Engineering Field Activity, West
Contract No. N44255-02-D-2008
Delivery Order No. 0031

Final

Decision Document

Site 20, Checkerboard Landfill
Naval Air Station Fallon
Fallon, Nevada

September 23, 2004

Prepared for

ENGINEERING FIELD ACTIVITY WEST
Daly City, California

Prepared by

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DECLARATION OF THE DECISION

SITE NAME AND LOCATION

Site 20, Checkerboard Landfill
Naval Air Station Fallon
Fallon, Nevada

CERCLIS Identification Number
NV9170022173

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for the Checkerboard Landfill (Installation Restoration [IR] Site 20) at Naval Air Station (NAS) Fallon in Fallon, Nevada. This decision is based on information contained in the Administrative Record for the site and is in accordance with the general guidelines of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is also in accordance with Nevada Administrative Code (NAC) 445A.226 through 445A.22755 and 444.570 through 444.7499.

The U.S. Navy selected the remedy, and the State of Nevada concurs with the remedy selection.

DESCRIPTION OF THE SELECTED REMEDIES

Data collected within, upgradient, and downgradient of Site 20 indicate that contaminants associated with waste disposal activities at the Checkerboard Landfill are present at very low concentrations in on-site soil and are not migrating from the site through groundwater transport. Based on evaluations of the available site data, a remedy of *Limited Action* is required for Site 20, Checkerboard Landfill, NAS Fallon, Nevada. The *Limited Action* alternative includes limited ground surface regrading to mitigate the potential for surface water ponding, which could infiltrate through the fill material, to improve surface drainage, limited groundwater monitoring to evaluate the off-site impact of fill material, and institutional controls to limit potential future exposure to fill material.

STATUTORY DETERMINATIONS

The selected remedy for Site 20 is protective of human health and the environment and in compliance with applicable statutes and regulations.

Extractable-range total petroleum hydrocarbons (TPH-E) was the only organic detected in soil at concentrations greater than state action levels. TPH-E exceeded criteria in 1 of the 31 soil samples tested by a factor of 1.4 times the state action level. Petroleum hydrocarbons, including TPH-E, were not reported at concentrations above state action levels in any of the 30 groundwater samples collected at the site. The volatile organic compound chloromethane was detected at concentrations greater than the state action level in 2 of the 30 groundwater samples tested. The maximum concentration of chloromethane was 2.3 times the state action level. Chloromethane was not detected in any of the nine groundwater samples collected at the site during 2003. The semivolatile organic compound bis(2-ethylhexyl)phthalate was detected at a concentration greater than the state action level in 1 of the 30 groundwater samples tested by a factor of 1.8 times the state action level. Bis(2-ethylhexyl)phthalate was also detected in the laboratory blanks associated with the sample containing the exceedance. Therefore, the detected bis(2-ethylhexyl)phthalate was considered to be the result of laboratory contamination. Metals tested for in soil and groundwater samples collected at the site were detected at concentrations below regulatory cleanup levels or at concentrations consistent with naturally occurring background concentrations.

The site may be reopened for further evaluation and, if necessary, cleanup, on the basis of newly discovered information that leads the U.S. Navy and the Nevada Division of Environmental Protection to determine that the remedy may not be protective of human health and the environment.

SITE NAME AND LOCATION

Site 20, Checkerboard Landfill
Naval Air Station Fallon
Fallon, Nevada

CERCLIS Identification Number
NV9170022173

USN Ryder

Captain Scott Ryder
Commanding Officer
Naval Air Station Fallon

10/13/04
Date

Jim Nagima
Chief, Bureau of Corrective Action
Nevada Division of Environmental Protection

11/09/04
Date

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ABBREVIATIONS AND ACRONYMS

ASGI	Automated Sciences Group, Inc.
avgas	aviation gasoline
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CRP	community relations plan
EPA	U.S. Environmental Protection Agency
FS	feasibility study
GRA	general response action
HBPHC	high-boiling-point hydrocarbon
IR	Installation Restoration
JP-4	jet petroleum No. 4
JP-5	jet petroleum No. 5
LBPHC	low-boiling-point hydrocarbons
LD	lower diagonal
MCL	maximum contaminant level
µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/L	milligram per liter
NAC	Nevada Administrative Code
NAAS	Naval Air Auxiliary Station
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	Naval Air Station
Navy	U.S. Navy
NDEP	Nevada Division of Environmental Protection
NHPA	National Historic Preservation Act
NRS	Nevada Revised Statutes
PA	preliminary assessment
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
RAB	Restoration Advisory Board
RAO	remedial action objective
RI	remedial investigation
SI	site inspection
SVOC	semivolatile organic compound
TCLP	toxicity characteristics leaching procedure

ABBREVIATIONS AND ACRONYMS (Continued)

TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TPH-E	total petroleum hydrocarbons—extractable
TPH-P	total petroleum hydrocarbons—purgeable
TRC	technical review committee
VOC	volatile organic compound

1.0 INTRODUCTION

This decision summary describes the site-specific factors and analyses that led to the selection of *Limited Action* as the remedy for Site 20, Checkerboard Landfill, at Naval Air Station (NAS) Fallon in Fallon, Nevada. The *Limited Action* alternative includes limited ground surface regrading to mitigate the potential for surface water ponding, which could infiltrate through the fill material, to improve surface drainage, limited groundwater monitoring to evaluate the off-site impact of fill material, and institutional controls to limit potential future exposure to fill material. The process used to identify and select *Limited Action* as the preferred remedy for Site 20, Checkerboard Landfill, is documented in "Remedial Alternatives Evaluation and Cost Analysis, Site 20 Checkerboard Landfill, Naval Air Station Fallon, Nevada" (U.S. Navy 2004). Documents supporting the decision are included in the Administrative Record for the site. Key documents are identified in Section 11.

The format and organization of this decision document are based on U.S. Environmental Protection Agency's (EPA's) *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* dated July 1999. This decision document includes the pertinent elements of Nevada Division of Environmental Protection's (NDEP's) *Requirements for IRP Decision Documents* transmitted in a letter dated December 30, 1998. This decision document is organized as follows:

- **Declaration of the Decision.** Functions as the abstract and formal authorizing signature page for the decision document
- **Section 1—Introduction.** Summarizes the purpose and organization of the decision summary portion of the decision document and identifies the site to which the decision document pertains
- **Section 2—Site Name, Location, Description, and History.** Identifies and describes the site, provides location and property ownership information, and summarizes the history of the site that led to conditions observed at the site as well as previous investigation activities
- **Section 3—Community Participation.** Documents community participation activities throughout the decisionmaking process, references the "responsiveness summary" in Appendix A, and describes the location and availability of the Administrative Record

- **Section 4—Scope and Role of Site.** Discusses Site 20 in relation to other sites at NAS Fallon and identifies when and where monitoring or remedial activities at other sites influence, or are influenced by, monitoring or remedial activities at Site 20

- **Section 5—Site Characteristics.** Summarizes the regional, facility, and site-specific characteristics and conditions, including the concentrations and distribution of contaminants and their fate and transport

- **Section 6—Current and Potential Site and Resource Uses.** Discusses the current and potential future uses of the land

- **Section 7—Summary of Site Risks.** Discusses risks due to contamination present at the site

- **Section 8—Basis for Decision.** Provides the rationale for selecting *Limited Action* as the remedial action for Site 20

- **Section 9—Statutory Authority Finding.** States the conclusion that *Limited Action* is selected as remedial actions for Site 20

- **Section 10—Documentation of Significant Changes.** Describes the changes made to this decision document on the basis of comments received during the public comment period

- **Section 11—Bibliography.** Lists the sources of information used in preparing this decision document

- **Appendix A—Responsiveness Summary.** Summarizes responses to public comments

2.0 SITE NAME, LOCATION, DESCRIPTION, AND HISTORY

NAS Fallon is located in west-central Nevada, approximately 6 miles southeast of the city of Fallon and 60 miles east of the city of Reno (Figure 2-1). NAS Fallon was originally established as a military facility in 1942, when the Civil Aviation Administration and Army Air Corps constructed four airfields in Nevada as part of the Western Defense Program. In 1943, the U.S. Navy (Navy) assumed control of the still-uncompleted facility, and on June 10, 1944, Naval Air Auxiliary Station (NAAS) Fallon was commissioned. The newly commissioned facility provided training, servicing, and support to air groups sent to the facility for combat training. From 1946 to 1951, NAAS Fallon experienced varying but reduced operational status and was eventually turned over to Churchill County and the Bureau of Indian Service.

In 1951, Fallon was used as an auxiliary landing field for NAS Alameda, California, and on October 1, 1953, NAAS Fallon was re-established. From 1945 to 1975, the Air Force also occupied part of the station as part of an early warning radar network. On January 1, 1972, NAAS Fallon was upgraded to its current status of NAS Fallon. NAS Fallon currently serves as the primary aircraft weapons delivery and tactical air combat training facility. With the construction of a new runway and additional aircraft maintenance facilities, NAS Fallon's training mission is expected to continue to expand.

2.1 SITE DESCRIPTION

Site 20, Checkerboard Landfill, is located in the southwestern corner of NAS Fallon (Figure 2-2) and occupies approximately 26 acres along the western boundary of the facility. The site's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number is listed as NV9170022173. NAS Fallon is the lead agency for site activities, and the NDEP serves as the lead regulatory agency. The nearest IR Program Site is UST 805 located approximately 500 feet southeast of site.

The landfilled portion of Site 20 occupies approximately 3,300 feet from its northern border to its southern border and approximately 300 to 450 feet from east to west. Landfilling operations were conducted at the site from 1951 to 1965. The site is currently flat and contains no structures. The ground surface is unpaved and supports native vegetation.

Site 20 received an estimated 85,000 tons of solid waste and 1,400 gallons of liquid waste collected from the entire NAS Fallon facility from 1951 to 1965. Solid waste was reported to be wet garbage, trash, and rubble. Liquid waste was reported to be aviation gasoline (avgas), waste oil, jet petroleum No. 4 (JP-4), jet petroleum No. 5 (JP-5), automotive gasoline, diesel fuel, and

hydraulic fluid. Waste was reportedly disposed of in east-west-oriented trenches constructed with a bulldozer. As a result of the construction method and shallow groundwater, excavation and disposal depths are assumed to be limited.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The purpose of the Navy's Installation Restoration (IR) Program is to identify, assess, characterize, and clean up or control contamination from past hazardous material spills and waste disposal activities at Navy and Marine Corps facilities. As part of the IR Program, NAS Fallon conducted the following investigations/assessment activities:

- Initially a preliminary assessment (PA)/site inspection (SI) was conducted (NEESA 1988). The PA/SI consisted of a records search; a site visit; and a site ranking based on characteristics of the wastes, the potential migration pathways, and possible receptors. No environmental samples were collected. Additional study in the form of soil and groundwater testing to assess the vertical and lateral extent of contamination was recommended for Site 20 because of the reported disposal of liquid wastes and the potential for other unknown wastes.

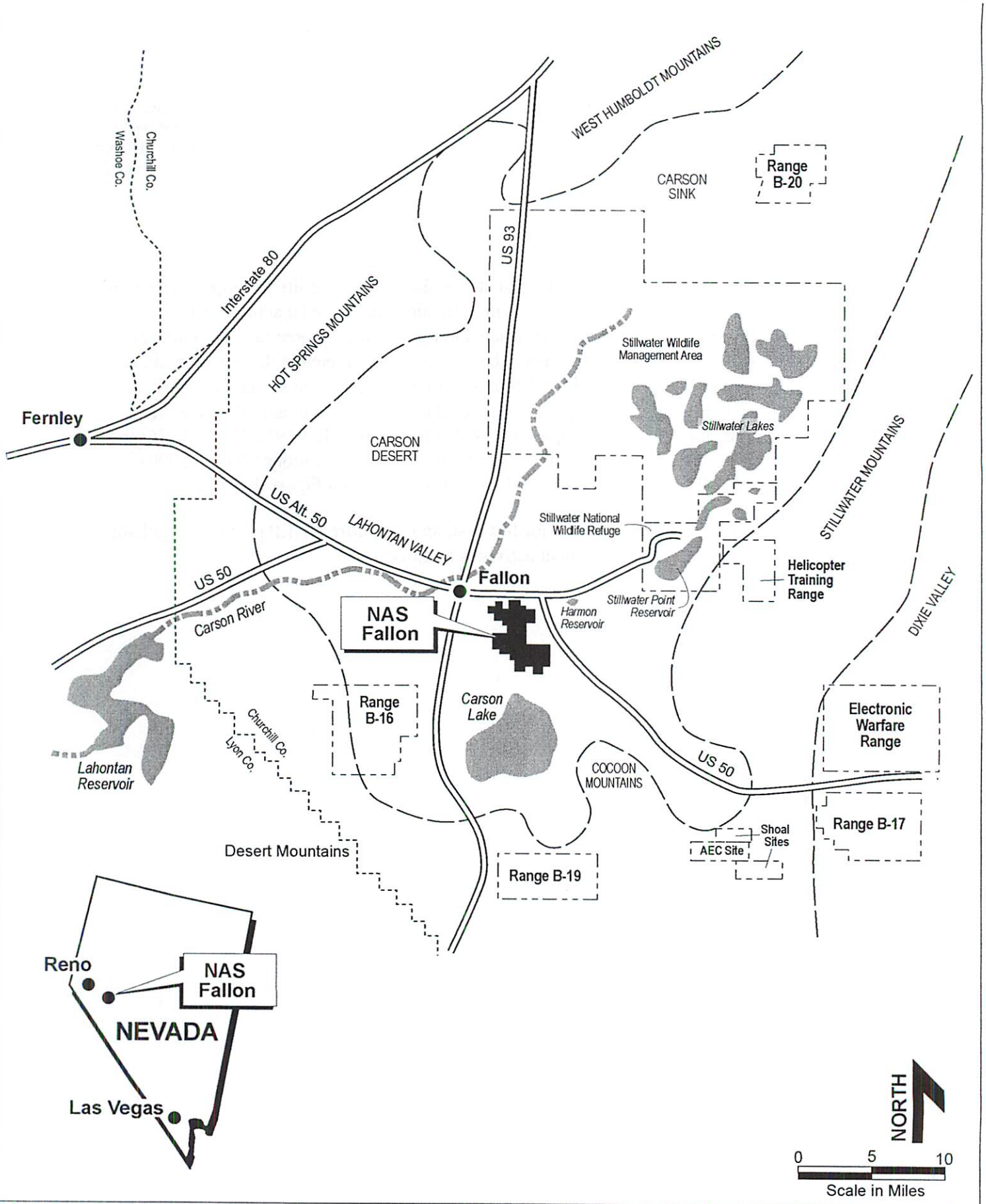
- In response to recommendations presented in the PA/SI, a remedial investigation (RI) was conducted at the site. Six groundwater monitoring wells were installed around the perimeter of the landfilled area at Site 20: two upgradient (MW-34 and MW-35), two downgradient (MW-36 and MW-37), and one cross-gradient pair of wells (MW-33L and MW-33U), which screen the upper and lower portions of the uppermost aquifer at the site. Sampling locations are shown on Figure 2-3.

