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Ser JE30.RE/0491
May 9, 2011

Mr. Scott Smale
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Nevada Division of Environmental Protection
Bureau of Corrective Actions
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Subject: SUBMITTAL OF THE FINAL FIVE-YEAR REVIEW FOR LANDFILL
SITES 20, 21, AND 22, NAVAL AIR STATION FALLON,
FALLON, NEVADA

Dear Mr. Smale:

Enclosed is one copy of the Final Five-Year Review for Landfill Sites 20, 21, and 22 at NAS Fallon, Fallon, Nevada. The purpose of this review is to evaluate the performance of the remedies implemented at Landfill Sites 20, 21, and 22 to verify that they remain protective of human health and the environment. The review is documented in this five-year review report, which will state whether the remedy is or will be protective, document any deficiencies identified in the review, and recommend actions for improvement if the remedies have not performed as designed.

The Navy received a letter from the NDEP dated February 17, 2011, which provided comments on the Draft Five Year Review. In this letter, the NDEP concurred with the bulk of the Draft Five Year Review, with the exception of two comments. In the first comment, the NDEP expressed the opinion that sampling soils under or surrounding the Construction and Debris (C&D) stockpile was not necessary as these materials would not be a source of hazardous substances. In the second comment, the letter stated that the NDEP does not see a compelling reason to sample the landfill covers for hazardous substances based on the presence of surface debris and the resulting questions regarding the quality of the fill material used for the cover. While the Navy acknowledges these comments, it feels that the additional sampling will contribute to a more robust conceptual site model of the landfills and thus will provide for a more accurate finding of protectiveness in the Five Year Review Addendum that will follow the additional work outlined in this Five Year Review.

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After receiving the NDEP's Comments on the Draft Five Year Review, the Navy decided that it would be more appropriate to change the expected completion timeframe of the recommended actions of this Five Year Review from one year to two years. On March 10, 2011, the Navy emailed the NDEP requesting comment from the NDEP on this proposed change. On March 15, 2011, the Navy received an email from the NDEP concurring with the change. The Final Five Year Review will reflect an expected two year time frame to complete the recommended actions which are outlined in Section 8.0, "Protectiveness Statement".

Please call me at (619) 532-1021 or R. Michael Quesada at (619) 532-4176 if you have any questions regarding this submittal.

Sincerely,



ROBERT EARNEY
Remedial Project Manager
By direction of the
Commanding Officer

Enclosure: Final Five-Year Review for Landfill Sites 20, 21, and 22 at NAS Fallon, Fallon, Nevada, dated March 2011.

Copy to:

Ms. Becky Kurtz, NASF (Environmental Department)
Ms. Debora Waxer, NASF (Environmental Department)
Ms. Diane Silva (NAVFAC Southwest Administrative Record)



Final

**Five-Year Review
Landfill Sites 20, 21, and 22**

**Naval Air Station Fallon
Fallon, Nevada**

March 18, 2011



Prepared for:
**Department of the Navy
Naval Facilities Engineering Command Southwest
San Diego, California**

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Final

**Five-Year Review for Landfill Sites 20, 21, and 22
Naval Air Station Fallon
Fallon, Nevada**

Contract Task Order 0060

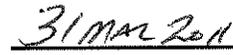
PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL



Captain Rinehart M. Wilke IV
Installation Commanding Officer
Naval Air Station Fallon



Date

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
§	Section
ARAR	Applicable or relevant and appropriate requirement
BAI	Barajas & Associates, Inc.
bgs	Below ground surface
BOCA	Bureau of Corrective Action
C&D	Construction and demolition
CAP	Corrective action plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
COC	Chemical of concern
COPC	Chemical of potential concern
DD	Decision document
DoD	U.S. Department of Defense
EPA	U. S. Environmental Protection Agency
FS	Feasibility study
IC	Institutional control
ICO	Installation Commanding Officer
IR	Installation restoration
JP	Jet petroleum
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
msl	Mean sea level

ACRONYMS AND ABBREVIATIONS (Continued)

NAAS	Naval Air Auxiliary Station
NAS	Naval Air Station
NAVFAC SW	Naval Facilities Engineering Command Southwest
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDEP	Nevada Division of Environmental Protection
NEESA	Naval Energy and Environmental Support Activity
NFA	No further action
NPL	National Priorities List
NRFIA	Northeast runway fuel impacted area
O&M	Operations and maintenance
ORNL	Oak Ridge National Laboratory
PA/SI	Preliminary assessment/site investigation
PCB	Polychlorinated biphenyl
POC	Point of compliance
QA	Quality assurance
QC	Quality control
RAB	Restoration Advisory Board
RAECA	Remedial alternatives evaluation and cost analysis
RAO	Removal action objective
RD	Remedial design
RI	Remedial investigation
ROD	Record of decision
RPM	Remedial project manager
RSL	Regional screening level
SARA	Superfund Amendments and Reauthorization Act
SVOC	Semivolatile organic compound
TBC	To be considered

ACRONYMS AND ABBREVIATIONS (Continued)

TCE	Trichloroethene
TDS	Total dissolved solid
Tetra Tech	Tetra Tech EM Inc.
TPH	Total petroleum hydrocarbons
TPH-DRO	Total petroleum hydrocarbons – diesel range organics
TPH-e	Total petroleum hydrocarbons - extractable
TPH-GRO	Total petroleum hydrocarbons - as gasoline range organics
TPH-o	Total petroleum hydrocarbons – oil range organics
TPH-p	Total petroleum hydrocarbons - purgeable
TPH-RRO	Total petroleum hydrocarbons – total residual range organics
URS	URS Corporation, Inc.
VOC	Volatile organic compound

EXECUTIVE SUMMARY

This report presents the first Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) five-year review conducted for Landfill Sites 20, 21, and 22 at Naval Air Station (NAS) Fallon, Nevada. The review was conducted in accordance with the *Navy Policy for Conducting CERCLA Statutory Five-Year Reviews* (Department of the Navy [Navy] 2004) and the U.S. Environmental Protection Agency's (EPA) *Comprehensive Five-Year Review Guidance* (EPA 2001).

This five-year review included document and data review, site inspections, personnel interviews, regulatory agency comments, and report development. The purpose of this review is to evaluate the performance of the remedies implemented at Landfill Sites 20, 21, and 22 to verify that they remain protective of human health and the environment. The review is documented in this five-year review report, which will state whether the remedy is or will be protective, document any deficiencies identified in the review, and recommend actions for improvement if the remedies have not performed as designed.

This statutory five-year review is required by, and conducted according to, CERCLA Section (§) 121(c) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 CFR § 300.430(f)(4)(ii) because the selected remedies will not reduce contaminant concentrations to levels allowing unlimited use and unrestricted exposure, and because decision documents (DD) were signed after October 17, 1986. The trigger date for this five-year review is the date of on-site mobilization for remedial actions at the sites, which was June 2006.

NAS Fallon is an active installation located in Churchill County, Nevada, 6 miles southeast of the City of Fallon, Nevada (see Figure 1). NAS Fallon was originally established as a military facility in 1942 and as a naval facility in 1943. NAS Fallon currently serves as an aircraft weapons delivery and tactical air combat training facility. Site 20, also known as the Checkerboard Landfill, is located southwest of the runways between Pasture Road and Carson Road (see Figure 2). Site 20 received solid and liquid waste collected from the entire NAS Fallon facility from 1951 to 1965 (URS 2004d). Site 21, also known as the Receiver Site Landfill, and Site 22, also known as the Northeast Runway Landfill, are located adjacent to each other between the runways and Perimeter Road (see Figure 2). Site 21 received solid and liquid waste between 1965 and 1980, and Site 22 received solid waste only from 1980 to 1987 (URS 2004e and 2004f). Solid wastes reportedly received at the landfills included wet trash, garbage, and rubble. Liquid wastes reportedly received at the landfills included aviation gas, waste oil, jet petroleum (JP)-4, JP-5, automotive gasoline, diesel fuel, and hydraulic fluid (URS 2004d, 2004e, and 2004f).

The Navy conducted environmental investigations under CERCLA at Landfill Sites 20, 21, and 22 beginning in 1987 and continuing through 2003. In 2004, based on the results of these investigations, the Navy identified remedial action objectives (RAOs) for all three sites in remedial alternatives evaluation and cost analysis (RAECA) reports (URS 2004a, 2004b, and 2004c). The RAOs for Landfill Sites 20, 21, and 22 are to prevent potential future risks to human health and the environment and to mitigate the potential for leaching of landfilled

material to groundwater. To fulfill the RAOs, the Navy analyzed four remedial alternatives in the RAECAs and documented the selection of *Limited Action* as the preferred remedy in decision documents (DD) signed in 2004. The *Limited Action* remedy includes the following measures:

- Limited ground surface regrading to improve surface drainage and to mitigate the potential for surface water ponding, which could infiltrate through the fill material;
- Limited groundwater monitoring to detect potential releases from landfill material; and
- Institutional controls (IC) to limit potential future exposure to landfill material.

To implement the components of the remedy, the Navy conducted limited regrading to level the landfill surfaces in 2007 and reseeded regraded areas with native vegetation in 2008. These actions were intended to reduce the potential impact of ponding water leaching through the landfill cover and contents, which could lead to contaminant transport via groundwater flow. The five-year review found that vegetation has not re-established itself in areas that were reseeded.

The Navy installed perimeter groundwater monitoring wells at all three sites and conducted groundwater monitoring in 2007, 2008, and 2010 to evaluate whether contaminants originating from the landfills have contaminated groundwater and migrated off site. Overall, groundwater monitoring data for Landfill Sites 20, 21, and 22 indicated low and infrequent detections of contaminants. Contaminant concentrations, when detected, generally existed at or below regulatory screening or guidance levels, with few exceptions.

Finally, the Navy adopted ICs in the NAS Fallon Overview Plan to restrict development at the landfills. The overview plan categorizes the sites as constrained to development because of their Installation Restoration (IR) Program status and because they are potentially contaminated. Additionally, access to the sites is restricted because of their proximity to active runways. The five-year review found that the ICs in the overview plan do not provide adequate and comprehensive landfill closure protection because they only limit development of the sites based on their IR status. The ICs do not require appropriate landfill inspection and maintenance.

The following EPA Five-Year Review Summary Form provides additional information on the results of the review assessment and the future effectiveness of the remedies implemented at Landfill Sites 20, 21, and 22.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Landfill Sites 20, 21, and 22		
EPA ID: NV9170022173		
Region: IX	State: NV	City/County: Fallon/Churchill
SITE STATUS		
NPL status: <input type="checkbox"/> Final <input type="checkbox"/> Deleted <input checked="" type="checkbox"/> Other (specify): Non NPL Status		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input type="checkbox"/> Complete		
Multiple OUs? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A		Construction completion date: <u>03/2008</u>
Has site been put into reuse? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
REVIEW STATUS		
Lead Agency <input type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input checked="" type="checkbox"/> Other Federal Agency - Navy		
Author name: Michael Anderson (under contract of NAVFAC Southwest)		
Author title: Project Manager/Environmental Scientist		Author affiliation: ChaduxTt JV
Review period: <u>06/2006</u> to <u>01/2011</u>		
Date(s) of site inspection: <u>05/19/2009</u>		
Type of review: <input type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-SARA <input type="checkbox"/> NPL-Removal only <input checked="" type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion		
Review number: <input checked="" type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction <input checked="" type="checkbox"/> Actual RA Start <input type="checkbox"/> Construction Completion <input type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify) _____		
Triggering action date: <u>06/2006</u>		
Due date (five years after triggering action date): <u>06/2011</u>		

FIVE-YEAR REVIEW SUMMARY FORM

ISSUES

Summarize Issues:

1. Existing institutional controls (IC) in the Naval Air Station (NAS) Fallon Overview Plan are not adequate and do not provide comprehensive landfill closure protection because they only limit development of the sites. The ICs do not require appropriate landfill inspection and maintenance.
2. A remedial design (RD) document addressing ICs, landfill maintenance, and groundwater monitoring was not developed after the decision documents (DD) were signed.
3. Point of compliance (POC) wells for determining if there has been a statistically significant release from the landfills were not established after the DDs were signed.
4. A formal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) applicable or relevant and appropriate requirements (ARAR) analysis was not conducted.
5. The construction and demolition (C&D) stockpile presents a potential hazard to the protectiveness of the landfill cover at Landfill Site 22 because its presence is a physical barrier to maintaining the landfill cover and may present an increased erosion hazard by channeling runoff. Furthermore, the exact composition of the C&D stockpile is unknown; therefore, effects of potential leaching and erosion of materials from the C&D stockpile to the landfill surface are unknown.
6. The thicknesses of the landfill covers are unknown. Therefore, whether the covers are adequate to prevent exposure to landfill wastes and reduce infiltration is unknown.
7. The presence of debris observed on the landfill surfaces calls into question whether clean fill was used to construct the landfill covers.
8. The revegetation efforts were not successful. These areas may therefore require more than the 3 years of maintenance that was specified in the DDs.
9. Groundwater monitoring wells that were not properly secured were observed during the site inspection. Unsecured groundwater monitoring wells present an unsatisfactory condition and are contrary to well head protection standards.

RECOMMENDATIONS AND FOLLOW UP ACTIONS:

Summarize recommendations and follow-up actions:

1. An RD document that describes specific roles and responsibilities related to implementing and maintaining ICs is planned for 2011. Continue to prepare the RD document as planned.
2. An RD document that describes specific actions to inspect and maintain the landfill and to monitor the groundwater, including establishment of a POC, is planned in 2011. Continue to prepare the RD document as planned.
3. The Navy will evaluate ARARs to determine if there are any ARARs that should be considered.
4. Conduct additional characterization to determine if the C&D stockpile presents an increased erosion hazard at Landfill Site 22. Conduct surface soil sampling in the vicinity of the C&D stockpile to determine if hazardous chemicals have leached or eroded from the C&D stockpile to the landfill cover.
5. Conduct additional characterization to measure the thickness of the landfill covers.
6. Conduct additional characterization to assess the chemical composition of the landfill covers.
7. Conduct additional maintenance to promote vegetation growth in reseeded areas.
8. The integrity of the unsecured wells should be evaluated to confirm that illegal disposal into the

wells has not occurred. Groundwater monitoring wells that are not secured should be provided with adequate bolting or locking mechanisms to prevent unauthorized access, and keys should be maintained at the NAS Fallon Environmental Division's offices.

PROTECTIVENESS STATEMENT(S)

The results of this five-year review indicate that a protectiveness determination should be deferred. A protectiveness determination of the remedy at Landfill Sites 20, 21, and 22 cannot be made until further information is obtained. Further information will be obtained by taking the following actions:

- The Navy will evaluate ARARs to determine if any should be considered.
- The Navy will conduct additional characterization at the landfills to include:
 - Evaluating whether the C&D stockpile presents an increased erosion hazard at Site 22.
 - Surface soil sampling in the vicinity of the C&D stockpile at Site 22 to evaluate whether hazardous chemicals have leached or eroded from the C&D stockpile to the landfill surface.
 - Surface soil sampling to assess the chemical composition of the landfill covers at all three sites so that an evaluation can be made as to whether clean soil was used to construct the landfill covers.
 - Measuring the thickness of the landfill covers at all three sites.
- The Navy plans an RD document in 2011 that will describe specific actions to inspect and maintain the landfill and to monitor the groundwater, including establishment of a POC. The Navy will analyze results from the POC to evaluate whether there has been a statistically significant release from the landfills.

It is expected that these actions will take approximately 2 years to complete, at which time a protectiveness determination will be made in a five-year review addendum.

1.0 INTRODUCTION

This report documents the results of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) five-year review conducted for Naval Air Station (NAS) Fallon Landfill Sites 20, 21, and 22 in Fallon, Nevada. This five-year review evaluates the in-place remedies at the sites and verifies that they remain protective of human health and the environment. The review is not intended to reconsider decisions made during selection of the remedies, but rather to evaluate implementation and performance of the selected remedies only. In addition, this report will identify any issues found during the review and offer recommendations to address them.

Consistent with Executive Order 12580, the Secretary of Defense is responsible for ensuring that five-year reviews are conducted at all qualifying U.S. Department of Defense (DoD) cleanup sites. The Department of the Navy (Navy) is authorized to conduct the five-year review for Landfill Sites 20, 21, and 22 in accordance with CERCLA Section (§) 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The NCP at title 40 *Code of Federal Regulations* (CFR) § 300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

The Navy issued this report to document the five-year review of the remedial actions implemented at Landfill Sites 20, 21, and 22 at NAS Fallon. The review was conducted from April 2009 through the date of this report, and this report documents the results of the review. The Navy is working in cooperation with the State of Nevada Division of Environmental Protection (NDEP) in producing this five-year review.

This is the first five-year review for NAS Fallon Landfill Sites 20, 21, and 22. Five-year reviews are required for the sites because (1) ongoing and completed remedial actions have left contaminants in place above concentrations that would allow unlimited use and unrestricted

exposure, and (2) the decision documents (DD) were signed on or after October 17, 1986 (the effective date of the Superfund Amendments and Reauthorization Act [SARA]). The review was conducted in accordance with the following guidance documents:

- *Navy and Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act Statutory Five-Year Reviews* ([Navy 2004](#)).
- U.S. Environmental Protection Agency (EPA) *Comprehensive Five-Year Review Guidance* ([EPA 2001](#)).

The triggering mechanism for the five-year review of Landfill Sites 20, 21, and 22 was the date of on-site mobilization for remedial actions at the sites, which was June 2006.

1.1 OVERVIEW OF NAS FALLON SITES AND REVIEW APPROACH

NAS Fallon is an active installation located in Churchill County, Nevada, 6 miles southeast of the City of Fallon (see [Figure 1](#)). NAS Fallon is centrally located in the Carson Desert, commonly referred to as the Lahontan Valley. The main installation covers 8,583 acres and contains airfield, maintenance, public works, and housing facilities. The main installation is fenced and all entrances are gated, allowing access only to authorized personnel. The installation is bounded on the north and east by U.S. Route 50 ([URS Corporation, Inc. \[URS\] 2004d](#)).

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 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. NAAS Fallon was re-established on October 1, 1953. From 1945 to 1975, the U.S. Air Force also occupied part of the installation as part of an early warning radar network. On January 1, 1972, NAAS Fallon was upgraded to its current status of NAS Fallon. NAS Fallon currently serves as an aircraft weapons delivery and tactical air combat training facility ([URS 2004d](#)).

Site 20, also known as the Checkerboard Landfill, is located southwest of the runways between Pasture Road and Carson Road (see [Figure 2](#)). Site 21, also known as the Receiver Site Landfill, and Site 22, also known as the Northeast Runway Landfill, are located adjacent to each other between the runways and Perimeter Road (see [Figure 2](#)). The sites are included in the Navy's Installation Restoration (IR) Program.

The purpose of the IR Program is to identify, assess, characterize, and clean up or control contamination from past hazardous material spills and waste disposal at Navy and Marine Corps

facilities. This review will evaluate and update progress toward remedial action goals at Landfill Sites 20, 21, and 22.

1.2 IR PROGRAM SITES AND CURRENT STATUS

There are 27 IR Program sites at NAS Fallon. Sixteen of these sites have been closed as “No Further Action (NFA)” with NDEP concurrence. Site 4 is currently in the decision phase, and Site 18 is in the alternatives analysis stage. There are six active IR Program sites (1, 2, 3, 6, 14, and 16) (Navy 2006). Landfill Sites 20, 21, and 22 are the subjects of this five-year review. Table 1 summarizes all IR Program sites at the NAS Fallon with a description and progress update.

TABLE 1 OVERVIEW AND CURRENT STATUS OF ALL NAS FALLON IR PROGRAM SITES
Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon, Nevada

IRP Site	Description	Status
Site 1 – Crash Crew Training Area	This active site consists of an unlined, earth-bermed pit and two aboveground storage tanks. The site was used from the mid 1950s to 1988 for fire training. Flammable waste fuels and solvents were placed in the pit and ignited to conduct the training.	Further site characterization is under way at this site.
Site 2 – New Fuel Farm	This is an active site where fuels are stored and dispensed. Jet fuel was spilled in 1985, and daily draining of fuel trucks in the loading rack area resulted in free-phase fuels in groundwater beneath the site.	Approximately 60,000 gallons of fuel had been recovered from the site by 2006. A pilot study using an internal combustion engine to remove free product and soil vapors was conducted in 2006. Further site characterization is under way at this site.
Site 3 – Hangar 300 Area	This active site consists of north and south disposal areas, bowser disposal area, the oil/water separator area, ground support equipment area, and the wells air start building area. Aircraft cleaning and maintenance fluids were disposed of at this site.	Further site characterization is under way at this site.
Site 4 – Transportation Yard	Free product and groundwater impacts at this site are considered the result of activities conducted at Site 2, located upgradient.	In March 2004, 278 cubic yards of petroleum-contaminated soil was removed. A draft Closure Report for soil was submitted to Nevada Division of Environmental Protection (NDEP) in June 2006 and is waiting on state approval. Affected groundwater at this site will be addressed with Site 2 groundwater.

TABLE 1 OVERVIEW AND CURRENT STATUS OF ALL NAS FALLON IR PROGRAM SITES (CONTINUED)

Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon, Nevada

IRP Site	Description	Status
Site 5 – Ordnance Area	This site is located in the northern portion of the installation.	The Installation Restoration Program (IRP) Preliminary Assessment/Site Investigation (PA/SI) that was submitted in April 1988 concluded that it was unlikely that contamination resulted from disposal practices at this site. The site was closed with No Further Action (NFA) status in May 2001.
Site 6 – Defuel Disposal Area	This active site consists of two locations where disposal of off-specification Jet Petroleum (JP)-4 and JP-5 took place. This fuel was reportedly contaminated with water or sediment.	Further site characterization is under way at this site.
Site 7 – Napalm Burn Pit	This site is located in the eastern central portion of the station within Site 21. There are two suspected locations where napalm canisters were opened, covered with diesel fuel, and burned.	Site characterization did not identify significant petroleum or other napalm-related impacts in either of the two areas. The site was closed with NFA status in June 2002.
Site 8 - Bore Site Gunbutt	This site is located in the east-central portion of the station. The gunbutt site was used for sighting in aircraft-mounted machine guns from the 1940s to the mid-1960s. The gunbutt was removed in 1987.	The April 1988 PA/SI concluded that it is unlikely that any substantial lead projectiles were remaining in near surface soil as a result of regrading in the area for runway construction. The site was closed with NFA status in January 2001.
Site 9 – Wastewater Treatment Plant	This site is located in the southeastern portion of the site.	Site characterization did not identify any chemicals of concern (COC) at sufficient quantities or concentrations to require active remediation. The site was closed with NFA status in November 2003.
Site 10 – GATAR Compound	This site is located in the southeastern portion of the installation.	Site characterization did not identify polychlorinated biphenyls (PCB) impacts at the site. However, minor amounts of chlorinated solvents were identified in groundwater at the site. The site was closed with NFA status in January 2005. Any impacts to groundwater at this site will be addressed with Site 16 groundwater.
Site 11 – Paint Shop	This site is located in the southeastern portion of the installation.	Minor amounts of chlorinated solvents were identified in groundwater at the site. The site was closed with NFA status in January 2005. Any impacts to groundwater at this site will be addressed with Site 16 groundwater.

TABLE 1 OVERVIEW AND CURRENT STATUS OF ALL NAS FALLON IR PROGRAM SITES (CONTINUED)

Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon, Nevada

IRP Site	Description	Status
Site 12 – Pest Control Shop	This site is located in the southeastern portion of the installation.	Site characterization identified limited pesticide impacts to near-surface soil, which do not pose a threat to human health or the environment. The site was closed with NFA status in January 2005.
Site 13 - Boiler Plant Tanks	Tank filling operations reportedly resulted in surface spills of fuels. Spills may have consisted of No. 6 fuel oil, waste lubrication oil, hydraulic fluid, JP-5, and diesel fuel.	The tanks were removed in 1992 and the site was closed with NFA status in May 1997.
Site 14 – Old Vehicle Maintenance Shop	This active site was used for vehicle maintenance from 1943 to 1971. Operation at the site resulted in significant petroleum hydrocarbon and solvent impacts to soil and groundwater.	Approximately 130 gallons of petroleum had been recovered from the site by 2006. Further site characterization is under way at this site.
Site 15 – Old Navy Exchange Gas Station	The gas station at this site reportedly operated from 1944 through the early 1960s.	This site was closed with NFA status in August 2001.
Site 16 – Old Fuel Farm	This active site served as the original fuel storage and distribution center for the installation from 1943 to 1962. Operations at the site resulted in significant petroleum hydrocarbon impacts to soil and groundwater.	A groundwater containment system that was previously operated at this site has since been shut down. Further site characterization is under way at this site.
Site 17 – Hangar 7	Runoff from aircraft maintenance and cleaning was suspected to have resulted in soil and groundwater impacts at this site.	Characterization identified limited petroleum hydrocarbon and solvent impacts to soil and groundwater. The site was closed with NFA status in November 2003.
Site 18 – Southeast Runway Landfill	This site served as a municipal landfill from 1943 to 1946.	A limited amount of characterization was conducted after low concentrations of pesticides were detected in groundwater immediately downgradient of the site. Pesticides and other contaminants were reported at non-detect levels in two groundwater sampling events. The Navy is currently in the remedy selection stage for this site.
Site 19 – Post World War II Burial Site	This site reportedly received refuse and trash generated during installation decommissioning activities between 1946 and 1949.	Site characterization identified petroleum, hydrocarbon impacts to groundwater that were attributed to an upgradient source. The site was closed with NFA status in June 2002.

TABLE 1 OVERVIEW AND CURRENT STATUS OF ALL NAS FALLON IR PROGRAM SITES (CONTINUED)

Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon, Nevada

IRP Site	Description	Status
Site 20 – Checkerboard Landfill	This site reportedly received trash and other rubble from installation operations between 1951 and 1965.	Site characterization indicated that contaminants associated with waste disposal are present at very low concentrations in the on-site soil and are not migrating from the site through groundwater transport. <i>Limited Action</i> involving limited ground surface regrading, groundwater monitoring, and institutional controls (IC) was chosen as the remedy in the decision document (DD) in October 2004. This site is included in this five-year review.
Site 21 – Receiver Site Landfill	This site reportedly received solid and liquid wastes between 1965 and 1975. Solid waste only was disposed of between 1975 and 1980.	Site characterization identified low levels of petroleum hydrocarbons and trichloroethene (TCE) in soil and groundwater above state action levels; however TCE is not migrating off site. <i>Limited Action</i> involving limited ground surface regrading, groundwater monitoring, and ICs was chosen as the remedy in the DD in October 2004. This site is included in this five-year review.
Site 22 – Northeast Runway Landfill	This site reportedly received only solid waste between 1981 and 1987.	Low levels of petroleum hydrocarbons were identified in soil and groundwater at the site; however, these hydrocarbons were attributed to a release from a jet fuel spill in 2000 on an adjacent parcel of land that has since been closed with NFA status. <i>Limited Action</i> involving limited ground surface regrading, groundwater monitoring, and ICs were chosen as the remedy in the DD in October 2004. This site is included in this five-year review.
Site 23 – Shipping and Receiving Disposal Site	This site reportedly received solid wastes from 1968 to 1984. Wastes included trash and rubble. Asbestos was buried in one location and later removed and properly disposed of. A burned DC-3 fuselage was also reportedly buried in the southern portion of the site. Burn pits were observed at the site in the late 1990s.	Site characterization identified petroleum hydrocarbon impacts in groundwater that were attributed to an upgradient source. The site was closed with NFA status in November 2003.
Site 24 - Road Oiling Area	This site is Perimeter Road, which runs along the eastern boundary of the installation. This road was oiled with waste oils, fuels, and solvents from 1943 to 1946 and 1951 to 1981 for dust control.	Site characterization did not identify petroleum hydrocarbon or solvent impacts to soil. Very low concentrations of PCBs were identified in shallow soil at one location. The site was closed with NFA status in November 2003.

