyon (two small populations with about 30 plants each).

Blochman's Dudleya (*Dudleya blochmaniae* ssp. *blochmaniae*). This small perennial herb in the Crassulaceae has less than 12 succulent oblanceolate leaves in a basal rosette, and the leaf base is less than 1 cm wide. Leaves are vernal and wither in late summer. The underground stem is corm-like and simple, with a spheric to fusiform caudex. The peduncle is more than 4 cm, and the bracts are deltate-lanceolate to ovate. The flower has a musky-sweet odor, with deltate-ovate sepals and spreading petals and follicles. Petals are white, elliptic, and acute, and the keel is often red-lined. Blochman's dudleya is found at elevations less than 450 meters on open rocky slopes, often on serpentine or clay-dominated soils. The range of the species is from San Luis Obispo County to northern Baja California, with about 20 populations recorded in California. The type location is in Santa Barbara County along Point Sal Road near Casmalia Beach; it also occurs on the western part of Burton Mesa. On Vandenberg AFB, this species has been observed in the 35th Street vernal pools, and along the coast from Point Sal south to Lion's Head. Threats to this species are destruction of its habitat, and invasion by exotic species. Blochman's dudleya was found in the southern part of the Proposed Action and Alternative 3 route north of Pine Canyon Road (two populations with a combined total of about 1000 plants).

Black-Flowered Figwort (*Scrophularia atrata*). This perennial herb in the family Scrophulariaceae can grow up to 2 meters tall, and flowers from April to June. Flowers are found in a long, glandular, puberulent inflorescence. It is characterized by an urn-shaped corolla that is colored blackish in the upper half and dark maroon in the lower half. The shape and color of the corolla distinguish it from the more common California figwort (*Scrophularia californica*) with which it intergrades, and whose corollas are more spheric and lighter in color, varying from yellow-green to dark maroon. Black-flowered figwort is found from southern San Luis Obispo County to northern Santa Barbara County, and occurs in coastal scrub, chaparral, and woodlands in calcareous or diatomaceous soils, at elevations less than 500 meters. It is relatively common on the base in coastal scrub, riparian and oak woodlands, and in chaparral. Black-flowered figwort was found along the eastern shore of the Upper Lake (about 500 plants), the western shore of the Lower Lake (about 200 scattered plants), and in Oak Canyon (two small populations with about 10 to 20 plants each).

La Purisima manzanita (*Arctostaphylos purissima*). This perennial shrub in the Ericaceae family can grow to over 4 meters tall. This species has stems that are covered with fine, white, long bristles, and has bright green leaves that are smooth. It is a rare species that typically occurs within sandstone outcrops, sandy soils, and chaparral habitats found at elevations below 1,000 feet. This species only occurs within Santa Barbara County. La Purisima manzanita is the dominant species in the Burton Mesa chaparral found in the project area. It also occurs scattered in different locations along the Proposed Action and Alternative 3 alignment, near the outlet and on the slopes of the tributary leading from the outlet into Lake Canyon, and around the Upper and Lower Lakes of Lake Canyon.

3.3 SPECIAL-STATUS WILDLIFE SPECIES

A list of federally endangered and threatened animal species and other species of concern potentially occurring in the vicinity of the project area is provided in Attachment 3. Species observed during field surveys in or near the project area were: California red-legged frog (FT); southwestern pond turtle (federal species of concern [FS]); and Bell's sage sparrow (FS). The western least bittern (*Ixobrychus exilis hesperis*, FS) and the coast/California horned lizard (*Phrynosoma coronatum frontale*, FS) have been recorded near the project area, but were not observed in the current surveys. Descriptions are given below for each of these species. The locations of those species observed within the project area are indicated in Attachment 1, Figure 2.

California Red-Legged Frog (*Rana aurora draytonii*). This amphibian species occurs in many of the larger permanent streams and ponds on Vandenberg AFB. Adults primarily are terrestrial, but require the presence of nearby water that is deep enough for them to escape from predators. They appear to prefer pools with overhanging vegetation, particularly willows. The species is known to breed from November through March, and eggs are laid among emergent vegetation or willows. It has been recorded in many of the San Antonio Terrace wetlands, as well as in San Antonio Creek, Cañada Honda Creek, and Jalama Creek (Christopher 1996). Two adult California red-legged frogs were observed in a small marsh on the east side of the road at the northeast corner of the Lower Lake in Lake Canyon.

Southwestern Pond Turtle (*Clemmys marmorata pallida*). This species occurs in aquatic habitats such as streams, ponds, and freshwater sloughs, preferring locations with logs, mats of vegetation, or other suitable basking sites. It is a long-lived species, surviving up to 40 years. Mating occurs usually in April or May, with eggs laid in nests up to 400 meters away from water. Hatchlings may move from the nests to aquatic sites the following March to April. On Vandenberg AFB, the southwestern pond turtle has been observed in the Santa Ynez River, San Antonio Creek, Jalama Creek, and numerous ponds (Christopher 1996). In the project area, two sightings of lone male individuals of the southwestern pond turtle were made in each of the three lakes in Lake Canyon.

Bell's Sage Sparrow (*Amphispiza belli belli*). This bird species is partial to open, low chaparral, particularly to previously burned areas with dead snags, which they use for perching and territorial display. Individuals are presumed to be year-round residents. The breeding season for this species extends from late April through early July; however, the sensitive period could begin as early as February, when they show evidence of pair formation and territory establishment (Holmgren and Collins 1999). An individual Bell's sage sparrow was heard singing during the current field surveys, but appeared to be outside the project area, west of Oak Canyon.

Western Least Bittern (*Ixobrychus exilis hesperis*). This small member of the heron family inhabits freshwater marshes, ponds, and lakes with emergent vegetation, including bulrushes and cattails. The western least bittern breeds from March through July, and although it has been observed during the breeding season, is not confirmed to breed at Vandenberg AFB. It has been recorded on the base at Punchbowl Lake, the Lower and Middle Pine Canyon Lakes, and the Waterfowl Management Ponds (Holmgren and Collins 1999).

California Horned Lizard (*Phrynosoma coronatum frontale*). This reptile species occurs in most habitats on Vandenberg AFB, and appears to prefer open areas for basking, and loose substrates for burrowing. Adults are most active in April and May, and juveniles emerge in July and August. The species has been reported near the Middle and Upper Lakes of Lake Canyon (Christopher 1996).

Within the project area, potential habitat exists for the federally endangered southwestern willow flycatcher (*Empidonax traillii extimus*) in the willow woodland of Lake Canyon. Suitable habitat is found in areas that have a mixture of closed and open canopy vegetation, and where standing water is present. This migratory bird species occurs on Vandenberg AFB from May to August, breeding mid-May to mid-July; if present in the project area, it should have been observable during the current field surveys. It was not observed, however, and has been sighted in undisturbed riparian willow woodland only in two locations along the Santa Ynez River within 3 miles of the ocean.

3.4 BIOLOGICAL SURVEY RESULTS

3.4.1 Proposed Action

Mowed annual introduced grasses and ruderal vegetation, including the exotic species iceplant (*Carpobrotus edulis*) and veldt grass (*Ehrharta calycina*), are found at the start of the Proposed Action route along New Mexico Avenue. Scattered native perennial needlegrasses (*Nassella* spp.) also occur. Patches of arroyo willow are found along the northern part of the landfill. As the route continues southeast along Pine Canyon Road, coastal sage scrub species become more prevalent, and grade into chaparral with scattered coast live oaks.

A topographic depression (location of sampling station [SS]-3) exists where the Proposed Action and Alternative 3 routes diverge from the Alternative 1 and 2 routes. This disturbed area near the road has relatively diverse vegetation, with annual grasses, ruderal species, and coastal sage scrub with coyote brush, California sagebrush, and goldenbush (*Isocoma menziesii* var. *menziesii*). In addition, there are three patches each of coast live oak and arroyo willow. The exotic species iceplant also is present in this area. Lower parts of the topographic depression have hedge nettle (*Stachys bullata*), western ragweed (*Ambrosia psilostachya*), and rushes (*Juncus* spp.) in the understory.

Northeast of Pine Canyon Road, the Proposed Action route crosses an area of nonnative grassland with scattered native perennial needlegrasses. The northern part of the Proposed Action route near the outlet has coastal sage scrub vegetation dominated by coyote brush, California sagebrush, western poison oak, California coffeeberry (*Rhamnus californica* ssp. *californica*), and pitcher sage (*Salvia spathacea*); annual grasses are found in the understory. The special-status species La Purisima manzanita is found scattered near the outlet area.

Within the survey area for the Proposed Action route, sign was noted for the mammal species mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), and pocket gopher (*Thomomys bottae*). Along New Mexico Road and Pine Canyon Road, 17 bird species were observed. The most common species were house finch (*Carpodacus mexicanus*), spotted towhee (*Pipilo maculatus*), California towhee (*Pipilo crissalis*), and bushtit (*Psaltriparus minimus*). In the section north of Pine Canyon Road, other common species were wrentit (*Chamaea fasciata*) and western meadowlark (*Sturnella neglecta*). A pair of white-tailed kites (*Elanus caeruleus*) and a great egret (*Casmerodius albus*) were observed hunting in the grassland. Herpetofauna observed on the Proposed Action route included the western fence lizard (*Sceloporus occidentalis*) and Pacific treefrog (*Hyla regilla*).

3.4.2 Alternative 1

The Alternative 1 route along Utah Avenue and Pine Canyon Road would be similar to the Proposed Action route. Observed plant and animal species are the same for this section of Alternative 1 and for the topographic depression where the routes diverge. South of the topographic depression at the northeast corner of the landfill, the Alternative 1 route would run near the fence of the Subtitle D boundary, the

active fill area at the landfill (Figure 1). In this area, activities within the landfill have created a berm which appears to have dammed surface water runoff. Ponding has occurred in this disturbed area, and wetland species are present, including brown-headed rush (*Juncus phaeocephalus* var. *phaeocephalus*), broad-leaved cattail (*Typha latifolia*), and creeping spikerush (*Eleocharis macrostachya*); saplings of arroyo willow (*Salix lasiolepis*) suggest that ponding may have occurred relatively recently. This area is surrounded by coyote brush (*Baccharis pilularis*) and coast live oaks. The invasive exotic species pampas grass (*Cortaderia jubata*) also is present.

Continuing south, the Alternative 1 route would enter an area with relatively dense Burton Mesa chaparral. The special-status species La Purisima manzanita is the dominant species in the chaparral, particularly in the northern part of this section. Sand mesa manzanita is more prevalent in the southern part. Round woolly marbles (*Psilocarphus tenellus* var. *globiferus*)was observed in scattered locations in disturbed mesic areas along the Alternative 1 route.

The southern part of the route has more disturbed chaparral. The area near the outlet has been used in the past as a wastewater disposal area; it is surrounded by a fence, and a sprinkler system is present within the enclosure. Species observed in the enclosure include coyote brush, chamise, black sage (*Salvia mellifera*), and La Purisima manzanita. Vegetation here has been degraded by the invasion of pampas grass and iceplant. Leachate from the wastewater system apparently has damaged some of the native shrubs.

South of the area where the three routes diverge, sign was noted along the Alternative 1 route for the mammals mule deer and coyote. The number of bird species observed was 26. The most common species were Bewick's wren (*Thryomanes bewickii*), wrentit (*Chamaea fasciata*), bushtit (*Psaltriparus minimus*), spotted towhee (*Pipilo erythrophthalmus clementae*), and California towhee (*Pipilo crissalis*). An individual of the special-status species Bell's sage sparrow (*Amphispiza belli belli*, FS) was heard singing within earshot of the outlet of Alternative 1, but appeared to be outside the project area, west of Oak Canyon. Herpetofauna observed on the Alternative 1 route included the southern alligator lizard (*Gerrhonotus multicarinata*), western fence lizard (*Sceloporus occidentalis*), and Pacific treefrog.

3.4.3 Alternative 2

The Alternative 2 route along Utah Avenue and Pine Canyon Road would be similar to the Alternative 1 route. After the divergence of the Proposed Action and Alternative 3 routes, the Alternative 2 route would be the same as Alternative 1 in the area of the depression at the northeast corner of the landfill. Observed plant and animal species are the same for this section of Alternative 2 as for the previously described routes. After the depression, Alternative 2 would continue southward east of Alternative 1.

For the most part, plant and animal species are the same for Alternatives 2 and 1. Alternative 2, however, would bypass the disturbed wet area near the fence of the Subtitle D boundary. The chaparral present along Alternative 2 also is dense, and is less disturbed than that found along Alternative 1. Species composition is similar, but more chamise is present in the chaparral. The outlet for Alternative 2 would occur in the same location as that of Alternative 1.

3.4.4 Alternative 3

The Alternative 3 route would be similar to the Alternative 1 and Alternative 2 routes until the crossing of Pine Canyon Road. Northeast of Pine Canyon Road, the Alternative 3 route crosses an area of nonnative grassland with numerous scattered vernal wetland swales dominated by brown-headed rush (*Juncus phaeocephalus* var. *phaeocephalus*). The special-status species Blochman's dudleya was found in the

southern part of this area, near swales containing the vernal pool plant coyote-thistle (*Eryngium armatum*). Round woolly marbles was observed in scattered locations in vernal wetland or mesic areas on the Alternative 3 route, along and northeast of Pine Canyon Road. Scattered native perennial needlegrasses also occur in the non-native grassland.

3.4.5 Existing Drainages Within the Landfill

Storm water runoff from the cantonment area and the mesa north of the landfill currently is directed through culverts into several unlined drainages within the landfill. The main drainage is a historical natural drainage, and is mapped as an intermittent stream in the soil survey for the region (U.S. Department of Agriculture 1972; U.S. Air Force 1997). The slopes of the drainage have coastal sage scrub, chaparral including the special-status species La Purisima manzanita, and ruderal species. Within the drainage at lower elevations, willow woodland is found, along with two small freshwater marsh areas. Arroyo willow dominates the overstory, and the understory and marshy areas have western poison oak, broad-leaved cattail, western goldenrod (*Euthamia occidentalis*), clustered field sedge (*Carex praegracilis*), and various species of rushes.

In the landfill area, sign was noted for the mammal species mule deer and coyote. The number of bird species observed was 23. The most common birds were European starling (*Sturnus vulgaris*), song sparrow (*Melospiza melodia*), wrentit, spotted towhee, and Wilson's warbler (*Wilsonia pusilla*); an individual yellow warbler (*Dendroica petechia*) was heard singing. Pools of water in the landfill drainage had larvae of Pacific treefrog; no other herpetofauna were observed.

3.4.6 Lake Canyon

The outlet for the Proposed Action and Alternative 3 occurs in upland vegetation above a draw leading to a tributary to Lake Canyon. The draw has scattered vegetation, including coyote brush, California sagebrush, toyon (*Heteromeles arbutifolia*), coast live oak, and bracken fern (*Pteridium aquilinum* var. *pubescens*). A marsh with brown-headed rush, and basket rush (*Juncus textilis*) occurs upstream of the main tributary drainage leading to Lake Canyon. This drainage is occupied with willow woodland in the upper part, and coast live oak woodland in the lower part near the lakes. The oak woodland has mature trees, and also contains several large black cottonwoods (*Populus balsamifera* ssp. *trichocarpa*). The understory is dominated by western poison oak and California blackberry. The slopes of the tributary drainage above the trees are covered with diverse chaparral and coastal sage scrub species, including chamise, black sage, spiny redberry (*Rhamnus crocea*), California monkey-flower (*Mimulus aurantiacus*), chaparral mallow (*Malacothamnus fasciculatus*), golden yarrow (*Eriophyllum confertiflorum* var. *confertiflorum*), California broom (*Lotus scoparius* var. *scoparius*), and California-aster (*Lessingia filaginifolia* var. *filaginifolia*).

The three lakes in Lake Canyon have open water with freshwater marsh vegetation at the edges dominated by California bulrush (*Scirpus californicus*), tule (*Scirpus acutus* var. *occidentalis*), and broad-leaved cattail. Mesic areas along the shorelines have willow woodland dominated by arroyo willow. Associated species in the willow woodland included sedges (*Carex barbarae*, *C. harfordii*), hoary nettle (*Urtica dioica* ssp. *holosericea*), basket rush, western poison oak, California blackberry, western goldenrod (*Euthamia occidentalis*), hedge nettle, mugwort (*Artemisia douglasiana*), gooseberry (*Ribes divaricatum*), California rose (*Rosa californica*), wax myrtle (*Myrica californica*), branching phacelia (*Phacelia ramosissima* var. *montereyensis*), and nightshade (*Solanum xanti*).

The special-status species sand mesa manzanita was observed scattered on the slopes of the tributary leading from the Proposed Action and Alternative 3 outlet into Lake Canyon, and around the Upper Lake

in Lake Canyon. Dune larkspur was found on the western slopes of the Upper Lake in Lake Canyon (two small populations with about 30 plants each). Black-flowered figwort was found along the eastern shore of the Upper Lake (about 500 plants) and the western shore of the Lower Lake (about 200 scattered plants). La Purisima manzanita occurs scattered in different locations on the slopes of the tributary leading from the outlet of the Proposed Action into Lake Canyon, and around the Upper and Lower Lakes of Lake Canyon. San Luis Obispo wallflower was found in coastal scrub on the slopes of the lower part of the tributary leading into Lake Canyon from the Proposed Action and Alternative 3 outlet and on slopes near the Middle Lake. California spineflower was found on the western slopes of the Upper Lake in Lake Canyon.

In the Lake Canyon survey area, sign was noted for the mammal species mule deer and coyote. The number of bird species recorded was relatively high, with 29 species noted at the Upper Lake, 41 at the Middle Lake, and 45 at the Lower Lake. Birds common at all three lakes included Bewick's wren (*Thryomanes bewickii*), marsh wren (*Cistothorus palustris*), Wilson's warbler (*Wilsonia pusilla*), and song sparrow (*Melospiza melodia*). Bushtit, wrentit, orange-crowned warbler (*Vermivora celata*), and spotted towhee were more abundant at the Upper and Middle Lakes, compared to the Lower Lake. The common yellowthroat (*Geothlypis trichas*) was more abundant at the Middle and Lower Lakes, compared to the Upper Lake. The American goldfinch (*Carduelis tristis*) was common at the Middle Lake, but was not recorded at the other two lakes. The house finch (*Carpodacus mexicanus*) was present at the Lower Lake, but not at the other two lakes. Waterfowl observations included ruddy duck (*Oxyura jamaicensis*) at all three lakes, and mallard (*Anas platyrhynchos*) at the Upper and Lower Lakes. Other species of note included yellow warbler (*Dendroica petechia*), recorded at the Upper and Lower Lakes, and yellow-breasted chat (*Icteria virens*) at the Middle and Lower Lakes. Additional noteworthy observations included Cassin's vireo (*Vireo cassinii*), black-throated gray warbler (*Dendroica nigrescens*), and Townsend's warbler (*Dendroica townsendi*) at the Middle Lake, and the white-tailed kite (*Elanus caeruleus*), spotted sandpiper (*Actitis macularia*), great blue heron (*Ardea herodias*), and black-crowned night heron (*Nycticorax nycticorax*) at the Lower Lake. A hairy woodpecker (*Picoides villosus*) nest cavity with vocal fledglings and a house finch (*Carpodacus mexicanus*) nest also were seen at the Lower Lake.

Two adults of the federally threatened species California red-legged frog were seen in a small marsh on the east side of the road at the northeast corner of the Lower Lake. The observations were made from within 2 meters, and the frogs positively identified by their dorsolateral folds and the lack of a clearly defined tympanum. Two sightings of lone male individuals of the special-status species southwestern pond turtle were made in each of the three lakes in Lake Canyon. They were seen basking on mats of bulrushes and tule (*Scirpus* spp.). Numerous observations of western fence lizard, Pacific treefrog, and bullfrog (*Rana catesbeiana*) also were made at all three lakes.

3.4.7 Oak Canyon

The outlet for Alternatives 1 and 2 would be located in an upland area about 200 to 300 feet upslope of a small tributary canyon to Oak Canyon. The tributary canyon has steep, rocky slopes, and the drainage is occupied by oak woodland, with chaparral species present on the upper slopes. Coast live oak dominates the overstory, and species present in the understory include western poison oak, hedge nettle (*Stachys bullata*), and California blackberry. These species also are present in the main drainage of Oak Canyon, along with scattered arroyo willow. No ponds or freshwater marshes were observed in Oak Canyon.

The special-status species sand mesa manzanita was observed in Burton Mesa chaparral on the upper slopes of Oak Canyon, with La Purisima manzanita. Black-flowered figwort was found in the tributary canyon and in the main drainage of Oak Canyon (two small populations with about 10 to 20 plants each).

Twenty-four bird species were observed in Oak Canyon. The most common birds were bushtit, wrentit, Bewick's wren, orange-crowned warbler (*Vermivora celata*), Wilson's warbler, and spotted towhee. A northern rough-winged swallow (*Stelgidopteryx serripennis*) was seen on a nest 6 feet up the canyon bank. Herpetofauna noted included a dead bullfrog; the eggs and tadpoles of Pacific treefrog also were seen.

3.5 WATERS OF THE UNITED STATES AND WETLANDS

Wetland surveys were carried out at 17 sampling stations in the project area. The location of the sampling stations is presented in Attachment 1, Figure 3. Data forms for the wetland surveys are presented in Attachment 6. Normal circumstances exist at all stations, and no problem areas were encountered. Atypical situations were observed at stations SS-3, SS-10, and SS-11.

3.5.1 Proposed Action

Along the Proposed Action route, wetland surveys were carried out at fourteen sampling stations, SS-3 through SS-10 and SS-12 through SS-17. Station SS-3 was located in the topographic depression along Pine Canyon Road, and SS-4 through SS-6 and SS-12 through SS-17 were established in the area of vernal swales north of Pine Canyon Road. Station SS-7 was located in the upstream part of the tributary leading from the Proposed Action outlet to Lake Canyon, SS-8 was established in a patch of willow woodland in the northeastern part of the landfill, and SS-9 and SS-10 in vernal swales near Pine Canyon Road in the same area.

Atypical situations were observed at two stations, SS-3 and SS-10. Positive indicators for hydrophytic vegetation were found at all stations except SS-3, where a mixture of plant communities and species is present, and at SS-13 and SS-15, which were placed in upland areas to investigate a potential realignment of the Proposed Action. Wetland hydrology and hydric soils indicators were noted during the surveys at all stations, except SS-13 and SS-15. The area where SS-3 was located is in a historical natural drainage tributary to Oak Canyon. Drainage patterns have been modified here by flow being directed through culverts, and fill has occurred downstream of the station. Although this topographic depression has been subject to hydrology modifications and soil disturbance, the station was determined to be in USACE waters of the United States because of its location in a tributary to Oak Canyon. Stations SS-4 through SS-6, and SS-9, SS-10, SS-12, SS-14, SS-16, and SS-17, were determined to occur in vernal wetlands, and SS-7 and SS-8 were in willow woodland wetlands. Station SS-10 had field indicators for all three wetland parameters, but may not qualify as a wetland because the wetland has been created artificially and is not located within or associated with Waters of the United States or navigable waters. Surface runoff from the mesa north of Pine Canyon Road has been obstructed by the road and directed through a culvert; the wetland likely has been created by outflow from the culvert. While SS-10 may not qualify as a jurisdictional wetland, it may qualify as an "isolated wetland" under Executive Order (EO) 11990 as the road that creates this wetland is a permanent feature that has become "naturalized". This road stabilizes the hydrologic character of this area.

3.5.2 Alternative 1

Along the Alternative 1 route, wetland surveys were carried out at five sampling stations, SS-3 and SS-8 through SS-11. SS-3 is waters of the United States. SS-8, SS-9, and SS-10 are wetlands; again, SS-8 was established in a patch of willow woodland in the northeastern part of the landfill, and SS-9 and SS-10 in vernal swales near Pine Canyon Road in the same area.

Atypical situations were observed at two stations, SS-3 and SS-10. Positive indicators for hydrophytic vegetation were found at all stations except SS-3, where a mixture of plant communities and species is present. Wetland hydrology and hydric soils indicators were noted during the surveys at all stations.

In addition to stations SS-3 and SS-10, an atypical situation also was observed at SS-11. This station was located in a ponded area at the northeast corner of the landfill where the Alternative 1 route would run near the fence of the Subtitle D boundary. SS-11 had positive indicators of hydrophytic vegetation, wetland hydrology, and hydric soils, and therefore was determined to be an atypical wetland. It is atypical since the inundated area present here likely has been created artificially by surface runoff being dammed by a berm within the landfill. With implementation of the project, it is likely that the man-made hydrologic condition at this location will cease to exist due to diversion of storm water flows from the landfill. Therefore, it would not qualify as a jurisdictional wetland or "isolated wetland" protected under Section 404 of the Clean Water Act or EO 11990.

