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

Final

Decision Document

Site 21, Receiver Site Landfill
Naval Air Station Fallon
Fallon, Nevada

September 23, 2004

Prepared for

ENGINEERING FIELD ACTIVITY WEST
Daly City, California

NAVFAC

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DECLARATION OF THE DECISION
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SITE NAME AND LOCATION

Site 21, Receiver Site Landfill
Naval Air Station Fallon
Fallon, Nevada

CERCLIS Identification Number
NV9170022173

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for Site 21, Receiver Site Landfill, 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 21 indicate that contaminants associated with waste disposal activities at the Receiver Site Landfill are present at 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 21, Receiver Site 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 21 is protective of human health and the environment and in compliance with federal and state applicable or relevant and appropriate requirements. Although soil and groundwater contain concentrations of trichloroethene (TCE) above state action levels, TCE is not migrating off site. Total petroleum hydrocarbon and phenol were detected at concentrations below the state action levels in soil and groundwater. 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 21, Receiver Site Landfill
Naval Air Station Fallon
Fallon, Nevada

CERCLIS Identification Number
NV9170022173

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

11/08/04
Date

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ABBREVIATIONS AND ACRONYMS

ASGI	Automated Sciences Group, Inc.
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
GC	gas chromatograph
GRA	general response action
HBPHC	high-boiling-point hydrocarbon
IR	Installation Restoration
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
ORNL	Oak Ridge National Laboratory
PA	preliminary assessment
PCB	polychlorinated biphenyl
PID	photoionization detector
PRG	preliminary remediation goal
RAB	Restoration Advisory Board
RAO	remedial action objective
RI	remedial investigation

ABBREVIATIONS AND ACRONYMS (Continued)

SI	site inspection
SVOC	semivolatile organic compound
TCE	trichloroethene
TCLP	toxicity characteristics leaching procedure
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TPH-E	total petroleum hydrocarbons—extractable
TPH-O	total petroleum hydrocarbons—heavy fraction/oil
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 21, Receiver Site 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 21 is summarized in "Remedial Alternatives Evaluation and Cost Analysis, Site 21, Receiver Site 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 21 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 21
- **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—Selection of Preferred Alternative.** Provides the rationale for selecting *Limited Action* as the remedial action for Site 21
- **Section 9—Statutory Authority Finding.** States the conclusion that *Limited Action* is selected as remedial actions for Site 21
- **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 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 21, Receiver Site Landfill, is located in the northeastern portion of NAS Fallon (Figure 2-2) and occupies approximately 60 acres. 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 NDEP serves as the lead regulatory agency.

The landfilled portion is approximately 3,200 feet from the western border to the eastern border and is approximately 700 to 1,800 feet from north to south. The site is currently flat, and the surface consists of native vegetation. Site 21 is one of the Group II sites that also include the Defuel Disposal Area (Site 6), the Napalm Burn Pit (Site 7), and the Northeast Runway Landfill (Site 22). Site 7 and a portion of Site 6 lie within Site 21 (Figure 2-2). Groundwater is shallow at the site ranging from approximately 4 to 7 feet below ground surface (bgs). Groundwater flow is to the southeast.

Based on the existing characterization data, the Navy and NDEP have determined that no further action is required for Site 7 (Napalm Burn Pit). The conditions in the northern half of Site 6 (Defuel Disposal Area) located within the boundaries of Site 21 are also being evaluated under Site 6. Remedial actions are currently being evaluated relative to Site 6.

Landfilling operations at Site 21 were conducted at the site in three phases from 1965 to 1980 (NEESA 1988). From 1965 to 1975, the site received an estimated 60,000 tons of solid waste and approximately 1,000 gallons of liquid waste. The solid waste reportedly consisted of wet trash, garbage, and rubble. The liquid waste reportedly consisted of jet petroleum No. 5 (JP-5), gasoline, diesel fuel, waste oils, and hydraulic fluid and was burned along with the solid waste. From 1975 to 1979, the site received approximately 30,000 tons of solid waste only (no liquid wastes). The solid waste reportedly consisted of wet trash, garbage, and rubble. From 1979 to 1980, the site received an estimated 6,000 tons of solid waste only, consisting of trash and rubble.

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:

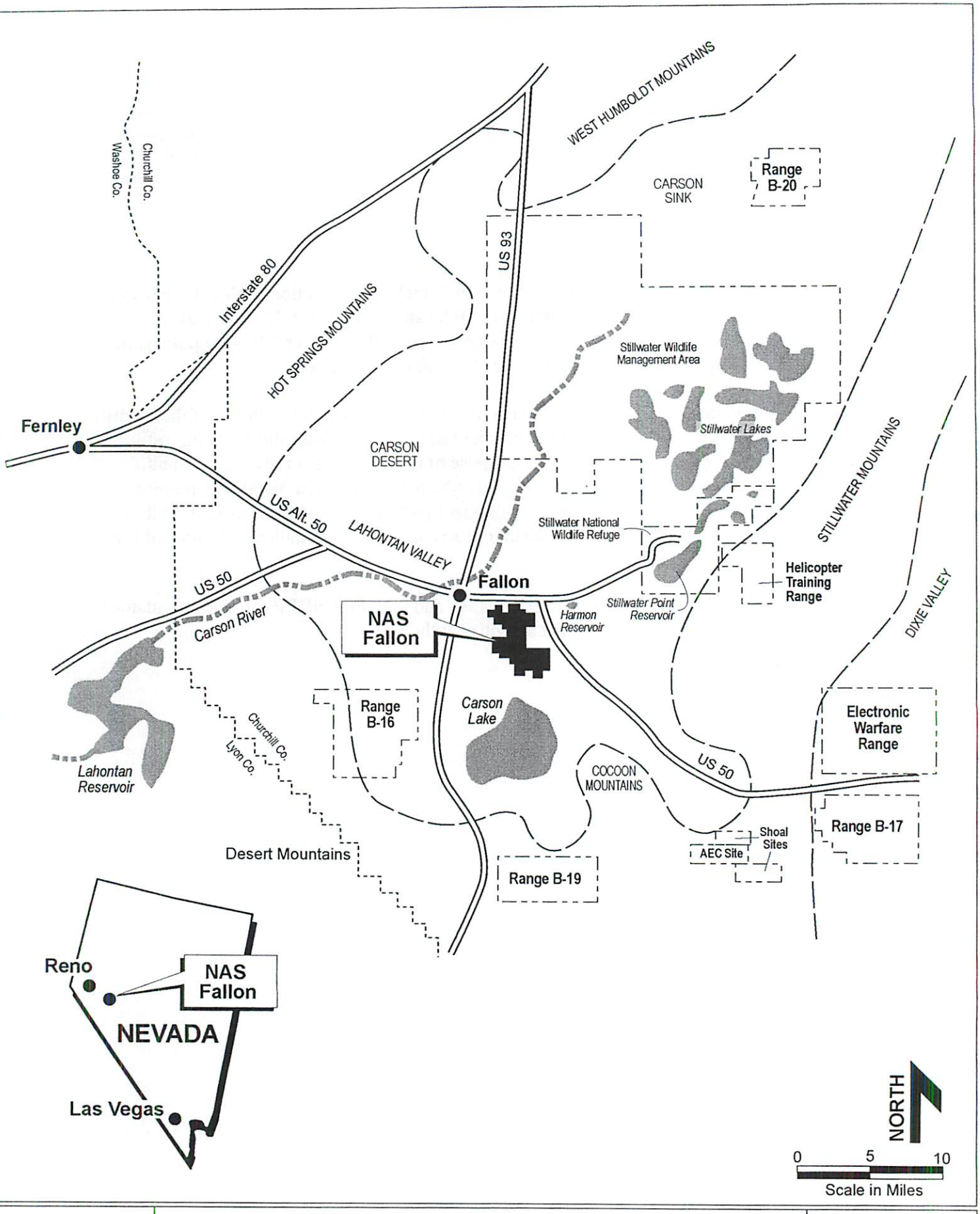
- A preliminary assessment/site inspection (PA/SI) was conducted at Site 21 in 1987 and reported in 1988 (NEESA 1988). It consisted of records searches, an on-site survey, ranking of the site (based on characteristics of the wastes, the potential migration pathways from the site, and possible receptors), and recommendations for further study or immediate mitigating action (NEESA 1988). The PA/SI concluded that characterization was required at Site 21 because of the reported disposal of liquid wastes and potentially other unknown wastes.

- A facility-wide remedial investigation (RI), which included Site 21, was completed in 1994 (ORNL 1994). Thirty-four groundwater test holes were completed around the entire perimeter of Site 21. Groundwater test holes were used to provide a qualitative assessment of the presence or absence of volatile organic compound (VOC) contamination in the general vicinity of Site 21. Five monitoring wells were installed along the perimeter (MW-12U and MW-12L) and downgradient (MW-45, PW-03, and MW-94) of the site. Soil and groundwater samples were collected from these monitoring well locations.