TABLE 1 OVERVIEW AND CURRENT STATUS OF ALL NAS FALLON IR PROGRAM SITES (CONTINUED)

Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon, Nevada

IRP Site	Description	Status
Site 25 – New Runway Rubble Disposal Area	Concrete, asphalt, and wood from installation road and runway projects were reportedly buried in pits or ditches from 1970 to 1980.	The site was closed with NFA status in March 2001.
Site 26 – Offsite Rubble Disposal Area	This site is located just off the base property in the west-central portion of the installation. Concrete, asphalt, and wood from installation road and runway projects were reportedly buried at this site.	The site was closed with NFA status in August 2001.
Site 27 – Diesel Fuel Spill Site	Diesel fuel was reportedly spilled and approximately 10 cubic yards of soil was affected.	The soil was excavated and re-located to a remote area of bombing range B-19. The site was closed with NFA status in May 2001.

Notes:

CAP	Corrective action plan	NDEP	Nevada Division of Environmental Protection
COC	Chemicals of concern	JP	Jet petroleum
DD	Decision document	PA/SI	Preliminary assessment/site investigation
FS	Feasibility study	PCB	Polychlorinated biphenyl
IC	Institutional control	ROD	Record of Decision
IRP	Installation Restoration Program	TCE	Trichloroethene
NFA	No further action		

2.0 CHRONOLOGY OF SITES

This section summarizes events in the history of contaminant detection, characterization, and remediation at Landfill Sites 20, 21, and 22.

TABLE 2 CHRONOLOGY OF SIGNIFICANT EVENTS FOR SITES 20, 21, AND 22
Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon, Nevada

Event	Date
Naval Energy and Environmental Support Activity (NEESA) conducted a basewide Preliminary Assessment/Site Investigation (PA/SI) that consisted of a records search, site visit, and site ranking based on the characteristics of the wastes, the potential migration pathways, and possible receptors (NEESA 1988).	1987
In response to the recommendations of the PA/SI, a basewide Remedial Investigation (RI) was conducted (Oak Ridge National Laboratory [ORNL] 1994).	1991 to 1994
A jet released an unknown amount of jet fuel in the vicinity of Site 22, creating the Northeast Runway Fuel Impacted Area (NRFIA) (Naval Air Station [NAS] Fallon 2000).	March 1993
Post-RI soil and groundwater sampling was conducted at all three sites (URS Corporation [URS] 2004d, 2004e, and 2004f).	1998
Post-RI soil and groundwater sampling was conducted at Site 21 (URS 2004e).	1999
Nevada Division of Environmental Protection (NDEP) issues a letter stating that no further remediation is required for the NRFIA.	June 2000
Supplemental field sampling was conducted to gather data to support decisions regarding the need for further site investigation or remedial action (U.S. Department of the Navy [Navy] 2003b).	March 2003
Remedial alternatives evaluation and cost analysis (RAECA) reports were signed. RAECAs were similar to feasibility studies in that they evaluated four remedial alternatives against the nine criteria and recommended <i>Limited Action</i> as the preferred alternative (URS 2004a, 2004b, and 2004c).	September 2004
Decision documents (DD) were signed selecting <i>Limited Action</i> as the preferred remedy at all three sites (URS 2004d, 2004e, and 2004f).	October 2004
First groundwater monitoring event was conducted (Barajas and Associates, Inc. [BAI] 2008).	February and March 2007
Landfill maintenance was conducted in accordance with the requirements of the final DDs (BAI 2008).	March and April 2007
Revegetation consisting of seeding with native species was conducted (BAI 2009).	March 2008
Second groundwater monitoring event was conducted (BAI 2009).	August and September 2008
Third groundwater monitoring event was conducted (BAI 2010).	April 2010

Notes:

BAI	Barajas and Associates, Inc.
DD	Decision Document
NDEP	Nevada Division of Environmental Protection
NAS	Naval Air Station
Navy	Department of the Navy
NEESA	Naval Energy and Environmental Support Activity

NRFIA Northeast Runway Fuel Impacted Area
ORNL Oak Ridge National Laboratory
PA/SI Preliminary assessment/site investigation
RAECA Remedial Alternatives Evaluation and Cost Analysis
RI Remedial Investigation
URS URS Corporation

BAI. 2008. 2007 Annual Post-Closure Maintenance and Groundwater Monitoring Report for Landfill Sites 20, 21, and 22. NAS Fallon, Fallon, Nevada. September.

BAI. 2009. Final 2008 Annual Landfill Maintenance and Groundwater Monitoring Report. Landfill Sites 20, 21, and 22. NAS Fallon, Fallon, Nevada. August.

BAI. 2010. Final 2010 Landfill Inspection and Groundwater Monitoring Report, Sites 20, 21, and 22. Naval Air Station Fallon, Fallon, Nevada. November.

Navy. 2003b. Final Summary Report, Supplemental Soil and Groundwater Sampling at IRP Sites 20, 21, and 22, NAS Fallon, Fallon, Nevada. Prepared for Engineering Field Activity, Northwest, under Contract No. N44255-02-D-2008. Seattle, Washington. December.

NAS Fallon. 2000. Progress Report for NRFIA at the NAS Fallon. Public Works Department, Environmental Division.

NEESA. 1988. PA/SI, NAS Fallon, Fallon, Nevada. April.

ORNL. 1994. Final RI Report NAS Fallon, Nevada. September.

URS. 2004a. Final RAECA, Site 20, Checkerboard Landfill, Naval Air Station Fallon, Fallon, Nevada. September 23.

URS. 2004e. Final RAECA, Site 21, Receiver Site Landfill, Naval Air Station Fallon, Fallon, Nevada. September 23.

URS. 2004f. Final RAECA, Site 22, Northeast Runway Landfill, Naval Air Station Fallon, Fallon, Nevada. September 23.

URS. 2004d. Final DD, Site 20, Checkerboard Landfill, NAS Fallon, Fallon, Nevada. October.

URS. 2004e. Final DD, Site 21, Receiver Site Landfill, NAS Fallon, Fallon, Nevada. October.

URS. 2004f. Final Decision Document, Site 22, Northeast Runway Landfill, NAS Fallon, Fallon, Nevada. October.

3.0 BACKGROUND

This section identifies threats posed to the public and environment when the DDs for Sites 20, 21, and 22 were developed. This section facilitates comparison of performances of selected remedies with site conditions the remedies were intended to address. General site conditions and all major activities for each site before its DD was signed will be discussed, including physical characteristics, land and resource use, history of contamination, initial responses, and basis for taking action. The sites are located in the same general vicinity; therefore, their common general physical characteristics and area land uses will be discussed together.

3.1 PHYSICAL CHARACTERISTICS AND LAND/RESOURCE USE

The following sections discuss the setting, geology, hydrogeology, and ecology of the Landfill Sites 20, 21, and 22.

3.1.1 Regional and Facility Setting

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. 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 ([URS 2004d](#)).

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 ([URS 2004d](#)).

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 ([URS 2004d](#)).

Site 20 is located in the southwestern portion of NAS Fallon, 2,000 feet west of the western end of runway 7-25 (see [Figure 3](#)). The landfilled portion of Site 20 encompasses 26 acres, extending 3,300 feet north to south and 300 to 450 feet east to west. The surface consists generally of unpaved areas that support native vegetation. NAS Fallon does not expect any

change in the use of this land or of the surrounding sites in the future. There are no areas of archaeological or historical significance at Site 20 (URS 2004d).

Site 21 is located in the northeastern portion of NAS Fallon (see Figure 4) and occupies 60 acres. The landfilled portion is 3,200 feet from the western border to the eastern border and is 700 to 1,800 feet from north to south. The surface consists generally of unpaved areas that support native vegetation. IRP Site 7 and the northern component of IRP Site 6 lie within Site 21 (see Figure 4). NAS Fallon does not expect any change in the use of this land or of the surrounding sites in the future. There are no areas of archaeological or historical significance at Site 21 (URS 2004e).

Site 22 is located in the northeastern corner of NAS Fallon, south of Landfill Site 21 (see Figure 4). Site 22 encompasses 18 acres, extending 1,200 feet from east to west and between 500 to 1,000 feet from north to south. The site is currently flat with some surface rubble that causes minor relief and supports native vegetation. NAS Fallon does not expect any change in the use of this land or of the surrounding sites in the future. There are no areas of archaeological or historical significance at Site 22 (URS 2004f).

Based on visual observations and groundwater monitoring well survey data collected in June 2008, topography of all three sites is relatively flat, with an elevation range of 3,926 feet to 3,934 feet above mean sea level (msl) (Barajas & Associates, Inc. [BAI] 2009).

3.1.2 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 (URS 2004d).

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 (URS 2004d).

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 interfingering and interbedded deposits of fluvial, deltaic, lacustrine, and eolian deposits (URS 2004d).

Previously published descriptions of these deposits were generally confirmed during installation of monitoring wells across the installation. 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 (see Figure 5) (URS 2004d).

Subsurface stratigraphy at Landfill Site 20 consists of the clay aquitard identified as the Seho Formation at a depth of approximately 20 to 22 feet below ground surface (bgs). Sand with variable amounts of silt, interlayered by silt with variable amounts of sand, constitute the main soil types observed within the alluvial aquifer (Fallon Formation) that overlies this aquitard. Typically, subsurface stratigraphy within the Fallon Formation beneath the site consists of sand with minor amounts of silt from the ground surface to the top of the Seho Formation. Two silt layers are present within this sand unit, which appear to be continuous across the site. The first silt layer is present from approximately 8 to 12 feet bgs. The second silt layer is present from approximately 16 to 20 feet bgs (see Figure 5) (URS 2004d).

Subsurface stratigraphy at Landfill Sites 21 and 22 consists of a shallow saturated formation dominated by sand with variable amounts of silt from the ground surface to approximately 20 feet bgs. Silt lenses are present at variable depths and locations beneath the site. A clay layer is present at a depth of approximately 20 feet bgs (URS 2004e and 2004f).

3.1.3 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 (URS 2004d).

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* (Oak Ridge National Laboratory [ORNL] 1992). 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 micrograms per liter ($\mu\text{g/L}$). Likewise, concentrations of arsenic in groundwater and surface water often exceed both federal and state criteria (URS 2004d).

The regional groundwater flow direction is to the east and southeast toward Grimes Point and slightly diagonal to the drainage ditches that cross the installation. P.A. Glancy estimated the regional groundwater velocity to be 35 feet per year (Glancy 1986). The site-specific groundwater flow velocities from numerous aquifer tests are highly variable (URS 2004d).

Intermediate and deep alluvial aquifers are present beneath the shallow alluvial aquifer in the Wyemaha Formation (see Figure 5). 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 (URS 2004d).

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 (URS 2004d). The basalt aquifer is approximately 10 miles long and consists of basalt representing volcanic activity about 1 to 2.5 million years ago. It has been described as an asymmetrical, mushroom-shaped body, mostly buried by Lake Lahontan sediments (SulTech 2007). 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 northwestern corner of the facility. However, NAS Fallon obtains all of its domestic water from this aquifer using deep wells northwest of the facility (URS 2004d).

Three monitoring wells located at some distance from each other penetrate the intermediate aquifer. A head difference of about 5 to 9 feet between the shallow unconfined aquifer and the intermediate confined aquifer was observed based on groundwater levels from these wells. The head is higher in the intermediate aquifer, indicating artesian conditions that retard or preclude

downward migration of groundwater at the facility. Investigations have focused on the shallow water-table aquifer (URS 2004d) because the upward hydraulic gradient across the installation indicates a low potential for groundwater contaminants to migrate from the shallow aquifer downward into the intermediate aquifer.

Based on groundwater level measurements taken in April 2010, which are generally consistent with historical groundwater conditions (BAI 2010):

- Depth to groundwater at Landfill Site 20 was generally between 7 and 10 feet bgs, and groundwater flow was toward the east-southeast at a gradient of 0.004 feet per foot.
- Depth to groundwater at Landfill Sites 21 and 22 was generally between 5 and 12 feet bgs, and groundwater flow was toward the southeast at a gradient of 0.001.

Groundwater velocity across Site 20 was estimated in 2004 to be 84 to 234 feet per year, but as low as 47 feet per year (URS 2004d). Groundwater velocity across Site 21 was estimated in 2004 to be 0.5 to 79 feet per year, but as high as 149 feet per year (URS 2004e). Groundwater velocity across Site 22 was estimated in 2004 to be 13 to 39 feet per year, but as high as 75 feet per year (URS 2004f). These velocity estimates were for groundwater and do not necessarily represent contaminant transport velocities, which are usually slower than the groundwater velocity. The degree the 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 (URS 2004d).

3.1.4 Ecology

The following section discusses important ecological aspects of NAS Fallon and the surrounding area.

3.1.4.1 Flora

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 that make 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 (URS 2004d).

3.1.4.2 Fauna

Terrestrial wildlife in the region consists of species adapted to the desert or that depend 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 ([URS 2004d](#)).

3.1.4.3 Aquatic Life

The drains at NAS Fallon may be inhabited by mosquito fish, carp, bullhead, catfish, sunfish, muskrats, herons, and egrets ([URS 2004d](#)).

3.1.4.4 Endangered Species

No endangered or threatened animal or plant species designated by the state or federal government are known or likely to occur in the region ([URS 2004d](#)).

3.2 HISTORY OF CONTAMINATION

Site 20 received an estimated 85,000 tons of solid waste and 1,400 gallons of liquid waste collected from the entire NAS Fallon facility from 1951 to 1965. Solid waste was reported to be wet garbage, trash, and rubble. Liquid waste was reported to be aviation gas, waste oil, jet petroleum (JP)-4, JP-5, automotive gasoline, diesel fuel, and hydraulic fluid. Wastes were reportedly disposed of in east-west oriented trenches constructed with a bulldozer. Disposal depths are assumed to be limited as a result of the construction method and the shallow groundwater conditions ([URS 2004d](#)).

Site 21 received an estimated 60,000 tons of solid waste and 1,000 gallons of liquid waste from 1965 to 1975. Solid waste reportedly consisted of wet garbage, trash, and rubble. Liquid waste reportedly was burned along with the solid waste and consisted of JP-5, gasoline, diesel fuel, waste oils, and hydraulic fluid. From 1975 to 1979, the site received approximately 30,000 tons of solid waste only (no liquid wastes), consisting 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 (URS 2004e).

The northern disposal area of IRP Site 6 is located within Landfill Site 21 (see Figure 4). The southern disposal area is situated just to the south. IRP Site 6 was used for disposal of off-specification JP-4 and JP-5 that was removed from aircraft, transported to the site by truck, and discarded directly to the ground surface. Approximately 70,000 gallons of fuel compounds are thought to have been discarded between 1966 and 1972. No historical records on the distribution of waste disposal between the two areas of IRP Site 6 were located.

IRP Site 7 is located in the western portion of Landfill Site 21. There were two suspected locations where napalm canisters were reportedly axed open, covered with diesel fuel, and burned at an unspecified time in the past (Navy 2006).

Site 22 received an estimated 60,000 tons of solid waste collected from the entire NAS Fallon facility (excluding the housing units) from 1980 to 1987. Solid waste was reported to be trash only. No liquid wastes were permitted, and operations were closely monitored to exclude disposal of materials that could have posed a threat to human health or the environment (URS 2004f).

A basewide preliminary assessment/site investigation (PA/SI) was conducted in 1987 by Naval Energy and Environmental Support Activity (NEESA) and reported in 1988 to identify areas at NAS Fallon where there could be contamination resulting from past or current activities. The PA/SI included a records search, a site visit, and a site ranking. The PA/SI report recommended additional study in the form of soil and groundwater testing because of the reported disposal of liquid waste at Site 20, the reported disposal of liquid wastes and potentially other unknown wastes at Site 21, and because of the potential for liquid waste to be inadvertently included in some of the accepted wastes at Site 22 (NEESA 1988).

3.3 BASIS FOR TAKING ACTION

3.3.1 Summary of Remedial Investigations

As recommended in the PA/SI report, a remedial investigation (RI) was conducted at Landfill Sites 20, 21, and 22, as summarized below.

Site 20: ORNL collected soil and groundwater samples at Site 20 during the RI. Six groundwater monitoring wells were installed around the perimeter of the landfilled area: two upgradient (MW-34 and MW-35), two downgradient (MW-36 and MW-37), and one cross-gradient pair of wells (MW33L and MW-33U), which screen the upper and lower portions of the uppermost aquifer at the site (ORNL 1994).

A post-RI soil and groundwater sampling effort was conducted at Site 20 in 1998, when soil and groundwater samples were collected from 20 direct-push locations just outside of the eastern boundary of the landfill. Supplemental field sampling was conducted in March 2003, including an electromagnetic survey, seven direct-push boring locations, and sampling groundwater from wells MW-33U, MW-36, and MW-37 (URS 2004d). Soil and groundwater samples collected at Site 20 were analyzed for total petroleum hydrocarbons (TPH), volatile organic compounds (VOC), semivolative organic compounds (SVOC), pesticides, and metals. See Figure 6 for a depiction of sample locations at Site 20 from 1998 and 2003.

Soil: TPH-extractable (TPH-e), methylene chloride, bis(2-ethylhexyl)phthalate and di-n-butylphthalate, and metals were detected in soil samples collected at Site 20. Detected metals concentrations were consistent with naturally occurring background concentrations and are not considered to have resulted from disposal at Site 20 (URS 2004d). None of the contaminants in soil exceeded the state action levels except TPH-e, which was detected in four of the 27 soil samples tested. Only one of the TPH-e detection (140 milligrams per kilogram [mg/kg]) was above the state action level of 100 mg/kg. This soil sample was collected from a depth of 5.5 to 8.5 feet bgs, near the water table. TPH-e was not detected in the associated groundwater sample located downgradient from the southern end of the landfill (URS 2004d).

Groundwater: TPH-e, TPH-purgeable (TPH-p), bromoform, chloromethane, methylene chloride, bis(2-ethylhexyl)phthalate, and metals were detected in groundwater samples collected at Site 20. Detected metals concentrations were consistent with naturally occurring background concentrations and are not considered to have resulted from disposal at Site 20 (URS 2004d). None of the contaminants in groundwater exceeded the state action levels, except for chloromethane and bis(2-ethylhexyl)phthalate. Chloromethane was detected in two of the 28 groundwater samples tested at concentrations exceeding the state action level of 1.5 µg/L in 1998. VOCs were not detected in any of the nine groundwater samples collected at Site 20 in 2003. Bis(2-ethylhexyl)phthalate was detected in four of the 28 groundwater samples tested, with only one detection (from well MW-33U) exceeding the state action level of 6.0 µg/L. This detection was determined to be the result of cross-contamination, as bis(2-ethylhexyl)phthalate was also detected in the associated laboratory blanks (URS 2004d).

Site 21: ORNL collected soil and groundwater samples at Site 21 during the RI. Four groundwater monitoring wells (MW-12U, MW-12L, MW-45, and PW-03) were installed along the perimeter and downgradient of the landfill. Well MW-94 was installed along the eastern boundary of the site in 1996. Additional groundwater samples were collected from wells MW-94 and MW-45 in September 1996 and September 1997. A post-RI soil and groundwater sampling effort was conducted at Site 21 in 1998 and 1999, when soil and groundwater samples were collected from more than 50 direct-push locations just outside of the eastern boundary of the landfill. Supplemental field sampling was conducted in 2003, including an electromagnetic survey, five direct-push boring locations, and sampling groundwater from wells PW-03 and MW-45. Soil and groundwater samples collected at Site 21 were analyzed for TPH, VOCs, SVOCs, and metals (URS 2004e). See Figure 7 for a depiction of sample locations from 1998, 1999, and 2003.

Soil: Of the 53 soil samples collected at Site 21 and analyzed for TPH, two contained TPH at concentrations that exceeded the state action level of 100 mg/kg in 1998. None of the VOC or SVOC analytes was detected in soil at concentrations that exceeded the state action levels. Metals were detected at concentrations consistent with naturally occurring background concentrations and are not considered to have resulted from disposal at Site 21 (URS 2004e).

Groundwater: Petroleum hydrocarbons were detected in three of the 52 groundwater samples collected at Site 21, with concentrations ranging from 580 to 1,900 µg/L. Only one groundwater sample exceeded the NDEP guidance concentration of 1,000 µg/L for TPH in 1998. The following VOCs were detected in one or more groundwater samples below the state action levels: acetone, ethylbenzene, xylenes, trichloroethene (TCE), dichlorodifluoromethane, 1,1-dichloroethene, 1,1,1-trichloroethane, and trichlorofluoromethane. TCE was also detected in five groundwater samples at concentrations ranging from 7 to 45 µg/L, exceeding the state action level of 5 µg/L. The 45 µg/L TCE sample was collected from 1998 direct-push location 19. Three of the four other results that exceeded the state criteria were collected from 1998 direct-push locations 18, 20, and 21002, and one sample that exceeded criteria was collected from monitoring well MW-45. TCE was detected at 7 µg/L in the September 1996 groundwater sample collected from well MW-45, but was not detected in the March 2003 sample from this well. Locations 18, 19, 20, and 21002 were near the center of the landfill, while monitoring well MW-45 is on the eastern boundary of and downgradient from these locations. These data suggested that TCE was attenuating naturally by the time it had reached the landfill boundary. Detected metals concentrations were consistent with naturally occurring background concentrations and are not considered to have resulted from disposal at Site 21 (URS 2004e).

IRP Site 6, a portion of which is located within Site 21, was originally thought to include both a northern and a southern disposal area. The northern disposal area is located in the southeast corner of Landfill Site 21. However, soil contamination was not detected in the northern disposal area during the RI (ORNL 1994), suggesting that in fact only the southern disposal area was actually used for disposal.

Passive soil gas sampling was completed for the northern disposal area of IRP Site 6 as part of the 2007 Workplan for Remedial Investigation Addendum for Active Sites report (SulTech 2007). The purpose of the soil gas sampling effort at IRP Site 6 was to confirm the assumptions made by previous investigations that only the southern disposal area actually received discharges of fuel compounds. Thirty passive soil gas modules were installed, covering the northern disposal area. The modules were submitted to the laboratory for analysis of fuel-related compounds, and the results showed no significant detections of these compounds. Based on the lack of detections, a soil gas map was not generated for this site.

Site characterization at IRP Site 7, also within the Site 21 boundary, did not identify significant petroleum or other napalm-related impacts in either of the two suspected locations. IRP Site 7 was closed with NFA status in June 2002.

Site 22: ORNL collected soil and groundwater samples at Site 22 during the RI. Two groundwater monitoring wells (MW-57 and PW-03) were installed downgradient of the landfill.

A post-RI soil and groundwater sampling effort was conducted at Site 22 in 1998, when soil and groundwater samples were collected from 28 direct-push locations along the downgradient border of the site. Supplemental sampling was conducted in 2003, including four direct-push soil boring locations within the landfill boundary, installation of well 22004, and groundwater sampling at wells 22004 and BAT-6B. Site 22 monitoring well locations are shown in [Figure 4](#). Soil and groundwater samples collected at Site 22 were analyzed for TPH, VOCs, and SVOCs ([URS 2004f](#)). See [Figure 8](#) for a depiction of sample locations from 1998 and 2003.

Soil: None of the soil or groundwater samples collected at Site 22 contained VOCs or SVOCs at concentrations that exceeded the state action levels. Metals detected in soil and groundwater were consistent with naturally occurring background concentrations and are not considered to have resulted from disposal at Site 22 ([URS 2004f](#)). Of the 35 soil samples analyzed for TPH, four contained TPH at concentrations that exceeded the state action level of 100 mg/kg. These results were reported in samples collected at direct-push sampling locations 23, 26, 29, and 30, which were south of the landfill and toward the runway in an area where JP-5 was spilled in March 1993 when a fuel tank fell off from a jet during takeoff ([URS 2004f](#)). The fuel spill was addressed in a report by NAS Fallon Public Works Department Environmental Division that requested NFA ([NAS Fallon 2000](#)). The NDEP Bureau of Corrective Action (BOCA) concurred with the report and required no further remediation with regard to the incident ([Kelso 2000](#)). A copy of this letter is included in [Appendix A](#).

Groundwater: Petroleum hydrocarbons were detected at concentrations exceeding the NDEP guidance concentration of 1,000 µg/L in two of the 27 groundwater samples collected at Site 22. The two samples were collected in 1998 from locations 28 and 30 and are attributed to the jet fuel release from the aircraft fuel tank accident. None of the groundwater samples collected from Site 22 contained VOCs or SVOCs at concentrations that exceeded the state action levels, except for bis(2-ethylhexyl)phthalate and naphthalene. Bis(2-ethylhexyl)phthalate exceeded the action level (6 µg/L) in one sample, but was also detected in the associated laboratory method blank and is considered a laboratory contaminant. Naphthalene was detected in one sample (location 30) above the state action level of 6.2 µg/L and is attributed to the jet fuel release from the aircraft fuel tank accident.

3.3.2 Summary of Site Risks

The primary mechanism for contaminant transport at Landfill Sites 20, 21, and 22 would be by rainwater infiltrating the landfills and carrying contaminants downward into groundwater, where they would be subject to groundwater transport. The arid climate at NAS Fallon (approximately 5 inches of rainfall per year), however, minimizes the potential for downward migration of chemicals of concern (COC) in soil by limiting the volume of rainwater available to infiltrate through the near-surface soil of the landfill ([URS 2004d](#)).

A baseline risk assessment was prepared for several sites at NAS Fallon in 1994, including Landfill Sites 20, 21, and 22 ([ASGI 1994](#)). This risk assessment included an evaluation of human health risk and ecological hazards from residual concentrations of COCs released to the environment at the three landfill sites.

Based on a qualitative review of analytical results available for the sites at that time, the baseline risk assessment concluded that concentrations of COCs in soil and groundwater did not warrant quantitative human health or ecological risk assessments (ASGI 1994). Results of sampling conducted after the RI further supported the conclusion of the baseline risk assessment.