3.5.3 Alternative 2

The Alternative 2 route along Utah Avenue and Pine Canyon Road would be similar to the Alternative 1 route. After the divergence of the Proposed Action and Alternative 3 routes, the Alternative 2 route would be the same as Alternative 1 in the area of the depression at the northeast corner of the landfill. After the depression, Alternative 2 would continue southward east of Alternative 1; no potential wetland areas were noted in this section and therefore, no sampling stations were established.

Wetland sampling stations and wetland resources are the same for Alternative 2 as for Alternative 1. Stations located on Alternative 2, SS-3 is in USACE waters of the United States, and SS-8 through SS-10 are in wetlands.

3.5.4 Alternative 3

Since Alternative 3 follows a similar route as the Proposed Action, waters of the United States and wetlands found within this route are identical to those found along the route of the Proposed Action.

3.5.5 Existing Drainages Within the Landfill

Storm water runoff from the cantonment area and the mesa north of the landfill currently is directed through culverts into several unlined drainages within the landfill. The main drainage is a historical natural drainage, and is mapped as an intermittent stream in the soil survey for the region (U.S. Department of Agriculture 1972; U.S. Air Force 1997). Wetland resources in the landfill drainage were surveyed and delineated in 1997 (U.S. Air Force 1997), therefore, the landfill area was not resurveyed for the current project. To provide summary information, the wetland resources delineated in the 1997 report are presented in Attachment 1, Figure 3. Details regarding sampling stations and observed wetland parameters are provided in that report.

3.5.6 Lake Canyon

For this project, wetland surveys were not required at the three Lakes in Lake Canyon. All three lakes are man-made impoundments, but they occur within the natural drainage of Lake Canyon, a tributary leading into the Santa Ynez River. This tributary is mapped as a blue-line stream on the USGS (United States Geological Survey) topographic map. Blue-line streams and their tributaries generally are considered to be USACE jurisdictional waters of the United States. In addition, impoundments of waters of the United

States, otherwise defined as waters, are themselves also considered jurisdictional waters. Therefore, all three lakes in Lake Canyon are jurisdictional resources.

3.5.7 Oak Canyon

Wetland surveys in Oak Canyon were carried out at two sampling stations, SS-1 and SS-2, located in riparian coast live oak woodland. SS-1 was established in the tributary to Oak Canyon found below the outlet of the Alternative 1 and 2 routes, and SS-2 was located just below the confluence of this tributary and the drainage leading south of the landfill. The hydrophytic vegetation criterion was not met at the two sampling stations. Wetland hydrology was indicated at both stations by the presence of a watercourse with flowing water. Inundation was observed at SS-1, and free water in the soil pit at SS-2. Hydric soils could not be confirmed at either station. The soil was too rocky to dig at SS-1, and soil colors could not be determined for the variable riverwash sand at SS-2. Both stations were determined to qualify as USACE jurisdictional waters of the United States.

4.0 PROJECT IMPACTS

Federal agencies are required by Section 7 of the ESA to assess the effect of any project on federally listed threatened and endangered species. Under Section 7, formal consultation with the USFWS is required for federal projects if such actions could directly or indirectly affect listed or proposed species. It also is Air Force policy to follow management goals and objectives specified in Integrated Natural Resources Management Plans, and to consider special-status species, sensitive communities, and habitats recognized by state and local agencies when evaluating impacts of a project. Impacts to biological resources are considered significant if special-status species (endangered, threatened, rare, or candidate) or their habitats, as designated by federal, state, or local agencies, would be affected directly or indirectly by project-related activities. In addition, impacts to biological resources are considered significant if substantial loss, reduction, degradation, disturbance, or fragmentation would occur in native species habitats or in their populations. These impacts could be short- or long-term impacts; for example, short-term or temporary impacts may occur during project implementation, and long-term impacts may result from the loss of vegetation and thereby loss of the capacity of habitats to support wildlife populations.

Impacts to jurisdictional waters of the United States and wetlands are considered significant if the project would result in net loss of wetland area or habitat value, either through direct or indirect impacts to wetland vegetation, loss of habitat for wildlife, degradation of water quality, or alterations in hydrological functions. The USACE and the U.S. Environmental Protection Agency (EPA) have been given jurisdiction to implement Section 404 of the CWA, which regulates activities that would impact waters of the United States and jurisdictional wetlands. All projects that would involve discharge or fill into jurisdictional waters or wetlands require a Section 404 permit from the USACE. Such projects also require certification under Section 401 of the CWA by the California Regional Water Quality Control Board (CRWQCB). In addition, as specified in AFI 32-7064, any action affecting a wetland, or occurring within a floodplain, must be preceded by the preparation and signing of a Finding of No Practicable Alternative (FONPA).

4.1 PROPOSED ACTION

4.1.1 Biological Resources

No impacts to listed threatened or endangered plant species would occur from implementing the Proposed Action within the direct construction zone. The most important botanical resources identified along and near the Proposed Action route are the special-status species Blochman's dudleya, and La Purisima

manzanita, as well as seasonal freshwater marshes. Blochman's dudleya is known to occur on the base from only two other locations; the other two species, although more widespread on the base, are relatively rare. Vernal marshes are ranked sensitive (very threatened) by the CDFG. To prevent impacts to special-status plant species and vernal marshes, the Proposed Action storm drain alignment will be constructed to avoid the environmentally sensitive areas were they occur.

The tributary below the Proposed Action outlet that leads to Lake Canyon, and the three Lake Canyon lakes, could be affected indirectly by increased storm water runoff resulting from implementing the Proposed Action. However, replacement of the outlet structure for Lower Lake and continued maintenance of the intakes and outlets of the other Lake Canyon Lakes would prevent flooding of Lake Canyon due to excess runoff from the landfill. Therefore, it is unlikely that upland special-status plant species found along the slopes of the tributary and Upper Lake would be affected by increased runoff. In addition, it is unlikely that the sensitive freshwater marsh and willow woodland (very threatened and threatened, respectively) would be affected by increased runoff from the landfill.

No impacts to listed threatened and endangered wildlife species, or to any species of concern, would occur due to implementation of the Proposed Action within the direct construction zone, due to the fact that special-status species are not expected to occur within or near the direct construction zone. The closest known locations of special-status species to the direct construction zone would be in Lower Lake near the replacement of the outlet structure. Observations of the southwestern pond turtle and California red-legged frog have been made in Lower Lake, however, these observations were at the other side of the lake from the outlet structure. Potential habitat for the southwestern willow flycatcher exists at the Lower Lake outlet, however, the species has not been observed there during past surveys. Biological monitoring during construction will also ensure that special-status species are not impacted during construction. In addition to biological monitoring during construction, pre-construction surveys for the California red-legged frog and southwestern willow flycatcher in the immediate area of the Lower Lake outlet will be conducted to ensure that they would not be impacted by construction of the Lower Lake outlet. Finally, construction and maintenance of the Lower Lake outlet will be conducted outside the nesting season of the southwestern willow flycatcher between 15 May and 30 August.

Since there will be relatively extensive trenching and excavation, and removal of vegetation, there would, however, be adverse impacts to other wildlife species not considered special-status and their habitats, particularly to birds protected under the Migratory Bird Treaty Act (MBTA). There is the potential for adverse impacts to bird species, both directly and indirectly due to disturbance-related nest abandonment, if project implementation takes place during their nesting season (15 April to 30 August). However, such potential impacts, although adverse, would not be significant because they would be limited and localized. Some other wildlife, such as small mammals and non-listed herpetofauna (e.g., Pacific treefrog), may be impacted directly by excavation. These impacts also would be localized and temporary, and most wildlife species that might occur within the disturbance zone likely would be able to move to suitable habitats away from the impact area. In addition, the area of impact would be revegetated to restore wildlife habitat.

As stated above, the tributary below the Proposed Action outlet that leads to Lake Canyon, and the three Lake Canyon lakes, would be affected indirectly by increased storm water runoff. Changes in hydrology, such as increases in water levels or waterflow, and sedimentation or turbidity, potentially could have indirect adverse impacts on the habitat quality for the California red-legged frog, observed at the Lower Lake. However, based upon the Water Resources impact analysis for this project, surface water quality and water levels would not be affected adversely by the Proposed Action. Additional runoff should not add a large sediment load or other contaminants to Lake Canyon. In addition, replacement of the outlet structure for Lower Lake and continued maintenance of the intakes and outlets of the other Lake Canyon

Lakes would prevent flooding of Lake Canyon due to excess runoff from the landfill. Therefore, impacts to the California red-legged frog and its habitat would not be considered significant. In conclusion, implementation of appropriate best management practices, pre-construction surveys, and biological monitoring during construction would reduce potential adverse impacts to vegetation and wildlife under the Proposed Action to less than significant levels.

4.1.2 Waters of the United States and Wetlands

Since the Proposed Action would avoid areas where vernal pools are located, impacts to vernal wetland swales would not occur. However, there would be fill in jurisdictional waters of the United States in the topographic depression where sampling station SS-3 was located. Also wetland areas (represented by sampling stations SS-8, SS-9, and SS-10) along the route of the Proposed Action likely would be impacted directly by construction. Due to the topography and hydrology in and near the landfill, construction of the storm drain through the topographic depression and impacts to this area are unavoidable; therefore, coordination with the USACE through the Section 404 permitting process will be required. Similarly, impacts to wetlands protected under Executive Order 11990 near sampling stations SS-8, SS-9, and SS-10 would also be unavoidable due to the topography and hydrology of the landfill. Because jurisdictional waters of the United States and wetlands will be revegetated after construction, less than significant impacts to these resources are anticipated. Any conditions of the Section 404 permit will also be implemented. Since wetlands would be impacted by construction of the Proposed Action, a Finding of No Practicable Alternative (FONPA) has been prepared to document that all practical measures are being taken to minimize destruction or modification of these resources.

Implementation of the Proposed Action would involve diverting storm water runoff from one drainage basin (the landfill and Oak Canyon) to another (Lake Canyon). Water flow would be increased in Lake Canyon, and peak 100-year flow rates are estimated to increase by as much as 30 to 70 percent. Conversely, water flow would be reduced in Oak Canyon. This diversion would be considered a significant change to conditions in these drainage areas, which comprise jurisdictional waters and wetland resources. Initial examination of flow rates and the capacities of the Lake Canyon lakes suggest that the Lower Lake appears to have deficient capacity to handle peak 100-year flow rates. Replacement of the outlet structure for Lower Lake and continued maintenance of the intakes and outlets of the other Lake Canyon Lakes, however, would prevent flooding of Lake Canyon due to excess runoff from the landfill. Therefore, impacts to these jurisdictional waters and wetland resources are not anticipated to be significant. Since replacement of the outlet structure for Lower Lake would be conducted from the existing road and the new culvert would be placed on top of the existing culvert, and routine maintenance of intakes and outlets of the other lakes is permissible under USACE regulations, an individual Section 404 permit for these activities would not be required.

4.2 ALTERNATIVE 1

4.2.1 Biological Resources

No impacts to listed threatened or endangered plant species would occur from implementation of Alternative 1 within the direct construction zone. However, impacts would occur to certain special-status (threatened) plant species. The most important botanical resource identified along the Alternative 1 route is the plant community Burton Mesa chaparral, designated as sensitive (threatened) by the CDFG. Two dominant species in this community are special-status species: sand mesa or shagbark manzanita and La Purisima manzanita. Impacts to Burton Mesa chaparral and its constituent species, including the manzanitas, and consequent habitat loss or degradation as a result of implementation of Alternative 1,

would be unavoidable and considered significant without mitigation. However, the proposed storm drain alignment for Alternative 1 would be modified to avoid sensitive plant species.

No impacts to listed threatened and endangered wildlife species, or to any species of concern, would occur due to implementation of Alternative 1 within the direct construction zone. Since there will be relatively extensive trenching and excavation, and removal of vegetation, there would be adverse impacts to non-listed wildlife species and habitats, particularly to birds protected under the Migratory Bird Treaty Act (MBTA). There is the potential for adverse impacts to these bird species, both directly and indirectly due to disturbance-related nest abandonment, if project implementation takes place during their nesting season. However, such impacts, although adverse, would not be significant, because they would be limited and localized. The impacts potentially could be most significant for the special-status species Bell's sage sparrow, recorded in the vicinity of Oak Canyon, but this species was not recorded in the impact area. Furthermore, the Burton Mesa chaparral found here is not ideal habitat because it is relatively dense and has not been burned recently. Some other wildlife, such as small mammals and non-listed herpetofauna, may be impacted directly by excavation. These impacts also would be localized and temporary, and most wildlife species that might occur within the disturbance zone likely would be able to move to suitable habitats away from the impact area.

In addition, implementation of appropriate best management practices and biological monitoring during construction would reduce potential adverse impacts to wildlife under the Alternative 1 to less than significant levels.

4.2.2 Waters of the United States and Wetlands

There would be fill in jurisdictional waters of the United States in the topographic depression where sampling station SS-3 was located. Also wetland areas (represented by sampling stations SS-8, SS-9, and SS-10) along Alternative 1 likely would be impacted directly by construction. Due to the topography and hydrology in and near the landfill, construction of the storm drain through the topographic depression and impacts to this area are unavoidable; therefore, coordination with the USACE through the Section 404 permitting process will be required. Similarly, impacts to wetlands protected under Executive Order 11990 near SS-8, SS-9, and SS-10 would also be unavoidable due to the topography and hydrology of the landfill. Because jurisdictional waters of the United States and wetlands will be revegetated after construction, less than significant impacts to these resources are anticipated. Any conditions of the Section 404 permit will also be implemented. Since wetlands would be impacted by construction of the Proposed Action, a Finding of No Practicable Alternative (FONPA) has been prepared to document that all practical measures are being taken to minimize destruction or modification of these resources.

Under Alternative 1, surface water would be diverted around the landfill and into the floodplain within Oak Canyon. The outlet area was formerly used as a spray discharge field for groundwater pumped from the groundwater extraction system. Therefore, additional surface drainage to this area would not be expected to cause flooding or erosion in the discharge area. Additionally, in contrast to the Proposed Action, no impacts would occur to Lake Canyon.

4.3 ALTERNATIVE 2

4.3.1 Biological Resources

Impacts to biological resources under Alternative 2 would be the same as for Alternative 1. The same plant communities, species, and wildlife would be affected.

4.3.2 Waters of the United States and Wetlands

Impacts to jurisdictional waters of the United States and wetlands under Alternative 2 would be identical to those for Alternative 1. Therefore, impacts would be less than significant.

4.4 ALTERNATIVE 3

4.4.1 Biological Resources

Since Alternative 3 follows a similar route as the Proposed Action, impacts to biological resources generated by Alternative 3 would be similar to those generated by the Proposed Action. Both alternatives avoid direct impacts to the vernal pools and special-status species located north of Pine Canyon Road. However, since Alternative 3 would bore underneath the vernal pools, removal of vegetation in this area would be less than the removal that would be required for the Proposed Action, even though nonnative grassland is the dominant habitat under the Proposed Action. Therefore, Alternative 3 would generate fewer impacts to wildlife species and habitats in this area, including birds protected under the MBTA. Any impacts on wildlife species and habitats would be temporary, occurring only during construction, and would be less than significant. Biological monitoring and revegetation would occur as described for the Proposed Action, although Alternative 3 would require less revegetation, since less native vegetation would be removed. Since the outfall for Alternative 3 would be identical to the outfall used for the Proposed Action, impacts to Lake Canyon, the three canyon lakes, and the California red-legged frog would be identical to those described for the Proposed Action. Under Alternative 3, implementation of best management practices would occur under as described for the Proposed Action.

4.4.2 Waters of the United States and Wetlands

Alternative 3 would bore under vernal pools located northeast of Pine Canyon Road. Therefore, no impacts to vernal pools located in this area would be generated by Alternative 3. However, as described for the Proposed Action, fill in jurisdictional waters of the United States in the topographic depression where sampling station SS-3 is located and wetlands where sampling stations SS-8, SS-9, and SS-10 are located would occur under Alternative 3, thus generating impacts to jurisdictional waters of the United States and wetlands. Impacts generated by Alternative 3 on storm water runoff, water flow rates, and the capacities of the Lake Canyon lakes would be identical to those generated by the Proposed Action.

4.5 PROJECT IMPACTS COMMON TO THE PROPOSED ACTION AND ALTERNATIVES

Under the Proposed Action and Alternatives, storm water from the base that currently is routed through the landfill would be diverted. This diversion would result in the permanent loss of the source of water that currently supports willow woodland habitat, small marshes, and pools in the northern part of the landfill. No listed threatened or endangered or other special-status plant and animal species were found in this area, therefore, no impacts to these species are anticipated from project implementation. There would be adverse impacts to the marsh and woodland habitats, both of which are ranked by the CDFG as sensitive communities (very threatened and threatened, respectively). The marsh likely would dry up and revert to upland ruderal or scrub vegetation. The willows may persist for a longer period, but the understory would change. Habitat values therefore would change in this area. These impacts are not likely to be significant because the affected habitats are small in extent, species diversity is relatively low compared to other parts of the project area, and no special-status species occur.

Under the Proposed Action and Alternatives, the topographic depression at the northeast corner of the landfill just south of Pine Canyon Avenue also would be affected similarly from project implementation. No listed threatened or endangered or other special-status plant and animal species were found in this area, therefore, no impacts to these species are anticipated from project implementation. Small patches of arroyo willow and coast live oak are present in this depression and would be lost from filling the area. However, the affected habitats are small in extent, no special-status species occur, and the area previously has been disturbed and is invaded by introduced species, including iceplant.

Introducing fill into the topographic depression, where USACE jurisdictional waters of the United States are present, would constitute jurisdictional impacts, and would require coordination with the USACE. In conjunction with other aspects of the project, Section 404 permitting would be required.

4.6 NO-ACTION ALTERNATIVE

4.6.1 Biological Resources

Under the No-Action Alternative, no impacts would occur to biological resources directly from project implementation. Potential risk to ecological receptors due to exposure to contaminants in the soil and groundwater from the landfill are currently under investigation during preparation of remedial investigations for the nearby IRP sites.

4.6.2 Waters of the United States and Wetlands

Under the No-Action Alternative, no impacts would occur to jurisdictional wetland resources directly from project implementation. The problem of leachate generation at the landfill and its disposal would continue.

4.7 MITIGATION AND RECOMMENDATIONS

Since no significant impacts are anticipated to occur to listed or proposed listed plant and bird species, no species-specific mitigation measures are required for these species.

If the Proposed Action or Alternative 3 is implemented, routine maintenance of the outlet structures of the lakes in Lake Canyon will be conducted, including clearing of clogged vegetation from the intake and outlet areas. In addition, the outlet structure at the Lower Lake will be replaced. Such maintenance would eliminate inundation of shoreline habitats and minimize potential impacts to special-status species, including California red-legged frog and the special-status plant black-flowered figwort.

Implementation of either Alternative 1 or Alternative 2 would cause adverse and significant direct impacts to the sensitive community Burton Mesa chaparral and its constituent special-status plant species, sand mesa or shagbark manzanita and La Purisima manzanita. To reduce these impacts and the fragmentation of chaparral habitat, the routes would be modified, to the maximum extent possible, to follow the fence of the Subtitle D boundary in the northern part, and areas that previously have been disturbed or cleared in the southern part (Attachment 1, Figure 4). This route modification would not avoid all impacts to chaparral or reduce them to a level of insignificance, but would reduce the extent of habitat impacted and the scope of future required restoration (see below).

Removal of native vegetation during project implementation will be minimized to the greatest extent possible. The limits of the disturbance corridor will be clearly marked in the field and enforced to prevent

further expansion of disturbance into sensitive biological and wetland resources. Areas cleared of native vegetation will be revegetated in all possible locations.

Pre-construction surveys and biological monitoring during project implementation will ensure that impacts to sensitive biological and wetland resources are minimized. During and after project completion, the project area will be monitored periodically to assess the effects of invasion, if any, of exotic species into native habitats. If exotic species are observed, appropriate measures will be planned and implemented for controlling their spread.

5.0 LIST OF PREPARERS

Gale, Nathan, Scientist/Geographer, FL*x*
M.A., 1980, Geography, University of California, Santa Barbara
Ph.D., 1985, Geography, University of California, Santa Barbara
PWS, Certified Professional Wetland Scientist #1216, Society of Wetland Scientists
Years of Experience: 20

Parikh, Anuja, Ecologist, FL*x*
B.S., 1979, Zoology and Geology, University of Bombay, India
M.S., 1981, Geography, University of Bombay, India
Ph.D., 1989, Plant Geography, University of California, Santa Barbara
PWS, Certified Professional Wetland Scientist #841, Society of Wetland Scientists
Years of Experience: 16

Collie, Stephen, Vertebrate Biologist, University of California, Santa Barbara
B.S., 1999, Biological Sciences, University of California, Santa Barbara
Years of Experience: 4

Gallo, John, Vertebrate Biologist, University of California, Santa Barbara
B.A., 1995, Environmental Studies, University of California, Santa Barbara
B.S., 1995, Biological Sciences, University of California, Santa Barbara
Years of Experience: 5

Wilson, Michelle, Environmental Scientist, Tetra Tech, Inc.
B.A., 1993, Environmental Science (concentration in Biology), University of California, Berkeley
Minor: Resource Management
Years of Experience: 11

6.0 PERSONS AND AGENCIES CONTACTED

Gillespie, Chris
2000 Botanist, Vandenberg AFB, 30 CES/CEVPN, Vandenberg AFB, California.

Read, Nancy
2000 Wildlife Biologist, Vandenberg AFB, 30 CES/CEVPN, Vandenberg AFB, California.

7.0 REFERENCES

American Ornithologists' Union

1983 *Check-list of North American Birds.* 6th edition. American Ornithologists' Union, Washington D.C.

Christopher, S.V.

1996 *Reptiles and Amphibians of Vandenberg Air Force Base, Santa Barbara County, California, 1995.* Report No. 4, Museum of Systematics and Ecology, University of California, Santa Barbara, in cooperation with National Biological Service. San Simeon, CA.

Collins, J.T.

1990 *Standard Common and Current Scientific Names for North American Amphibians and Reptiles*, 3rd Edition. Herpetological Circular No. 19. Society for the Study of Amphibians and Reptiles.

Environmental Laboratory

1987 *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1. United States Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Hickman, J.C. (Ed.)

1993 *The Jepson Manual, Higher Plants of California.* University of California Press, Berkeley, California.

Holland, R.F.

1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. Unpublished Report. State of California, The Resources Agency, Department of Fish and Game, Natural Heritage Division, Sacramento, California.

Holmgren, M.A. and P.W. Collins (Eds.)

1999 *Distribution and Habitat Associations of Six Bird Species of Special Concern at Vandenberg Air Force Base, Santa Barbara County, California.* Environmental Report No. 7, Museum of Systematics and Ecology, University of California, Santa Barbara, and Monographs No. 1, Studies in Biodiversity No. 1, Santa Barbara Museum of Natural History. Santa Barbara, California.

Jameson, E.W., and H.J. Peeters

1988 *California Mammals.* University of California Press, Berkeley, California.

Jones, J.K., Jr., D.C. Carter, and H.H. Genoways

1986 *Revised Checklist of North American Mammals North of Mexico, 1986.* Occ. Papers No. 107:1-22, The Museum, Texas Tech University.

Munsell Color

1990 Munsell Soil Color Charts. Macbeth Division of Kollmorgen Instruments Corporation, Baltimore, Maryland.

Reed, P.B., Jr.

1988 *National List of Plant Species That Occur in Wetlands: California (Region 0).* Biological Report 88(26.10). United States Fish and Wildlife Service, Washington, D.C.

Skinner, M.W., and B.M. Pavlik
1994 *Inventory of Rare and Endangered Vascular Plants of California.* Fifth Edition. California Native Plant Society, Sacramento, California.

Stebbins, R.C.
1985 *A Field Guide to Western Reptiles and Amphibians.* Houghton Mifflin Company, Boston, Massachusetts.

U.S. Air Force
1996 *Integrated Natural Resources Management Plan.* Prepared by Tetra Tech, Inc. for 30 CES/CEV, Vandenberg AFB, California.

