DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH FIGHTER WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

U.S. AIR FORCE
1947 - 1997

9 OCT 1997

MEMORANDUM FOR NEW MEXICO ENVIRONMENT DEPARTMENT
Attn: Dr. Stu Dinwiddie
Manager, RCRA Permits Management Program
2044 Galisteo
Santa Fe, NM 87502

FROM: 49 CES/CEV
550 Tabosa Avenue
Holloman AFB NM 88330-8458

SUBJECT: Response to Request for Supplementary Information (RSI) on Table 3 Solid Waste Management Units (SWMUs)

1. In response to your 10 September 1997 RSI, Holloman AFB (HAFB) submits the Final RFI Report for Table 3 SWMUs (Atch 1) and the following informational comments. First, in response to General Comment 1, all of the active SWMUs (1, 9, 10, 16, 28, 30, and 37) already have a maintenance program in place. Atch 2, Guidance on Management of Oil/Water Separators, developed by Air Combat Command (ACC) and implemented at HAFB in 1993, outlines the management procedures for all oil/water separators (O/WS) on HAFB. HAFB has an excellent O/WS management program that was recognized as the best in ACC. Under this guidance, O/WSs are inspected at least quarterly and pumped out as required. As similarly discussed in the Response to NMED's Request for Supplementary Information for the Table 2 RFI Report, HAFB recommends the use of ACC's Guidance on Management of Oil/Water Separators to properly manage and inspect those O/WSs which remain active, in lieu of yearly TPH sampling.

2. In regard to General Comment 2, voluntary corrective actions (VCAs) have been completed at SWMUs 1, 3, 4, 7, 8, 10, 11, 12, 13, 14, 18, 19, 23, 27, 28, 29, 31 and 41. The results of the VCAs are presented in three separate documents: 1) *Remediation of POL-Contaminated Sites and Oil/Water Separator Removals, Holloman Air Force Base, New Mexico, July-November 1995* submitted February 1996, 2) *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites and O/WS and WOT Removals, Holloman Air Force Base, New Mexico, July 1997,* and 3) *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites and O/WS and WOT Removals, Holloman Air Force Base, New Mexico* to be submitted in October 1997. Each SWMU-specific section in the attached Final Table 3 RFI Report has been revised similarly to the Final Table 2 RFI Report and will discuss the results of the VCAs.

3. Regarding Site-Specific Comment 1, SWMUs 3, 4, 8, 10 and 18 have all been remediated. Page 1-2, Section 1.2.1 has been revised to include all remedial activities associated with these SWMUs. All of the above SWMUs are recommended for no further action (NFA).

4. In regard to Site-Specific Comment 2, SWMUs 19 (removed) and 20 (inactive) are located within the contaminated plume caused by SWMU 229, the T-38 Test Cell. NFA is recommended for SWMU 20 based upon the HRMB approval of NFA for SWMU 19 with the requirement to submit confirmation boring information upon the remediation of SWMUs 19, 20 and 229 using high-vacuum dual-phase extraction (HVDPE). This HVDPE system is anticipated to operate through 2001. Confirmation borings will be taken across the site, including the area where SWMU 20 is located, to ensure the system has remediated the site to less than 1000 mg/kg.

5. Site-Specific Comment 3 requests the remediation of SWMU 7 and the mitigation of leakage from the piping related to the O/WS. These activities were completed as part of Holloman's Phase 2 Basewide POL project. SWMU 7 was removed as part of the project. Page 5-20, Section 5.2.5 has been revised to provide this information. SWMU 7 is recommended for NFA.

6. In regard to Site-Specific Comment 4, SWMU 11 was removed in 1991. The area to the south is not believed to be related to SWMU 11 since TPH concentrations drop significantly between SWMU 11 and the southern area. However, a VCA was performed as part of Holloman's Phase 2 Basewide POL project. Soil was excavated to the south along with soil near SWMU 11. Approximately 168 cubic yards of soil were excavated. However, no soil with TPH in excess of 1000 mg/kg was found and, therefore, no soil required offsite disposal. Page 5-30, Section 5.3.6 has been revised to provide this information. SWMU 11 is recommended for NFA.

7. Regarding Site-Specific Comment 5, SWMU 23 was removed and remediated as part of Holloman's Phase 2 Basewide POL project. The piping connecting the separator was replaced at that time. No evidence of leakage was found. Page 5-73, Section 5.7.5 has been revised to provide this. SWMU 23 is recommended for NFA.

8. In addition to those SWMUs listed in the RSI, SWMUs 5, 6, 26, 30 and 33 were also recommended and approved for NFA in the Table 3 RFI Workplan submitted in 1994. These SWMUs, discussed on Page 1-2, Section 1.2.1, passed pre-screening criteria set forth in the workplan and were, therefore, approved for NFA. Specifically, SWMUs 5 and 26 were removed several years ago and no evidence of leakage was found during the field screening. SWMUs 6 and 33 are not active O/WSs but instead are used as sediment traps. SWMU 30 is an active O/WS but was fairly new with no evidence of leakage. Since SWMU 30 is active, it is managed in accordance with guidance set forth in Atch 2. Based on the above information, these SWMUs were approved for NFA. HAFB requests these SWMUs be listed with those discussed in the RSI when approval of this report is given.

9. If you have any questions regarding these comments, or require additional information, please contact Warren Neff at (505) 475-5395.

Howard E. Moffitt

HOWARD E. MOFFITT
Deputy Base Civil Engineer

Attachments:
1. Final Table 3 RFI Report
2. Guidance on Management of Oil/Water Separators

Headquarters, Air Combat Command
Langley Air Force Base,
Virginia

RFI Report

Table 3 RCRA Facility Investigation

Volume I

October 1997

49th FIGHTER WING

49 CES/CEV
Holloman Air Force Base,
New Mexico

HOLLOMAN AFB's RESPONSE TO NMED COMMENTS ON TABLE 3 RFI REPORT

WARREN NEFF
49 CES/CEVR

Not associated with the (New Mexico Environment Department) NMED's Request for Supplementary Information are the following Solid Waste Management Units (SWMUs): 5, 6, 26, 30, 33. None of the SWMUs had evidence of leakage. All of the above SWMUs were approved for NFA in the approved workplan for Table 3 submitted in 1994. Information was provided to EPA and NMED regarding these SWMUs (SWMUs 5 and 26 were removed several years ago and no evidence of spills/leaks were found. SWMUs 6 and 33 are not active oil/water separators (O/WSs), but instead are used as sediment traps. SWMU 30 is active and relatively new with no evidence of leakage. SWMU 30 is managed in accordance with our Guidance on Management of Oil/Water Separators. All of the above will be discussed in the cover letter.

Note: The following responses to comments correspond to the NMED's Request for Supplementary Information on Table 3 SWMUs. (EPA I.D. No. NM6572124422)

Sites Where Additional Information is Needed:

SWMUs 7, 11, 12, 13, and 23 were remediated during the Basewide Phase 2 POL Project. SWMU 20 is inactive and is similar to SWMU 19 in that we are requesting NFA based on the requirement to submit confirmation boring information upon the completion of the High Vacuum Dual-Phase Extraction (HVDPE) system at SWMU 229. These sites will be discussed in detail later.

Sites Where Conditional No Further Action is Proposed

Holloman has performed VCAs at these SWMUs and will provide remediation details to each individual SWMU's Recommendation Section. The proposed changes will be discussed later.

General Comments

1. Regarding General Comment 1, only SWMUs 1, 9, 10, 16, 28, 30, and 37 are still active O/WSs. SWMUs 24 and 34 are used as sediment traps and SWMU 38 is inactive. Holloman's Guidance on Management of Oil/Water Separators (Attachment to cover letter), developed by Air Combat Command (ACC) and implemented at HAFB in 1993, outlines the management procedures for all O/WSs on HAFB. HAFB has an excellent O/WS management program and was recognized as the best in ACC. Under the attached guidance, O/WSs are inspected at least quarterly and pumped out as required. As similarly discussed in the Response to NMED's Request for Supplementary Information for the Table 2 RFI Report, HAFB recommends the use of ACC's Guidance on Management of Oil/Water Separators to properly manage and inspect those O/WSs which remain active, in lieu of yearly Total Petroleum Hydrocarbon (TPH) sampling.

For SWMUs 9, 16, and 37, the Recommendations section for each of these SWMUs will be revised to state (Example for SWMU 9):

> NFA is recommended for SWMU 9. A Class 3 permit modification request will be submitted to NMED for this purpose. In addition, this unit will be managed according to HAFB's *Guidance on Management of Oil/Water Separators*, developed by Air Combat Command to insure proper maintenance and quarterly inspections.

The above will also be addressed in the cover letter submitted with the Final Table 3 RFI Report.

2. In regard to General Comment 2, VCAs have been completed at SWMUs 1, 3, 4, 7, 8, 10, 11, 12, 13, 14, 18, 19, 23, 27, 28, 29, 31 and 41. The results of the VCAs are presented in three separate documents: 1) *Remediation of POL-Contaminated Sites and Oil/Water Separator Removals, Holloman Air Force Base, New Mexico, July-November 1995* submitted February 1996; 2) *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997;* and 3) *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico* to be submitted in October 1997, Each SWMU-specific section in the Final Table 3 RFI Report will also discuss the results of the VCAs (just as we revised the Table 2 RFI Report). I will discuss the above in the cover letter.

Site-Specific comments

1. Pg 1-2, Section 1.2.1

HAFB has performed VCAs at SWMUs 3, 4, 8, 10, and 18. Section 1.2.1 will be revised to add the following paragraphs:

> The removal and remediation of SWMU 3 took place during two field efforts and was completed in September 1996. Approximately 1475 cubic yards of TPH-contaminated soil were excavated and disposed. Confirmation samples ranged from not-detected to 24 mg/kg.
>
> SWMU 4 was removed in July 1995. Approximately 92 cubic yards of TPH-contaminated soil was excavated and disposed. Confirmation samples ranged from not-detected to 47 mg/kg.
>
> SWMU 8 was removed and remediated during two field efforts and was completed in April 1997. Approximately 21 cubic yards of TPH-contaminated soil were excavated and disposed in August 1995. Additional excavation took place in April 1997. However, no soil with TPH in excess of 1000 mg/kg was detected and therefore no soil required offsite disposal. Confirmation samples ranged from not-detected to 78 mg/kg, excluding one confirmation sample (6500 mg/kg) taken adjacent to Building 231. No further excavation was possible. As discussed with NMED, in these cases where 80% to 90% of the contaminated soil has been removed and further remediation is not possible, NFA is appropriate.

Confirmation samples ranged from not-detected to 39 mg/kg. A more detailed account of SWMU 14 activities can be found in the *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico* to be submitted in October 1997. Based on these efforts, SWMU 14 is recommended for NFA.

SWMU 19 – SWMU 19 was removed under the Phase 2 Basewide POL project. SWMU 19 was approved for NFA by NMED in September 1997 based on its concurrent remediation with SWMU 229, the T-38 Test Cell and submission of confirmation boring data upon the remediation of both SWMUs. Sec 4.3.4 will be revised to state:

SWMU 19 was recommended for conditional NFA. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 19 was removed in 1996 as part of Holloman's Phase 2 Basewide POL project. Further information can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.*" SWMU 19 was approved for NFA by NMED in September 1996 based on the remediation of the site along with SWMU 229, the T-38 Test Cell, which has a high-vacuum dual-phase extraction (HVDPE) system in place. The HVDPE system is anticipated to operate through 2001. Once the sites have been remediated, confirmation boring information will be submitted to NMED. Therefore, based on its prior approval of NFA by NMED, SWMU 19 is recommended for NFA.

SWMU 23 – See Site Specific Comment 5 above.

SWMU 27 – SWMU 27 was removed and remediated under Holloman's Phase 2 Basewide POL project. Section 5.8.5 will be revised to state:

CNFA was recommended for SWMU 27. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 27 was removed and remediated as part of Holloman's Phase 2 Basewide POL project in April 1996. Approximately 3726 cubic yards of TPH-contaminated soil were excavated and disposed. No LNAPL was found during the excavation. Confirmation samples ranged from not-detected to 32 mg/kg. SWMU 27 was subsequently approved for NFA by NMED in September 1997. Further details regarding the remediation of SWMU 27 can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.* Based on the discussed remediation, SWMU 27 is recommended for NFA.

SWMU 28 – SWMU 28 was remediated under Holloman's Phase 2 Basewide POL project. Section 5.9.5 will be revised to state:

CNFA was recommended for SWMU 28. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 28 was remediated as part of Holloman's Phase 2 Basewide POL project. Approximately 200 cubic yard of TPH-contaminated soil were excavated and disposed in January 1996. Further delineation efforts were conducted in June 1996. Only one sampling point (1200 mg/kg) detected TPH in excess of 1000 mg/kg. A second phase of excavation was conducted in January 1997 resulting in the excavation and disposal of approximately 110 cubic yards of TPH-contaminated soil. All three confirmation samples from the second phase of

excavation were not-detected for TPH. Further details can be found in the *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico* to be submitted in October 1997. Based on the discussed remediation, SWMU 28 is recommended for NFA.

SWMU 29 – SWMU 29 was removed as part of Holloman's Phase 2 Basewide POL project. Section 4.7.4 will be revised to state:

SWMU 29 was recommended for CNFA. The condition of NFA was the remediation of TPH-contaminated soil. SWMU 29 was removed as part of Holloman's Phase 2 Basewide POL project. SWMU 29 was located within SWMU 230, the Building 828 Fuel Spill Site, which is currently undergoing remediation via a HVDPE system. Further details can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.* SWMU 29 was approved for NFA by NMED in September 1997. NMED required confirmation samples once SWMUs 29 and 230 are remediated. Therefore, SWMU 29 is recommended for NFA.

SWMU 31 – SWMU was removed and remediated as part of Holloman's Phase 2 Basewide POL project. Section 5.10.5 will be revised to state:

SWMU 31 was recommended for CNFA. The conditions of the NFA were the remediation of the vadose zone soils with greater than 1000 mg/kg TPH and the repair of the separator. SWMU 31 was removed and remediated as part of Holloman's Phase 2 Basewide POL project. Approximately 76 cubic yards of TPH-contaminated soil were excavated and disposed. Confirmation samples ranged from not-detected to 93 mg/kg. Further details can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.* SWMU 31 was approved for NFA by NMED in September 1997. Therefore, SWMU 31 is recommended for NFA.

SWMU 41 – SWMU 41 was removed and remediated as part of Holloman's Phase 2 Basewide POL project. Section 5.14.5 will be revised to state:

SWMU 41 was recommended for CNFA. The condition of NFA was the remediation of TPH-contaminated soil. SWMU 41 was removed as part of Holloman's Phase 2 Basewide POL project. No soil with TPH in excess of 1000 mg/kg was detected during the removal of SWMU 41 and therefore no soil required offsite disposal. Confirmation samples ranged from 72 mg/kg to 320 mg/kg. Further details can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.* SWMU 41 was approved for NFA by NMED in September 1997. Therefore SWMU 41 is recommended for NFA.

Air Combat Command

Environmental Program

Guidance Document

93-019

Reference Number

To: All ACC/CEV
From: HQ ACC/CEV
Subject: Guidance on Management of Oil/Water Separators
Program: Compliance, Water
Effective Date: 22 OCT 1993
CC: All ACC Base Civil Engineers, HQ ACC/LGS/JAV/PAC/SGB

The attached Guidance Document is provided for your implementation as appropriate.

The HQ ACC Program Manager for Oil/Water Separator Management is

Mrs Michelle Dandeneau at DSN 574-4430.

JOHN W. MOGGE, JR., Colonel, USAF
Chief, Environmental Programs

1 Atch
Guidance on Management of Oil/Water Separators

Atch 2

AIR COMBAT COMMAND (ACC) OIL/WATER SEPARATOR MANAGEMENT GUIDANCE DOCUMENT

Purpose: To comply with federal regulations related to the discharges from oil/water separators, to take action to upgrade, minimize installation of, and eliminate oil/water separators, and to properly maintain and monitor oil/water separators. This guidance document is effective as of 1 Jun 93 and shall remain in effect until rescinded or superseded by HQ ACC/CEV. Revisions will be made on an as required basis.

Authority: This guidance document has been developed to comply with the following regulations as applicable: 40 CFR 261 Hazardous Waste Characteristics; Section 304 of the Clean Water Act, Effluent Guidelines and Standards for Direct Discharges; and 40 CFR 122 through 125, NPDES Regulations. This guidance document replaces/supersedes former HQ TAC/SAC policies and applies to all ACC gained units, excluding tenant organizations on non-ACC bases and all ACC gained ANG and AFRES organizations not located on ACC installations.

SECTION I. INTRODUCTION

1. The federal regulations and laws cited above are indirect regulatory requirements for oil/water separators and govern the release/leakage/discharge from them. Oil/water separators musts be properly maintained so that these laws and regulations are not violated. Federal installations must comply with these regulations and any state regulations (which may be more stringent).

2. This guidance document is organized in 12 sections that describe the main guidance document requirements and issues. The contents are as follows:

SECTION II. DEFINITIONS

1. Oil/water Separator: A flow through chamber used for primary treatment (by physical means) of industrial wastewater to remove free oils and fuels. A separator is typically constructed of concrete or steel and may be rectangular or cylindrical in shape. Components of the separator are defined in this section.

2. Baffle: A flat plate inside the oil/water separator chamber which serves to slow the velocity of wastewater flowing into the separator so that oil rises above the wastewater in the chamber. Typically, a series of baffle plates are required to slow the flow and provide adequate separation.

3. CFR: The Code of Federal Regulations, in particular, 40 CFR 122 is EPA's promulgation of the Clean Water Act.

4. Dissolved Oil: Oil which is completely soluble in water and cannot be removed by gravity (physical) separation provided by an oil/water separator.

5. Effluent: Water and dissolved constituents which discharge from the separator.

6. Emulsified Oil: Oil globules that are less than 20 microns (one millionth of a meter) in diameter which form a stable suspension in water. Separation of this oil is possible by gravity separation, however, complete separation is unlikely.

7. Free Oil: Oil globules in the separation chamber of the separator are large enough to rise above the water level and form an oil layer on top of the water.

8. Grit Chamber: Can be a component of the separator or a compartment upstream of the separator which serves as s screening device to remove large solids from the wastewater.

9. Holding Tank: A tank independent of the oil/water separator which receives oil or petroleum products skimmed from the separator.

10. Influent: Wastewater entering the oil/water separator chamber via a floor drain (typically).

11. Inspection Checklist: Atch 1

12. NPDES: The National Pollutant Discharge Elimination System, developed by the US EPA which requires that any discharge of pollutants from a point source to a water of the U.S. requires a permit.

13. Pretreatment: In the sense that it will be used in this guidance document, pretreatment is defined as the standards imposed on a discharger to a Publicly Owned Treatment Works (POTW) or also known as a municipal wastewater treatment plant.

14. Primary Separation Chamber: The portion of the oil/water separator where adequate time provides for separation of the petroleum products or oil from the water layer, typically the span of area between the first and last baffle plate.

15. RCRA: The Resource Conservation Recovery Act which deals with the management, treatment, and disposal of hazardous waste.

16. Skimmer: The component of the separator which is at the static water level and serves to remove the oil layer from the primary separation chamber.

17. Specific Gravity: The ratio of the specific weight of a substance to the specific weight of water. A constituent's specific gravity of less than 1 will cause the substance to float in water.

18. SWMU: Solid Waste Management Unit defined under RCRA 40 CFR 264. For the purposes of this guidance document, oil/water separators could be listed as SWMUs which require a series of testing to show that the separator has not released hazardous waste into any surrounding media.