- Supplemental sampling in 1998 and 1999 included collection of direct-push soil and groundwater samples from over 50 locations (Figure 2-3). Soil and groundwater analytical results generated during the 1998 and 1999 supplemental sampling efforts were used to guide the 2003 investigation.

- The March 2003 field event involved conducting a magnetic survey of the landfill area, direct-push soil and groundwater sampling, and sampling and slug testing existing monitoring wells. The purpose of the magnetic survey was to identify magnetic highs, which were inferred to be potential buried metal and, therefore, potential contaminant sources. Six direct-push sampling locations (21000 through 21005) were placed downgradient of these magnetic anomalies and sampled for soil and groundwater.

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 21

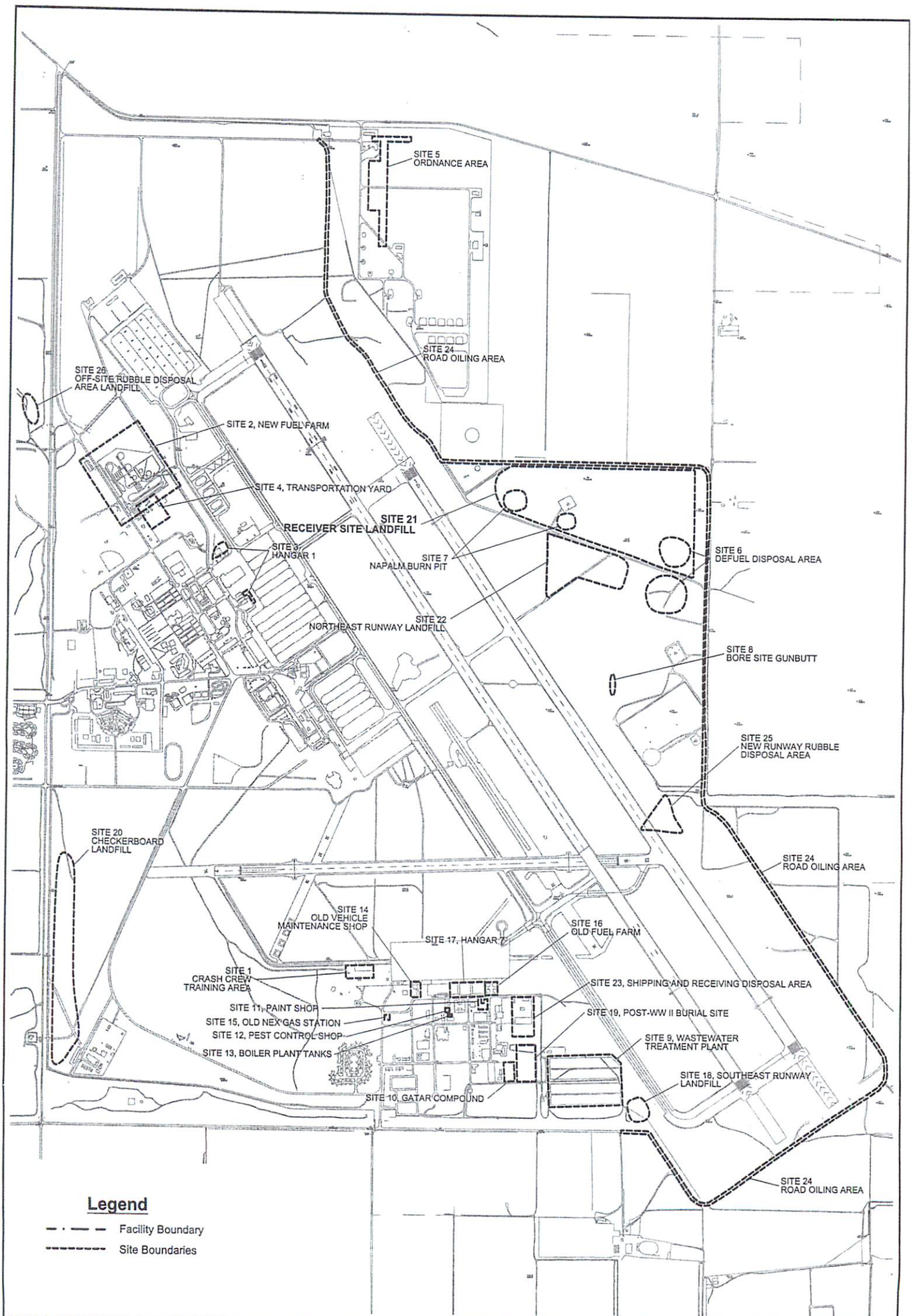


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Figure 2-2
NAS Fallon Facility Map

Delivery Order 0031
NAS Fallon
SITE SUMMARY
SITE 21

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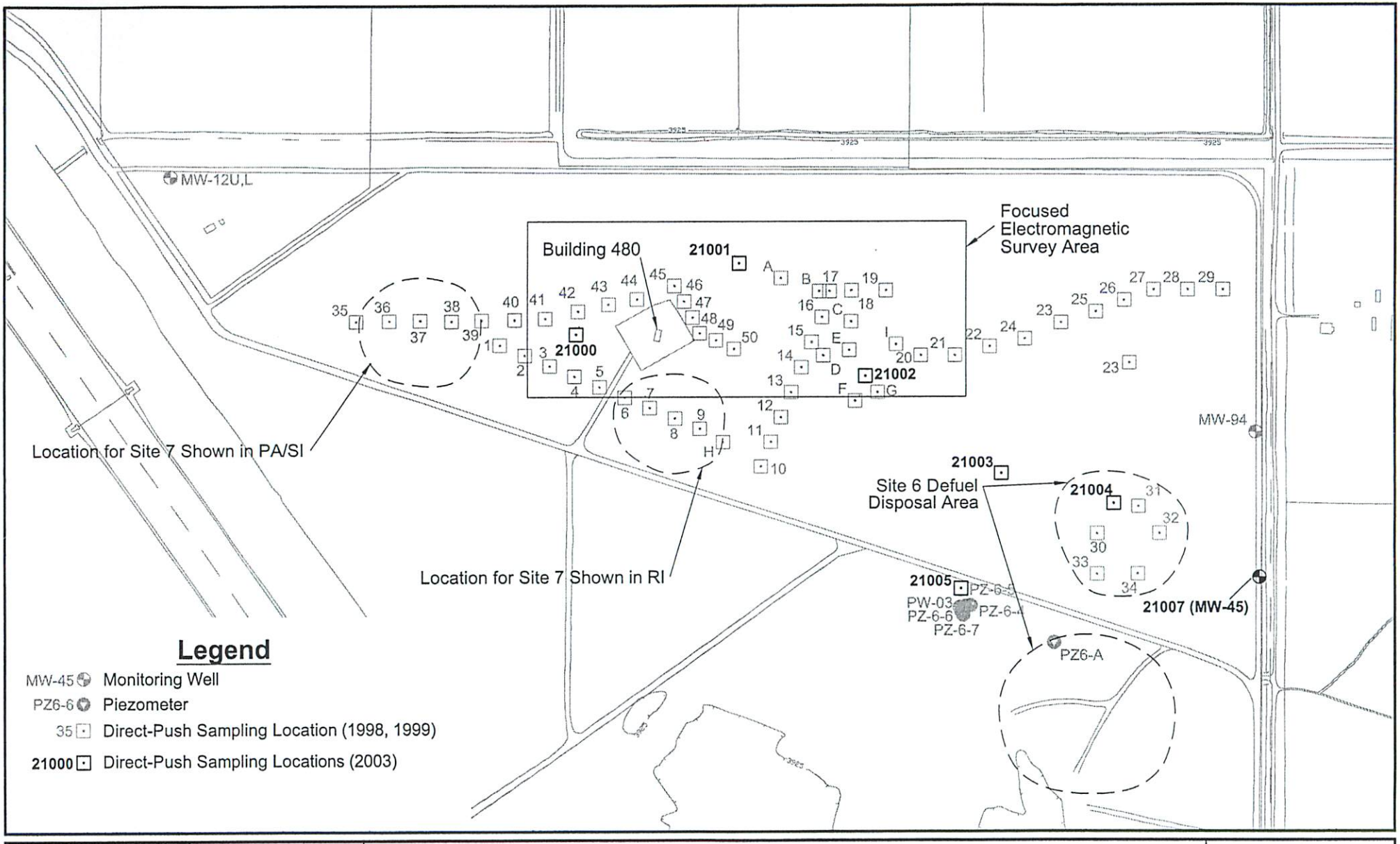

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Figure 2-3
Soil Sampling Locations at
Site 21, Receiver Site Landfill

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NAS Fallon
DECISION DOCUMENT
SITE 21

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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 21, 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 members of the RAB. A public comment period extended from August 9, 2004 to September 9, 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 21 (Receiver Site Landfill) is located along the midpoint of the eastern station boundary. There are two areas identified as Site 6 (Defuel Disposal Area). The northern area identified as Site 6 is located within the boundaries of Site 21. Site 6 is considered an active site and remedial alternatives are being evaluated. Two possible areas have also been identified as Site 7 (Napalm Burn Pit), both of which are located within the boundaries of Site 21. Based on characterization results, the Navy and NDEP have taken the decision that no further action is required at Site 7. This decision was taken by the Navy on May 17, 2002, and NDEP concurred with the decision on June 4, 2002. Site 22 (Northeast Runway Landfill) is located adjacent to the southern border of Site 21.