- A post RI soil and groundwater sampling effort was conducted at Site 20 during 1998. Soil and groundwater samples were collected from 20 direct-push locations during this investigation. These locations were positioned just outside of the eastern boundary of the landfilled area (Figure 2-3).

- Supplemental field sampling was conducted at Site 20 during March 2003 in response to an NDEP request. The scope of the supplemental sampling activities was negotiated with and approved by NDEP. The objective of these supplemental activities was to assess the potential for material in the landfill or soil within the landfill boundaries to serve as a source of petroleum hydrocarbon, volatile organic compound (VOC), or semivolatile organic compound (SVOC) contamination to groundwater and, if present, to assess the potential for off-site contaminant migration. The intent of the sampling program was not to comprehensively sample

the entire site, but to gather representative data across the site to support decisions regarding the need for further site investigations or remedial action. An electromagnetic survey was conducted to identify areas potentially containing buried metal. Six direct-push soil borings were completed at the site immediately downgradient from locations determined to potentially contain buried metal. A seventh direct-push boring was completed to collect an upgradient groundwater sample. Groundwater samples were collected from wells MW-33U, MW-36, and MW-37 during this phase of the investigation. These locations (20000, 20001, 20002, 20003, 20004, 20005, and 20165) are shown on Figure 2-3.

NAS Fallon is not listed on the National Priorities List, and therefore NDEP provides regulatory oversight. There have been no enforcement activities at the site.



U.S. NAVY	**Figure 2-1** **Location Map, NAS Fallon**	Delivery Order 0031 NAS Fallon DECISION DOCUMENT SITE 20

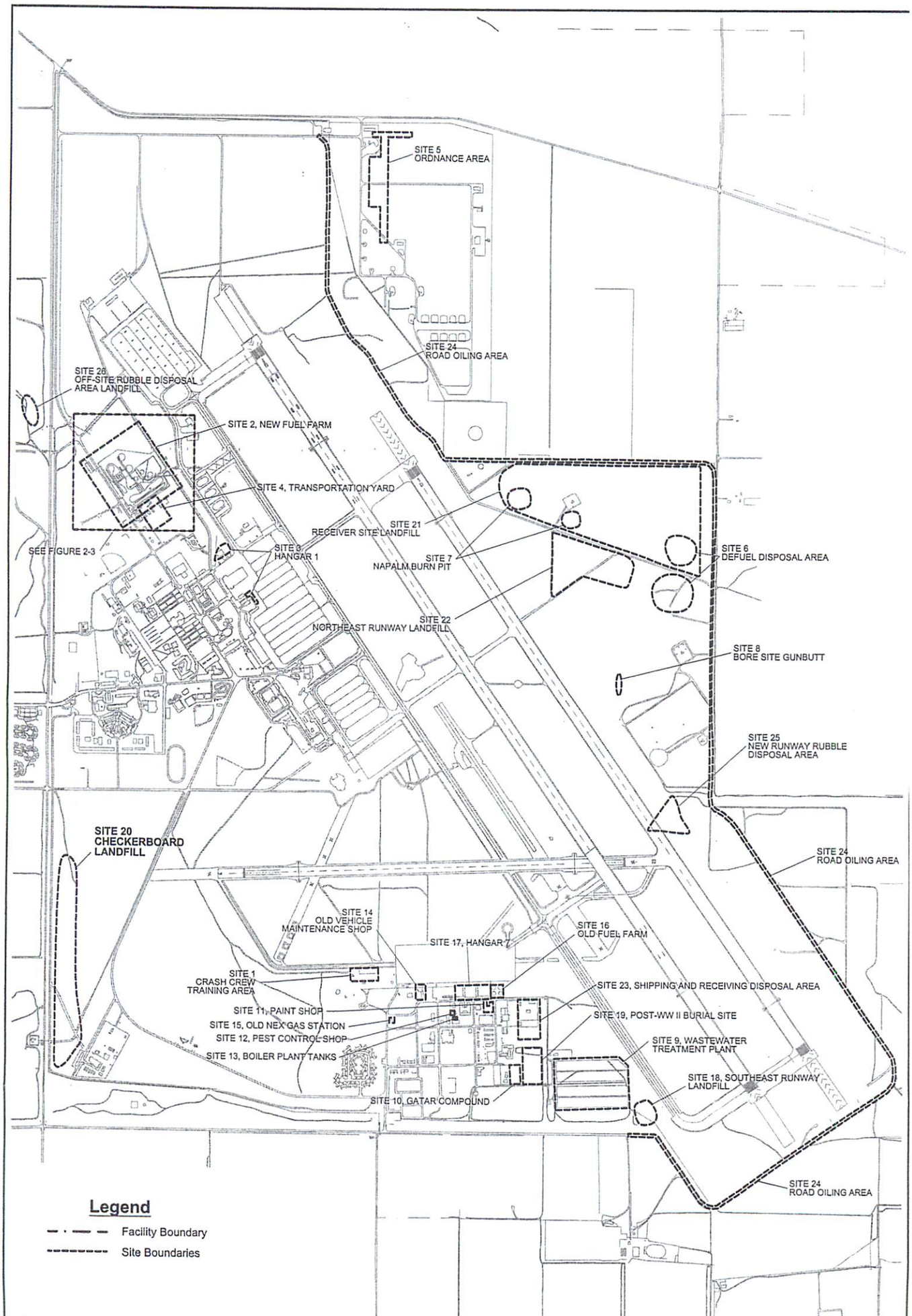


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Figure 2-2
NAS Fallon Facility Map

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SITE 20

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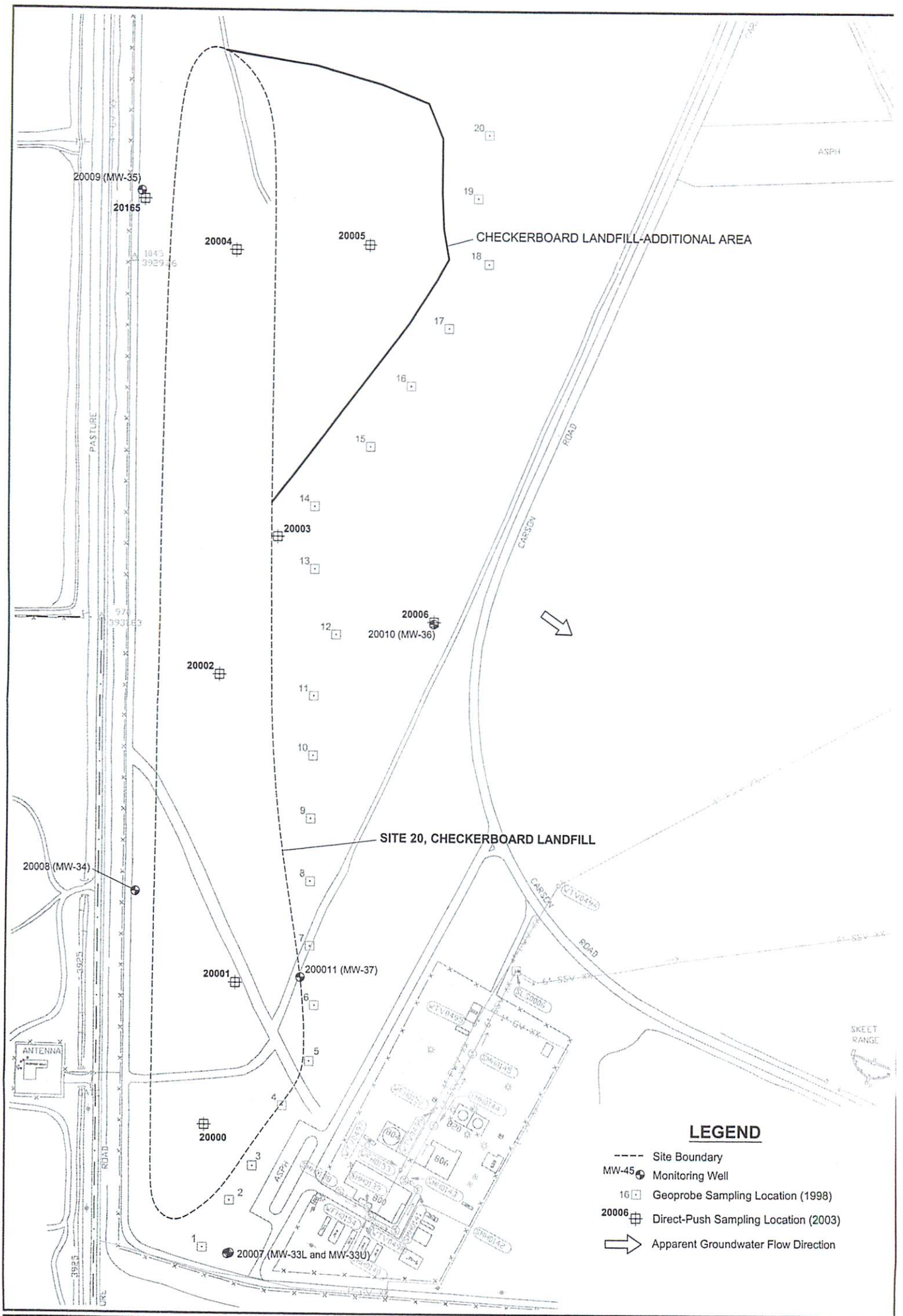

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Figure 2-3
Sampling Locations, Site 20,
Checkerboard Landfill

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3.0 COMMUNITY PARTICIPATION

Community participation is being encouraged under a community relations plan (CRP) drafted pursuant to Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). This plan was updated in 2004.

In 1989, a Technical Review Committee (TRC) was formed in an effort to increase community participation and awareness regarding the IR sites and to provide comments on proposed actions under the NAS Fallon's IR Program. The TRC consisted of state and local regulatory representatives and NAS Fallon personnel. The TRC met in June 1989 to discuss potential requirements for future PA/SI or RI and feasibility study (FS) activities at NAS Fallon. This meeting provided an opportunity for the regulatory agencies to comment on and provide input to the proposed IR Program at NAS Fallon.

In August 1994, a Restoration Advisory Board (RAB) was established to replace the TRC. The RAB meets once a year and consists of members originally on the TRC and representatives from the local community.

All documents associated with this site, such as the PA/SI report, the RI report, the CRP and the Proposed Plan for Site 20, were made available to the public in the Administrative Record at NAS Fallon (Fallon, Nevada), the Churchill County Public Library (Fallon, Nevada), and at the Engineering Field Activity, West, Offices (Daly City, California). The notice of the availability of these documents was published in the *Lahontan Valley News* on August 5, 2004. Notices were also sent to RAB members. A public comment period was extended from August 9, 2004 through September 8, 2004. In addition, a public meeting was held on August 12, 2004 to present the Proposed Plan to the community. At this meeting, representatives from NAS Fallon and the NDEP presented the Proposed Plan. No public comments were received by the Navy during the public comment period.

4.0 SCOPE AND ROLE OF SITE

There are 27 IR sites at NAS Fallon. The locations of all 27 IR sites are shown on Figure 2-2. Site 20 (Checkerboard Landfill) is located in the extreme southwestern portion of the station. Site 20 is positioned along the western border of the station and there are no IR sites located upgradient of Site 20. IR Program Site UST 805 is located approximately 500 feet southeast of the site. Site 1 (Crash Crew Training Area) and Site 15 (Old NEX Gas Station) are approximately 4,000 to 5,000 feet east of Site 20.

The sampling locations used to evaluate Site 20 are as follows:

- Five soil borings drilled during 1991 for the installation of monitoring wells from which 4 soil samples were collected
- Six permanent monitoring wells, two located upgradient, two located downgradient, and two located cross-gradient from Site 20 from which 13 groundwater samples were collected
- Twenty direct-push borings located downgradient from Site 20 from which 20 soil and 9 groundwater samples were collected in 1998
- Seven direct-push boring locations within or at the margin of the landfilled portion of Site 20 from which soil and groundwater samples were collected in 2003

The sampling locations used as a basis for the decision for Site 20 are summarized in Table 4-1, along with the gradient relationships to Site 20 and the uses of the data from each location. Table 4-2 provides a chronological summary of quantitative sampling activities at each location.