SECTION III. OPERATION/DESIGN CONSIDERATIONS

1. Operation: Oil/water separators function as physical treatment devices to remove residual oils, petroleum products, and other floatable constituents from wastewater. Oil/water separators will not be used as a collection/storage point for waste fuels or oils. Waste fuels/oils must never be intentionally dumped or drained into oil/water separators. It is important to note that surfactants, or detergents, will lessen the effectiveness of a separator by causing the oil to disperse and become soluble in water.

1.1 Washracks should be adequately sloped so that washwater enters a drain to the sanitary sewer. If the washrack is outdoors, provisions should be made for storm water bypass, i.e. close off the drain to the sanitary sewer. In locations where the washwater consists of unacceptable constituents to go to the POTW, a recycle washwater system should be considered.

2. Design Considerations: Several types of separators exist from precast concrete boxes to more sophisticated tanks. The following general guidelines should be considered for designing a separator:

2.1 Parallel plate separators decrease tendencies of short-circuiting, decreases turbulence to improve separator efficiency, and increases surface area for separation.

2.2 Floor drains shoud be equipped with bars/grates to retain large solids. Sediment traps or grit chambers should be provided to separate out other solid material prior to the wastewater entering the primary chamber.

2.3 Provisions should be made to divert storm water runoff from outdoor separator inlet drains. In order to avoid the requirement for a permit, the storm water must not come in contact with the separator contents. A bypass valve to the storm drainage system solves this problem, however, this valve must be in the off position when disposing of wastewater. Another method of diverting storm water is to cover the separator inlet drain when it is not in use.

2.4 The maximum design flow for the separator should be three feet per minute for gravity separation. Above this limit, turbulence tends to redistribute oil droplets.

SECTION IV. INVENTORY

1. An inventory must be completed by the environmental flight of all oil/water separators on the base. Input from the using agencies and the water and waste shop in Civil Engineering is essential in order to get an accurate i ry. The inventory should include a listing and site plan

of all separators, the shop and building number where the separator is located, a description of the constituents in the wastewater going to the separator, the destination of the effluent wastewater, and any testing records of the separator contents or effluent. Check with ACC/CEVC to see if an inventory has already been done (centralized contract with Law Environmental is currently under contract to locate and characterize the oil/water separators at approximately 20 bases). This inventory must be used to develop a service contract for separator cleaning if one does not already exist.

SECTION V. MAINTENANCE/SERVICING

1. The frequency of servicing separators will be dependent on frequency and volume of use, separator size, and volume of petroleum product in the waste stream. A good rule of thumb is a sludge volume of no greater than 20 percent of the tank's holding capacity and/or the volume of the oil collection chamber at 70-80 percent full. An indication that the separator is past its need for servicing is the presence of petroleum products passing through to the effluent or overflow of the separator. The using agency should determine the required frequency of servicing for each separator.

1.1 Each using agency will complete a weekly inspection of their separators (Atch 1) for potential problems. Any problems with the separator that would require maintenance or repair should be reported immediately to the OPR on the separator maintenance contract (CEV or CEO) for action. Components that should be inspected are:

1.1.1 Skimmer: Ensure that the skimmer opening is positioned at the static water level. Manual skimmers will be operated weekly, or more often if required to ensure the separator chamber is not overloaded with free oil/petroleum products.

1.1.2 Water Level: The water level in the separator must be within one to two inches of the skimmer to ensure the oil is at a high enough elevation to be skimmed off.

1.1.3 Sludge Volume: If the sludge volume exceeds 20 percent of the separator holding capacity, maintenance is required.

1.1.4 Oil Collection Chamber: If present, ensure that the volume is no greater than 70-80 percent of the tank volume. If it is above this level, maintenance is required. Free oil/petroleum products collected in the collection chamber/holding tank must be maintained at a level below the skimmer to prevent back flow into the separation chamber.

1.1.5 Grit Chamber: Ensure solids are not blocking wastewater from the influent pipe to the separator.

1.2 CEO and/or CEV should initially inspect each separator or review each using agency's inspection records monthly to identify any potential problems. The BCE shall determine an adequate inspection frequency if monthly inspections are not possible.

2. Maintenance Contract Components:

2.1 A local service contract to clean all separators is recommended in order to ensure timeliness and handling of hazardous waste if it occurs. At a minimum, the service contract for separator cleaning should contain the following:

2.1.1 Complete removal of separator sludge, oil, and solids.

2.1.2 Testing of separator contents as required for hazardous waste.

2.1.3 Quarterly (or as required) complete removal of all separator contents and cleaning of the separator, inspection of the separator and components integrity.

2.1.4 Separator cleaning upon request in case of an emergency.

2.1.5 Removal of separator contents if hazardous. Consider a separate contract for this type of removal because most of the routine removal should be nonhazardous waste.

2.2 The maintenance contract should be updated for any addition, removal, maintenance, or upgrade of any separators or changes in mission which would affect the frequency of cleaning required.

SECTION VI. REGULATORY REQUIREMENTS

1. The regulatory requirements which apply to oil/water separators are governed by the classification of the influent and the connection of the separator. Also, if the state has the authority to administer RCRA and NPDES, each base must investigate their state's requirements in order to comply. General federal requirements in general terms will be discussed here.

1.1 NPDES: NPDES will regulate discharges from oil/water separators which are connected to the storm drainage system and which receive any type of waste water not entirely composed of storm water. As an example, a separator simply draining a POV parking lot does not require a permit under federal regulations (yet*), however, a separator which receives wash water from aircraft washing must have a separate permit for that discharge. Separators at fuel tank farms are covered under the storm water permits under the federal rules because they are technically used for small amounts of leaks in these areas. The NPDES Storm Water Permits do not cover nonstorm water discharges, therefore, a separate NPDES permit is required. EPA Forms 1, 2C (for process wastewater), and/or 2E (for nonprocess wastewater) must be submitted for individual permit coverage. States may have their own forms for these permits.

2. RCRA: If the oil/water separator is equipped with a holding tank for the skimmed oil, the tank will be regulated as an UST under 40 CFR 280. The separator and/or the holding tank can be listed as a SWMU under the base's RCRA permit and will require sufficient evidence (as required by the regulatory agency, typically sampling) to show that no hazardous waste has been released to any media.

3. Pretreatment Standards: If the separator is connected to a POTW (some POTWs may not allow them to be connected to their system), the POTW may require a permit for the discharge and/or will impose pretreatment standards. The municipality is typically the authority for this situation.

SECTION VII. FUNDING

1. Defense Environmental Restoration Account (DERA) Eligibility: DERA funds may be used if the oil/water separator was taken out of service before Jan 1984. The separator may be eligible for DERA funding if it can be proven that the majority of contamination occurred prior to Jan 84. Any separator still in service is not eligible for DERA funding.

2. O&M Environmental Compliance Program (ECP) Funding: ECP funding should be requested for routine maintenance, upgrade, replacement, repair, testing/sampling, etc of oil/water separators.

2.1 Level I ECP funding should be requested for any of the above work when the present condition is an out of compliance situation, i.e., violation of a NPDES permit, leaks from the separator, holding tank, or associated piping.

2.2 Level II ECP funding should be requested for any separator upgrade work, separator elimination, or any other work required by the implementing agency to remain in compliance.

2.3 Operations and Services (O&S) ECP funding should be requested for recurring requirements, such as routine maintence.

SECTION VIII. UPGRADE/REPLACEMENT/ELIMINATION GUIDANCE DOCUMENT

1. When an inventory has been completed at the base, CEV must coordinate with each using agency to determine if the separator requires upgrade/replacement or should be eliminated. Any damage to the separator or its components which reduces the efficiency or results in leaks to surrounding media must be repaired or replaced immediately.

2. Other factors which will drive the need for upgrade/replacement are: mission change (change in materials or frequency of use) and increase in volume of waste water entering the separator. A modification to the service contract for separator maintenance may solve the problem and should be considered prior to upgrade/replacement in such circumstances.

3. Elimination of separators must be considered and is in the interest of pollution prevention. Some areas where separators should be eliminated are as follows:

3.1 Maintenance Areas where small amounts of petroleum products can be absorbed with absorbent pads or mopped up and disposed of as part of the maintenance process. Hosing down leaks/spills should no longer be authorized.

3.2 Wash Racks: Unless a nonemulsifying soap is used, separators in these areas are ineffective because the detergents break down the oil droplets and cause them to become soluble in water. Any oil droplets smaller than 20 microns in diameter cannot be removed by gravity separation. A recycle system is expensive but can be a feasible solution. If the discharge is not hazardous and can be separated from storm water inflow, discharge to the sanitary sewer system may be permitted if approved by the local POTW. A grit removal chamber or screen is recommended to remove solids from entering the system.

3.3 If adequate spill containment can be implemented in areas without use of a separator, it is recommended that the separator be tested for hazardous waste, cleaned and emptied, and removed from service.

SECTION IX. OIL/WATER SEPARATOR MANAGEMENT RECORDS

1. Records of oil/water separators are important to protect the Air Force from liability for other parties' contamination and to provide history necessary for sound management decisions.

2. The separator records identified below are recommended for ensuring compliance:

2.1 Complete separator inventory as defined in SECTION IV, paragraph 1. The inventory should be updated as separators are added, removed, upgraded etc.

2.2 Separator maintenance contract as defined in SECTION V, paragraph 2.

2.3 Any catalog data, operation manuals/instructions, or descriptive information for each separator if available.

2.4 Any separator or separator component repair records, including CE work orders.

2.5 Inspection checklists and records completed by CE and the using agency. (one year holding time)

2.6 Inspection records by any regulatory agency.

SECTION X. CLOSURE GUIDANCE DOCUMENT Separator removal is not regulated unless a separate holding tank exists. In this case, the holding tank and its components must follow the guidance on USTs outlined in ACC's UST Management Guidance document and 40 CFR 280.71-280.74. In addition, a regulatory agency can require that testing be done to ensure that no contamination exists. It is good practice to complete testing of the separator contents and the surrounding area prior to closure.

SECTION XI. REFERENCES

1. **Oil/Water Separator Design Criteria**, 8 Jul 91, Charles G. Rhode, Colonel, USAF, Director, Operations & Maintenance, HQ Strategic Air Command (Rescinded)

2. **Gravity Oil/Water Separator Guidance**, HQ Strategic Air Command (Rescinded)

3. **Testing and Disposing of Waste Contained Within Oil/Water Separators, Grit Chambers, and Holding Tanks**, 12 Jun 90, Chester B. Duncan Jr, Capt, USAF, Chief, Information Management Branch, HQ Strategic Air Command (Rescinded)

4. **Maintenance of Industrial Wastewater/Gravity Oil/Water Separators**, 13 Jun 91, Robert A. Hipschman, P.E., Dep Director, Operations & Maintenance, HQ Strategic Air Command (Rescinded)

5. **Oil/Water Separation**, May/Jun 93, Paul N. Cheremisinoff, P.E., The National Environmental Journal

6. **Monographs on Refinery Environmental Control - Management of Water Discharges, Design and Operation of Oil/Water Separators**, Feb 90, API Publication 421

ATTACHMENT 1
INSPECTION CHECKLIST

1. Separator and Associated Components:

Skimmer positioned correctly and operated weekly (if manual type) or more often as required
Water Level at or one to two inches below the skimmer
Sludge Volume no greater than 20 percent of the tank's capacity
Grit Chamber properly maintained to allow proper flow into separator
Oil Collection Chamber does not exceed 75 percent of chamber volume
Effluent Chamber does not contain petroleum products

2. Maintenance Requirements:

Records kept of when separator is serviced and what work was done
Cleaning frequency is adequate and completed on time
If permitted, permit requirements are met
Changes are made to servicing if mission changes occur

3. Testing Criteria:

State and/or Local Regulatory requirements are met
Baseline of waste stream is established:
- Total Petroleum Hydrocarbons
- BTEX
- TCLP

Waste stream tested if it suspected that it differs from the baseline

PURPOSE OF DOCUMENT

A. This RCRA facility investigation (RFI) report documents the investigation of 25 solid waste management units (SWMUs) on Table 3 of Holloman AFB's HSWA permit. This document was prepared for, and in cooperation with, the Base Environmental Office: 49 CES/CEV, 550 Tabosa Avenue, Holloman AFB, NM, (505) 475-3931 and Foster Wheeler Environmental Corporation, Lakewood, CO 80228-1824, (303) 980-3520.

B. Information contained in the report will be used to support the Resource Conservation and Recovery Act corrective action program and was also prepared to comply with the Installation Restoration Program where applicable.

C. The primary objectives of the investigation were to: 1) determine whether a release of hazardous waste or hazardous constituents had occurred from any of the SWMUs and 2) define the nature and extent of waste constituents if it was determined that a release had occurred from a SWMU.

D. The report describes the regulatory framework, environmental setting, contains data evaluation criteria, and results, conclusions, and recommendations for each SWMU investigated.

E. No further action, conditional no further action, or further investigation is recommended for each of the SWMUs. Recommendations are based on results of the RFI, risk-based screening, and quantitative risk assessment.

DCN 97.670008.20

RFI REPORT
TABLE 3 RCRA FACILITY INVESTIGATION

Volume I

Prepared for:

49 CES/CEV
Holloman Air Force Base, NM

and

HQ ACC #CES/ESVR
Langley Air Force Base, VA

Prepared by:

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Under Contract No. DACW45-94-D-0003, DO No. 3, WAD No. 1 with:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

October 1997

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LIST OF ACRONYMS

AFB	Air Force Base
AGE	Aerospace ground equipment
AOC	Area of concern
ASTM	American Society for Testing and Materials
bgl	Below ground level
BTEX	Benzene, toluene, ethyl benzene, xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CL	Clay
CMI	Corrective measures implementation
CMS	Corrective measures study
CNFA	Conditional no further action
COC	Chemical of concern
COPC	Chemical of potential concern
DPT	Direct push technology
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
HHE	Human health and the environment
HSWA	Hazardous and Solid Waste Amendments
IR	Infrared
IRA	Interim Remedial Action
IRP	Installation Restoration Program
LNAPL	Liquid nonaqueous phase liquid
MS	Matrix spike
NCP	National Contingency Plan
NFA	No further action
NMED	New Mexico Environment Department
O/WS	Oil/water separator
PA	Preliminary assessment
POL	Petroleum, oil, and lubricants
QA/QC	Quality assurance/quality control
RA	Remedial Action
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial investigation
RL	Reporting Limit
SARA	Superfund Amendments and Reauthorization Act
SI	Site investigation
SM	Silty sand
SQCSR	Sampling and Quality Control Summary Report

LIST OF ACRONYMS (Continued)

SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
TDS	Total dissolved solids
TRPH	Total Recoverable Petroleum Hydrocarbons
USACE	U.S. Army Corps of Engineers
UST	Underground storage tank
UTL	Upper tolerance level
VCA	Voluntary cleanup action
VOC	Volatile organic compound

Section 1
INTRODUCTION

This report summarizes the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) at Holloman Air Force Base (AFB), New Mexico, for the Table 3 solid waste management units (SWMUs). Addressed in this report are the SWMUs appearing on Table 3 of the Hazardous and Solid Waste Amendments (HSWA) portion of Holloman AFB's RCRA permit. During the Table 3 RFI, 23 SWMUs were investigated. The remaining SWMUs on Table 3 have been already recommended for no further action (NFA), are being remediated under a voluntary cleanup action (VCA) or an interim remedial action (IRA), or will be remediated pending completion of remedial action (RA) designs.

The primary objectives of the RFI were to:

- Determine whether a release of hazardous waste or hazardous constituents had occurred from any of the SWMUs;
- Define the nature and extent of waste constituents if a release had occurred;
- Evaluate risk using a risk-based screen and quantify the risks for SWMUs where there are chemicals of concern (COCs); and
- Recommend no further action (NFA) or conditional no further action (CNFA) as appropriate for each of the SWMUs.

This section contains a brief discussion of the regulatory framework at Holloman AFB, a summary of the status of all Table 3 SWMUs, and a summary of the conclusions and recommendations for each of the investigated SWMUs. A brief overview of other sections in the report is also included.

1.1 Regulatory Framework

Holloman AFB has a RCRA permit for an on-site container storage area for currently generated hazardous wastes and is subject to the requirements of the RCRA corrective action program. The HSWA portion of Holloman AFB's RCRA permit requires that the Base investigate and remediate the release of any hazardous waste or constituents from active and inactive SWMUs listed on Tables 1, 2, and 3 of the HSWA permit.

Holloman AFB also implements the Installation Restoration Program (IRP) to ensure that past waste management sites are identified and remediated, as necessary, to mitigate hazards to human health and the environment. The IRP follows the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the 1986 statutory amendments to CERCLA (the Superfund Amendments and Reauthorization Act [SARA]) requiring federal facilities to comply with the National Contingency Plan (NCP).

As appropriate, the Base must comply with the requirements of both programs. Both are similarly phased and ultimately intended to ensure remediation of sites that pose a threat to human health or the environment. Prior to this investigation, four of the SWMUs on Table 3 had been investigated as part of the IRP program. This is discussed in further detail in Sections 1.2 and 1.3.

In addition to RCRA and the IRP, the Base must meet a cleanup standard for total recoverable petroleum hydrocarbons (TRPH) of 1000 mg/kg established by the State of New Mexico for Holloman AFB (see Appendix A for letter from the State of New Mexico Environment Department [NMED] dated 2 November 1992). Any vadose zone soils exceeding this level must

be remediated. The Base must also remediate any light non-aqueous phase liquids (LNAPLs) found on the groundwater.

1.2 Status of Table 3 SWMUs

Table 3 of Holloman AFB's HSWA permit currently contains 33 oil/water separators (O/WSs), the T-38 Test Cell Fuel Spill (SWMU 229), the Building 828 Fuel Spill (SWMU 230), the Officer's Club (Area of Concern-V [AOC-V]), and the Incinerator/ Landfill (SWMU 231). SWMUs 229, 230, and 231 and AOC-V have been or are being studied under other IRP investigations. Prior to this RFI, the 33 O/WSs had not been investigated. Table 1-1 lists each SWMU and its current status. Figure 1-1 shows the general location of each of the Table 3 SWMUs.

1.2.1 Status of SWMUs Not Investigated During this RFI

During the work plan stage of the investigation, a prescreen test was developed and agreed upon with U.S. Environmental Protection Agency (EPA) Region VI to identify sites that were considered to have a low possibility for having a release. Each SWMU was evaluated, and to pass the pre-screen test the SWMU had to meet all of the following criteria:

1) O/WS be less than 10 years old;

2) Have no history of leaks or spills;

3) Be a structurally sound unit; and

4) Have a documented history of good management.

Five of the O/WS SWMUs (5, 6, 26, 30, and 33) passed this pre-screen test and were therefore recommended for NFA in the EPA Region VI-approved *Work Plan, Table 3 RCRA Facility Investigation* (Radian, 1994a).

SWMU 21, the Building 702 O/WS, was investigated in conjunction with the Table 2 RFI (Radian, 1994b) because of its close proximity to SWMUs 22 and 123. A permit modification request will be submitted to move this SWMU to Table 2 of Holloman AFB's RCRA permit.

Of the remaining O/WS SWMUs, five SWMUs (3, 4, 8, 10, and 18) were not investigated because they are inactive and will be excavated. Their removal is being conducted as a voluntary cleanup action under the Base-wide petroleum, oil, and lubricants (POL) remediation; as part of the action, any contaminated soil around the SWMU will be removed during the excavation. Confirmation sampling will be conducted to ensure that all soil exceeding the Base-specific cleanup level has been removed.