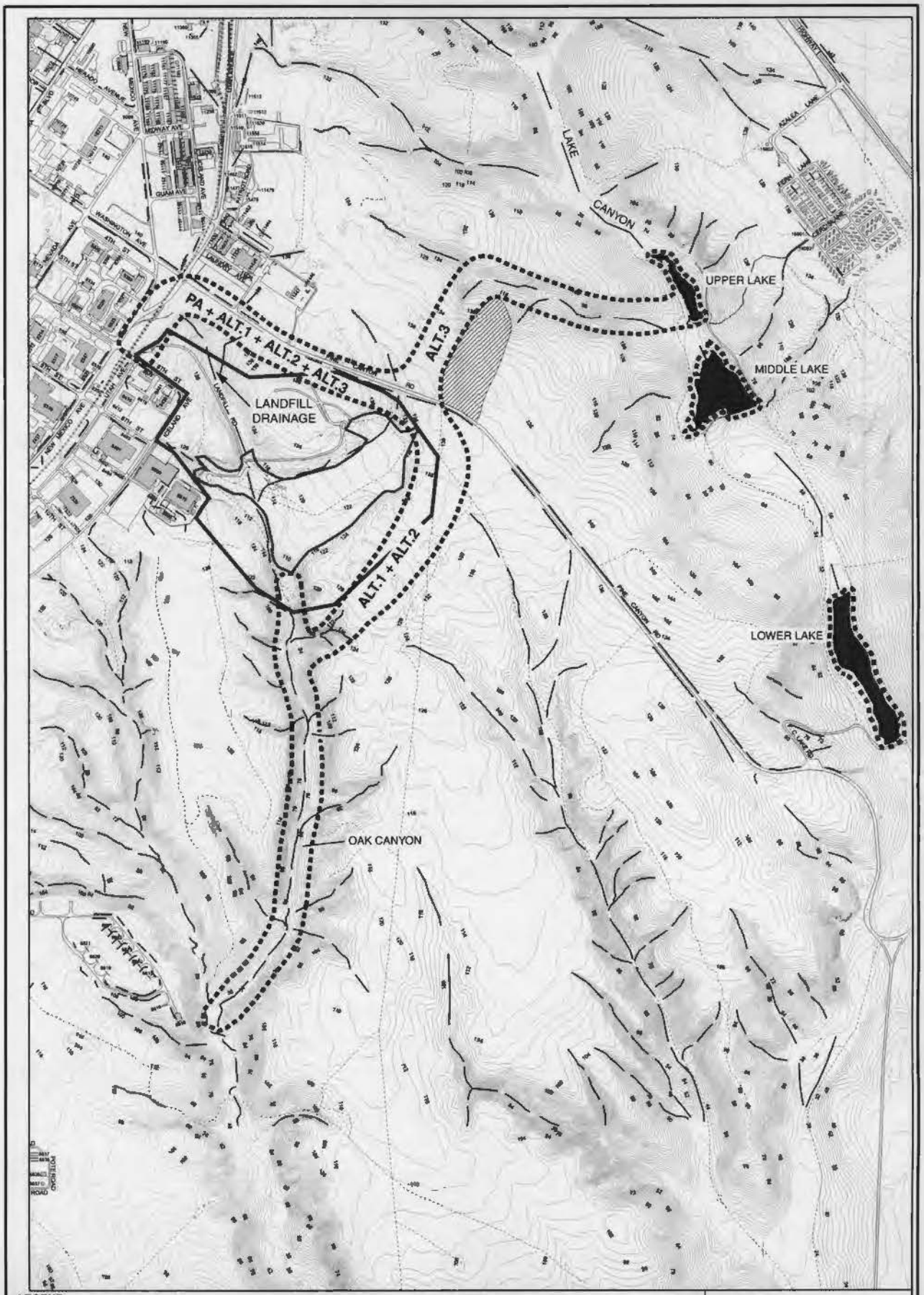
U.S. Air Force
1997 *Wetlands Delineation Report, Source Control Corrective Actions, Vandenberg Air Force Base Sanitary Landfill.* Prepared by FL*x* and Tetra Tech, Inc. for 30 CES/CEV, Vandenberg AFB, California.

U.S. Department of Agriculture
1972 *Soil Survey of Northern Santa Barbara Area, California.* Soil Conservation Service, Washington, D.C.

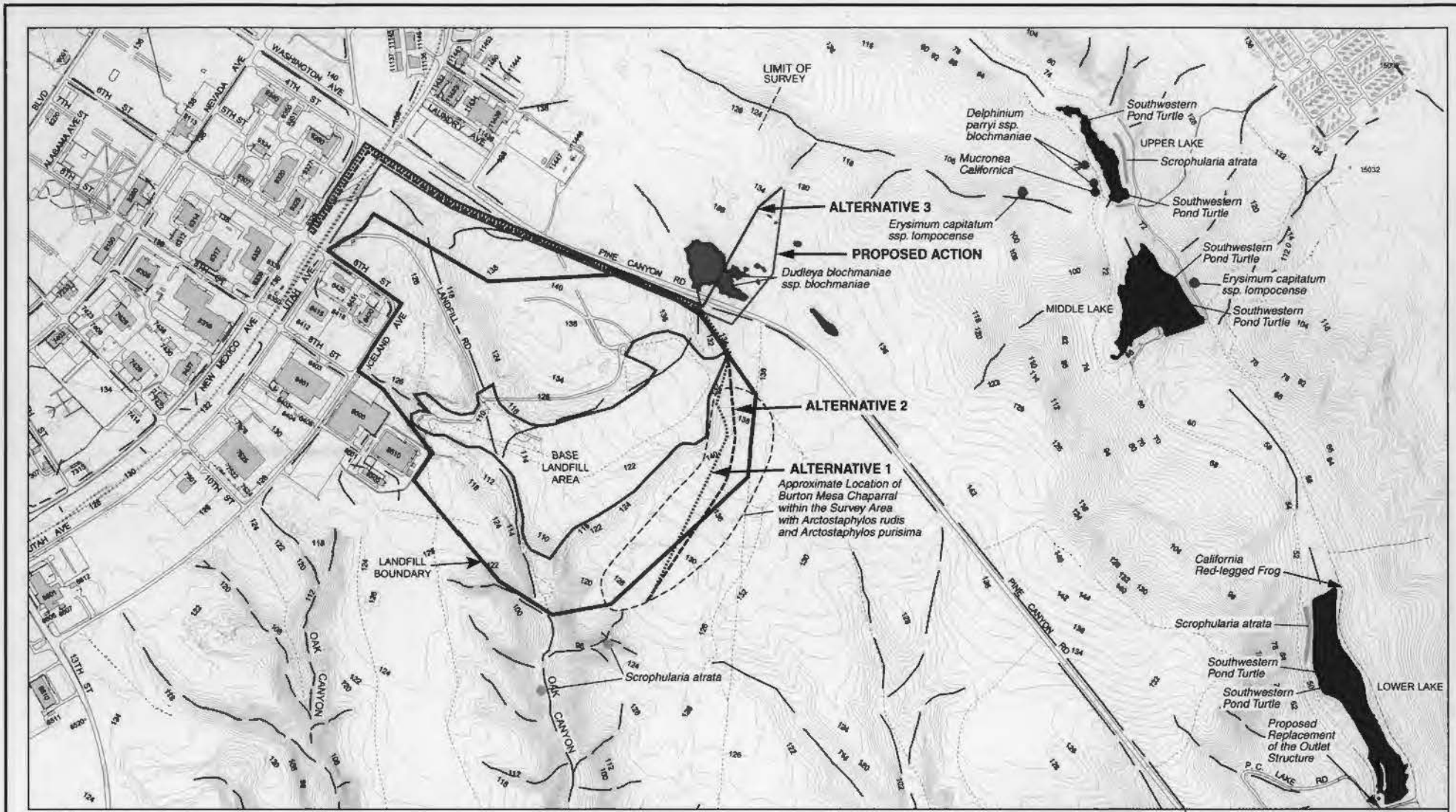
Appendix A, Attachment 1

Maps of the Project Survey Areas, Observed Natural Resources, and Suggested Route Modifications

Figure 1: Biological and Wetland Resources Survey Areas
Figure 2: Special-Status Biological Resources
Figure 3: Wetland Sampling Stations and Jurisdictional Wetland Resources
Figure 4: Suggested Route Modifications for Alternative 1 and Alternative 2


LAKE CANYON
UPPER LAKE
MIDDLE LAKE
LOWER LAKE
PA + ALT.1 + ALT.2 + ALT.3
ALT.3
LANDFILL DRAINAGE
ALT.1 + ALT.2
OAK CANYON
LANDFILL ROAD
PINE CANYON RD
AZALEA LANE
MIDWAY AVE
GUAM AVE
WASHINGTON AVE
NEW MEXICO AVE
ORLAND AVE
LEGEND
CONTOUR LINES, 4 METER INTERVALS (MSL, NAD83)
RAILROAD
PAVED ROADS AND PARKING
UNPAVED ROADS AND TRAILS
DRAINAGE
8801 BUILDINGS
LANDFILL BOUNDARY
SUBTITLE "D" BOUNDARY
SURVEY AREA
PA PROPOSED ACTION
ADDITIONAL AREAS SURVEYED IN 2002
N
550 0 550 1100 FEET
Base map from 30th CES CECB Base Planning, April 2000
LANDFILL DRAINAGE IMPROVEMENTS
BIOLOGICAL AND WETLAND
RESOURCES SURVEY AREAS
VANDENBERG AFB
DATE 03/17/03
DRAWN BY Vance Hoyt RANDALL
MADE FROM VAFB
GIS FILE # R:/TA/TA508 1 AppA Bio.ai
FIGURE 1

This page intentionally left blank.



LEGEND

- CONTOUR LINES, 4 METER INTERVALS (MSL, NAD83)
- RAILROAD
- PAVED ROADS AND PARKING
- UNPAVED ROADS AND TRAILS
- DRAINAGE
- 8801 BUILDINGS
- LANDFILL BOUNDARY
- SUBTITLE "D" BOUNDARY
- PROPOSED ACTION
- ALTERNATIVE 1
- ALTERNATIVE 2
- ALTERNATIVE 3
- SEASONAL WETLANDS
- *Dudleya blochmaniae ssp. blochmaniae*

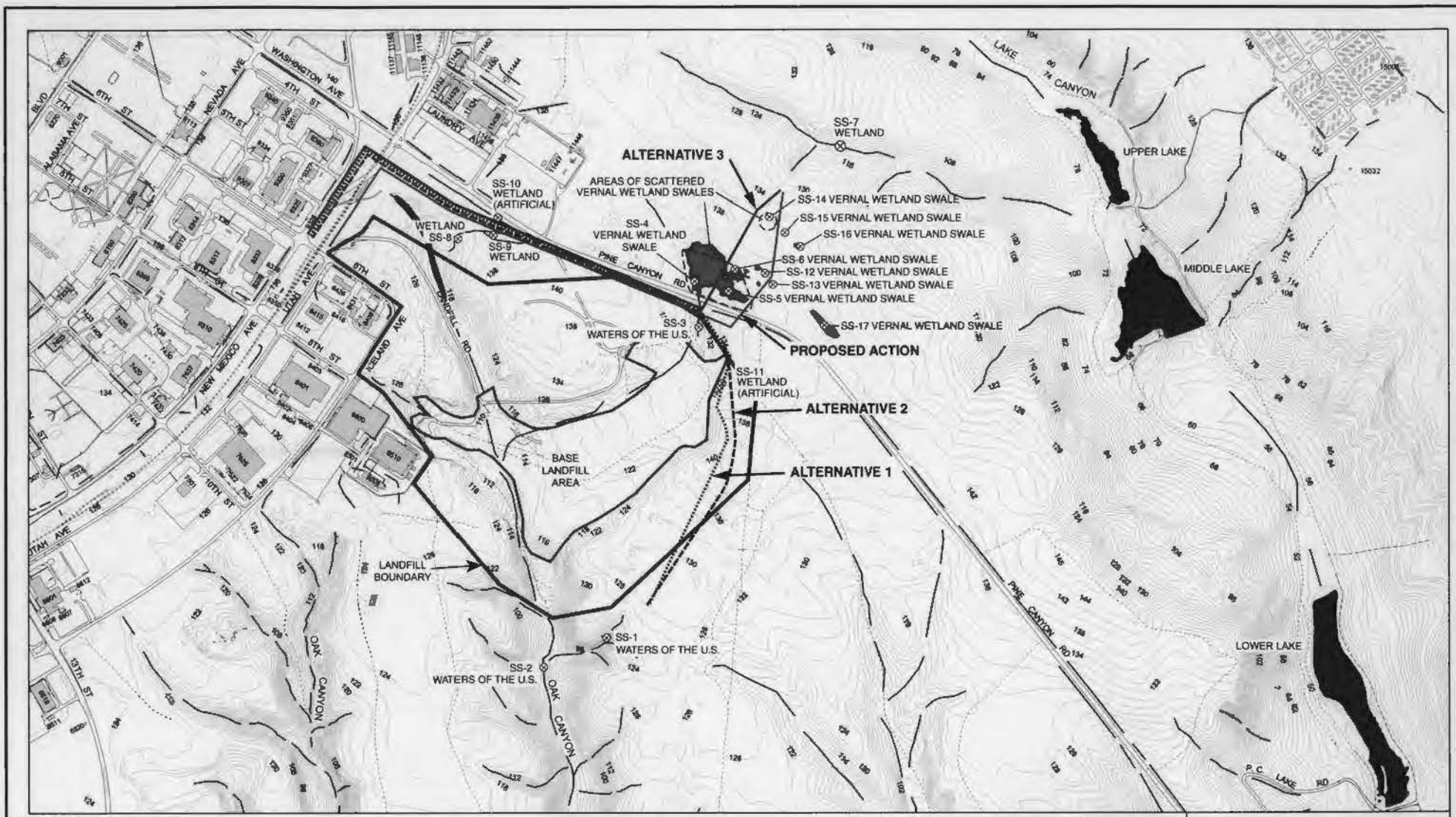
400 0 400 800 FEET

Base map from 30th CES CECB Base Planning, April 2000

LANDFILL DRAINAGE IMPROVEMENTS SPECIAL-STATUS BIOLOGICAL RESOURCES VANDENBERG AFB

TASK NO.	DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
12102 -14	03/17/03	Vance Hoyt RANDALL	VAFB	Graphics:\TA\TASK\ 2 Appx SS Bio.ai	2

This page intentionally left blank.



LANDFILL DRAINAGE IMPROVEMENTS WETLAND SAMPLING STATIONS AND JURISDICTIONAL WETLAND RESOURCES VANDENBERG AFB

TASK NO.	DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
12102 -14	03/18/03	Vance Hoyt RANDALL	VAFB	Graphics\TA\TA50\ 3 AppA Wet.ai	3

This page intentionally left blank.

LEGEND

- CONTOUR LINES, 4 METER INTERVALS (MSL, NAD83)
- RAILROAD
- PAVED ROADS AND PARKING
- UNPAVED ROADS AND TRAILS
- DRAINAGE
- BUILDINGS
- LANDFILL BOUNDARY
- SUBTITLE "D" BOUNDARY
- SUGGESTED ROUTE MODIFICATION

N

400 0 400 800 FEET

Base map from 30th CES CECB Base Planning, April 2000

LANDFILL DRAINAGE IMPROVEMENTS SUGGESTED ROUTE MODIFICATIONS FOR ALTERNATIVE 1 AND ALTERNATIVE 2 VANDENBERG AFB

TASK NO	DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
12102 -14	03/17/03	Vance Hoyt RANDALL	VAFB	Graphics\TA\TASOE 4 Appx\BioDrainImp.ai	4

This page intentionally left blank.

Appendix A, Attachment 2

Rare Plants Potentially Occurring at or in the Vicinity of the Landfill Drainage Improvements Project Area, Vandenberg AFB, CA

RARE PLANTS POTENTIALLY OCCURRING AT OR IN THE VICINITY OF THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

SPECIES Common name *Scientific name*	STATUS			OCCUR-RENCE ON VAFB[4]	HABITAT	BLOOMING PERIOD
	USFWS[1]	CDFG[2]	CNPS[3]			
Gambel's watercress *Rorippa gambelii*	E	T	1B	O	Freshwater marsh	Apr-Aug
Gaviota tarplant *Hemizonia increscens* ssp. *villosa*	E	E	1B	O	Grassland, coastal sage scrub, coastal bluff scrub	May-Aug
Lompoc yerba santa *Eriodictyon capitatum*	E	R	1B	O	Chaparral, coast live oak woodland, Bishop pine forest	May-Aug
Seaside bird's-beak *Cordylanthus rigidus* ssp. *littoralis*	S	E	1B	O	Coastal dune scrub, coastal sage scrub, chaparral, coast live oak woodland, Bishop pine forest	May-Sep
Sand mesa manzanita *Arctostaphylos rudis*	S		1B	O	Chaparral, coast live oak woodland	Nov-Feb
Straight-awned spineflower *Chorizanthe rectispina*	S		1B	O	Coastal sage scrub, chaparral, coast live oak woodland	May-Jul
Dune larkspur *Delphinium parryi* ssp. *blochmaniae*	S		1B	O	Coastal dune scrub, coastal sage scrub, chaparral, coast live oak woodland, grassland	Apr-May
Blochman's dudleya *Dudleya blochmaniae* ssp. *blochmaniae*	S		1B	O	Coastal bluff scrub, grassland, vernal pools	Apr-Jun
Kellogg's horkelia *Horkelia cuneata* ssp. *sericea*	S		1B	O	Coastal dune scrub, chaparral, coast live oak woodland, Bishop pine forest, seasonal freshwater wetlands	Apr-Sep
Black-flowered figwort *Scrophularia atrata*	S		1B	O	Coastal dune scrub, coastal sage scrub, chaparral, coast live oak woodland, Bishop pine forest, tanbark oak forest, riparian woodland	Apr-Jun
La Purisima manzanita *Arctostaphylos purissima*			1B	O	Chaparral, coast live oak woodland, Bishop pine forest, tanbark oak forest	Nov-May
Hoover's bent grass *Agrostis hooveri*			4	O	Chaparral, coast live oak woodland, grassland	Jun-Jul
Western dichondra *Dichondra occidentalis*			4	O	Coastal sage scrub, chaparral, coast live oak woodland, grassland	Mar-May
Saint's daisy *Erigeron sanctarum*			4	O	Coastal sage scrub, chaparral, coast live oak woodland	Mar-Jun

RARE PLANTS POTENTIALLY OCCURRING AT OR IN THE VICINITY OF THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

SPECIES Common name *Scientific name*	STATUS			OCCUR-RENCE ON VAFB[4]	HABITAT	BLOOMING PERIOD
	USFWS[1]	CDFG[2]	CNPS[3]			
San Luis Obispo wallflower *Erysimum capitatum* ssp. *lompocense*			4	O	Coastal sage scrub, chaparral, coast live oak woodland	Feb-May
Prickly phlox *Leptodactylon californicum* ssp. *tomentosum*			4	O	Coastal dune scrub, coastal sage scrub, chaparral, coast live oak woodland	Mar-Aug
Curly-leaved monardella *Monardella undulata*			4	O	Coastal dune scrub, chaparral, coast live oak woodland	May-Jul
California spineflower *Mucronea californica*			4	O	Coastal bluff scrub, coastal dune scrub, chaparral, coast live oak woodland	Mar-Aug
Michael's rein orchid *Piperia michaelii*			4	O	Coastal bluff scrub, coastal dune scrub, chaparral, coast live oak woodland, coastal dune swale wetlands	May-Aug
Round woolly-marbles *Psilocarphus tenellus* var. *globiferus*			4	O	Chaparral, coastal dune swale wetlands, vernal pools	Apr-May
Santa Cruz Island oak *Quercus parvula* var. *parvula*			4	O	Chaparral, coast live oak woodland, Bishop pine forest, tanbark oak forest	Mar-Jun

NOTES

1 E=endangered; PE=proposed endangered; C=candidate; S=species of concern.
2 E=endangered; T=threatened; R=rare.
3 1B=plants rare, threatened, or endangered throughout their range; 4=plants of limited distribution (Skinner and Pavlik, 1994).
4 E=expected; O=observed.
CDFG= California Department of Fish and Game.
CNPS = California Native Plant Society.
USFWS = U.S. Fish and Wildlife Service.
VAFB = Vandenberg Air Force Base.

Appendix A, Attachment 3

Federally Endangered or Threatened Wildlife Species, and Other Species of Concern Potentially Occurring at or in the Vicinity of the Landfill Drainage Improvements Project Area, Vandenberg AFB, CA

FEDERALLY ENDANGERED OR THREATENED WILDLIFE SPECIES, AND OTHER SPECIES OF CONCERN POTENTIALLY OCCURRING AT OR IN THE VICINITY OF THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Species **Common name** ***Scientific name***	**Status[1]**	**Occurrence On VAFB[2]**	**Seasonal Occurrence[3]**	**Habitat**	**Breeding Season (VAFB Breeders Only)**	**Additional Comments**
Peregrine falcon *Falco peregrinus*	E	O	Y, M, W	Nest on cliffs, forage over all open habitats	Mid February-July	
Southwestern willow flycatcher *Empidonax traillii extimus*	E	O	M, B: present May through August	Undisturbed willow riparian	Mid May-mid July	Breeds on VAFB along the Santa Ynez River only
Bald eagle *Haliaeetus leucocephalus*	T, Bald and Golden Eagle Protection Act	O	M, W	Large lakes and wetlands		
California red-legged frog *Rana aurora draytonii*	T	O	Y	Perennial ponds and streams	February-mid April	Nearly all permanent lakes, streams and ponds on VAFB
Western spadefoot toad *Spea hammondii*	S	O	Y	Grassland, vernal pools	Late January-March	
Two-striped garter snake *Thamnophis hammondii*	S	O	Y	Permanent water bodies; in winter, grassland/coastal sage scrub 50-180 meters from water	March; young born August-November	Primarily inactive in rodent burrows in winter, but may emerge to forage on warm days
Southwestern pond turtle *Clemmys marmorata pallida*	S	O	Y	Perennial lakes, ponds, streams; eggs laid in upland areas 16-400 meters from water	Can occur year-round; peak May-June	Hatchlings overwinter in nest; move to aquatic sites March-April
California horned lizard *Phrynosoma coronatum frontale*	S	O	Y	Most habitats on VAFB with loose substrates for burrowing	April-August	
Western least bittern *Ixobrychus exilis hesperis*	S	O	M, potential B	Freshwater marshes, ponds, lakes with emergent vegetation	Late March-July	Puchbowl Lake, Lake Canyon, Waterfowl Management Ponds
Bell's sage sparrow *Amphispiza belli belli*	S	O	Y	Open chaparral	March-July	On VAFB, closely associated with successional (burned) habitat
Little willow flycatcher *Empidonax traillii brewsteri*	S	O	M	Willow thickets, marshes, oak woodland, eucalyptus woodland		Brief spring and fall migrant

FEDERALLY ENDANGERED OR THREATENED WILDLIFE SPECIES, AND OTHER SPECIES OF CONCERN POTENTIALLY OCCURRING AT OR IN THE VICINITY OF THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Species Common name *Scientific name*	Status[1]	Occurrence On VAFB[2]	Seasonal Occurrence[3]	Habitat	Breeding Season (VAFB Breeders Only)	Additional Comments
Ferruginous hawk *Buteo regalis*	S	O	M, W	Open country		
Tricolored blackbird *Agelaius tricolor*	S	O	M, W	Dense tule stands, fields, and pastures		
White-faced ibis *Plegadis chihi*	S	O	M, W	Shallow grassy marshes		
Golden eagle *Aquila chrysaetos*	Bald and Golden Eagle Protection Act	O	Y	Cliffs, large trees in open areas	January-August, March-July peak	

NOTES
1 E=endangered; T=threatened; C=candidate; S=species of concern.
2 E=expected; O=observed.
3 M=migrant; W=winter; B=breeding; Y=year-round.
VAFB = Vandenberg Air Force Base.