The six permanent groundwater-monitoring wells were initially completed to assess potential contamination upgradient, cross-gradient, and downgradient from the landfilled portion of Site 20. The 20 direct-push sampling locations were established along the downgradient edge of the landfilled portion of the site to further assess the impacts of Site 20 disposal activities in the downgradient direction. Initial results obtained from analyses on soil and groundwater samples collected from these locations are considered to be qualitative and were used to guide subsequent investigations.

A coarse grid magnetic survey was conducted to identify magnetic highs within the landfill, which were inferred to represent potential contaminant sources. This survey was used to select direct-push sampling locations immediately downgradient from potential contaminant sources.

Six direct-push sampling locations were established within the landfilled portion of the site to quantitatively evaluate potential contamination in vadose zone soil and groundwater relative to these magnetic anomalies. In addition, groundwater samples were collected from the three existing downgradient monitoring wells and one additional upgradient direct-push sampling location to quantitatively evaluate potential contamination in groundwater upgradient, cross-gradient, and downgradient from the landfilled portion of Site 20. Results obtained from quantitative analyses of soil and groundwater samples collected from these locations are the primary basis for remedial decisions made for the site.

Table 4-1
Summary of Data From Sampling Locations Used as Basis of Decision for Site 20, Checkerboard Landfill

Sampling Location		Data Type and Use
Locations Within or Adjacent to Landfilled Portion of Site 20		
Direct-push locations 20000 through 20005	Quantitative	Quantitative assessment of the presence or absence of potential contaminants in vadose zone soil just above the groundwater surface to evaluate the potential for vadose zone soil to act as a continuing source of groundwater contamination. One soil sample was also collected from each location for grain size analysis. Quantitative assessment of the presence or absence of potential contaminants in groundwater within the landfilled portion of the site.
Locations Upgradient of Site 20		
Locations 20008 (MW-34) and 20009 (MW-35)	Qualitative	Qualitative assessment of the presence or absence of potential contaminants in background soil upgradient of the site. Qualitative assessment of the presence or absence of potential contaminants in background groundwater migrating onto the site.
Direct-push sample location 20165 (MW-35)	Quantitative	Quantitative assessment of the presence or absence of potential contaminants in background groundwater migrating on site.
Locations Downgradient of Site 20		
Location 20006	Quantitative	Collection of soil samples for composite grain size analysis.
Location 20010 (MW-36)	Qualitative	Qualitative assessment of the presence or absence of potential contaminants in soil downgradient of the site (Pre-2003).
	Quantitative	Quantitative assessment of the presence or absence of contaminants and total dissolved solids in groundwater (2003)
Location 20011 (MW-37)	Qualitative	Qualitative assessment of the presence or absence of potential contaminants in groundwater migrating off site (Pre-2003).
	Quantitative	Quantitative assessment of the presence or absence of potential contaminants and total dissolved solids in groundwater migrating off site (2003).
Locations 1 through 20	Qualitative	Qualitative assessment of the presence or absence of potential contaminants in soil and groundwater at the downgradient edge of the landfilled section of the site.
Locations Cross-gradient From Site 20		
Location 20007 (MW-33U and MW-33L)	Qualitative	Qualitative assessment of the presence or absence potential contaminants in soil and groundwater (Pre-2003).
	Quantitative	Quantitative assessment of the presence or absence of potential contaminants and total dissolved solids in groundwater (2003).

Table 4-2
Chronological Quantitative Sampling Summary

Sampling Location	Matrix	Sampling Dates	Range of Analyses
20000, 20002, 20004, and 20005	Soil and groundwater	March 2003	TPH-E, TPH-P, VOCs, SVOCs, pesticides, and grain size
20003	Soil	March 2003	TPH-E, TPH-P, VOCs, SVOCs, pesticides, and grain size
20006	Soil	March 2003	Grain size
20007 (MW-33U)	Groundwater	March 2003	TPH-E, TPH-P, VOCs, SVOCs, pesticides, and TDS
20010 (MW-36)	Groundwater	March 2003	TPH-E, TPH-P, VOCs, SVOCs, pesticides, and TDS
20011 (MW37)	Groundwater	March 2003	TPH-E, TPH-P, VOCs, SVOCs, pesticides, and TDS
20165	Groundwater	March 2003	TPH-E, TPH-P, VOCs, SVOCs, pesticides, and TDS

Notes:
SVOCs - semivolatile organic compounds
TDS – total dissolved solids
TPH-E - total petroleum hydrocarbons—extractable
TPH-P - total petroleum hydrocarbons—purgable
VOCs - volatile organic compounds

5.0 SITE CHARACTERISTICS

This section summarizes the characteristics and conditions of the region, the facility, and the site. It describes the physical and ecological setting, climate, surface water patterns, and geology and hydrogeology, as well as the nature and extent of contamination and the fate and transport of chemicals of concern.

5.1 PHYSICAL SETTING

5.1.1 Physical Setting of Facility

NAS Fallon lies on a broad, flat alluvial plain in the southern Carson Desert referred to as the Lahontan Valley. The Carson Desert is part of the Basin and Range geological province. Carson Lake, a series of ditches and small marshes, is a few miles south of the facility. The Stillwater Lakes, a chain of small lakes, ponds, and marshes, extend for 20 miles south of the Carson Sink in the northern half of the Carson Desert (Figure 2-1). Carson Lake and the Stillwater Lakes are two wetland areas that serve as an important stopover for migratory birds during the spring and fall. Recent drought years have caused the Stillwater Lakes to shrink from approximately 100,000 acres of wetlands in 1983 to 4,000 acres of wetlands in 1991.

The Carson Desert is a hydrologically closed depression that forms the sink for the Carson River. The entire area is in the rain shadow of the Sierra Nevada Mountains; consequently, precipitation is about 5 inches per year. About 80 percent of the Carson Desert surface consists of the Carson River floodplain, with the rest composed of playas and alluvial fans. The surface soils are enriched with salts and cations such as arsenic, lithium, mercury, and molybdenum that have been transported to the basin by the river and have been concentrated as a result of evaporation of ancient Lake Lahontan.

The Carson River, augmented by the Truckee River via the Truckee canal (part of the Newlands Irrigation Project), provides more than 95 percent of all surface runoff received by the Carson Desert. Much of the area around the facility is irrigated; several irrigation ditches deliver water, and drainage canals remove excess water. The drainage canals generally intersect the shallow water table aquifer and drain excess water from the farmland.

There are two major drainage canals at NAS Fallon:

- The "lower diagonal (LD) drain," the alignment of which is along the southwestern edge of the facility and east along the southern boundary of the facility proper

- The "LD #1 drain," which crosses onto the facility just north of Site 2 (the New Fuel Farm), drains to the east from the west side of the facility, and then drains to the south

The most important distinction between the irrigation ditches and the drainage canals (drains) is that the drains are intended to intersect shallow groundwater as well as surface water and to conduct the water away from the drained areas. Conversely, the irrigation ditches deliver water to the fields. In the process of carrying off excess surface water and shallow groundwater, the drains remove minerals or salts leached from the farmland. The drains carry water southeastward to Carson Lake and northeastward to the Harmon and Stillwater Point Reservoirs.

The LD drain is approximately 500 feet south of the Group IV Sites. In addition, an unnamed drain is located just east of Group IV Sites 23 and 19. The primary sources of water in this drain are backflow from the LD drain during the irrigation season and discharge from the waste water treatment plant. During rare storm events, stormwater in small ditches may enter the unnamed drain.

5.1.2 Site 20 Physical Setting

Site 20, Checkerboard Landfill, is located in the southwestern portion of NAS Fallon, approximately 2,000 feet west of the western end of runway 7-25 (Figure 2-2). The landfilled portion of Site 20 encompasses approximately 26 acres, extending approximately 3,300 feet north to south and 300 to 450 feet east to west. The surface consists generally of unpaved areas supporting native vegetation. NAS Fallon does not expect any change in the use of this land, or that of the surrounding sites in the foreseeable future. There are no areas of archaeological or historical significance at Site 20.

5.2 ECOLOGY

5.2.1 Vegetation

NAS Fallon was originally a greasewood community typical of alkali valley bottom lands, portions of which have since been irrigated and used as pasture. Typical plants for this area include saltbush, shadscale, quailbush, greasewood, milkweed, poverty weed, alkali sacaton, rabbitbrush, saltgrass, and alkali seepweed.

The flat, alkali bottom lands making up the southern portion of the Carson Sink currently receive sufficient irrigation return flow and Carson River water to be recognized as a wetland habitat, especially for waterfowl. Vegetation typical of these areas includes bullbush, cattail, pondweed,

widgeon grass, muskgrass, and coontail. Cottonwoods and willows occupy portions of the banks of various ponds, ditches, and drains.

5.2.2 Endangered and Threatened Plant Species

No endangered or threatened plant species designated by the state or federal government are known or likely to occur in the region.

5.2.3 Wildlife

Terrestrial wildlife in the region consists of species adapted to the desert or dependent on wetlands. About 67 species of mammals inhabit the area. Mountain ranges in the region, outside of the area of human impact, support large mammals such as mountain lions and mule deer. Common mammals of the area include bats, coyote, kit fox hare, jackrabbit, deer mouse, ground squirrel, and kangaroo rat.

More than 252 species of birds have been recorded regionally. Upland game birds of the desert are the ring-necked pheasant, sage grouse, the introduced chukar partridge, quail, and mourning dove. A variety of raptors and songbirds are also present.

The Stillwater National Wildlife Management Area, 7 miles east of NAS Fallon, and Carson Lake, 4 miles south of NAS Fallon, support the two largest concentrations of waterfowl and shorebirds in the state. Important game birds include canvasbacks, whistling swans, and Canada geese. Nongame species include the American avocet, black-necked stilt, white-faced ibis, and dowitchers.

5.2.4 Aquatic Life

The drains at NAS Fallon may be inhabited by mosquito fish, carp, bullhead catfish, sunfish, muskrats, herons, and egrets.

5.2.5 Endangered Animal Species

Federally listed endangered and threatened animal species that may utilize the NAS Fallon and range areas include the bald eagle. These species are most likely to be found hunting the wetland portions of the area but may occasionally be seen elsewhere. The nearest breeding habitat is to the northwest, outside the boundaries of the NAS Fallon facility.

5.3 GEOLOGY AND HYDROGEOLOGY

5.3.1 Regional and Facility Geology

The area within and surrounding NAS Fallon consists of an intermontane valley. The mountains near NAS Fallon are composed primarily of a variety of consolidated igneous, sedimentary, and metamorphic rocks that range in age from Triassic to Quaternary in age.

The Basin and Range faulting that occurred during the Cenozoic Era probably formed the bedrock surface below the valley fill sediments. This formation of the intermontane valley was accompanied by deposition of valley-fill sediments on the floor to depths of several thousand feet. Sediment composing the valley fill was derived from three primary sources:

- Upstream valleys of the Carson River drainage
- Upstream valleys of the Humbolt River basin
- Mechanical weathering of consolidated rocks within the Carson Desert itself

It appears that most of the valley-fill sediments in and around NAS Fallon were transported into the valley by the ancestral Carson River.

The depositional character of the valley-fill sediments at NAS Fallon was greatly influenced by the presence of the ancient Lake Lahontan, a Quaternary-age lake that was subject to numerous cycles of advancement and retreat. Regional climatic changes caused dramatic oscillations of lake stages and shorelines throughout the Pleistocene Epoch. Subsurface stratigraphic evidence also suggests the existence of pre-Quaternary-age lakes in the valley. The pluvial influences on sediment deposition were extensive and probably varied during the greater part of Cenozoic time. The alternating influences of wave action, standing water, flowing water, and wind on the sediment transported into the valley by the Humbolt and Carson Rivers resulted in a complex sequence of interfingered and interbedded deposits of fluvial, deltaic, lacustrine, and eolian deposits.

Previously published descriptions of these deposits were generally confirmed during the installation of monitoring wells across the facility. However, the highly transmissive, coarse-grained deposits were found to be both laterally and vertically discontinuous. Below the upper 20 feet of interbedded coarse-grained and fine-grained deposits, a laterally continuous bed of fine-grained silts and clays forms an aquitard, providing a natural barrier to the downward migration of groundwater and contaminants.

The generalized stratigraphy beneath NAS Fallon is provided in Figure 5-1.

5.3.2 Regional and Facility Hydrogeology

Abundant groundwater is present in the valley-fill sediments and the underlying volcanic strata of the Carson Desert as a result of the closed nature of the hydrologic basin and the remnants of Pleistocene Lake Lahontan that once covered the entire area. Groundwater occurs in three principal aquifer systems: (1) a shallow alluvial aquifer, (2) intermediate and deep alluvial aquifers, and (3) a basalt aquifer.

The shallow water-table aquifer occupies the alluvium from near the ground surface to about 25 feet below ground surface (bgs). The shallow aquifer is composed of many interconnected zones of varying permeability, ranging from highly transmissive channel sands to less-transmissive silty clay floodplain and lake deposits. The water quality is generally poor because the water has a high concentration of dissolved solids; however, freshwater recharge from the surface-water irrigation system helps maintain water quality in some parts of the valley.

Reports of regional water quality in the shallow alluvial aquifer and irrigation return flows contain information on the range of concentrations of various metals and anions. This information is summarized in the *Preliminary Site Characterization Summary*. Although the concentrations of these constituents vary considerably, there is a trend of increasing concentrations toward discharge areas at the Stillwater Lakes and Carson Lake. Concentrations of many trace metals exceed various criteria for the protection of aquatic life and crops, effect levels for fish reproduction, and limits for the propagation of wildlife. For example, background concentrations of boron in surface water often exceed the effect level for fish reproduction of 200 µg/L, and concentrations of arsenic in groundwater and surface water often exceed the Nevada criterion for the protection of aquatic life of 40 µg/L and the drinking water standard of 50 µg/L.