The removal and remediation of SWMU 3 took place during two field efforts and was completed in September 1996. Approximately 1475 cubic yards of TPH-contaminated soil were excavated and disposed. Confirmation samples ranged from not-detected to 24 mg/kg.

SWMU 4 was removed in July 1995. Approximately 92 cubic yards of TPH-contaminated soil was excavated and disposed. Confirmation samples ranged from not-detected to 47 mg/kg.

SWMU 8 was removed and remediated during two field efforts and was completed in April 1997. Approximately 21 cubic yards of TPH-contaminated soil were excavated and disposed in August 1995. Additional excavation took place in April 1997. However, no soil with TPH in excess of 1000 mg/kg was detected and therefore no soil required offsite disposal. Confirmation samples ranged from not-detected to 78 mg/kg, excluding one confirmation sample (6500 mg/kg) taken adjacent to Building 231. No further

Table 1-1
Table 3 Solid Waste Management Units

SWMU No.	Unit Name	Current Status	SWMU No.	Unit Name	Current Status
1	Bldg. 55 O/WS	Phase I/II RFI	25	Bldg. 805 O/WS	Phase I RFI
3	Bldg. 130 O/WS	VCA	26	Bldg. 809 O/WS	NFA[c]
4	Bldg. 131 O/WS	VCA[a], Phase I RFI[b]	27	Bldg. 810 O/WS	Phase I/II RFI
5	Bldg. 137 O/WS	NFA[c]	28	Bldg. 822 O/WS	Phase I/II RFI
6	Bldg. 193 O/WS	NFA[c]	29	Bldg. 827 O/WS	Phase I RFI
7	Bldg. 198 O/WS	Phase I/II RFI	30	Bldg. 830 O/WS	NFA[c]
8	Bldg. 231 O/WS	VCA	31	Bldg. 855 O/WS	Phase I/II RFI
9	Bldg. 282 O/WS	Phase I RFI	33	Bldg. 869 O/WS	NFA[c]
10	Bldg. 283 O/WS	VCA	34	Bldg. 902 O/WS	Phase I/II RFI
11	Bldg. 300 O/WS	Phase I/II RFI	35	Bldg. 903 O/WS	Phase I RFI
12/13	Bldg. 304 and 304A O/WSs	Phase I/II RFI	37	Bldg. 1080 O/WS	Phase I/II RFI
			38	Bldg. 1080A O/WS	Phase I/II RFI
14	Bldg. 306 O/WS	Phase I/II RFI	41	Bldg. 1266 O/WS	Phase I/II RFI
16	Bldg. 315 O/WS	Phase I/II RFI	229	T-38 Test Cell Fuel Spill	IRA
18	Bldg. 500 O/WS	VCA			
19	Bldg. 638 O/WS	Phase I RFI	230	Bldg. 828 Fuel Spill	CMS/CMI
20	Bldg. 639 O/WS	Phase I RFI[d]	231	Incinerator/Landfill (IRP Site LF-58)	Phase I/II RFI
21	Bldg. 702 O/WS	NFA			
23	Bldg. 800 O/WS	Phase I/II RFI	AOC-V	Officer's Club (IRP Site SS-57)	CMS/CMI
24	Bldg. 801 O/WS	Phase I RFI			

CMI = Corrective measures implementation.
CMS = Corrective measures study.
IRA = Interim remedial action.
NFA = No further action.
RFI = RCRA facility investigation.
VCA = Voluntary cleanup action.

[a] O/WS only.
[b] Leach field only.
[c] Passed "pre-screen" test at work plan stage of RFI.
[d] Permit modification request in process to move SWMU to Table 2.

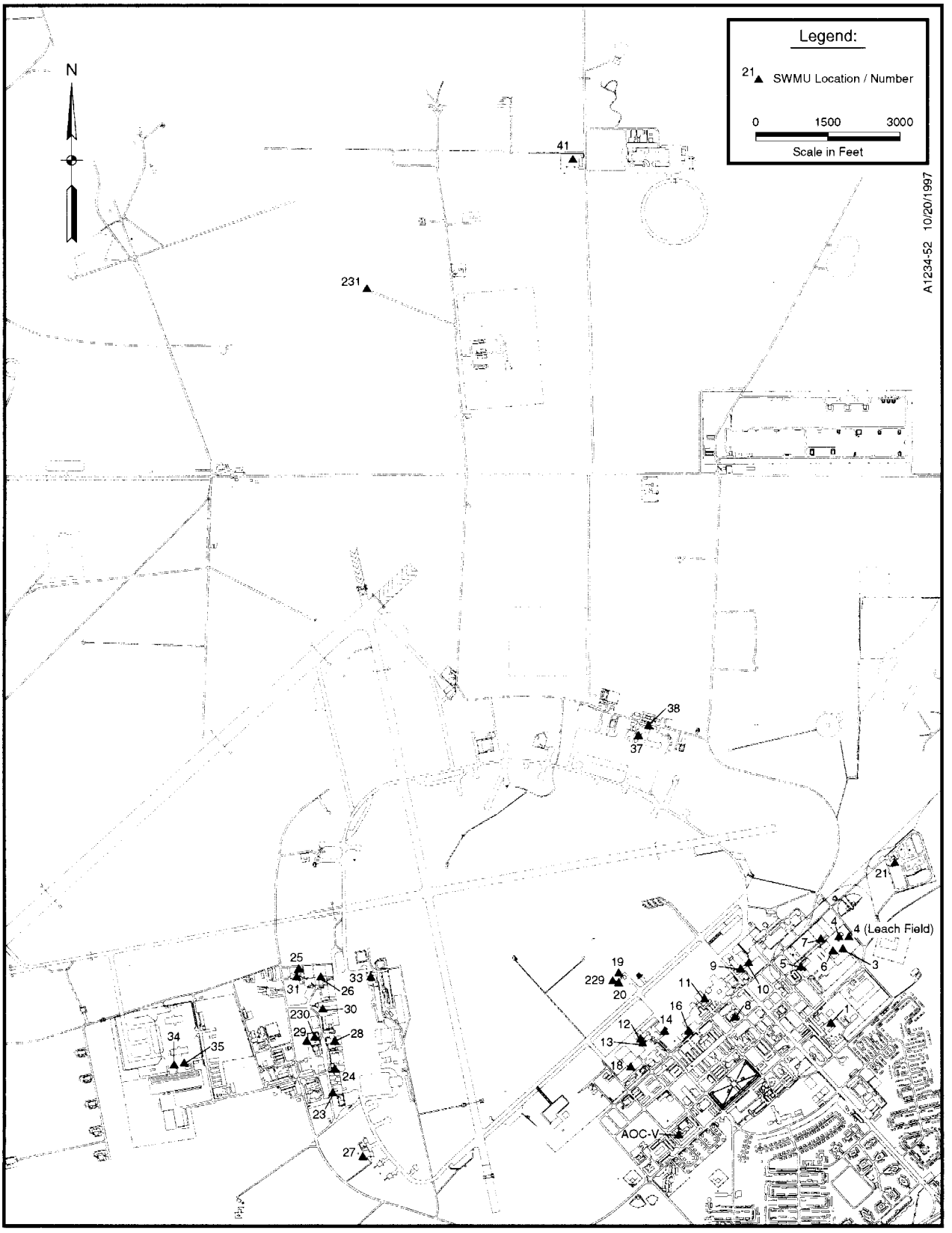

Figure 1-1. Location of the Table 3 SWMUs

excavation was possible. As discussed with NMED, in these cases where 80% to 90% of the contaminated soil has been removed and further remediation is not possible, NFA is appropriate.

SWMU 10 was remediated in August 1995. Approximately 50 cubic yards of soil were excavated but no soil was found with a TPH concentration in excess of 1000 mg/kg. Confirmation samples ranged from 12 mg/kg to 480 mg/kg. Again, no soil with TPH in excess of 1000 mg/kg was detected and therefore no soil required offsite disposal.

SWMU 10 is managed in accordance with the *Guidance on Management of Oil/Water Separators*, developed by Air Combat Command to insure proper maintenance and quarterly inspections.

SWMU 18 was removed and remediated in July 1995. Approximately 70 cubic yards of TPH-contaminated soil was excavated and disposed. Confirmation samples ranged from not-detected to 100 mg/kg.

More detailed information for SWMUs 4, 10, and 18 can be found in *Remediation of POL-Contaminated Sites and Oil/Water Separator Removals, Holloman Air Force Base, New Mexico, July-November 1995* submitted February 1996. Further details regarding SWMUs 3 and 8 can be found in *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico* to be submitted October 1997. Based on the remediation of these sites, SWMUs 3, 4, 8, 10, and 18 are all recommended for NFA.

The T-38 Test Cell Fuel Spill (SWMU 229), the Building 828 Fuel Spill (SWMU 230), and the Officer's Club (AOC-V) were investigated as part of the IRP program. SWMU 229 is currently in the IRA phase, and construction of a full-scale treatment system as part of an RA is scheduled to commence in the summer of 1995. The remedial technology being used at this site is a dual-phase, high-vacuum total fluid extraction system. A dual-phase remediation system is currently being designed for SWMU 230, and construction for the RA will also begin in the summer of 1995. AOC-V is currently in the corrective measures study/corrective measures implementation (CMS/CMI) stage of the RCRA process. Designs are being prepared for an in situ bioremediation system.

1.2.2 SWMUs Investigated During this RFI

Twenty-three O/WS SWMUs were investigated from October to December 1994 using an iterative, multiphase approach. Previous RFIs at Holloman AFB have been performed in two distinct phases: Phase I to determine whether a release has occurred, and Phase II to fully charac terize the nature and extent of the release. To expedite the RFI process and with the intent of bringing Table 3 SWMUs to RA or NFA, this RFI was designed to gather data required for Phase I and Phase II investigations in one comprehensive field effort by using efficient sampling techniques and in-field analysis.

In evaluating these SWMUs, a consistent procedure was used to determine whether a release had occurred. If it was determined that there had been a release from a SWMU, a Phase II investigation began immediately to evaluate the nature and extent of the release. Investigation continued at the SWMU until the extent of the release had been accurately determined. The technical approach and data evaluation criteria are presented in Section 3.

SWMU 231 (the Incinerator/Landfill) was also investigated between October and December 1994 under the Table 1 Phase II RFI. Because the nature of the field activities required to implement

Phase II at SWMU 231 were similar to the field activities for the Table 1 Phase II RFI, SWMU 231 was included in that investigation. SWMU 231 had been previously investigated under the IRP program (Site LF-58), and data had been gathered during the preliminary assessment/site investigation (PA/SI) that suggested releases had occurred to the surface soils. The Incinerator/Landfill, therefore, underwent a more typical Phase II investigation to further evaluate the nature and extent of releases at the site. A summary of the PA/SI results, along with the Phase II results, conclusions, and recommendations for this SWMU are presented in Section 6.

1.3 Summary of O/WS Investigation

The investigation of the 23 O/WS SWMUs involved field activities to collect environmental data to determine the nature and extent of any releases detected at the SWMUs. These activities were guided by the *Table 3 RFI Work Plan* (Radian, 1994a), which provided technical guidelines for performing the field investigation, including procedures for the execution of field tasks, criteria for data collection, quality assurance/quality control (QA/QC) procedures, and requirements for laboratory analysis. Guidelines to ensure the health and safety of project personnel were also completed prior to the investigation and can be found in Volume III of the *Table 3 RFI Work Plan*. The field investigation commenced in October 1994 and was completed in December 1994.

All samples for the Table 3 RFI were collected using direct push technology (DPT) or hand augers. With the DPT technique, soil was collected from a piston-type sampler, and groundwater was collected from temporarily installed slotted standpipes. All sampling equipment was thoroughly decontaminated as specified in the work plan. During the field investigation, all planned Phase I samples for the SWMUs investigated were collected, with the exception of two samples at SWMU 25 where poor sample recovery led to no samples at one of the locations. Fifteen of the Phase I SWMUs proceeded into a Phase II investigation. Soil and groundwater samples were collected to fully define vertical and lateral extent of the release and to characterize the release.

Following the field investigation and prior to preparation of this report, a QA/QC review of the analytical data was completed. QC data associated with this investigation indicate that chemical data are acceptable and defensible. Data show that QC mechanisms were effective in ensuring measurement data reliability within expected limits of sampling and analytical error. Data validation conclusions are presented in detail in the *Sampling and Quality Control Summary Report (SQCSR), Table 3 RCRA Facility Investigation, Holloman Air Force Base, NM* (Radian, 1995a). Greater detail on the field QA/QC activities is provided in the SQCSR. The data and conclusions for SWMU 231 are presented in the *Sampling and Quality Control Summary Report, Table 1 Phase II RCRA Facility Investigation, Holloman Air Force Base, NM* (Radian, 1995b).

This report summarizes the investigation and presents conclusions and recommendations for each of the investigated SWMUs. NFA was recommended for SWMUs where no release has occurred, where a release from the SWMU falls within an area currently being remediated, or where the SWMU results show no risk to human health. CNFA was recommended for SWMUs that pose no risk to human health but have TRPH-contaminated soil that must be remediated. The evaluation process for collecting and evaluating the data to make the recommendations is discussed in detail in Section 3. Tables 1-2 and 1-3 summarize results and recommendations for the Phase I and Phase I/II SWMUs, respectively.

Table 1-2
Investigation Summary for Phase I SWMUs

SWMU[a]	Release to Soil?	Type of Release	Maximum TRPH Concentration (mg/kg)	Special Considerations	Current Operation	RFI Recommendation
4 (Leach Field)	No	No Release	< 100	None	Abandoned	NFA
9	No	No Release	< 100	None	In use	NFA
19	Yes	Overflow	>1000	Suspected release from this SWMU will be addressed under the SWMU 229 IRA/RA	In use as sediment trap	NFA[b]
20	No	No Release	< 100	None	Abandoned	NFA
24	No	No Release	< 100	None	In use as sediment trap	NFA
25	No	No Release	< 100	None	Removed and replaced with new O/WS	NFA
29	Yes	Overflow	>1000	Suspected release from this SWMU will be addressed under the SWMU 230 CMI	Replaced with new O/WS	NFA[b]
35	No	No Release	< 100	None	Removed and replaced with new O/WS	NFA

CMI = Corrective measures implementation.
IRA = Interim remedial action.
NFA = No further action.
O/WS = Oil/water separator.
RA = Remedial action.
SWMU = Solid waste management unit.
TRPH = Total recoverable petroleum hydrocarbons.

[a] With the exception of SWMU 4, all investigated SWMUs are oil/water separators. Their associated building numbers are given in each subsection and are on the sample location figures.
[b] The original recommendation was conditional NFA. The TRPH-contaminated soils were removed under the Phase 2 Basewide POL project in 1996; therefore, the current recommendation is NFA.

Table 1-3
Investigation Summary for Phase I/II SWMUs

SWMU[a]	Soil					Groundwater		Special Considerations	Current Operation	RFI Recommendations
	Release to Soil?	Type of Release	Maximum TRPH (mg/kg)	Risk-Based Screen COCs[b]	Risk Assessment Results	Release in Groundwater?	Chemicals Detected in Groundwater			
1	Yes	Overflow	>1000	Benzo(a)pyrene, Mercury, Thallium	Risk within acceptable range.	Yes	VOCs and metals	Elevated TRPH results east of the SWMU are the result of previous asphalt paving activities.	In use	NFA[d]
7	Yes	Subsurface	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use as sediment trap	NFA[e]
11	Yes	Overflow	>1000	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Cadmium, Indeno(1,2,3-cd)pyrene	Risk within acceptable range.	Yes	VOCs, SVOCs, and metals	Interviews with personnel in Building 292 during the investigation indicated that above-ground tanks were located in the parking lot. These may be a potential distinct source.	Replaced with new O/WS	NFA[d]
12&13	Yes	Overflow	>1000	Benzo(a)pyrene	Risk within acceptable range.	Yes	VOCs, SVOCs, and metals	None	Replaced with new O/WS	NFA[d]
14	Yes	Subsurface	>1000[c]	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use	NFA[f]
16	Yes	Overflow	100 - 1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use	NFA
23	Yes	Subsurface	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use as sediment trap	NFA[e]
27	Yes	Overflow	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	Free-product lense	Abandoned and filled with sand	NFA[e]
28	Yes	Overflow/ subsurface	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	Release from SWMU 29 may affect results near SWMU 28.	Removed and replaced with new O/WS	NFA[d]

Table 1-3
(Continued)

SWMU[a]	Soil					Groundwater		Special Considerations	Current Operation	RFI Recommendations
	Release to Soil?	Type of Release	Maximum TRPH (mg/kg)	Risk-Based Screen COCs[b]	Risk Assessment Results	Release in Groundwater?	Chemicals Detected in Groundwater			
31	Yes	Subsurface	>1000	No COCs	NA	Yes	VOCs and metals	None	In use/ unknown	NFA[e]
34	Yes	Overflow/ runoff	100 - 1000	Beryllium, Cadmium	Risk within acceptable range.	Yes	VOCs and metals	None	In use as sediment trap	NFA
37	Yes	Overflow	100 - 1000	No COCs	NA	No	NS	None	In use	NFA
38	Yes	Subsurface/ overflow	100 - 1000	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene	Risk within acceptable range.	No	NS	Potential point sources or spills related to AGE machinery.	Inactive	NFA
41	Yes	Overflow	>1000	No COCs	NA	No	NS	None	In use as sediment trap	NFA[e]

COC = Chemical of concern.
NA = Not applicable.
NFA = No further action.
NS = Not sampled.
SVOC = Semivolatile organic compound.
SWMU = Solid waste management unit.
TRPH = Total recoverable petroleum hydrocarbons.
VOC = Volatile organic compound.

[a] All SWMUs are oil/water separators. Their associated building numbers are given in each subsection and are on the sample location figures.
[b] Arsenic was detected at levels above the EPA Region III risk-based concentration at all SWMUs except 11, 16, 27, and 31. However, all arsenic results were below the background upper tolerance limit. It was therefore eliminated as a COC.
[c] All soils with TRPH > 1000 mg/kg are below the water table.
[d] The original recommendation was conditional NFA. The TRPH-contaminated soils were removed during the Phase 2 Basewide POL project in 1996; therefore, the current recommendation is NFA.
[e] The original recommendation was conditional NFA. The oil/water separator and TRPH-contaminated soils were removed during the Phase 2 Basewide POL project; therefore, the current recommendation is NFA.
[f] The original recommendation was conditional NFA. The oil/water separator was taken out of service as part of the Phase 2 Basewide POL project; therefore, the current recommendation is NFA.

1.4 Organization of Report

This RFI report has a total of seven sections. The contents of Sections 2 through 7 are described below.

Section 2—Environmental Setting presents information about physiography, geology, hydrogeology, and land and water use. This information is fundamental to the technical development of the investigation and provides background information that is referred to in the report.

Section 3—Data Objectives and Evaluation Criteria presents the guidelines used to evaluate analytical results and formulate conclusions and recommendations. It includes discussions concerning the release determination criteria, decision processes, risk-based screen methodology, and risk assessment.

Section 4—Phase I SWMU Results presents the investigation results, conclusions, and recommendations for the SWMUs that underwent only a Phase I investigation.

Section 5—Phase I/II SWMU Results presents the investigation results, conclusions, and recommendations for the SWMUs that showed a release in the first phase of investigation and underwent a Phase II characterization for nature and extent of the release.

Section 6—SWMU 231 Investigation Results contains subsections describing the current and previous investigations at the Incinerator/Landfill (IRP Site LF-58).

Section 7—References contains a list of references used in preparing this RFI report.