Site 20: TPH-e was detected in one soil sample and chloromethane was detected in two groundwater samples collected in 1998 at concentrations greater than state action levels. However, these compounds were not detected during subsequent sampling in 2003. The only chemical detected in groundwater during the 2003 sampling event at concentrations greater than state action levels was bis(2-ethylhexyl)phthalate. However, this detection was attributable to laboratory contamination and was not considered a result of conditions at Site 20. Furthermore, groundwater at the site is not used as a source of drinking water or for any other purpose because of its high total dissolved solids (TDS) content (URS 2004d).

Site 21: The analytical results 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) (see Figure 7). 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, Landfill Site 21 did not appear to contain a source of phenol to groundwater and did not pose a risk to human health or the environment relative to phenol (URS 2004e).

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 soil samples analyzed. TPH-oil range organics (TPH-o) was detected in two 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 indicated that the volume of soil at the site that could act as a source of TPH to groundwater was limited. TPH as JP-5 was detected in three of 52 groundwater samples, with one of these detections greater than the guidance concentration of 1,000 µg/L. TPH was not detected at concentrations greater than the reporting limit in the remaining 49 groundwater samples. Furthermore, TPH was not detected in groundwater samples collected from locations downgradient of these soil and groundwater detections. These results indicated that Site 21 did not represent a large-scale or high-concentration source of TPH in groundwater and that the limited TPH impacts at the site were not migrating off site (URS 2004e).

TCE was the only other analyte that was detected in groundwater at a concentration greater than the state action level. TCE was detected in five of the 65 groundwater samples collected at Landfill Site 21 (see Figure 7). The highest concentration of 45 µg/L was detected in the 1998 groundwater sample collected from location 19, which is 1,100 feet upgradient of the downgradient site boundary and on an approximate flow line to well PW-03. Concentrations of TCE decreased along the flow path toward well 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 was not detected in 1997 or 2003 samples

collected from well PW-03. In addition, TCE was not detected at concentrations above the reporting limit in any of the 58 soil samples collected at Site 21. These results indicated that Site 21 did not represent a large-scale or high-concentration source of TCE to the environment and that TCE was not migrating off site. In addition, the distribution of TCE suggests that TCE was attenuating before reaching the downgradient site boundary (URS 2004e).

Groundwater is not currently used as a source of drinking water because of its high TDS content, or for any other purpose at or immediately downgradient of Site 21. Site 21 did not pose a risk to human health or the environment at that time. This conclusion was 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 groundwater (URS 2004e).

Site 22: The analytical results from on-site sampling showed no results that exceeded state action levels for soil or state action levels or guidance concentrations for groundwater collected within the landfill boundaries as a result of past activities. Results that exceed action levels for JP-5, TPH-p, and naphthalene were documented just southwest of the site boundary; however, the source was an accidental jet fuel release unrelated to the landfill that was remediated and requires no further action, according to BOCA.

No risk was posed by Site 22 to human health and the environment at that time. Again, this conclusion was reached because there were no results that exceeded state action levels in soil or action or guidance levels in groundwater as a result of past activities at Landfill Site 22. Furthermore, groundwater at the site is not used as a source of drinking water or for any other purpose because of its high TDS content. Finally, potential COCs had not leached from the landfill and had not migrated downgradient of the site in the 20 years since closure.

3.4 REMEDIAL ALTERNATIVES EVALUATION AND COST ANALYSES

Based on the results of previous investigations at Landfill Sites 20, 21, and 22, the Navy identified remedial action objectives (RAOs) for all three sites in remedial alternatives evaluation and cost analysis reports (RAECA) (URS 2004a, 2004b, and 2004c). The RAOs for Landfill Sites 20, 21, and 22 are to prevent potential future risks to human health and the environment and to mitigate the potential for leaching of landfilled material to groundwater. To fulfill the RAOs, the Navy identified four remedial alternatives in the RAECAs as described below:

- Alternative 1 – No Action. This alternative was used as a baseline for evaluation of the other alternatives. Under this alternative, no active remedial measures would be undertaken, and no ICs would be imposed to limit contact with landfilled material.
- Alternative 2 – Limited Action. Remedial actions included in this alternative were ICs, monitoring, and limited capping. ICs were assumed to consist of existing land use controls specified in the NAS Fallon Overview Plan (Navy 2003a).

- Alternative 3 – Limited Source Removal. Remedial actions included in this alternative were ICs, monitoring, selective soil and exposed waste removal, and limited capping. The ICs and groundwater monitoring described in Alternative 2 would also be implemented for Alternative 3.
- Alternative 4 – Engineered Cap. Remedial actions included in this alternative were ICs, monitoring, and capping. The ICs and groundwater monitoring described in Alternative 2 would also be implemented for Alternative 4.

In accordance with the general guidelines of CERCLA, as amended, and, to the extent practicable, Alternatives 1, 2, 3, and 4 were evaluated against the nine NCP criteria. The Navy identified Alternative 2, Limited Action, as the preferred alternative for Landfill Sites 20, 21, and 22 ([URS 2004a](#), [2004b](#), and [2004c](#)).

4.0 REMEDIAL/REMOVAL ACTIONS

This section discusses the initial plans, implementation history, status of the remedies, and relevant site activities since the DDs were signed to the present. Remedy selection, remedy implementation, remedy performance, and any changes to or problems with the components of the remedy will be discussed.

4.1 REMEDY SELECTION

This section describes the RAOs and the remedies selected for each site. RAOs were established to allow selection of remedies that achieve protection of human health and the environment and are consistent with continued use as NAS Fallon in the future.

4.1.1 Statement of RAOs and Selected Remedies

The RAOs agreed on in the DDs for Landfill Sites 20, 21, and 22, dated October 13, 2004 ([URS 2004d](#), [2004e](#), and [2004f](#)), are as follows:

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

The DDs selected the following *Limited Action* remedy to achieve the RAOs at all three landfill sites:

- Institutional controls (IC) to limit potential future human exposure to landfill material
- Limited groundwater monitoring to evaluate the off-site impact of landfill material
- Limited ground surface regrading, repairing the existing soil cover by placing native fill in selected areas, revegetating the regraded areas, and maintaining the cover for a 3-year period to improve surface drainage and mitigate the potential for surface water ponding, which could infiltrate through the landfill material

4.1.2 Basis for Decision

The Navy selected *Limited Action* as the preferred remedy for **Site 20** for the following reasons ([URS 2004d](#)):

- Site 20 has no ongoing contaminant sources. Disposal operations at Site 20 (Checkerboard Landfill) were terminated during 1965.

- TPH-e was the only organic COC detected in soil at concentrations greater than the state action level. TPH-e exceeded criteria in only one of the 20 soil samples tested by a factor of 1.4 times the cleanup level in a sample from 5.5 to 8.5 feet bgs.
- Petroleum hydrocarbons, including TPH-e, were not reported at concentrations above the state action levels in any of the 30 groundwater samples collected at the site.
- Chloromethane was detected in groundwater samples at concentrations greater than the state action level. Chloromethane exceeded criteria in two of the 30 groundwater samples analyzed by a factor of 2.3 times the state action level. Chloromethane was not detected in any of the nine groundwater samples collected at Site 20 during 2003.
- Bis(2-ethylhexyl)phthalate was detected in groundwater samples at concentrations greater than the state action level. Bis(2-ethylhexyl)phthalate exceeded criteria in one of the 30 groundwater samples tested by a maximum magnitude of 1.8 times the maximum contaminant level (MCL). Bis(2-ethylhexyl)phthalate was also detected in the laboratory blanks associated with the sample containing the exceedance. Therefore, the detected concentration was considered to be the result of laboratory contaminants.
- Metals analyzed in soil and groundwater samples collected at the site were detected at concentrations below MCLs or EPA Preliminary Remediation Goals, or are consistent with naturally occurring background concentrations ([EPA 1994](#)).
- The site is currently vacant land, and the Navy does not expect any change in the use of Site 20, or of the surrounding sites, in the future.

The Navy selected *Limited Action* as the preferred remedy for **Site 21** for the following reasons ([URS 2004e](#)):

- The observed TCE impacts to groundwater are low in concentration.
- Soil samples collected at the site did not contain TCE at concentrations above state action levels, which indicates that there is no ongoing source of TCE in soil at the site.
- Measured TDS concentrations (greater than 10,000 milligrams per liter [mg/L]) indicate that the shallow groundwater is unlikely to be used as a source of drinking water
- The shallow groundwater is not currently used at NAS Fallon for any purpose as a groundwater source and is unlikely to be used as a source of drinking water in the future because of its poor quality.
- 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.

The Navy selected *Limited Action* as the preferred remedy for **Site 22** for the following reasons (URS 2004f):

- TPH and naphthalene detections that exceeded their state guidance and action levels are related to the jet-fuel spill addressed under BOCA, as discussed in [Section 3.3.1](#). The release occurred when a fuel tank fell off an aircraft during takeoff. The release occurred in the area of these TPH detections. After cleanup action was completed at this location, the NDEP BOCA required no further remediation.
- VOCs were not detected at concentrations above state action levels for soil or action levels for groundwater at Site 22. SVOCs were not detected above state action levels for soil. Naphthalene and bis(2-ethylhexyl)phthalate were detected above the action level in one groundwater sample. The elevated level of naphthalene is a result of the fuel release from an aircraft fuel tank. Bis(2-ethylhexyl)phthalate was detected in one of the 35 analyzed groundwater samples at a concentration greater than the state action level of 6 µg/L. However, this detection is likely a result of laboratory contamination, because it was present in a laboratory blank. Bis(2-ethylhexyl)phthalate was not detected in any of the 36 soil samples at concentrations greater than the state action level of 35 mg/kg. The results suggest that landfilling operations at Site 22 have not resulted in impacts to soil or groundwater.
- The Navy does not expect any change in land use at Site 22 or of the surrounding sites.
- Shallow groundwater at Site 22 (and NAS Fallon) is not currently used for domestic purposes. The naturally occurring high TDS concentrations will make shallow groundwater a poor choice for future residential use. Site 22 is also an industrial area and will remain active as an industrial area in the future.

In summary, *Limited Action* was selected for Sites 20, 21, and 22. The limited ground surface regrading component of the remedy was intended to mitigate the potential for surface water ponding, which could infiltrate through the fill material, and improve surface drainage. It was anticipated that the potential for future leaching and or migration of potential chemicals of concern would be low because potential COCs had not leached to groundwater or migrated off-site in the many years that the landfills had been closed. The low annual precipitation (approximately 5 inches per year) suggested a low potential for future leaching. Regrading, in association with the arid climate at NAS Fallon, was intended to minimize the potential for downward transport of COCs that remain in vadose zone soil within the landfilled portion of the sites. The remedy also provided for limited groundwater monitoring to assess the potential for landfilled material to migrate off site. The ICs portion of the remedy was intended to limit potential future human exposure to landfilled material.

4.2 REMEDY IMPLEMENTATION

The main goals of the remedies were to prevent transport and migration of contamination in groundwater and to prevent human and ecological exposure to contamination. The following sections discuss the steps taken, from the date of the DDs through the present, to implement the RAOs for Sites 20, 21, and 22.

4.2.1 Institutional Controls

ICs were selected as a component of the *Limited Action* remedy for Sites 20, 21, and 22. The *Limited Action* remedy adopted ICs in the NAS Fallon Overview Plan (Navy 2003a) to limit human exposure to landfill materials. The ICs categorize the sites as constrained to development because of their IR status and because they are potentially contaminated. The plan states that the sites may be developed only after they have been mitigated. Before they could be developed, they must undergo extensive study by the Environmental Division at NAS Fallon. Additionally, compliance with all applicable environmental requirements is required. ICs are discussed further in Section 6.1.4.

4.2.2 Limited Groundwater Monitoring

The following sections summarize three groundwater monitoring events that were conducted at Sites 20, 21, and 22 since the DDs were signed. The first event occurred in February and March 2007, the second in August and September 2008, and the third in April 2010.

4.2.2.1 2007 Groundwater Monitoring Results Summary

In February and March 2007, samples were collected and analyzed from the 23 following groundwater monitoring wells (including 14 new monitoring wells installed by BAI) to assess the potential for landfilled material to migrate off site:

- Site 20: MW33L, MW-33U, MW-36, MW-37, BA20-MW01, BA20-MW02, BA20-MW03, BA20-MW04, and BA20-MW05 (see Figure 3)
- Site 21: MW-12L, MW-45, MW-94, BA21-MW01, BA21-MW02, BA21-MW03, BA21-MW04, BA21-MW05, PW-03, and 22004 (see Figure 4)
- Site 22: BA22-MW01, BA22-MW02, BA22-MW03, and BA22-MW04 (see Figure 4)

All groundwater samples were analyzed for TPH, VOCs, SVOCs, and TDS by a NDEP-certified laboratory approved by the Navy. The results of the 2007 groundwater monitoring (BAI 2008) are discussed in the following paragraphs:

Groundwater Elevation Measurement

Groundwater elevation measurements indicate a very shallow groundwater gradient (0.001 feet per foot) at Landfill Sites 20, 21, and 22 with groundwater flow directed toward the southeast. This finding is consistent with historical data collected for these sites.

Total Petroleum Hydrocarbons

TPH was not detected above the reporting limit in samples from Site 20. TPH as gasoline range organics (TPH-GRO) was not detected at concentrations above the reporting limit in samples collected from any of the wells. TPH as diesel range organics (TPH-DRO) and residual range organics (TPH-RRO) were detected in samples from two wells at Site 21 and three wells at Site 22. All of the reported TPH detections were well below the NDEP guidance concentration (1,000 µg/L), except for the following:

- BA22-MW-03 – 2,500 µg/L TPH-DRO (Site 22)

The analytical results for TPH in groundwater were generally consistent with historical trends, although new well BA22-MW03 was reported to contain the highest concentrations (2,500 µg/L of TPH-DRO and 340 µg/L of TPH-RRO). The elevated concentration of TPH-DRO at this location was considered likely attributable to the jet fuel spill reported to NDEP BOCA in March 1993 (URS 2004d, 2004e, and 2004f). Soil samples collected from this area in 2003 exceeded the state action level for TPH (100 mg/kg).

Volatile Organic Compounds

No VOCs were detected in groundwater samples collected from Site 20 and Site 22. However, toluene was detected in two groundwater samples collected at Site 21, but at concentrations below the EPA Regional Screening Level (RSL) for tap water (2,300 µg/L) (EPA 2008). Toluene was detected at a concentration of 1.1 µg/L in well MW-12L and 7.2 µg/L in well BA21-MW05.

Semivolatile Organic Compounds

No SVOCs were detected above applicable screening levels in samples collected from any of the sites, except for the following:

- Well MW-94 — 38 µg/L bis(2-ethylhexyl)phthalate (Site 21)

The EPA Region 9 tap water RSL for bis(2-ethylhexyl)phthalate is 4.8 µg/L (EPA 2008). Historically, bis(2-ethylhexyl)phthalate had not been detected at well MW-94.

Total Dissolved Solids

TDS results exceeded the Nevada secondary MCL (1,000 mg/L) for all wells except BA20-MW02 (Site 20), BA20-MW05 (Site 20), and MW-12L (Site 21). The high concentrations of TDS at Sites 20, 21, and 22 were consistent with the historical results for TDS in samples collected at Sites 20, 21, and 22 as well as background concentrations in the shallow aquifer.

4.2.2.2 2008 Groundwater Monitoring Activities and Results Summary

In early 2008, Tetra Tech EM Inc. (Tetra Tech) removed and replaced well MW-37 at Site 20 with TT20-MW02, well 22004 at Site 22 with TT22-MW01, and well PW-03 at Site 22 with TT22-MW01. In June 2008, the Tetra Tech team modified monitoring wells MW33U and MW33L to convert the surface-grade completion to an aboveground completion and elevated the top of casing height by nearly 3.5 feet. Tetra Tech re-surveyed the replacement wells, the modified wells, and all existing groundwater monitoring wells (BAI 2009).

In August and September 2008, BAI collected and analyzed samples from the 23 following groundwater monitoring wells to assess the potential for landfilled material to migrate off site:

- Site 20: BA20-MW01, BA20-MW02, BA20-MW03, BA20-MW04, BA20-MW05, MW33L, MW-33U, MW-36, and TT20-MW02 (see [Figure 3](#))
- Site 21: BA21-MW01, BA21-MW02, BA21-MW03, BA21-MW04, and BA21-MW05, MW-12L, MW-45, and MW-94 (see [Figure 4](#))
- Site 22: TT22-MW01, BA22-MW01, BA22-MW02, BA22-MW03, and BA22-MW04, and TT22-MW02 (see [Figure 4](#))

All groundwater samples were analyzed for TPH, VOCs, SVOCs, and TDS by a NDEP-certified laboratory approved by the Navy. The results of the 2008 groundwater monitoring are discussed in the following paragraphs ([BAI 2009](#)).

Groundwater Elevation Measurement

Groundwater elevations measured in August and September 2008 were generally consistent with the 2007 groundwater levels measurements, except at Site 20, where groundwater elevations rose more than 1 foot in wells BA20-MW04 and BA20-MW05 and declined 0.4 foot in well MW-36. The NAS Fallon environmental staff reported a water leak in the general vicinity that could explain the rise in groundwater levels at this site. Several thousands of gallons of water were reportedly flushed during installation of water lines along Pasture Road during the summer ([BAI 2009](#)).

Based on the August and September 2008 groundwater level measurements, groundwater flow at Site 20 is directed toward the east-southeast at a gradient of approximately 0.004, and

groundwater flow at Sites 21 and 22 is directed toward the southeast at a gradient of approximately 0.001. The groundwater gradients and flow directions were generally consistent with the previous (2007) estimates, except at Site 20, where the groundwater gradient had increased from the previous (2007) estimate of 0.001.

Total Petroleum Hydrocarbons

All of the groundwater samples were analyzed for TPH-GRO, TPH-DRO, and TPH-RRO. TPH-GRO was not detected at concentrations above the reporting limit in groundwater samples collected from any of the wells.

TPH-RRO was detected in groundwater samples collected from nine wells (one at Site 20, four at Site 21, and four at Site 22), with the highest concentration (210 µg/L) reported at well BA22-MW03. All of the reported TPH-RRO detections were well below the NDEP guidance concentration (1,000 µg/L).

TPH-DRO was detected in groundwater samples collected from 14 wells (four at Site 20, four at Site 21, and six at Site 22). All of the detections were below the NDEP guidance concentration (1,000 µg/L), except for two. Additionally, the same wells exhibited increases over year 2007 concentrations, as presented below:

- BA21-MW04 – 1,600 µg/L (2008) vs. 97 µg/L (2007) (Site 21)
- BA22-MW03 - 3,200 µg/L (2008) vs. 2500 µg/L (2007) (Site 22)

Analytical results for TPH-DRO concentrations at Sites 21 and 22 in 2008 are plotted in [Figure 11](#). The Navy created a new petroleum site in 2010 because of the increasing TPH-DRO concentrations. This site is discussed further in [Section 6.1.5](#).

Volatile Organic Compounds

VOCs detected in one or more groundwater samples collected in 2008 included:

- 1,2-dichloropropane
- acetone
- benzene
- carbon disulfide
- chloroform
- chloromethane
- dichlorodifluoromethane
- isopropylbenzene
- m,p-xylenes
- methylene chloride
- naphthalene
- propylbenzene
- sec-butylbenzene
- toluene
- TCE

None of the detected VOCs was reported at concentrations that exceeded screening levels, except for the following:

- MW-33U - 6.1 µg/L TCE (Site 20)
- BA21-MW04 - 1.8 µg/L naphthalene detected as a VOC with EPA method 8260B (Site 21)

The federal MCL for TCE in drinking water is 5 µg/L. TCE was not detected in the previous groundwater sample collected from this well (February 2007) and was not detected in any of the other groundwater samples collected from Site 20 in 2008 or 2007.

The EPA Region 9 RSL for naphthalene in tap water is 0.14 µg/L. Naphthalene was not detected in the previous groundwater sample collected from well BA21-MW04 (February 2007) and has not been detected in any of the other groundwater samples previously collected from Site 21.

Semivolatile Organic Compounds

No SVOCs were detected in groundwater samples collected from Site 20. Six SVOCs (2-methylnaphthalene, benzoic acid, diethylphthalate, di-n-butylphthalate, naphthalene, and phenol) were detected in one or more groundwater samples collected from wells at Site 21 and Site 22. None of the detected SVOCs was reported at concentrations that exceeded screening levels except for the following:

- MW-12L - 0.41 µg/L (estimated) naphthalene detected as an SVOC with EPA method 8270C (Site 21)

The EPA Region 9 RSL for naphthalene in tap water is 0.14 µg/L. Naphthalene was not detected in the previous groundwater sample collected from well MW-12L (February 2007) and has not been detected in any of the groundwater samples previously collected from Site 21.

Total Dissolved Solids

All of the groundwater samples were analyzed for TDS. TDS was detected at concentrations that exceeded the Nevada secondary MCL (1,000 mg/L) in all except three groundwater samples collected at Site 20 and one sample collected at Site 21. High TDS levels are consistent with the historical results for TDS in samples collected at Sites 20, 21, and 22 as well as background concentrations in the shallow aquifer.

4.2.2.3 2010 Groundwater Monitoring Activities and Results Summary

In April 2010, BAI collected and analyzed samples from the 23 following groundwater monitoring wells to assess the potential for landfilled material to migrate off site:

- Site 20: BA20-MW01, BA20-MW02, BA20-MW03, BA20-MW04, BA20-MW05, MW33L, MW-33U, MW-36, and TT20-MW02 (see [Figure 3](#))
- Site 21: BA21-MW01, BA21-MW02, BA21-MW03, BA21-MW04, and BA21-MW05, MW-12L, MW-45, and MW-94 (see [Figure 4](#))
- Site 22: BA22-MW01, BA22-MW02, BA22-MW03, and BA22-MW04, TT22-MW01, and TT22-MW02 (see [Figure 4](#))

All groundwater samples were analyzed for TPH, VOCs, SVOCs, and TDS by an NDEP-certified laboratory approved by the Navy. The results of the 2010 groundwater monitoring are discussed in the following paragraphs ([BAI 2010](#)).

Groundwater Elevation Measurement

Groundwater elevations measured in April 2010 were generally consistent with previous measurements. Groundwater gradient maps based on the April 2010 groundwater level measurements were produced using Surfer 8.05 software, and are presented as [Figure 9](#) (Site 20) and [Figure 10](#) (Sites 21 and 22). Based on these measurements, groundwater flow at Site 20 is directed toward the east-southeast at a gradient of approximately 0.004, and groundwater flow at Sites 21 and 22 is directed toward the southeast at a gradient of approximately 0.001. The groundwater gradients and flow directions were generally consistent with the previous (2007 and 2008) estimates.

Total Petroleum Hydrocarbons

Groundwater samples from all 23 monitoring wells were analyzed for TPH-GRO by purge and trap, and TPH-DRO and TPH-RRO by extraction. TPH-GRO was not detected above the reporting limit in groundwater samples collected from any of the wells.

TPH-RRO was detected in groundwater samples collected from one well at Site 21 and two wells at Site 22, with the highest concentration (46 µg/L) reported at well BA22-MW03. This decrease is significant from the previous result in this well (210 µg/L in 2008) and well below the 1,000 µg/L NDEP guidance concentration.

TPH-DRO was detected in one well at Site 21 and four wells at Site 22, with the highest concentration (3,000 µg/L) reported at well BA22-MW03. All other TPH-DRO detections were reported at concentrations less than the 1,000 µg/L NDEP guidance concentration. TPH-DRO concentrations have been increasing slightly in three wells at Site 22, most notably BA22-MW02, as presented below:

- BA22-MW01 – 90 µg/L (2007); 100 µg/L (2008); 120 µg/L (2010)
- BA22-MW02 – 350 µg/L (2007); 500 µg/L (2008); 790 µg/L (2010)

- BA22-MW03 – 2,500 µg/L (2007); 3,200 µg/L (2008); 3,000 µg/L (2010)

Analytical results for TPH-DRO concentrations at Sites 21 and 22 in 2010 are plotted in Figure 12. The source of the TPH-DRO detections is located upgradient of the landfills and is being investigated as Site 28. This site is discussed further in [Section 6.1.5](#).

Volatile Organic Compounds

The following VOCs were detected in 2010 groundwater samples:

- | | |
|---------------------------|-----------------------|
| • TCE | • isopropylbenzene |
| • acetone | • propylbenzene |
| • chloroform | • sec-butylbenzene |
| • dichlorodifluoromethane | • 1,1-dichloroethane |
| • 1,2-dichloropropane | • 1,4-dichlorobenzene |

None of the detected VOCs was reported at concentrations that exceeded screening levels.

Semivolatile Organic Compounds

No SVOCs were detected in any of the 2010 groundwater samples collected from Sites 21 or 22. Bis(2-ethylhexyl)phthalate and 2,4,6-trichlorophenol were detected in groundwater samples from two wells at Site 20 (BA20-MW03 and MW-36, respectively). The bis(2-ethylhexyl)phthalate detection was a laboratory estimated concentration of 5 µg/L, which was slightly above the 4.8 µg/L EPA Region 9 RSL for tapwater but less than the MCL of 6 µg/L. The detected concentration of 2,4,6-trichlorophenol was well below the screening level.

Total Dissolved Solids

TDS concentrations were reported to exceed the Nevada secondary MCL (1,000 mg/L) in all but four groundwater samples (three at Site 20 and one at Site 21). The 2010 analytical results for TDS were generally comparable with the 2007 and 2008 results and consistent with the historical results for TDS in samples collected at Sites 20, 21, and 22, as well as background concentrations in the shallow aquifer.

4.2.3 Landfill Maintenance Activities

According to the remedies as stated in the DDs, landfill maintenance consists of:

- Regrading the landfill and repairing the existing soil cover by placing native fill in selected areas.
- Revegetating the regraded areas of the landfill.
- Maintaining the landfill for a 3-year period.

Regrading and repair: BAI conducted a post-closure landfill inspection at Sites 20, 21, and 22 in June 2006 to observe the integrity and effectiveness of the landfill cover and to identify areas that required maintenance. Points of potential ponding or exposed waste were identified and located using a field global positioning system receiver. Future maintenance was to address the issues noted at all of these locations, at a minimum. Additional areas that were not identified on the maps were to be addressed at the discretion of the site superintendent based on the severity of the condition and the resources available. Debris was observed on the landfill surfaces during the inspection and consisted of various kinds of trash, including metallic debris, concrete and asphalt, wire trash, wooden pieces, mechanical parts, pipe, and glass.