The sampling locations used to evaluate Site 21 are as follows:

- Thirty-four groundwater test holes were completed along the perimeter of Site 21.
- Four groundwater monitoring wells were installed during the RI along the perimeter of the site (MW-12U, MW-12L, MW-45, and PW-03). Sampled groundwater was analyzed for the presence of high-boiling-point hydrocarbon (HBPHC), low-boiling-point hydrocarbon (LBPHC), polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs) and VOCs.
- During the RI, soil samples were collected from two monitoring well locations (MW-45 and PW-03) and analyzed for the presence of HBPHC, LBPHC, SVOCs, and VOCs.
- One groundwater well was installed during the 1996 post-RI activities (MW-94), and soil and groundwater samples were collected and analyzed for the presence of total petroleum hydrocarbons—extractable (TPH-E) and VOCs.
- Soil and groundwater sampling was conducted at 60 direct-push sampling locations within Site 21 in 1998 and 1999. These samples were analyzed for TPH-E, VOCs, SVOCs, and metals. Soil and groundwater analytical results generated during the 1998 and 1999 supplemental sampling efforts are considered to be qualitative and were used to guide the 2003 quantitative investigation reported herein.

- Groundwater and soil sampling in March 2003 provides defensible analytical data for this site, which was used as the primary decision-making data for the site. This investigation included collecting soil and groundwater samples from six direct-push soil boring locations (locations 21000 through 21005) for analysis of TPH-E, TPH—purgeable (TPH-P), SVOCs, and VOCs. Groundwater samples were also collected from two existing monitoring wells (PW-03 and MW-45) for TPH-E, TPH-P, SVOCs, VOCs, and total dissolved solids (TDS).

The sampling locations used as a basis for the decision for Site 21 are summarized in Table 4-1, along with the gradient relationships to Site 21 and the uses of the data from each location. Table 4-2 provides a chronological summary of quantitative sampling activities at each location.

The thirty-four groundwater test holes were initially completed to qualitatively evaluate potential contamination related to Site 21 and Site 6. Sampling was conducted at the 60 direct-push boring locations in 1998 to assess the impacts of Site 21 activities on the soil and groundwater at Site 21. The permanent monitoring wells located upgradient of Site 21 (MW-12U and MW-12L) were used to assess whether contaminants were migrating onto Site 21 from upgradient sources. The permanent monitoring wells located downgradient of Site 21 (MW-45, PW-03, and MW-94) were used to assess whether contaminants were migrating from Site 21 to adjoining areas. The RI and 1998 and 1999 direct-push sampling results are considered to be qualitative because the laboratory Form 1s are not available for review and confirmation. Additional direct-push boring locations (21000 through 21005) were sampled in March 2003 to confirm results reported in qualitative soil and groundwater samples.

Table 4-1
Summary of Data From Sampling Locations Used as Basis of Decision for Site 21, Receiver Site Landfill

Sampling Location	Data Type	Data Uses
Locations Within Site 21		
34 groundwater test holes	Qualitative	Qualitative assessment of the presence or absence of volatile organic compounds in groundwater along the perimeter of the site
Direct-push sampling locations A through I and 1 though 50	Quantitative	Quantitative assessment of presence or absence of potential contaminants in soil and groundwater related to site activities. Results from these locations were intended to be quantitative, however, results are considered to be qualitative because laboratory Form 1s are not available to confirm the reported results.
Direct-push sampling locations 21000 through 21005	Quantitative	Quantitative assessment of presence or absence of potential contaminants in soil and groundwater related to site activities
Locations Upgradient of Site 21		
Wells MW-12U and MW-12L	Quantitative	Quantitative assessment of presence or absence of potential contaminants migrating on site from upgradient source. Results from these locations were intended to be quantitative, however, results are considered to be qualitative because laboratory Form 1s are not available to confirm the reported results.
Locations Downgradient of Site 21		
Wells MW-94, PW-03, and MW-45	Quantitative	Quantitative assessment of presence or absence of potential contaminants in soil and groundwater down and side gradient to the Receiver Site Landfill. Results from these locations were intended to be quantitative, however, the pre-2003 results are considered to be qualitative because laboratory Form 1s are not available to confirm the reported results.

Note:
MW - monitoring well

Table 4-2
Chronological Quantitative Sampling Summary

Sampling Location	Matrix	Sampling Date	Range of Analyses[a]
MW-45	Groundwater	03/2003	TPH, SVOCs, VOCs, TDS
PW-03	Groundwater	03/2003	TPH, SVOCs, VOCs, TDS
21000 – 21005	Soil and groundwater	03/2003	TPH, VOCs, SVOCs

[a]All analyses in the range shown were not necessarily performed on each sampling date.

Notes:
DP – direct-push
MW – monitoring well
PCBs – polychlorinated biphenyls
SVOCs - semivolatile organic compounds
TDS – total dissolved solids
TPH – total petroleum hydrocarbons (including TPH-extractable, TPH-purgeable, TPH-heavy oil, HBPHC [high-boiling-point hydrocarbon], LBPHC [low-boiling-point hydrocarbon])
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 waste water treatment plant discharge. During rare storm events, stormwater in small ditches may enter the unnamed drain.

5.1.2 Site 21 Physical Setting

Site 21 is located in the northeastern portion of NAS Fallon (Figure 2-2) and occupies approximately 60 acres. The site is currently flat, and the surface consists of native vegetation. Site 21 is one of the Group II sites that also include the Defuel Disposal Area (Site 6), the Napalm Burn Pit (Site 7), and the Northeast Runway Landfill (Site 22). Site 7 and a portion of Site 6 lie within Site 21. Groundwater is shallow at the site ranging from approximately 4 to 7 feet bgs. Groundwater flow is to the southeast. 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 21.

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.

A 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 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, investigations at the facility have focused on the shallow water-table aquifer, with three widely spaced wells drilled into the intermediate aquifer.

5.3.3 Site 21 Geology and Hydrogeology

The geologic information for Site 21 was obtained during drilling wells MW-12U, MW-12L, MW-45, MW-94, PW-03, direct-push borings 21000 through 21005 and slug testing at wells MW-45 and PW-03.

Monitoring wells installed around the perimeter of the site typically penetrate the entire Fallon Formation and from 2 to 10 feet of the Sehoo Formation (see Figure 5-1 for the generalized stratigraphy in the area of NAS Fallon). Borings for these wells were completed to depths between 12 and 20 feet. A generalized fence diagram is provided as Figure 5-2.

The shallow saturated formation is dominated by sand with variable amounts of silt from the ground surface to approximately 20 feet bgs. A silt lens is present at location 21000 from the ground surface to a depth of approximately 16 feet bgs. A thin silt lens is present at locations 21002 and PW-03 at a depth of approximately 10 feet bgs, which is interpreted to extend to the southeast and thicken at the 21003 location (Figure 5-2). A clay layer is present beneath the site at a depth of approximately 20 feet bgs.

Slug testing was performed at wells MW-45 and PW-03 to estimate hydraulic conductivity at these two locations. Hydraulic conductivity is estimated to range from 29.6 to 32.3 feet per day at MW-45. Hydraulic conductivity is estimated at approximately 0.2 foot per day at well PW-03. Results of the slug tests appear to compare favorably to the rough estimates from the grain-size analysis.

Depth to groundwater, as measured in wells PW-03, MW-45, and MW-94, varied from 5.21 (PW-03) to 11.44 (MW-45) feet below the top of the casing. Groundwater surface elevation contours for March 2003 are shown on Figure 5-3. Groundwater flow was estimated to be to the southeast. The average hydraulic gradient across the site was approximately 0.002 in March 2003. Assuming a porosity of 30 percent and using the slug test data, estimated groundwater velocity across the site ranges from 0.5 to 79 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 1.3 to 1.9 times lower than the pumping test based estimates suggesting that groundwater velocity across the site could be as high as 149 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 21 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 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 EPA, 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 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. The 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.

5.5 NATURE AND EXTENT OF CONTAMINATION

This section first summarizes results of investigations at Site 21, then discusses in detail (in the following subsections) contaminants in soil and groundwater. Investigations at the site include the following:

- Qualitative analysis of groundwater test holes to assess the presence or absence of volatile contaminants at Site 21
- Magnetic survey to identify potential buried metal that could be serving as contaminant sources
- Soil and groundwater sampling at Site 21 to determine if site activities have impacted site soils or groundwater
- Groundwater sampling upgradient and downgradient of the Receiver Site Landfill to determine if site activities have impacted site 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.