Section 2
ENVIRONMENTAL SETTING

The following section describes the environmental setting of Holloman AFB, New Mexico. Detailed discussions of physiography, geology, and hydrogeology are presented. These discussions were compiled from existing Base records, published literature, previous reports, and this field investigation.

2.1 Geography

Holloman AFB is situated in south-central New Mexico, in the northwest-central part of Otero County (Figure 2-1). The Base occupies about 50,000 acres in the northeast quarter of Township 17S, Range 8E. Additional land extending northward is occupied by the White Sands Missile Range testing facilities. Privately and publicly owned lands border the remainder of the Base. The major highway serving the Base is Highway 70, which runs southwest from Alamogordo and forms a boundary between the Base and public lands. Alamogordo is located approximately 7 miles east of the Base. With a population of approximately 31,000, it is the only town of appreciable size within 40 miles of the Base. Holloman AFB has a population of approximately 5500.

2.2 Physiography

The Base is located in the Tularosa Basin, which is bound by the San Andres Mountains in the west and the Sacramento mountains in the east. The basin's interior plain has low relief, with altitudes ranging from about 4000 ft in the southwest to about 4400 ft in the northeast. The surrounding mountains rise abruptly to altitudes of 7000–12,000 ft.

The climate in the Tularosa Basin is arid, with low annual rainfall and low relative humidity. The surrounding mountain ranges greatly influence local weather. They modify approaching weather systems and provide orographic lifting, which produces summer thunderstorms. Mean annual precipitation is 7.9 in., mostly from thunderstorm activity from May through October. Winter is generally dry and is characterized by clear skies and erratic snowfall. The period from March through May is characterized by strong southerly wind flow and periods of blowing dust and sand.

The mean annual lake evaporation rate, commonly used as an estimate of the mean annual evapotranspiration rate, is approximately 67 in. per year. Therefore, the annual net precipitation (mean annual net precipitation minus mean annual evapotranspiration) for the Holloman AFB area is approximately minus 59 in. per year.

2.3 Geology

The Tularosa Basin is a bolson, or a basin that has no surface drainage outlet. Bolson deposits are sediments carried by water into a closed basin. The bolson fill in the Tularosa Basin is derived from the erosion of limestone, dolomite, and gypsum in the surrounding mountains. Coarser material is deposited at the base of the mountains; finer material is carried to the basin's interior. The near-surface bolson deposits consist of sediments that are of alluvial, eolian, and lacustrine or playa origin.

Alluvial fan deposits are characteristically laterally discontinuous units of interbedded sand, silt, and clay. The eolian deposits consist primarily of gypsum sand. Alluvial and eolian deposits are often indistinguishable because of the reworking of alluvial sediments by eolian processes. Lacustrine or playa deposits in the area consist of clay containing gypsum crystals. Lacustrine deposits are juxtaposed with alluvial fan and

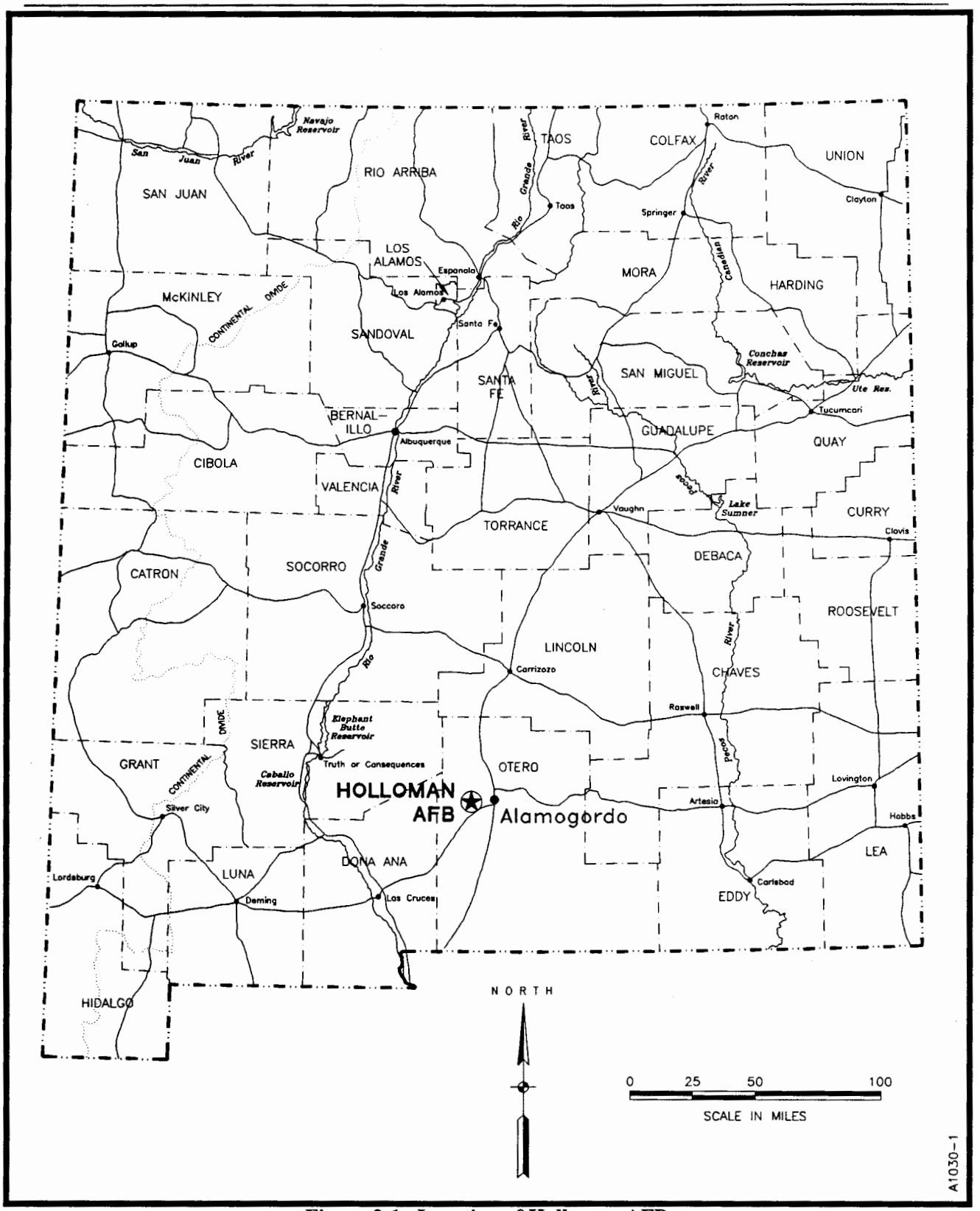

Figure 2-1. Location of Holloman AFB

eolian deposits throughout the Base *29 Sites Remedial Investigation (RI) Report*, (Radian, 1992).

2.4 Current and Future Land Use

Land use surrounding Holloman AFB consists of residential areas to the east and northeast (Alamogordo), rangeland to the south, the White Sands National Monument to the west, and military activities to the north. The desert terrain of the area surrounding Holloman AFB has limited development in the immediate vicinity. There are no agricultural operations, residential communities, or large industrial operations located adjacent to the Base.

Holloman AFB is an active military installation and is expected to remain active in the foreseeable future. No transfer of military property to the public domain is anticipated. Public access to the Base is restricted.

Residential development on Base is limited by environmental and operational constraints that include the 100-year floodplain, historic sites, and areas identified under the IRP. Safety and noise zones also limit residential development on Base. Future plans for residential development on Base include renovation of existing structure, replacement of inefficient buildings, and expansion into open areas in the southeast corner of the Base (*Horizons 2000 Facility Improvement Plan II*, Holloman AFB, 1987). Future land use is not expected to differ significantly from current land use practices.

2.5 Hydrogeology

Both surface water and groundwater contribute to the hydrological setting at Holloman AFB.

2.5.1 Surface Water

Since the Tularosa Basin is a closed basin with no surface water outlet, water is lost to evaporation, transpiration, and infiltration, or collects in

Lake Lucero, the lowest point in the basin, approximately 20 miles southwest of Holloman AFB.

The Base is crossed by several southwest-trending arroyos that control surface drainage in the undeveloped part of the Base (see Figure 2-2). These arroyos consist of Hay Draw, in the far northern part of the Base; Malone Draw and Ritas Draw, which drain into Lost River; and Dillard Draw to the east, which runs in a southwesterly direction along the eastern and southern boundaries of the Base. Lost River, the largest arroyo, is dammed near the western boundary of the Base. Runoff from Lost River, Malone Draw, and Ritas Draw collects in the dammed area. Drainage within the developed portions of the Base flows through ditches and culverts to various outfall areas.

The wastewater treatment system at Holloman AFB consists of seven aeration/ evaporation lagoons. Southwest of these lagoons, a natural playa lake known as Lake Holloman receives some runoff from the Base as well as effluent from the sewage lagoons. A dam/dike has been constructed across the southern quarter of Lake Holloman. Seepage through and overflow of the dam filled an existing smaller playa lake known as Lake Stinky.

2.5.2 Groundwater

To understand the effects of groundwater on the environmental setting, groundwater flow and groundwater quality must be understood.

Groundwater Flow

Groundwater occurs under unconfined conditions in the unconsolidated bolson deposits at Holloman AFB. The primary source of recharge for groundwater in the bolson aquifer is

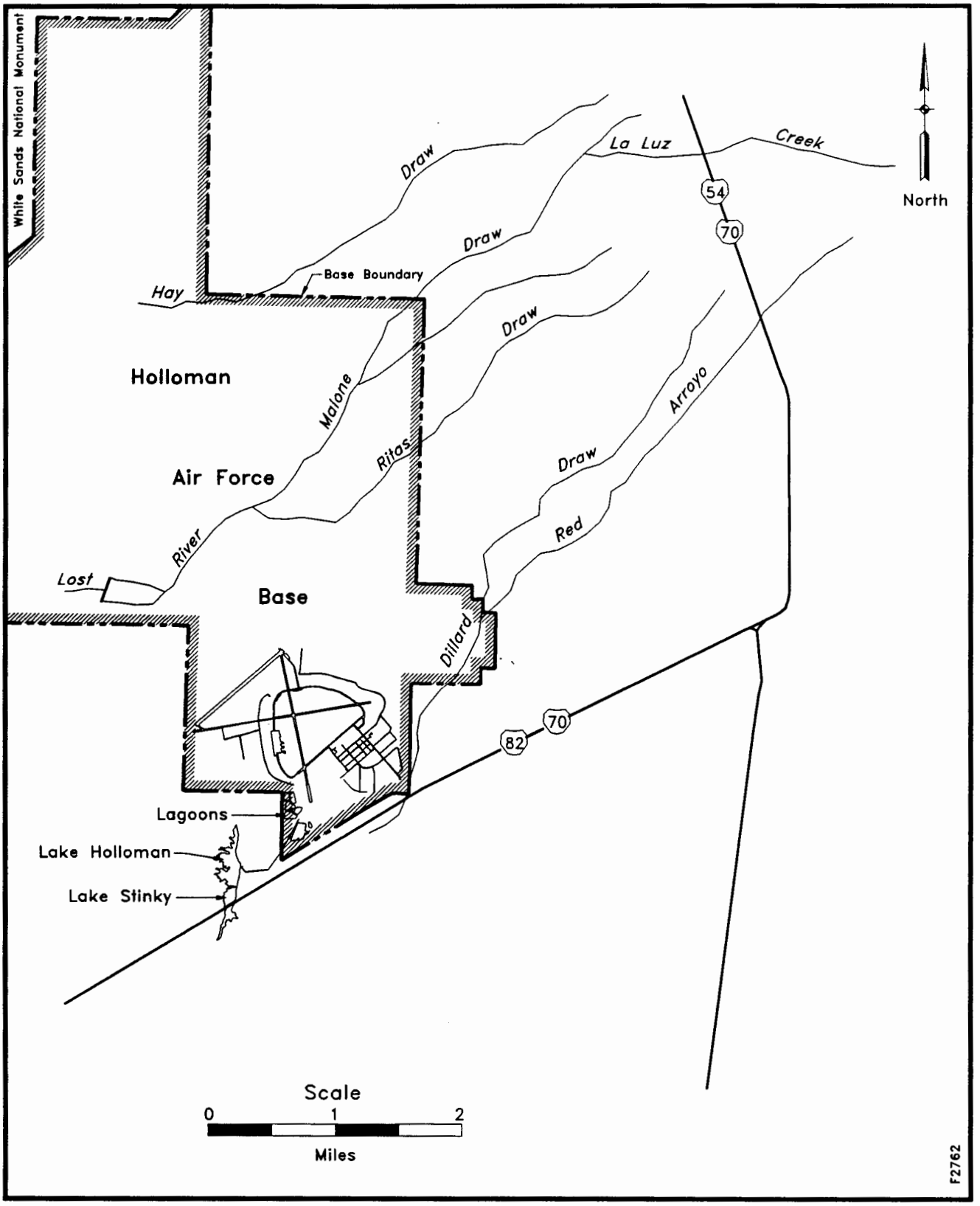

Figure 2-2. Surface Drainages at Holloman AFB

percolation of rainfall and stream runoff through the coarse, unconsolidated alluvial fan deposits along the western flank of the Sacramento Mountains. Water migrates downward into the bolson fill aquifer and flows downgradient through progressively finer grained sediments into the basin. Beneath Holloman AFB the depth to groundwater ranges from less than 5 ft to nearly 50 ft below ground level (bgl) .

A Base-wide synchronous water-level survey was conducted in March 1993, and a surface map of the aquifer was developed. In the vicinity of Holloman AFB, groundwater generally flows toward the west and southwesterly, following surface topography. Local groundwater flow direction, however, is influenced by the arroyos that drain the Base. In the southeastern portion of the Base, regional groundwater flows southwest, toward the Dillard Draw surficial drainage system. In the northern and western portions of the Base, groundwater flows in a more westerly direction, toward the Ritas Draw, Malone Draw, and Lost River drainages. Localized effects occur in areas immediately adjacent to arroyos, where groundwater flows directly toward drainage regardless of regional flow patterns.

Groundwater Quality

Water quality in the Tularosa Basin is good near the recharge areas at the base of the mountains, but groundwater becomes progressively more mineralized as it flows downgradient toward the interior of the basin. This decrease in water quality can be attributed to slow groundwater migration from recharge to discharge areas, and the presence of readily soluble minerals in the bolson sediments.

On the basis of New Mexico Water Quality Control Commission Regulations (NM WQCC 82-1, as amended through August 18, 1991, Parts 3-100 through 3-103), the groundwater beneath Holloman AFB is designated as unfit for human consumption because it exceeds New Mexico human health standards for total dissolved solids (TDS) and sulfate.

According to the EPA document *Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy* (U.S. EPA, 1986), the groundwater beneath Holloman AFB can be classified as III B. Class III groundwater is characterized by having a TDS concentration greater than 10,000 mg/L, and is not considered a source or a potential source of drinking water. Class III B groundwater is characterized by a low degree of interconnection to adjacent surface waters or groundwater of a higher class. Because the Tularosa Basin is a closed basin, its groundwater does not discharge or connect to any adjacent aquifers. Adjacent surface waters include Lost River and Lake Holloman, which also have high concentrations of TDS and thus are not potential drinking water sources.

2.6 Current and Future Water Use

At present, the primary fresh water resource for the City of Alamogordo is Lake Bonita, 60 miles northeast of the Tularosa Basin. Currently, there are no potable supplies of ground or surface water located on Base. Holloman AFB obtains its water supply from the City of Alamogordo and the Holloman AFB wells in Boles, San Andres, and Douglas well fields at the base of the Sacramento Mountains. No water supply wells are located on or near the Base because of poor groundwater quality. The nearest production well downgradient of Holloman AFB is a livestock well located 3.5 miles west of the Base (Computrac, Inc., 1986). No other downgradient or near-Base potable or irrigation wells exist.

Section 3
DATA OBJECTIVES AND EVALUATION CRITERIA

This section summarizes the objectives of the Table 3 RFI and the technical approach for meeting the objectives. It also presents the criteria used to evaluate the data and develop recommendations for the O/WS SWMUs investigated. The data objectives and evaluation criteria for SWMU 231 are addressed separately in Section 6 of this report.

3.1 Data Objectives

The primary objectives of the investigation are as follows:

- To determine whether a release of hazardous waste or hazardous constituents has occurred from any of the SWMUs (Phase I);
- To define the nature and extent of waste constituents if a release has occurred (Phase II); and
- To evaluate risk using a risk-based screen and quantify the risks for SWMUs where there are COCs.

To meet these objectives, analytical data were collected in the field and analyses of risk (risk-based screen and risk assessments) were performed. The overall objective of the RFI was to determine whether action is necessary to protect human health and the environment. To this end, the data objectives were used in deciding to recommend NFA, CNFA, or further evaluation for each of the SWMUs.

3.2 Technical Approach

The subsections that follow briefly summarize the technical approach used during this investigation to determine whether a release has occurred from the SWMU and to define the nature and extent of the release. Section 3.2 addresses only the technical aspects of the sample collection and analysis; a discussion of the key decision points and conclusions made during the investigation—the data evaluation criteria—follows in Section 3.3.

3.2.1 Phase I Sampling

Initially, each of the 23 SWMUs listed in Tables 1-2 and 1-3 were investigated by collecting soil samples directly adjacent to and on the sides of the unit. Samples were generally collected from the target intervals proposed in the work plan (at the surface and directly below the O/WS), unless there was reason to believe that by collecting only the target intervals a release could be missed (visual or olfactory evidence). In this case, the suspect interval was collected either in lieu of a target interval or in addition to the target interval.

Because all of the separators managed petroleum-based wastes during their operation, the Phase I samples were analyzed for an indicator compound (TRPH) to determine whether a release had occurred from the SWMU. TRPH was selected as the indicator compound because the separators managed oily petroleum wastes that would be detected by TRPH analysis and serve as the transport medium for other potentially hazardous constituents. The 23 O/WSs on Table 3 service five major operations on Base that produce wastewater with oily residues:

- Washracks;
- Vehicle maintenance;
- Aircraft and equipment maintenance;
- Corrosion control; and
- Engine test cells.

Wastes generated at these facilities include waste engine oils, hydraulic fluid, gasoline, diesel, jet fuel, grease, solvents, soaps, and other agents that may be used to clean engine parts. Elevated levels of TRPH, therefore, would be indicative of a release.

An infrared (IR) TRPH analyzer was used to analyze all field samples by modified EPA Method 418.1 (EPA 418.1M). This analysis was performed in a field laboratory with QA/QC measures including analysis of method blanks, matrix and laboratory control spikes, and laboratory and field duplicates. To validate the field analytical results, 10% of the field samples were split and analyzed in a fixed laboratory for TRPH by Method E418.1. Statistical analysis of relationships between samples analyzed by EPA Methods 418.1 and 418.1M showed good correlation (see Appendix B). Because of the need for rapid turnaround results during the investigation, results from EPA 418.1M were used in the field and are used throughout this report. TRPH tables in Sections 4 and 5, however, show results by EPA 418.1 for comparison.

3.2.2 Phase II Sampling

If a release was detected in Phase I, a Phase II investigation was triggered that focused on defining the nature and extent of the release. The objective of the Phase II investigation was not only to collect data to define the nature and extent of the release, but to collect the data required to perform a risk-based screen and support a risk assessment, if necessary. To determine the extent of the release, Phase II soil samples were collected and analyzed for TRPH in the field by E418.1M until the extent of TRPH contamination was laterally and vertically delineated.