Appendix A, Attachment 4

Plant Species Observed in the
Landfill Drainage Improvements Project Area, Vandenberg AFB, CA

PLANT SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Family	Scientific Name	Common Name	Origin & Habit[1]	Occurrence[2]					
				PA	A1	A2	Lf	LC	OC
Aizoaceae	*Carpobrotus edulis* (L.) N.E. Br. X *C. chilensis* (Molina) N.E. Br.	Fig-Marigold X Sea Fig	IS/Ss	x	x	x	x	x	x
Anacardiaceae	*Toxicodendron diversilobum* (Torrey & A. Gray) E. Greene	Western Poison Oak	NSTV	x	x	x	x	x	x
Apiaceae	*Conium maculatum* L.	Poison Hemlock	IBH					x	
Apiaceae	*Eryngium armatum* (S. Watson) J. Coulter & Rose	Coyote-Thistle	NPH	x					
Apiaceae	*Foeniculum vulgare* Miller	Fennel	IPH						x
Apiaceae	*Lomatium utriculatum* (Torrey & A. Gray) J. Coulter & Rose	Biscuit-Root	NPH	x	x	x			x
Apiaceae	*Oenanthe sarmentosa* J.S. Presl	Water-Parsley	NPH				x		
Apiaceae	*Sanicula crassicaulis* DC.	Sanicle	NBPH	x	x	x		x	
Apiaceae	*Sanicula laciniata* Hook. & Arn.	Cut-Leaf Sanicle	NPH	x	x	x			
Asteraceae	*Ambrosia psilostachya* DC.	Western Ragweed	NPH	x	x	x	x	x	
Asteraceae	*Artemisia californica* Less.	California Sagebrush	NS	x	x	x	x	x	x
Asteraceae	*Artemisia douglasiana* Besser	Mugwort	NPH					x	
Asteraceae	*Baccharis douglasii* DC.	Marsh Baccharis	NPH/Ss	x				x	
Asteraceae	*Baccharis pilularis* DC.	Coyote Brush	NS	x	x	x	x	x	x
Asteraceae	*Baccharis salicifolia* (Ruiz Lopez & Pavon) Pers.	Mule Fat	NS						x
Asteraceae	*Chaenactis glabriuscula* DC. var. *glabriuscula*	Yellow Pincushion	NAH					x	
Asteraceae	*Cotula coronopifolia* L.	Brass-Buttons	IPH	x	x	x		x	
Asteraceae	*Erechtites glomerata* (Poiret) DC.	Cut-Leaved Coast Fireweed	IAH		x	x		x	x
Asteraceae	*Ericameria ericoides* (Less.) Jepson	Goldenbush	NS	x	x	x		x	
Asteraceae	*Eriophyllum confertiflorum* (DC.) A. Gray var. *confertiflorum*	Golden Yarrow	NSsS	x	x	x		x	x
Asteraceae	*Euthamia occidentalis* Nutt.	Western Goldenrod	NPH				x	x	
Asteraceae	*Filago gallica* L.	Narrow-Leaved Herba Impia	IAH	x				x	
Asteraceae	*Gnaphalium californicum* DC.	Green Everlasting	NABH	x	x	x	x	x	x
Asteraceae	*Gnaphalium luteo-album* L.	Weedy Cudweed	IAH		x	x		x	
Asteraceae	*Gnaphalium purpureum* L.	Everlasting	NAH	x	x	x		x	
Asteraceae	*Gnaphalium ramosissimum* Nutt.	Pink Everlasting	NBH	x	x	x			
Asteraceae	*Gnaphalium stramineum* Kunth	Cotton-Batting Plant	NABH	x	x	x		x	

PLANT SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Family	Scientific Name	Common Name	Origin & Habit[1]	Occurrence[2]					
				PA	A1	A2	Lf	LC	OC
Asteraceae	*Helenium puberulum* DC.	Sneezeweed	NAPH	x	x	x		x	x
Asteraceae	*Hemizonia increscens* (Keck) B.D. Tanowitz ssp. *increscens*	Tarplant	NAH		x	x		x	
Asteraceae	*Heterotheca grandiflora* Nutt.	Telegraph Weed	NAPH	x	x	x		x	
Asteraceae	*Hypochaeris glabra* L.	Smooth Cat's-Ear	IAH	x	x	x	x	x	
Asteraceae	*Isocoma menziesii* (Hook. & Arn.) G. Nesom var. *menziesii*	Goldenbush	NSs	x	x	x		x	
Asteraceae	*Lasthenia californica* Lindley	Common Goldfields	NAH					x	
Asteraceae	*Layia glandulosa* (Hook.) Hook. & Arn.	White Layia	NAH					x	
Asteraceae	*Layia platyglossa* (Fischer & C. Meyer) A. Gray	Tidy-Tips	NAH					x	
Asteraceae	*Lessingia filaginifolia* (Hook. & Arn.) M.A. Lane var. *filaginifolia*	California-Aster	NPH/Ss					x	
Asteraceae	*Picris echioides* L.	Bristly Ox-Tongue	IABH					x	
Asteraceae	*Psilocarphus tenellus* Nutt. var. *globiferus* (DC.) Morefield	Round Woolly Marbles	■NAH	x	x	x			
Asteraceae	*Silybum marianum* (L.) Gaertner	Milk Thistle	IABH					x	
Asteraceae	*Solidago californica* Nutt.	California Goldenrod	NPH	x					
Asteraceae	*Sonchus asper* (L.) Hill ssp. *asper*	Prickly Sow Thistle	IAH	x	x	x	x	x	
Boraginaceae	*Amsinckia spectabilis* Fischer & C. Meyer var. *microcarpa* (E. Greene) Jepson & Hoover	Showy Fiddleneck	NAH	x	x	x		x	
Boraginaceae	*Cryptantha clevelandii* E. Greene	Cleveland's Cryptantha	NAH					x	
Boraginaceae	*Plagiobothrys bracteatus* (J. Howell) I.M. Johnston	Popcorn Flower	NAH		x	x			
Brassicaceae	*Brassica nigra* (L.) Koch	Black Mustard	IAH					x	
Brassicaceae	*Erysimum capitatum* (Douglas) E. Greene ssp. *lompocense* (Rossbach) R.A. Price	San Luis Obispo Wallflower	■NPH					x	
Brassicaceae	*Hirschfeldia incana* (L.) Lagr.-Fossat	Mediterranean Mustard	IBPH	x	x	x		x	
Brassicaceae	*Thysanocarpus laciniatus* Torrey & A. Gray	Fringepod	NAH					x	
Caprifoliaceae	*Lonicera subspicata* Hook. & Arn. var. *denudata* Rehder	Honeysuckle	NS					x	x
Caprifoliaceae	*Sambucus mexicana* C. Presl	Blue Elderberry	NS						x
Caryophyllaceae	*Cardionema ramosissimum* (J.A. Weinm.) Nelson & J.F. Macbr.	Sand Mat	NPH					x	
Caryophyllaceae	*Spergula arvensis* L. ssp. *arvensis*	Stickwort, Starwort	IAH	x					
Caryophyllaceae	*Spergularia rubra* (L.) J.S. Presl & C. Presl	Purple Sand-Spurrey	IAPH						x

PLANT SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Family	Scientific Name	Common Name	Origin & Habit[1]	Occurrence[2]					
				PA	A1	A2	Lf	LC	OC
Chenopodiaceae	*Atriplex semibaccata* R.Br.	Australian Saltbush	IPHSs	x	x	x			
Chenopodiaceae	*Chenopodium californicum* (S. Watson) S. Watson	California Goosefoot	NPH					x	
Cistaceae	*Helianthemum scoparium* Nutt.	Peak Rush-Rose	NPHS	x	x	x			x
Convolvulaceae	*Calystegia macrostegia* (E. Greene) Brummitt ssp. *cyclostegia* (House) Brummitt	Morning-Glory	NPHSs	x	x	x		x	x
Crassulaceae	*Crassula connata* (Ruiz López & Pavón) A. Berger	Pygmy-Weed	NAH	x	x	x		x	
Crassulaceae	*Dudleya blochmaniae* (Eastw.) Moran ssp. *blochmaniae*	Blochman's Dudleya	■NPH	x					
Crassulaceae	*Dudleya cespitosa* (Haw.) Britton & Rose	Sea Lettuce	NPH	x	x	x		x	x
Cucurbitaceae	*Marah fabaceus* (Naudin) E. Greene	California Man-Root	NPH	x	x	x		x	
Cyperaceae	*Carex barbarae* Dewey	Santa Barbara Sedge	NPH					x	
Cyperaceae	*Carex harfordii* Mackenzie	Harford's Sedge	NPH					x	
Cyperaceae	*Carex praegracilis* W. Boott	Clustered Field Sedge	NPH	x	x	x	x	x	x
Cyperaceae	*Eleocharis macrostachya* Britton	Creeping Spikerush	NPH	x	x	x			
Cyperaceae	*Scirpus acutus* Bigelow var. *occidentalis* (S. Watson) Beetle	Tule	NPH					x	
Cyperaceae	*Scirpus californicus* (C. Meyer) Steudel	California Bulrush	NPH					x	
Dennstaedtiaceae	*Pteridium aquilinum* (L.) Kuhn var. *pubescens* L. Underw.	Bracken Fern	NF					x	x
Ericaceae	*Arctostaphylos purissima* P. Wells	La Purisima Manzanita	■NS	x	x	x	x	x	x
Ericaceae	*Arctostaphylos rudis* Jepson & Wieal.	Sand Mesa Manzanita	■NS		x	x		x	x
Euphorbiaceae	*Croton californicus* Muell. Arg.	California Croton	NPHSs	x	x	x		x	
Fabaceae	*Lotus scoparius* (Nutt.) Ottley var. *scoparius*	California Broom	NPHSs	x	x	x	x	x	x
Fabaceae	*Lotus wrangelianus* Fischer & C. Meyer	Chile Hosackia	NAH					x	
Fabaceae	*Lupinus arboreus* Sims (blue-flowered)	Bush Lupine	NS	x	x	x		x	x
Fabaceae	*Lupinus bicolor* Lindley	Miniature Lupine	NAH	x	x	x		x	
Fabaceae	*Lupinus chamissonis* Eschsch	Chamisso's Bush Lupine	NS	x	x	x		x	
Fabaceae	*Lupinus nanus* Benth.	Sky Lupine	NAH	x	x	x			
Fabaceae	*Lupinus truncatus* Hook. & Arn.	Truncate Lupine	NAH					x	
Fabaceae	*Medicago polymorpha* L.	California Burclover	IAH	x	x	x		x	
Fabaceae	*Melilotus indicus* (L.) All.	Sourclover	IAH	x	x	x	x	x	

PLANT SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Family	Scientific Name	Common Name	Origin & Habit[1]	Occurrence[2]					
				PA	A1	A2	Lf	LC	OC
Fabaceae	*Trifolium barbigerum* Torrey var. *barbigerum* Torrey	Bearded Clover	NAH		x	x			
Fabaceae	*Trifolium campestre* Schreber	Hop Clover	IAH	x	x	x			
Fabaceae	*Vicia benghalensis* L.	Purple Vetch	IAH	x	x	x			
Fagaceae	*Quercus agrifolia* Nee var. *agrifolia*	Coast Live Oak	NT	x	x	x		x	x
Gentianaceae	*Cicendia quadrangularis* (Lam.) Griseb.	Cicendia	NAH	x					
Geraniaceae	*Erodium cicutarium* (L.) L'Hér.	Red-Stemmed Filaree	IAH	x	x	x	x	x	
Geraniaceae	*Geranium dissectum* L.	Wild Geranium	IAH	x	x	x			
Grossulariaceae	*Ribes divaricatum* Douglas	Gooseberry	NS					x	
Hydrophyllaceae	*Phacelia douglasii* (Benth.) Torrey	Douglas' Phacelia	NAH					x	
Hydrophyllaceae	*Phacelia ramosissima* Lehm. var. *montereyensis* Munz	Branching Phacelia	NPH	x	x	x		x	
Hydrophyllaceae	*Pholistoma auritum* (Lindley) Lilja var. *auritum*	Fiesta Flower	NAH					x	
Iridaceae	*Sisyrinchium bellum* S. Watson	Blue-Eyed-Grass	NPH	x	x	x			
Juncaceae	*Juncus balticus* Willd.	Baltic Rush	NPH						x
Juncaceae	*Juncus bufonius* L. var. *bufonius*	Toad Rush	NAH	x					
Juncaceae	*Juncus effusus* L. var. *brunneus* Engelm.	Common Bog Rush	NPH	x	x	x	x	x	x
Juncaceae	*Juncus occidentalis* (Cov.) Wieg.	Western Rush	NPH	x					
Juncaceae	*Juncus patens* E. Meyer	Spreading Rush	NPH	x	x	x	x	x	
Juncaceae	*Juncus phaeocephalus* Engelm. var. *phaeocephalus*	Brown-Headed Rush	NPH	x	x	x	x	x	x
Juncaceae	*Juncus textilis* Buchenau	Basket Rush	NPH	x	x	x	x	x	x
Juncaceae	*Luzula comosa* E. Meyer	Hairy Wood Rush	NPH					x	
Lamiaceae	*Salvia columbariae* Benth.	Chia	NAH					x	
Lamiaceae	*Salvia mellifera* E. Greene	Black Sage	NS		x	x		x	x
Lamiaceae	*Salvia spathacea* E. Greene	Pitcher Sage	NPH	x				x	
Lamiaceae	*Satureja douglasii* (Benth.) Briq.	Yerba Buena	NPH						x
Lamiaceae	*Stachys bullata* Benth.	Hedge Nettle	NPH	x	x	x	x	x	x
Liliaceae	*Chlorogalum pomeridianum* (DC.) Kunth var. *pomeridianum*	Soap Root	NPH	x	x	x		x	
Liliaceae	*Dichelostemma capitatum* Alph. Wood ssp. *capitatum*	Blue Dicks	NPH	x	x	x		x	x

PLANT SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Family	Scientific Name	Common Name	Origin & Habit[1]	Occurrence[2]					
				PA	A1	A2	Lf	LC	OC
Liliaceae	*Zigadenus fremontii* (Torrey) S. Watson	Death Camas	NPH		x	x			
Lythraceae	*Lythrum hyssopifolium* L.	Loosestrife	IABH				x		
Malvaceae	*Malacothamnus fasciculatus* (Torrey & A. Gray) E. Greene	Chaparral Mallow	NSsS					x	
Malvaceae	*Sidalcea malvaeflora* (DC.) Benth. ssp. *malvaeflora*	Checker Mallow	NPH	x					
Myricaceae	*Myrica californica* Cham. & Schldl.	Wax Myrtle	NST					x	
Myrtaceae	*Eucalyptus globulus* Labill.	Blue Gum	IT	x	x	x			
Nyctaginaceae	*Abronia umbellata* Lam. ssp. *umbellata*	Sand Verbena	NAH	x	x	x			
Onagraceae	*Camissonia micrantha* (Sprengel) Raven	Small Primrose	NAH					x	
Onagraceae	*Camissonia strigulosa* (Fischer & C. Meyer) Raven	Field Primrose	NAH					x	
Onagraceae	*Epilobium ciliatum* Raf. ssp. *ciliatum*	Northern Willow Herb	NPH					x	x
Oxalidaceae	*Oxalis corniculata* L.	Wood Sorrel	IPH	x	x	x		x	
Papaveraceae	*Dendromecon rigida* Benth.	Bush Poppy	NS		x	x		x	x
Papaveraceae	*Platystemon californicus* Benth.	Cream Cups	NAH					x	
Papaveraceae	*Eschscholzia californica* Cham.	California Poppy	NAH					x	
Pinaceae	*Pinus muricata* D. Don	Bishop Pine	NT	x	x	x			x
Plantaginaceae	*Plantago coronopus* L.	Cut-Leaved Plantain	IABH	x	x	x		x	
Plantaginaceae	*Plantago erecta* E. Morris	California Plantain	NAH		x	x		x	
Poaceae	*Aira caryophyllea* L.	Silver European Hairgrass	IAG	x	x	x		x	
Poaceae	*Avena barbata* Link	Slender Wild Oat	IAG	x	x	x	x	x	
Poaceae	*Bromus carinatus* Hook. & Arn. var. *carinatus*	California Brome	NPG	x	x	x		x	
Poaceae	*Bromus diandrus* Roth	Ripgut Grass	IAG	x	x	x	x	x	x
Poaceae	*Bromus hordeaceus* L.	Soft Chess	IAG	x	x	x	x	x	x
Poaceae	*Bromus madritensis* L. ssp. *rubens* (L.) Husnot	Foxtail Chess	IAG	x	x	x	x	x	x
Poaceae	*Cortaderia jubata* Stapf	Pampas Grass	IPG	x	x	x	x	x	
Poaceae	*Ehrharta calycina* Smith	Veldt Grass	IPG	x	x	x	x	x	x
Poaceae	*Hordeum marinum* Hudson ssp. *gussoneanum* (Parl.) Thell.	Mediterranean Barley	IAG	x					
Poaceae	*Hordeum murinum* L.	Wall Barley	IAG	x	x	x		x	
Poaceae	*Leymus condensatus* (C. Presl) A. Löve	Giant Ryegrass	NPG	x	x	x	x	x	x

PLANT SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Family	Scientific Name	Common Name	Origin & Habit[1]	Occurrence[2]					
				PA	A1	A2	Lf	LC	OC
Poaceae	*Leymus triticoides* (Buckley) Pilger	Alkali (Creeping) Ryegrass	NPG	x	x	x			
Poaceae	*Nassella lepida* (A. Hitchc.) Barkworth	Foothill Needlegrass	NPG	x	x	x			x
Poaceae	*Nassella pulchra* (A. Hitchc.) Barkworth	Purple Needlegrass	NPG	x	x	x			
Poaceae	*Piptatherum miliaceum* (L.) Cosson	Smilo Grass	IPG		x	x			
Poaceae	*Vulpia myuros* (L.) C. Gmelin var. *hirsuta* (Hackel) Asch. & Graebner	Foxtail Fescue	IAG	x	x	x		x	
Polemoniaceae	*Leptodactylon californicum* Hook. & Arn. ssp. *californicum*	Prickly Phlox	NPH		x	x			x
Polemoniaceae	*Navarretia hamata* E. Greene ssp. *leptantha* (E. Greene) H. Mason	Navarretia	NAH		x	x			
Polygonaceae	*Chorizanthe angustifolia* Nutt.	Narrow-Leaved Spineflower	NAH	x	x	x			
Polygonaceae	*Eriogonum parvifolium* Smith	Dune Eriogonum	NS	x	x	x		x	
Polygonaceae	*Lastarriaea coriacea* (Goodman) Hoover	Lastarriaea	NAH	x	x	x		x	
Polygonaceae	*Mucronea californica* Beath.	California Spineflower	■NAH					x	
Polygonaceae	*Rumex acetosella* L.	Sheep Sorrel	IPH	x	x	x		x	
Polygonaceae	*Rumex crispus* L.	Curly Dock	IPH	x	x	x	x	x	
Polygonaceae	*Rumex salicifolius* J.A. Weinm. var. *salicifolius*	Willow Dock	NPH						x
Polypodiaceae	*Polypodium californicum* Kaulf.	California Polypody	NF						x
Portulacaceae	*Calandrinia ciliata* (Ruiz López & Pavón) DC.	Red Maids	NAH					x	x
Portulacaceae	*Claytonia perfoliata* Willd. ssp. *perfoliata*	Miner's Lettuce	NAH	x					x
Primulaceae	*Anagallis arvensis* L.	Scarlet Pimpernel	IAH	x	x	x		x	
Pteridaceae	*Adiantum jordanii* C. Mueller	California Maiden Hair Fern	NF					x	
Pteridaceae	*Pellaea andromedifolia* (Kaulf.) Fée	Coffee Fern	NF						x
Ranunculaceae	*Delphinium parryi* A. Gray ssp. *blochmaniae* (E. Greene) Harlan Lewis & Epling	Blochman's Larkspur	■NPH					x	
Ranunculaceae	*Ranunculus californicus* Benth.	Buttercup	NPH	x				x	
Rhamnaceae	*Ceanothus cuneatus* (Hook.) Nutt. var. *cuneatus*	Buckbrush	NS		x	x			x
Rhamnaceae	*Ceanothus cuneatus* var. *fasciculatis* (McMinn) Hoover	Buckbrush	NS		x	x			x
Rhamnaceae	*Ceanothus impressus* Trel.	Santa Barbara Ceanothus	NS	x	x	x			x
Rhamnaceae	*Rhamnus californica* Eschsch. ssp. *californica*	California Coffeeberry	NS	x				x	
Rhamnaceae	*Rhamnus crocea* Nutt.	Spiny Redberry	NS					x	

PLANT SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Family	Scientific Name	Common Name	Origin & Habit[1]	Occurrence[2]					
				PA	A1	A2	Lf	LC	OC
Rosaceae	*Acaena pinnatifida* Ruiz Lopez & Pavon var. *californica* (Bitter) Jepson	Acaena	NPH	x				x	
Rosaceae	*Adenostoma fasciculatum* Hook. & Arn.	Chamise	NS	x	x	x	x	x	x
Rosaceae	*Cercocarpus betuloides* Torrey & A. Gray var. *betuloides*	Birch-Leaf Mountain Mahogany	NST						x
Rosaceae	*Heteromeles arbutifolia* (Lindley) Roemer	Toyon	NS	x	x	x		x	x
Rosaceae	*Horkelia cuneata* Lindley ssp. *cuneata*	Wedge-Leaved Horkelia	NPH	x	x	x		x	x
Rosaceae	*Potentilla glandulosa* Lindley ssp. *glandulosa*	Cinquefoil	NPH					x	
Rosaceae	*Rosa californica* Cham. & Schldl.	California Rose	NS	x				x	x
Rosaceae	*Rubus ursinus* Cham. & Schldl.	California Blackberry	NPHS				x	x	x
Rubiaceae	*Galium andrewsii* A. Gray ssp. *andrewsii*	Prickly Bedstraw	NPH		x	x			
Rubiaceae	*Galium angustifolium* Nutt. ssp. *angustifolium*	Narrow-Leaved Bedstraw	NPH	x				x	
Rubiaceae	*Galium aparine* L.	Goose Grass	NAH					x	x
Rubiaceae	*Galium nuttallii* A. Gray ssp. *nuttallii*	San Diego Bedstraw	NPHSs					x	x
Salicaceae	*Populus balsamifera* L. ssp. *trichocarpa* (Torrey & A. Gray)	Black Cottonwood	NT					x	
Salicaceae	*Salix lasiolepis* Benth.	Arroyo Willow	NST	x	x	x	x	x	x
Scrophulariaceae	*Castilleja exserta* (A.A. Heller) Chuang & Heckard	Purple Owl's-Clover	NAH	x				x	
Scrophulariaceae	*Collinsia bartsiifolia* Benth. var. *bartsiifolia*	Chinese Houses	NAH					x	
Scrophulariaceae	*Mimulus aurantiacus* Curtis	California Monkey-Flower	NSsS		x	x	x	x	x
Scrophulariaceae	*Pedicularis densiflora* Hook.	Indian Warrior	NPH						x
Scrophulariaceae	*Penstemon centranthifolius* (Benth.) Benth.	Scarlet Bugler	NPH					x	
Scrophulariaceae	*Scrophularia atrata* Pennell	Black-Flowered Figwort	*NPH					x	x
Solanaceae	*Solanum xanti* A. Gray	Nightshade	NPHSs					x	
Typhaceae	*Typha latifolia* L.	Broad-Leaved Cattail	NPH	x	x	x	x	x	
Urticaceae	*Urtica dioica* L. ssp. *holosericea* (Nutt.) Thorne	Hoary Nettle	NPH				x	x	x
Verbenaceae	*Verbena lasiostachys* Link var. *lasiostachys*	Western Vervain	NPH					x	x

NOTES

1 *N = special status species; N = native; I = introduced or naturalized; N* = native to California, introduced to the base;
A = annual; B = biennial; P = perennial;
T = tree; S = shrub; Ss = subshrub; G = grass; H = herb; V = vine; F = fern; Q = aquatic plant; R = parasite.