BAI selectively regraded the landfill surfaces at Sites 20, 21, and 22 in March and April 2007. The regraded locations which consisted of pits (low elevation locations) as wells as stockpiles (high elevation locations), were leveled off for better drainage and did not include the entire surface of each landfill. These locations are depicted in Figures 5-1 and 5-2 in the Final 2007 Annual Post-Closure Maintenance and Groundwater Monitoring Report for Landfill Sites 20, 21, and 22 (BAI 2008). The earthen soil stockpiles 2 miles north of Sites 21 and 22, which contained clean, native fill material, were used to cover debris that could not be covered with the soil on site. All the stockpiled soil was used for landfill maintenance and the area was smoothed out. A 2,000-gallon water truck was used for dust suppression and moisture conditioning the fill material to aid in compaction. Soil was placed in lifts of 8 inches or less and compacted with a rammer. The upper 8 inches of fill material was not compacted, but instead was tracked with the loader to enhance revegetation. Water was also applied along the drainage channels and surrounding area to enhance natural revegetation. After landfill maintenance was completed, a final site walk was conducted. The site walk was performed by Navy personnel, the site supervisor, and the quality control (QC) manager for quality assurance (QA) to concur that this component of landfill maintenance had been completed in accordance with the requirements of the remedies as described in the DDs (BAI 2008).

Revegetation: BAI began efforts to re-vegetate Sites 20, 21, and 22 in March 2008. Native species were selected in consultation with the natural resource specialist at NAS Fallon. The following is a summary of the acreage, seed mix, and pounds of seeds per acre applied at each Site (BAI 2009).

Site 20 (2 acres):

- Black greasewood (*Sarcobatus vermiculatus*) - 3 pounds seed/acre
- Inland saltgrass (*Distichlis spicata*) - 5 pounds seed/acre

Site 21 (20 acres):

- Black greasewood (*Sarcobatus vermiculatus*) - 3 pounds seed/acre
- Inland saltgrass (*Distichlis spicata*) - 5 pounds seed/acre
- (In the sandy soil in the northeast corner) Big basin sagebrush (*Artemisia tridentata* ssp. *tridentata*) - 10 pounds seed/acre; and fourwing saltbush (*Atriplex canescens*) - 10 pounds seed/acre

Site 22 (15 acres):

- Black greasewood (*Sarcobatus vermiculatus*) - 3 pounds seed/acre

The seeded areas will require monitoring to ensure that the revegetation efforts are successful. Bare ground may require further seeding and maintenance as necessary.

Maintenance: The Navy will maintain the landfill for 3 years in accordance with the *Limited Action* remedy.

5.0 FIVE-YEAR REVIEW PROCESS

This section describes activities during the five-year review process for Sites 20, 21, and 22, and provides a summary of the findings of each step in the process, where appropriate. The five-year review was conducted between April 2009 and the date of this report.

5.1 ADMINISTRATIVE COMPONENTS

Potentially interested parties were notified of the start of the five-year review via a public notice published in the local newspaper. The notice is discussed in [Section 5.2](#), and a copy of the public notice is included in [Appendix B](#).

Members of the review team included:

- Mr. R. Michael Quesada, Remedial Project Manager (RPM), Naval Facilities Engineering Command Southwest (NAVFAC SW), Navy
- Mr. Darren Knight, Program Manager, ChaduxTt
- Mr. Dave Harr, Lead Project Manager, ChaduxTt
- Mr. Michael Anderson, Project Manager, ChaduxTt

- Ms. Shara Churchwell, Environmental Scientist, ChaduxTt

5.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

The Fallon, Nevada, community was informed of the start of the five-year review for Landfill Sites 20, 21, and 22 in a public notice printed in the *Lahontan Valley News & Fallon Eagle Standard* on May 24, 2009. The notice stated the purpose of the five-year review under CERCLA, identified the types of chemicals of potential concern (COPC) at NAS Fallon, described the remedies selected to deal with on-site contamination, and conveyed the status of remedy implementation for each site. A copy of the published public notice is in [Appendix B](#).

When the five-year review report has been completed, a second public notice and fact sheet will inform the community of the findings. In addition, the fact sheet will be sent to current Restoration Advisory Board (RAB) members, regulatory agency personnel, and community representatives who indicated an interest in prior mailings on environmental restoration at NAS Fallon. This five-year review report will be made available at the Churchill County Public Library, 553 S. Maine Avenue, Fallon, NV 89406.

The local community was not involved directly in the five-year review process. The public does not live adjacent to these sites, and manned access points into NAS Fallon restrict users of the land to Navy personnel. Interested community representatives had the opportunity to meet with and become members of the RAB during earlier phases of the site RI and remedy selection and evaluation, and the opportunity is still open for interested community members to join the RAB. This group was established to provide a forum for exchange of information and partnership among the community, the Navy, and NDEP by reviewing and commenting on technical documents relating to the ongoing environmental cleanup at the NAS Fallon.

5.3 DOCUMENT REVIEW

Relevant documents issued before and since the DDs for Landfill Sites 20, 21, and 22 had been signed were reviewed. RAOs and applicable or relevant and appropriate requirements (ARAR) were documented in the DDs. A complete list of documents reviewed is provided in [Appendix C](#).

5.4 DATA REVIEW

Data from groundwater monitoring events in 2007, 2008, and 2010 ([BAI 2008](#), [2009](#), and [2010](#)) were reviewed to identify relevant trends and evaluate whether compliance with RAOs was being met. The data review included examination of groundwater monitoring information and regulatory standards.

Overall, groundwater monitoring data for Landfill Sites 20, 21, and 22 indicate low and infrequent detections of contaminants. Contaminant concentrations, when detected, generally

existed at or below regulatory screening or guidance levels with few exceptions, as discussed below.

Total Petroleum Hydrocarbons

Over three groundwater monitoring events, TPH-DRO was detected in samples collected from 15 wells, with four detections exceeding the 1,000 µg/L NDEP guidance concentration:

- 1,600 µg/L in Site 21 well BA21-MW04 (2008)
- 2,500 µg/L (2007), 3,200 µg/L (2008), and 3,000 µg/L (2010) in Site 22 well BA22-MW03

The TPH-DRO concentration in well BA21-MW04 decreased to 210 µg/L by 2010. However, TPH-DRO concentrations have been increasing slightly in three wells at Site 22, as discussed in [Section 4.2.2.3](#). These elevated TPH-DRO concentrations were previously attributed to a jet fuel spill reported to NDEP in March 1993 ([URS 2004f](#)). However, the 2008 and 2010 TPH-DRO contamination contours (see [Figures 11 and 12](#)) indicate that the primary source of TPH-DRO in this area is located upgradient of the previously reported jet fuel spill and that the source does not originate from Sites 21 or 22. Furthermore, the contamination contours indicate that TPH-DRO is migrating into the sites and that the plume remains within the NAS Fallon installation boundary. The Navy is currently investigating this source of TPH-DRO as Site 28.

Volatile Organic Compounds

No VOCs were detected in groundwater samples collected from any of the monitoring wells at concentrations that exceed screening levels, except for the following:

- TCE was detected at 6.1 µg/L in Site 20 well MW-33U in 2008.
- Naphthalene was detected at 1.8 µg/L in Site 21 well BA21-MW04 in 2008 as a VOC by EPA method 8260B.

The TCE detection slightly exceeds the federal MCL of 5 µg/L. TCE was not detected in the lower screened interval at MW-33L (collocated with well MW-33U and screened between 7 and 12 feet deeper). TCE was not detected in the equipment rinsate blank and trip blank collected the day before well MW-33U was sampled or in the source blank collected the next day. A matrix spike/matrix spike duplicate sample was collected from this well, which yielded recovery and reproducibility results well within the QC acceptance limits for TCE. The source of elevated TCE concentrations reported in the sample from well MW-33U could be attributed to either a shallow and very localized release at or near well MW-33U, or to cross-contamination of the sample in the field or during shipping and handling before analysis. TCE has not been detected in any of the previous groundwater or soil samples collected from Site 20 ([BAI 2009](#)) and the concentration of TCE detected in this well in 2010 had decreased to 1.8 µg/L ([BAI 2010](#)).

The naphthalene detection exceeds the EPA Region 9 RSL of 0.14 µg/L. However, naphthalene was not detected in groundwater samples collected from well BA21-MW04 in 2007 or 2010 and has not been detected in any of the other groundwater samples previously collected from Site 21 (BAI 2009 and 2010).

Semivolatile Organic Compounds

No SVOCs were detected in groundwater samples collected from any of the monitoring wells at concentrations that exceed screening levels, except for the following:

- Bis(2-ethylhexyl)phthalate was detected at 38 µg/L in Site 21 well MW-94 in 2007.
- Bis(2-ethylhexyl)phthalate was detected at 5 µg/L (estimated) at Site 20 well BA20-MW03 in 2010.
- Naphthalene was detected at 0.41 µg/L (estimated) at Site 21 well MW-12L in 2008 as an SVOC by EPA method 8270C.

The 2007 bis(2-ethylhexyl)phthalate detection exceeds the EPA Region 9 tap water RSL of 4.8 µg/L (EPA 2008). Historically, bis(2-ethylhexyl)phthalate had not been detected at well MW-94 (BAI 2008), and it was not detected in samples from this well in 2008 or 2010 (BAI 2010).

The 2010 bis(2-ethylhexyl)phthalate detection was slightly above the 4.8 µg/L EPA Region 9 RSL for tapwater but less than the MCL of 6 µg/L.

The naphthalene detection exceeds the EPA Region 9 tap water RSL of 0.14 µg/L (EPA 2008). Naphthalene was not detected in the 2007 or 2010 groundwater samples collected from well MW-12L and was not detected in any of the historical groundwater samples collected from Site 21 (BAI 2010).

Except for increasing TPH-DRO concentrations originating from an off-site source in three Site 22 wells, the detections discussed in this section do not indicate contaminant trends because screening and guidance levels have not been consistently exceeded and because of the low concentrations and sporadic nature of the detections. Monitoring is discussed further in Section 6.1.5, and progress toward meeting RAOs is discussed further in Section 6.2.5.

5.5 SITE INSPECTIONS

ChaduxTt conducted site inspections for this review on May 19, 2009. The purpose of the site inspections was to review and document current site conditions and evaluate visual evidence on the protectiveness of the remedial systems and land use restrictions. This effort included noting current land use of the sites, points of access, and access requirements for the sites; presence and location of fencing; and locations and conditions of monitoring wells. EPA's *Comprehensive*

Five-Year Review Guidance (EPA 2001) provides a site inspection checklist that was modified and used during the site inspections. The modified checklists filled out during the inspections are presented in [Appendix D](#). Photographs selected to show the conditions noted during the site inspections are provided in [Appendix E](#).

5.5.1 Site 20

Site 20 is located in the southwestern portion of NAS Fallon, 2,000 feet west of the western end of runway 7-25 (see [Figure 3](#)). The landfilled portion of Site 20 encompasses 26 acres, extending 3,300 feet north to south and 300 to 450 feet east to west. The surface consists generally of unpaved areas supporting native vegetation. Areas of bare land were located within the site (see [Photo #1](#)). The bare areas appeared to be the result of previous maintenance grading and seeding that was intended to prevent ponding of water. No evidence of revegetation was observed. Minor debris and trash were scattered across the surface.

Advance arrangements must be made to access Site 20. Anyone trying to access the area without authorization would likely be intercepted by military security because of its proximity to active runways. No signage was located at the landfill to warn station personnel that the site is a closed landfill and should not be disturbed.

All monitoring wells located at the time of the site inspection appeared to be in good condition. Warning signs identifying the wells as environmental monitoring wells were located adjacent to the wells. Most of the wells were locked, preventing access; however, some of the wells were unlocked and easily accessible without tools (see [Photo #2](#)). Monitoring wells that were unlocked or unbolted included the following:

- MW-36 (not bolted)
- TT20-MW01 (not locked)
- MW-33U (not locked)

The unsecured wells are an unsatisfactory condition and are contrary to well head protection standards. Even though access to the wells by the public is unlikely because of secured entry gates that restrict access onto NAS Fallon, the integrity of the unsecured wells should be evaluated to confirm that illegal disposal into the wells has not occurred. Additionally, all wells should be bolted or locked, and keys should be maintained at the Environmental Division's offices.

No activity that would be considered inconsistent with use as a closed landfill was noted.

5.5.2 Sites 21 and 22

Site 21 is located in the northeastern portion of NAS Fallon (see [Figure 4](#)) and occupies 60 acres. The landfilled portion is 3,200 feet from the western border to the eastern border and is 700 to 1,800 feet from north to south. The surface consists generally of unpaved areas that support native vegetation (see [Photo #3](#)). Building 480 and three associated antennas were located in the west-central section of the site. Debris, consisting of broken glass, wire, rusted metal, rusted cans, wood pieces, asphalt, and other miscellaneous items, was scattered across the surface of the site. Areas of bare land were located within the site (see [Photo #4](#)). The bare areas appeared to be the result of previous maintenance grading and seeding that was intended to prevent ponding of water. No evidence of revegetation was observed.

Site 22 is located in the northeastern corner of NAS Fallon, south of Site 21 (see [Figure 4](#)). Site 22 encompasses 18 acres, extending 1,200 feet from east to west and between 500 and 1,000 feet from north to south. The site is currently flat and supports native vegetation. Areas of bare land were located within the site (see [Photo #5](#)). The bare areas appeared to be the result of previous maintenance grading and seeding that were intended to prevent ponding of water. No evidence of revegetation was observed. A low area reported to be the 1993 jet fuel spill area was located adjacent to and south of the site (see [Photo #6](#)).

Advance arrangements must be made to access Sites 21 and 22 because vehicular is prevented by a locked gate on the southeastern portion of the base at the beginning of Site 24, Road Oiling Area. Anyone trying to access the area without authorization would likely be intercepted by military security because of its proximity to active runways. No signage was located at the landfills to warn station personnel that the sites are closed landfills and should not be disturbed.

A large area of broken slabs of asphalt and concrete (construction and demolition [C&D] stockpile) was located along the entire northern portion of Site 22, adjacent to Perimeter Road (see [Photo #7](#)). According to a letter from the Installation Commanding Officer (ICO) of the Navy to the NDEP Bureau of Waste Management dated January 19, 2006, the C&D stockpile was likely deposited from about 1993 to 2001 to reduce construction and demolition costs and to save money on future construction projects that could reuse the material for backfill. Sources of the material were likely large-scale construction projects, the Base Support contractor, and the Seabees. The stockpile was not considered hazardous. The letter further states that measures were taken to prevent further dumping in the area and that the Navy planned to reuse the material on runway construction projects within 5 to 10 years. A sign that reads “No Dumping by order of the C.O.” was observed in front of the area of broken slabs (see [Photo #8](#)). The C&D stockpile is discussed further in [Section 6.1.2](#). A copy of the letter from the ICO is included in [Appendix A](#).

All monitoring wells located at the time of the site inspection appeared to be in good condition (see [Photo #9](#)). Most of the wells were locked, preventing access; however, some of the wells were unlocked and easily accessible without tools (see [Photos #10 and #11](#)). Three older wells that are no longer in use were located adjacent to well TT22-MW02 (see [Photo #12](#)). Warning

signs identifying the wells as environmental monitoring wells were located adjacent to the wells (see [Photo #13](#)).

Monitoring wells that were unlocked or unbolted included the following:

- MW-12L (not bolted)
- BA21-MW02 (not locked)
- MW-94 (not bolted)
- BA22-MW01 (not locked)
- BA22-MW04 (not locked)
- BA21-MW01 (not locked)
- BA21-MW03 (not locked)
- MW-45 (not bolted)
- BA22-MW03 (not locked.)
- MW-33U (not locked)

The unsecured wells are an unsatisfactory condition and are contrary to well head protection standards. Even though access to the wells by the public is unlikely because of secured entry gates that restrict access onto NAS Fallon, the integrity of the unsecured wells should be evaluated to confirm that illegal disposal into the wells has not occurred. Additionally, all wells should be bolted or locked, and keys should be maintained at the Environmental Division's offices.

Other than the C&D stockpile at Site 22, no activity that would be considered inconsistent with use as a closed landfill was noted.

5.6 INTERVIEWS

The Navy and NDEP personnel responsible for or familiar with current and historical activities at Landfill Sites 20, 21, and 22 were interviewed in May and June 2009. Highlights from the information gathered during each interview are presented below. The full interviews are located within interview documentation forms (see [Appendix F](#)) listing the name, title, and organization of the interviewee; date, time, and location of the interview; and response to interview questions.

Mr. Chuck Deverin, Navy, *on-site interview on May 19, 2009*

Mr. Deverin is an Environmental Specialist with the Environmental Division of the Public Works Department at NAS Fallon. Mr. Deverin answered questions and provided the status of the IRP Sites at NAS Fallon that are summarized in [Table 1](#). Additionally, he provided a tour of the sites and pointed out the approximate area of the 1993 jet fuel spill area that is indicated on [Figure 4](#).

Summary:

- Site 6 is currently an active petroleum-only site and is being monitored.
- The ICs that are mentioned in the DDs include limited access and building restrictions.

- The Navy is not sure why TPH-DRO levels are increasing at Sites 21 and 22. The Navy plans to continue monitoring.
- No one is sure of the exact location of the 1993 jet fuel release near Sites 21 and 22. However, the Navy has a good idea of the general area where it occurred.

Mr. Ramon Naranjo, NDEP, telephone interview on June 5, 2009

Mr. Naranjo is an environmental scientist at NDEP and has been involved with NAS Fallon for the last 7 years.

Summary:

- NDEP investigates and characterizes contaminants from the Navy's previous releases. NDEP reviews the documents and evaluates them for technical defensibility and regulatory compliance. The division holds the Navy responsible for investigation and remediation.
- For the duration that he has been involved, Mr. Naranjo has been content with the monitoring results that are leading toward closure of the landfills. Furthermore, he feels strongly about the decision to concur with the Navy's request for closure with limited action, which included monitoring groundwater for three years. After three years of groundwater monitoring, the sites will be re-evaluated for NFA status.
- There have been no changes in state laws or regulations regarding concentrations for metals, TPH, VOCs, or SVOCs that may alter the protectiveness of human health and the environment.
- He feels that the Navy has handled the environmental remediation of the sites adequately.
- The State of Nevada has regulatory guidance for TPH in groundwater, but not an action level. NDEP views specific compounds in petroleum as individual components of concern, and not total TPH. TPH is guidance for what might be detected in terms of the heavier chain compounds that have not been assigned action levels.
- With regard to the increasing concentrations of TPH-DRO at Sites 21 and 22, the Navy is undertaking an extensive amount of work to revise its groundwater monitoring to ensure the plume migration is steady. The 1993 jet fuel spill may have to be evaluated under a different program. Since there is no action level for TPH, specific compounds in TPH would have to be analyzed individually and decisions made accordingly. The *Limited Action* remedy is adequate to address the increasing TPH-DRO concentrations at this time.

6.0 TECHNICAL ASSESSMENT

Three questions will be examined in the technical assessment to evaluate whether the *Limited Action* remedy at Sites 20, 21, and 22 is protective of human health and the environment:

- *Question A:* Is the remedy functioning as intended by the decision documents?
- *Question B:* Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?
- *Question C:* Has any other information come to light that could call into question the protectiveness of the remedy?

Each of these questions is addressed in the following subsections, building on the information and data summaries presented previously. The discussion presented here is a framework for the protectiveness determination that explains the conclusions of the review.

6.1 QUESTION A

Is the remedy functioning as intended by the decision documents? Uncertain.

EPA's guidance document for five-year reviews identifies several areas that need to be considered in evaluating whether the remedy selected in the DD is functioning as designed (EPA 2001). Areas of consideration include:

- Remedial Action Performance — Is the remedy operating as designed?
- System Operation and Maintenance (O&M) — Will the system and current O&M activities maintain the effectiveness of the response actions?
- Cost of O&M — Are there large variances between current annual costs and original cost estimates that might indicate potential remedy problems?
- Implementation of Institutional Controls and Other Measures — Are these elements functioning as planned?
- Monitoring — Does the current monitoring provide adequate information to assess the protectiveness and effectiveness of the remedy implemented?
- Optimization Opportunities — Are there any areas for improvement?
- Early Indications of Potential Issues — Are there problems that could indicate that the remedy may not be protective or suggest protectiveness is at risk unless changes are made?

6.1.1 Remedial Action Performance

A review of documents, site inspections, and interviews with personnel knowledgeable about the sites indicates that remedial actions as outlined in the DDs have been implemented. The Navy conducted limited ground surface regrading in 2007 and reseeding in 2008 at each of the landfills, which was intended to improve surface drainage and mitigate the potential for surface water ponding (BAI 2008 and 2009). The Navy has conducted post-maintenance monitoring and inspections of the landfill covers in conjunction with groundwater monitoring events (BAI 2008, 2009, and 2010). The Navy collected and analyzed groundwater samples from the sites in 2007, 2008, and 2010 to monitor the potential for off-site migration of contaminants (BAI 2008, 2009, and 2010). Finally, ICs previously established in the NAS Fallon Overview Plan were selected to restrict development of the landfills because of their IR status (Navy 2003a). Even though remedial actions have been implemented at the sites, an RD document was not developed to identify specific remedial implementation actions. Therefore it is uncertain if the remedy is performing as intended by the DDs. Performance of the remedy is discussed further in the following sections.

6.1.2 System Operations and O&M

There are no continuous operating systems associated with Sites 20, 21, and 22 and no regular O&M activities. Past O&M included one-time regrading of high and low areas on the landfill surfaces so that ponding was minimized and surface drainage was improved, followed by reseeding regraded areas with native vegetation (see Section 4.2.3) (BAI 2008). Additionally, the *Limited Action* remedy calls for 3 years of landfill maintenance (URS 2004d, 2004e, and 2004f). The following issues have been identified regarding maintenance of the landfills:

- An RD document to describe specific actions to maintain the landfills was not developed after the DDs were signed. Consequently, there is no written plan for landfill maintenance.
- Additional maintenance may be required to ensure vegetation growth in the areas that were regraded and reseeded. These areas may therefore require more than the 3 years of maintenance that was specified in the DDs.
- The C&D stockpile at Site 22 (see Section 5.5.2) presents a potential hazard to the protectiveness of the landfill cover because its presence is a physical barrier to maintaining the landfill cover and may present an increased erosion hazard by channeling runoff. Furthermore, the exact composition of the C&D stockpile is unknown, including the constituents of the individual materials located within the C&D stockpile; therefore, effects of potential leaching and erosion of materials from the C&D stockpile to the landfill surface are unknown.
- The effectiveness of containment cannot be evaluated solely on the presence of infrequent detections of low concentrations of contaminants in groundwater. The landfill covers are integral components in containing and preventing potential

exposure to landfill wastes and in reducing leaching of precipitation through the landfill into groundwater. The thicknesses of the landfill covers are unknown. Therefore, whether the covers are adequate to protect human and ecological receptors from coming into contact with landfill wastes is unknown, and whether the covers are adequate to reduce infiltration is unknown.

- The presence of miscellaneous debris on the landfill surfaces calls into question whether clean fill was used to construct the landfill covers.

An RD document that will address landfill maintenance is planned for 2011. The RD should include the following components:

- Description of specific actions to inspect and maintain the landfills.
- Measures for maintaining the reseeded areas to ensure that vegetation establishes itself as intended by the DDs.

Additional characterization should be conducted at the landfills and include the following:

- Evaluating whether the C&D stockpile presents an increased erosion hazard at Site 22.
- Surface soil sampling in the vicinity of the C&D stockpile at Site 22 to determine if hazardous chemicals have leached or eroded from the C&D stockpile to the landfill surface.
- Measuring the thickness of the landfill covers at all three sites.
- Surface soil sampling to determine the chemical composition of the landfill covers at all three sites.

6.1.3 Costs of O&M

O&M costs were not reviewed as part of the five-year review because currently no annual costs are associated with maintaining the landfills.

6.1.4 Institutional Controls

ICs implemented in the NAS Fallon Overview Plan categorize the sites as constrained to development because of their IR status and because they are potentially contaminated. This categorization currently prevents human exposure to landfill materials. The overview plan states that the sites may be developed only after they have undergone extensive study by the Environmental Division at NAS Fallon and been mitigated. Compliance with all environmental

regulations is also required. Furthermore, access to the sites is currently restricted because of their proximity to active runways.

Existing ICs in the NAS Fallon overview plan do not adequately ensure maintenance of the landfill cover. Even though measures are currently in place to prevent development and access, ICs should be expanded so that they require inspections and maintenance of the landfill cover so that the landfill covers may prevent exposure to waste and prevent leaching of the waste into groundwater in the future. A formal RD document that describes implementation actions related to specific roles and responsibilities associated with implementing and maintaining ICs is planned for 2011.

6.1.5 Monitoring Activities

Groundwater monitoring during 2007, 2008, and 2010 detected small amounts of contaminants in some of the perimeter monitoring wells at the landfills (BAI 2008 and 2009). These detections are discussed in detail in Section 4.2.2. Sites with samples that exceeded applicable screening levels are discussed below.

In 2008, TCE was detected in one well associated with Site 20 at a concentration exceeding the MCL. TCE was detected at 6.1 µg/L, which is slightly higher than the MCL of 5 µg/L. TCE had not been detected in any of the previous groundwater or soil samples from Site 20 (BAI 2009). TCE was not detected above the MCL in any other samples from Site 20 or any of the samples from Site 21 or 22 since the DDs were signed.

In 2007, bis(2-ethylhexyl)phthalate was detected in Site 21 well MW-94 at a concentration of 38 µg/L, exceeding the EPA Region 9 tap water RSL of 4.8 µg/L (EPA 2008). Historically, bis(2-ethylhexyl)phthalate had never been detected at that well. It was not detected in any of the other wells in 2007 or at any of the wells at any of the three sites in 2008 (BAI 2008 and 2009). In 2010, bis(2-ethylhexyl)phthalate was detected in Site 20 well BA20-MW03 at a laboratory estimated concentration of 5 µg/L, which was slightly above the 4.8 µg/L EPA Region 9 RSL for tapwater but less than the MCL of 6 µg/L. Bis(2-ethylhexyl)phthalate was not detected in any other wells at Sites 20, 21, and 22 in 2010 (BAI 2010).

In 2008, naphthalene was detected in two wells associated with Site 21 (1.8 µg/L and 0.41 µg/L) at concentrations exceeding the EPA Region 9 tap water RSL (0.14 µg/L). Naphthalene was not detected in samples collected from the same wells in 2007, nor from any other wells at all three sites in 2007, 2008, or 2010.

TPH-DRO concentrations exceeded the NDEP guidance level for TPH in groundwater at one well at Site 22 in 2007, one well each at Sites 21 and 22 in 2008, and one well at Site 21 in 2010. Through 2007, the release was attributed to a jet fuel spill that was reported to NDEP BOCA in 1993. The spill consisted of dumping off-specification jet fuel in the vicinity of the northeast runway until 1975. Based on analytical data available at the time, NDEP issued a letter in June

2000 stating that no further remediation was required at the site. A copy of this letter is included in [Appendix A](#).