To define the nature of the release, approximately 40% of the Phase II soil samples were split and submitted to a laboratory for complete characterization. Analytical methods used to define the nature of the release included:

- EPA Method SW8260—volatile organic compounds;
- EPA Method SW8270—semivolatile organic compounds;
- EPA Method 418.1—total recoverable petroleum hydrocarbons; and
- EPA Methods SW6010, SW7041, SW7060, SW7421, SW7740, and SW7841—RCRA metals.

Throughout the report this set of samples is referred to as "characterization" or "nature" samples. The intent of these samples was to determine which, if any, hazardous constituents were present and to evaluate the significant results of the analyses for risk to human health.

A similar field screening technique was used to determine the presence or absence and extent of groundwater contaminants. Temporary standpipes were installed and sampled at locations upgradient from the SWMU, at the SWMU, and downgradient of the SWMU. All groundwater samples were analyzed for TRPH by E418.1M. Two thirds of the groundwater samples were split and sent to a laboratory for full characterization by EPA Methods SW8260, SW8270, and E418.1 and RCRA metals.

3.3 Data Evaluation Criteria

To evaluate data, draw conclusions, and make recommendations consistently for every SWMU, a structured decision process was followed throughout all portions of the investigation. The following sections outline the evaluation criteria used at each decision-making step—determination of release, definition of nature and extent, and analysis of risk. The data evaluation

process is summarized in Figure 3-1. These procedures follow those that were established in the *Table 3 RFI Work Plan* (Radian, 1994a).

3.3.1 Determination of Release

Phase I samples were collected and analyzed in the field for an indicator compound, TRPH, to determine whether a release had occurred from the SWMU. As established in the work plan, a release was defined by a TRPH concentration greater than the release criterion: 100 mg/kg for soils and 10 mg/L for water.

3.3.2 Extent of Release to Soil

After a release was confirmed in Phase I, the investigation proceeded to Phase II. The release pathway was evaluated to further guide the investigation at the SWMU toward the area of the release. Two possible pathways for releases were identified for the O/WSs at the Base. The first pathway is a surface release from an overflow of the O/WS or a surface spill during sludge cleanout activities at the SWMU. The second pathway is a subsurface release from leaking pipes at the O/WS or a leaking O/WS chamber. In some instances it appeared that a combination of the above pathways had occurred. Once a determination of the release mechanism was made, a focused approach was used for collecting the Phase II samples.

On the basis of the TRPH results from the Phase I sampling, Phase II samples were collected by stepping out from the release using knowledge of the release pathway, field observations, and real-time TRPH results to guide the investigation. Ultimately, following the approved Table 3 RFI Work Plan, the TRPH analyses and 100-mg/kg release criterion were used to determine when the extent had been delineated at each of the Phase I/II SWMUs.

Phase II sampling was conducted by stepping out in three approximately perpendicular directions from each sample location showing TRPH concentrations greater than the 100-mg/kg release criterion. By always stepping out in three directions from a detected release greater than 100 mg/kg (referred to as a "hot spot"), a systematic gridding process was established that ensured consistent sampling at each of the SWMUs. Sampling proceeded until all hot spots were surrounded by samples with TRPH concentrations less than the release criterion. In this way the lateral extent of the release was fully delineated at all SWMUs.

Vertical extent was defined by sampling at 2-ft intervals from the release depth (surface or subsurface) to below the deepest contamination. The vertical extent of the release was delineated by continuing to sample at deeper intervals until results were less than the release criterion.

3.3.3 Characterization of Release to Soil

The nature of the release was characterized by analyzing a portion of the Phase II samples for volatile, semivolatile, and metal constituents. The soil characterization samples were collected inside and outside the area of contamination to ensure accurate characterization and to verify that extent has been defined. Samples for characterization were selected on the basis of their representativeness of site conditions and were collected primarily for their use in the risk-based screen or potential risk assessments.

3.3.4 Risk-Based Screen

Following the field investigation, a risk-based screen was used to evaluate the significance of any releases. Risk-based screening is a conservative procedure for identifying the constituents at a site that have the potential to pose a risk to human health and the environment. By using a risk-based screen, constituents at the site that are unlikely to contribute significantly to risk are eliminated, allowing the quantitative risk assessment to focus on the remaining constituents. The

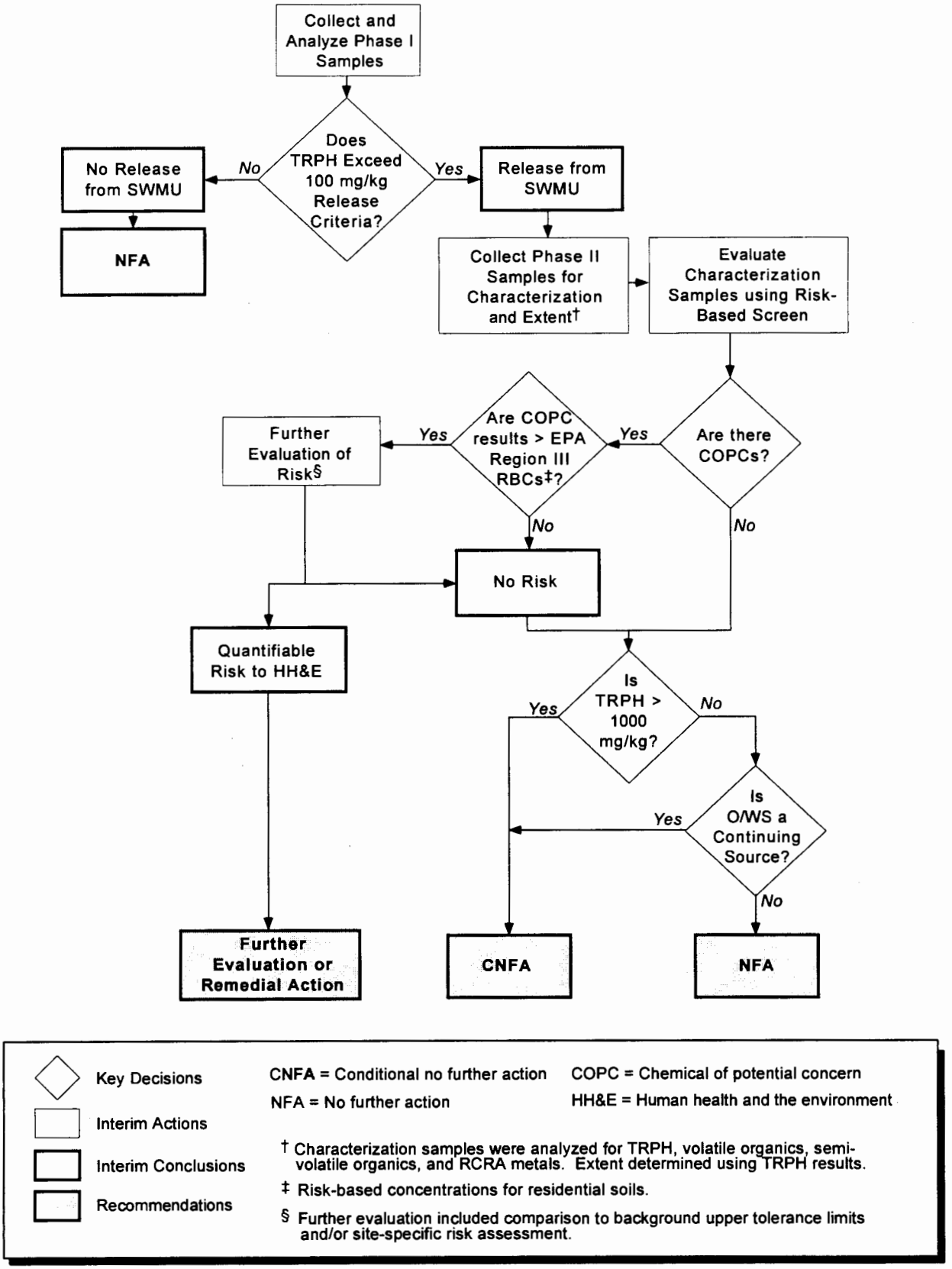

Figure 3-1. Decision Process for RFI Recommendations

risk-based screen is essentially a comparison of detected concentrations at a site with calculated, chemical-specific screening levels as described in "Selecting Exposure Routes and Chemicals of Concern" (U.S. EPA, 1991). The screening levels that were used for comparison are based on a worst-case exposure scenario and include an additional safety factor to ensure conservatism. The following text and Figure 3-2 explain the risk-based screen in greater detail.

The risk-based screen incorporated data for all constituents at a SWMU that were detected at greater than 5% of the blank upper tolerance limit (UTL). Additionally for metals, analytes were selected only if they were determined to be significantly different than the background mean (*Base-wide Background Study—Sewage Lagoons and Lakes Investigation, Holloman Air Force Base*, Radian, 1993) at Holloman AFB. These SWMU-specific analytes, called chemicals of potential concern (COPCs), were then compared with their respective risk-based screening levels. The screen compares the maximum detected concentration for each constituent with a risk-based concentration (RBC) calculated using EPA Region III's methodology for risk-based screening (U.S. EPA, 1991) and the most current available toxicity information. The equations used for calculating Region III levels are based on a residential exposure scenario and the ingestion pathway. Constituents that had a maximum detected concentration below the conservative risk-based level are considered to pose no significant risk to human health and were eliminated from further consideration. All other constituents are retained for further evaluation and are considered to be COCs. These COCs were then evaluated on an individual basis.

Upon further evaluation of the COCs, it was found that arsenic was present at 12 of the 15 Phase I/II SWMUs at levels above the RBCs. At all of these SWMUs, the maximum detected concentration of arsenic was below the background UTL for Holloman AFB. Because of this, and the fact that arsenic is unlikely to be related to oil/water separators, it was eliminated as a COC at these SWMUs. Arsenic is commonly found at naturally occurring levels above risk-based levels at Holloman AFB and the surrounding area. All other SWMUs showing COCs after the risk-based screening and further evaluation were carried forward for further evaluation in the risk assessment. Appendix C contains a detailed risk-based screen methodology and a list of COPCs at each site; the supporting statistical analysis is provided in Appendix B.

3.3.5 Risk Assessment

the screen were evaluated according to the most significant and most conservative exposure pathways for each constituent. The pathways considered were dermal contact with soil, ingestion of soil, and inhalation of fugitive dusts. Because the SWMUs are all O/WSs that are mostly covered by drain rock, asphalt, or concrete, a construction/maintenance worker excavating around the O/WS is considered to be the only likely receptor. The exposure parameters to this receptor were based on an industrial setting and the amount of time required to excavate the maximum amount of contaminated soil at each of the SWMUs. The complete methodology, results, and conclusions of the risk assessment are detailed in Appendix D.

3.3.6 Extent and Characterization of Release in Groundwater

The objective of groundwater sampling during Phase II was to determine whether constituents released to the soil had impacted the groundwater at the SWMU. The extent of the groundwater contamination was evaluated in the context of both analytical soil and groundwater results for TRPH, and the nature of the release was evaluated based on groundwater characterization samples.

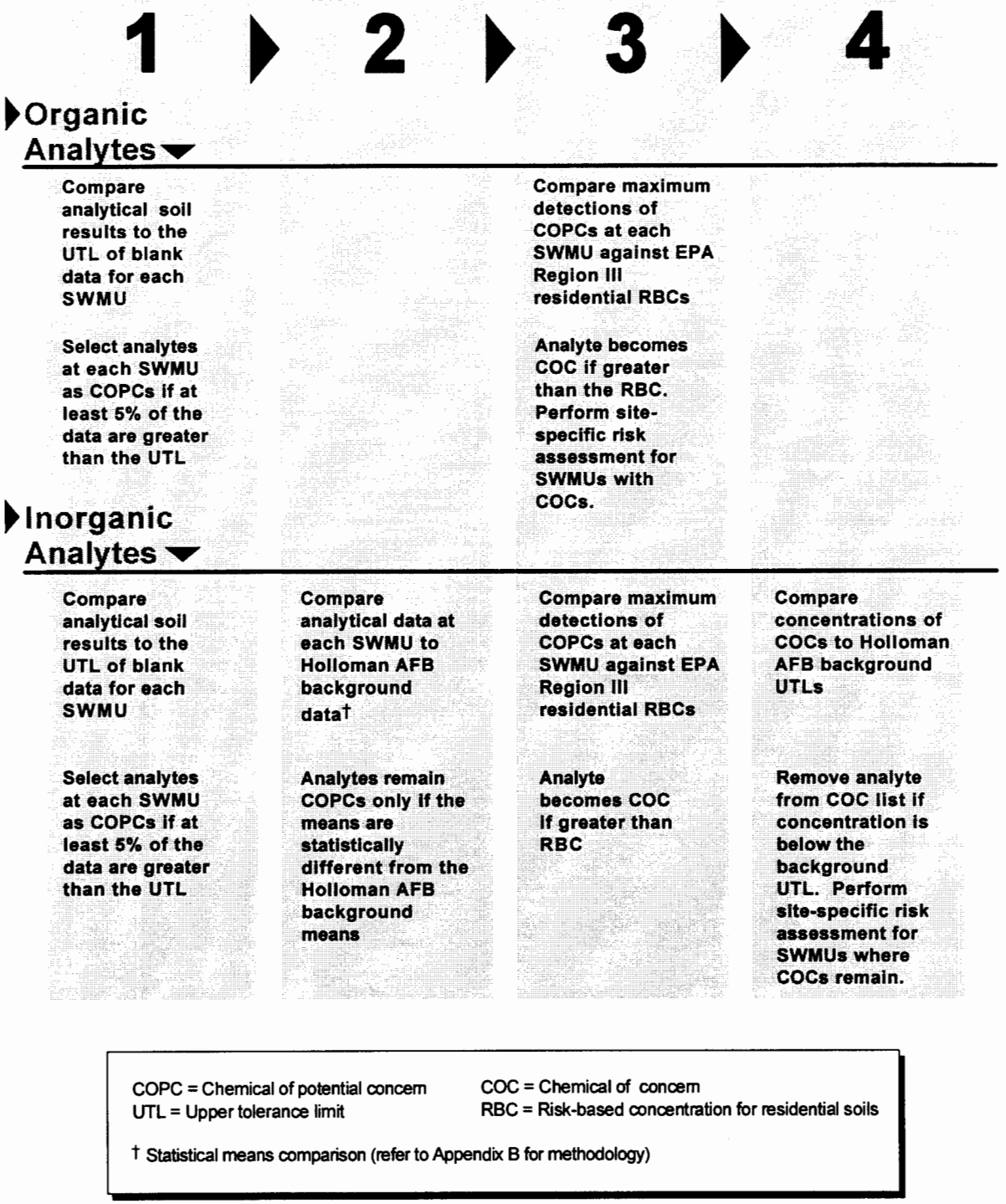

Figure 3-2. Summary of the Risk-Based Screening Process.

Before groundwater samples were collected at the Phase II SWMUs, the release pathway at each SWMU was evaluated. Groundwater was sampled only at SWMUs where TRPH in soil was detected at a depth immediately above or into the groundwater table. At these SWMUs, groundwater samples were collected upgradient of the SWMU for TRPH analysis, and groundwater samples were also collected from beneath the contaminated soil zone and downgradient of the SWMU for TRPH and characterization analysis. Using field results, if either the initial upgradient or downgradient samples contained TRPH concentrations greater than the 10-mg/L release criterion, an additional sample was taken farther from the source to evaluate the extent of the release to groundwater. At all SWMUs, groundwater was sampled downgradient of the source until TRPH was less than 10 mg/kg.

Above all, the analytical results for groundwater were evaluated with respect to the affected aquifer. The aquifer at Holloman AFB is a Class III B, nonpotable aquifer and, therefore, is not considered a potential drinking source (see Section 2.5.2). There are no potential receptors for the groundwater and thus it was not considered in the risk-based screen.

Continuing releases to the groundwater, however, are unacceptable to Holloman AFB and the State of New Mexico (see Appendix A for letter from NMED dated 25 January 1993). Therefore, releases to the vadose zone soil above 1000 mg/kg (the Base-specific cleanup level) will be remediated to prevent further releases to the groundwater. Leaks from any separator showing subsurface contaminant releases will be mitigated to also prevent further releases to the groundwater. Any LNAPL detected at a site would also be remediated.

3.3.7 Decision Process for Recommendations

On the basis of the decisions made using the analytical results, the risk-based screen, and risk assessment, one of three possible recommendations could be made for each SWMU. These recommendations are discussed below.

NFA—No further action was recommended for SWMUs where TRPH did not exceed the 100-mg/kg release criterion, and therefore there was no significant release from the SWMU. NFA was also recommended when there was no risk at the SWMU based on risk-based screen or risk assessment results *and* TRPH in vadose zone soils was less than 1000 mg/kg.

CNFA—The recommendation of CNFA was made for SWMUs where TRPH concentrations exceeded the Base-specific standard for TRPH of 1000 mg/kg or when action is necessary to prevent further releases to the environment. The condition of NFA for these SWMUs varies depending on the current status of the unit and the type of release. For SWMUs where the release was caused by a historic overflow, the condition of NFA may be limited to remediation of the vadose zone soil that exceeds the Base-specific cleanup standard (1000 mg/kg). In cases where a release appears to be caused by a leaking separator, remediation of soil above 1000 mg/kg will be combined with an action to mitigate further releases. Remediation of contaminated soil may include, but is not limited to, excavation, bioremediation, or in situ treatment.

Further Evaluation—No SWMUs were recommended for further evaluation. The risk-based screen and risk assessment indicate that there is no risk to human health at any of the SWMUs. All SWMUs with TRPH greater than 1000 mg/kg will be remediated and sources of groundwater contamination will be removed.

Section 4
PHASE I INVESTIGATION RESULTS

SWMUs that underwent a Phase I investigation only are presented in this section. Of these eight SWMUs, six are recommended for NFA because a release was not identified. Although a release was suspected from the remaining two SWMUs (19 and 29), they were not investigated further because of their proximity to other SWMUs that are currently undergoing an RA or that will be under remediation through a CMI. The release from SWMU 19 will be remediated with the SWMU 229 IRA and forthcoming RA; the release from SWMU 29 will be remediated with SWMU 230. CNFA is recommended for these SWMUs with the condition of NFA being the remediation of the TRPH-contaminated soils. This approach was approved by the EPA during a conference call in November 1994 (see Appendix A for the meeting notes).

A list of the Phase I SWMUs and a summary of the results and recommendations at each site are provided in Table 4-1. The locations of each SWMU are shown in Figure 4-1. Each of the Phase I sites are presented in a consistent manner beginning with a summary of the results and recommendations, and followed by subsections describing each SWMU, the geological and chemical results, conclusions, and recommendations. Background descriptions were compiled from information gathered in the RCRA facility assessment (RFA) (*RCRA Facility Assessment Preliminary Review/Visual Site Investigation*, A.T. Kearney, 1990), during the literature search (conducted prior to writing the *Table 3 RFI Work Plan*, Radian, 1994a), and during this investigation.

For each SWMU, the analytical data are presented in a figure and a table. The figure shows sampling locations in plan view and an isometric inset (or result boxes for some SWMUs) illustrates the depth of the samples and their associated result. The table presents TRPH results at each SWMU and includes duplicate and confirmation results. Section 4.7 (SWMU 29) also has a figure showing results from previous investigations at SWMU 230.

Appendix E contains photographs of each separator, and Appendix F contains the field data for the Phase I investigation SWMUs (boring logs and survey data).