2 PA = Proposed Action; A1 = Alternative 1; A2 = Alternative 2; Lf = Landfill; LC = Lake Canyon; OC = Oak Canyon.

WILDLIFE SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Common Name	Scientific Name	Occurrence[1]					
		PA	A1	A2	Lf	LC	OC
Terrestrial Mammals							
Brush rabbit	*Sylvilagus bachmani*		O	O			
California ground squirrel	*Spermophilus beecheyi*	O	O	O			
Botta's pocket gopher	*Thomomys bottae*	S	S	S			
Dusky-footed wood rat	*Neotoma fuscipes*					S	S
Coyote	*Canis latrans*	S	S	S	S	S	
Mule deer	*Odocoileus hemionus*	S	S	S	S	S	
Birds							
Great blue heron*	*Ardea herodias*					F	
Great egret	*Casmerodius albus*	O					
Black-crowned night heron	*Nycticorax nycticorax*					F	
Mallard*	*Anas platyrhynchos*	F				O	
Ruddy duck*	*Oxyura jamaicensis*					O	
Turkey vulture*	*Cathartes aura*					F	
White-tailed kite*	*Elanus caeruleus*	O				O	
Red-shouldered hawk*	*Buteo lineatus*		O	O			
Red-tailed hawk*	*Buteo jamaicensis*					F	
California quail*	*Callipepla californica*		O	O		O	
American coot*	*Fulica americana*					O	
Killdeer*	*Charadrius vociferus*	O				O	
Spotted sandpiper	*Actitis macularia*					O	
Mourning dove*	*Zenaida macroura*				O		O
White-throated swift*	*Aeonautes saxatalis*		F	F			
Anna's hummingbird*	*Calypte anna*	O	O	O	O	O	O
Allen's hummingbird*	*Selasphorus sasin*					O	
Nuttall's woodpecker*	*Picoides nuttallii*		O	O		O	
Downy woodpecker*	*Picoides pubescens*					O	
Hairy woodpecker*	*Picoides villosus*					O	
Northern flicker*	*Colaptes auratus*	O	O	O		O	O
Pacific-slope flycatcher*	*Empidonax difficilis*					O	O
Black phoebe*	*Sayornis nigricans*				O	O	O
Ash-throated flycatcher*	*Mylarchus cinerascens*					O	
Cassin's kingbird*	*Tyrannus vociferans*	O	O	O		O	
Violet-green swallow*	*Tachycineta thalassina*					F	F
Northern rough-winged swallow*	*Stelgidopteryx serripennis*						O
Cliff swallow*	*Hirundo pyrrhonota*	F	F	F		F	
Barn swallow*	*Hirundo rustica*				O		
Western scrub-jay*	*Aphelocoma coerulescens*	O	O	O	O	O	O
American crow*	*Corvus brachyrhynchos*	O	O	O	O	O	
Plain (oak) titmouse*	*Parus inornatus*					O	O
Bushtit*	*Psaltriparus minimus*	O	O	O	O	O	O
Bewick's wren*	*Thryomanes bewickii*	O	O	O	O	O	O
House wren*	*Troglodytes aedon*					O	
Marsh wren*	*Cistothorus palustris*					O	
Ruby-crowned kinglet	*Regulus calendula*		O	O		O	

WILDLIFE SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Common Name	Scientific Name	Occurrence[1]					
		PA	A1	A2	Lf	LC	OC
Blue-grey gnatcatcher*	*Polioptila caerulea*					O	O
Wrentit*	*Chamaea fasciata*	O	O	O	O	O	O
California thrasher*	*Toxostoma redivivum*	O	O	O	O	O	O
European starling*	*Sturnus vulgaris*				O		
Cassin's vireo	*Vireo cassinii*					O	
Hutton's vireo*	*Vireo huttoni*		O	O	O	O	O
Warbling vireo*	*Vireo gilvus*					O	O
Orange-crowned warbler*	*Vermivora celata*	O	O	O	O	O	O
Nashville warbler	*Vermivora ruficapilla*		O	O			
Yellow warbler*	*Dendroica petechia*				O	O	
Yellow-rumped warbler	*Dendroica coronata*					O	F
Black-throated gray warbler	*Dendroica nigrescens*					O	
Townsend's warbler	*Dendroica townsendi*					O	O
Common yellowthroat*	*Geothlypis trichas*		O	O	O	O	
Wilson's warbler*	*Wilsonia pusilla*				O	O	O
Yellow-breasted chat*	*Icteria virens*					O	
Western tanager	*Piranga ludoviciana*					O	
Lazuli bunting*	*Passerina amoena*					O	
California towhee*	*Pipilo crissalis*	O	O	O	O	O	
Spotted towhee	*Pipilo maculatus*	O	O	O	O	O	O
Song sparrow*	*Melospiza melodia*	O	O	O	O	O	O
Dark-eyed junco*	*Junco hyemalis*				O	O	O
Red-winged blackbird*	*Agelaius phoeniceus*	O	O	O		O	
Western meadowlark*	*Sturnella neglecta*	O	O	O			
Brewer's blackbird*	*Euphagus cyanocephalus*				F		
Hooded oriole*	*Icterus cucullatus*	O	O	O		O	
Purple finch*	*Carpodacus purpureus*	O	O	O	O	O	O
House finch*	*Carpodacus mexicanus*	O	O	O	O	O	
Lesser goldfinch*	*Carduelis psaltria*	O	O	O		O	
American goldfinch*	*Carduelis tristis*					O	
Reptiles							
Southwestern pond turtle■	*Clemmys marmorata pallida*					O	
Western fence lizard	*Sceloporus occidentalis*	O	O	O		O	
Coast horned lizard■	*Phrynosoma coronatum frontale*					R	
Southern alligator lizard	*Elgaria multicarinata*		O	O			
Amphibians							
Pacific chorus frog	*Pseudacris regilla*	O	O	O	O	O	O
California red-legged frog■	*Rana aurora draytonii*					O	
Bullfrog	*Rana catesbeiana*					O	O

NOTES

1 PA = Proposed Action; A1 = Alternative 1; A2 = Alternative 2; Lf = Landfill; LC = Lake Canyon; OC = Oak Canyon.
O = observed/heard; F = observed as a fly-over; S = indirect evidence observed by sign;
R = recently recorded at or near the site, but not observed in field surveys.

* Breeding birds of Vandenberg AFB.

■ Federal special status species: threatened, endangered, and species of concern.

Appendix A, Attachment 5

Wildlife Species Observed in the Landfill Drainage Improvements Project Area, Vandenberg AFB, CA

WILDLIFE SPECIES OBSERVED IN THE
LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Common Name	Scientific Name	Occurrence[1]					
		PA	A1	A2	Lf	LC	OC
Terrestrial Mammals							
Brush rabbit	*Sylvilagus bachmani*		O	O			
California ground squirrel	*Spermophilus beecheyi*	O	O	O			
Botta's pocket gopher	*Thomomys bottae*	S	S	S			
Dusky-footed wood rat	*Neotoma fuscipes*					S	S
Coyote	*Canis latrans*	S	S	S	S	S	
Mule deer	*Odocoileus hemionus*	S	S	S	S	S	
Birds							
Great blue heron*	*Ardea herodias*					F	
Great egret	*Casmerodius albus*	O					
Black-crowned night heron	*Nycticorax nycticorax*					F	
Mallard*	*Anas platyrhynchos*	F				O	
Ruddy duck*	*Oxyura jamaicensis*					O	
Turkey vulture*	*Cathartes aura*					F	
White-tailed kite*	*Elanus caeruleus*	O				O	
Red-shouldered hawk*	*Buteo lineatus*		O	O			
Red-tailed hawk*	*Buteo jamaicensis*					F	
California quail*	*Callipepla californica*		O	O		O	
American coot*	*Fulica americana*					O	
Killdeer*	*Charadrius vociferus*	O				O	
Spotted sandpiper	*Actitis macularia*					O	
Mourning dove*	*Zenaida macroura*				O		O
White-throated swift*	*Aeonautes saxatalis*		F	F			
Anna's hummingbird*	*Calypte anna*	O	O	O	O	O	O
Allen's hummingbird*	*Selasphorus sasin*					O	
Nuttall's woodpecker*	*Picoides nuttallii*		O	O		O	
Downy woodpecker*	*Picoides pubescens*					O	
Hairy woodpecker*	*Picoides villosus*					O	
Northern flicker*	*Colaptes auratus*	O	O	O		O	O
Pacific-slope flycatcher*	*Empidonax difficilis*					O	O
Black phoebe*	*Sayornis nigricans*				O	O	O
Ash-throated flycatcher*	*Mylarchus cinerascens*					O	
Cassin's kingbird*	*Tyrannus vociferans*	O	O	O		O	
Violet-green swallow*	*Tachycineta thalassina*					F	F
Northern rough-winged swallow*	*Stelgidopteryx serripennis*						O
Cliff swallow*	*Hirundo pyrrhonota*	F	F	F		F	
Barn swallow*	*Hirundo rustica*				O		
Western scrub-jay*	*Aphelocoma coerulescens*	O	O	O	O	O	O
American crow*	*Corvus brachyrhynchos*	O	O	O	O	O	
Plain (oak) titmouse*	*Parus inornatus*					O	O
Bushtit*	*Psaltriparus minimus*	O	O	O	O	O	O
Bewick's wren*	*Thryomanes bewickii*	O	O	O	O	O	O
House wren*	*Troglodytes aedon*					O	
Marsh wren*	*Cistothorus palustris*					O	
Ruby-crowned kinglet	*Regulus calendula*		O	O		O	

WILDLIFE SPECIES OBSERVED IN THE LANDFILL DRAINAGE IMPROVEMENTS PROJECT AREA, VANDENBERG AFB, CA

Common Name	Scientific Name	Occurrence[1]					
		PA	A1	A2	Lf	LC	OC
Blue-grey gnatcatcher*	*Polioptila caerulea*					O	O
Wrentit*	*Chamaea fasciata*	O	O	O	O	O	O
California thrasher*	*Toxostoma redivivum*	O	O	O	O	O	O
European starling*	*Sturnus vulgaris*				O		
Cassin's vireo	*Vireo cassinii*					O	
Hutton's vireo*	*Vireo huttoni*		O	O	O	O	O
Warbling vireo*	*Vireo gilvus*					O	O
Orange-crowned warbler*	*Vermivora celata*	O	O	O	O	O	O
Nashville warbler	*Vermivora ruficapilla*		O	O			
Yellow warbler*	*Dendroica petechia*				O	O	
Yellow-rumped warbler	*Dendroica coronata*					O	F
Black-throated gray warbler	*Dendroica nigrescens*					O	
Townsend's warbler	*Dendroica townsendi*					O	O
Common yellowthroat*	*Geothlypis trichas*		O	O	O	O	
Wilson's warbler*	*Wilsonia pusilla*				O	O	O
Yellow-breasted chat*	*Icteria virens*					O	
Western tanager	*Piranga ludoviciana*					O	
Lazuli bunting*	*Passerina amoena*					O	
California towhee*	*Pipilo crissalis*	O	O	O	O	O	
Spotted towhee	*Pipilo maculatus*	O	O	O	O	O	O
Song sparrow*	*Melospiza melodia*	O	O	O	O	O	O
Dark-eyed junco*	*Junco hyemalis*				O	O	O
Red-winged blackbird*	*Agelaius phoeniceus*	O	O	O		O	
Western meadowlark*	*Sturnella neglecta*	O	O	O			
Brewer's blackbird*	*Euphagus cyanocephalus*				F		
Hooded oriole*	*Icterus cucullatus*	O	O	O		O	
Purple finch*	*Carpodacus purpureus*	O	O	O	O	O	O
House finch*	*Carpodacus mexicanus*	O	O	O	O	O	
Lesser goldfinch*	*Carduelis psaltria*	O	O	O		O	
American goldfinch*	*Carduelis tristis*					O	
Reptiles							
Southwestern pond turtle[■]	*Clemmys marmorata pallida*					O	
Western fence lizard	*Sceloporus occidentalis*	O	O	O		O	
Coast horned lizard[■]	*Phrynosoma coronatum frontale*					R	
Southern alligator lizard	*Elgaria multicarinata*		O	O			
Amphibians							
Pacific chorus frog	*Pseudacris regilla*	O	O	O	O	O	O
California red-legged frog[■]	*Rana aurora draytonii*					O	
Bullfrog	*Rana catesbeiana*					O	O

NOTES

1 PA = Proposed Action; A1 = Alternative 1; A2 = Alternative 2; Lf = Landfill; LC = Lake Canyon; OC = Oak Canyon.
O = observed/heard; F = observed as a fly-over; S = indirect evidence observed by sign;
R = recently recorded at or near the site, but not observed in field surveys.

* Breeding birds of Vandenberg AFB.

■ Federal special status species: threatened, endangered, and species of concern.

Appendix A, Attachment 6

Data Forms for Wetland Surveys

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Anuja Parikh Nathan Gale	Date: Apr. 19 2000 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: oak woodland riparian Transect ID: Oak Canyon Plot ID: SS-1

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Quercus agrifolia	T	UPL	9.		
2. Toxicodendron diversilobum	S/V	UPL	10.		
3. Pteridium aquilinum	F	FACU	11.		
4. Heteromeles arbutifolia	S	UPL	12.		
5. Polypodium californicum	F	UPL	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). < 50%

Remarks: Hydrophytic vegetation absent

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water:	1	(in.)
Depth to Free Water in Pit:	N/A	(in.)
Depth to Saturated Soil:	N/A	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ✓ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: rocky watercourse with flowing water present
Wetland hydrology present

SOILS

Map Unit Name (Series and Phase): GuE Gullied land — Drainage Class: N/A

Taxonomy (Subgroup): N/A — Field Observations Confirm Mapped Type? Yes No N/A

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions, drainageways
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: too rocky to dig in watercourse
Hydric soils not confirmed

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes (No) (Circle)		(Circle)
Wetland Hydrology Present?	(Yes) No	Is this Sampling Point Within a Wetland?	Yes (No)
Hydric Soils Present?	Yes (No)		

Remarks: Sample point is in jurisdictional waters of the U.S.
Intermittent stream present

2ft ↔ / 3-4ft ↕

Approved by HQUSACE 3/92

Anuja K. Pandit, PWS 841

Nathan Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements	Date: Apr 19 '00
Applicant/Owner: Vandenberg AFB	County: Santa Barbara
Investigator: Annie Parker, Nalton Gale	State: CA
Do Normal Circumstances exist on the site? (Yes) No	Community ID: oak woodland riparian
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: Oak Canyon
Is the area a potential Problem Area? Yes (No)	Plot ID: SS-2
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Quercus agrifolia	T	UPL	9.		
2. Toxicodendron diversilobum	S/V	UPL	10.		
3. Juncus effusus	H	OBL	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). <50%

Remarks: hydrophytic vegetation absent

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water:	none	(in.)
Depth to Free Water in Pit:	2	(in.)
Depth to Saturated Soil:	N/A	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated 1 ft away in channel, depth 2"
- ✓ Saturated in Upper 12 Inches
- ___ Water Marks
- ✓ Drift Lines
- ✓ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wide watercourse of Oak Canyon with flowing water
wetland hydrology present

SOILS

Map Unit Name (Series and Phase): SpG Sedimentary rock land — Drainage Class: N/A

Field Observations — Confirm Mapped Type? Yes No N/A

Taxonomy (Subgroup): N/A

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12" = pit bottom		indeterminable, varied			organic material + river wash sand

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

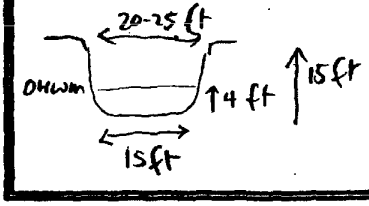
Remarks: Colors not determinable, hydric soils not confirmed

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? Yes (No)

Is this Sampling Point Within a Wetland? (Circle) Yes (No)

Remarks: sample is in COE jurisdictional waters of the U.S.



Approved by HQUSACE 3/92

Angie K. Smith, PWS 841
Walton Gale, PWS 1214

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements	Date: Apr. 20, '00
Applicant/Owner: Vandenberg AFB	County: Santa Barbara
Investigator: Anuja Parikh, Nattan Gale	State: CA
Do Normal Circumstances exist on the site? (Yes) No	Community ID: Coastal scrub, grassland, oak woodlands
Is the site significantly disturbed (Atypical Situation)? (Yes) No	Transect ID: PA Alt 1, Alt 2
Is the area a potential Problem Area? Yes (No)	Plot ID: SS-3
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Bromus diandrus	H	UPL	9.		
2. Stachys bullata	H	UPL	10.		
3. Lonicera phaeocephalus	H	FACW	11.		
4. Quercus agrifolia	T	UPL	12.		
5. Artemisia californica	S	UPL	13.		
6. Toxicodendron diversilobum	S/V	UPL	14.		
7. Ambrosia psilostachya	H	FAC	15.		
8. Salix lasiolepis	T	FACW	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). <50%

Remarks: Hydrophytic vegetation absent

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: none (in.)

Depth to Free Water in Pit: none (in.)

Depth to Saturated Soil: 6 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated channel 1 in area
- ✓ Saturated in Upper 12 Inches
- ___ Water Marks
- ✓ Drift Lines in channel
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present

SOILS

Map Unit Name (Series and Phase): GuE Gullied land — Drainage Class: N/A

Taxonomy (Subgroup): N/A — Field Observations Confirm Mapped Type? Yes No N/A

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Size Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16" = pit bottom		10YR3/2	7.5YR4/6	few, fine, distinct	mixed gravel and sandy loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions, drainageways
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes (No) (Circle)	(Circle)
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	Is this Sampling Point Within a Wetland? Yes (No)

Remarks: sample point is in depression, which appears to be previously disturbed or artificially created. Shallow channel or watercourse with flowing water has been created as outflow from a drainage pipe - flow leads into another drainage pipe
Station is in COE waters of the U.S.

Approved by HQUSACE 3/92

Angie K. Parrish, PWS 841
Nathan Gale, PWS 1216

DATA FORM 3

ATYPICAL SITUATIONS

Applicant Name: Vandenberg AFB Application Number: _____ Project Name: Landfill Drainage Improvements

Location: S of Pine Canyon Rd Plot Number: SS-3 Date: Apr. 20, '00

A. VEGETATION:

1. Type of Alteration: unknown

2. Effect on Vegetation: unknown

3. Previous Vegetation: unknown
(Attach documentation)

4. Hydrophytic Vegetation? Yes _____ No ✓

B. SOILS:

1. Type of Alteration: Fill has occurred, particularly downstream of station where flow enters culvert

2. Effect on Soils: soil has some fill material and mixed textures

3. Previous Soils: unknown
(Attach documentation)

4. Hydric Soils? Yes ✓ No _____

C. HYDROLOGY:

1. Type of Alteration: Flow has been directed through culverts, both upstream + downstream. Natural drainage patterns have been modified.

2. Effect on Hydrology: Natural drainage way channelized through culvert + filled south of station

3. Previous Hydrology: Station is located in an area that was historically in a natural drainage Tributary to Oak Canyon
(Attach documentation)

4. Wetland Hydrology? Yes ✓ No _____

Characterized By: Anuja Parikh, PWS 841

Walton Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Annija Parikh, Nathan Gale	Date: Apr 20, '00 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: vernal swale Transect ID: PA Plot ID: SS-4

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus phaeocephalus	H	FACW	9.		
2. Sisyrinchium bellum	H	FAC	10.		
3. Rumex crispus	H	FACW-	11.		
4. Baccharis pilularis	S	UPL	12.		
5. Rumex acetosella	H	FAC-	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water:	1	(in.)
Depth to Free Water in Pit:	N/A	(in.)
Depth to Saturated Soil:	N/A	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present

SOILS

Map Unit Name (Series and Phase): NsC Nankin loamy sand, 2-9% slopes
Drainage Class: moderately well-drained
Taxonomy (Subgroup): Aeric Ochraqualf
Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Size Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16" = pit bottom		10YR 3/2	10YR 4/6	few, medium, faint	sandy clay loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Yes) No (Circle)

Remarks: station is in COE jurisdictional wetland, natural swale shallow topographic swale, freshwater marsh vegetation, dominated by Juncus phaeocephalus

Approved by HQUSACE 3/92
Anuja K. Parikh, PWS 841
Nathan Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Anuja Parikh, Nathan Gale	Date: Apr 20 '00 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: vernal swale Transect ID: PA Plot ID: SS-5

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus phaeocephalus	H	FACW	9.		
2. Rumex acetosella	H	FAC-	10.		
3. Eryngium armatum	H	FACW	11.		
4. Plantago coronopus	H	FAC	12.		
5. Geranium dissectum	H	UPL	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water:	1	(in.)
Depth to Free Water in Pit:	N/A	(in.)
Depth to Saturated Soil:	N/A	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present

SOILS

Map Unit Name (Series and Phase): NSA Narlon loamy sand, 0-2% slopes Drainage Class: moderately well-drained

Taxonomy (Subgroup): Aeric Ochraquult Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast/Size	Texture, Concretions, Structure, etc.
0-6"		10YR 3/2			clay loam
6-10"		10YR 5/3			sandy clay loam
10-16" = pit bottom		10YR 4/2	10YR 4/6	few, fine, faint	clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample station is in COE wetland, in a vernal swale

Approved by HQUSACE 3/92
Anuja K. Parikh, PWS 841
Anthony Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Anuja Parikh, Nathan Gale	Date: Apr. 20, '00 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: Vernal Swale Transect ID: PA Plot ID: SS-6

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus phaeocephalus	H	FACW	9.		
2. Baccharis douglasii	H	OBL	10.		
3. Rumex acetosella	H	FAC-	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water:	none (in.)
Depth to Free Water in Pit:	5 (in.)
Depth to Saturated Soil:	1 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ✓ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ✓ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Wetland hydrology present

SOILS

Map Unit Name (Series and Phase): NsA Norfolk loamy sand, 0-2% slopes
Drainage Class: moderately well-drained
Taxonomy (Subgroup): Aeric Ochraquult
Field Observations Confirm Mapped Type? (Yes) No — inclusions

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6"		10YR 2/2			sandy loam
6-16"+ pit bottom		10YR 7/2	10YR 4/6	common, medium, distinct	sandy clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List — inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No (Circle)	
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample point is in a COE jurisdictional wetland, in a vernal swale

Approved by HQUSACE 3/92

Ronja K. Landis, PWS 841
Nathan Gale, PWS 816

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements	Date: Apr 20 '00
Applicant/Owner: Vandenberg AFB	County: Santa Barbara
Investigator: Anuja Parikh, Nathan Gale	State: CA
Do Normal Circumstances exist on the site? (Yes) No	Community ID: willow woodland
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: LL
Is the area a potential Problem Area? Yes (No)	Plot ID: SS-7
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Salix lasiolepis	T	FACW	9.		
2. Rubus ursinus	S	FACW*	10.		
3. Juncus textilis	H	OBL	11.		
4. Toxicodendron diversilobum	S/V	UPL	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water:	none	(in.)
Depth to Free Water in Pit:	4	(in.)
Depth to Saturated Soil:	2	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated within 1 ft
- ✓ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present

SOILS

Map Unit Name (Series and Phase): IdF Terrace Escarpments, loamy — Drainage Class: N/A

Taxonomy (Subgroup): N/A — Field Observations Confirm Mapped Type? Yes No N/A

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16" = pit bottom		10YR 3/2	7.5YR 3/4	few, medium, distinct	sandy clay loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ✓ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample point in willow woodland is within COE jurisdictional wetland

Approved by HQUSACE 3/92

Anuja K. Pandit PWS 841
Kathryn Gale PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements
Applicant/Owner: Vandenberg AFB
Investigator: Anuja Parikh, Nathan Gale

Date: Apr. 21, '00
County: Santa Barbara
State: CA

Do Normal Circumstances exist on the site? (Yes) No
Is the site significantly disturbed (Atypical Situation)? Yes (No)
Is the area a potential Problem Area? Yes (No)
(If needed, explain on reverse.)

Community ID: Willow woodland
Transect ID: PA, A1+1, A1+2
Plot ID: SS-8

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Salix lasiolepis	T	FACW	9.		
2. Cortaderia jubata	H	UPL	10.		
3. Typha latifolia	H	OBL	11.		
4. Juncus textilis	H	OBL	12.		
5. Carex praegracilis	H	FACW-	13.		
6. Juncus phaeocephalus	H	FACW	14.		
7. Juncus patens	H	FAC	15.		
8. Toxicodendron diversilobum S/V		UPL	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). > 50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
___ Stream, Lake, or Tide Gauge
___ Aerial Photographs
___ Other
✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: none (in.)
Depth to Free Water in Pit: 6 (in.)
Depth to Saturated Soil: 4 (in.)

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated within 1m
✓ Saturated in Upper 12 Inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 Inches
___ Water-Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks: Wetland hydrology present

SOILS

Map Unit Name (Series and Phase): NsC Nankin loamy sand, 2-9% slopes
Drainage Class: moderately well-drained
Taxonomy (Subgroup): Aeric Ochraqualf
Field Observations Confirm Mapped Type? (Yes) No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16" = pit bottom		10YR 3/3	7.5YR 4/4	common fine distinct	loamy sand

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ✓ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors (mottling)
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List (inclusions in depressions)
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Color determination in sandy soils not conclusive mottling & sulfidic odor indicate hydric soils, as also listing on local hydric soils list

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Yes) No (Circle)

Remarks: sample station in willow woodland with varied vegetation & species. Station is in COE wetland

Approved by HQUSACE 3/92

Anuja K. Parikh, PWS 841
& Nathan Good, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Anuja Parikh, Nathan Gale	Date: Apr. 21, '00 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: Vernal swale Transect ID: PA.A1t1, A1t2 Plot ID: SS-9

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus phaeocephalus	H	FACW	9.		
2. Plantago coronopus	H	FAC	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: Saturated at surface (in.)

Depth to Free Water in Pit: N/A (in.)

Depth to Saturated Soil: N/A (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ✓ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ✓ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present

SOILS

Map Unit Name (Series and Phase): NsC Nankin loamy sand, 2-9% slopes
Drainage Class: moderately well-drained
Taxonomy (Subgroup): Aeric Ochraquult
Field Observations Confirm Mapped Type? (Yes) No inclusions

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16" = pit bottom		10YR 3/2 variable (sandy soil)	7.5YR 3/4	few, fine, faint	sandy loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List — inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample station is in vernal swale, in COE wetland

Approved by HQUSACE 3/92

Annie K. Pandl, PWS 841
& Nathan Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Anuja Parikh, Nathan Gale	Date: Apr. 21 '00 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? (Yes) No Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: Vernal Swale Transect ID: PA Alt 1 Alt 2 Plot ID: SS-10

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus phaeocephalus	H	FACW	9.		
2. Lemna acetosella	H	FAC-	10.		
3. Rumex crispus	H	FACW-	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: 1 (in.)