Soil samples collected during the phases of investigation at Site 21 were analyzed for TPH, VOCs, SVOCs, pesticides, and metals. Fifty-two soil samples were analyzed for TPH. One soil sample contained TPH as JP-5 above the reporting limit, and two soil samples contained TPH-E and TPH—heavy fraction/oil (TPH-O) at concentrations above the reporting limits. Of these detections, one soil sample contained TPH-JP-5 at a concentration of 250 mg/kg, and one soil sample contained TPH-O at a concentration of 470 mg/kg. These concentrations are greater than the state action level of 100 mg/kg. None of the remaining soil samples contained TPH at concentrations above the state action level, including TPH-E and TPH-P. Fifty-eight soil samples were analyzed for VOCs and SVOCs. None of the analyzed soil samples contained

VOCs or SVOCs at concentrations above state action levels. Fifty-two soil samples were analyzed for pesticides. None of the analyzed samples contained pesticides at concentrations greater than the reporting limits. Metals were detected at concentrations in soil that are consistent with naturally occurring background concentrations.

Groundwater samples collected during the phases of investigation at Site 21 were analyzed for TPH, VOCs, SVOCs, pesticides, PCBs, and metals. Over 50 groundwater samples were collected across the site and analyzed for TPH. TPH-P was not detected in any of the analyzed groundwater samples at concentrations greater than the reporting limits. TPH as JP-5 was detected in one groundwater sample (1,900 µg/L) at a concentration greater than the guidance concentration of 1,000 µg/L. TPH-E was detected in one groundwater sample (28 µg/L) at a concentration less than the guidance concentration of 1,000 µg/L. TPH-O was detected in two groundwater samples at concentrations less than the guidance concentration of 1,000 µg/L. Trichloroethene (TCE) was the only VOC detected in groundwater at a concentration greater than the state action level. TCE was detected in 5 of 65 groundwater samples at concentrations ranging from 5 to 45 µg/L, all of which are greater than the state action level of 5 µg/L. SVOCs and pesticides were not detected at concentrations greater than reporting limits or state action levels. Metals were detected at concentrations in groundwater that are consistent with naturally occurring background concentrations.

5.5.1 Qualitative Data From Groundwater Test Holes

Qualitative data were initially collected to assess the presence or absence of volatile contaminants in the general vicinity of the Group II sites, including Site 21. Sampling locations were then selected for quantitative analysis of soil and groundwater samples on the basis of the qualitative results and the regional groundwater flow direction. The sampling locations from which qualitative data were collected were called "groundwater test holes"; they consisted of hollow-stem auger borings from which one-time groundwater samples were collected. Each groundwater test hole was screened with the use of a hand-held photoionization detector (PID) to analyze the air space of the open boring. Then a groundwater sample was collected from the boring, and an aliquot of air from the headspace above the groundwater sample was analyzed with the use of a portable field gas chromatograph (GC). The generated data consisted of "presence or absence" indicators including detect or nondetect records for each instrument at each sampling location. The rationale and methodology for sampling from the groundwater test holes is described in detail in Appendix C of the RI report (ORNL 1994).

Thirty-four groundwater test holes were completed around the perimeter of Site 21. The groundwater test holes provided screening-level data to assess the presence or absence of volatile contaminants that could be related to Site 21 or migrating onto and across Site 21 from upgradient sources. More specifically, results from the groundwater test holes were typically

used as yes or no responses to the question "is contamination present or absent?" Contamination was not identified using this method at any of the test hole locations.

5.5.2 Quantitative Soil Data

A summary of detected organics in soil is provided in Table 5-1. This table summarizes results from both the pre-2003 and 2003 sampling events. Results from the pre-2003 sampling events are considered qualititative because the laboratory Form 1s are not available to confirm the reported results.

Fifty-two soil samples were analyzed for TPH as JP-5, TPH-E, and TPH-O. JP-5 was detected in one soil sample at a concentration of 250 mg/kg, which is greater than the state action level of 100 mg/kg. This sample was collected from the 1998 direct-push location 38 (Figure 2-3). TPH-O was detected in two soil samples at concentrations of 24 and 470 mg/kg. The later result measured in the sample from the 1998 direct-push location 48 is greater than the state action level (Figure 2-3). TPH-E was detected in two soil samples at concentrations of 10 and 94 mg/kg, both of which are less than the state action level of 100 mg/kg.

Fifty-eight soil samples were analyzed for VOCs. Ethylbenzene, methlyene chloride, xylenes, 1,2,4-trichloroebenzene, and trichlorofluoromethane were detected in up to four samples, depending upon the compound (Table 5-1). None of the detected VOCs was measured in soil at a concentration greater than its respective state action level.

Fifty-eight soil samples were also analyzed for SVOCs. Bis(2-ethylhexyl)phthalate was detected in two soil samples at concentration of 0.099 and 1.3 mg/kg, both of which are below the state action level of 35 mg/kg. Phenol was detected in seven soil samples at concentrations ranging from 0.8 to 4.1 mg/kg. Phenol was not detected in soil at a concentration greater than the state action level of 37,000 mg/kg.

Pesticides were not detected above the reporting limits in the 51 analyzed samples.

Forty-nine soil samples were analyzed for aluminum, antimony, arsenic, beryllium, chromium, lead, nickel, selenium, and vanadium (Table 5-2). Aluminum, arsenic, chromium, lead, nickel, and vanadium were detected in all 49 samples. Arsenic was detected at concentrations ranging from 1.1 to 8.5 mg/kg, which is greater than the PRG of 0.39 mg/kg. However, measured arsenic concentrations are consistent with naturally occurring background concentrations at NAS Fallon and are not considered to be a result of Site 21 activities. The remaining inorganic analyte concentrations were below their respective PRGs.

Results for select analytes in the March 2003 soil samples are summarized in Table 5-3. Location 21000 was positioned to evaluate phenol detections in soil samples collected during the 1998 and 1999 soil sampling events at the site. The soil sample from location 21000 was collected at a depth of 6.5 to 8 feet bgs, which is just above saturation. This sample was analyzed for VOCs and SVOCs. The VOC 1,2,4-trichlorobenzene was detected at an estimated concentration of 0.002 mg/kg, which is less than the state action level of 650 mg/kg. There were no other VOCs detected at concentrations greater than the reporting limits in this sample. SVOCs, including phenol, were not detected at concentrations above the reporting limits.

Soil samples from all five March 2003 locations (21000 through 21004) were analyzed for VOCs. Locations 21001, 21002, and 21003 were specifically positioned to evaluate TCE detections in groundwater samples collected during the 1998 and 1999 sampling events at the site. TCE was not detected above the reporting limit in any of the five analyzed soil samples. Trichlorofluoromethane was detected in two soil samples at estimated concentrations of 0.002 and 0.003 mg/kg. Both of the detections are below the state action level of 390 mg/kg. Location 21004 was positioned to evaluate petroleum hydrocarbons in soil and groundwater relative to the suspected portion of Site 6 within Site 21. TPH-E, TPH-P, and VOCs were not detected in the soil sample from this location at concentrations above reporting limits.

5.5.3 Groundwater Monitoring

Table 5-4 summarizes all detected analytes in groundwater for samples collected at the site to date. Fifty-two groundwater samples were analyzed for TPH. TPH-P was not detected at concentrations above the reporting limits. TPH as JP-5 was detected in 3 of the 52 analyzed samples at concentrations ranging from 580 to 1,900 µg/L. The sample from the 1998 location 38 contained TPH as JP-5 at a concentration of 1,900 µg/L, which is greater than the guidance concentration of 1,000 µg/L. TPH-E was detected in 1 of 52 groundwater samples at a concentration of 28 µg/L, which is less than the guidance concentration of 1,000 µg/L. TPH-O was detected in 2 of 52 groundwater samples at a concentrations of 52 and 840 µg/L, both of which are less than the guidance concentration of 1,000 µg/L.

Eight VOCs were detected in groundwater samples collected from the site. The detected compounds were acetone, ethylbenzene, xylenes, TCE, dichlorodifluoromethane, 1,1-dichloroethene, 1,1,1-trichloroethane, and trichlorofluoromethane. TCE was detected in 5 of 65 analyzed groundwater samples at concentrations ranging from 7 to 45 µg/L, all of which are greater than the state action level of 5 µg/L. None of the remaining detected VOCs were measured at concentrations in groundwater greater than their respective state action levels.

Two SVOC compounds, bis(2-ethylhexyl)phthalate and butylbenzylphthalate were detected in groundwater samples collected at the site. Bis(2-ethylhexyl)phthalate was detected in 4 of 50 analyzed groundwater samples at concentrations ranging from 3 to 5 µg/L, all of which are below the state action level of 6 µg/L. Butylbenzylphthalate was detected in one sample at a concentration of 22 µg/L, which is below the state action level of 7,300 µg/L.

Pesticides and PCBs were not detected in groundwater samples at concentrations greater than the reporting limits.