Table 4-1
Investigation Summary for Phase I SWMUs

SWMU[a]	Release to Soil?	Type of Release	Maximum TRPH Concentration (mg/kg)	Special Considerations	Current Operation	RFI Recommendation
4 (Leach Field)	No	No Release	< 100	None	Abandoned	NFA
9	No	No Release	< 100	None	In use	NFA
19	Yes	Overflow	>1000	Suspected release from this SWMU will be addressed under the SWMU 229 IRA/RA	In use as sediment trap	NFA[b]
20	No	No Release	< 100	None	Abandoned	NFA
24	No	No Release	< 100	None	In use as sediment trap	NFA
25	No	No Release	< 100	None	Removed and replaced with new O/WS	NFA
29	Yes	Overflow	>1000	Suspected release from this SWMU will be addressed under the SWMU 230 CMI	Replaced with new O/WS	NFA[b]
35	No	No Release	< 100	None	Removed and replaced with new O/WS	NFA

CMI = Corrective measures implementation.
IRA = Interim remedial action.
NFA = No further action.
O/WS = Oil/water separator.
RA = Remedial action.
SWMU = Solid waste management unit.
TRPH = Total recoverable petroleum hydrocarbons.

[a] With the exception of SWMU 4, all investigated SWMUs are oil/water separators. Their associated building numbers are given in each subsection and are on the sample location figures.
[b] The original recommendation was conditional NFA. The TRPH-contaminated soils were removed under the Phase 2 Basewide POL project in 1996; therefore, the current recommendation is NFA.

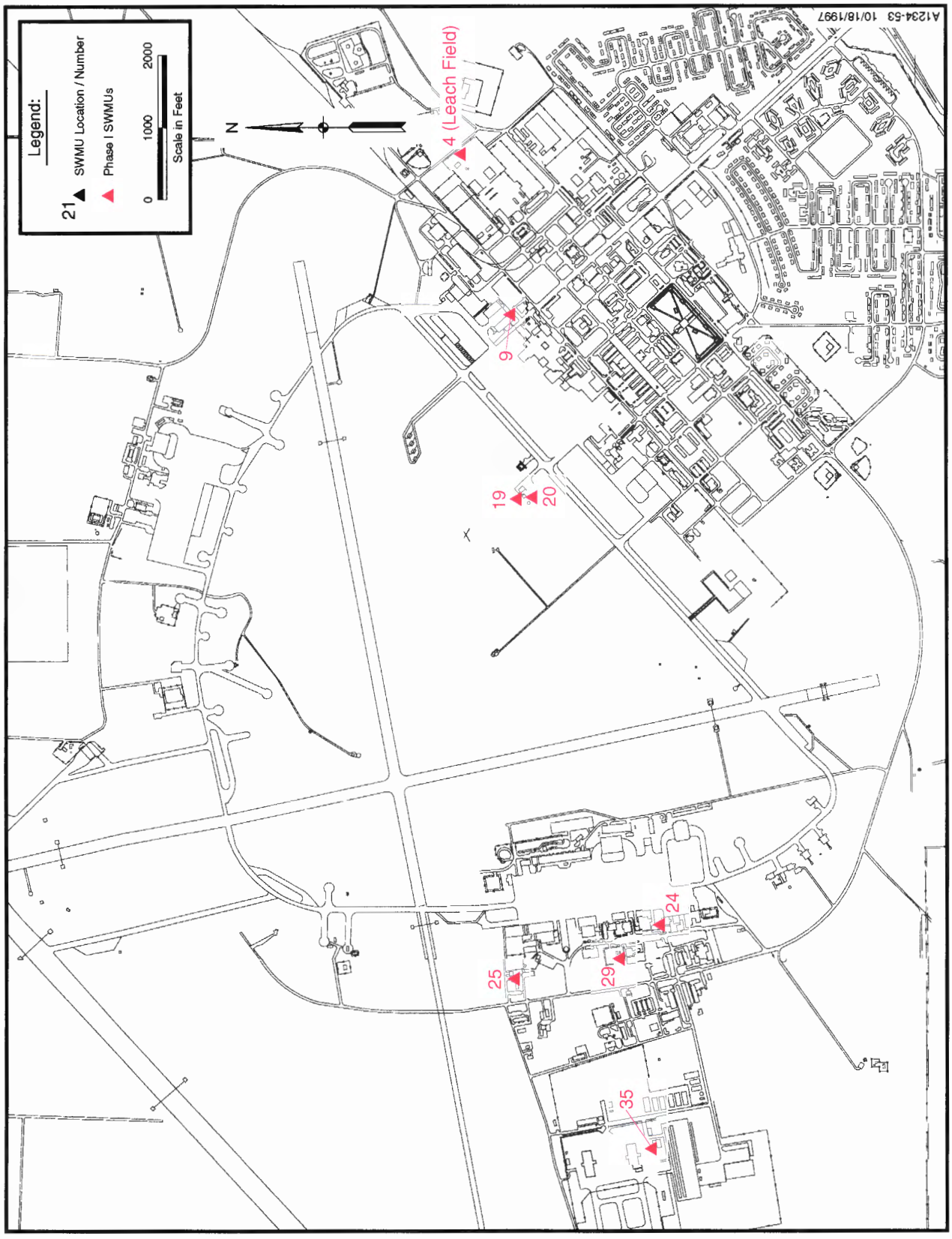

Figure 4-1. Location of the Phase I SWMUs

4.1 SWMU 4, Leach Field–Building 131 O/WS

SWMU 4 serviced the washrack near Building 131 in the vehicle maintenance area. The separator has never been connected to the sewer system and during its use drained to a leach field east of Building 195.

The area of the reported leach field was investigated during this RFI to determine whether hazardous constituents had been released from the SWMU. Phase I soil samples were collected at locations in the area of the leach field and near Building 195. The separator itself is scheduled to be excavated as part of the Base-wide POL remediation (see Section 1.2.1), so no investigation was performed at locations adjacent to the O/WS.

Analytical TRPH results indicated that there have been no releases in the area of the suspected leach field. For this reason, SWMU 4 is recommended for NFA.

4.1.1 SWMU Description

Unit Type: Single-chamber O/WS
Period of Operation: Pre-1970 to 1980
Current Status: Inactive
Disposition of Unit: Abandoned in place; to be excavated as part of Base-wide POL remediation
Source of Waste: Washrack (no longer in use)
Major Operations: Washing all types of vehicles
Construction Material: Steel and concrete (cylindrical chamber at bottom of unit)
Physical Condition: Very old and rusted; walls on three sides only
Total Capacity: 50 gal.
Historic Releases: RFA noted stains on the concrete pad near the unit, indicating a potential overflow

4.1.2 Investigation Results

Geology and Hydrogeology

The near surface lithology at the SWMU 4 leach field consists of silty sand and sand with silt. Groundwater was encountered at approximately 3 ft. Details of the site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 4.1-1, three locations were sampled in the area of the suspected leach field. One sample (04-05) was collected near the corner of Building 195, where it was reported that the leach field pipe was encountered during construction of the building. The depths at which each of the samples were collected are indicated on the figure.

All samples were analyzed for TRPH by EPA 418.1M. The results are listed in Table 4.1-1. TRPH concentrations at each location are below or near the reporting limits and substantially below the 100 mg/kg release criterion. No odor or visible staining was seen at any of the sampling locations.

4.1.3 Conclusions

There is no evidence to support that there has been a release in the area of the suspected leach field or along the drain pipe to the leach field. TRPH results at all sampling locations were considerably less than 100 mg/kg, indicating that there has been no release associated with the SWMU.

4.1.4 Recommendations

NFA is recommended for SWMU 4. To achieve NFA status, a Class 3 permit modification request will be completed by Holloman AFB, pending the removal of the SWMU 4 O/WS.

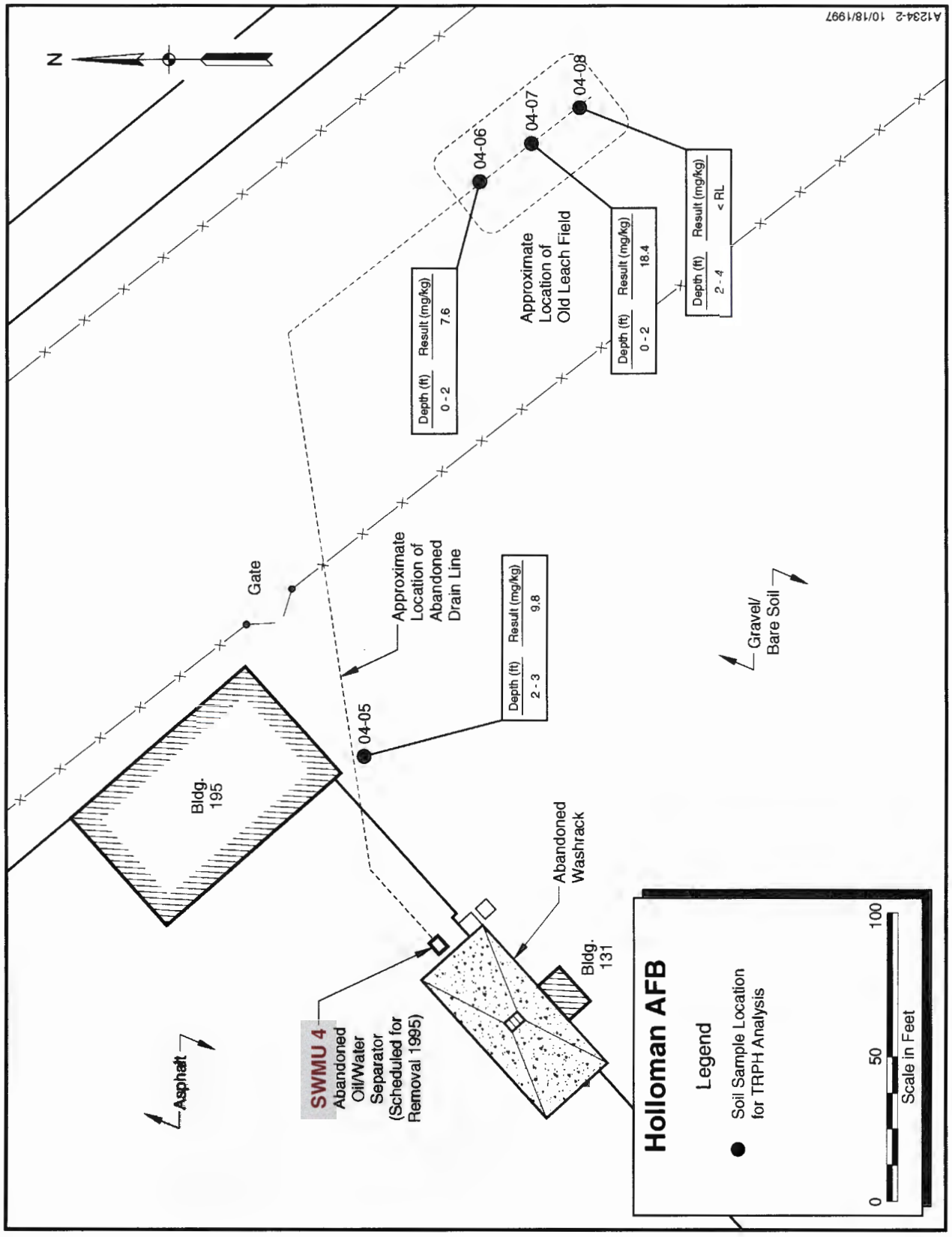

Figure 4.1-1. SWMU 4, Leach Field - Building 131 O/WS Sample Locations and Phase I TRPH Results

Table 4.1-1
TRPH Results for Soil at SWMU 4

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
04-05	2	3	9.8	04-07	0	2	18.4
04-06	0	2	7.6 (< RL)	04-08	2	4	< RL

RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈30 mg/kg).
( ) = Result from fixed analytical laboratory.

4.2 SWMU 9–Building 282 O/WS

SWMU 9 services aircraft maintenance and corrosion control operations in Building 282. In 1991, a sediment trap was added upstream of this SWMU.

To investigate whether a release had occurred from the Building 282 O/WS, samples were collected on all sides of the separator at two depths and analyzed for TRPH. Results from all samples indicate that there have been no significant releases from this SWMU. SWMU 9 is recommended for NFA.

4.2.1 SWMU Description

Unit Type: Three-chamber O/WS
Period of Operation: 1978 to present
Current Status: Active
Disposition of Unit: Continued use
Source of Waste: Building 282
Major Operations: Corrosion control and aircraft and engine maintenance
Construction Material: Concrete
Physical Condition: Concrete in good condition
Oil/Total Capacity: 160 gal./1000 gal.
Historic Releases: None known

4.2.2 Investigation Results

Geology and Hydrogeology

The soils around the separator consists of fine-grained sand with silt. The lithology is homogeneous in the first 8 ft, but grades rapidly into a silty sand at approximately 8.5 to 9 ft. The groundwater table was encountered at 4 ft. Details of site geology are provided in the boring logs in Appendix F.

Phase I Investigation

Four locations were sampled on each of the four sides of the separator and one location was also sampled down slope from the adjoining sediment trap. Sample locations and depths are shown in Figure 4.2-1. TRPH analysis was performed on each of the samples and results indicated no detections of TRPH above the release criterion. Analytical results are provided in Table 4.2-1 and on the figure.

4.2.3 Conclusions

TRPH results indicate that there has been no release from the separator. Slightly elevated results at location 09-02 suggest that an isolated surface spill may have occurred at this location. The concentration of TRPH, however, is well below 100 mg/kg, and boring logs show no visible evidence of a release.

4.2.4 Recommendations

NFA is recommended for SWMU 9. A Class 3 permit modification request will be submitted to NMED for this purpose. In addition, this unit will be managed according to Holloman AFB's *Guidance on Management of Oil/Water Separators*, developed by Air Combat Command to insure proper maintenance and quarterly inspections.

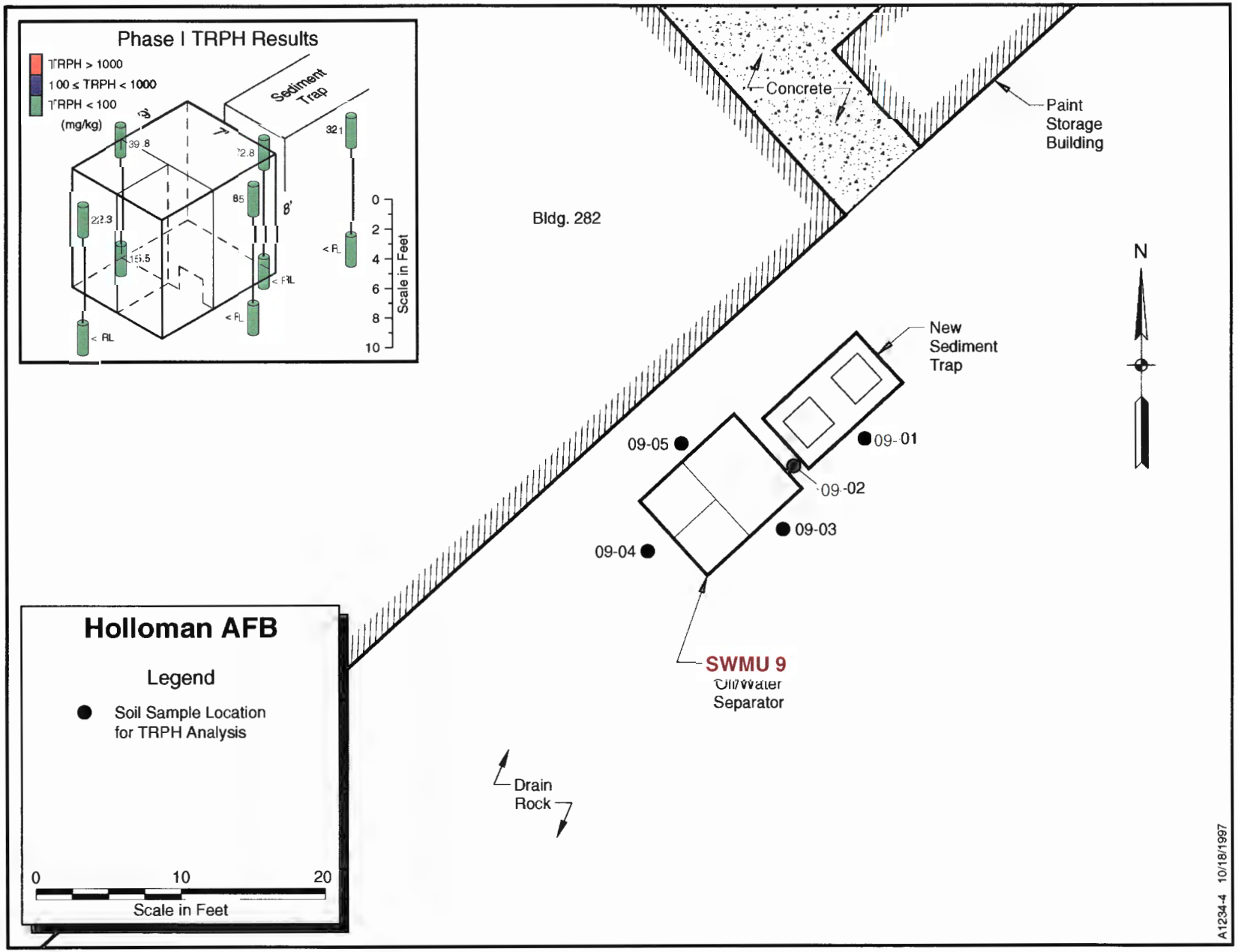

Figure 4.2-1. SWMU 9 - Building 282 O/WS Sample Locations and Phase I TRPH Results

Table 4.2-1
TRPH Results for Soil at SWMU 9

Location	Depth (ft)		TRPH (mg/kg)	Location	Depth (ft)		TRPH (mg/kg)
	Top	Bottom			Top	Bottom	
09-01	0	2	32.1	09-04	0	2	22.3
	8	10	< RL		8	10	< RL
09-02	0	2	72.8/60 (57.9/50.4)	09-05	0	2	39.8
	8	10	< RL		8	10	15.5
09-03	0	2	8.5				
	8	10	< RL				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit, 5 mg/kg.
( ) = Result from fixed analytical laboratory.

4.3 SWMU 19–Building 638 O/WS

SWMU 19 services the engine test cell and aircraft maintenance operations in Building 639. The effluent from this O/WS used to drain to a leach field until a new separator was installed in 1991. The oil collected in the separator was stored in a separate oil storage tank. The original separator (SWMU 19) was converted to a sediment trap when the new O/WS was installed. Currently, the new separator effluent pipe is plugged, and the oil and water are removed regularly.

The area surrounding SWMU 19 and its leach field were investigated under SWMU 229 (T-38 Test Cell Fuel Spill) for a 400,000-gallon JP-4 fuel spill discovered in 1993. Across the site, LNAPL is present. Subsurface contamination associated with the fuel spill was reported as shallow as 3 ft bgl (*Multi-Site RFI Report*, Woodward-Clyde, 1993). An IRA has been in place since 31 March 1995 to address contamination in the area. The T-38 IRA consists of a high vacuum, total fluid extraction system consisting of 11 extraction wells from which soil gas, groundwater, and jet fuel are extracted. Fluids are separated at a treatment compound, where jet fuel is stored, soil gas is burned in a thermal oxidizer, and groundwater is treated and then discharged to an infiltration gallery. A full-scale RA is being designed and will be constructed in the summer and fall of 1995.

Elevated levels of TRPH, distinct from the spill at SWMU 229, were detected in the shallow soils around SWMU 19. The release, however, is insignificant compared with the T-38 test cell release. The affected soil will be remediated in conjunction with the T-38 test cell IRA and RA. Therefore, CNFA is recommended for SWMU 19.