The regional groundwater flow direction is to the east and southeast toward Grimes Point and slightly diagonal to the drainage ditches that cross the facility. Glancy estimated the regional groundwater velocity to be approximately 35 feet per year in 1986. The site-specific groundwater flow velocities from numerous aquifer tests are highly variable.

Intermediate and deep alluvial aquifers are present beneath the shallow alluvial aquifer in the Wyemaha Formation. The boundary between the shallow and the intermediate aquifer is a relatively impermeable clay layer (Sehoo Formation), approximately 20 feet thick. The water in the intermediate and deep aquifers is generally of better quality than the water in the shallow aquifer. The boundary between the intermediate and deep aquifers is defined primarily on the basis of water quality, rather than the presence of a physical boundary. Water quality in the intermediate and deep alluvial aquifers generally improves with depth.

The deep alluvial aquifer extends to approximately 2,200 feet bgs near the center of the basin. The basalt aquifer lies within the intermediate and deep alluvial aquifers at a depth of approximately 600 feet bgs, within an approximately 4-mile radius around Rattlesnake Hill, a small volcanic cone that outcrops just north of the city of Fallon. The basalt aquifer is the only source of municipal domestic water in the area and is recharged from the intermediate and deep alluvial aquifers. The basalt aquifer is not present beneath NAS Fallon except possibly in the extreme northwest corner of the facility. However, NAS Fallon obtains all of its domestic water from this aquifer using deep wells northwest of the facility.

Three monitoring wells penetrating the intermediate aquifer on the facility indicate a head difference of about 5 to 9 feet between the shallow unconfined aquifer and the intermediate confined aquifer. The head is higher in the intermediate aquifer, indicating artesian conditions that retard or preclude downward migration of groundwater at the facility. Because of this upward hydraulic gradient with three widely spaced wells drilled into the intermediate aquifer, investigations at the facility have focused on the shallow water-table aquifer.

5.3.3 Site 20 Geology and Hydrogeology

The geologic information for the Site 20 was obtained by soil sampling during the installation of monitoring wells MW-33U, MW-33L, MW-34, MW-35, MW-36, and MW-37; and direct push locations 20000 through 20005 (Figure 5-2). Subsurface investigations at the site were limited to the shallow alluvial aquifer material known as the Fallon Formation, because of the presence of a silty clay aquitard (Sehoo Formation) underlying this alluvial aquifer. None of the permanent monitoring wells are located within the landfilled portion of the site. Wells MW-34 and MW 35 are located upgradient from the site along the western margin of the landfill. Wells MW-36 and MW-37 are located downgradient from the site, east of the landfill. Wells MW-33U (upper) and MW-33L (lower), are co-located crossgradient from the site south of the landfill.

The monitoring wells listed in the previous paragraph typically penetrated the water-bearing portions of the Fallon Formation. Wells MW-33U and MW-33L are respectively screened in the upper and lower portions of the Fallon Formation. Borings for these wells were completed to depths of approximately 25 below ground surface (bgs). A generalized fence diagram showing subsurface stratigraphy beneath the site is provided as Figure 5-3.

The clay aquitard identified as the Sehoo Formation was generally observed at a depth of approximately 20 to 22 feet bgs. Sand with variable amounts of silt, interlayered by silt with variable amounts of sand constitute the main soil types observed within the alluvial aquifer (Fallon Formation) overlying this aquitard. Typically, subsurface stratigraphy within the Fallon Formation beneath the site consists of sand with minor amounts of silt from the ground surface to the top of the Sehoo Formation. Two silt layers are present within this sand unit, which appear

to be continuous across the site. The first silt layer is present from approximately 8 to 12 feet bgs. The second silt layer is present from approximately 16 to 20 feet bgs (Figure 5-3). Groundwater surface elevation contours derived from data collected across the southern station area during February 1998 and November 2002 indicate a gradient and flow direction at Site 20 that is consistent with the regional flow direction, which is to the southeast. Depth to groundwater in wells used to evaluate conditions at Site 20 varies seasonally. Data from November 2002 indicates that depth to groundwater at the site ranges from approximately 5.43 to 7.47 feet bgs. Groundwater surface elevation contours estimated from data collected during November 2002 is shown on Figure 5-4. The average hydraulic gradients across the site during February 1998 and November 2002 were estimated to be 0.001 and 0.002 respectively. Assuming a porosity of 30 percent and using the slug test data from the site (69 to 96 feet per day), estimated groundwater velocity across the site ranges from 84 to 234 feet per year. Slug testing results for hydraulic conductivity are considered to be approximations. Pumping tests were conducted in the area of Site 2. Pumping test-derived hydraulic conductivities were estimated at 38.9 to 61.6 feet per day. The slug test estimates are approximately 1.6 to 1.8 times higher than the pumping test based estimates suggesting that groundwater velocity across the site could be as low as 47 feet per year.

These velocity estimates are for groundwater and do not necessarily represent contaminant transport velocities, which are usually slower than groundwater velocity. The degree to which contaminant velocity is "retarded" relative to groundwater depends on the amount of organic carbon in the saturated formation and the contaminant type. Contaminant velocities are typically slower than groundwater velocities because of chemical retardation.

5.4 NUMERICAL VALUES FOR COMPARISON TO CONTAMINANT CONCENTRATIONS

Comparative numerical values for action decisions at Site 20 are provided in the Nevada Administrative Code (NAC), which states the following:

- The "soil action level" established by NAC 445A.2272 is 100 mg/kg for petroleum substances (typically referred to as total petroleum hydrocarbons [TPH]).
- For contaminants in soil, compare the toxicity characteristics leaching procedure (TCLP)-allowable levels listed in 40 Code of Federal Regulations (CFR) Part 261.24 and the state action level pursuant to NAC 445A.2272 to contaminant concentrations detected during the investigation and/or remedial activities.

- If inhalation, ingestion or dermal exposure is the primary pathway of concern or an applicable level of concentration is not listed in the Toxicity Characteristics Leaching Rule, the presence of a hazardous substance, hazardous waste or a regulated substance in the soil at an appropriate level of concentration that is based on the protection of public health and safety and the environment. The appropriate level of concentration must be determined by the division using the Integrated Risk Information System, adopted by the Environmental Protection Agency, as it existed on October 3, 1996, or an equivalent method chosen by the division. (Note: The equivalent method is generally assumed by NDEP to be EPA Region 9 preliminary remediation goals [PRGs]).

- Except as otherwise provided by NAC 445A.2272, if more than one action level for soil may be established using the criteria set forth in subsection 1, the most restrictive action level must be used. In no case may the action level be more restrictive than the background concentration of the hazardous substance, hazardous waste or regulated substance.

- If contaminated soil is to be left in place, provide an A through K analysis pursuant to NAC 445A.227 to determine if corrective action is required.

- The presence of 1/2 inch or more of a petroleum substance that is free-floating on the surface of the water of an aquifer, using a measurement accuracy of 0.01 foot (NAC 445A.22735).

- For contaminants in groundwater, compare the maximum contaminant levels (MCLs) listed in EPA Drinking Water Regulations and Health Advisories to contaminant concentrations detected during the investigation and/or remedial activities (NAC 445A.22735).

- The action level may be set at a level of concentration equal to the background concentration of a hazardous substance, hazardous waste or a regulated substance, if that level of concentration is greater than the maximum contaminant level for that hazardous substance, hazardous waste, or regulated substance.

- In the absence of an MCL, a level of concentration equal to the background concentration of a hazardous substance or an appropriate level of concentration that is based on the protection of public health and safety and the environment. The appropriate level of concentration must be determined by the division using the Integrated Risk Information System, adopted by reference in NAC

445A.2272, or an equivalent method approved by the division. (Note: The equivalent method is generally assumed by NDEP to be EPA Region 9 PRGs).

The NAC does not provide a state action level for TPH in groundwater. NDEP provided a guidance concentration of 1,000 µg/L in comments to the PA/SI. As a result, 1,000 µg/L has been used consistently as guidance for TPH in groundwater in various reports prepared by the Navy for work conducted at NAS Fallon.

In the absence of an MCL for groundwater, the Navy will use EPA Region 9 PRGs as goals. In the absence of a NAC specified state action level for soil, the Navy will use EPA Region 9 PRGs as goals.

The PA/SI identified landfilling operations conducted at the site from 1951 to 1965 as the source of contaminants released to the environment at Site 20. The site received an estimated 85,000 tons of solid waste consisting of wet garbage, trash, and rubble; and 1,400 gallons of liquid waste reported to be avgas, waste oil, JP-4, JP-5, automotive gasoline, diesel fuel, and hydraulic fluid. Waste was reportedly disposed of in east-west-oriented trenches constructed with a bulldozer (NEESA 1988).

5.5 NATURE AND EXTENT OF CONTAMINATION

This section first summarizes results of investigations at Site 20, then discusses in detail (in the following subsections) contaminants in soil and groundwater. Investigations at the site include the following:

- Analysis of samples from six monitoring wells surrounding the landfilled portion of the site to assess the presence or absence of petroleum hydrocarbons, VOCs, and SVOCs in soil and petroleum hydrocarbons, VOCs, and SVOCs, organochlorine pesticides, and polychlorinated biphenyls (PCBs) in groundwater

- Analysis of samples from 20 locations downgradient from the landfilled portion of the site to assess the presence or absence of petroleum hydrocarbons, VOCs, SVOCs, organochlorine pesticides, and metals in soil

- Analysis of samples from nine locations downgradient from the landfilled portion of the site to assess the presence or absence of petroleum hydrocarbons, VOCs, SVOCs, organochlorine pesticides, and metals in groundwater

- An electromagnetic survey across the entire site to identify magnetic anomalies, which may represent buried contaminant sources

- Quantitative analysis of samples from seven locations (20000 through 20005 and 20165) within the landfill boundaries to assess the presence or absence of petroleum hydrocarbons, VOCs, SVOCs, and organochlorine pesticides in soil and groundwater

- Quantitative analysis of samples from the three existing monitoring wells (MW-33U, MW-36, and MW-37) surrounding the landfilled portion of the site to assess the presence or absence of petroleum hydrocarbons, VOCs, SVOCs, organochlorine pesticides, and total dissolved solids in groundwater

Results of analyses conducted prior to 2003 are considered to be qualitative and were used to guide the 2003 sampling event. Decisions at the site are based on the 2003 results.

The COCs in soil at Site 20 were TPH—purgeable (TPH-P), TPH—extractable (TPH-E), VOCs, SVOCs, and organochlorine pesticides. None of the COCs were detected in seven soil samples collected for analyses during the March 2003 sampling event at concentrations above state action levels. One of the 20 soil samples collected during the 1998 direct-push sampling event contained TPH-E at a concentration of 140 mg/kg, which is above the state action level of 100 mg/kg. This sample was collected from location 2, which is located approximately 150 feet north of MW-33U (Figure 2-2). None of the remaining COCs was reported in 1998 soil samples at concentrations above the state action levels or naturally occurring background concentrations. None of the COCs was detected four soil samples collected for analyses during 1991 monitoring well installation activities at concentrations above state action levels.

Bis(2-ethylhexyl)phthalate was detected in the March 2003 groundwater sample from MW-33U at a concentration of 11 µg/L, which is greater than the state action level of 6 µg/L. However, this bis(2-ethylhexyl)phthalate detection is considered to be the result of laboratory contaminants. None of the remaining COCs was detected in the nine groundwater samples collected during the March 2003 sampling event at concentrations greater than the state action levels. Chloromethane was detected in the 1998 direct-push sampling locations 17 and 20 at concentrations of 3.3 and 3.4 µg/L, which are greater than the state action level of 1.5 µg/L. These sampling locations are situated downgradient from the northern most portion of the landfill (see Figure 5-2). None of the remaining COCs was detected in the nine groundwater samples collected during the 1998 sampling event at concentrations greater than the state action levels or naturally occurring background concentrations. Bis(2-ethylhexyl)phthalate was detected in the 1991 groundwater sample from MW-35 at a concentration of 6 µg/L, which is equal to the state action level. Well MW-35 was located adjacent to the upgradient boundary of

Site 20 near the northern end of the landfill. None of the remaining COCs were detected in the 12 groundwater samples collected during 1991 at concentrations greater than the state action levels.

5.5.1 1991 Remedial Investigation and 1998 Post-Remedial-Investigation Sampling

In response to recommendations presented in the PA/SI an RI was conducted at Site 20 during 1991 (NEESA 1988). During the RI, six groundwater monitoring wells were installed around the perimeter of the landfilled area at the site. Two of these wells (MW-34 and MW-35) were installed upgradient from the landfilled area, two (MW-36 and MW-37) were installed downgradient, and two (MW-33U and MW-33L) were installed as a cross-gradient pair of wells (Figure 2-3). The cross-gradient pair of wells screen the upper (MW-33U) and lower (MW-33L) portions of the uppermost aquifer at the site.

Soil samples were collected from well locations MW-33L (at 7 to 9 feet bgs), MW-34 (at 5 to 7 feet bgs), MW-35 (at 5 to 7 feet bgs), and MW-36 (at 7 to 9 feet bgs) during drilling for well installation. These four soil samples were analyzed for high-boiling-point hydrocarbons (HBPHCs), low-boiling-point hydrocarbons (LBPHCs), VOCs, and SVOCs. Groundwater sampling was conducted in April and August 1991. Groundwater samples were collected from each of the six wells during these events and analyzed for HBPHCs, LBPHCs, VOCs, SVOCs, pesticides, and PCBs.

During a subsequent post- RI sampling effort conducted in 1998, 20 direct-push sampling locations (1 through 20) were established along the downgradient edge of the site (Figure 2-3). One soil sample was collected from each of these 20 locations. These soil samples were analyzed for TPH-E, VOCs, SVOCs, pesticides, and metals. Groundwater samples were collected from 9 of the 20 locations (1, 2, 7, 9, 12, 13, 17, 18, and 20). Groundwater samples collected from these nine locations were analyzed for TPH-E, VOCs, SVOCs, pesticides, and metals.