Table 5-5 summarizes detected inorganic concentrations in groundwater at the site. Up to 35 groundwater samples were analyzed for inorganics at the site. Table 5-5 provides a summary of detected metals (inorganics) in groundwater. Antimony was detected in 33 of 35 analyzed samples at concentrations ranging from 7 to 39 µg/L. All of these detections are greater than the maximum contaminant level (MCL) of 6 µg/L. However, the measured antimony concentrations are consistent with naturally occurring background concentrations and are not considered to be a result of Site 21 activities. Arsenic was detected in 34 of the 35 analyzed groundwater samples at concentrations ranging from 6 to 6,400 µg/L. Boron was detected in all nine analyzed samples at concentrations ranging from 3,070 to 150,000 µg/L. Boron was detected in seven of these samples at concentrations greater than the PRG of 7,300 µg/L. However, the measured boron concentrations in groundwater are consistent with naturally occurring background concentrations and are not considered to be a result of Site 21 activities. Selenium was detected in 23 of the 35 analyzed samples at concentrations ranging from 11 to 120 µg/L. Six of the selenium detections were greater than the MCL of 50 µg/L. The measured selenium concentrations in groundwater are consistent with naturally occurring background concentrations and are not considered to be a result of Site 21 activities. Vanadium was detected in 34 of the 35 analyzed samples at concentrations ranging from 7 to 2,200 µg/L. Thirty-two of the selenium detections were greater than the PRG of 260 µg/L. The measured vanadium concentrations in groundwater are consistent with naturally occurring background concentrations and are not considered to be a result of Site 21 activities.

Results for select analytes in the March 2003 groundwater samples are summarized in Table 5-6. Location 21000 was positioned to evaluate phenol detections in soil samples collected during the 1998 and 1999 soil sampling events at the site. Groundwater samples were also collected from wells PW-03 and MW-45 to further evaluate the extent of phenol in groundwater. The groundwater samples collected from location 21000, MW-45, and PW-03 were analyzed for SVOCs. SVOCs, including phenol, were not detected at concentrations above the reporting limits in the groundwater samples from these locations.

Groundwater samples from all five direct-push locations (21000 through 21004) and wells MW-45 and PW-03 were analyzed for VOCs. Locations 21001, 21002, and 21003 were specifically positioned to evaluate TCE detections in groundwater samples collected during the 1998 and 1999 sampling events at the site. TCE was detected in groundwater sample from location 21002 at a concentration of 36 µg/L, which is above the state action level of 5 µg/L. None of the other six groundwater samples contained TCE at a concentration above the reporting limit. Bis(2-ethylhexyl)phthalate was detected at an estimated concentration of 4 µg/L from locations 21000 and MW-45. This concentration is below the state action level of 6 µg/L. The groundwater sample from PW-03 contained bis(2-ethylhexyl)phthalate at an estimated concentration of 5 µg/L, which is also below the state action level of 6 µg/L. Bis(2-ethylhexylphthalate was also detected in the laboratory method blank and these detections are considered to be laboratory contaminants. TDS was measured at 34,000 and 15,000 mg/L in groundwater samples from wells PW-03 and MW-45, respectively.

5.6 CONTAMINANT FATE AND TRANSPORT

Soil and groundwater samples were collected from location 21000 to evaluate the extent of phenol detected in soil samples collected from the 1998 direct-push locations 10, 39, 40, 41, 42, 43, and 44. None of the 1998 pheonol detections in soil exceeded the state action level of 37,000 mg/kg. Phenol was not detected at concentrations above the reporting limit in both soil and groundwater samples collected at location 21000 or in groundwater samples collected from wells PW-03 and MW-45. Direct-push location 21000 was positioned near the 1998 sampling locations, which identified phenol in soil. Based on these results, Site 21 does not appear to contain a source of phenol to groundwater.

TCE was detected in groundwater samples collected from the 1998 direct-push sampling locations 18, 19, and 20 and in the 1996 groundwater sample from well MW-45. Soil and groundwater samples were collected from locations 21001 through 21003 to further assess the extent of TCE in groundwater at Site 21. TCE has not been detected above the reporting limit in 58 soil samples collected at the site, including locations 21001 through 21003. TCE was detected in the groundwater sample collected from location 21002 at a concentration of 36 µg/L, which is greater than the state action level of 5 µg/L. Groundwater samples collected from well MW-45 (located approximately 1,600 feet downgradient of location 21002) in 2002 and 2003 did not contain TCE at concentrations above the reporting limit. A groundwater sample collected from well MW-94 (located approximately 1,400 feet downgradient and slightly cross-gradient of location 21002) in 1996 also did not contain TCE at a concentration above the reporting limit. Groundwater samples collected in March 2003 from locations 21003 and 21004 (located approximately 600 and 1,000 feet downgradient of location 21002, respectively) also did not contain TCE at concentrations above the reporting limit. TCE has been detected in 5 of

the 65 groundwater samples collected at the site from 1990 to 2003. The detected TCE concentrations in groundwater (7 to 45 µg/L) are not indicative of a high concentration source at Site 21. The low number of TCE detections in groundwater (5 of 65) indicates that the concentrations of TCE are currently limited to the area from the 1998 direct-push location 19 and to a point between the 2003 direct-push locations 21002 and 21003. The lack of detectable concentrations in groundwater from locations 21003, 21004, well MW-45, and well PW-03 suggests that these concentrations are naturally attenuating and not migrating off site.

Soil and groundwater samples were collected from direct-push location 21004 to confirm 1998 direct-push sampling results for the portion of Site 6 (Defuel Disposal Area) that is within the Site 21 boundary. The 1998 direct-push sampling results indicated the petroleum hydrocarbons were not present in soil or groundwater at the sampled locations at concentrations above the reporting limits or above state action levels. Results from location 21004 confirm this observation.

TPH as JP-5 was detected in 1 of the 52 soil samples at a concentration of 250 mg/kg (1998 location 38). TPH-O was detected in 1 of the 52 soil samples at a concentration of 470 mg/kg (1998 location 48). Both of these detections are above the state action level of 100 mg/kg. Fifty-eight soil samples have been collected across the site and analyzed for VOCs and SVOCs with none of these analytes detected at a concentration greater than the state action level. These data suggest that there are no significant contaminant sources in soil at Site 21.

TPH as JP-5 was detected in one of 52 groundwater samples collected at the site at a concentration of 1,900 µg/L, which is greater than the guidance concentration of 1,000 µg/L. No other petroleum hydrocarbon fractions were detected in groundwater above the guidance concentration. Between 50 and 65 groundwater samples have been collected at the site from 1990 to 2003 and analyzed for VOCs and SVOCs. TCE was the only analyte detected at concentrations above the state action level as previously discussed. The observations suggest that the only contaminant at Site 21 in groundwater is TCE, which is present at low concentrations in a limited area. Furthermore, historical and recent data suggest that the TCE is naturally attenuate prior to migrating off site. These TCE detections in groundwater are also located upgradient of Site 6. Remedial Alternatives are currently being evaluated for Site 6 and any remedy implemented at Site 6 will directly benefit Site 21.