Depth to Free Water in Pit: N/A (in.)

Depth to Saturated Soil: N/A (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present

SOILS

Map Unit Name (Series and Phase): NsC Narlon loamy sand, 2-9% slopes
Drainage Class: moderately well-drained
Taxonomy (Subgroup): Aeric Ochraquult
Field Observations Confirm Mapped Type? Yes No N/A

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6" +		10YR3/2			too wet to
pit bottom	surface layers				determine
					texture

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present; soils are on the local hydric soils list

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample station has field indicators for the three wetland parameters, but may not qualify as COE jurisdictional wetland because it has been created artificially + drainage patterns have been modified

Approved by HQUSACE 3/92

Angie K. Rauch, PWS 841
Matthew Gale, PWS 1216

DATA FORM 3

ATYPICAL SITUATIONS

Applicant Name: Vandenberg AFB Application Number: _____ Project Name: Landfill Drainage Improvements

Location: S of Pine Canyon Rd Plot Number: SS-10 Date: Apr. 21, 00

A. VEGETATION:

1. Type of Alteration: unknown

2. Effect on Vegetation: unknown

3. Previous Vegetation: unknown

(Attach documentation) _____

4. Hydrophytic Vegetation? Yes ✓ No _____.

B. SOILS:

1. Type of Alteration: unknown

2. Effect on Soils: unknown

3. Previous Soils: unknown

(Attach documentation) _____

4. Hydric Soils? Yes ✓ No _____.

C. HYDROLOGY:

1. Type of Alteration: Surface runoff north of Pine Canyon Road has been obstructed by construction of road + directed through a culvert.

2. Effect on Hydrology: natural drainage patterns from mesa north of road has been concentrated through culvert to location of culvert outflow

3. Previous Hydrology: natural hydrology patterns

(Attach documentation) _____

4. Wetland Hydrology? Yes ✓ No _____.

Characterized By: Ranja Pandit, PWS 841

William Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Annie Parikh, Nolton Gale	Date: Apr. 21, '00 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? (Yes) No Is the site significantly disturbed (Atypical Situation)? (Yes) No Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: disturbed area with wetland species Transect ID: Alt 1 Plot ID: SS-11

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Salix lasiolepis	Sapling	FACW	9.		
2. Juncus phaeocephalus	H	FACW	10.		
3. Eleocharis macrostachya	H	OBL	11.		
4. Typha latifolia	H	OBL	12.		
5. Cotula coronopifolia	H	FACW+	13.		
6. Cortaderia jubata	H	UPL	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). > 50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water:	6	(in.)
Depth to Free Water in Pit:	N/A	(in.)
Depth to Saturated Soil:	N/A	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ✓ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present

SOILS

Map Unit Name (Series and Phase): TaC Tangier sand, 2-9% slopes
Drainage Class: somewhat poorly drained
Taxonomy (Subgroup): Typic Psammaquent
Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6"		10YR3/2	7.5YR4/4	few, fine, faint	Sandy loam
6-16"= pit bottom		10YR3/3	7.5YR4/6	few fine, faint	loamy sand

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ✓ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List (inclusions in depressions)
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present, sulfidic odor + organic content. Color determination not conclusive because soils are sandy

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample station has field indicators for the three wetland parameters, but may not qualify as COE jurisdictional wetland because it has been created artificially.

Approved by HQUSACE 3/92

Annie K. Parnell, PWS 841
Nathan Gale, PWS 1216

DATA FORM 3

ATYPICAL SITUATIONS

Applicant Name: Vandenberg AFB Application Number: _____ Project Name: Landfill Drainage Improvements

Location: S of Pine Canyon Rd Plot Number: SS-11 Date: Apr 21, 00

A. VEGETATION:

1. Type of Alteration: unknown

2. Effect on Vegetation: changes in hydrology may have led to growth of wetland vegetation, specifically, willow saplings.

3. Previous Vegetation: unknown
(Attach documentation) _____

4. Hydrophytic Vegetation? Yes ✓ No _____.

B. SOILS:

1. Type of Alteration: fill material present in the landfill area to the south

2. Effect on Soils: mixed textures in fill material

3. Previous Soils: unknown
(Attach documentation) _____

4. Hydric Soils? Yes ✓ No _____.

C. HYDROLOGY:

1. Type of Alteration: Surface runoff has been obstructed by berm created in landfill area from landfill activities.

2. Effect on Hydrology: ponding created by damming, inundation present

3. Previous Hydrology: unknown
(Attach documentation) _____

4. Wetland Hydrology? Yes ✓ No _____.

Characterized By: Anuja Parikh, PWS 841
William Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Annia Parikh, Nathan Gale	Date: April 4, 02 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? Yes (No) Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.)	Community ID: vernal swale Transect ID: PA, Alt A Plot ID: SS-12

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus phaeocephalus	H	FACW	9.		
2.			10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ✓ Other inundation observed in previous delineation in 2000

___ No Recorded Data Available

Field Observations:

Depth of Surface Water:	none	(in.)
Depth to Free Water in Pit:	>12	(in.)
Depth to Saturated Soil:	>12	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ✓ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ✓ Other (Explain in Remarks)

Remarks: Lack of rain in 2002 has caused swales to dry up. During previous delineations in 2000, inundation was observed in similar pools in the same vernal pool/swale complex.

SOILS

Map Unit Name (Series and Phase): NsA Norlon loamy sand 0-2% slopes Drainage Class: moderately well-drained

Taxonomy (Subgroup): Aeric Ochraquult

Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6"		10YR 3/2			sandy loam
6-16" pit bottom		10YR 3/2	7.5YR 4/6	common, medium distinct	sandy clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample point is in a COE jurisdictional wetland in a vernal swale
Hydrology indicators not directly observed this year after low rainfall levels. Swale complex observed to be inundated in previous years.

Approved by HQUSACE 3/92

Anya R. Tankl PWS 841
Nathan Gale PWS 1210

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements	Date: April 4, '02
Applicant/Owner: Vandenberg AFB	County: Santa Barbara
Investigator: Annie Faribb, Nathan Gale	State: CA
Do Normal Circumstances exist on the site? Yes (No)	Community ID: grassland/coastal sage scrub
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: PA, A4A
Is the area a potential Problem Area? Yes (No)	Plot ID: SS-13
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Avena barbata	H	UPL	9.		
2. Juncus phaeocephalus	H	FACW	10.		
3. Baccharis pilularis	S	UPL	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). < 50%

Remarks: Hydrophytic vegetation absent

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none (in.)

Depth to Free Water in Pit: > 12 (in.)

Depth to Saturated Soil: > 12 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology absent

SOILS

Map Unit Name (Series and Phase): NsA Nankin loamy sand 0-2% slope Drainage Class: moderately well-drained

Taxonomy (Subgroup): Aeric Ochraquult Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16" pit bottom		10YR 3/3			Sandy loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils absent

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

Is this Sampling Point Within a Wetland? (Circle) Yes (No)

Remarks: Sample point is located in an upland area.

Approved by HQUSACE 3/92

Angie K. Parrish PWS 841
or Nathan Gale PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Anuja Parikh, Nathan Gale	Date: April 4, '02 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? Yes (No) Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? (Yes) No (If needed, explain on reverse.)	Community ID: vernal swale Transect ID: PA Alt A Plot ID: SS-14

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus phaeocephalus	H	FACW	9.		
2. Juncus patens	H	FAC	10.		
3. Rumex acetosella	H	FAC-	11.		
4. Sisyrinchium bellum	H	FACW	12.		
5. Plantago coronopus	H	FAC	13.		
6. Avena barbata	H	UPL	14.		
7. Bacharis pilularis	S	UPL	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

✓ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ___ Aerial Photographs ✓ Other Inundated area in previous delineations 2000 ___ No Recorded Data Available	Wetland Hydrology Indicators: Primary Indicators: ___ Inundated ___ Saturated in Upper 12 Inches ___ Water Marks ___ Drift Lines ___ Sediment Deposits ___ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ✓ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: none (in.) Depth to Free Water in Pit: >12 (in.) Depth to Saturated Soil: >12 (in.)	

Remarks: Inundation of similar pools observed in the same vernal pool/swale complex in 2000. Current year - little rain and the pools have dried out

SOILS

Map Unit Name (Series and Phase): NsC Narlon loamy sand 2-9% slopes
Drainage Class: moderately well-drained
Taxonomy (Subgroup): Aeric Ochraqualf
Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5"		10YR 3/2			sandy loam
4-10" variable		10YR 4/2			sandy loam
6-16" = variable pitbottom		10YR 4/2	7.5YR 4/6	few, medium, distinct	clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Soils disturbed, mixed layers. Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Area has been disturbed. Sample point is in COE jurisdictional wetland in a vernal swale. Hydrology indicators not observed directly this year after low rainfall levels, but swale complex has been observed to be inundated in previous years.

Approved by HQUSACE 3/92

Angie C. Panebl, PWS 841

Nathan Gea, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Annija Paikli, Nathan Sale	Date: April 4 '02 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? Yes (No) Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: grassland/coastal sage scrub Transect ID: PA. Alt A Plot ID: SS-15

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Avena barbata	H	UPL	9.		
2. Rumex acetosella	H	FAC-	10.		
3. Baccharis pilularis	S	UPL	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). <50%

Remarks: Hydrophytic vegetation absent

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water:	none	(in.)
Depth to Free Water in Pit:	>12	(in.)
Depth to Saturated Soil:	>12	(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology absent

SOILS

Map Unit Name (Series and Phase): NsC Norton loamy sand, 2-9% slopes
Drainage Class: moderately well-drained
Taxonomy (Subgroup): Aeric Ochraqualf
Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16" = pit bottom		10YR 3/3			Sandy loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils absent

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

Is this Sampling Point Within a Wetland? — Yes (No) (Circle)

Remarks: Sample point is in an upland area.

Approved by HQUSACE 3/92

Amy K. Parish, PWS 841
Nathan Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements	Date: Apr 4 92
Applicant/Owner: Vandenberg AFB	County: Santa Barbara
Investigator: Anuja Parikh, Nathan Gale	State: CA
Do Normal Circumstances exist on the site? Yes (No)	Community ID: Vernal Swale
Is the site significantly disturbed (Atypical Situation)? Yes (No)	Transect ID: PA. Alt A
Is the area a potential Problem Area? Yes (No)	Plot ID: SS-16
(If needed, explain on reverse.)	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Eleocharis macrostachya	H	OBL	9.		
2. Juncus phaeocephalus	H	FACW	10.		
3. Rumex crispus	H	FACW-	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none (in.)

Depth to Free Water in Pit: >12 (in.)

Depth to Saturated Soil: >12 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ✓ Sediment Deposits algal/vegetation mats
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: wetland hydrology present. Station in swale/depression

SOILS

Map Unit Name (Series and Phase): NsA Norton loamy sand, 0-2% slopes Drainage Class: moderately well-drained

Taxonomy (Subgroup): Aeric Ochraqualf Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6"		10YR3/2			sandy loam
6-16"+ pit bottom		10YR4/2	7.5YR4/6	common medium distinct	sandy clay loam

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Sample point is in a COE jurisdictional wetland in a vernal swale

Approved by HQUSACE 3/92

Angie K. Parker, PWS 841
Nathan Gale, PWS 1216

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Landfill Drainage Improvements Applicant/Owner: Vandenberg AFB Investigator: Anuja Parikh, Walton Gale	Date: Apr 4, '02 County: Santa Barbara State: CA
Do Normal Circumstances exist on the site? Yes (No) Is the site significantly disturbed (Atypical Situation)? Yes (No) Is the area a potential Problem Area? Yes (No) (If needed, explain on reverse.)	Community ID: vernal swale Transect ID: PA Alt A Plot ID: SS-17

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Eleocharis macrostachya	H	OBL	9.		
2. Alopecurus saccatus	H	OBL	10.		
3. Juncus phaeocephalus	H	FACW	11.		
4. Baccharis douglasii	S	OBL	12.		
5. Phalaris lemmonii	H	FACW	13.		
6. Rumex crispus	H	FACW-	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). >50%.

Remarks: Hydrophytic vegetation present

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none (in.)

Depth to Free Water in Pit: >12 (in.)

Depth to Saturated Soil: >12 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ✓ Sediment Deposits algal/vegetation mats
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Wetland hydrology present. Station located in a swale.

SOILS

Map Unit Name (Series and Phase): NSA Norton loamy sand, 0-2% slope Drainage Class: moderately well-drained

Taxonomy (Subgroup): Aeric Ochraqualf Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast Size	Texture, Concretions, Structure, etc.
0-7"		10YR 3/2	7.5YR 3/4	few, fine, distinct	sandy loam
7-16" pit bottom		10YR 3/1	7.5YR 4/6	few, medium distinct	sandy clay

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ✓ Listed on Local Hydric Soils List inclusions in depressions
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Hydric soils present

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? (Yes) No

Remarks: Sample point is in a COE jurisdictional wetland in a vernal swale

Approved by HQUSACE 3/92

Angie K. Panik, PWS 841
Matthew Goetz, PWS 1216

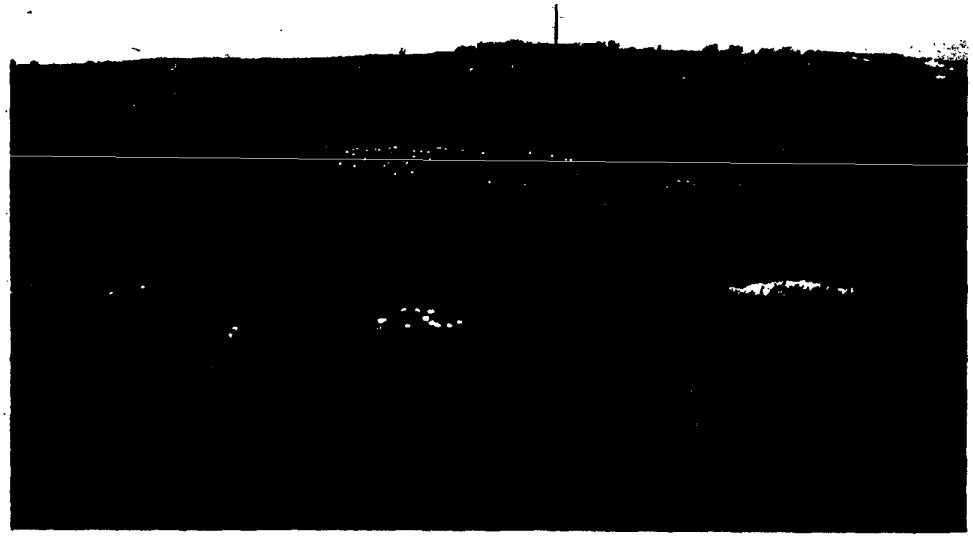
Appendix A, Attachment 7

Photodocumentation for Wetland Surveys

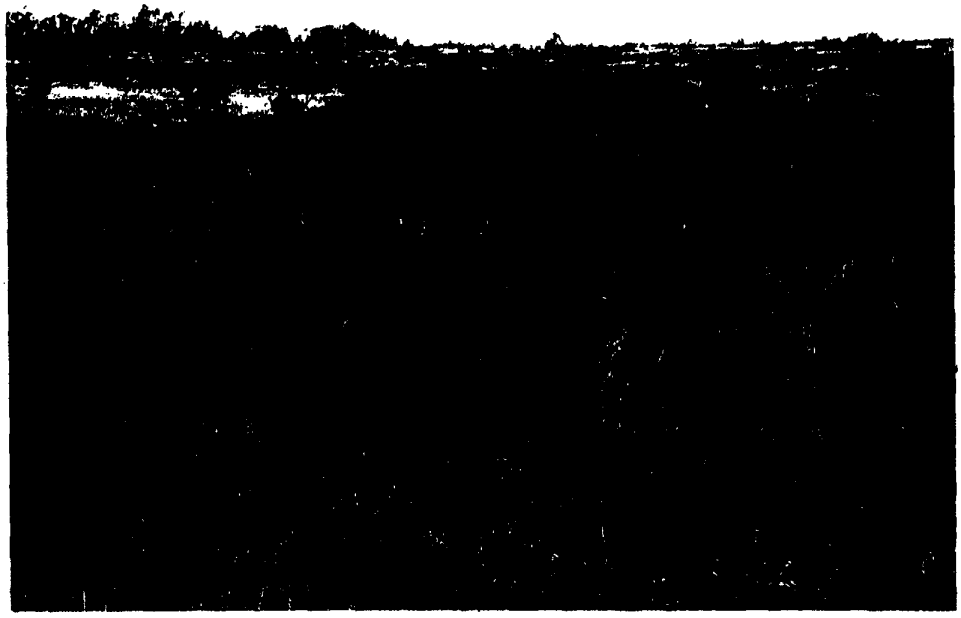
Sampling Station SS-1
Tributary to Oak Canyon
Waters of the United States

Sampling Station SS-2
Oak Canyon
Waters of the United States

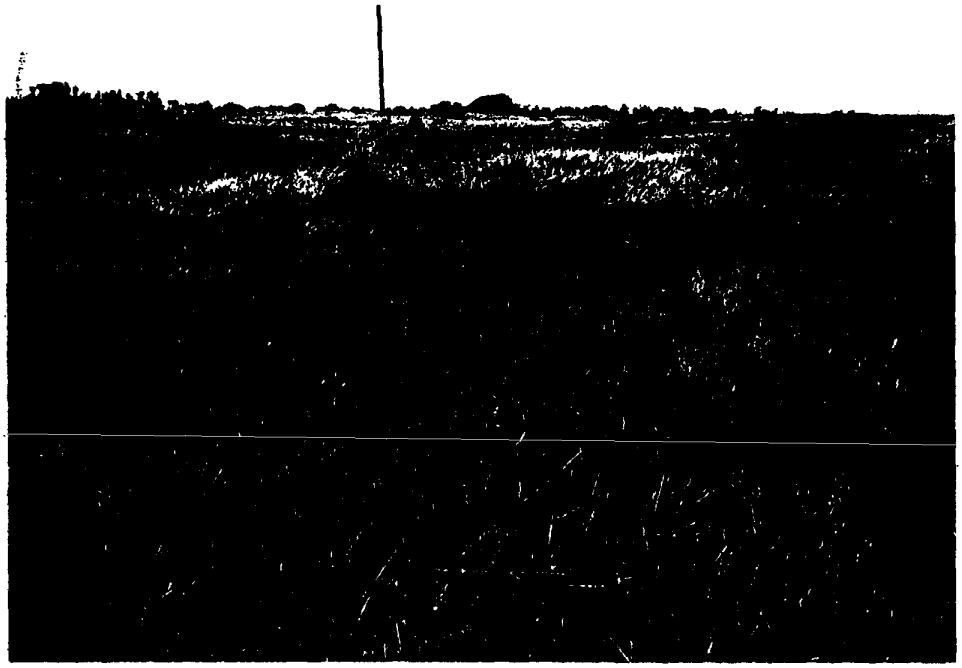
Sampling Station SS-3
Northeast Corner of Landfill
Waters of the United States



Non-Native Grassland with
Vernal Wetland Swales
North of Pine Canyon Road



Sampling Station SS-4, North of Pine Canyon Road, Vernal Wetland Swale

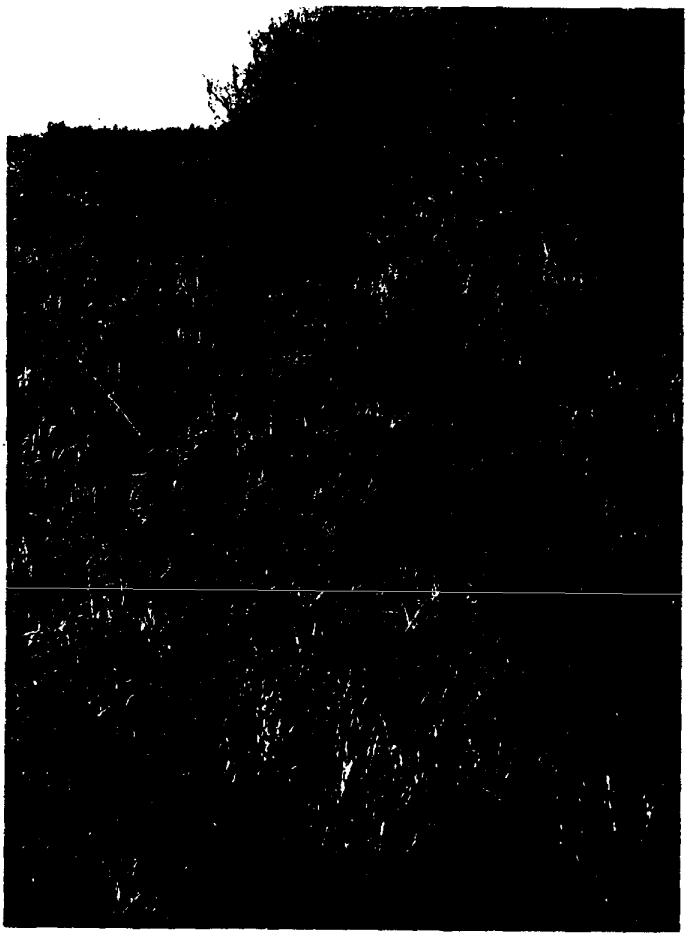


Sampling Station SS-5, North of Pine Canyon Road, Vernal Wetland Swale

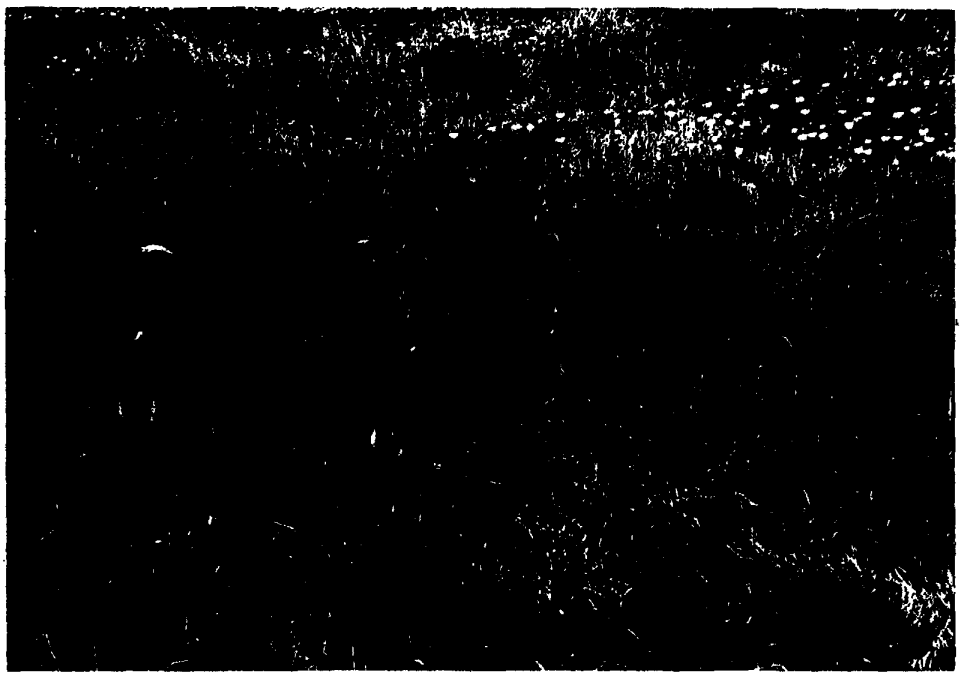
Sampling Station SS-6
North of Pine Canyon Road
Vernal Wetland Swale

Sampling Station SS-7
Tributary to Lake Canyon
Willow Woodland Wetland

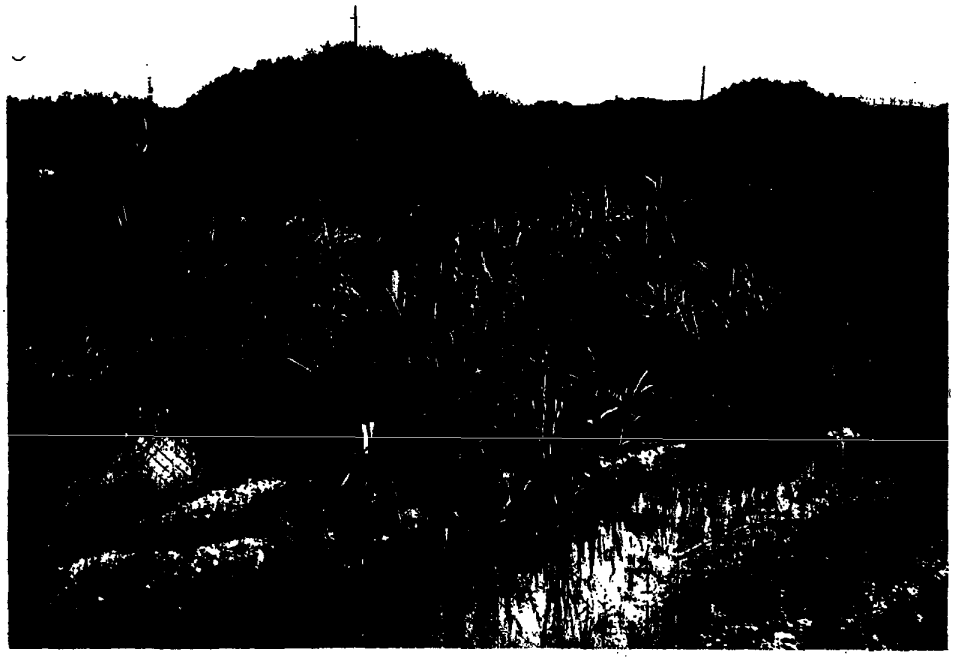
Sampling Station SS-8
North of Landfill
Willow Woodland Wetland