Analytical results are summarized below on soil and groundwater samples collected during the 1991 RI and the 1998 post-RI sampling. The RI and 1998 data were collected as quantitative data. However, these data cannot be documented in terms of laboratory reports and are therefore considered to be qualitative. The RI and 1998 data were used to guide the subsequent quantitative investigation conducted in 2003.

A summary of detected organic analytes in soil samples collected at Site 20 between 1991 and 1998 is provided in Table 5-1. Total petroleum hydrocarbons in the extractable range (TPH-E) was detected in 4 of the 20 samples at concentrations ranging from 14 to 140 mg/kg. The sample

collected from the 1998 direct-push location 2 (located along the extreme southeastern site boundary) contained TPH-E at a concentration of 140 mg/kg, which is above the state action level of 100 mg/kg. This sample was collected from a depth of approximately 5.5 to 8.5 feet bgs. HBPHCs, LBPHCs, and TPH-P were not detected in soil at concentrations above the respective reporting limits. Methylene chloride was detected in 4 of the 24 soil samples collected from the site at concentrations ranging from 0.006 to 0.01 mg/kg. All of the methylene chloride detections are below the state action level of 9.1 mg/kg. No other VOCs were detected in soil samples collected at Site 20 between 1991 and 1998 at concentrations above the reporting limits. Bis(2-ethylhexyl)phthalate was detected in 4 of the 24 soil samples at concentrations ranging from 0.066 to 0.093 mg/kg. All of the bis(2-ethylhexyl)phthalate detections are below the state action level of 35 mg/kg. No other SVOCs were detected at concentrations above the reporting limits in soil samples collected at the site between 1991 and 1998. Pesticides were also not detected at concentrations above the reporting limits in soil samples collected at the site during this period.

Soil samples collected during the post-RI (1998) direct-push sampling event were also analyzed for aluminum, antimony, arsenic, beryllium, chromium, lead, nickel, and vanadium. A summary of metal concentrations in soil is provided in Table 5-2. Arsenic was detected in all 20 analyzed samples at concentrations ranging from 1.6 to 21 mg/kg. All of these detections are greater than the PRG of 0.39 mg/kg. However, arsenic detections at Site 20 are consistent with naturally occurring background concentrations. Vanadium was detected in all 20 analyzed samples at concentrations ranging from 17 to 62 mg/kg. Three of these detections are greater than the PRG of 55 mg/kg. Vanadium detections at Site 20 are also consistent with naturally occurring background concentrations. None of the remaining metals was detected at concentrations above the PRG.

A summary of detected organic analytes reported in 21 groundwater samples collected at Site 20 between 1991 and 1998 is provided in Table 5-3. Two of the 21 groundwater samples, both collected from MW-35 during 1991, produced detected TPH-E concentrations of 72 µg/L. These concentrations are below the guidance concentration of 1,000 µg/L. Bromoform was detected in one sample at an estimated concentration of 4 µg/L, which is below the state action level of 62 µg/L. Chloromethane was detected in two groundwater samples at concentrations of 3.3 and 3.4 µg/L, which are 1.8 to 1.9 µg/L above the state action level of 1.5 µg/L. The two chloromethane detections above the state action levels were in groundwater samples from the 1998 direct-push sampling locations 17 and 20, located along the northeastern border of the landfilled area approximately 750 to 1,400 feet north of MW-36 (Figure 2-3). Chloromethane was not detected in the remaining 17 groundwater samples collected at the site during this period. Methylene chloride was detected in one groundwater sample at a concentration of 2 µg/L, which is below the state action level of 4.3 µg/L. The SVOC bis(2-ethylhexyl)phthalate

was detected in two groundwater samples at concentrations of 2 and 6 µg/L. The higher of these two concentrations equals the state action level of 6.0 µg/L and was reported in the groundwater sample obtained from upgradient monitoring well MW-35 during 1991. The remaining VOCs, SVOCs, pesticides, and PCBs were not detected in groundwater samples collected at the site between 1991 and 1998.

Between 6 and 14 groundwater samples collected at Site 20 between 1991 and 1998 from both monitoring well and direct-push locations have been analyzed for selected total metals (depending upon the specific metal). A summary of detected metals analytes in groundwater samples collected during this period is provided in Table 5-4. Arsenic was detected in all 14 analyzed samples at concentrations ranging from 0.0135 to 1.74 mg/L. These concentrations are greater than the PRG of 0.01 mg/L; however, these reported arsenic concentrations are within naturally occurring background concentrations. In addition, the highest arsenic concentration was detected in the groundwater sample collected from the upgradient well MW-35 during 1991. Boron was detected in all six analyzed samples at concentrations ranging from 2.54 to 51.2 mg/L. Five of these boron detections were above the PRG of 7.3 mg/L. Manganese was detected in all six of the analyzed samples at concentrations, ranging from 0.018 to 3.14 mg/L. The sample collected from MW-33U in 1991 contained manganese at a concentration of 3.14 mg/L, which is greater than the PRG of 0.88 mg/L. However, this reported maximum manganese concentration is within naturally occurring background concentrations. Molybdenum was also detected in all six of the analyzed samples at concentrations, ranging from 0.0167 to 1.98 mg/L. Molybdenum concentrations in five of the six samples were greater than the PRG of 0.18 mg/L. However, these molybdenum concentrations are also within naturally occurring background concentrations. Lastly, selenium was detected in seven of the eight analyzed samples at concentrations ranging from 0.008 to 0.084 mg/L. The 1998 sample from direct-push location 9 contained the maximum selenium concentration of 0.084 mg/L, which is greater than the MCL of 0.05 mg/L. This maximum selenium concentration is within naturally occurring background concentrations. No other groundwater samples collected at Site 20 contained metals concentrations greater than MCLs or PRGs.

5.5.2 2003 Supplemental Samples

The Navy conducted supplemental sampling at the site to fill the on-site data gaps identified at Site 20 during a June 2002 meeting with representatives of the NDEP Federal Facilities Bureau. The sampling objectives were to assess the potential for material in the landfill or soil within the landfill boundaries to serve as a continuing source of petroleum hydrocarbon, VOC, or SVOC contamination to groundwater and, if present, to assess the potential for off-site contaminant migration.

An electromagnetic survey was conducted to identify areas potentially containing buried metal. Several high-magnetic anomalous zones were identified during the magnetic survey. Six direct-push soil borings were completed immediately downgradient from selected locations determined to potentially contain buried metal. For health and safety purposes, direct-push sampling locations were not positioned immediately on top of the identified anomalies. These locations (20000, 20001, 20002, 20003, 20004, and 20005) are shown on Figure 2-3. One soil sample was collected from just above the groundwater surface at each location for laboratory analysis. These samples were obtained between 2 and 12 feet bgs depending on the location. Because saturated conditions were not observed at direct-push location 20003, the direct-push rod was advanced to a depth of 22 feet bgs, where a second soil sample was collected between 22 and 24 feet bgs. These seven soil samples were analyzed for TPH-P, TPH-E, VOCs, SVOCs, and pesticides. The samples were selected to assess the potential for buried material creating the identified magnetic anomalies within the landfilled portion of the site to act as contaminant sources to soil and/or groundwater.

A soil sample was also collected from location 2006, located immediately adjacent to well MW-36, at a depth coincident with the middle of the screen for MW-36. This sample was subjected to grain-size analysis. The purpose of this analysis was to compare hydraulic conductivity of the formation based on slug testing at MW-36 with literature values of hydraulic conductivity for the soil type identified by the grain-size analysis. The slug-test- derived hydraulic conductivity was comparable to the range of literature values of hydraulic conductivity for the identified soil type.

Groundwater samples were collected from the top of the shallow aquifer at nine locations. These locations (20000, 20001, 20002, 20004, 20005, 20007 [MW-33U], 20010 [MW-36], 20011 [MW-37], and 20165) are also shown on Figure 2-3. Groundwater samples collected from these locations were analyzed for TPH-P, TPH-E, VOCs, SVOCs, and pesticides. Groundwater samples from the monitoring well locations were also analyzed for total dissolved solids (TDS). These samples were collected and analyzed to assess the potential for off-site contaminant migration.

Groundwater sample collection was planned at wells MW-34 and MW-35 in 2003. Several attempts were made to locate these wellheads without success. As a result, groundwater samples were not collected from these wells. The purpose of collecting groundwater samples from these wells was to assess upgradient site conditions. Therefore, a groundwater sample was collected from location 20165, located in the approximate area of well MW-35, and analyzed for TPH-P, TPH-E, VOCs, SVOCs, and pesticides for this purpose.

Analytical results of soil and groundwater samples collected during the 2003 supplemental sampling, summarized below, are considered to be quantitative and were used as the basis for the decision documented herein.

A summary of the analytes detected in soil samples collected at Site 20 during 2003 is provided in Table 5-5. TPH-E and TPH-P were not detected at concentrations above the reporting limits in any of the seven soil samples analyzed. EPA Method 8260 analytes (VOCs) were not detected in any of the seven soil samples at concentrations above the compound-specific reporting limits. The SVOC bis(2-ethylhexyl)phthalate was detected in two soil samples at estimated concentrations (qualified J) of 0.23 mg/kg (location 20003) and 1.3 mg/kg (location 20004). Both of these detections are below the state action level of 35 mg/kg. Di-n-butylphthalate was detected in one soil sample at an estimated concentration of 0.17 mg/kg (location 20003), which is below the state action level of 6,100 mg/kg. Bis(2-ethylhexyl)phthalate and di-n-butylphthalate were also detected in the laboratory blanks associated with these samples. The detected concentrations of these chemicals are considered to be laboratory contaminants. Organochlorine pesticides were not detected in any of the seven soil samples at concentrations above the chemical-specific reporting limits.

Analytical results for groundwater samples collected at Site 20 during 2003 are summarized in Table 5-6. TPH-P was detected in the groundwater sample from location 20005 at a concentration of 41 µg/L, which is below the guidance concentration of 1,000 µg/L. The SVOC bis(2-ethylhexylphthalate) was detected in the groundwater sample from location 20007 (MW-33U) at a concentration of 11 µg/L, which is above the MCL of 6 µg/L. In addition, bis(2-ethylhexylphthalate) was detected in the groundwater sample from location 20010 (MW-35) at an estimated concentration of 4 µg/L, which is below the state action level of 6 µg/L. Bis(2-ethylhexyl)phthalate was also detected in the laboratory blanks associated with these samples. As a result, the bis(2-ethylhexyl)phthalate detections are considered to be laboratory contaminants.

No other SVOC compounds were detected at concentrations above the reporting limit. TPH-E, VOCs, and organochlorine pesticides were not detected at concentrations above the reporting limits. Total dissolved solids were detected in the 2003 groundwater samples collected from wells MW-33U, MW-36, and MW-37 at concentrations ranging from 10,000 to 51,000 mg/L.

5.6 CONTAMINANT FATE AND TRANSPORT

Based on historical disposal activities at Site 20, petroleum hydrocarbons, VOCs, SVOCs, pesticides, PCBs, and metals were suspected contaminants at this site. The chemical analyses of shallow soil and groundwater samples collected at the site identified concentrations of petroleum

hydrocarbons, VOCs, SVOCs, and metals at or near reporting limits or action levels. Pesticides and PCBs were not detected at concentrations above reporting limits in soil and groundwater samples collected at the site. The primary mechanism for contaminant transport at the site would be by rainwater infiltrating the landfill and transporting contaminants downward into groundwater. Groundwater transport would constitute the primary mechanism for contaminant transport from the site. It should be noted that the arid climate at NAS Fallon (approximately 5 inches of rainfall per year) minimizes the potential for downward migration of COCs in soil by limiting the volume of rainwater available to infiltrate through the near-surface soil of the landfill.