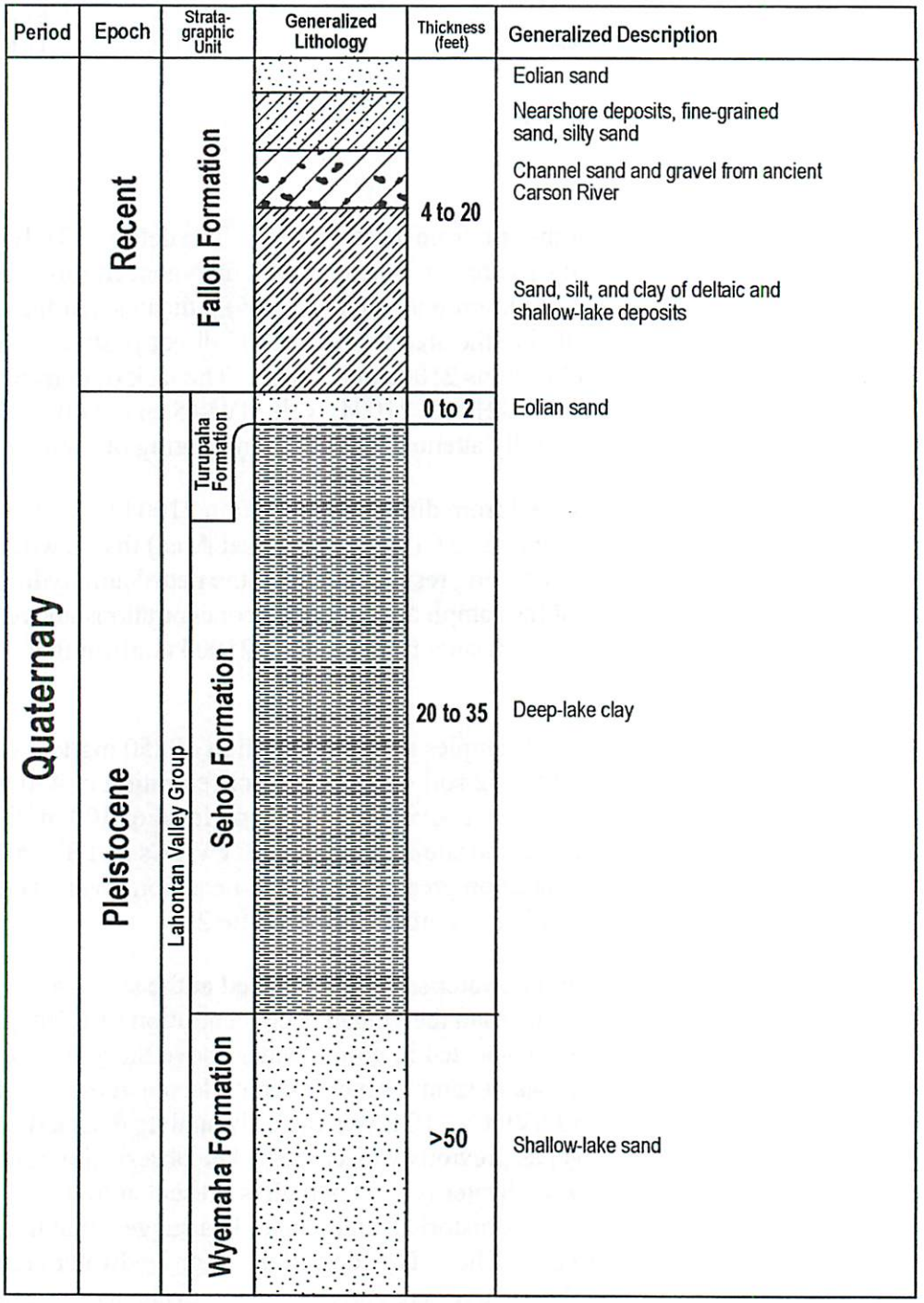

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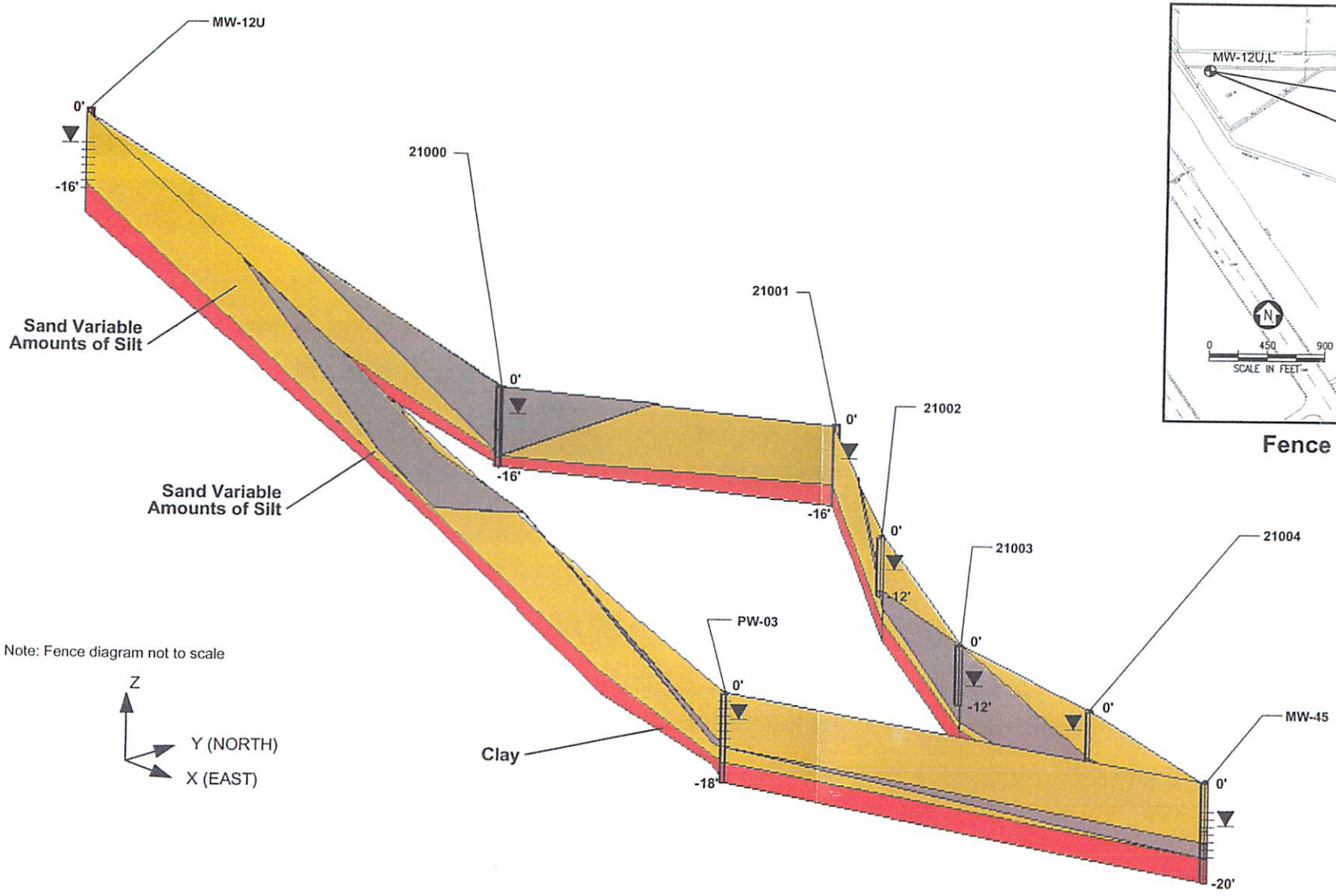
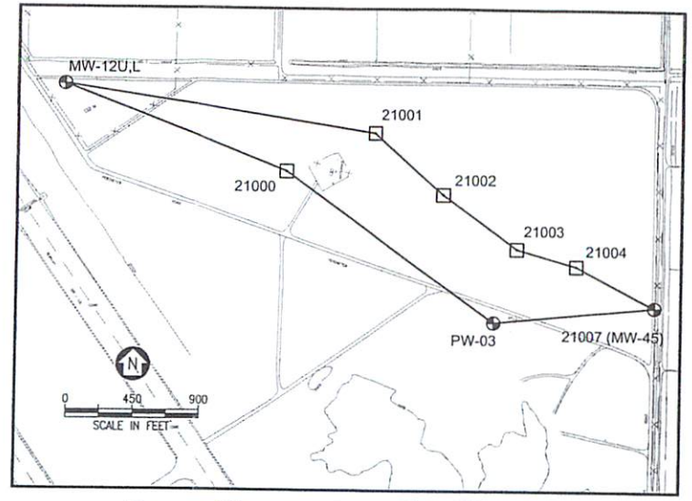
Figure 5-1
Generalized Stratigraphy of NAS Fallon