4.3.1 SWMU Description

Unit Type: Single-chamber O/WS with separate oil storage tank

Period of Operation: 1977 to present

Current Status: Active

Disposition of Unit: Converted to a sediment trap in 1991; continued use

Source of Waste: Building 639

Major Operations: Engine test cell and maintenance

Construction Material: Concrete

Physical Condition: Concrete in fairly good condition; corroded pipes

Oil/Total Capacity: 250 gal./400 gal.

Historic Releases: Contaminated soil discovered during installation of new O/WS

4.3.2 Investigation Results

Geology and Hydrogeology

The near-surface soils at SWMU 19 consist of damp, reddish-yellow and pink fine-grained sand with silt. Olive-gray staining is prevalent in all borings beginning at 3 to 5 ft and continues with depth. The staining, however, is attributed to the free-product plume from the T-38 Test Cell Fuel Spill. Bluish-black staining was observed at location 19-02 and may be related to SWMU 19. Groundwater was encountered at approximately 6 ft bgl. Appendix F contains boring logs showing the specific geology at SWMU 19.

Phase I Investigation

Eleven samples were collected around the old O/WS, old leaching tank, excavated soil pile, and surrounding area (Figure 4.3-1). Results at locations 19-02 and 19-07 show TRPH concentrations above 100 mg/kg in the surface interval. The samples at location 19-11 in the excavated soil pile also show results greater than the release criterion. Samples at locations 19-04, -05, -08, and -09 show relatively high TRPH concentrations, but these samples were collected from depths greater than 3.5 ft and are most likely

related to the fuel spill. TRPH results are shown in the figure and are provided in Table 4.3-1.

4.3.3 Conclusions

On the basis of the analytical results from the surface soils around SWMU 19, it is likely that a release occurred from this SWMU. Results from deeper than 3 ft are either indistinguishable from or likely to be the result of the T-38 Test Cell Fuel Spill. Given the literature search findings and what is known of the T-38 test cell operations, waste managed at SWMU 19 was predominantly fuel. This waste would be indistinguishable from the JP-4 spill associated with the T-38 test cell and would be remediated with the dual-phase treatment system.

4.3.4 Recommendations

SWMU 19 was recommended for conditional NFA. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 19 was removed in 1996 as part of Holloman's Phase 2 Basewide POL project. Further information can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997*. SWMU 19 was approved for NFA by NMED in September 1996 based on the remediation of the site along with SWMU 229, the T-38 Cell, which has a high-vacuum dual-phase extraction (HVDPE) system in place. The HVDPE system is anticipated to operate through 2001. Once the sites have been remediated, confirmation boring information will be submitted to NMED. Therefore, based on its prior approval of NFA by NMED, SWMU 19 is recommended for NFA.

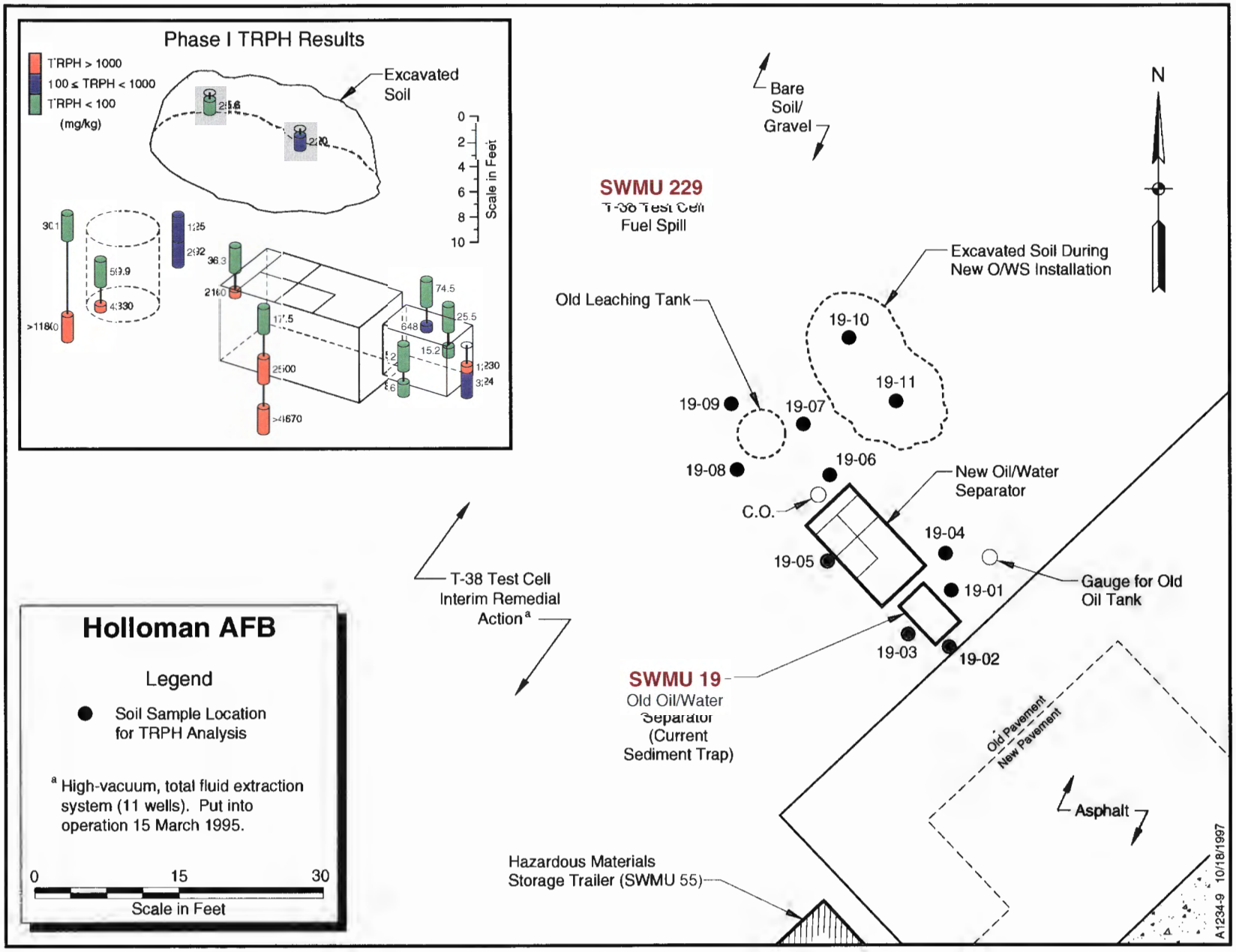

Figure 4.3-1. SWMU 19 - Building 638 O/WS Sample Locations and Phase I TRPH Results

Table 4.3-1
TRPH Results for Soil at SWMU 19

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
19-01	0	2	25.5	19-06	0	2	36.3
	3.25	4	15.2 (109)		3.5	4	2160
19-02	1.5	2	1230	19-07	0	2	125
	2	4	324		2	4	292
19-03	0	2	5.2	19-08	0	2	59.9
	3	4	8.6		3.5	4	4330
19-04	0	2	74.5	19-09	0	2	30.1
	3.5	4	648		8	10	>11800
19-05	0	2	17.5	19-10	0.5	1.5	25.6
	4	6	2110/2500	19-11	0.5	1.5	220 (160)
	8	10	>4670				

Note—Normal and duplicate results are separated by a "/".
( ) = Result from fixed analytical laboratory.
> = Result greater than value. Additional dilutions not performed.

4.4 SWMU 20–Building 639 O/WS

SWMU 20 services the sound suppressors at the T-38 test cell. The waste oil from the separator was originally collected in a separate oil storage tank. The tank, however, had been removed prior to the literature search in 1993. The O/WS was taken out of service and abandoned in place in 1994.

The area surrounding SWMU 20 was investigated in conjunction with the T-38 Test Cell Fuel Spill (SWMU 229). LNAPL has been detected downgradient from SWMU 20, and the separator is entirely within the estimated contaminant plume for the fuel spill. Background information relating to SWMU 229 is presented in Section 4.3 of this report.

Phase I samples were collected near the surface at SWMU 20 to determine whether a release had occurred from the SWMU. No releases were detected from SWMU 20, and NFA is recommended.

4.4.1 SWMU Description

Unit Type: Single-chamber O/WS with separate oil storage tank
Period of Operation: Pre-1978 to 1994
Current Status: Inactive
Disposition of Unit: Abandoned in place
Source of Waste: T-38 test cell sound suppressors
Major Operations: Engine testing and maintenance
Construction Material: Concrete
Physical Condition: Concrete in fairly good condition
Oil/Total Capacity: 250 gal./400 gal.
Historic Releases: None known

4.4.2 Investigation Results

Geology and Hydrogeology

The shallow soils around SWMU 20 consist of reddish yellow silty sand. The material is predominantly fine-grained, homogeneous, and soft. Gray visible staining was noted beginning at 5 ft bgl and is most likely related to the SWMU 229 JP-4 plume. Groundwater was encountered at approximately 7.5 ft bgl. Appendix F contains further detail on the geology for SWMU 20.

Phase I Investigation

Four locations were sampled on each side of the separator at two depths as shown in Figure 4.4-1. Analytical results indicated no detections of TRPH above the release criterion. Analytical results are provided in Table 4.2-1 and on the figure. No samples were collected below 4 ft because of the known contaminant plume beneath the separator.

4.4.3 Conclusions

No release was detected from the SWMU 20 O/WS. All TRPH results were below the 100 mg/kg release criterion, and there was no visible evidence of an overflow or leak from the SWMU. Although staining and a petroleum odor were noted at location 20-01, the affected soil was 5 ft bgl and is attributable to SWMU 229.

4.4.4 Recommendations

SWMU 20 is inactive and is recommended for NFA based on the unit being remediated in-situ with the T-38 Test Cell high-vacuum dual phase extraction system. This system is anticipated to operated through 2001. Confirmation borings will be taken across the site, including the area where SWMU 20 is located, to insure that the system has remediated the site to less than 1000 mg/kg.

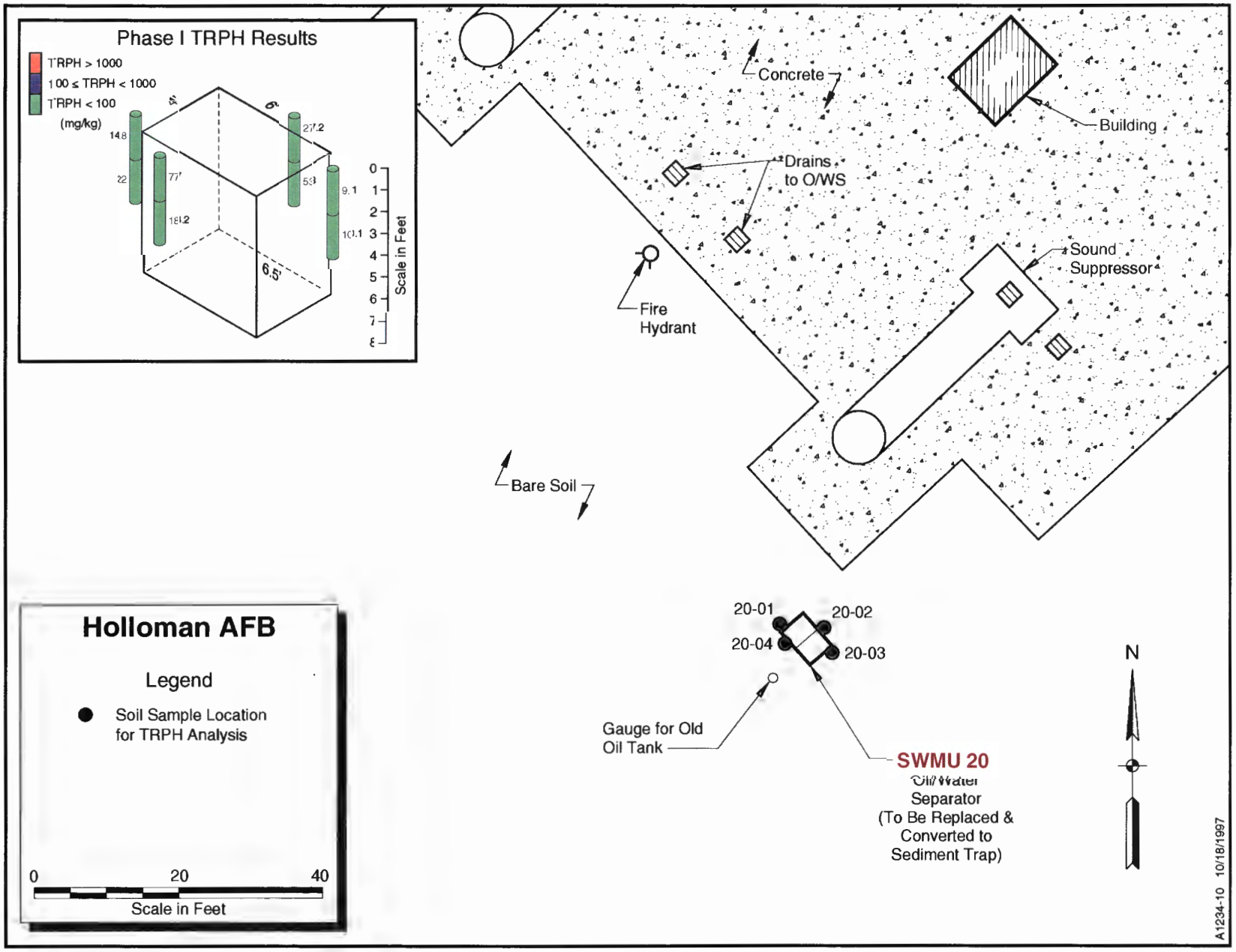

Figure 4.4-1. SWMU 20 - Building 639 O/WS Sample Locations and Phase I TRPH Results

Table 4.4-1
TRPH Results for Soil at SWMU 20

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
20-01	0	2	14.6	20-03	0	2	9.1
	2	4	22		2	4	10.1
20-02	0	2	27.2/29.4 (49.8)	20-04	0	2	22
	2	4	53		2	4	16.2

Note—Normal and duplicate results are separated by a "/".
( ) = Result from fixed analytical laboratory.

4.5 SWMU 24–Building 801 O/WS

SWMU 24 services the aerospace ground equipment (AGE) washrack at Building 801 (demolished in 1992). The separator was converted to a sediment trap when a new O/WS was installed in 1991.

The area around the current sediment trap was investigated to determine whether a release of hazardous constituents had occurred from the SWMU. Eight samples were collected around SWMU 24 and analyzed for TRPH. No TRPH concentrations exceeded the 100 mg/kg release criterion, and physical data does not indicate that there has been a release from the SWMU. Because no release has occurred from SWMU 24, it is recommended for NFA.

4.5.1 SWMU Description

Unit Type: Single-chamber O/WS
Period of Operation: 1979 to present
Current Status: Inoperable
Disposition of Unit: Converted to a sediment trap in 1991; continued use in future
Source of Waste: Washrack
Major Operations: Washing AGE
Construction Material: Concrete
Physical Condition: Concrete in fairly good condition; sediment buildup in unit
Oil/Total Capacity: 70 gal./100 gal.
Historic Releases: None known

4.5.2 Investigation Results

Geology and Hydrogeology

Surrounding SWMU 24, the soils consist of fill material and native silty sands. On two sides of the separator, below the surface asphalt, the gravelly sand fill occurred to a depth of 2 to 3.5 ft (see DPT boring logs in Appendix F). In the other locations (24-01 and 24-02) and below the fill, the lithology consisted of silty sand and sandy silt and is undisturbed native soil. Groundwater was not encountered in borings at depths ranging from 1.5 to 3.5 ft bgl.

Phase I Investigation

Because of the poor recovery at 24-01, -03, and -04 surface soil samples (0 to 2 ft) were not collected at these locations. Samples, however, were collected from upper depths between 2 and 4 ft. Figure 4.5-1 shows the sampling locations and depths; Table 4.5-1 presents the analytical results for TRPH. All of the TRPH detections were near the reporting limit, with a maximum result of 35 mg/kg.

4.5.3 Conclusions

TRPH results are all substantially below the 100-mg/kg release criterion, and boring logs show no evidence of a release from SWMU 24. Therefore, it does not appear that any substantial releases have occurred from SWMU 24.

4.5.4 Recommendations

NFA is recommended for SWMU 24. To achieve NFA status, a Class 3 permit modification request will be completed by Holloman AFB.

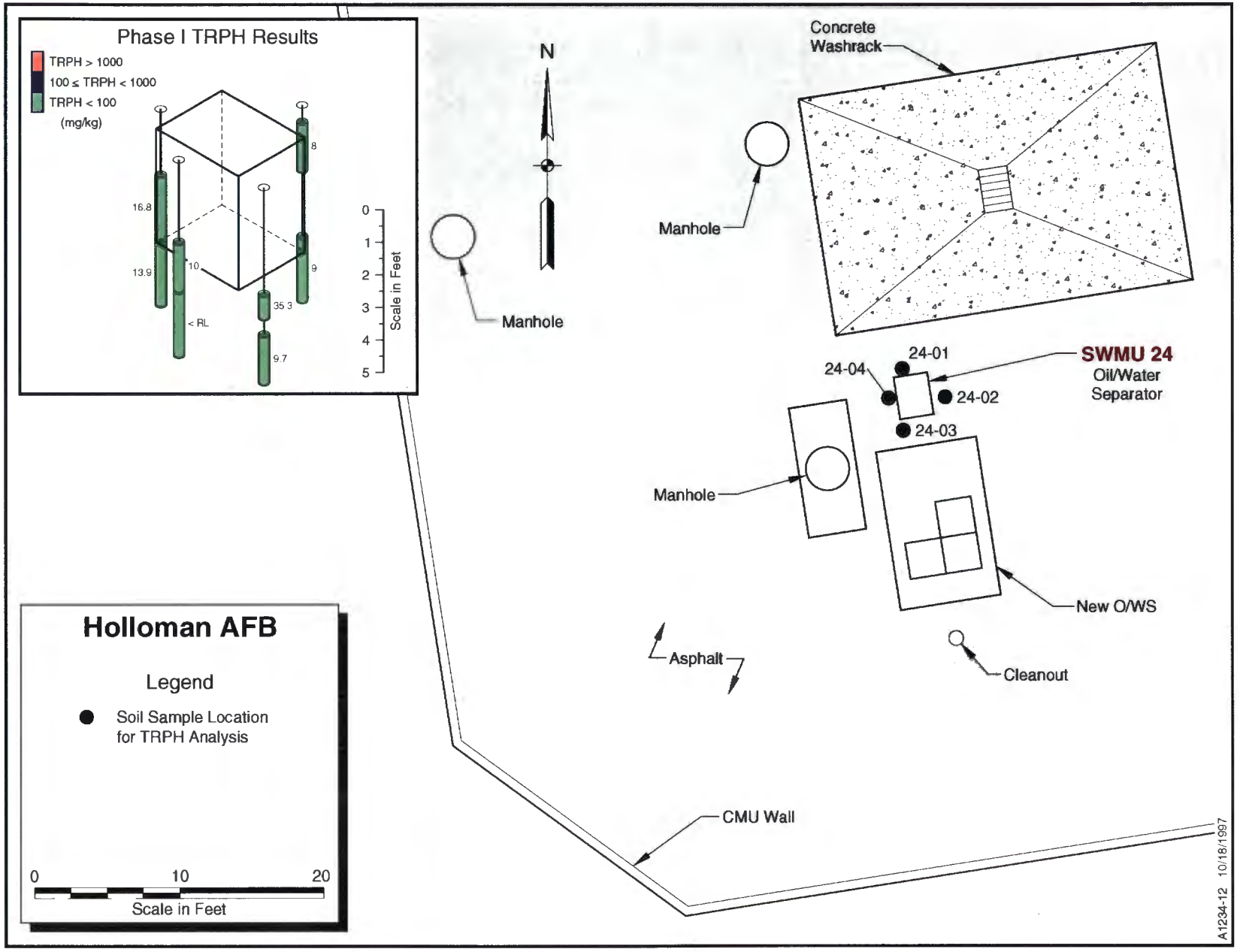

Figure 4.5-1. SWMU 24 - Building 801 O/WS Sample Locations and Phase I TRPH Results

Table 4.5-1
TRPH Results for Soil at SWMU 24

Location	Depth (ft) Top	Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Bottom	TRPH (mg/kg)
24-01	2	4	16 [illegible]	24-03	1.25	4	35.3
	4	6	13.9		4.5	6	9.7/8.7
24-02	0.5	2	6	24-04	2.5	4	10
	4	6	V		4	6	< RL (42)

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit, 5 mg/kg.
( ) = Result from fixed analytical laboratory.