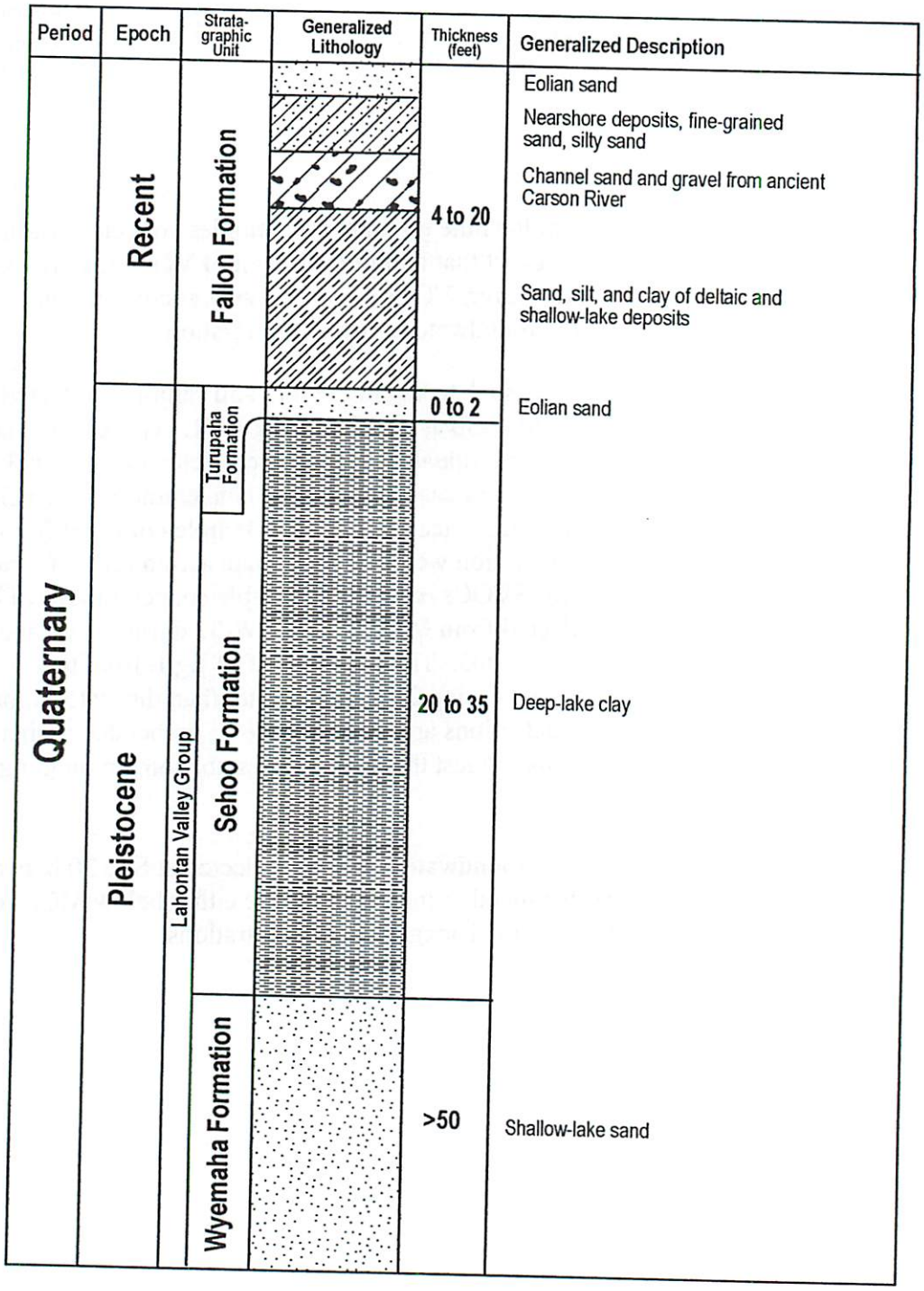
TPH-E was detected in one soil sample at a concentration above the guidance concentration. This soil sample was collected from a depth of 5.5 to 8.5 feet bgs at location 2 during 1998. This sample represents soil situated near the groundwater surface. Location 2 is a direct-push sampling location situated downgradient from the southern end of the landfill. Chemical analyses of the associated groundwater sample collected at the same time from location 2 resulted in concentrations of TPH-E below the reporting limit. Analyses of the remaining 19 groundwater samples collected at the site resulted in detected concentrations of TPH-E in both 1991 samples from MW-35 and TPH-P in the 2003 sample collected from direct-push sample location 20005. Both of these sampling locations are associated with the northern end of the landfill. In neither case did the detected concentrations of TPH-E or TPH-P exceed their respective guidance concentration. These data suggest that a limited amount of petroleum hydrocarbons may remain in shallow soil or groundwater at the site. However, landfilling operations were terminated at the site almost 40 years ago, which would have given contaminants, if present in sufficient volumes, time to migrate to the downgradient monitoring points. TPH-E and TPH-P were not detected in the 2003 groundwater samples from the downgradient monitoring locations. Based on these observations, petroleum hydrocarbons are not present at concentrations or volumes sufficient to result in leaching to groundwater or off-site migration.

The VOC methylene chloride was detected in the four soil samples collected from locations MW-33L, MW-34, MW-35, and MW-36 at the Site 20 during 1991, but at concentrations below the state action levels (Table 5-1). Chemical analyses of the 28 groundwater samples for VOCs reported 1 detectable concentration of methylene chloride at location 18. This concentration was also below the state action levels. Analyses of the remaining groundwater samples collected at the site resulted in detected concentrations of bromoform in one sample and chloromethane in 2 samples. The detected concentration of bromoform was below the state action level, but the detected concentrations of chloromethane were approximately 2 µg/L above the state action level established for this chemical. The chloromethane detections were reported in 1998 groundwater samples collected from direct-push sampling locations 17 and 20 near the northern end of the

landfill. VOCs were not detected in any of the nine groundwater samples collected within the landfill boundaries in 2003. These data suggest that a limited amount of VOCs may remain in shallow soil or groundwater at the site. However, VOCs are not present at concentrations or volumes sufficient to result in leaching to groundwater or off-site migration.

The SVOC bis(2-ethylhexyl)phthalate was also detected in the four soil samples collected from locations MW-33L, MW-34, MW-35, and MW-36 at Site 20 during 1991. This compound was also detected at estimated concentrations in individual soil samples collected during 2003 from locations 20003 and 20004 during 2003. In every case the reported concentrations are below the state action levels. Di-n-butylphthalate was also detected in the soil sample collected from location 20003 during 2003, but at a concentration well below the state action level. Chemical analyses of the 21 groundwater samples for SVOCs reported detectable concentrations of bis(2-ethylhexyl)phthalate in 4 samples: 2 collected from MW-35 and MW-37 during 1991 and 2 collected from MW-33U and MW-36 during 2003. The detection of 11 µg/L from the groundwater sample collected from MW-33U during 2003 was greater than the state action level. The two 2003 bis(2-ethylhexyl)phthalate detections are considered to be associated with a laboratory contaminant. These observations suggest that Site 20 does not contain ongoing contaminant sources for SVOCs.

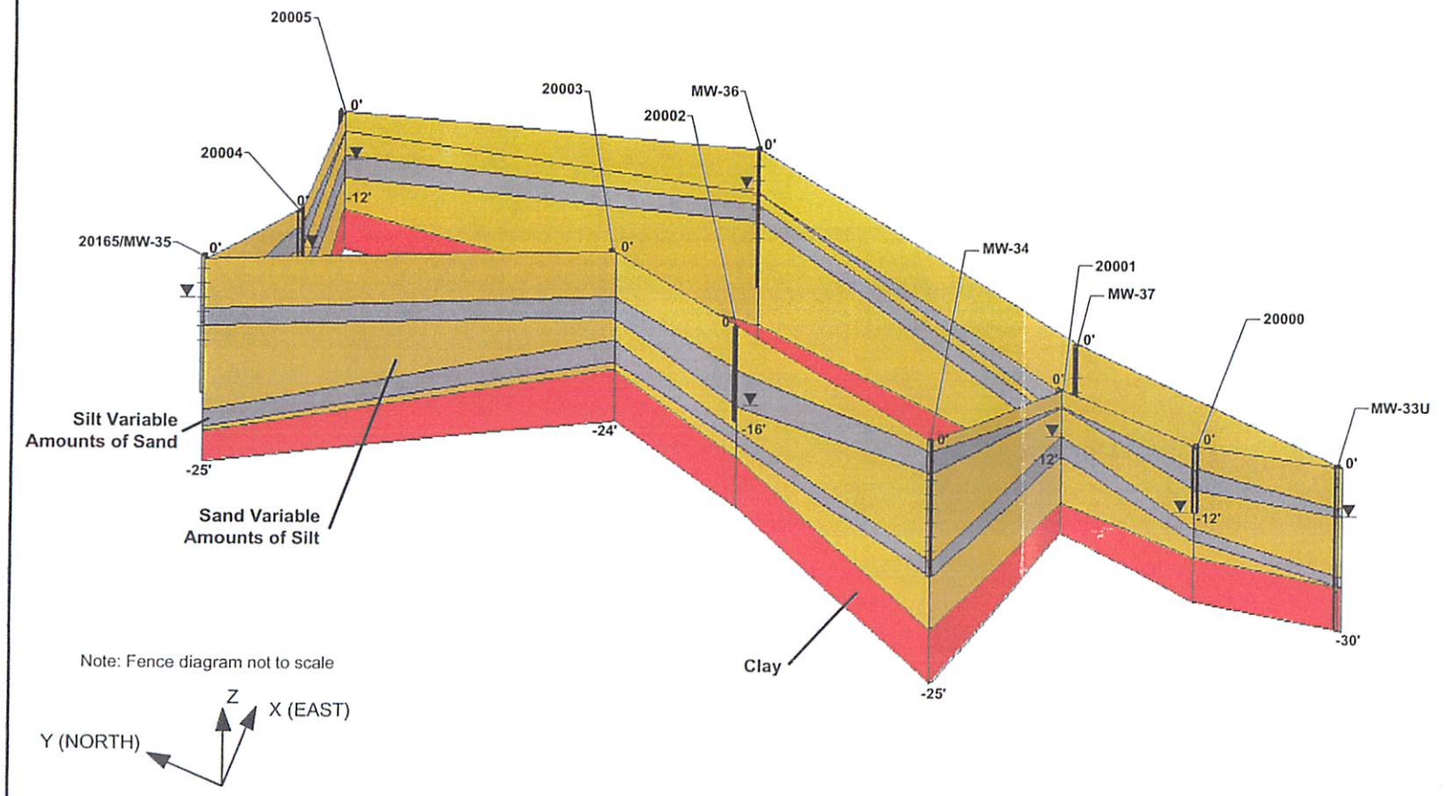
Metals were detected in numerous soil and groundwater samples collected at Site 20 between 1991 and 1998. In every case, the reported metals concentrations are either below MCLs or PRGs, or are consistent with naturally occurring background concentrations.



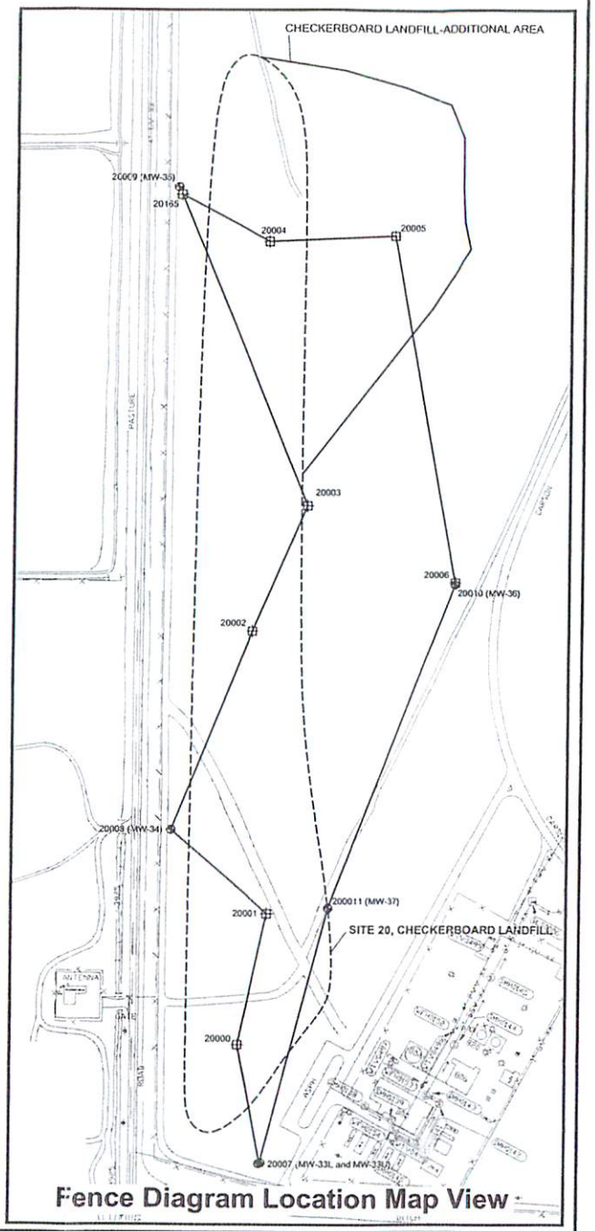
U.S. NAVY

Figure 5-1
Generalized Stratigraphy of NAS Fallon

Delivery Order 0031
NAS Fallon
DECISION DOCUMENT
SITE 20



Note: Fence diagram not to scale



Legend

----	Site Boundary
MW-45	Monitoring Well
20006	Direct-Push Sampling Location (2003)
BRL	Below Reporting Limits
bgs	Below Ground Surface
GW	Groundwater
	Screen Interval
MSL	Mean Sea Level
a	Excludes common laboratory contaminants bis (2-ethylhexyl)phthalate and di-n-butylphthalate
TOC	Top of Casing

Notes:
1. Results are for March 2003 sampling event.
2. Soil and GW samples analyzed for total petroleum hydrocarbons, volatile organic compounds, semivolatile organic compounds, and pesticides.
3. MW-35 and 20165 are colocated. MW-35 represents the soil formation; 20165 represents the analytical data.