Delivery Order 0031
NAS Fallon
DECISION DOCUMENT
SITE 21





Fence Diagram Location Map View

Legend

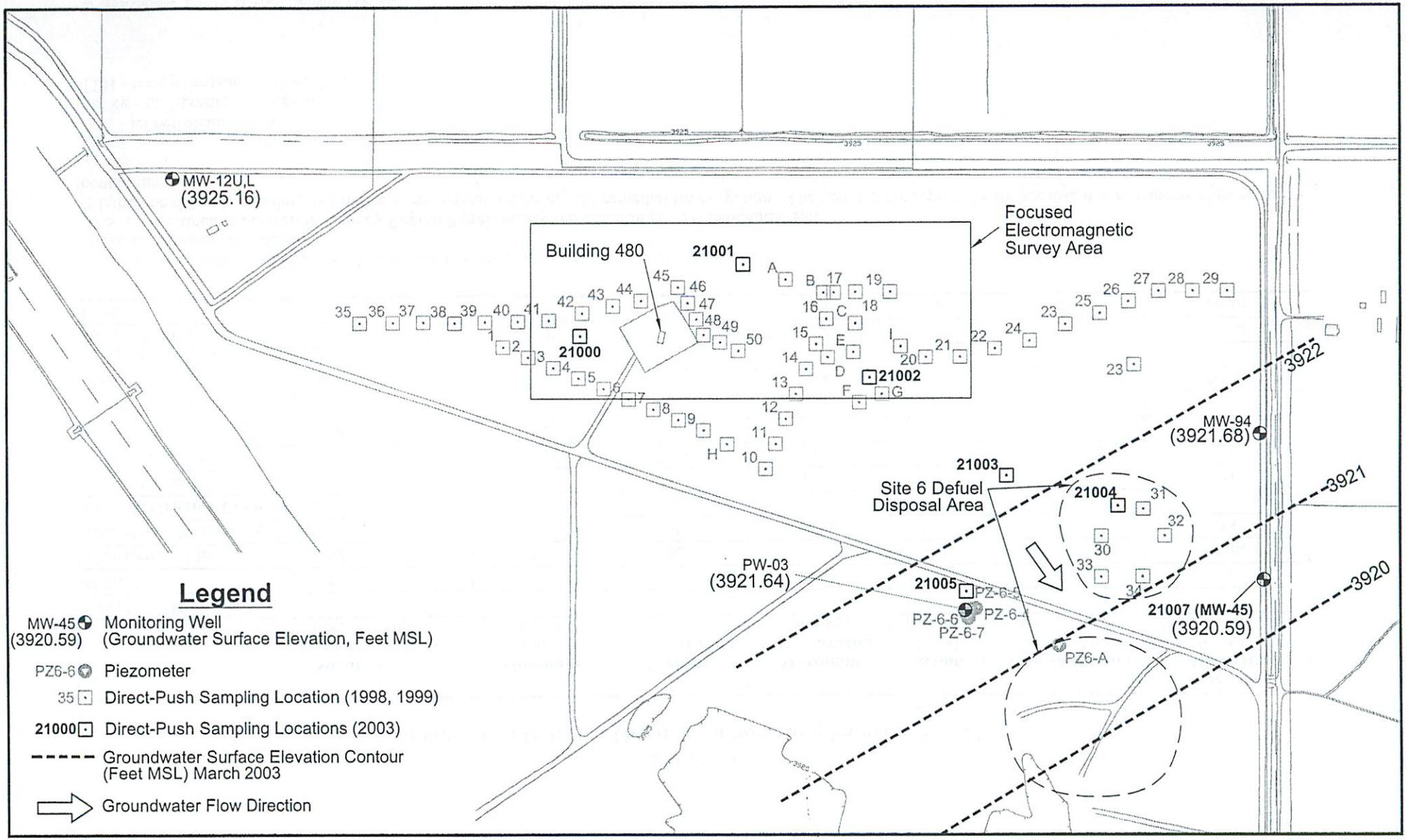
MW-12U,L — Monitoring Well

21000 — Direct-Push Sampling Locations (2003)

Screen Interval

FILENAME: T:\NAVY\Fallon\Sub-Tasks\DO 31\DD\SITE 21\FIG 5-2 FENCE.dwg
EDIT DATE: 04/27/04 AT: 13:46

U.S. NAVY	Delivery Order 0031 NAS Fallon DECISION DOCUMENT SITE 21	SCALE AS NOTED	**Figure 5-2** **Generalized Fence Diagram** **Site 21**



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SCALE IN FEET

Figure 5-3
March 2003 Groundwater
Surface Elevation Contours, Site 21

Delivery Order 0031
NAS Fallon
DECISION DOCUMENT
SITE 21

FILENAME: T:\NAVY\Fallon\Sub-Tasks\DO 31\DD\SITE 21\FIG 5-3 MAR 03 GW.dwg
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Table 5-1
Summary of Detected Organics in Soil Samples From Site 21[a]

Analyte	No. of Samples Tested	No. of Detections	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	Action Level (mg/kg)	No. of Detections Greater Than Action Level	Location IDs With Detections Greater Than Action Level
Petroleum Hydrocarbons								
TPH-JP-5	52	1	250	250	250	100[b]	1	38
TPH-Extractable	52	2	10	52	94	100[b]	0	None
TPH-Heavy Fraction/Oil	52	2	24	247	470	100[b]	1	48
Volatile Organic Compounds								
Ethylbenzene	58	2	0.021	0.032	0.042	8.9[c]	0	None
Methylene chloride	58	2	0.003	0.006	0.008	9.1[c,d]	0	None
Total xylenes	58	3	0.022	0.084	0.189	270[c]	0	None
1,2,4-Trichlorobenzene	58	1	0.002	0.002	0.002	650[c]	0	None
Trichlorofluoromethane	58	4	0.002	0.008	0.022	390[c]	0	None
Semivolatile Organic Compounds								
Bis(2-ethylhexyl)phthalate	58	2	0.099	0.7	1.3	35[c]	0	None
Phenol	58	7	0.8	2.35	4.1	37,000[c]	0	None

[a]Includes March 2003 sampling results and qualitative RI and qualitative 1998–1999 data
[b]Nevada Administrative Code
[c]U.S. Environmental Protection Agency Region 9 preliminary remediation goals – residential soil
[d]Methylene chloride was detected in one sample obtained during the remedial investigation. The result is not reported here because it is a suspected laboratory contaminant.

Notes:
JP-5 - jet petroleum No. 5
mg/kg - milligram per kilogram
TPH - total petroleum hydrocarbon

Table 5-2
Summary of Detected Metals in Soil Samples From Site 21[a]

Analyte	No. of Tests	No. of Detections	Minimum Detection (mg/kg)	Average Detection (mg/kg)	Maximum Detection (mg/kg)	PRG (mg/kg)	Naturally Occurring Background (mg/kg)	No. of Detections Greater Than PRG	Location IDs Greater Than PRG
Aluminum	49	49	2,400	8010	15,000	76,000[b]	1,800 to 20,700	0	None
Antimony	49	5	0.5	0.5	0.5	31[b]	0.4 to 5	0	None
Arsenic	49	49	1.1	4.2	8.5	0.39[b]	1.1 to 40	49	All
Beryllium	49	20	0.3	0.4	0.7	150[b]	0.11 to 1.5	0	None
Chromium	49	49	1.9	6.4	12	10,000[b]	0.014 to 64	0	None
Lead	49	49	0.7	3.8	19	150[b]	0.019 to 55	0	None
Nickel	49	49	3.1	8.4	49	1,600[b]	0.011 to 49	0	None
Vanadium	49	49	8.6	24.6	44	55[b]	0.054 to 74	0	None

[a]Includes March 2003 sampling results and qualitative RI and qualitative 1998–1999 data
[b]U.S. Environmental Protection Agency Region 9 preliminary remediation goals – residential soil

Notes:
mg/kg – milligram per kilogram
No. - number
PRG – preliminary remediation goal

Table 5-3
Summary of Select Analytes in March 2003 Soil Samples From Site 21

Location Cross-Reference	Sample ID	Beginning Depth (ft bgs)	Ending Depth (ft bgs)	TPH-E (mg/kg)	TPH-P (mg/kg)	Phenol (mg/kg)	TCE (mg/kg)	Trichlorofluoromethane (mg/kg)
GP-21000	230068	6.5	8	NS	NS	0.44U	0.004U	0.004U
GP-21001	230072	6	8	NS	NS	NS	0.004U	0.002J
GP-21002	230077	6	7	NS	NS	NS	0.004U	0.003J
GP-21003	230081	4	5.5	NS	NS	NS	0.004U	0.004U
GP-21004	230084	4	6	30U	6U	NS	0.004U	0.004U
State Action Level				100[a]	100[a]	37,000[b]	0.053[b]	390[b]

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

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

Table 5-4
Summary of Detected Organics in Groundwater Samples From Site 21[a]

Analyte	No. of Tests	No. of Detections	Minimum Detection (µg/L)	Average Detection (µg/L)	Maximum Detection (µg/L)	State Action Level (µg/L)	No. of Detections Greater Than Action Level	Location IDs Greater Than Action Level
Petroleum Hydrocarbons								
TPH-JP-5	52	3	580	1037	1,900	1,000[b]	1	38
TPH-Extractable	60	1	28	28	28	1,000[b]	0	None
TPH-Heavy Fraction/Oil	56	2	52	446	840	1,000[b]	0	None
Volatile Organic Compounds								
Acetone	9	1	1	1	1	1,600[c]	0	None
Ethylbenzene	65	1	11	11	11	700[d]	0	None
Xylenes	65	4	2	3.5	4.9	10,000[d]	0	None
Trichloroethene	65	5	7	24.4	45	5[d]	5	18, 19, 20, MW-45, 21002
Dichlorodifluoromethane	9	1	0.6	0.6	0.6	390[c]	0	None
1,1-Dichloroethene	65	1	3.9	3.9	3.9	7[d]	0	None
1,1,1-Trichloroethane	65	1	20	20	20	200[d]	0	None
Trichlorofluoromethane	65	2	1.2	1.7	2.1	1,300[c]	0	None
Semivolatile Organic Compounds								
Bis(2-ethylhexyl)phthalate	50	4	3	4	5	6[d]	0	None
Butylbenzylphthalate	50	1	22	22	22	7,300[c]	0	None

[a]Includes March 2003 sampling results and qualitative RI and qualitative 1998–1999 data
[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:
JP-5 - jet petroleum No. 5
µg/L - microgram per liter
No. - number
TPH - total petroleum hydrocarbons

Table 5-5
Summary of Detected Metals in Groundwater Samples From Site 21[x]