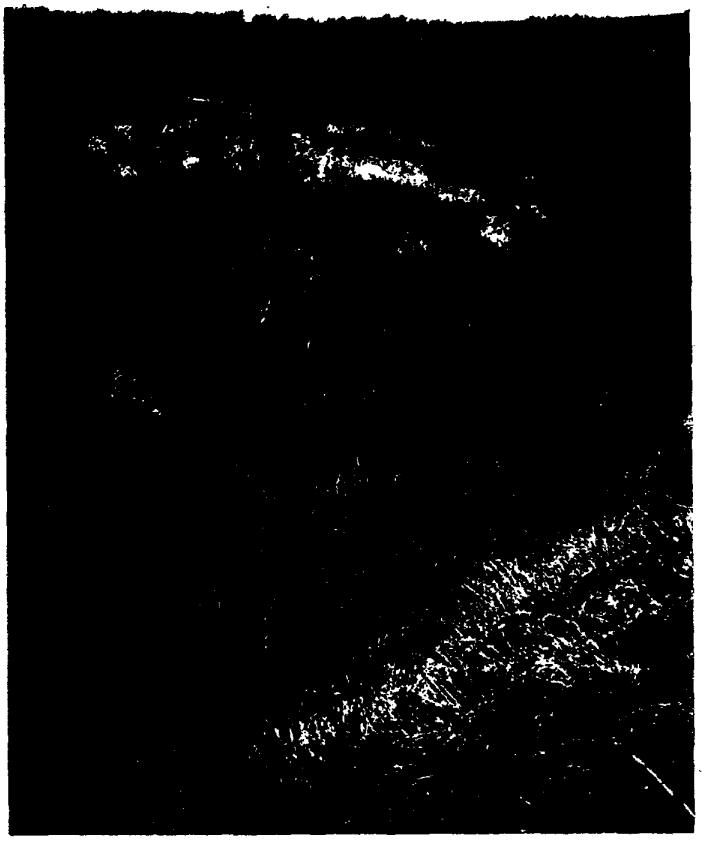
Sampling Station SS-9
North of Landfill
Vernal Wetland Swale



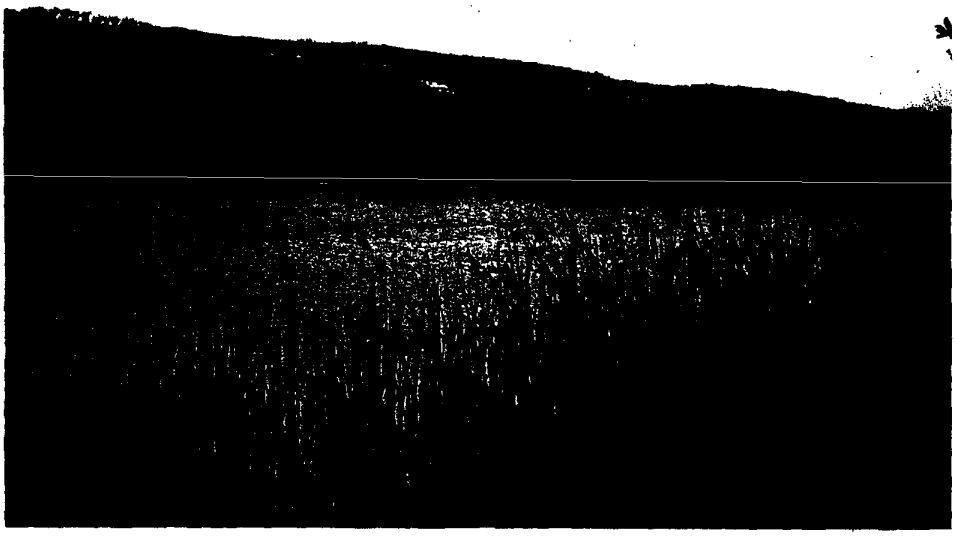
Sampling Station SS-10, South of Pine Canyon Road, Artificially Created Wetland



Sampling Station SS-11, Northeast Part of Landfill, Artificially Created Wetland

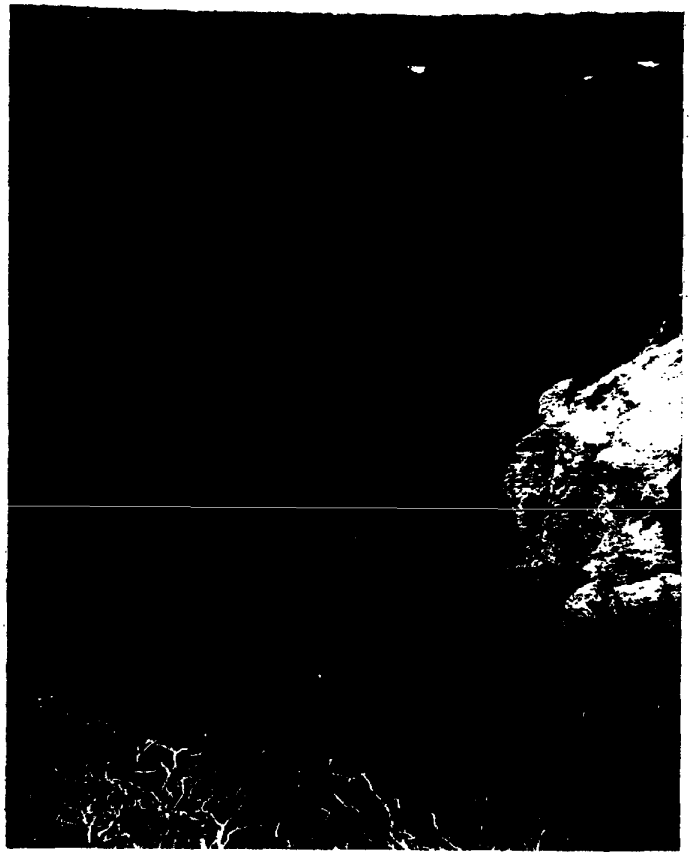


Area of the Outlet for the Proposed Action Storm Drain

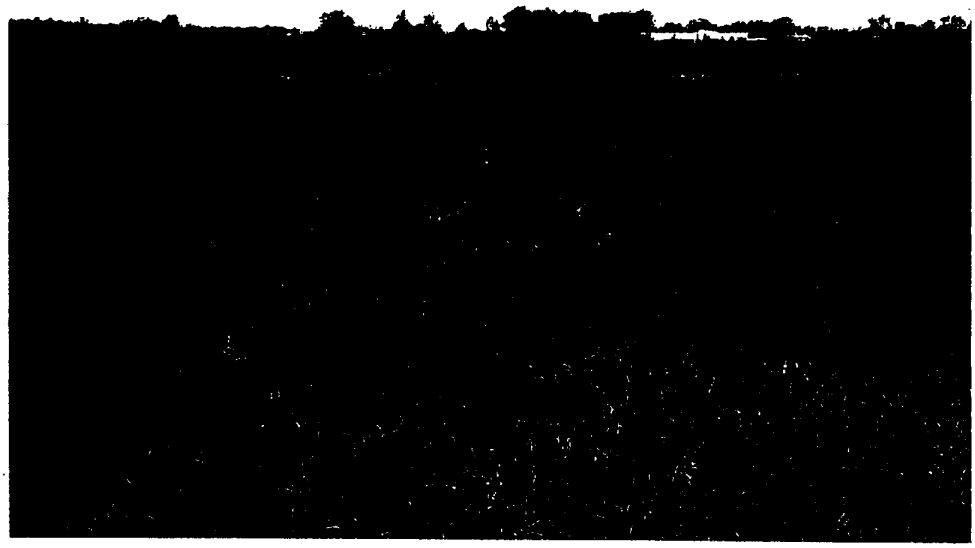


Freshwater Marsh and Willow Woodland Middle Lake, Lake Canyon

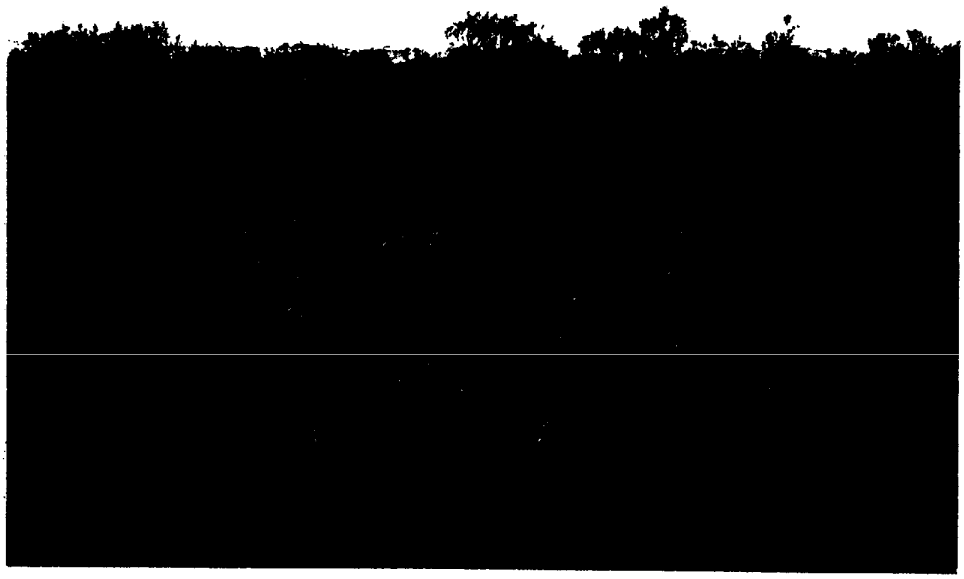
Area of the Outlet for the Alternative 1 and Alternative 2 Storm Drain



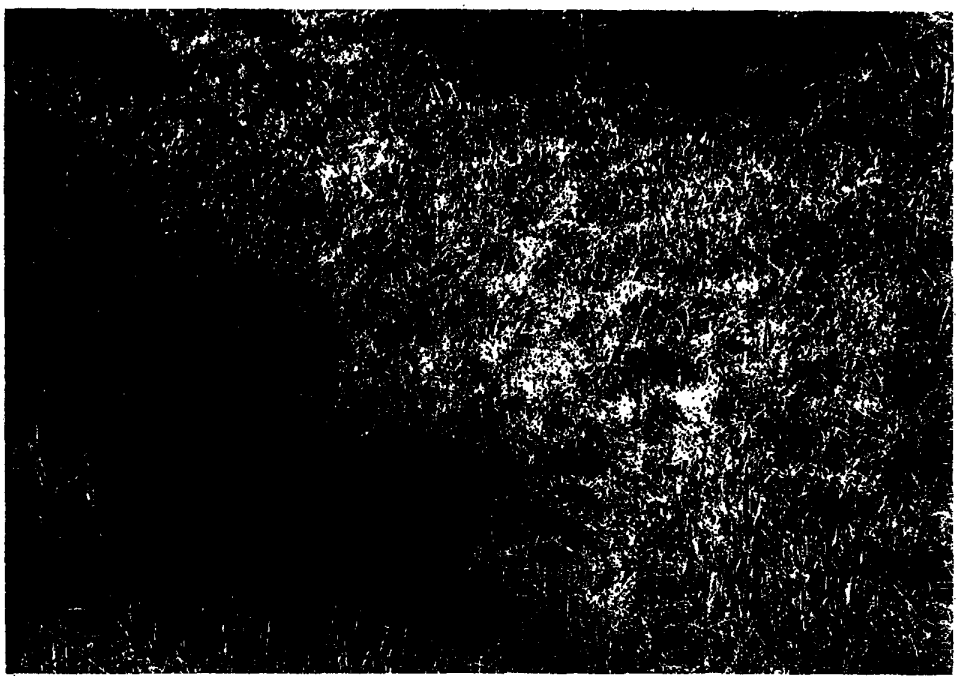
Oak Woodland Tributary to Oak Canyon and Oak Canyon



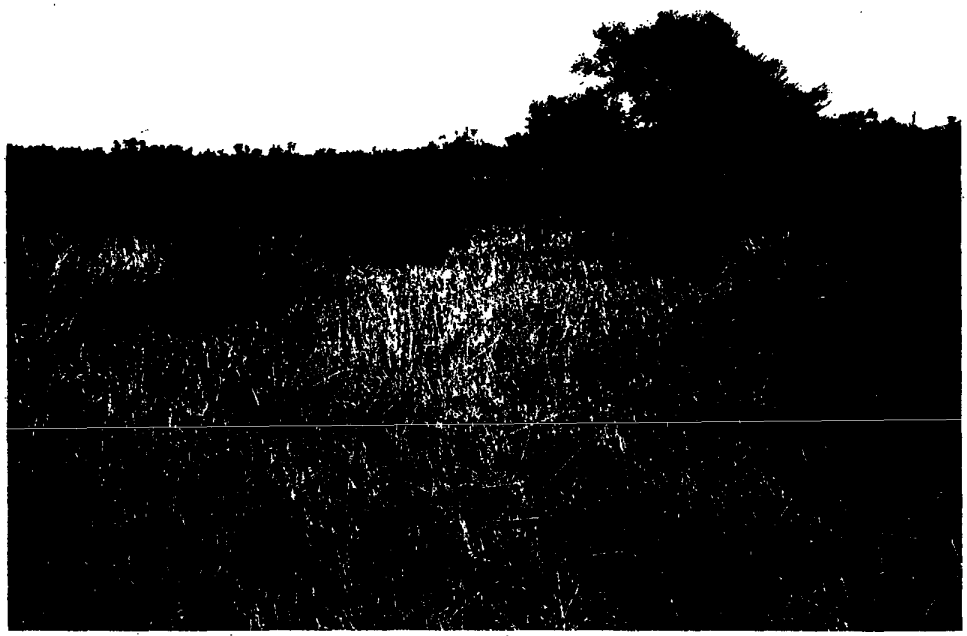
Sampling Station SS-12, North of Pine Canyon Road, Vernal Wetland Swale



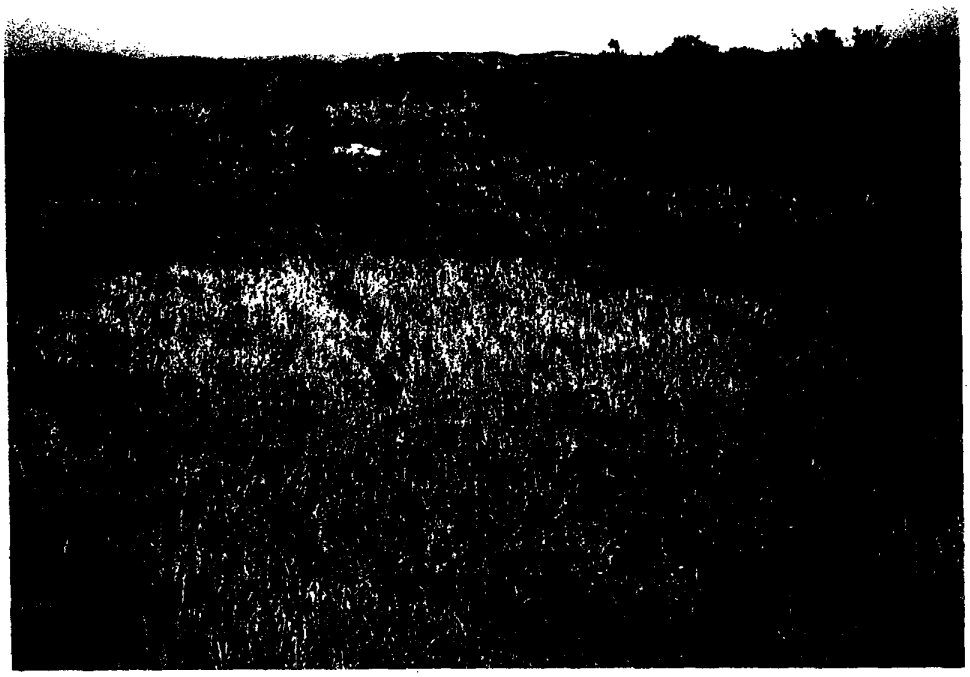
Sampling Station SS-13, North of Pine Canyon Road, Upland Grassland/Coastal Sage Scrub



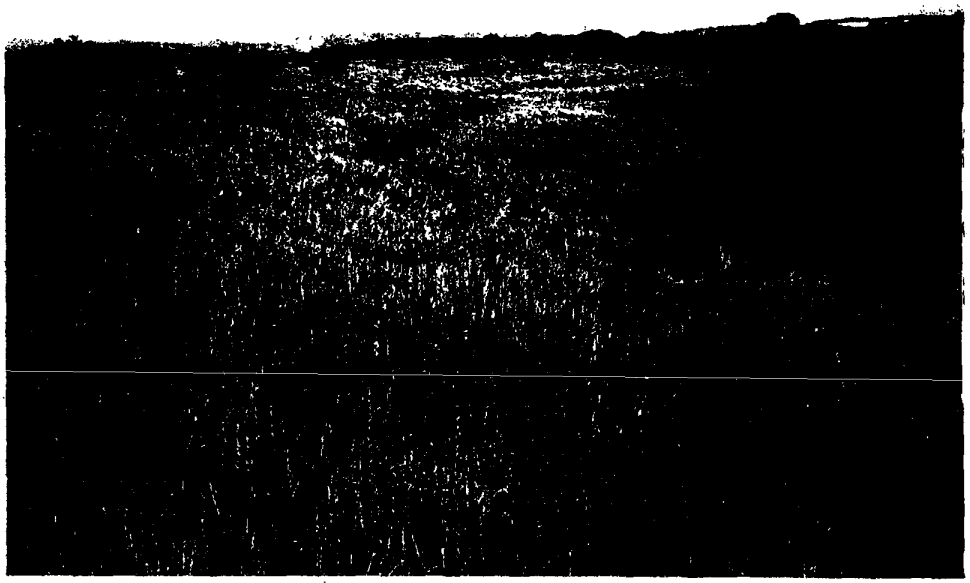
Sampling Station SS-14, North of Pine Canyon Road, Vernal Wetland Swale



Sampling Station SS-15, North of Pine Canyon Road, Upland Grassland/Coastal Sage Scrub



Sampling Station SS-16, North of Pine Canyon Road, Vernal Wetland Swale



Sampling Station SS-17, North of Pine Canyon Road, Vernal Wetland Swale

B AIR QUALITY CONFORMITY ANALYSIS

APPENDIX B
AIR QUALITY CONFORMITY ANALYSIS

1.0 CONFORMITY DETERMINATION

1.1 EMISSION THRESHOLDS AND QUANTIFICATION

The emission threshold for determining conformity is based on the National Ambient Air Quality Standard (NAAQS) attainment standard for Santa Barbara County. The NAAQS classification for Santa Barbara County is serious nonattainment for ozone. Particulate matter 10 microns or less in diameter (PM_{10}), sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead are classified as in attainment. The serious nonattainment status and corresponding threshold of 50 tons per year for ozone will be used to determine general conformity.

Emission quantification is defined as the sum of all direct and indirect criteria pollutants and precursor emissions, including stationary and mobile emission sources. Direct and indirect emissions are distinguished by timing and location rather than the type of emission source. Direct emissions occur at the same time and place as the federal action. Indirect emissions include those that may occur later or at a distance from the federal action. General conformity limits the scope of indirect emissions to those that can be quantified and are reasonably foreseeable by the federal agency at the time of analysis, and those for which the federal agency can practicably control and maintain control through its continuing program responsibility.

1.2 EVALUATING CONFORMITY AND REPORTING REQUIREMENTS

General conformity rule applies to federal actions that are not covered by transportation conformity rule, with several listed exceptions. Other than the listed exemptions and presumptions of conformity, general conformity applies to actions in which projected emissions exceed applicable conformity *de minimis* thresholds. However, if the emissions from a federal action do not equal or exceed *de minimis* thresholds but do represent 10 percent or more of a nonattainment or maintenance area's total emissions of any criteria pollutant, the action is considered "regionally significant" and the requirements of conformity determination apply.

The reporting requirements for the conformity analysis are not required if the proposed project's direct and indirect emissions are less than the established *de minimis* thresholds and are not considered regionally significant.

1.3 AIR QUALITY JURISDICTION AND ATTAINMENT STATUS

The proposed project would take place in the North Base section of Vandenberg Air Force Base (AFB) in Santa Barbara County, California. The proposed project is subject to Santa Barbara County Air Pollution Control District (SBCAPCD) rules, regulations, and jurisdiction.

The NAAQS classification for SBCAPCD is serious nonattainment for ozone. Sulfur dioxide, nitrogen dioxide, carbon monoxide, PM_{10}, and lead are classified as in attainment. The serious nonattainment status and corresponding threshold for ozone will be used to determine general conformity. U.S. Environmental Protection Agency (U.S. EPA) threshold limits used to determine general conformity are listed in Table B-1.

Table B-1
U.S. EPA Threshold Limits Used to Determine General Conformity

Pollutant	Attainment Status	Threshold Level (tons/yr)
Ozone (volatile organic compound [VOC] or nitrogen oxides)	Serious	50
	Severe	25
	Extreme	10
	Other ozone nonattainment areas outside of ozone transport region	100
VOC	Not applicable No attainment standards	50
Nitrogen oxides	Not applicable No attainment standards	100
Carbon monoxide	All nonattainment areas	100
PM_{10}	Moderate	100
	Serious	70
Sulfur dioxide or nitrogen dioxide	All nonattainment areas	100
Lead	All nonattainment areas	25

Source: 40 CFR 93.135 (b).

1.4 SBCAPCD EMISSIONS SUMMARY

The SBCAPCD 2005 Forecast Planning Emission Inventory, as listed in the 2001 Maintenance Plan, was compared with the total emissions generated from the basewide demolition program at Vandenberg AFB. This comparison was performed to determine whether federal action is "regionally significant." The SBCAPCD 2005 Forecast Planning Emission Inventory is listed in Table B-2.

Table B-2
2005 Forecast Planning Emission Inventory
SBCAPCD Summary of Emissions, Major Source Categories

Source	Nitrogen Oxides	Volatile Organic Compounds
Stationary Source Area Sources (tons/day)	5.09	14.65
Mobile Sources (tons/day)	35.03	17.66
Outer Continental Shelf Sources (tons/day)	34.26	2.68
Total	**74.38**	**34.99**

Source: SBCAPCD 2001 Maintenance Plan.

Outer Continental Shelf sources are part of SBCAPCD jurisdiction and the county emission inventory; therefore, these emission sources were included in the total emissions when determining whether a federal action is regionally significant.

1.5 WORST CASE SCENARIO EMISSIONS AND CONFORMITY DETERMINATION

The serious nonattainment status of Santa Barbara County and the corresponding threshold of 50 tons per year for ozone are used to determine general conformity. Table B-3 shows a comparison of the estimated annual project emissions with the threshold levels.

Table B-3
Construction Project Emissions
at Vandenberg AFB

Emissions	Nitrogen Oxides (tons/year)	Volatile Organic Compounds (tons/year)
Project emissions	7.22[1]	2.23[1]
Conformity threshold	50	50
Significance	No	No

Notes: 1 - Proposed project emissions for NO_x and VOC are obtained from Table B-5, Table B-6, Table B-7, and Table B-8.

A comparison among the SBCAPCD 2005 Forecast Planning Emission Inventory Levels, the proposed project emissions, and the latter as percent of the former is shown in Table B-4.