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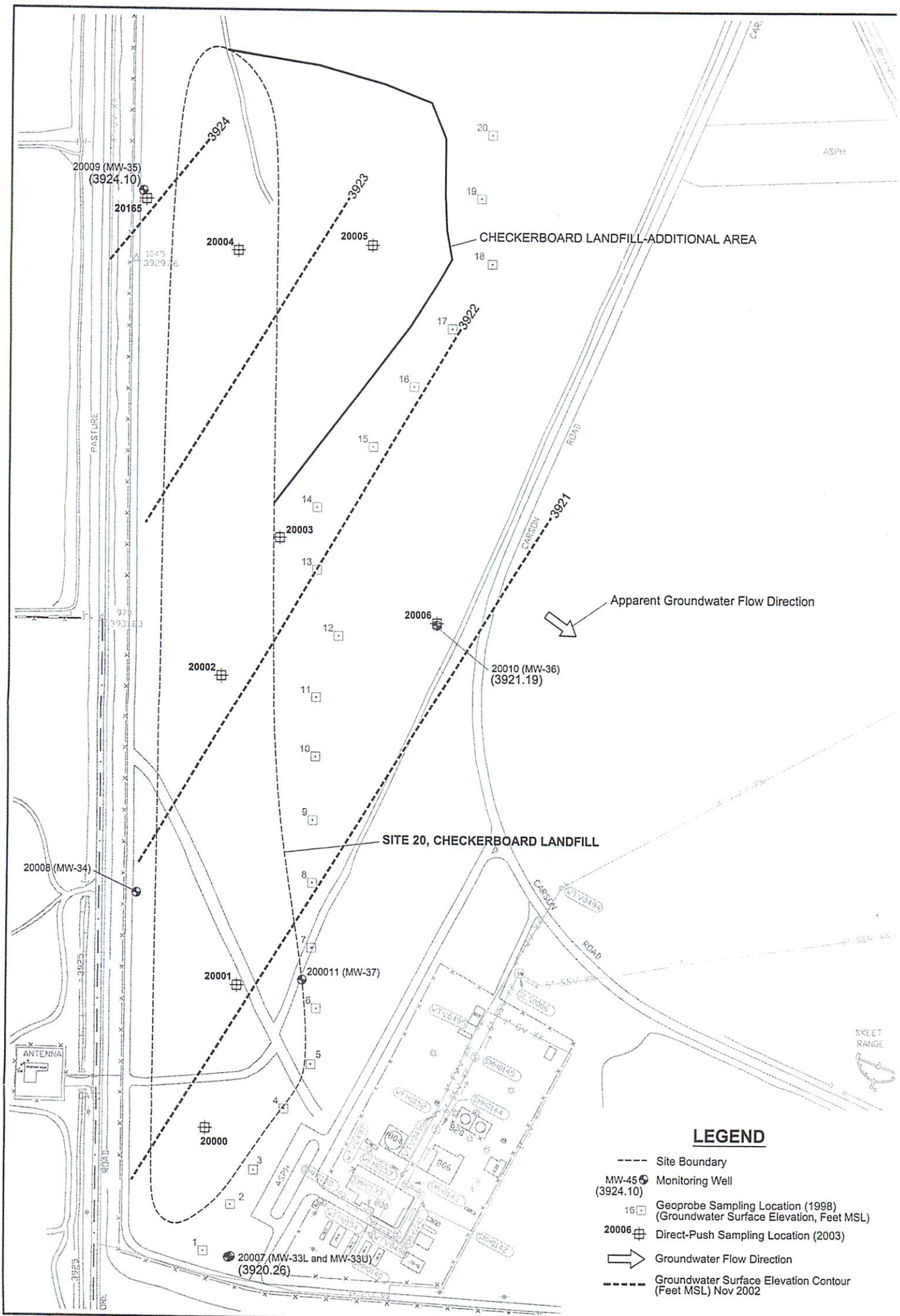
SITE 20

0 100 200 400
SCALE IN FEET

Figure 5-2
Generalized Fence Diagram
Site 20, Checkerboard Landfill



U.S. NAVY

0 125 250
SCALE IN FEET

Figure 5-3
November 2002 Groundwater Surface Elevation Contours, Site 20, Checkerboard Landfill

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SITE 20

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Table 5-1
Summary of Detected Organics in Soil Samples From Site 20, 1991 Through 1998

Analyte	No. of Samples Tested	No. of Detections	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	State Action Level (mg/kg)	No. of Detections Greater Than State Action Level	Location IDs With Detections Greater Than State Action Level
Petroleum Hydrocarbons								
TPH—extractable	20	4	14	54	140	100[a]	1	2
Volatile Organic Compounds								
Methylene chloride	24	4	0.006	0.008	0.01	9.1[b]	0	None
Semivolatile Organic Compounds								
Bis(2-ethylhexyl)phthalate	24	4	0.066	0.077	0.093	35[b]	0	None

[a]Nevada Administrative Code
[b]U.S. Environmental Protection Agency Region 9 preliminary remediation goals – residential soil

Notes:
mg/kg - milligram per kilogram
TPH - total petroleum hydrocarbon

Table 5-2
Summary of Detected Total Metals in Soil at Site 20, 1991 Through 1998

Chemical	No. of Tests	No. of Detections	Detection Frequency	Minimum Detection (mg/kg)	Average Detection (mg/kg)	Maximum Detection (mg/kg)	PRG Action Level (mg/kg)	Naturally Occurring Background Concentrations (mg/kg)	No. of Detections Greater Than PRG	Location IDs with Detections Greater Than PRG
Aluminum	20	20	100%	3,400	12,460	19,000	76,000 [a]	1,800 to 20,700	0	None
Antimony	20	3	1.5%	0.4	0.5	0.6	31 [a]	0.4 to 5	0	None
Arsenic	20	20	100%	1.6	8.1	21	0.39 [a]	1.1 to 64.2	20	1 through 20
Beryllium	20	15	75%	0.3	0.61	1.5	150 [a]	0.11 to 1.5	0	None
Chromium	20	20	100%	3.7	10.2	17	10,000 [a,b]	0.014 to 64	0	None
Lead	20	20	100%	2.1	7	16	150 [a]	0.019 to 55	0	None
Nickel	20	20	100%	2.7	8.8	19	1,600 [a]	0.011 to 23	0	None
Vanadium	20	20	100%	17	39.5	62	55 [a]	0.02 to 1	3	10, 11, 12

[a]U.S. Environmental Protection Agency Region 9 preliminary remediation goals – residential soil
[b]Assumes total chromium

Notes:
mg/kg - milligram per kilogram
PRG - preliminary remediation goal

Table 5-3
Summary of Detected Organics in Groundwater Samples From Site 20, 1991 Through 1998

Parameter	No. of Samples Tested	No. of Detections	Minimum Concentration µg/L	Average Concentration µg/L	Maximum Concentration µg/L	State Action Level µg/L	No. of Detections Greater Than State Action Level	Location IDs With Detections Greater Than State Action Level
Petroleum Hydrocarbons								
TPH-extractable	21	2	72	72	72	1,000[a]	0	None
Volatile Organic Compounds								
Bromoform	21	1	4 J	4 J	4 J	62[b]	0	None
Chloromethane	21	2	3.3	3.35	3.4	1.5[b]	2	17, 20
Methylene chloride	21	1	2	2	2	4.3[c]	0	None
Semivolatile Organic Compounds								
Bis-(2-ethylhexyl)phthalate	21	2	2	4	6	6[c]	0	None

[a]Nevada Department of Environmental Protection guidance concentration
[b]U.S. Environmental Protection Agency Region 9 preliminary remediation goals – tap water
[c]Maximum contaminant level

Notes:
µg/L - microgram per liter
TPH - total petroleum hydrocarbon

Table 5-4
Summary of Detected Metals in Groundwater Samples From Site 20, 1991 Through 1998

Parameter	No. of Samples Tested	No. of Detections	Minimum Concentration (mg/L)	Average Concentration (mg/L)	Maximum Concentration (mg/L)	MCL or PRG Level (mg/L)	Naturally Occurring Background Concentration (mg/L)	No. of Detections Greater Than MCL or PRG	Location IDs With Detections Greater Than MCL or PRG
Metals									
Aluminum	11	11	0.041	0.58	5.2	36[a]	0.041 to 1.46	0	None
Arsenic	14	14	0.0135	0.340	1.74	0.01[b]	0.006 to 21	14	All sampled
Barium	6	6	0.0068	0.017	0.0337	2[b]	0.0068 to 0.66	0	None
Boron	6	6	2.54	25.3	51.2	7.3[a]	0.57 to 240	5	Various
Calcium	6	6	5.47	198	616	NE	1.33 to 616	NA	NA
Chromium	8	4	0.013	0.015	0.018	0.1[b]	0.005 to 0.031	0	None
Copper	6	6	0.0138	0.018	0.0213	1.3[c]	0.1 to 0.333	0	None
Iron	6	6	0.0136	0.02	0.0312	11[a]	0.011 to 3.04	0	None
Lead	8	1	0.006	0.006	0.006	0.015[c]	0.002 to 2.39	0	None
Lithium	6	6	0.0495	0.265	0.668	0.73[a]	0.028 to 0.875	0	None
Magnesium	6	6	8.28	421	740	NE	0.97 to 812	NA	NA
Manganese	6	6	0.018	0.66	3.14	0.88[a]	0.002 to 8.95	1	MW-33U
Molybdenum	6	6	0.167	1.11	1.98	0.18[a]	0.023 to 5.2	5	Various
Nickel	8	8	0.01	0.036	0.068	0.73[a]	0.005 to 0.178	0	None
Potassium	6	6	5.84	109	283	NE	5.63 to 487	NA	NA
Selenium	8	7	0.008	0.034	0.084	0.05[b]	0.003 to 0.14	1	9
Sodium	6	6	461	6,195	11,300	NE	128 to 22,500	NA	NA
Vanadium	14	13	0.0149	0.077	0.19	0.26[a]	0.007 to 3.0	0	None
Zinc	6	6	0.0309	0.052	0.0759	11[a]	0.006 to 0.338	0	None

[a]U.S. Environmental Protection Agency (EPA) Region 9 preliminary remediation goals – tap water

Table 5-4 (Continued)
Summary of Detected Metals in Groundwater Samples From Site 20, 1991 Through 1998

[b]Maximum contaminant level
[c]EPA action level

Notes:
MCL - maximum contaminant level
mg/L - milligram per liter
NA - not applicable
NE - not established
PRG - preliminary remediation goal

Table 5-5
Summary of Detected Organics in Soil Samples From Site 20, 2003 Supplemental Sampling

Location ID	Location Cross-Reference	Sample ID	Beginning Depth (ft bgs)	Ending Depth (ft bgs)	TPH-E (mg/kg)	TPH-P (mg/kg)	Bis(2-Ethylhexyl) phthalate (mg/kg)	Di-n-butylphthalate (mg/kg)
20000	GP-20000	230090	3.5	5.5	29 U	5.7 U	0.38 U	0.38 U
20001	GP-20001	230129	2	4	30 U	6 U	0.4 U	0.4 U
20002	GP-20002	230093	10	12	34 U	6.8 U	0.45 U	0.45 U
20003	GP-20003	230097	10	12	34 U	6.8 U	0.23J[a]	0.17J[a]
20003	GP-20003	230120	22	24	31 U	6.2 U	0.42 U	0.42 U
20004	GP-20004	230123	4	6	27 U	5.4 U	1.3 J[a]	0.36 U
20005	GP-20005	130121	4	6	27 U	5.4 U	0.36 U	0.36 U
Regulatory Cleanup Level:					100[b]	100[b]	35[b]	6,100[c]

[a]Associated compound was detected in laboratory blank and result is considered to be a laboratory contaminant.
[b]Nevada Administrative Code
[c]U.S. Environmental Protection Agency Region 9 preliminary remediation goals – residential soil

Notes:
ft bgs - foot below ground surface
J - assocaited numerical value is an estimate
mg/kg - milligram per kilogram
TPH-E - total petroleum hydrocarbons—extractable
TPH-P - total petroleum hydrocarbons—purgeable
U - analyte not detected above the specified reporting limit

Table 5-6
Summary of Detected Results in Groundwater Samples From Site 20, 2003 Supplemental Sampling

Location ID	Location Cross-Reference	Sample ID	TPH-E (µg/L)	TPH-P (µg/L)	Bis(2-ethylhexyl)phthalate (µg/L)	TDS (mg/L)
20000	GP-20000	230091	250U	25U	5U	NS
20001	GP-20001	230131	250U	25U	5U	NS
20002	GP-20002	230095	250U	25U	5U	NS
20004	GP-20004	230125	250U	25U	5U	NS
20005	GP-20005	230118	250U	41	5U	NS
20007	MW-33U	230106	250U	25U	**11**[a]	30,000
20010	MW-36	230110	250U	25U	4J	51,000
20011	MW-37	230108	250U	25U	5U	10,000
20165	GP-20165	230126	250U	25U	5U	NS
Regulatory Cleanup Level:			1,000[b]	1,000[b]	6[d]	

[a]Associated compound was detected in laboratory blank and result is considered to be a laboratory contaminant.
[b]Nevada Division of Environmental Protection guidance concentration
[c]U.S. Environmental Protection Agency Region 9 preliminary remediation goals – tap water
[d]Maximum contaminant level

Notes:
Bolded value indicates exceedance of state action level
J – associated numerical value is an estimate
µg/L – microgram per liter
NS – not sampled
TDS - total dissolved solids
TPH-E - total petroleum hydrocarbons—extractable
TPH-P - total petroleum hydrocarbons—purgeable
U - analyte not detected above the specified reporting limit

6.0 CURRENT AND POTENTIAL SITE AND RESOURCE USES

NAS Fallon currently serves primarily as an aircraft weapons delivery and tactical air combat training facility. The Navy is expected to maintain NAS Fallon in the future. Disposal operations at the Checkerboard Landfill were terminated during 1965, and Site 20 is currently vacant land. NAS Fallon is not currently using this land for waste disposal operations or any other uses. The Navy does not expect any change in the use of this land or that of the surrounding sites in the foreseeable future.

Excavation restrictions have also been established for former disposal sites at NAS Fallon as part of the facility Overview Plan. The Overview Plan for NAS Fallon includes a discussion of all potentially contaminated areas in the IR Program and their locations. Activities that involve excavation at Site 20 will be prohibited as part of the overview planning process. Any future construction projects conducted at Site 20 will be subjected to an environmental review. The Environmental Department at NAS Fallon oversees the environmental review process. Relevant projects are reviewed by the Occupational Safety and Health Office, Fire Department, Security Department, the Engineering and Planning Divisions of Public Works, and the Environmental Department. This review process is included in all NAS Fallon planning activities. Information provided by the Environmental Department relates to potential contact with contaminated soil and groundwater as a result of these projects.

Groundwater at the site is not currently using as a drinking water or other water source. The Navy does not expect to use groundwater at this site for any purpose in the foreseeable future.