However, TPH-DRO contamination contour maps generated from sampling in 2008 and 2010 indicate that the primary source of TPH-DRO in this area is located off site and that TPH-DRO contamination is migrating toward Sites 21 and 22 (see [Figure 11](#)) (BAI 2009). The increasing TPH-DRO concentrations and migrating plume prompted the Navy to open it as a new petroleum site in 2010. This release will be addressed under the petroleum program. Since the release originates from an off-site source, the performance of the remedies for Sites 21 and 22 has not been compromised.

The following issues have been identified regarding monitoring at Sites 20, 21, and 22:

- An RD document to describe specific actions related to groundwater monitoring was not developed after the DDs were signed. Consequently, there is no written plan for groundwater monitoring.
- Point of compliance (POC) wells were not established after the DDs were signed. POC wells are required to satisfy ARARs and to determine whether groundwater is being contaminated by the landfills.

An RD document that will address groundwater monitoring is planned for 2011. The RD should include the following components:

- Description of specific actions for implementing and maintaining a groundwater monitoring program and establishing POC wells to satisfy ARARs appropriate to the conditions at the sites.

6.1.6 Optimization

The Navy is currently conducting groundwater monitoring at Sites 20, 21, and 22 in accordance with the *Limited Action* remedy. Opportunities to improve the performance of sampling and monitoring include writing an RD document that addresses implementing and maintaining a groundwater monitoring program and establishing a POC. These issues are discussed in [Section 6.1.5](#).

No additional opportunities for optimization have been identified.

6.1.7 Early Indicators of Potential Problems

Early indicators of potential problems at Sites 20, 21, and 22 that could make the *Limited Action* remedy not protective or suggest protectiveness is at risk unless changes are made include:

- Insufficient data on potential impacts of the C&D stockpile at Site 22 and the uncertainty associated with the thickness and chemical composition of the landfill covers at all three sites; and lack of vegetation growth in reseeded areas at all three sites (see [Section 6.1.2](#)).
- ICs that restrict only the use of the sites and that do not require inspection and maintenance of the landfill cover (see [Section 6.1.4](#)).
- Contaminant detections at all three sites and lack of an RD for groundwater monitoring with which to evaluate the detections (see [Section 6.1.5](#)).

6.2 QUESTION B

Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid? Uncertain

EPA’s guidance document for five-year reviews identifies several areas that need to be considered in evaluating whether the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection remain valid ([EPA 2001](#)). Areas of consideration include changes in standards and “to be considered (TBC),” changes in exposure pathways, changes in toxicity and other contaminant characteristics, changes in risk assessment methods, and expected progress toward meeting RAOs.

6.2.1 Changes in Standards and TBCs

The DDs did not consider Sites 20, 21, and 22 to be CERCLA sites and therefore only identified requirements that were determined to be potentially applicable to the sites or remedial actions being conducted at the sites. The DDs did not identify “relevant and appropriate” requirements, and did not fully consider federal applicable or relevant and appropriate requirements (ARARs). Requirements identified as potentially legally applicable in the DDs were researched, and there have been no modifications or revisions to these requirements that appear to call into question the protectiveness of the remedies. However, a formal analysis of ARARs normally associated with a landfill was not conducted under CERCLA. Protectiveness cannot be evaluated until the ARARs analysis is complete. The Navy will evaluate ARARs to determine if there are any that should be considered.

6.2.2 Changes in Exposure Pathways

Land use at NAS Fallon and at Landfill Sites 20, 21, and 22 has not changed since the DDs were signed, nor is it expected to change in the near future. No changes to physical site conditions that could affect the protectiveness of the remedies have occurred.

No new human health or ecological routes of exposure that could affect the protectiveness of the remedies have been identified. No changes to site conditions that could result in increased

exposure have been identified. However, even though no actual changes in exposure pathways have been identified, there have been changes in the understanding of the exposure pathways in that the landfill covers were not properly characterized in the past. It appears that direct contact with potentially contaminated surface soil was not evaluated for either human or ecological receptors. Additional site characterization of surface soil and evaluation of the soil cover thickness will indicate whether the remedy is adequately protective for the direct soil exposure pathway.

No new contaminants or contaminant sources originating from the sites have been identified or detected during monitoring. No toxic byproducts have been generated as a result of remedy implementation.

6.2.3 Changes in Toxicity and Other Contaminant Characteristics

The remedies selected for Sites 20, 21, and 22 did not involve establishing site-specific, risk-based cleanup levels; therefore, toxicity and contaminant characteristics were not a factor.

6.2.4 Changes in Risk Assessment Methods

A baseline risk assessment was prepared for several sites at NAS Fallon, including Sites 20, 21, and 22 ([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. Based on a qualitative review of analytical results available for the sites at that time, the baseline risk assessment concluded that concentrations of COCs in soil and groundwater at Sites 20, 21, and 22 did not warrant quantitative human health or ecological risk assessments ([ASGI 1994](#)). Results of soil and groundwater sampling conducted after the RI until the time of the DDs ([URS 2004d, 2004e, and 2004f](#)) and of groundwater sampling conducted in 2007, 2008, and 2010 ([BAI 2008, 2009, and 2010](#)) further support the conclusion of the baseline risk assessment. However, the surface soil exposure pathway has not been evaluated, as discussed in [Section 6.2.2](#).

6.2.5 Expected Progress toward Meeting RAOs

The RAOs as stated in the DDs are to:

- Prevent potential future risks to human health and the environment.

To meet this RAO, the Navy adopted ICs in the NAS Fallon Overview Plan to restrict development at the landfills; however, ICs that require landfill inspection and maintenance have not been included in the Overview Plan and are necessary to prevent future risks.

Even though no actual changes to exposure pathways have been identified, there have been changes in understanding exposure pathways because the landfill covers were

not properly characterized in the past. It appears that direct contact with contaminated surface soil was not evaluated for either human or ecological receptors. Additionally, risk to ecological receptors coming in contact with potential contaminants by burrowing into the landfill contents was not evaluated. Therefore, whether future risks are being prevented cannot be assessed.

- Mitigate the potential for landfilled material to leach to groundwater.

To meet this RAO, the Navy conducted limited regrading to level the landfill surfaces and seeded regraded areas with native vegetation. These actions were intended to reduce the potential impact of ponding water leaching through the landfill cover and contents, which could lead to contaminant transport via groundwater flow. The Navy also installed perimeter groundwater monitoring wells at all three sites and conducted groundwater monitoring to determine if contaminants originating from the landfills have contaminated groundwater and migrated off site.

A determination on whether RAOs are being met cannot be made at this time. Additional characterization as discussed in [Section 6.1.2](#) and evaluation of data from POC wells as discussed in [Section 6.1.5](#) will determine whether the RAOs are currently being met. The Navy has planned a five-year review addendum after the additional characterization has been conducted and the RD document has been developed to determine whether the remedy is protective of human and ecological receptors. A formal RD document that describes specific actions for implementing and maintaining groundwater monitoring, ICs, and landfill maintenance is planned in 2011 to ensure that RAOs are met in the future.

6.3 QUESTION C

Has any other information come to light that could call into question the protectiveness of the remedy? No.

There have been no natural disasters that have impaired the effectiveness of the remedies.

No information other than that presented in Sections 6.1 and 6.2 has been identified that suggests that the remedies for Sites 20, 21, and 22 as defined in the DDs ([URS 2004d](#), [2004e](#), and [2004f](#)) may not be protective of human health and the environment.

7.0 ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS

Table 3 presents issues, recommendations, and follow-up actions for Landfill Sites 20, 21, and 22 in tabular form.

TABLE 3 ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS
 Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon Nevada

Site	Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Completion Milestone Date	Affects Protectiveness (Yes / No / Deferred)	
						Current	Future
All	Existing institutional controls (IC) in the Naval Air Station (NAS) Fallon Overview Plan are not adequate and do not provide comprehensive landfill closure protection because they only limit development of the sites. The ICs do not require appropriate landfill inspection and maintenance.	A remedial design (RD) document that describes specific roles and responsibilities related to implementing and maintaining ICs is planned for 2011. Continue to prepare the RD document as planned.	Navy	Nevada Division of Environmental Protection (NDEP)	2011	Deferred	Deferred
All	An RD document addressing landfill maintenance and groundwater monitoring was not developed after the decision documents (DD) were signed.	An RD document that describes specific actions to inspect and maintain the landfill and to monitor the groundwater, including establishment of a POC, is planned in 2011. Continue to prepare the RD document as planned.	Navy	NDEP	2011	Deferred	Deferred
All	Point of compliance (POC) wells for determining if there has been a statistically significant release from the landfills were not established after the DDs were signed.						
All	A formal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) applicable or relevant and appropriate requirements (ARAR) analysis was not conducted.	The Navy will evaluate ARARs to determine if there are any that should be considered.	Navy	NDEP	2013	Deferred	Deferred
22	The construction and demolition (C&D) stockpile presents a potential hazard to the protectiveness of the landfill cover	Conduct additional characterization to determine if the C&D stockpile presents an increased erosion hazard at	Navy	NDEP	2013	Deferred	Deferred

TABLE 3 ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS (CONTINUED)
 Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon Nevada

Site	Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Completion Milestone Date	Affects Protectiveness (Yes / No / Deferred)	
						Current	Future
	at Landfill Site 22 because its presence is a physical barrier to maintaining the landfill cover and may present an increased erosion hazard by channeling runoff. Furthermore, the exact composition of the C&D stockpile is unknown; therefore, effects of potential leaching and erosion of materials from the C&D stockpile to the landfill surface are unknown.	Landfill Site 22. Conduct surface soil sampling in the vicinity of the C&D stockpile to determine if hazardous chemicals have leached or eroded from the C&D stockpile to the landfill cover.					
All	The thicknesses of the landfill covers are unknown. Therefore, whether the covers are adequate to prevent exposure to landfill wastes and reduce infiltration is unknown.	Conduct additional characterization to measure the thickness of the landfill covers.	Navy	NDEP	2013	Deferred	Deferred
All	The presence of debris observed on the landfill surfaces calls into question whether clean fill was used to construct the landfill covers.	Conduct additional characterization to determine the chemical composition of the landfill covers.	Navy	NDEP	2013	Deferred	Deferred
All	The revegetation efforts were not successful. These areas may therefore require more than the 3 years of maintenance that was specified in the DDs.	Conduct additional maintenance to promote vegetation growth in reseeded areas.	Navy	NDEP	2011	Deferred	Deferred
All	Groundwater monitoring wells that were not properly secured were observed during the site	The integrity of the unsecured wells should be evaluated to confirm that illegal disposal into	Navy	NDEP	2011	Deferred	Deferred

TABLE 3 ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS (CONTINUED)
 Five-Year Review, Landfill Sites 20, 21, and 22, NAS Fallon Nevada

Site	Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Completion Milestone Date	Affects Protectiveness (Yes / No / Deferred)	
						Current	Future
	inspection. Unsecured groundwater monitoring wells present an unsatisfactory condition and are contrary to well head protection standards.	the wells has not occurred. Groundwater monitoring wells that are not secured should be provided with adequate bolting or locking mechanisms to prevent unauthorized access, and keys should be maintained at the NAS Fallon Environmental Division's offices.					

Notes:

- ARAR Applicable or relevant and appropriate requirement
- C&D Construction and demolition
- CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
- DD Decision document
- IC Institutional control
- IR Installation restoration
- NAS Naval air station
- Navy Department of the Navy
- NDEP Nevada Division of Environmental Protection
- POC Point of compliance
- RD Remedial Design

8.0 PROTECTIVENESS STATEMENT

The results of this five-year review indicate that a protectiveness determination should be deferred. A protectiveness determination of the remedy at Landfill Sites 20, 21, and 22 cannot be made until further information is obtained. Further information will be obtained by taking the following actions:

- The Navy will evaluate ARARs to determine if any should be considered.
- The Navy will conduct additional characterization at the landfills to include:
 - Evaluating whether the C&D stockpile presents an increased erosion hazard at Site 22.
 - Surface soil sampling in the vicinity of the C&D stockpile at Site 22 to evaluate whether hazardous chemicals have leached or eroded from the C&D stockpile to the landfill surface.
 - Surface soil sampling to assess the chemical composition of the landfill covers at all three sites so that an evaluation can be made as to whether clean soil was used to construct the landfill covers.
 - Measuring the thickness of the landfill covers at all three sites.
- As a component of the RD document that is planned in 2011, the Navy will establish POC wells. The Navy will analyze results to evaluate whether there has been a statistically significant release from the landfills.

It is expected that these actions will take approximately 2 years to complete, at which time a protectiveness determination will be made.

9.0 NEXT REVIEW

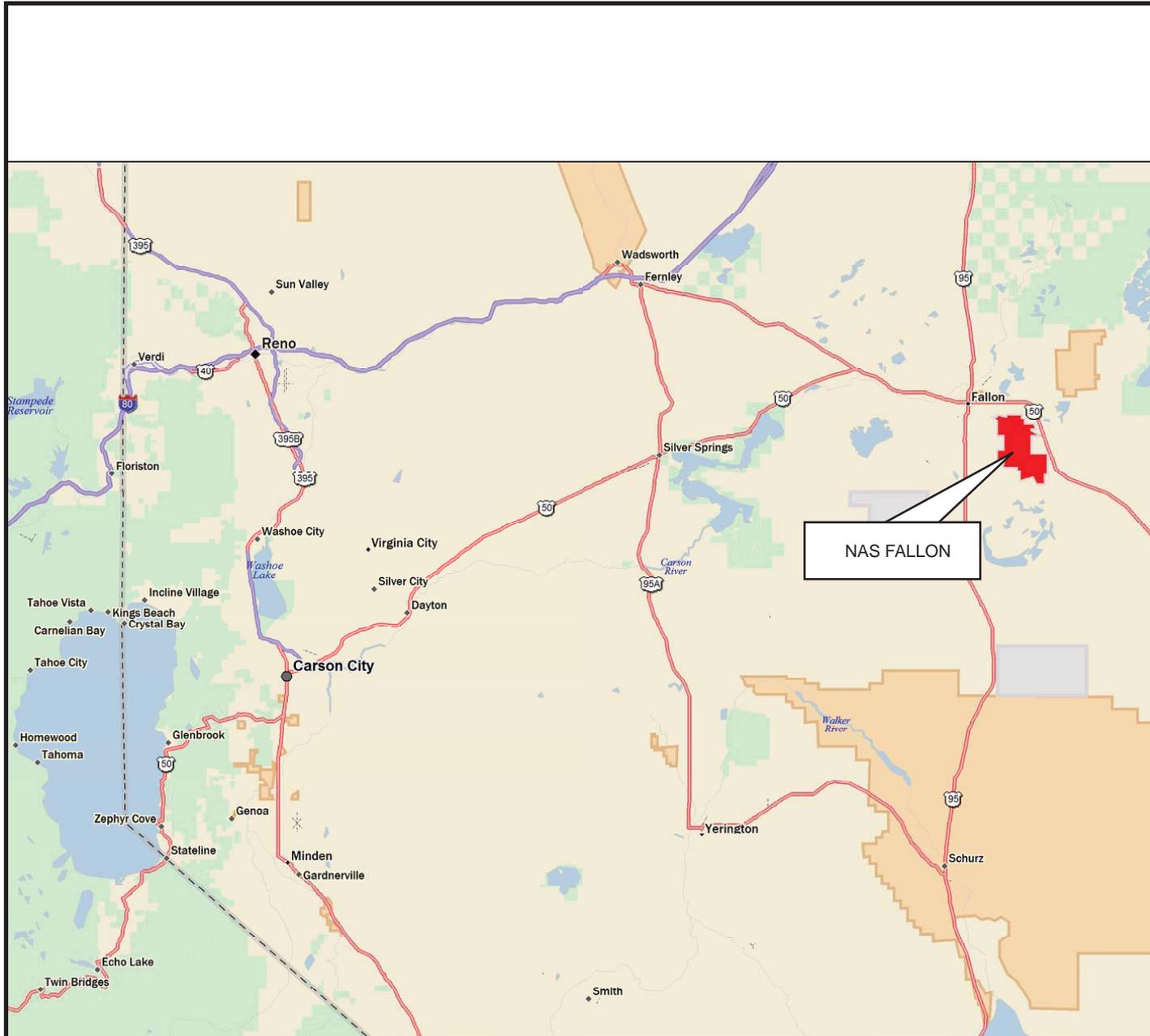
The next five-year review for Landfill Sites 20, 21, and 22 at NAS Fallon will be due five years from the date this document is signed. Consecutive five-year reviews will be required for these sites as long as contamination remains that does not allow for unlimited use and unrestricted exposure.

10.0 REFERENCES

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FIGURES



NAS FALLON

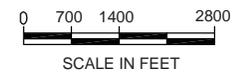
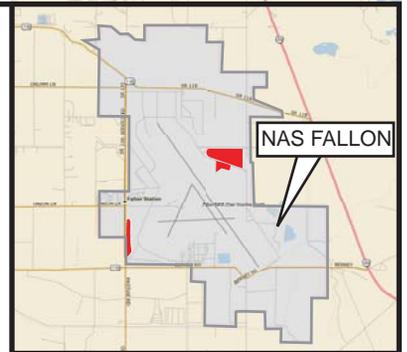


Scale 1 : 600,000
 0 3 6 9 12 15 mi
 1" = 9.47 mi



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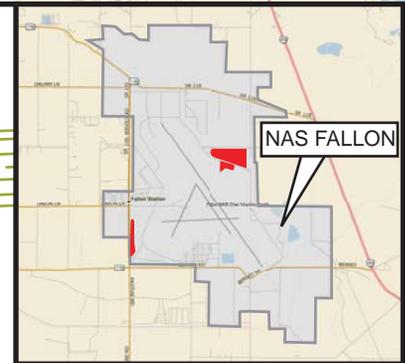
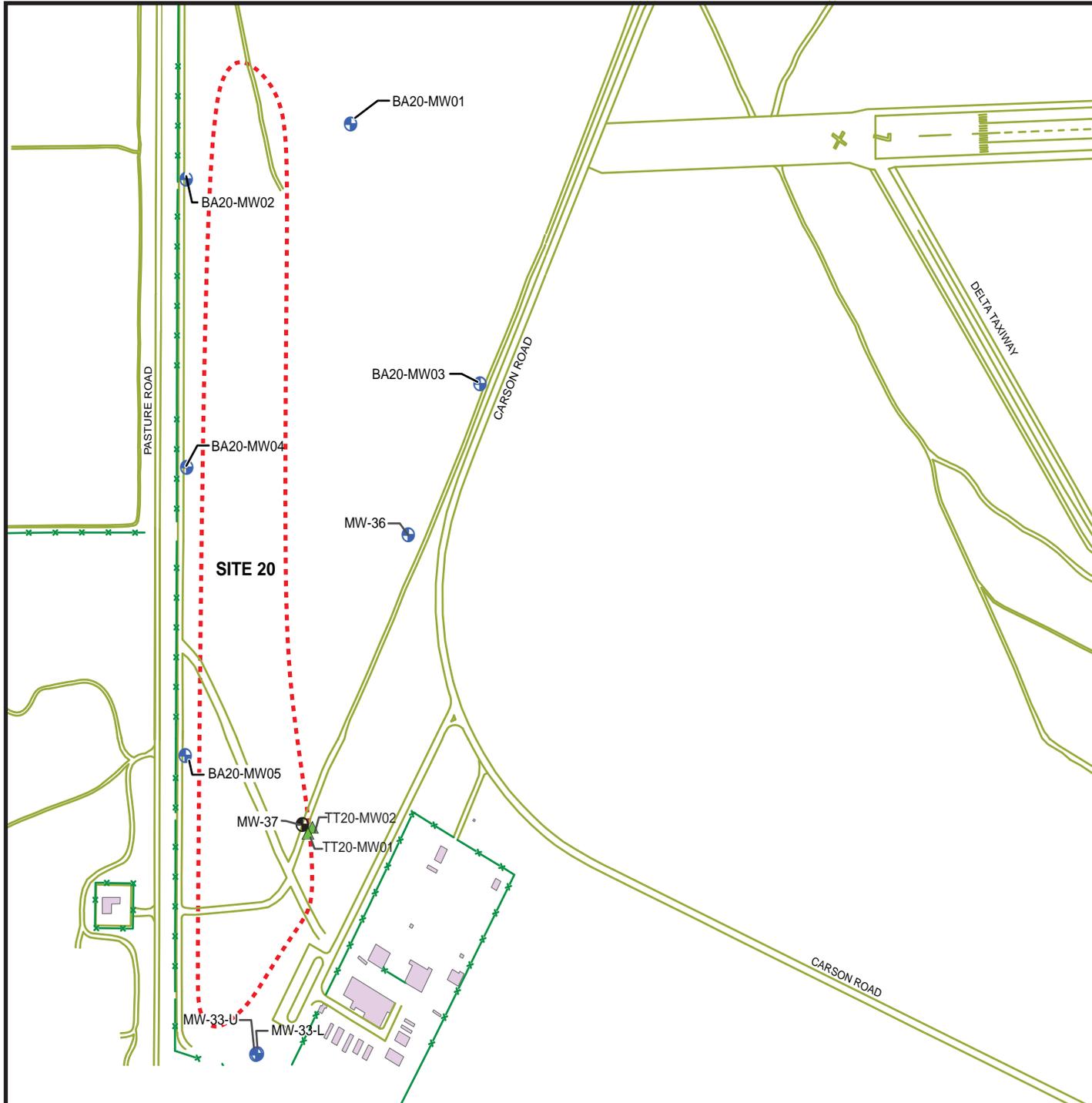
Figure 1
Site Location Map
 Five-Year Review, Sites 20, 21 and 22



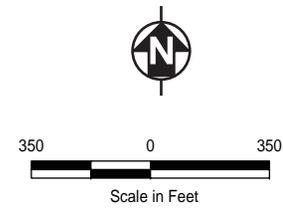
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Figure 2
NAS Fallon Facility Map

Five-Year Review, Sites 20, 21 and 22

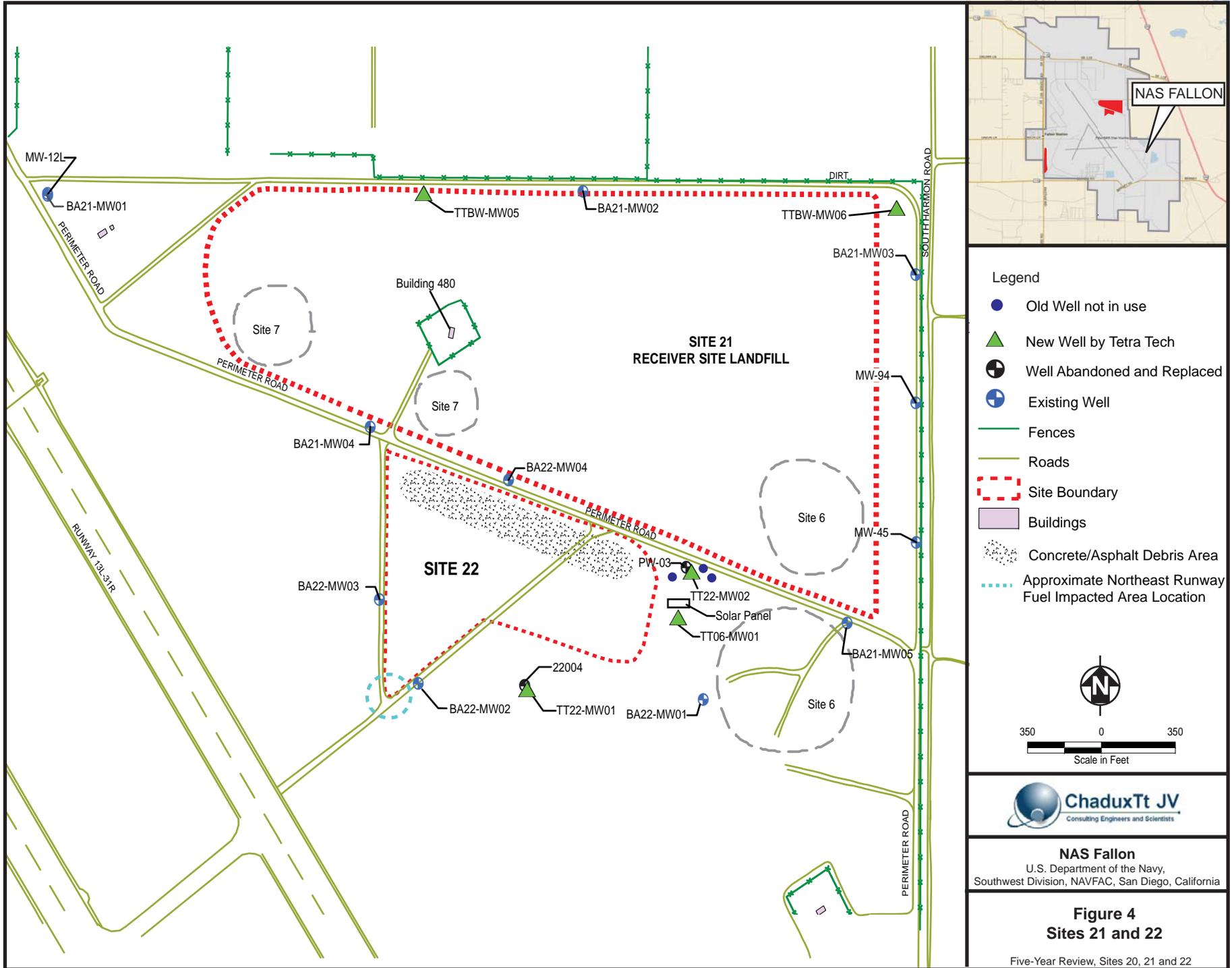


- Legend**
- New Well by Tetra Tech
 - Well Abandoned and Replaced
 - Existing Well
 - Fences
 - Roads
 - Site Boundary
 - Buildings



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Figure 3
Site 20
 Five-Year Review, Sites 20, 21 and 22