Table B-4
Comparison of SBCAPCD 2005 Forecast Planning Emission Inventory and Proposed Project Emissions

Source Summary	Nitrogen Oxides	Volatile Organic Compound
SBCAPCD 2005 Forecast Planning Emission Inventory (tons/day)	74.38	34.99
Proposed Project Emissions (tons/day[1])	0.03	0.01
Percent of SBCAPCD 2005 Forecast Planning Emission Inventory (%)	<1.00	<1.00
Percent Conformity Threshold (%)	10	10
Significance	No	No

1 - Assuming 21 working days per month/252 working days per year

2.0 TECHNICAL ASSUMPTIONS

Based on the proponent's worst-case scenario, Alternative 1, the following assumptions are made regarding the required manpower, construction equipment, work duration, construction materials, and motor vehicle travel for the proposed project.

2.1 MANPOWER AND DURATION

A maximum of 50 workers per day are required to perform the various construction operations and related tasks. The project's estimated completion period is 6 months.

2.2 MOBILE EQUIPMENT

The following heavy-duty mobile vehicles would be used to complete this project (number and type):

2 excavators	1 concrete mixer
6 front-end loaders/backhoes	1 crane
4 rubber tire dozers	4 water truck
4 sheep's foot	2 haul trucks
2 grader	4 pickup trucks
4 scraper	1 concrete truck
1 concrete pump	30 dump trucks

2.3 CONSTRUCTION MATERIALS AND REFILL SOIL

- Drain length is 6,500 feet;
- For drain interconnections, the volume of concrete required is 500 cubic yards;
- Volume of soil removed by trenching is 88,452 cubic yards;
- Refill soil required is 25,000 cubic yards; and
- Disturbed area is 12.5 acres.

The concrete drain will be prefabricated. All storage areas of refill soil and storage piles of construction materials will be covered. Refill soil will be taken from North Vandenberg AFB. Unused excavated soil will be transported to North Vandenberg AFB sites. Distance from these sites will be no more than 25 miles from construction site.

2.4 TRAVEL BY HEAVY-DUTY TRUCKS

The dump trucks and water trucks will travel an average of 5 miles on-site and 25 miles off-site per day. The haul truck and pickup trucks will travel an average of 10 miles on-site and 25 miles off-site per day. The concrete truck will travel 25 miles from and to Lompoc and will also travel 10 miles on base.

2.5 WORKER COMMUTES

At maximum, 23 and 50 light-duty, gasoline-powered vehicles will be used by workers to commute to the job site each working day during trenching/pipe laying and grading operations, respectively. The average commute for a worker is estimated at 10 miles on-site and 25 miles off-site.

2.6 ASSESSMENT OF VOC EMISSIONS FROM IRP SITE 3

A section of the project will involve trenching through the Installation Restoration Program Site 3, which is contaminated with volatile and non-volatile hydrocarbons and various metals. Site 3 is an area of approximately 784,000 square feet and is located on the southeast side of New Mexico Avenue and surrounded by New Mexico Avenue, Washington Avenue, and Sixth Street. During trenching, soil excavation and piling, and ground disturbance activities at Site 3, the volatile hydrocarbons in the contaminated soil will potentially volatilize and result in fugitive hydrocarbon emissions. For the purpose of this analysis, the potential hydrocarbon emissions are estimated and included in the total project VOC emissions. Table B-5 presents the estimated total hydrocarbon emissions from the excavated soil. The following assumptions are made in order to estimate those emissions.

- Hydrocarbon concentrations are uniform throughout the excavated soil;
- As a worst case scenario, 100 percent of the hydrocarbon will volatilize;
- Trench depth is 19.25 feet;
- The trench width is 70 inches;
- The Site 3 trench length is 2,275 feet; and
- The soil density is 2.47 g/cm^3 (2,470 kg/m^3) based on the average soil density at Site 3 (Installation Restoration Program Vandenberg Air Force Base Remedial Investigation Report -Site 3, July 1997).

The Site 3 groundwater containing VOCs is at a depth of 26 feet. Potentially, some trenching would involve groundwater disturbance. VOC concentrations in groundwater (ranging from 0.78 microgram per liter to 26,000 micrograms per liter) are negligible. Therefore, VOC emissions resulting from groundwater are negligible and included in this analysis.

The following equation was used to calculate the VOC emissions from the excavated soil from Site 3:

$A_m = (A_c)(D_s)(S)$

Where

A_m = Amount of VOC A present in excavated soil
A_c = Concentration of A in excavated soil

A = 1,1,2-Trichloroethane
D_s = Soil density
S = Soil Volume = (trench length) (trench width) (trench depth)

Example for 1,1,2-trichloroethane

A_c =0.0081 mg/kg

D_s = (2.47g/cm^3) (1x10^6 cm^3/m^3) (0.001kg/g) = 2,470 kg/m^3

S = {(2,275 ft) [(70 in)(1 ft/12 in)] (19.5 ft)} (2.8316846x10^{-2} m^3/ ft^3) = 7,327.87 m^3

A_m = [(0.0081 mg/kg)(0.000001kg/mg)] (2.47x10^3 kg/m^3) (7327.87 m^3)= 1.47E-01 kg

A_m = (1.47E-01 kg) (1 lb /0.454 kg) = 3.23E-01 lb

A_m = (3.23E-01 lb) (1ton/2000 lb) = 1.61E-04 tons

Table B-5
VOC Emissions from Excavated Soil at Site 3

VOC	VOC Concentration (kg/kg)	Soil Density (kg/m^3)	Soil Volume (m^3)	Total VOC (kg)	Total VOC (lb)	Total VOC (ton)
1,1,2-Trichloroethane	8.10E-09	2.47E+03	7,327.87	0.15	3.23E-01	1.61E-04
Benzo(g,h,i)perylene	9.77E-07	2.47E+03	7,327.87	17.67	3.89E+01	1.95E-02
Carbon disulfide	6.50E-09	2.47E+03	7,327.87	0.12	2.59E-01	1.30E-04
Dibenz(a,h)anthracene	6.55E-07	2.47E+03	7,327.87	11.86	2.61E+01	1.31E-02
Fluoranthene	6.57E-08	2.47E+03	7,327.87	1.19	2.62E+00	1.31E-03
Indeno(1,2,3-cd)pyrene	1.80E-07	2.47E+03	7,327.87	3.25	7.17E+00	3.58E-03
Pyrene	4.60E-08	2.47E+03	7,327.87	0.83	1.83E+00	9.17E-04
Toluene	1.30E-09	2.47E+03	7,327.87	0.02	5.18E-02	2.59E-05
Diesel range total petroleum hydrocarbons	6.83E-05	2.47E+03	7,327.87	1,236.22	2.72E+03	1.36E+00
Trichloroethene	1.23E-07	2.47E+03	7,327.87	2.23	4.90E+00	2.45E-03
					Total VOCs	**1.40E+00**

Notes: kg - kilograms
kg/kg - kilograms per kilogram
kg/m^3 - kilograms per cubic meter
m^3 - cubic meter
VOC - volatile organic compound

2.7 DAILY AND PROJECT EMISSIONS

Estimated daily and project construction, mobile equipment, and worker on-road mobile emissions are presented on Tables B-6, B-7, and B-8.

Table B-6
Daily and Project Emissions for Construction

Activity/Source		HP	Fuel	Units	Days/ project	Hrs/ day	Hrs/ project	NO_X			SO_X		
								lbs/hr	lbs/day	lbs/project	lbs/hr	lbs/day	lbs/project
Trenching and Pipe Laying													
Excavator		34	Diesel	2	30	8	240	0.48	7.68	230.40	0.04	0.64	19.20
FE Loader/Backhoe		77	Diesel	6	30	8	240	0.78	37.44	1,123.20	0.07	3.36	100.80
Rubber Tire Dozer		356	Diesel	1	30	8	240	4.83	38.64	1,159.20	0.42	3.36	100.80
Sheep's Foot (Tractor)		69	Diesel	2	30	8	240	0.91	14.56	436.80	0.08	1.28	38.40
	Subtotal							**7.00**	**98.32**	**2,949.60**	**0.61**	**8.64**	**259.20**
Grading													
Grader		157	Diesel	2	30	8	240	1.89	30.24	907.20	0.18	2.88	86.40
Scraper		267	Diesel	4	30	8	240	3.35	107.20	3,216.00	0.35	11.20	336.00
Rubber Tire Dozer		356	Diesel	4	30	8	240	4.83	154.56	4,636.80	0.42	13.44	403.20
Sheep's Foot (Tractor)		69	Diesel	4	30	8	240	0.91	29.12	873.60	0.08	2.56	76.80
	Subtotal							**10.98**	**321.12**	**9,633.60**	**1.03**	**30.08**	**902.40**
Concrete Use													
Concrete Pump		11	Diesel	1	30	8	240	0.31	2.48	74.40	0.03	0.24	7.20
Concrete Mixer		11	Diesel	1	30	8	240	0.15	1.20	36.00	0.01	0.08	2.40
	Subtotal							**0.46**	**3.68**	**110.40**	**0.04**	**0.32**	**9.60**
Drain Material Placement													
Crane		194	Diesel	1	30	8	240	1.92	15.36	460.80	0.17	1.36	40.80
	Subtotal							**1.92**	**15.36**	**460.80**	**0.17**	**1.36**	**40.80**
Total Emissions (lbs)									**438.48**	**13,154.40**		**40.40**	**1,212.00**
Total Emissions (tons)									**0.22**	**6.58**			**0.61**

Table B-6
Daily and Project Emissions for Construction

Activity/Source		CO			PM_{10}			HC (a)			Notes
		lbs/hr	lbs/day	lbs/project	lbs/hr	lbs/day	lbs/project	lbs/hr	lbs/day	lbs/project	
Trenching and Pipe Laying											
Excavator		0.22	3.52	105.60	0.03	0.48	14.40	0.02	0.32	9.60	b
FE Loader/Backhoe		0.54	25.92	777.60	0.04	1.92	57.60	0.11	5.28	158.40	b
Rubber Tire Dozer		2.10	16.80	504.00	0.10	0.80	24.00	0.42	3.36	100.80	b
Sheep's Foot (Tractor)		0.44	7.04	211.20	0.04	0.64	19.20	0.08	1.28	38.40	b
	Subtotal	**3.30**	**53.28**	**1,598.40**	**0.21**	**3.84**	**115.20**	**0.63**	**10.24**	**307.20**	
Grading											
Grader		0.72	11.52	345.60	0.09	1.44	43.20	0.27	4.32	129.60	b
Scraper		1.94	62.08	1,862.40	0.26	8.32	249.60	0.18	5.76	172.80	b
Rubber Tire Dozer		2.10	67.20	2,016.00	0.10	3.20	96.00	0.42	13.44	403.20	b
Sheep's Foot (Tractor)		0.44	14.08	422.40	0.04	1.28	38.40	0.08	2.56	76.80	b
	Subtotal	**5.20**	**154.88**	**4,646.40**	**0.49**	**14.24**	**427.20**	**0.95**	**26.08**	**782.40**	
Concrete Use											
Concrete Pump		0.19	1.52	45.60	0.02	0.16	4.80	0.03	0.24	7.20	b
Concrete Mixer		0.06	0.48	14.40	0.01	0.08	2.40	0.01	0.08	2.40	
	Subtotal	**0.25**	**2.00**	**60.00**	**0.03**	**0.24**	**7.20**	**0.04**	**0.32**	**9.60**	
Drain Material Placement											
Crane		0.75	6.00	180.00	0.13	1.04	31.20	0.25	2.00	60.00	b
	Subtotal	**0.75**	**6.00**	**180.00**	**0.13**	**1.04**	**31.20**	**0.25**	**2.00**	**60.00**	
Total Emissions (lbs)			**216.16**	**6,484.80**		**19.36**	**580.80**		**38.64**	**1,159.20**	
Total Emissions (tons)				**3.24**			**0.29**			**0.58**	

Table B-6
Daily and Project Emissions for Construction

Notes:	a	-	Hydrocarbon emissions are the sum of hydrocarbon and aldehyde emission factors.
	b	-	SCAQMD CEQA guidance document.
	CO	-	carbon monoxide
	g	-	grams
	HC	-	hydrocarbon is a VOC emission
	hr	-	hour
	lbs	-	pounds
	NOx	-	oxides of nitrogen
	PM	-	particulate matter
	VMT	-	vehicle miles traveled

Table B-7
Daily and Project Mobile Source Emissions for Construction

Activity/Source	Emission Type	Fuel	Units	Days/ Project	VMT/day	VMT/ Project	NO_x (g/VMT)	NO_x lbs/day	NO_x lbs/project	SO_x (g/VMT)	SO_x lbs/day	SO_x lbs/project
Trenching and Pipe Laying												
Water Truck	On-site	Diesel	2	30	5	150	12.01	0.26	7.94	0.00	0.00	0.00
	Off-site	Diesel	2	30	25	750	13.69	1.51	45.27	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**1.77**	**53.21**		**0.00**	**0.00**
Haul Truck	On-site	Diesel	2	15	10	150	12.01	0.53	7.94	0.00	0.00	0.00
	Off-site	Diesel	2	15	25	375	13.69	1.51	22.64	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**2.04**	**30.58**		**0.00**	**0.00**
Pick-Up Truck	On-site	Diesel	4	30	10	300	12.01	1.06	31.77	0.00	0.00	0.00
	Off-site	Diesel	4	30	25	750	13.69	3.02	90.54	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**4.08**	**122.32**		**0.00**	**0.00**
Concrete Use												
Concrete Truck	On-site	Diesel	1	15	10	150	12.01	0.26	3.97	0.00	0.00	0.00
	Off-site	Diesel	1	15	25	375	13.69	0.75	11.32	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**1.02**	**15.29**		**0.00**	**0.00**
Grading												
Dump Truck	On-site	Diesel	30	15	5	75	12.01	3.97	59.57	0.00	0.00	0.00
	Off-site	Diesel	30	15	25	375	13.69	22.64	339.54	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**26.61**	**399.11**		**0.00**	**0.00**
Water Truck	On-site	Diesel	4	30	5	150	12.01	0.53	15.89	0.00	0.00	0.00
	Off-site	Diesel	4	30	25	750	13.69	3.02	90.54	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**3.55**	**106.43**		**0.00**	**0.00**
Haul Truck	On-site	Diesel	2	15	10	150	12.01	0.53	7.94	0.00	0.00	0.00
	Off-site	Diesel	2	15	25	375	13.69	1.51	22.64	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**2.04**	**30.58**		**0.00**	**0.00**
Pick-Up Truck	On-site	Diesel	4	30	10	300	12.01	1.06	31.77	0.00	0.00	0.00
	Off-site	Diesel	4	30	25	750	13.69	3.02	90.54	0.00	0.00	0.00
	Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**4.08**	**122.32**		**0.00**	**0.00**
Construction Employee Commuting During Trenching												
Construction Employee	25 Surface Road	Gas	23	60	10	600	0.90	0.46	27.38	0.00	0.00	0.00
	55 Highway	Gas	23	60	25	1,500	0.60	0.76	45.64	0.00	0.00	0.00
	Cold Start	Gas	23	60	4	240	2.77	0.56	33.71	0.00	0.00	0.00
	Hot Start	Gas	23	60	4	240	1.76	0.36	21.42	0.00	0.00	0.00
	Hot Soak	Gas	23	60	4	240	0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal (g/veh/day)	Gas	23	60	1	60	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**2.14**	**128.14**		**0.00**	**0.00**
Construction Employee Commuting During Grading												
Construction Employee	25 Surface Road	Gas	50	60	10	600	0.90	0.99	59.52	0.00	0.00	0.00
	55 Highway	Gas	50	60	25	1,500	0.60	1.65	99.21	0.00	0.00	0.00
	Cold Start	Gas	50	60	4	240	2.77	1.22	73.28	0.00	0.00	0.00
	Hot Start	Gas	50	60	4	240	1.76	0.78	46.56	0.00	0.00	0.00
	Hot Soak	Gas	50	60	4	240	0.00	0.00	0.00	0.00	0.00	0.00
	Diurnal (g/veh/day)	Gas	50	60	1	60	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal								**4.64**	**278.57**		**0.00**	**0.00**
Total Emissions (lbs)								**51.96**	**1,286.55**		**0.00**	**0.00**
Total Emissions (tons)								**0.03**	**0.64**			**0.00**

Table B-7
Daily and Project Mobile Source Emissions for Construction

Activity/Source		CO (g/VMT)	CO lbs/day	CO lbs/project	PM_{10} (g/VMT)	PM_{10} lbs/day	PM_{10} lbs/project	HC (g/VMT)	HC lbs/day	HC lbs/project	Notes
Trenching and Pipe Laying											
Water Truck		11.03	0.24	7.30	2.63	0.06	1.74	2.78	0.06	1.84	a
		6.73	0.74	22.26	2.63	0.29	8.70	1.60	0.18	5.29	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**0.99**	**29.55**		**0.35**	**10.44**		**0.24**	**7.13**	
Haul Truck		11.03	0.49	7.30	2.63	0.12	1.74	2.78	0.12	1.84	a
		6.73	0.74	11 13	2.63	0.29	4.35	1.60	0.18	2.65	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**1.23**	**18.42**		**0.41**	**6.09**		**0.30**	**4.48**	
Pick-Up Truck		11.03	0.97	29.18	2.63	0.23	6.96	2.78	0.25	7.35	a
		6.73	1 48	44.51	2 63	0.58	17.39	1.60	0.35	10.58	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0 00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**2.46**	**73.69**		**0.81**	**24.35**		**0.60**	**17.94**	
Concrete Use											
Concrete Truck		11.03	0.24	3.65	2.63	0.06	0.87	2.78	0 06	0.92	a
		6.73	0.37	5.56	2.63	0.14	2.17	1.60	0.09	1.32	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0 00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**0.61**	**9.21**		**0.20**	**3.04**		**0.15**	**2.24**	
Grading											
Dump Truck		11.03	3.65	54.71	2.63	0.87	13.05	2.78	0.92	13.79	a
		6.73	11 13	166.92	2.63	4.35	65.23	1.60	2.65	39.68	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**14.78**	**221.63**		**5.22**	**78.27**		**3.56**	**53.47**	
Water Truck		11.03	0.49	14.59	2.63	0.12	3.48	2.78	0.12	3.68	a
		6.73	1.48	44.51	2.63	0.58	17.39	1.60	0.35	10.58	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**1.97**	**59.10**		**0.70**	**20.87**		**0.48**	**14.26**	
Haul Truck		11.03	0.49	7.30	2.63	0.12	1.74	2.78	0.12	1.84	a
		6.73	0.74	11.13	2.63	0.29	4.35	1.60	0.18	2.65	a
		0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**1.23**	**18.42**		**0.41**	**6.09**		**0.30**	**4.48**	
Pick-Up Truck		11.03	0.97	29.18	2.63	0.23	6.96	2.78	0.25	7.35	a
		6.73	1.48	44.51	2.63	0.58	17.39	1.60	0.35	10.58	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**2.46**	**73.69**		**0.81**	**24.35**		**0.60**	**17.94**	
Construction Employee Commuting During Trenching											
Construction Employee	25	8.87	4.50	269.86	0.11	0.06	3.35	0.91	0.46	27.69	d
	55	4.09	5.18	311.08	0.11	0.14	8.37	0.12	0.15	9.13	d
		93.49	18.96	1,137.72	0.00	0.00	0.00	5.21	1.06	63.40	d
		12.74	2.58	155.04	0.00	0.00	0.00	1.38	0.28	16.79	d
		0.00	0.00	0.00	0.00	0.00	0.00	2.11	0.43	0.28	d
		0.00	0.00	0.00	0.00	0.00	0.00	5.01	0.25	0.66	d
	Subtotal		**31.23**	**1,873.69**		**0.20**	**11.71**		**2.63**	**117.95**	
Construction Employee Commuting During Grading											
Construction Employee	25	8.87	9 78	586.64	0.11	0.12	7.28	0.91	1.00	60.19	d
	55	4.09	11.27	676.26	0.11	0.30	18.19	0.12	0.33	19.84	d
		93.49	41.22	2,473.30	0.00	0.00	0.00	5.21	2.30	137.83	d
		12.74	5.62	337.04	0.00	0.00	0.00	1 38	0.61	36.51	d
		0.00	0.00	0.00	0.00	0.00	0.00	2.11	0.93	0.28	d
		0.00	0.00	0.00	0.00	0.00	0.00	5.01	0.55	0.66	d
	Subtotal		**67.89**	**4,073.24**		**0.42**	**25.46**		**5.72**	**255.31**	
Total Emissions (lbs)			**124.83**	**6,450.65**		**9.52**	**210.68**		**14.58**	**495.20**	
Total Emissions (tons)				**3.23**			**0.11**			**0.25**	

Table B-7
Daily and Project Mobile Source Emissions for Construction

Notes:	a	-	EMFAC7F (emission factor in grams /mile)
	b	-	EMFAC7F (emissions in grams/start)
	c	-	EMFAC7F (emission factor in grams/day)
	d	-	SCAQMD CEQA Guidance Document
	CO	-	carbon monoxide
	g	-	grams
	HC	-	hydrocarbon is a VOC emission
	NO_x	-	oxides of nitrogen
	PM	-	particulate matter
	SO_x	-	sulfur oxides
	VMT	-	vehicle miles traveled

Table B-8
Site Preparation PM_{10} Emissions

Vehicle Type	Travel Route	Duration (days)	Number of Units (#)	VMT/day	Emission Factor (lbs/VMT)[1]	PM_{10} (lbs/day)	PM_{10} (lbs/project)	PM_{10} (tons/project)	Emission Factor Criteria
Passenger (Trenching)	surface road	60	23	10	0.018	4.14	248.40	0.12	Passenger vehicle on paved road with street cleaning
Passenger (Trenching)	highway	60	23	25	0.018	10.35	621.00	0.31	Passenger vehicle on paved road with street cleaning
Passenger (Grading)	surface road	60	50	10	0.018	9.00	540.00	0.27	Passenger vehicle on paved road with street cleaning
Passenger (Grading)	highway	60	50	25	0.018	22.50	1,350.00	0.68	Passenger vehicle on paved road with street cleaning
Pickup Truck	surface road	60	4	10	0.018	0.72	43.20	0.02	Passenger vehicle on paved road with street cleaning
Pickup Truck	highway	60	4	25	0.018	1.80	108.00	0.05	Passenger vehicle on paved road with street cleaning
Dump Truck[2]	unpaved road	15	30	5	6.540	981.00	14,715.00	7.36	Trucks on unpaved roadway
Water Truck[2] (Trenching)	unpaved road	30	2	5	6.540	65.40	1,962.00	0.98	Trucks on unpaved roadway
Water Truck[2] (Grading)	unpaved road	30	4	5	6.540	130.80	3,924.00	1.96	Trucks on unpaved roadway
Haul Truck[2]	unpaved road	30	2	10	6.540	130.80	3,924.00	1.96	Trucks on unpaved roadway
Concrete Truck[2]	unpaved road	15	1	10	6.540	65.40	981.00	0.49	Trucks on unpaved roadway
Dump Truck[2]	surface road	15	30	25	0.400	300.00	4,500.00	2.25	Trucks on paved roadways with street cleaning
Water Truck[2] (Trenching)	surface road	30	2	25	0.400	20.00	600.00	0.30	Trucks on paved roadways with street cleaning
Water Truck[2] (Grading)	surface road	30	4	25	0.400	40.00	1,200.00	0.60	Trucks on paved roadways with street cleaning
Haul Truck[2]	surface road	30	2	25	0.400	20.00	600.00	0.30	Trucks on paved roadways with street cleaning
Concrete Truck[2]	surface road	15	1	25	0.400	10.00	150.00	0.08	Trucks on paved roadways with street cleaning
Bulldozing[3] (Trenching)	-	30	-	5	21.800	109.00	3,270.00	1.64	Dirt/Debris pushing operations
Bulldozing[3] (Grading)	-	30	-	5	21.800	109.00	3,270.00	1.64	Dirt/Debris pushing operations
Scraping	-	30	4	10	4.300	172.00	5,160.00	2.58	Earthmoving (cut and fill operations, and pan scraper operations)
Grading[4]	-	30	-	0.056	26.400	1.48	44.35	0.02	Graded surface
Wind Erosion[4]	-	130	-	0.056	85.600	4.79	623.17	0.31	Open storage piles
Dirt Piling or Material Handling[5]	-	130	-	5	0.009075	0.05	5.90	0.00	Storage pile filling or truck dumping
Total PM_{10} Emissions						2,208.23	47,840.02	23.92	

Notes:

1 - Emission factors are from SCAQMD CEQA Air Quality Handbook 1993, Table A9-9 (default values).
2 - Emission factors are from SCAQMD CEQA Air Quality Handbook 1993, Table A9-9D with average mean vehicle weight of 13 tons.
3 - Emission factor is expressed in lbs/hour; therefore, VMT/day is expressed in hrs/day.
4 - Emission factors is expressed in lbs/day/acre; therefore, VMT/day is expressed in acre/day.
5 - Emission factors is expressed in lbs/ton of material handled; therefore, VMT/day is expressed in tons/day.

This document printed on recycled paper