Analyte	No. of Tests	No. of Detections	Minimum Detection (µg/L)	Average Detection (µg/L)	Maximum Detection (µg/L)	MCL or PRG (µg/L)	Naturally Occurring Background	No. of Detections Greater Than MCL or PRG	Location IDs Greater Than MCL or PRG
Aluminum	35	29	41.7	151	750	36,000[b]	41 to 1,460	0	None
Antimony	35	33	7	21.8	39	6[c]	7 to 59.7	33	All
Arsenic	35	33	6	4,168	6,400	10[c]	6 to 21,000	All	Various
Barium	9	5	27.5	195.7	440	2,000[c]	6.8 to 660	0	None
Beryllium	35	2	2.4	7.2	12	73[b]	1.2 to 18	0	None
Boron	9	9	3,070	50,238	150,000	7,300[b]	570 to 240,000	7	Various
Calcium	5	4	1,430	38,683	104,000	NE	1,330 to 616,000	NA	NA
Chromium	35	19	5	10.5	31	100[c]	5 to 31	0	None
Copper	5	2	10.2	15.6	22.6	1,300[c]	100 to 333	0	None
Iron	5	2	31.5	39.5	47.5	11,000[b]	11 to 3,040	0	None
Lithium	5	5	41.4	88.5	141	730[b]	28 to 875	0	None
Magnesium	5	3	3,200	10,377	24,300	NE	970 to 812,000	NA	NA
Manganese	5	3	11.3	154.1	382	880[b]	2 to 895	0	None
Molybdenum	5	4	23.3	602.7	1,400	50[c]	23 to 5,200		MW-45, MW-94, PW-03
Nickel	35	9	5	12.4	41	730[b]	5 to 178	0	None
Potassium	5	3	1,000	57,600	194,000	NE	5,630 to 487,000	NA	NA
Selenium	35	23	11	36.4	120	50[c]	3 to 140	6	10, 21, 30, MW-12U, MW-12L
Sodium	5	5	128,000	4,333,600	12,700,00	NE	128,000 to 22,500,000	NA	NA
Vanadium	35	34	7	1,379.80	2,200	260[b]	7 to 3,000	32	Various

Table 5-5 (Continued)
Summary[a] of Detected Metals in Groundwater Samples From Site 21

[a]Includes March 2003 sampling results and qualitative RI and qualitative 1998–1999 data
[b]U.S. Environmental Protection Agency (EPA) Region 9 preliminary remediation goals – tap water
[c]Maximum contaminant level

Notes:
MCL - maximum contaminant level
mg/L - milligram per liter
NA - not applicable
NE - not established
No. - number
PRG - preliminary remediation goal

Table 5-6
Summary of Select Analytes in March 2003 Groundwater Samples From Site 21

Location ID	Location Cross-Reference	Sample ID	TPH-E (µg/L)	TPH-P (µg/L)	Phenol (µg/L)	TCE (µg/L)	Bis(2-ethylhexyl)phthalate[a] (µg/L)	TDS (mg/L)
21000	GP-21000	230070	NS	NS	5U	1U	4J	NS
21001	GP-21001	230075	NS	NS	NS	1U	NS	NS
21002	GP-21002	230079	NS	NS	NS	36	NS	NS
21003	GP-21003	230083	NS	NS	NS	1U	NS	NS
21004	GP-21004	230086	250U	50U	NS	1U	NS	NS
21006	PW-03	230100/230102	250U	50U	5U	1U	5J	34,000
21007	MW-45	230101	250U	50U	5U	1U	4J	15,000
State Action Level:			1,000[b]	1,000[b]	2,200[c]	5[d]	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 result greater than state action level
J – associated value is an estimate
µg/L – microgram per liter
NS – not sampled for specified analyte
TCE - trichloroethene
TDS - total dissolved solids
TPH-E – total petroleum hydrocarbons—extractable
TPH-P – total petroleum hydrocarbons—purgeable
u – analyte not detected above 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 Receiver Site Landfill were terminated in 1980, and Site 21 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 21 will be prohibited as part of the overview planning process. Any future construction projects conducted at Site 21 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 used 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 21 (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 Receiver Site 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.

The analytical results from Site 21 sampling reported the presence of phenol in site soil and groundwater samples. The soil and groundwater samples were collected in March 2003 to evaluate the extent of phenol detected in the 1998 soil samples collected (locations 10, 39, 40, 41, 42, 43, and 44). Phenol was detected in 1998 at concentrations below the state action level of 37,000 mg/kg. The March 2003 sampling effort did not detect phenol at concentrations above the reporting limit in both soil and groundwater samples collected. Based on these results, Site 21 does not appear to contain a source of phenol to groundwater and does not pose a risk to human health or the environment relative to phenol.

TPH as JP-5 was detected in one soil sample at a concentration greater than the state action level of 100 mg/kg. TPH as JP-5 was not detected in the remaining 51 analyzed soil samples. TPH-O was detected in 2 of 52 analyzed soil samples with one of these detections greater than the state action level of 100 mg/kg. The remaining 50 samples did not contain TPH-O at concentrations greater than the reporting limit. These results indicate that there is a limited volume of soil at the site, which could act as a source of TPH to groundwater. TPH as JP-5 was detected in 3 of 52 groundwater samples with one of these detections greater than the guidance concentration of 1,000 µg/L. TPH was not detected in the remaining 49 analyzed groundwater samples at concentrations greater than the reporting limit. TPH was not detected in groundwater samples collected from locations downgradient of these soil and groundwater detections. These results indicate that Site 21 does not represent a large-scale or high-concentration source of TPH to groundwater and that the limited TPH impacts at the site are not migrating off site.

TCE was the only other analyte that was detected in groundwater at a concentration greater than the state action level. TCE has been detected in 5 of the 65 groundwater samples collected at the site. The highest concentration of 45 µg/L was detected in the 1998 groundwater sample collected from location 19, which is approximately 1,100 feet upgradient of the downgradient site boundary and on an approximate flow line to well PW-03. Concentrations of TCE decrease

along the flowpath towards PW-03, and TCE was not detected above the reporting limit at the March 2003 direct-push location 21003 (approximately 800 feet downgradient of the highest TCE concentration). TCE has not been detected in 1997 or 2003 samples collected from PW-03. In addition, TCE has not been detected at concentrations above the reporting limit in any of the 58 soil samples collected at Site 21. These results indicate that Site 21 does not represent a large-scale or high-concentration source of TCE to the environment and that TCE is not currently migrating off site. Also, the distribution of TCE suggests that TCE is attenuating well before the downgradient site boundary. In addition, these TCE detections in groundwater are upgradient of Site 6. Remedial alternatives are currently being evaluated at Site 6 and any remedy implemented at Site 6 will directly benefit Site 21.

Groundwater is not currently used as a water source for any purpose at or immediately downgradient of Site 21. Based on this condition and the observed concentrations of TPH and TCE in soil and the observed concentrations and distribution of TPH and TCE in soil, Site 21 does not pose a risk to human health or the environment.

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 21, Receiver Site 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 focused 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 444.570 through 444.7499 - Solid Waste 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 21. The regulations include general provisions addressing cover design and post-closure groundwater monitoring. Assuming that Site 21 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 1975 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 30 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 areas that are regraded, and maintaining the areas that are regarded 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 21, Receiver Site 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 21 for the following reasons:

- The observed TCE impacts to groundwater are low in concentration.
- Soil samples collected at the site did not contain TCE above state action levels, which indicates that there is not an ongoing source of TCE in soil at the site.
- Measured TDS concentrations (greater than 10,000 mg/L) make the shallow aquifer at Site 21 a poor choice as a groundwater source.
- The shallow aquifer is not currently used at NAS Fallon as groundwater source and will not be used as a groundwater source in the foreseeable future.
- TCE is not currently migrating off site and the closest TCE detection in groundwater is approximately 1,200 feet upgradient of the downgradient site boundary.

In summary, *Limited Action* was selected for Site 21. 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 30 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 21 is summarized in "Remedial Alternatives Evaluation and Cost Analysis, Site 21, Receiver Site Landfill, Naval Air Station Fallon, Nevada" (U.S. Navy 2004).

9.0 STATUTORY AUTHORITY FINDING

Site 21 has no identified contaminant sources. Disposal operations at the Receiver Site Landfill were terminated in 1980. The site is currently vacant land and the Navy does not expect any change in the use of Site 21, or of the surrounding sites, in the foreseeable future.

TPH as JP-5 and TPH-O were the only organic compounds detected in soil at concentrations greater than the state action level. TPH as JP-5 and TCE were the only organic compounds detected in groundwater at concentrations greater than state action levels. The distribution and concentrations of TPH in soil and groundwater are not indicative of a large-scale or high-concentration TPH source at Site 21. TCE was not detected in soil and the concentrations and distribution of TCE in groundwater are not indicative of a large-scale or high-concentration TCE source at Site 21. These observations suggest that Site 21 does not pose a threat to human health or the environment.

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 30 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 statues 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 21, Receiver Site 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 Offices in West, Daly City, California. The primary documents used as sources of the information contained in this decision document are listed below.

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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.