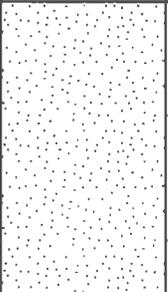
Source: BAI 2009



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Figure 4
Sites 21 and 22

Five-Year Review, Sites 20, 21 and 22

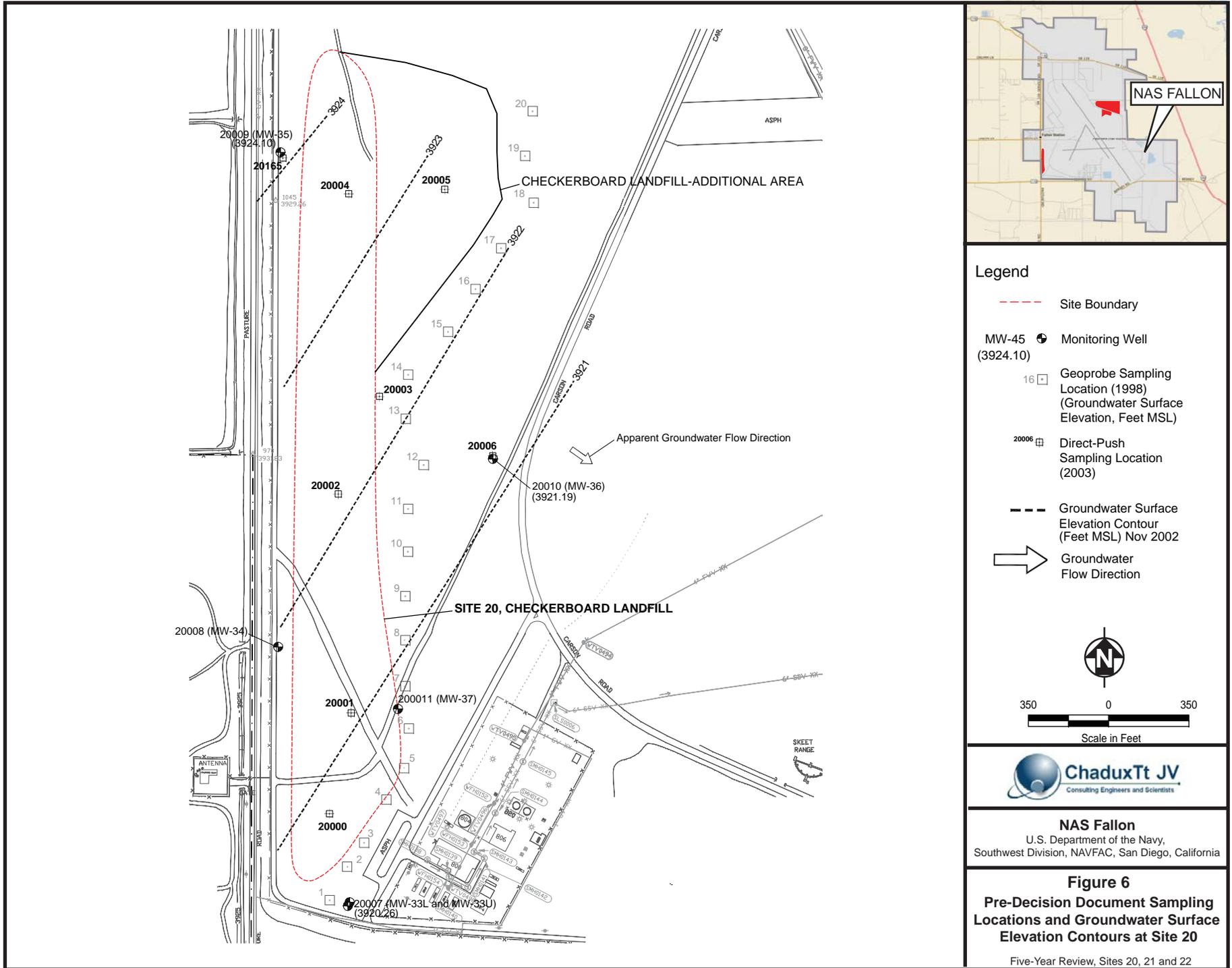
Period	Epoch	Stratigraphic Unit	Generalized Lithology	Thickness (feet)	Generalized Description
Quaternary	Recent	Fallon Formation		4 to 20	Eolian sand
					Nearshore deposits, fine-grained sand, silty sand
					Channel sand and gravel from ancient Carson River
					Sand, silt, and clay of deltaic and shallow-lake deposits
Pleistocene	Lahontan Valley Group	Turupaha Formation		0 to 2	Eolian sand
		Sehoo Formation		20 to 35	Deep-lake clay
		Wyemaha Formation		>50	Shallow-lake sand

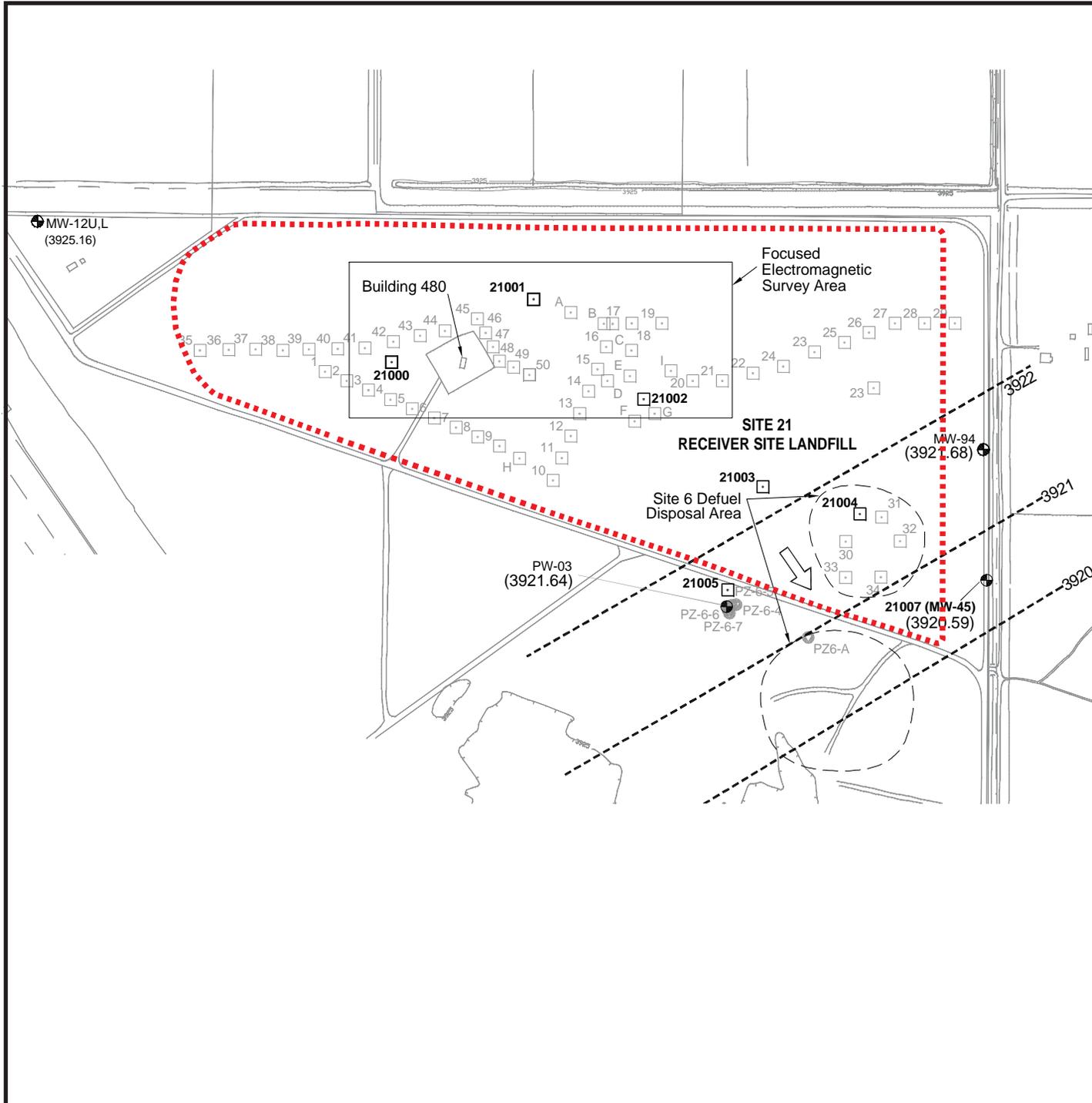


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Figure 5
Generalized Stratigraphy
of NAS Fallon

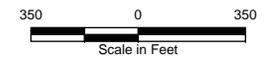
Five-Year Review, Sites 20, 21 and 22





Legend

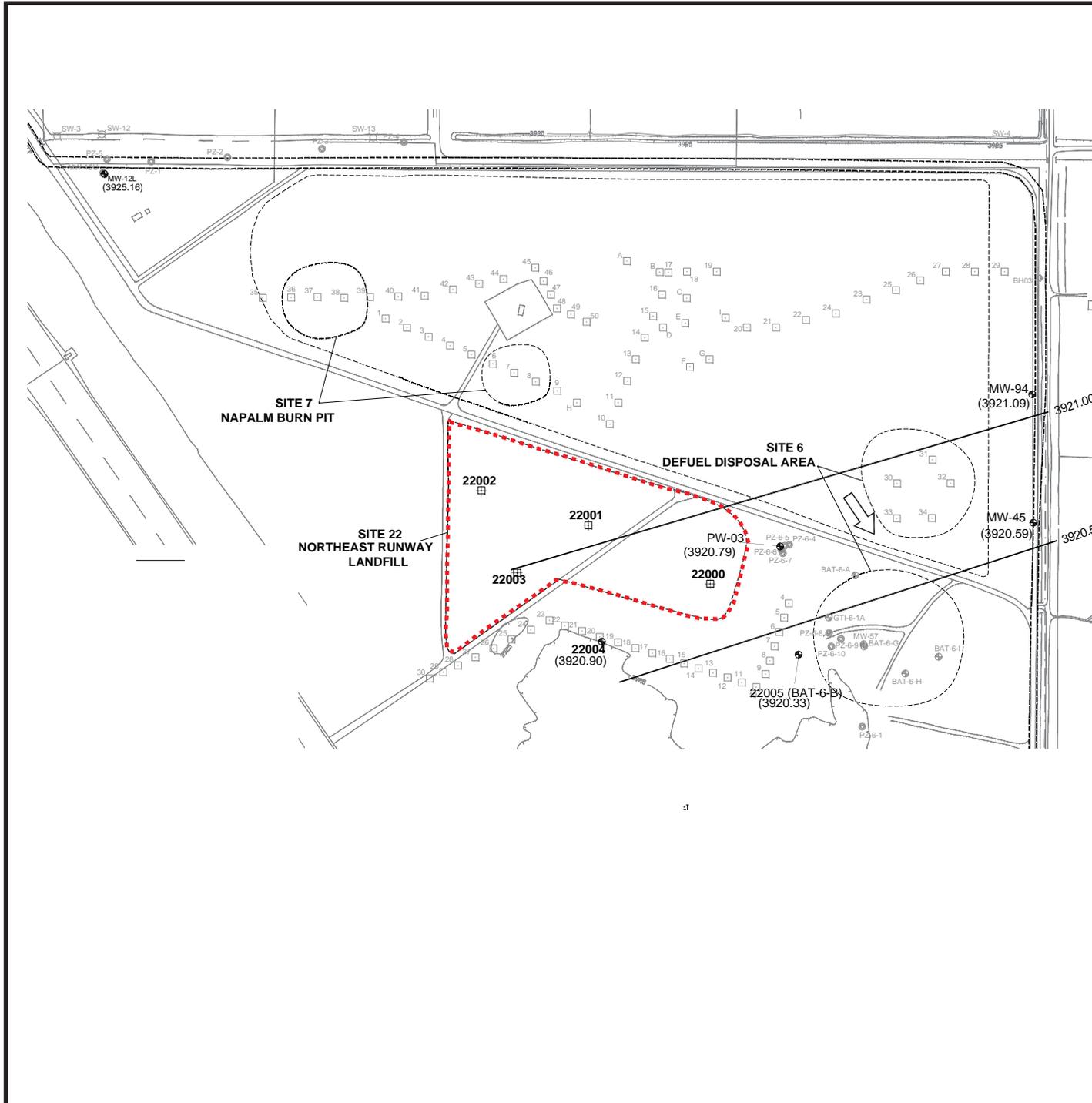
- - - - - Site Boundary
- MW-45** **Monitoring Well**
(3920.59) (Groundwater Surface Elevation, Feet MSL)
- PZ6-6** **Piezometer**
- 35** **Direct-Push Sampling Location**
(1998, 1999)
- 21000** **Direct-Push Sampling Locations** (2003)
- - - - - **Groundwater Surface Elevation Contour**
(Feet MSL) March 2003
- Groundwater Flow Direction**



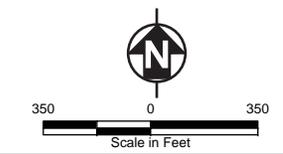
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Figure 7
Pre-Decision Document Sampling Locations and Groundwater Surface Elevation Contours at Site 21

Five-Year Review, Sites 20, 21 and 22



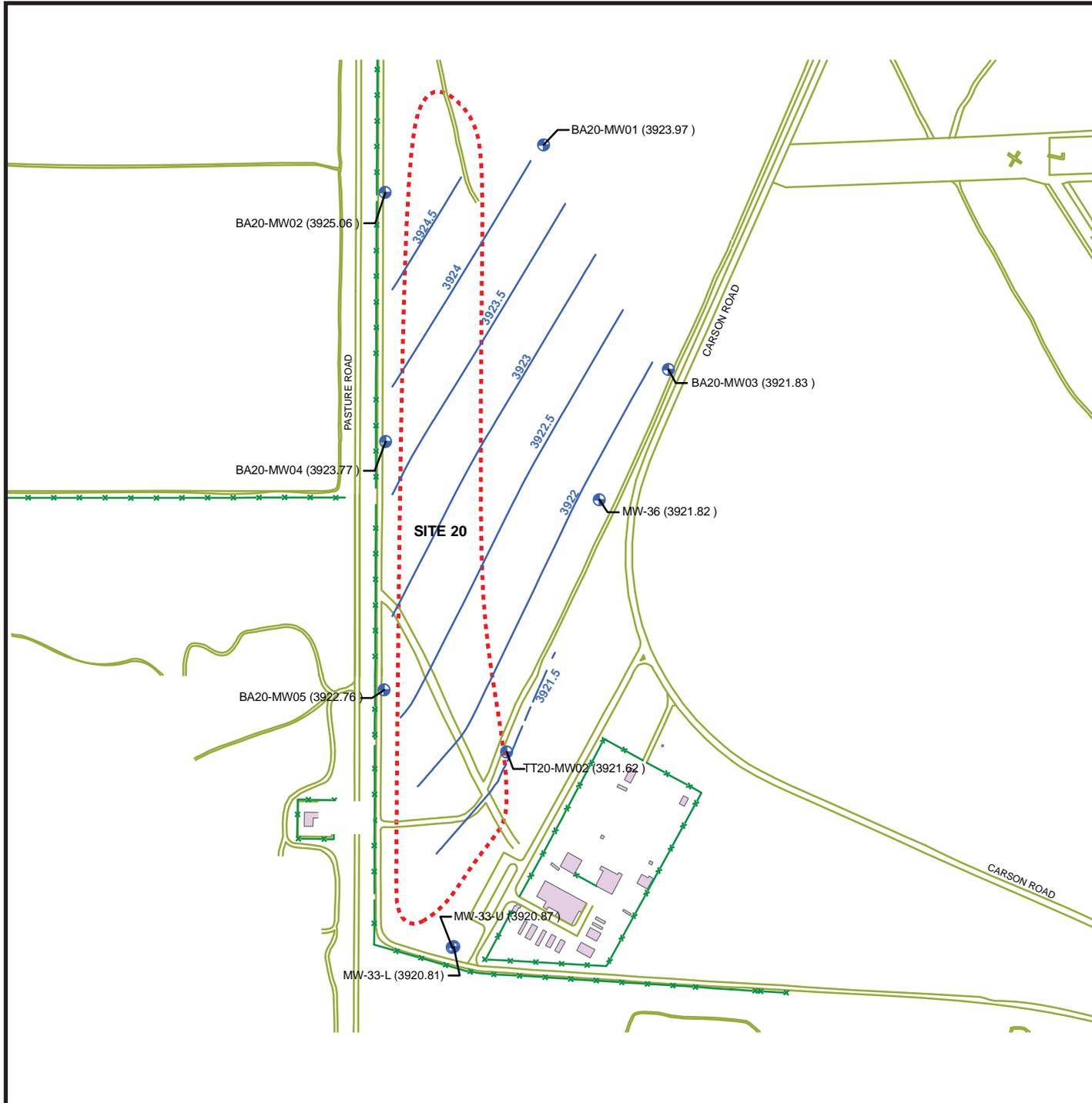
- Legend**
- - - - - Site Boundary
 - MW-45 Monitoring Well (Groundwater Surface Elevation, Feet MSL)
 - 3920.59 Piezometer
 - 35 Geoprobe Sampling Location (1998)
 - 22000 Direct-Push Sampling Locations (2003)
 - Groundwater Surface Elevation Contour (Feet MSL) March 2003
 - Groundwater Flow Direction



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Figure 8
Pre-Decision Document Sampling Locations and Groundwater Surface Elevation Contours at Site 22

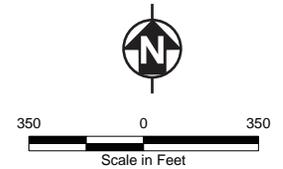
Five-Year Review, Sites 20, 21 and 22



- Legend
- Well Sampled
 - Groundwater Gradient
 - Fences
 - Roads
 - Site Boundary
 - Buildings

Notes:

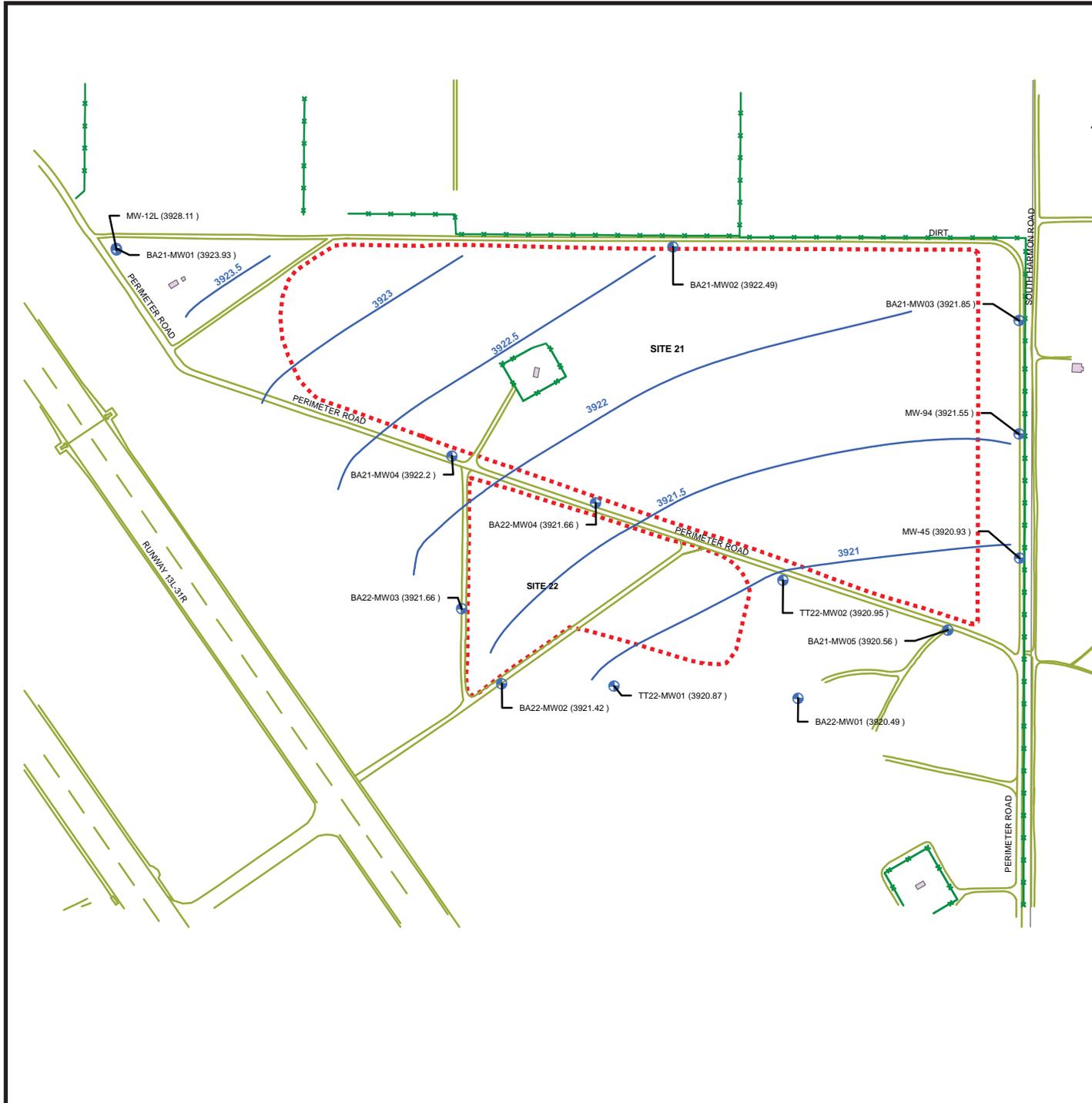
BA20-MW04 Well ID (3924.34) Groundwater elevation (feet+MSL)



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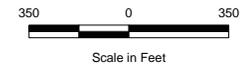
Figure 9
Groundwater Gradient Map
Site 20

Five-Year Review, Sites 20, 21 and 22



- Legend**
- Well Sampled
 - Groundwater Gradient
 - Fences
 - Roads
 - Site Boundary
 - Buildings

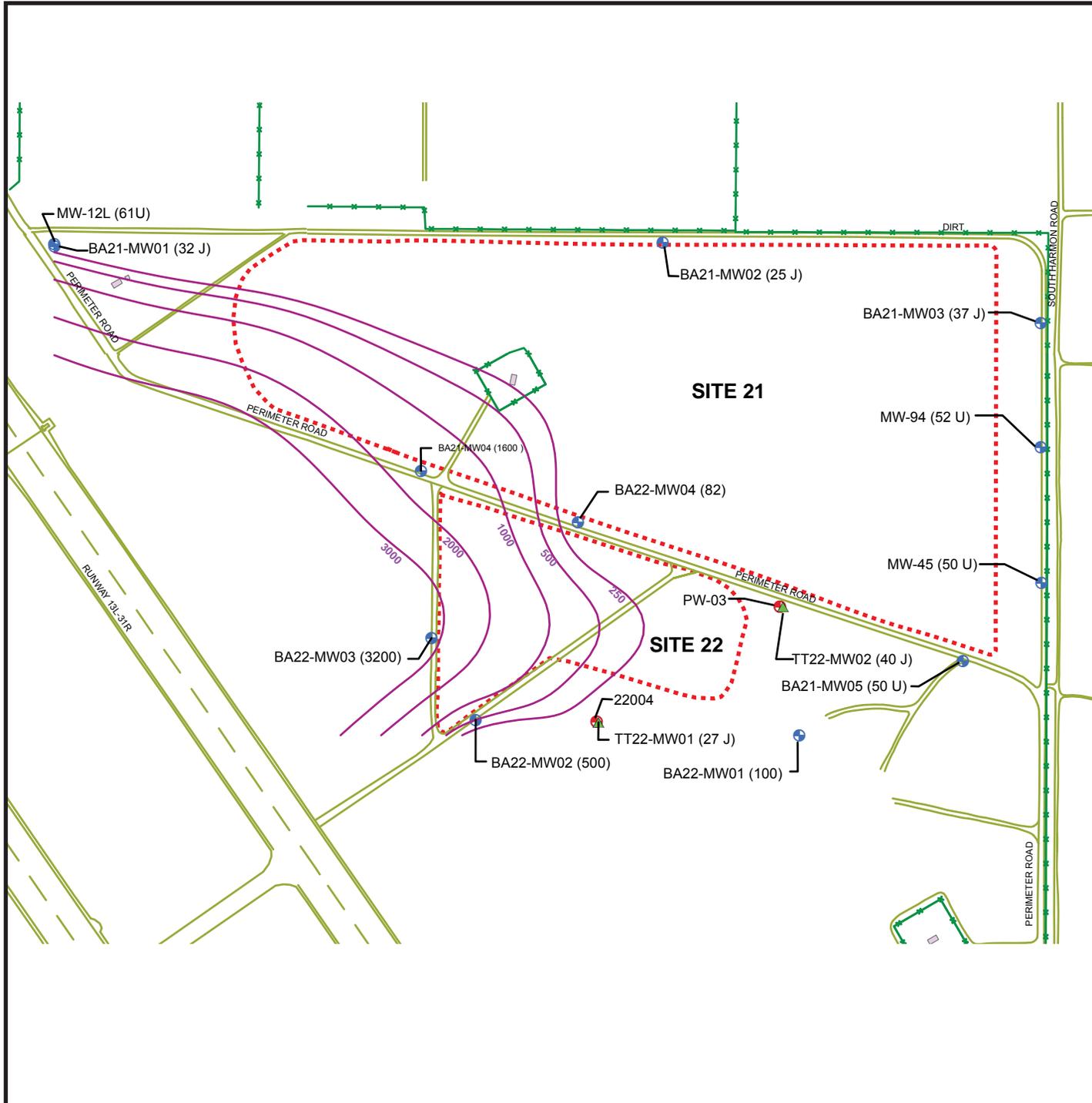
Notes:
 BA22-MW04 Well ID
 (3921.24) Groundwater elevation (feet+MSL)



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Figure 10
Groundwater Gradient Map
Sites 21 and 22

Five-Year Review, Sites 20, 21 and 22

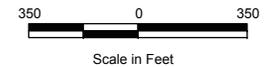


Legend

- ▲ New Well by Tetra Tech
- ⊕ Well Abandoned and Replaced
- ⊕ Existing Well
- TPH-DRO Concentration Contour
- Fences
- Roads
- Site Boundary
- Buildings