7.0 SUMMARY OF SITE RISKS

A baseline risk assessment was prepared for several sites at NAS Fallon, including Site 20 (ASGI 1994). This risk assessment included an evaluation of human health risk and ecological hazards resulting from residual concentrations of COCs released to the environment at the Checkerboard Landfill.

Based on a qualitative review of analytical results available for the site at that time, the baseline risk assessment concluded that concentrations of COCs in soil and groundwater at the site did not warrant quantitative human health or ecological risk assessments (ASGI 1994). Results of sampling conducted after the RI further support the baseline risk assessment conclusion. Although TPH-E was detected in one soil sample and chloromethane was detected in two groundwater samples collected in 1998 at concentrations greater than state action levels, these compounds were not detected during subsequent sampling performed in 2003. The only chemical detected in groundwater during the 2003 sampling event at concentrations greater than state action levels was bis(2-ethylhexyl)phthalate. However, this detection is attributable to laboratory contamination and is not considered to be a result of conditions at Site 20.

8.0 SELECTION OF PREFERRED ALTERNATIVE

This section provides rationale for the selection of Limited Action as the remedial action alternative for the landfill. A summary of the identification and evaluation of remedial action alternatives is provided in Section 8.1, and the basis for the decision is provided in Section 8.2. An expanded discussion of the alternatives evaluation is provided in "Remedial Alternatives Evaluation and Cost Analysis, Site 20 Checkerboard Landfill, Naval Air Station Fallon, Nevada" (U.S. Navy 2004).

8.1 SUMMARY OF THE IDENTIFICATION AND EVALUATION OF REMEDIAL ACTION ALTERNATIVES

Although current site conditions pose no unacceptable risk to human health or the environment, remedial actions were considered for this site to mitigate future potential human and ecological exposure to landfilled material at the site. Therefore, an evaluation of potential remedial alternatives was prepared to identify and select a preferred remedial action alternative for the site. The process used to identify and select an appropriate remedial action generally follows the evaluation process set forth by the CERCLA program. This process includes the following:

- Identification of potentially applicable statutes and regulations
- Development of remedial action objectives (RAOs)
- Identification of general response actions (GRAs), technology types, and process options
- Screening of technology types and process options
- Development of remedial action alternatives
- Analysis of remedial action alternatives
- Selection of the preferred alternative

First, state and federal statutory and regulatory requirements potentially applicable to remedial actions were identified. This evaluation focussed on the statutes and regulations applicable to specific actions to be conducted on the site, since chemical-specific state action levels have been

previously discussed in Section 5.4. The analysis of statutes and regulations differed from those typically prepared for CERCLA sites. Since the site is not a CERCLA removal or remedial action site, only the legally applicable (and not the relevant and appropriate) requirements are considered. The statutes and regulations identified for the remedial actions at the site are the following:

- Nevada Administrative Code 444.530 through 444.7499 - Solid Waste Disposal Regulations
- Nevada Revised Statutes (NRS) 445A.465—Stormwater Program, which incorporates the requirements of the federal stormwater program (40 CFR 122.26)
- NAC 445B.22037—Emissions of Particulate Matter: Fugitive Dust
- 40 CFR Part 10—Native American Graves Protection and Repatriation Act (NAGPRA) Regulations
- 36 CFR Parts 60, 63, and 800—National Historic Preservation Act (NHPA) Regulations
- 16 USC 703-712 – Migratory Bird Treaty Act

Nevada solid waste regulations (NAC 444.570 through 444.7499) are potentially applicable to remedial actions at Site 20. The regulations include general provisions addressing cover design and post-closure groundwater monitoring. Assuming that Site 20 is a Class II landfill because municipal-type waste was disposed of there, a deviation from the standard final cover requirements is provided in NAC 444.7175(2). Under this provision, the solid waste management authority may allow the landfill owner to deviate from the provisions concerning the infiltration barrier that are set forth in NAC 444.6891. To allow the deviation from the infiltration provisions, the solid waste management authority must consider the unique characteristics of small communities, climatic and hydrogeologic conditions, and whether allowing the deviation would have an adverse effect on human health or the environment.

The landfill was closed in 1965 according to standards at the time. Groundwater samples collected from direct-push sampling locations within the landfill boundary and from groundwater monitoring wells positioned downgradient of the landfill do not contain potential chemicals of concern at concentrations that pose a risk to human health or the environment. Since potential chemicals of concern have not leached to groundwater or migrated off-site in the almost 40 years since closure, it is anticipated that the potential for future leaching and or migration of potential

chemicals of concern is low. The low annual precipitation (approximately 5-inches per year) at the station is indicative of the low potential for future leaching. In addition, NAS Fallon does not currently use groundwater from the shallow aquifer and will not use this resource in the foreseeable future. As a result, it is assumed that the current cover, with the amendments specified in the selected alternative described below, is sufficient and a deviation from the cover requirements as specified in NAC 444.7175(2) is appropriate.

The RAOs are general cleanup objectives for the remedial alternatives. The RAOs identified for the site are as follows:

- Prevent potential future risks to human health and the environment
- Mitigate the potential for leaching of landfilled material to groundwater

GRAs are broad, generic categories of remedial actions that either alone or in combination are capable of achieving the RAOs. The GRAs provide the basis for developing the remedial action alternatives for the site. No action, institutional controls, containment, monitoring, and removal/disposal are the GRAs identified for the site. Two GRAs, in situ treatment and removal/treatment/disposal, were not considered for the site, because these GRAs are not necessary for meeting the RAOs and are more expensive than other GRAs. In addition, in situ treatment and removal/treatment/disposal would result in an increase in short-term risks during remediation, with no additional benefit to human health or ecological receptors. Four GRAs—no action, institutional controls, containment, and removal/disposal—were considered for soil, and three GRAs—no action, institutional controls, and monitoring—were considered for groundwater.

Technology types and process options applicable to each GRA were then identified. Technology types are general categories of technologies, remediation processes, or other actions within a general response action. Process options are specific processes within a technology type. For example, capping is a technology type under the GRA containment. An example of a process option included under the capping technology type is a vegetative cover. Once the technology types and process options were identified, they were screened to reduce the list of technologies to be considered for incorporation into the remedial alternatives. The technologies and process options were screened based on their technical feasibility, effectiveness (in achieving RAOs), and implementability.

The process options retained after the screening were combined to develop four alternatives for the site. These alternatives are Alternative 1, No Action; Alternative 2, Limited Action; Alternative 3, Limited Source Removal; and Alternative 4, Engineered Cap. A summary of the components of each of the alternatives is presented below.

- Alternative 1, No Action. No active measures would be used to remediate soil and groundwater contaminants, and no institutional controls would be imposed. Evaluation of this alternative is required in all cases to provide a comparative baseline.

- Alternative 2, Limited Action. This alternative includes the following components: institutional controls (land use controls); groundwater monitoring; regrading of the landfill, repairing the existing soil cover by placing native fill in selected areas, revegetating the landfill, and maintaining the landfill for a 3-year period.

- Alternative 3, Limited Source Removal. This alternative includes the following components: institutional controls, (land use controls); groundwater monitoring; selectively removing target contaminated surface soil and shallow buried wastes and debris, regrading and fill activities in the targeted removal areas, revegetating disturbed areas of the landfill, and maintaining the landfill for a 3-year period.

- Alternative 4, Engineered Cap. This alternative includes the following components: institutional controls (land use controls); groundwater monitoring; regrading of the landfill, selective filling and grading landfill surface, installing passive venting structures, constructing a engineered cover system consistent with current solid waste regulations over the entire landfill, and maintaining the landfill for a 3-year period.

These four alternatives were then evaluated against nine criteria: protection of human health and the environment; compliance with statutes and regulations; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; long-term effectiveness and permanence; implementability; cost; state acceptance; and community acceptance. State and community comments have not been solicited at this time. Therefore, two of the nine criteria (state and community acceptance) cannot be evaluated until these alternatives have been presented to the public, comments solicited, and the public comment period is closed. Details of the evaluation are presented in the "Remedial Alternatives Evaluation and Cost Analysis, Site 20, Checkerboard Landfill, Naval Air Station Fallon, Nevada" (U.S. Navy 2004).

The alternative preferred by the Navy and NDEP is Alternative 2, Limited Action. The actions included in the preferred alternative should reduce the potential for human and environmental exposures in the future, reduce the potential for migration of chemicals from the landfill, and control the landfill's uses and future development.

8.2 BASIS FOR DECISION

The Navy has selected *Limited Action* as the preferred alternative for Site 20 for the following reasons:

- Site 20 has no ongoing contaminant sources. Disposal operations at the Checkerboard Landfill were terminated during 1965.
- TPH-E was the only organic COC detected in soil at concentrations greater than the state action level. This COC exceeded criteria in only 1 of the 20 soil samples tested by a factor of 1.4 times the cleanup level in a sample from 5.5 to 8.5 ft. logs.
- Petroleum hydrocarbons, including TPH-E, were not reported at concentrations above the state action levels in any of the 30 groundwater samples collected at the site.
- The VOC chloromethane was detected in groundwater samples at concentrations greater than the state action level. This COC exceeded criteria in 2 of the 30 groundwater samples tested by a factor of 2.3 times the state action level. Chloromethane was not detected in any of the nine groundwater samples collected at the site during 2003.
- The SVOC bis(2-ethylhexyl)phthalate was detected in groundwater samples at concentrations greater than the state action level. This COC exceeded criteria in one of the 30 groundwater samples tested by a maximum magnitude of 1.8 times the MCL. Bis(2-ethylhexyl)phthalate was also detected in the laboratory blanks associated with the sample containing the exceedance. This detected concentration was considered to be the result of laboratory contaminants.
- Metals tested for in soil and groundwater samples collected at the site were detected at concentrations below MCLs or PRGs, or are consistent with naturally occurring background concentrations.

- The site is currently vacant land and the Navy does not expect any change in the use of Site 20, or of the surrounding sites, in the foreseeable future.

In summary, *Limited Action* was selected for Site 20. The limited ground surface regrading component of this alternative will mitigate the potential for surface water ponding, which could infiltrate through the fill material, and improve surface drainage. Because potential chemicals of concern have not leached to groundwater or migrated off-site in the almost 40 years since closure, it is anticipated that the potential for future leaching and or migration of potential chemicals of concern is low. The low annual precipitation (approximately 5-inches per year) at the station is indicative of the low potential for future leaching. This regrading in association with the arid climate at NAS Fallon should further minimize the potential for downward transport of COCs remaining in vadose zone soil within the landfilled portion of the site. The alternative will also provide limited groundwater monitoring to assess the potential for landfilled material to migrate off site. The institutional controls portion of this alternative will limit potential future human exposure to landfilled material. The process used to identify and select *Limited Action* as the preferred remedy for Site 20, Checkerboard Landfill, is summarized in Remedial Alternatives Evaluation and Cost Analysis, Site 20, Checkerboard Landfill, Naval Air Station Fallon, Nevada (U.S. Navy 2004).

9.0 STATUTORY AUTHORITY FINDING

Site 20 has no identified contaminant sources. Disposal operations at the Checkerboard Landfill were terminated during 1965. The site is currently vacant land and the Navy does not expect any change in the use of Site 20, or of the surrounding sites, in the foreseeable future.

TPH-E was the only organic COC detected in soil at concentrations greater the state action level. This COC exceeded the state action level of 100 mg/kg in 1 of the 27 soil samples tested by a factor of 1.4 times. Petroleum hydrocarbons, including TPH-E, were not reported at concentrations above the guidance concentration in any of the 30 groundwater samples collected at the site.

The VOC chloromethane was detected in groundwater samples at concentrations greater than the state action level. This COC exceeded the state action level in 2 of the 28 groundwater samples tested by a factor of 2.3 times. Chloromethane was not detected in any of the nine groundwater samples collected at the site during 2003.

The SVOC bis(2-ethylhexyl)phthalate was detected in groundwater samples at concentrations greater than the state action level. This COC exceeded the state action level in 1 of the 30 groundwater samples tested by a maximum magnitude of 1.8. Bis(2-ethylhexyl)phthalate was also detected in the laboratory blanks associated with the sample containing the exceedance. This detected concentration was considered to be the result of laboratory contamination.

Metals tested for in soil and groundwater samples collected at the site were detected at concentrations below MCLs or PRGs, or are consistent with naturally occurring background concentrations.

Based on these observations and conditions, current or potential future site conditions pose no unacceptable risk to human health or the environment. Landfilling activities were terminated almost 40 years ago and there is no evidence of contaminant leaching to groundwater or off-site migration. However, to limit human and ecological exposure to buried waste or contaminants remaining in soil at the site, and to evaluate the impact of contaminants left in place that could migrate to off-site receptors, *Limited Action* is selected as the preferred remedial alternative at this site. This action is in accordance with and complies with applicable statutes and regulations.

10.0 DOCUMENTATION OF SIGNIFICANT CHANGES

No public comments were received during the public comment period. As a result, there were no significant changes to the Proposed Plan or this decision document.

11.0 BIBLIOGRAPHY

This document was prepared with the use of information contained in the Administrative Record for Site 20, Checkerboard Landfill, NAS Fallon, Nevada. The Administrative Record is available at the Churchill County Public Library in Fallon, Nevada; at NAS Fallon; and at Engineering Field Activity, West, Offices in Daly City, California. The primary documents used as sources of the information contained in this decision document are listed below.

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Oak Ridge National Laboratory (ORNL). 1994. *Naval Air Station Fallon, Remedial Investigation, Remedial Investigation Report, Final.* September 1994.

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APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

Notice of the public comment period was published in the *Lahontan Valley News* on August 5, 2004. The public comment period extended from August 9, 2004 through September 8, 2004. The public meeting presenting the Proposed Plan was held at the Fallon Convention Center in Fallon, Nevada, on August 12, 2004. As of September 13, 2004, the Navy had received no public comments.