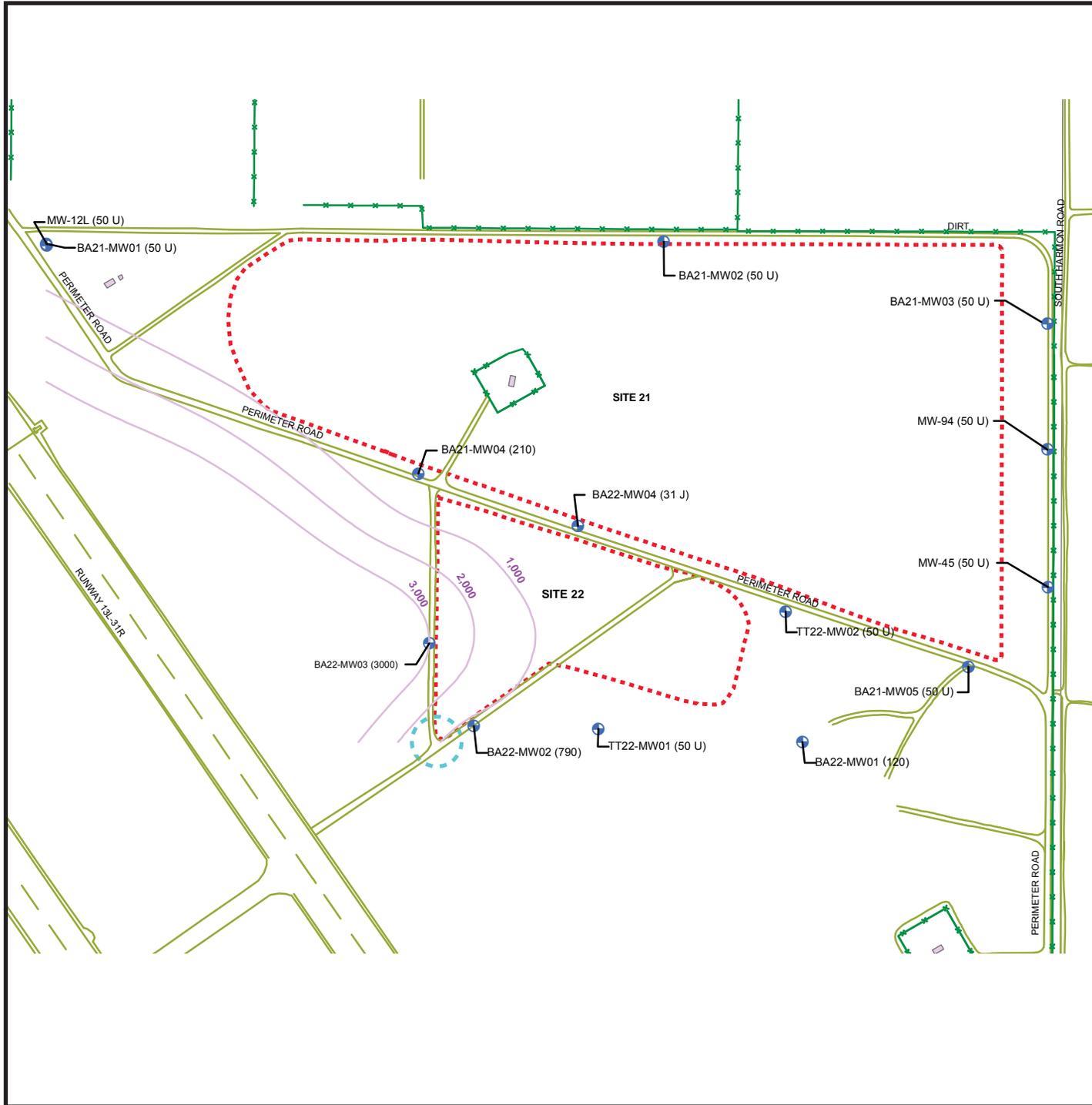
Notes:

- | | |
|-----------|-------------------------------|
| BA21-MW04 | Well ID |
| (1600) | TPH-DRO Concentration in µg/L |
| DRO | Diesel Range Organics |
| TPH | Total Petroleum Hydrocarbons |
| J | Estimated Value |
| U | Not detected |



NAS Fallon
 U.S. Department of the Navy,
 Southwest Division, NAVFAC, San Diego, California

Figure 11
2008 TPH-DRO Concentrations
in Groundwater Sites 21 and 22
 Five-Year Review, Sites 20, 21 and 22



- Well Sampled
- TPH-DRO Concentration Contour
- Fences
- Roads
- Site Boundary
- Buildings
- Approximate Northeast Runway Fuel Impacted Area Location

Notes:

BA21-MW04	Well ID
(1600)	TPH-DRO Concentration in µg/L
DRO	Diesel Range Organics
TPH	Total Petroleum Hydrocarbons
J	Estimated Value
U	Not detected



NAS Fallon
 U.S. Department of the Navy,
 Southwest Division, NAVFAC, San Diego, California

Figure 12
2010 TPH-DRO Concentrations
in Groundwater Sites 21 and 22
 Five-Year Review, Sites 20, 21 and 22

APPENDIX A – LETTERS



ALLEN BLAGG, Administrator

Telephone 687-6070

Telex 687-4675

Air Pollution
Water Pollution Control

Facsimile 687-5856

Mining Regulation and Reclamation
Facsimile 687-6250

Waste Management
Corrective Actions
Federal Facilities

Air Quality
Water Quality Planning
Facsimile 687-6396

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION

333 W. Nye Lane, Room 138
Carson City, Nevada 89706-0851

June 6, 2000

MR D S PURSEL
NAVAL AIR STATION FALLON
PUBLIC WORKS DEPARTMENT
ENVIRONMENTAL DIVISION-CODE 187GB
4755 PASTURE ROAD
FALLON NV 89496

NDEP Facility Id Number: E-001152-1
SUBJECT: NDEP requires no further remediation regarding historic
jet fuel release near northeast runway fuel impacted area

Dear Mr. Pursel:

The Nevada Division of Environmental Protection (NDEP) received and evaluated your 5/8/00 report and closure request for the above-referenced facility.

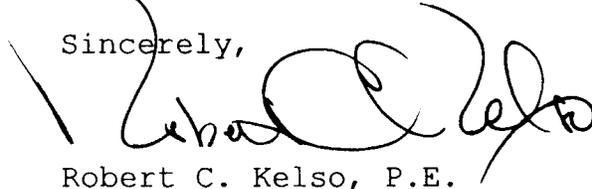
NDEP understands that the northeast runway fuel impacted area (NRFIA) was impacted by the process of dumping off-specification jet fuel (otherwise known as defuel) in the vicinity of the northeast runway landfill. FNAS reports state that this practice was discontinued in 1975. Sampling and delineation work have shown that TPH is above the State Action level in some soil locations and that other fuel components (BTEX) are below soil and water State Action levels and maximum contaminant levels in the groundwater. At some groundwater sampling locations TPH is present in low levels in the dissolved phase. Free product is not present.

NDEP has inspected the site, examined your TPH groundwater model studies, and evaluated the NAC 459.227 factors. NDEP concurs with your report and NDEP will require no further remediation regarding this incident.

Page 2
Mr. Pursel
June 6, 2000 letter

If you have any questions or require assistance, please call Mr. James Lukasko at (775) 687-4670, extension 3056.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert C. Kelso". The signature is fluid and cursive, with a large initial "R" and "K".

Robert C. Kelso, P.E.
Remediation Branch Supervisor
Bureau of Corrective Actions

cc: Mr. John Dirickson, Public Works Department, Naval Air Station
Fallon, 4755 Pasture Road, Fallon, NV 89496
Mr. Eric Noack, NDEP Bureau of Federal Facilities
Mr. James Lukasko

Handwritten: *Check*
To Compliance File
cc - Raj
Chuck



STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Kenny S. Guinn, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

January 26, 2006

Captain W.S. Ryder
Department of the Navy
Naval Air Station Fallon
4755 Pasture Rd
Fallon NV 89496-5000

Re: NASFC&D Stockpile

Dear Captain Ryder:

The Nevada Division of Environmental Protection (NDEP), Solid Waste Branch, has reviewed your letter of January 06, 2006 regarding the storage of C&D material for future use. The NDEP concurs with your plan to secure the area from future C&D stockpiling and to use the existing material in planned runway construction and repair projects. Concurrence with this plan is subject to the material being stored in such a way that it does not pose an environmental hazard or public nuisance. Solid Waste Branch staff may inspect the site to ensure compliance with solid waste regulations.

If you have any questions regarding this issue, please do not hesitate to contact me at 775-687-9472 or bmicklis@ndep.nv.gov.

Sincerely,

Bill Micklish
Staff Engineer II
Solid Waste Branch
Bureau of Waste Management

BM:ah

cc: Les Gould, Supervisor, Solid Waste Branch, Bureau of Waste Management

File: 000_bricklis_01262006_C2_LTR_Fallon NAS C&D.doc





DEPARTMENT OF THE NAVY
NAVAL AIR STATION FALLON
4755 PASTURE ROAD
FALLON, NV 89496-5000

File outgoing
Rej.
CNDK

5090
Ser N00F/0024
19 Jan 06

Mr. Les Gould
Division of Environmental Protection
Bureau of Solid Waste
901 South Steward St, Suite 4001
Carson City, Nevada 89701-5249

Dear Mr. Gould:

Subj: NAVAL AIR STATION FALLON CONSTRUCTION AND DEMOLITION
(C&D) STOCKPILE

As discussed in the phone call of 8 December 2005 between yourself, Eric Noack, Cecil Cook (our Solid Waste and Recycling Manager), and Chuck Deverin from our Environmental Office, we are providing background information on the construction and demolition (C&D) stockpile at Naval Air Station Fallon (NASF) and the steps being taken to remove/reuse the material.

The stockpile consists mostly of concrete rubble, with smaller amounts of asphalt, cinder blocks, wood and landscaping material (dirt, weeds and brush), and covers approximately 9 acres. A visual inspection by the Environmental Department determined that there are no visible environmental hazards associated with this material. The area is located on the undeveloped east side of the NASF main runway, with one private residence several hundred yards away. There has never been a complaint from the community on this stockpile. The area is barely visible from outside the security fence and does not pose a dust issue. Enclosure (1) is an aerial photograph of the area, enclosure (2) is an estimation of types of materials and amounts deposited.

The material was most likely deposited from about 1993 to 2001 to reduce construction and demolition costs and to save money on future construction projects that could potentially reuse the material for backfill. Sources of the material were most likely from large-scale construction projects, the Base Support contractor and the Seabees. Since the stockpile is not considered hazardous there has never been a concern about long-term storage.

Steps have been taken to prevent any future dumping of C&D material at the site. I have instructed the Security Department

Subj: NAVAL AIR STATION FALLON CONSTRUCTION AND DEMOLITION
(C&D) STOCKPILE

not to open the access gates to the east side for anyone hauling demolition or construction material without my permission. In addition, Public Works and the Resident Officer in Charge of Construction (ROICC) will ensure all contracts adhere to the requirements of CNRSWINST 11350.1, the Regional Construction and Demolition Instruction, which establishes policy to formally address the issue of C&D management and diversion within the Navy Region Southwest, including NASF.

NASF currently has two very large runway repair and construction projects planned for future execution. Both of these projects will require a significant amount of fill material. It is our plan to include reuse of the described (C&D) stockpile as a cost incentive on these contracts. Timing of the contracts is unknown and subject to annual Congressional Military Appropriations. However, both of the projects are a top installation priority and we expect to see completion of the work within the next 5 to 10 years.

If you have any questions or comments please feel free to contact me at (775) 426-2700.

Sincerely,



W. S. RYDER
Captain, USN
Commanding Officer

Enclosure (1) Aerial Photograph
Enclosure (2) Estimate of types and amount of materials

Copy to:

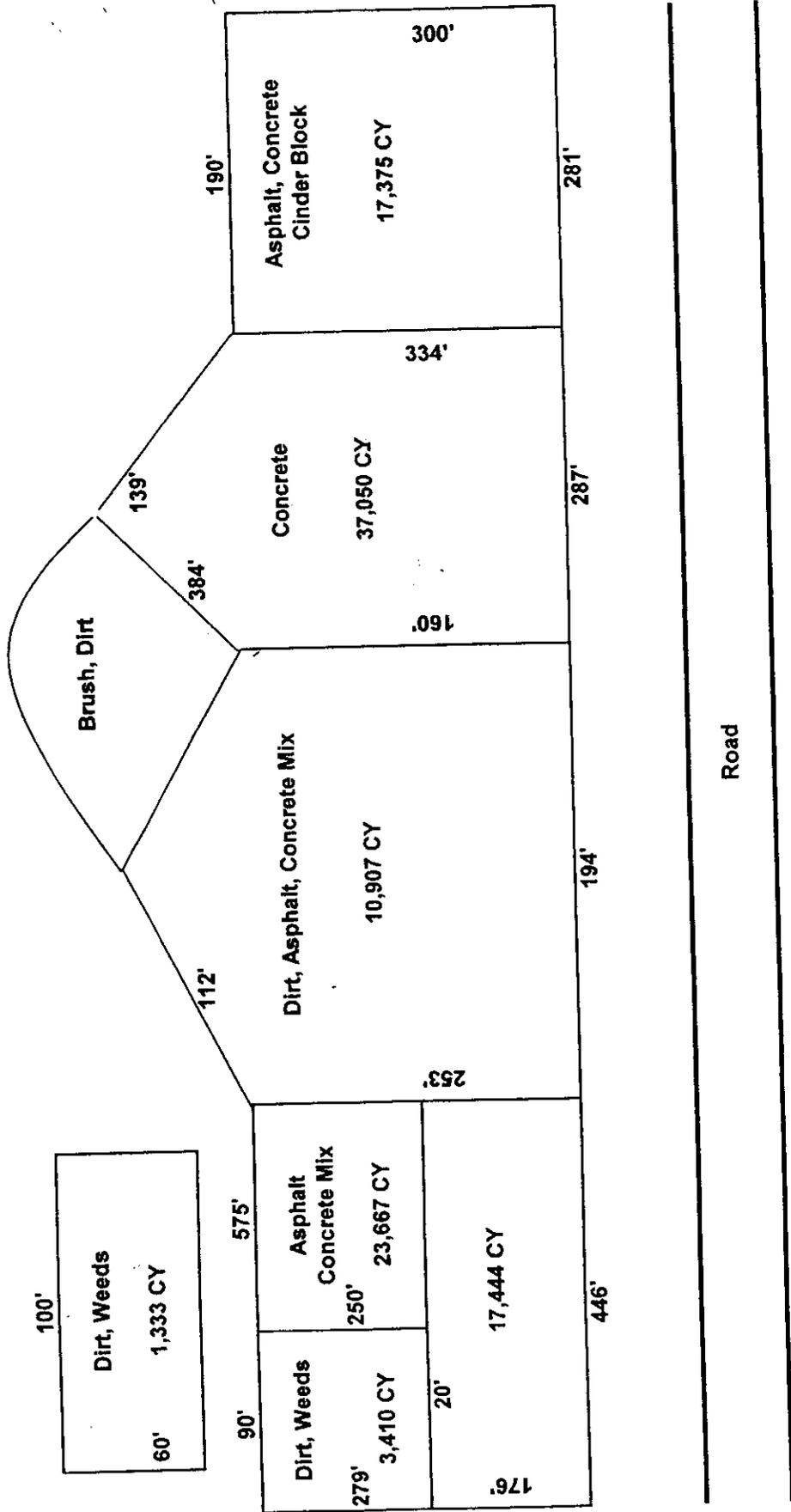
CDR Steve Stevenson, Public Works Department
Del Pursel, Public Works Department
Cecil Cook, Solid Waste/Recycling
Chuck Deverin, Environmental Department
Raj Krishnamoorthy, Environmental Department

Chugach Estimates

CUBIC YARDS = 111,186

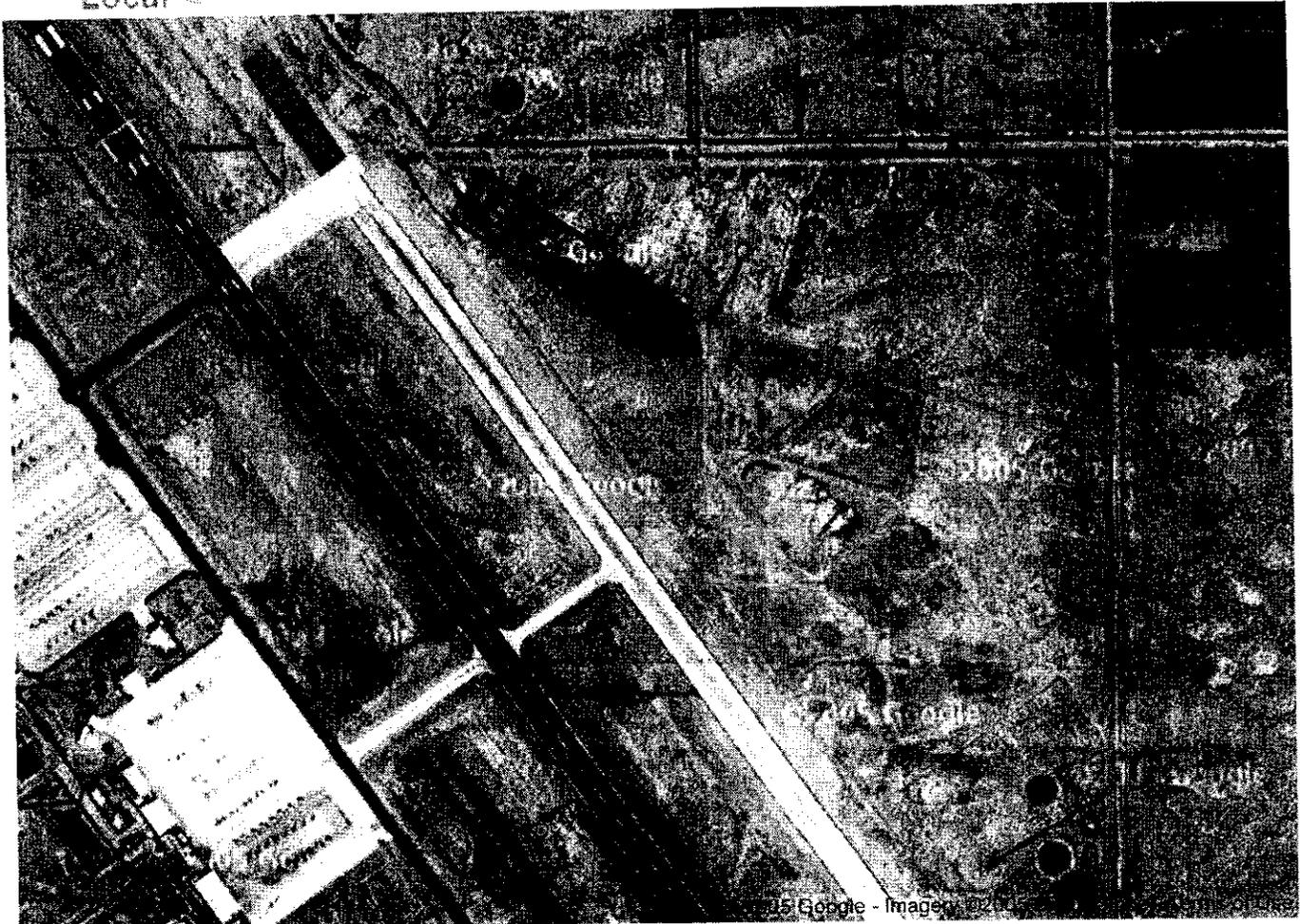
CONCRETE AND ASPHALT = 106,443

RUNWAY



ENCL (a)

Google
Local



Search results for **naval air station** near **Fallon, NV**

US Naval Air Station
4755 Pasture Rd, Fallon, NV

APPENDIX B – PUBLIC NOTICE

562 N. Maine Street, Fallon, NV 89406
P.O. Box 1297, Fallon, NV 89407-1297
(775) 423-6041 FAX: (775) 423-0474

Customer Number: # 9645046

Legal Account
St. George Chadux Corp
501 W. Broadway, Ste. 809
San Diego, CA 92101

Lisa Barwig says:

That (s)he is a legal clerk of the **LAHONTAN VALLEY NEWS**, a newspaper published Wednesday, Friday, Sunday at Fallon, in the State of Nevada.

Public Notice
**Five Year Review of Environmental
Cleanup**
Ad #3476071

of which a copy is hereto attached, was published in said newspaper for the full required period of **1 time** commencing on **May 24, 2009**, and ending on **May 24, 2009**, all days inclusive.

Signed: _____

Lisa Barwig

STATEMENT:



PUBLIC NOTICE

Naval Air Station Fallon, Nevada
Five Year Review of Environmental Cleanup Actions at
Installation Restoration Sites 20, 21, and 22
May 2009

The Department of the Navy has started the first five-year review process for the environmental cleanup actions (selected remedies) taken under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at the Naval Air Station (NAS) Fallon, Fallon Nevada. The purpose of five-year reviews is to evaluate if remedies selected to prevent exposure to contaminants in soil and groundwater are currently and will continue to be protective of human health and the environment in the future. This five-year review will evaluate selected remedies at Fallon Installation Restoration (IR) Checkerboard Landfill Site 20, Receiver Landfill Site 21 and Northeast Landfill Site 22. This five-year review will be completed by September 2009.

Contaminants present at IR Sites 20, 21, and 22 include total petroleum hydrocarbons, volatile organic compounds, and semivolatile organic compounds. The remedy selected to address the presence of these contaminants at all three IR Sites was Limited Action as presented in the Decision Documents (DD) signed by the Navy and Nevada Division of Environmental Protection. The Limited Action alternative includes limited ground surface regrading to mitigate the potential for surface water ponding, which could infiltrate through the fill material, and to improve surface drainage; limited groundwater monitoring to evaluate the off-site impact of fill material; and institutional controls (ICs) to limit potential future exposure to fill material. Native species were planted in March 2008 to comply with revegetation efforts. Groundwater monitoring and implementation of ICs are ongoing at IR Sites 20, 21, and 22.

The remedies for each site were selected based on results from soil and groundwater investigations after comment from the public and acceptance from state regulatory agencies. All agreed these remedies would: 1) reduce the amount of contamination to standards that would protect public health and the environment; 2) keep the contaminant plumes within the NAS Fallon property; and 3) ensure there was no unacceptable risk to the health of personnel working at these sites. The five-year review will not reconsider the selected remedies. Instead, it will evaluate the performance of each selected remedy and recommend improvements if the remedy is not performing as designed. The five-year review findings will be presented to the public in a report to be issued in September 2009. A public notice and fact sheet will be published after the report is issued. Citizens with questions or comments about the preparation of this Five-Year Review (or other environmental activities at NAS Fallon) may contact:

Remedial Project Manager

R. Michael Quesada
Naval Facilities Engineering Command Southwest
1220 Pacific Coast Highway
San Diego, CA 92132-5183
Code OPDE.MQ
richard.quesada@navy.mil

The full report will also be available at:

Information Repository
Churchill County Public Library
553 S. Maine Ave
Fallon, NV 89406
(775) 423-7581

Administrative Record
Contact: Ms. Diane Silva
Naval Facilities Engineering
Command Southwest
1220 Pacific Highway,
San Diego, CA 92132

Pub: May 24, 2009

Ad#3476071

APPENDIX C – LIST OF DOCUMENTS REVIEWED

- Barajas & Associates, Inc. (BAI). 2008. *2007 Annual Post-Closure Maintenance and Groundwater Monitoring Report for Landfill Sites 20, 21, and 22. Naval Air Station Fallon, Fallon, Nevada.* September.
- BAI. 2009. *Final 2008 Annual Landfill Maintenance and Groundwater Monitoring Report. Landfill Sites 20, 21, and 22. Naval Air Station Fallon, Fallon, Nevada.* August.
- BAI. 2010. *Final 2010 Landfill Inspection and Groundwater Monitoring Report, Sites 20, 21, and 22. Naval Air Station Fallon, Fallon, Nevada.* November.
- Department of the Navy (Navy). 2003. *Naval Air Station Fallon Overview Plan, Fallon, Nevada.* May.
- Navy. 2004. *Navy and Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act Statutory Five-Year Reviews.* April.
- Navy. 2006. *Naval Air Station Fallon Installation Restoration Program 2006-2007.* Power Point Presentation available on-line at http://ndep.nv.gov/nasf/0607_ir_fact_sheet.pdf. August 22.
- Kelso, Robert C. 2000. Letter to Mr. D.S. Pursel, re: NDEP requires no further action regarding historical jet fuel release near northeast runway fuel impacted area. Nevada Division of Environmental Protection. June 6.
- Naval Air Station (NAS) Fallon. 2000. *Progress Report for Northeast Runway Fuel Impacted Area at the Naval Air Station Fallon.* Public Works Department, Environmental Division.
- SulTech. 2007. *Final Work Plan. Remedial Investigation Addendum for Active Sites.* August 31.
- URS. 2004a. *Final Remedial Alternatives Evaluation and Cost Analysis, Site 20, Checkerboard Landfill, Naval Air Station Fallon, Fallon, Nevada.* September 23.
- URS. 2004b. *Final Remedial Alternatives Evaluation and Cost Analysis, Site 21, Receiver Site Landfill, Naval Air Station Fallon, Fallon, Nevada.* September 23.
- URS. 2004c. *Final Remedial Alternatives Evaluation and Cost Analysis, Site 22, Northeast Runway Landfill, Naval Air Station Fallon, Fallon, Nevada.* September 23.
- URS. 2004d. *Final Decision Document, Site 20, Checkerboard Landfill, Naval Air Station Fallon, Fallon, Nevada.* October.
- URS. 2004e. *Final Decision Document, Site 21, Receiver Site Landfill, Naval Air Station Fallon, Fallon, Nevada.* October.

URS. 2004f. *Final Decision Document, Site 22, Northeast Runway Landfill, Naval Air Station Fallon, Fallon, Nevada*. October.

U.S. Environmental Protection Agency (EPA). 1994. *Region IX Preliminary Remediation Goals (PRGs), Second Half 1994*. Region IX, San Francisco, CA. August 1.

EPA. 2001. *Comprehensive Five-Year Review Guidance*, EPA/540/R-01/007. OSWER 9355.7-03B-P. June.

EPA. 2008. *Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites*.
On-line address: <http://www.epa.gov/region09/waste/sfund/prg/index.html>

APPENDIX D – SITE INSPECTION CHECKLISTS

O&M site manager

Name

Title

Date

Interview: at site at office by phone phone no. _____

Report attached: _____

Problems, suggestions:

O&M site staff

Name

Name

Title

Date

Interview: at site at office by phone phone no. _____

Report attached: _____

Problems, suggestions:

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

A. O&M Documents

- | | | | |
|--|--|-------------------------------------|---|
| <input type="checkbox"/> O&M manual | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> As-built drawings | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Maintenance logs | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

B. Site-Specific Health and Safety Plan

- | | | | |
|---|--|---|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A | |
| <input type="checkbox"/> Contingency plan/emergency response plan | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

C. O&M and OSHA Training Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

D. Permits and Service Agreements:

- | | | | |
|---|--|-------------------------------------|---|
| <input type="checkbox"/> Air discharge permit | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Effluent discharge | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Waste disposal, POTW | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Other permits | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

E. Gas Generation Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

F. Settlement Monument Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

G. Groundwater Monitoring Records:

- | | | |
|---|-------------------------------------|------------------------------|
| <input checked="" type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input type="checkbox"/> N/A |
|---|-------------------------------------|------------------------------|

Remarks:

H. Leachate Extraction Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

I. Discharge Compliance Records:

- | | | | |
|---|--|-------------------------------------|---|
| <input type="checkbox"/> Air | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Water (effluent) | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

J. Daily Access/Security Logs:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

IV. ACCESS AND INSTITUTIONAL CONTROLS

A. FENCING:

- | | | | |
|--|---|---|------------------------------|
| <input type="checkbox"/> Fencing Damaged | <input type="checkbox"/> Location shown on site map | <input checked="" type="checkbox"/> Gates | <input type="checkbox"/> N/A |
|--|---|---|------------------------------|

Remarks:

This site is not individually fenced, however it is located within NAS Fallon, which is fenced.

B. OTHER ACCESS RESTRICTIONS:

Signs and other security measures Location shown on site map N/A

Remarks:

This site is located entirely within NAS Fallon. Access to NAS Fallon is restricted and tightly controlled. Additionally, there are regular security patrols.

C. INSTITUTIONAL CONTROLS (ICs):

1. Implementation and Enforcement:

Site Conditions Imply ICs Not Properly Implemented Yes No N/A

Site Conditions Imply ICs Not Being Fully Enforced Yes No N/A

Type of Monitoring (e.g., self-reporting, drive-by): self

Frequency: in conjunction with any proposed construction activities

Responsible party/agency: NAS Fallon Environmental Division and Planning Department

Contact:	<u>Chuck Deverin</u>	<u>Environmental Specialist</u>	<u>May 19, 2009</u>	<u>775-426-2242</u>
	Name	Title	Date	Phone no.

Reporting is up-to-date Yes No N/A

Reports are verified by the lead agency Yes No N/A

Specific requirements in deed or decision documents have been met Yes No N/A

Violations have been reported Yes No N/A

Other Problems or Suggestions: Report Attached

2. Adequacy: ICs are Adequate ICs are Inadequate N/A

Remarks:

Existing ICs in the NAS Fallon Overview Plan are not adequate and do not provide comprehensive landfill closure protection because they only limit development of the sites. The ICs do not require appropriate landfill inspection and maintenance.

D. GENERAL

1. Vandalism/Trespassing Location shown on site map No Vandalism evident

Remarks:

2. Land use changes on-site N/A

Remarks:

There were no land use changes on site.

3. Land use changes off-site N/A

Remarks:

No land use changes were observed off site.

V. O&M COSTS

A. O&M Organization

- State in-house
- PRP in-house
- Federal Facility in-house
- Other _____
- Contractor for State
- Contractor for PRP
- Contractor for Federal Facility

Remarks:

N/A

B. O&M Cost Records

- Readily available
- Funding mechanism/agreement in place
- Up to date

Original O&M cost estimate: Not Available Breakdown attached

Total annual cost by year for review period: N/A

From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			

C. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons:

N/A

VI. GENERAL SITE CONDITIONS

A. Roads

Applicable N/A

1. Road Damaged Location shown on site map Roads Adequate N/A

Remarks:

Access to the site was via maintained dirt roads.

B. Other Site Conditions:

VII. GROUNDWATER/SURFACE WATER REMEDIES

Applicable N/A

A. Monitoring Wells

Properly Secured/Locked Functioning Routinely sampled Good Condition
 All Required Wells Located Needs Maintenance N/A

Remarks:

Several of the wells were observed to be unlocked and/or unbolted. All wells appeared to be in good condition and are routinely sampled.

B. Groundwater Extraction Wells, Pumps, and Pipelines

Applicable N/A

1. Pumps, Wellhead Plumbing, and Electrical

Good condition All required wells properly operating Needs Maintenance N/A

Remarks:

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

Good condition Needs Maintenance

Remarks:

N/A

3. Spare Parts and Equipment

Readily available Good condition Requires upgrade Needs to be provided

Remarks:

N/A

C. Treatment System

Applicable N/A

1. Treatment Train (Check components that apply)

Metals removal Oil/water separation Bioremediation

Air stripping Carbon adsorbents

Filters _____

Additive (e.g., chelation agent, flocculent) _____

- Others: _____
- Good Condition Needs Maintenance
- Sampling ports properly marked and functional
- Sampling/maintenance log displayed and up to date
- Equipment properly identified
- Quantity of groundwater treated annually _____
- Quantity of surface water treated annually _____

Remarks:

2. Electrical Enclosures and Panels (properly rated and functional)

- N/A Good condition Needs Maintenance

Remarks:

3. Tanks, Vaults, Storage Vessels

- N/A Good condition Proper secondary containment Needs Maintenance

Remarks:

4. Discharge Structure and Appurtenances

- N/A Good condition Needs Maintenance

Remarks:

5. Treatment Building(s)

- N/A Good condition (esp. roof and doorways) Needs repair
- Chemicals and equipment properly stored

Remarks:

VIII. LANDFILL COVERS **Applicable** N/A

A. Landfill Surface

- 1. Settlement (Low spots)** Location shown on site map Settlement not evident

Areal extent _____ Depth _____

Remarks:

<p>2. Cracks <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Cracking not evident</p> <p>Lengths _____ Widths _____ Depths _____</p> <p>Remarks:</p>												
<p>3. Erosion <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Erosion not evident</p> <p>Areal extent _____ Depth _____</p> <p>Remarks:</p>												
<p>4. Holes <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Holes not evident</p> <p>Areal extent _____ Depth _____</p> <p>Remarks:</p>												
<p>5. Vegetative Cover <input type="checkbox"/> Grass <input type="checkbox"/> Cover properly established <input type="checkbox"/> No signs of stress</p> <p><input checked="" type="checkbox"/> Trees/Shrubs (indicate size and locations on a diagram)</p> <p>Remarks:</p> <p>The majority of the site was covered with native vegetation.</p>												
<p>6. Alternative Cover (armored rock, concrete, etc.) <input checked="" type="checkbox"/> N/A</p> <p>Remarks:</p>												
<p>7. Bulges <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Bulges not evident</p> <p>Areal extent _____ Height _____</p> <p>Remarks:</p>												
<p>8. Wet Areas/Water Damage <input checked="" type="checkbox"/> Wet areas/water damage not evident</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;"><input type="checkbox"/> Wet areas</td> <td style="width: 33%;"><input type="checkbox"/> Location shown on site map</td> <td style="width: 33%;">Areal extent _____</td> </tr> <tr> <td><input type="checkbox"/> Ponding</td> <td><input type="checkbox"/> Location shown on site map</td> <td>Areal extent _____</td> </tr> <tr> <td><input type="checkbox"/> Seeps</td> <td><input type="checkbox"/> Location shown on site map</td> <td>Areal extent _____</td> </tr> <tr> <td><input type="checkbox"/> Soft subgrade</td> <td><input type="checkbox"/> Location shown on site map</td> <td>Areal extent _____</td> </tr> </table> <p>Remarks:</p>	<input type="checkbox"/> Wet areas	<input type="checkbox"/> Location shown on site map	Areal extent _____	<input type="checkbox"/> Ponding	<input type="checkbox"/> Location shown on site map	Areal extent _____	<input type="checkbox"/> Seeps	<input type="checkbox"/> Location shown on site map	Areal extent _____	<input type="checkbox"/> Soft subgrade	<input type="checkbox"/> Location shown on site map	Areal extent _____
<input type="checkbox"/> Wet areas	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<input type="checkbox"/> Ponding	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<input type="checkbox"/> Seeps	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<input type="checkbox"/> Soft subgrade	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<p>9. Slope Instability <input type="checkbox"/> Slides <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of slope instability</p> <p>Areal extent _____</p> <p>Remarks:</p> <p>N/A</p>												
<p>B. Cover Penetrations <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A</p>												

- 1. Gas Vents** Active Passive
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

- 2. Gas Monitoring Probes**
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

- 3. Monitoring Wells** (within surface area of landfill)
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

All monitoring wells were located off site just past the boundary.

- 4. Leachate Extraction Wells**
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

- 5. Settlement Monuments** Located Routinely surveyed N/A

Remarks:

- C. Gas Collection and Treatment** Applicable N/A

- 1. Gas Treatment Facilities**
 Flaring Thermal destruction Collection for reuse
 Good condition Needs Maintenance

Remarks:

- 2. Gas Collection Wells, Manifolds and Piping**
 Good condition Needs Maintenance

Remarks:

- 3. Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)
 Good condition Needs Maintenance N/A

Remarks:

IX. OVERALL OBSERVATIONS

A. IMPLEMENTATION OF THE REMEDY

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.)

The Limited Action remedy was selected to mitigate the potential for surface water ponding and improve surface drainage, prevent migration of contaminants off site, and prevent exposure to landfill material. The remedy appears to be effective and functioning as designed.

B. ADEQUACY OF O&M (Including pre-construction communications)

Describe issues and observations relating to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long term protectiveness of the remedy.

N/A

C. EARLY INDICATORS OF POTENTIAL REMEDY PROBLEMS

Describe issues and observations such as unexpected changes in the cost of scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. OPPORTUNITIES FOR OPTIMIZATION

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The remedy appears to be functioning as intended. No opportunities for optimization are recommended.



Five-Year Review Site Inspection Checklist

I. SITE INFORMATION

Site Name: Receiver LF IR Site 21 & NE Runway LF IR Site 22		Date of Inspection: 5/19/09
Location and Region: NAS Fallon, NV		EPA ID: NV9170022173
Agency, office or company leading the five-year review:	DON	Weather/ Temperature: Partly cloudy, windy, upper 80s

Remedy Includes: (Check all that apply)

- | | | |
|--|---|--|
| <input type="checkbox"/> Landfill Cover/Containment | <input type="checkbox"/> Monitored Natural Attenuation | <input checked="" type="checkbox"/> Institutional Controls |
| <input type="checkbox"/> Access Controls | <input type="checkbox"/> Groundwater Containment | <input type="checkbox"/> Vertical Barrier Walls |
| <input type="checkbox"/> Groundwater Pump and Treatment | <input type="checkbox"/> Surface water Collection and Treatment | <input checked="" type="checkbox"/> Groundwater Monitoring |
| <input checked="" type="checkbox"/> Other Ground surface regrading to improve surface drainage | | |

II. INTERVIEWS

Agency: DON, NAS Fallon

Contact: <u>Chuck Deverin</u>	<u>Environmental Specialist</u>	<u>5/19/09</u>
Name	Title	Date

Interview: at site at office by phone phone no. (775) 426-2242

Report attached: _____

Problems, regulations or policy changes, suggestions:
See Interview Appendix for the detailed interview.

Agency: _____

Contact: _____	_____	_____
Name	Title	Date

Interview: at site at office by phone phone no. _____

Report attached: _____

Problems, regulations or policy changes, suggestions:

O&M site manager

Name

Title

Date

Interview: at site at office by phone phone no. _____

Report attached: _____

Problems, suggestions:

O&M site staff

Name

Name

Title

Date

Interview: at site at office by phone phone no. _____

Report attached: _____

Problems, suggestions:

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

A. O&M Documents

- | | | | |
|--|--|-------------------------------------|---|
| <input type="checkbox"/> O&M manual | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> As-built drawings | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Maintenance logs | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

B. Site-Specific Health and Safety Plan

- | | | | |
|---|--|---|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A | |
| <input type="checkbox"/> Contingency plan/emergency response plan | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

C. O&M and OSHA Training Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

D. Permits and Service Agreements:

- | | | | |
|---|--|-------------------------------------|---|
| <input type="checkbox"/> Air discharge permit | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Effluent discharge | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Waste disposal, POTW | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Other permits | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

E. Gas Generation Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

F. Settlement Monument Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

G. Groundwater Monitoring Records:

- | | | |
|---|-------------------------------------|------------------------------|
| <input checked="" type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input type="checkbox"/> N/A |
|---|-------------------------------------|------------------------------|

Remarks:

H. Leachate Extraction Records:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

I. Discharge Compliance Records:

- | | | | |
|---|--|-------------------------------------|---|
| <input type="checkbox"/> Air | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
| <input type="checkbox"/> Water (effluent) | <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |

Remarks:

J. Daily Access/Security Logs:

- | | | |
|--|-------------------------------------|---|
| <input type="checkbox"/> Readily available | <input type="checkbox"/> Up-to-date | <input checked="" type="checkbox"/> N/A |
|--|-------------------------------------|---|

Remarks:

IV. ACCESS AND INSTITUTIONAL CONTROLS

A. FENCING:

- | | | | |
|--|---|---|------------------------------|
| <input type="checkbox"/> Fencing Damaged | <input type="checkbox"/> Location shown on site map | <input checked="" type="checkbox"/> Gates | <input type="checkbox"/> N/A |
|--|---|---|------------------------------|

Remarks:

This site is not individually fenced, however it is located within NAS Fallon, which is fenced.

B. OTHER ACCESS RESTRICTIONS:

Signs and other security measures Location shown on site map N/A

Remarks:

This site is located entirely within NAS Fallon. Access to NAS Fallon is restricted and tightly controlled. Additionally, there are regular security patrols.

C. INSTITUTIONAL CONTROLS (ICs):

1. Implementation and Enforcement:

Site Conditions Imply ICs Not Properly Implemented Yes No N/A

Site Conditions Imply ICs Not Being Fully Enforced Yes No N/A

Type of Monitoring (e.g., self-reporting, drive-by): self

Frequency: in conjunction with any proposed construction activities

Responsible party/agency: NAS Fallon Environmental Division and Planning Department

Contact:	<u>Chuck Deverin</u>	<u>Environmental Specialist</u>	<u>May 19, 2009</u>	<u>775-426-2242</u>
	Name	Title	Date	Phone no.

Reporting is up-to-date Yes No N/A

Reports are verified by the lead agency Yes No N/A

Specific requirements in deed or decision documents have been met Yes No N/A

Violations have been reported Yes No N/A

Other Problems or Suggestions: Report Attached

2. Adequacy: ICs are Adequate ICs are Inadequate N/A

Remarks:

Existing ICs in the NAS Fallon Overview Plan are not adequate and do not provide comprehensive landfill closure protection because they only limit development of the sites. The ICs do not require appropriate landfill inspection and maintenance.

D. GENERAL

1. Vandalism/Trespassing Location shown on site map No Vandalism evident

Remarks:

2. Land use changes on-site N/A

Remarks:

There were no land use changes on site.

3. Land use changes off-site N/A

Remarks:

No land use changes were observed off site.

V. O&M COSTS

A. O&M Organization

- State in-house
- PRP in-house
- Federal Facility in-house
- Other _____
- Contractor for State
- Contractor for PRP
- Contractor for Federal Facility

Remarks:

N/A

B. O&M Cost Records

- Readily available
- Funding mechanism/agreement in place
- Up to date

Original O&M cost estimate: Not Available Breakdown attached

Total annual cost by year for review period: N/A

From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			
From _____ Date	To _____ Date	_____	<input type="checkbox"/> Breakdown attached
Total cost			

C. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons:

N/A

VI. GENERAL SITE CONDITIONS

A. Roads

Applicable N/A

1. Road Damaged Location shown on site map Roads Adequate N/A

Remarks:

Access to the site was via maintained dirt roads.

B. Other Site Conditions:

VII. GROUNDWATER/SURFACE WATER REMEDIES

Applicable N/A

A. Monitoring Wells

Properly Secured/Locked Functioning Routinely sampled Good Condition
 All Required Wells Located Needs Maintenance N/A

Remarks:

The majority of the wells were observed to be unlocked and/or unbolted. Three old, unlabeled wells reportedly not in use were located adjacent to TT22-MW02. All other wells appeared to be in good condition and are routinely sampled.

B. Groundwater Extraction Wells, Pumps, and Pipelines

Applicable N/A

1. Pumps, Wellhead Plumbing, and Electrical

Good condition All required wells properly operating Needs Maintenance N/A

Remarks:

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

Good condition Needs Maintenance

Remarks:

N/A

3. Spare Parts and Equipment

Readily available Good condition Requires upgrade Needs to be provided

Remarks:

N/A

C. Treatment System

Applicable N/A

1. Treatment Train (Check components that apply)

Metals removal Oil/water separation Bioremediation
 Air stripping Carbon adsorbents
 Filters _____
 Additive (e.g., chelation agent, flocculent) _____

- Others: _____
- Good Condition Needs Maintenance
- Sampling ports properly marked and functional
- Sampling/maintenance log displayed and up to date
- Equipment properly identified
- Quantity of groundwater treated annually _____
- Quantity of surface water treated annually _____

Remarks:

2. Electrical Enclosures and Panels (properly rated and functional)

- N/A Good condition Needs Maintenance

Remarks:

3. Tanks, Vaults, Storage Vessels

- N/A Good condition Proper secondary containment Needs Maintenance

Remarks:

4. Discharge Structure and Appurtenances

- N/A Good condition Needs Maintenance

Remarks:

5. Treatment Building(s)

- N/A Good condition (esp. roof and doorways) Needs repair
- Chemicals and equipment properly stored

Remarks:

VIII. LANDFILL COVERS **Applicable** N/A

A. Landfill Surface

- 1. Settlement (Low spots)** Location shown on site map Settlement not evident

Areal extent _____ Depth _____

Remarks:

<p>2. Cracks <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Cracking not evident</p> <p>Lengths _____ Widths _____ Depths _____</p> <p>Remarks:</p>												
<p>3. Erosion <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Erosion not evident</p> <p>Areal extent _____ Depth _____</p> <p>Remarks:</p>												
<p>4. Holes <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Holes not evident</p> <p>Areal extent _____ Depth _____</p> <p>Remarks:</p>												
<p>5. Vegetative Cover <input type="checkbox"/> Grass <input type="checkbox"/> Cover properly established <input type="checkbox"/> No signs of stress</p> <p><input checked="" type="checkbox"/> Trees/Shrubs (indicate size and locations on a diagram)</p> <p>Remarks:</p> <p>The majority of the site was covered with native vegetation. Re-vegetation activities were conducted in March 2008. There were several areas where re-vegetation had not established itself due to lack of precipitation.</p>												
<p>6. Alternative Cover (armored rock, concrete, etc.) <input checked="" type="checkbox"/> N/A</p> <p>Remarks:</p>												
<p>7. Bulges <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> Bulges not evident</p> <p>Areal extent _____ Height _____</p> <p>Remarks:</p>												
<p>8. Wet Areas/Water Damage <input checked="" type="checkbox"/> Wet areas/water damage not evident</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;"><input type="checkbox"/> Wet areas</td> <td style="width: 33%;"><input type="checkbox"/> Location shown on site map</td> <td style="width: 33%;">Areal extent _____</td> </tr> <tr> <td><input type="checkbox"/> Ponding</td> <td><input type="checkbox"/> Location shown on site map</td> <td>Areal extent _____</td> </tr> <tr> <td><input type="checkbox"/> Seeps</td> <td><input type="checkbox"/> Location shown on site map</td> <td>Areal extent _____</td> </tr> <tr> <td><input type="checkbox"/> Soft subgrade</td> <td><input type="checkbox"/> Location shown on site map</td> <td>Areal extent _____</td> </tr> </table> <p>Remarks:</p>	<input type="checkbox"/> Wet areas	<input type="checkbox"/> Location shown on site map	Areal extent _____	<input type="checkbox"/> Ponding	<input type="checkbox"/> Location shown on site map	Areal extent _____	<input type="checkbox"/> Seeps	<input type="checkbox"/> Location shown on site map	Areal extent _____	<input type="checkbox"/> Soft subgrade	<input type="checkbox"/> Location shown on site map	Areal extent _____
<input type="checkbox"/> Wet areas	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<input type="checkbox"/> Ponding	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<input type="checkbox"/> Seeps	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<input type="checkbox"/> Soft subgrade	<input type="checkbox"/> Location shown on site map	Areal extent _____										
<p>9. Slope Instability <input type="checkbox"/> Slides <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of slope instability</p> <p>Areal extent _____</p> <p>Remarks:</p> <p>N/A</p>												
<p>B. Cover Penetrations <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A</p>												

- 1. Gas Vents** Active Passive
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

- 2. Gas Monitoring Probes**
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

- 3. Monitoring Wells** (within surface area of landfill)
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

All monitoring wells were located off site just past the boundary.

- 4. Leachate Extraction Wells**
 Properly secured/locked Functioning Routinely sampled Good condition
 Evidence of leakage at penetration Needs Maintenance N/A

Remarks:

- 5. Settlement Monuments** Located Routinely surveyed N/A

Remarks:

- C. Gas Collection and Treatment** Applicable N/A

- 1. Gas Treatment Facilities**
 Flaring Thermal destruction Collection for reuse
 Good condition Needs Maintenance

Remarks:

- 2. Gas Collection Wells, Manifolds and Piping**
 Good condition Needs Maintenance

Remarks:

- 3. Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)
 Good condition Needs Maintenance N/A

Remarks:

IX. OVERALL OBSERVATIONS

A. IMPLEMENTATION OF THE REMEDY

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.)

The Limited Action remedy was selected to mitigate the potential for surface water ponding and improve surface drainage, prevent migration of contaminants off site, and prevent exposure to landfill material. The remedy appears to be effective and functioning as designed.

B. ADEQUACY OF O&M (Including pre-construction communications)

Describe issues and observations relating to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long term protectiveness of the remedy.

N/A

C. EARLY INDICATORS OF POTENTIAL REMEDY PROBLEMS

Describe issues and observations such as unexpected changes in the cost of scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. OPPORTUNITIES FOR OPTIMIZATION

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Except for areas where re-vegetation has not established itself, the remedy appears to be functioning as intended. No opportunities for optimization are recommended.

APPENDIX E – SITE PHOTOGRAPHS



Photo #1 – Site 20 interior showing native vegetation and bare land
(view north from southern area of the site)



Photo #2 – Monitoring wells MW33L and MW33U at Site 20,
with typical view of Site 20 in background



Photo #3 – Site 21 interior view with northern disposal area of Site 6 in foreground
(view west from eastern site boundary)



Photo #4 – Bare land at Site 21
(view north from southern area of the site)



Photo #5 – Typical Site 22 interior showing native vegetation and bare land
(view northeast from southwestern corner of site)



Photo #6 – Area reported to be the 1993 jet fuel spill area adjacent to and south of Site 22
(view south from southern boundary of Site 22)



Photo #7 – Concrete and asphalt slab debris piles at Site 22
(view southeast from northwestern corner of the site)



Photo #8 – No dumping sign at Site 22



Photo #9 – Monitoring well TT22-MW02 at Site 22 (properly locked)



Photo #10 – Monitoring well BA21-MW06 at Site 21 (unlocked)



Photo #11 – Monitoring well PW-03 at Site 22 (unbolted)



Photo #12 – Unlabeled, old well near well TT22-MW22



Photo #13 – Monitoring well BA21-MW04 (unlocked) at Site 21 showing warning sign, with typical view of Site 21 and Building 480 antennas in background

APPENDIX F – INTERVIEWS

Interview Record

SITE IDENTIFICATION			
Site Name: NAS Fallon		EPA ID: NV9170022173	
Subject: 5 Year Review of Sites 20, 21, and 22		Time: 12 p.m.	Date: 5/19/09
Type: <input type="checkbox"/> Telephone <input checked="" type="checkbox"/> Visit <input type="checkbox"/> Email <input type="checkbox"/> Other			
Location of Visit: N/A			
CONTACT MADE BY:			
Name: Michael Anderson		Title: Environmental Scientist	Organization: ChaduxTt
INDIVIDUAL CONTACTED			
Name: Chuck Deverin		Title: Environmental Specialist, PW Dept., Environmental Division	Organization: DON, NAS Fallon
Telephone: 775-426-2242		Address: 4755 Pasture Road	
Fax:	City: Fallon		State: NV
Zip: 89496			
E-mail address: chuck.deverin@navy.mil			
SUMMARY OF CONVERSATION			
<p>Site 6 is currently an active petroleum-only site and is being monitored.</p> <p>The ICs that are mentioned in the decision documents include limited access and building restrictions.</p> <p>The status of all IR sites at Fallon:</p> <ul style="list-style-type: none"> -Sites 1, 3, 14, 16 are currently undergoing further site characterization to be followed by a Feasibility Study (FS). -Sites 2, 4, and 6 are currently undergoing further site characterization to be followed by a Corrective Action Plan (CAP). -A Record of Decision (ROD) is being formulated for Site 18. -Sites 5, 7, 8, 9, 10, 11, 12, 13, 15, 17, 19, 23, 24, 25, 26, and 27 have been closed with No Further Action (NFA) status. <p>DON is unsure why TPH-DRO levels are increasing at Sites 21 and 22. DON plans to continue monitoring.</p> <p>Mr. Deverin also provided a tour of the sites and pointed out the approximate area of the 1993 jet fuel spill area. He further indicated that no one is sure of the exact location of the release. The Navy has only a good idea of the general area in which it occurred.</p>			

Interview Record

SITE IDENTIFICATION			
Site Name: NAS Fallon		EPA ID: NV9170022173	
Subject: 5 Year Review of Sites 20, 21, and 22		Time: 3 p.m.	Date: 6/5/09
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Email <input type="checkbox"/> Other			
Location of Visit: N/A			
CONTACT MADE BY:			
Name: Michael Anderson		Title: Environmental Scientist	Organization: ChaduxTt
INDIVIDUAL CONTACTED			
Name: Ramon Naranjo		Title: Environmental Scientist	Organization: NDEP
Telephone: 775-687-9387		Address:	
Fax:	City: Carson City		State: NV
Zip:			
E-mail address: rrananjo@ndep.nv.gov			
SUMMARY OF CONVERSATION			
<p>1. What is your overall impression of the remedial activities at Landfill Sites 20, 21, and 22 at NAS Fallon?</p> <p><i>For the duration that I have been involved, I've been content with the monitoring results that are leading us toward our final decision, which is closure for these landfills. And I feel strongly about our decision to concur with the Navy's request for closure with limited action, which was to monitor groundwater for 3 years. After three years, NDEP will re-evaluate the sites for No Further Action status.</i></p> <p>2. What is your title and how long have you worked on environmental issues at NAS Fallon?</p> <p><i>Environmental Scientist. I've been reviewing documents for the Navy for 7 years.</i></p> <p>3. Have there been any complaints, violations, or other incidents related to the sites requiring a response by your office? If so, please give details of the events and results of the responses.</p> <p><i>No.</i></p>			

4. Please briefly summarize activities conducted by your office regarding the site.

NDEP investigates and characterizes contaminants from DON's previous releases. NDEP reviews the documents and evaluates them for technical defensibility and regulatory compliance. They hold the Navy responsible for investigation and remediation.

5. Do you feel well informed about the site's activities and progress?

Yes.

6. Do you have any comments, suggestions, or recommendations regarding the site's managements or operation?

I think they are handling things sufficiently.

7. Are you aware of any changes in State laws or regulations regarding concentrations for metals, TPHs, VOCs, or SVOCs that may impact protectiveness of human health and the environment?

Not currently.

8. Have any problems been encountered which will require, changes to the remedial design or Decision Document?

No.

9. Are you aware of any other environmental issues at the site that have not been addressed?

None that I'm aware of.

10. Regarding the 1993 jet fuel spill, TPH-DRO levels were above the state action level in the August-September monitoring event at two wells associated with sites 21 and 22, and had increased over 2007 concentrations. However, contamination contours indicate that the source is upgradient and the plume is migrating toward the sites. What is your impression of this phenomenon?

The state of NV has a regulatory guidance for TPH in groundwater, not necessarily an action level. We treat specific compounds in petroleum as individual components of concern, not total TPH. We use TPH as guidance for what might be detected in terms of the heavier chain compounds that don't have action levels. With regard to the increasing concentrations at these two monitoring wells, the Navy is undergoing an extensive amount of work to revise their groundwater monitoring to ensure the plume migration is steady. If concentrations are increasing at a specific rate, we could act upon the plumes that are moving. As of yet, we may have to re-evaluate the 1993 jet fuel spill under a different program to evaluate the migration onto our IRP sites. With regard to the TPH increase, again, since we don't have an action level for TPH, we would have to look at specific compounds in the TPH and make our decision accordingly.

Do you feel the limited action remedy is sufficient to handle this now? *Yes.*