4.6 SWMU 25–Building 805 O/WS

SWMU 25 serviced vehicle maintenance operations in nearby Building 855. In 1987, the original O/WS was replaced with a new unit. The new separator was then converted to a sediment trap when a third O/WS was installed in 1991.

To determine whether a release had occurred at SWMU 25, samples were collected adjacent to existing unit at two depths and near the unit to the northeast. The data indicate that no release from the separator has occurred. SWMU 25 is recommended for NFA.

4.6.1 SWMU Description

Unit Type: Single-chamber O/WS with separate oil storage tank
Period of Operation: April 1987 to present
Current Status: Unknown
Disposition of Unit: Converted to a sediment trap in 1991
Source of Waste: Building 855
Major Operations: Vehicle maintenance
Construction Material: Steel Material
Physical Condition: Good condition; history of clogging problems for floor drains in Building 855
Oil/Total Capacity: 800 gal. (with oil tank)/50 gal.
Historic Releases: Previous unit perforated prior to removal in 1987 indicating a potential release

4.6.2 Investigation Results

Geology and Hydrogeology

The near-surface soils at SWMU 25 consist of dry, reddish-brown fine-grained silty sand. Near the O/WS, at locations 25-01, -02, and -04, non-native silty gravel (fill) was observed to a depth of 4 ft bgl. Groundwater occurs at approximately 4.5 ft bgl and the groundwater flow direction in this portion of the Base is know to vary from the south to southwest. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

Two locations were sampled next to the O/WS (25-01 and 25-04) and the results at each depth interval were less than or very near the reporting limit for TRPH (see Figure 4.6-1). No samples could be retrieved at locations 25-02 and 25-03 because of poor recovery in the piston sampler. The locations were offset several times on the north and east side of the separator, however, no sample could be collected because of the large drain-rock fill that caused continued poor recovery. In lieu of these borings, location 25-05 was placed as close as possible to 25-02 and 25-03 and was sampled at two depth intervals. The TRPH results at location 25-05 were also below the release criterion. The analytical results for normal and duplicate samples are provided in Table 4.6-1 and in the figure.

4.6.3 Conclusions

TRPH concentrations for each sample were below the release criterion of 100 mg/kg. The data indicate that there has been no release from the SWMU. Site geologic conditions show clean fill material and native soil in the vicinity of the O/WS.

4.6.4 Recommendations

NFA is recommended for SWMU 25. To achieve NFA status, a Class 3 permit modification request will be completed by Holloman AFB.

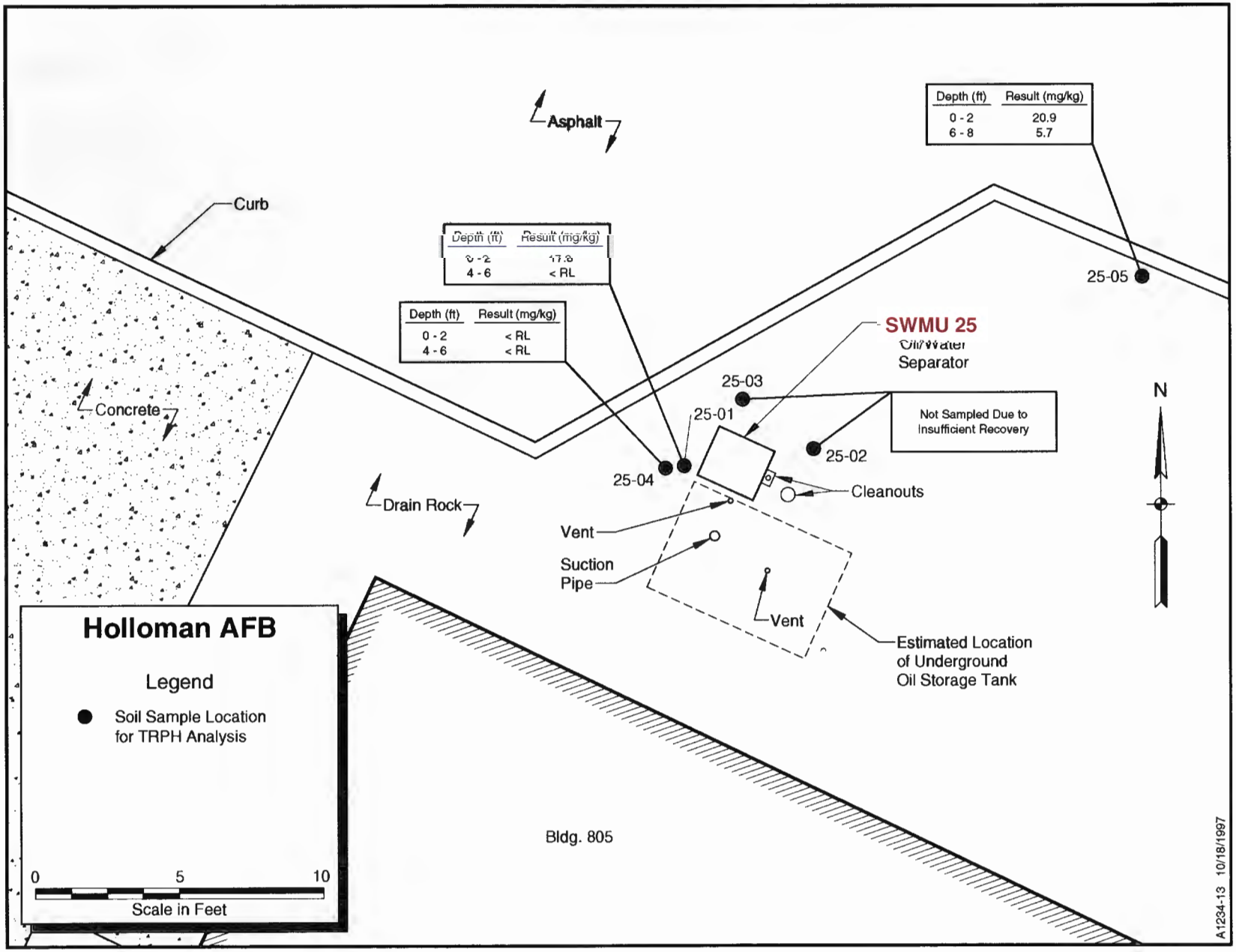

Figure 4.6-1. SWMU 25 - Building 805 O/WS Sample Locations and Phase I TRPH Results

Table 4.6-1
TRPH Results for Soil at SWMU 25[a]

Location	Depth (ft) Top	Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Bottom	TRPH (mg/kg)
25-01	0	2	17 b	25-05	0	2	20.9
	4	6	< RL		6	8	5.7
25-04	0	2	< RL				
	4	6	< RL/< RL (< RL)				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈30 mg/kg).
( ) = Result from fixed analytical laboratory.

[a] Locations 25-02 and 25-03 not sampled because of insufficient recovery.

4.7 SWMU 29–Building 827 O/WS

SWMU 29 serviced the AGE washrack at Building 827. The separator was abandoned in place and covered with asphalt in 1991 when a new O/WS was installed. SWMU 29 was investigated under this RFI to determine whether a release had occurred from the separator.

The area surrounding SWMU 29 has been investigated for diesel, JP-4, and unleaded fuel leaks from the abandoned underground storage tanks (USTs) at Building 828 (SWMU 230). These tanks are located on the east side of Building 828 (east of the O/WS). Significant contamination was detected in the soil and groundwater around the tanks and the pump island, and LNAPL is present on the groundwater (Woodward-Clyde, 1993). Most of the elevated constituents occur from 6-9 ft bgl. The proposed remedial system is currently in the design stage of a CMS/CMI, and construction is scheduled to commence in the summer of 1995. The corrective measure will consist of a dual-phase extraction system that will treat soil and groundwater across the site.

The TRPH results at SWMU 29 suggest that a historic release in the form of an overflow had occurred from the abandoned separator. However, because SWMU 29 is within the treatment area for the SWMU 230 corrective measure and will be treated in conjunction with the remediation, CNFA is recommended for SWMU 29.

4.7.1 SWMU Description

Unit Type: Single-chamber O/WS
Period of Operation: 1977 to April 1991
Current Status: Inactive
Disposition of Unit: Abandoned in place and covered with asphalt
Source of Waste: Washrack
Major Operations: Washing AGE
Construction Material: Concrete
Physical Condition: Unknown
Oil/Total Capacity: 675 gal./900 gal.
Historic Releases: None known

4.7.2 Investigation Results

Geology and Hydrogeology

The near-surface soils at SWMU 29 consist of reddish-yellow fine-grained sand with silt. Gray staining is prevalent in all borings beginning at surface and continuing with depth. Groundwater occurs at approximately 4.5 ft bgl. Appendix F contains the boring logs for SWMU 29.

Phase I Investigation

Eight samples were collected around SWMU 29 as part of the Phase I investigation as shown in Figure 4.7-1. Although seven of the samples showed TRPH results above 1000 mg/kg (see Table 4.7-1 for analytical results), four of the samples were collected at depths of 6 to 8 ft bgl, and it is likely that these detections are associated with the constituent plume at SWMU 230. TRPH results at the surface, however, are believed to be associated with a release from SWMU 29, with levels ranging from 10.6 to 2240 mg/kg.

Figure 4.7-2 shows the sampling locations and maximum TRPH results from this investigation. Soil borings and monitor wells identified from the previous investigations at SWMU 230 are included on this figure (Woodward-Clyde, 1993).

4.7.3 Conclusions

TRPH results in the surface soils suggest that there has been a historic release from SWMU 29. TRPH results from samples taken below 6 ft bgl, however, could be elevated due to contaminant plumes associated with the Building 828 Fuel Spill (SWMU 230).

4.7.4 Recommendations

SWMU 29 was recommended for CNFA.

The condition of NFA was the remediation of TPH-contaminated soil. SWMU 29 was removed as part of Holloman AFB's Phase 2 Basewide POL project. SWMU 29 was located within SWMU 230, the Building 828 Fuel Spill Site, which is currently undergoing remediation via a HVDPE system. Further details can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.* SWMU 29 was approved for NFA by NMED in September 1997. NMED required confirmation samples once SWMUs 29 and 230 are remediated. Therefore, SWMU 29 is recommended for NFA.

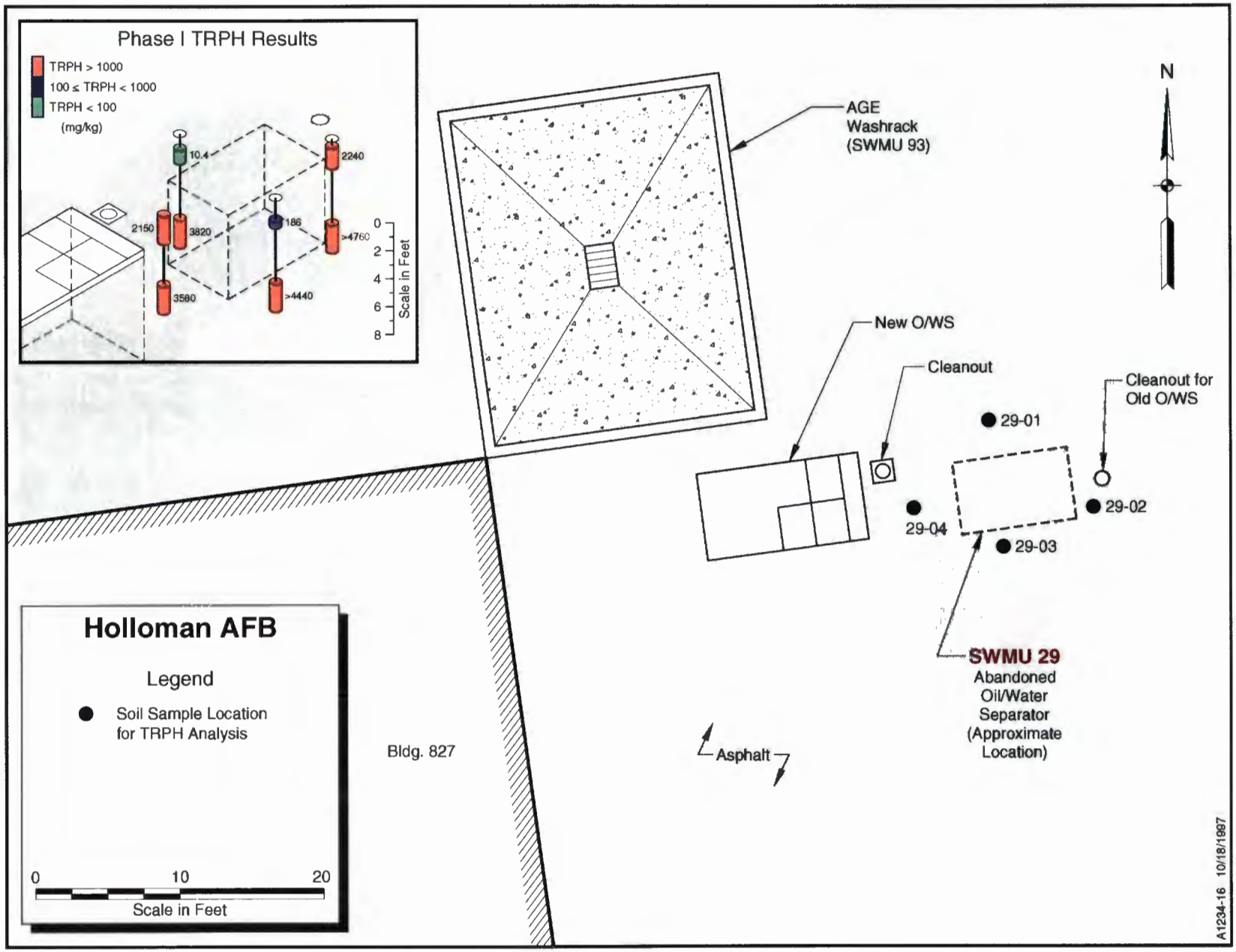

Figure 4.7-1. SWMU 29 - Building 827 O/WS Sample Locations and Phase I TRPH Results

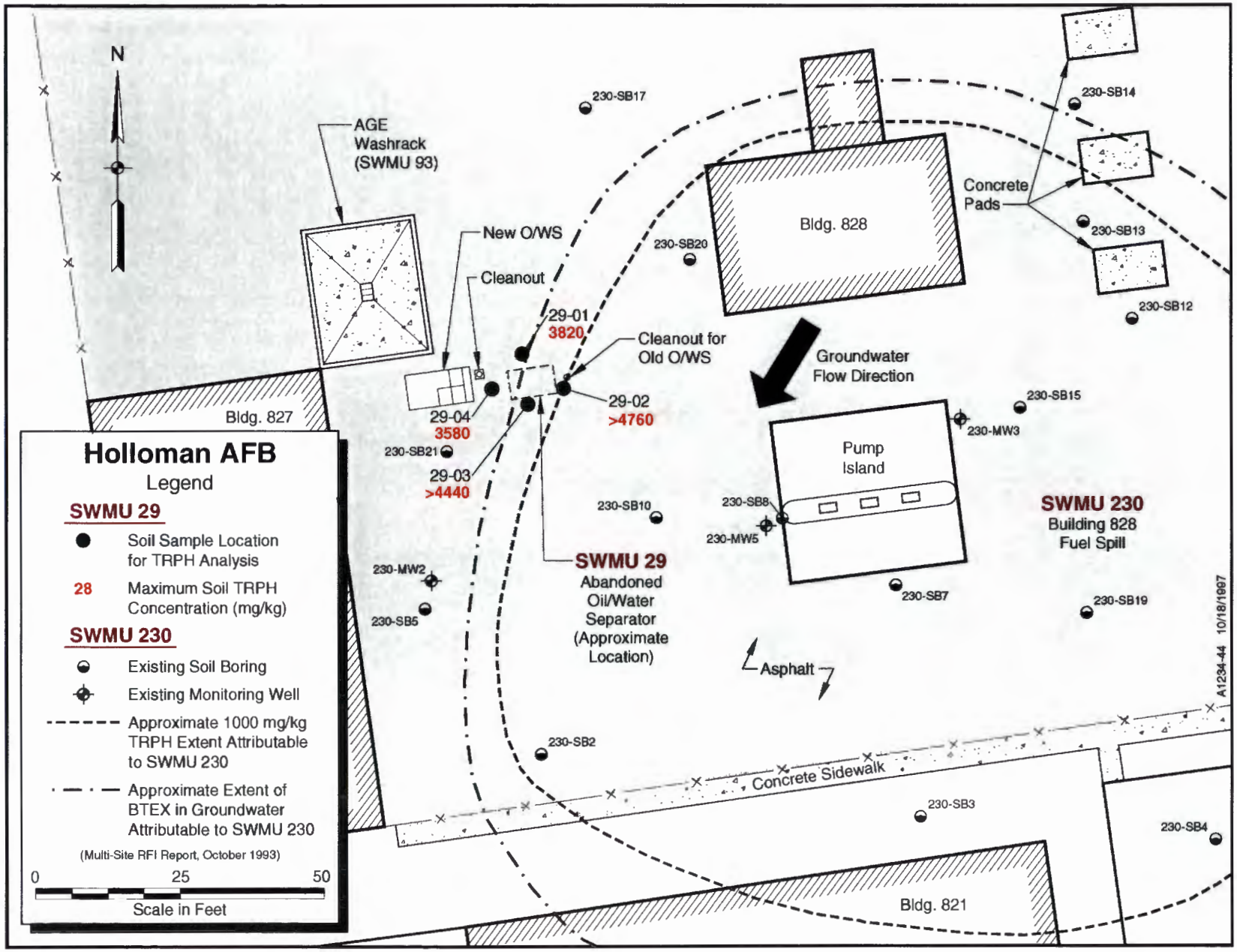

Figure 4.7-2. SWMU 29 - Maximum TRPH Concentrations and Estimated Extent of Building 828 Fuel Spill (SWMU 230)

Table 4.7-1
TRPH Results for Soil at SWMU 29

Location	Depth (ft)		TRPH (mg/kg)	Location	Depth (ft)		TRPH (mg/kg)
	Top	Bottom			Top	Bottom	
29-01	1	2	7034	29-03	1.5	2	186
	6	8	7820		6	8	>4401
29-02	0.5	2	1880/2240 (4140/4690)	29-04	0	2	2150
	6	8	>4761		5	7	3580

Note—Normal and duplicate results are separated by a "/".
( ) = Result from fixed analytical laboratory.
> = Result greater than value. Additional dilutions not performed.

4.8 SWMU 35–Building 903 O/WS

SWMU 35 services corrosion control and vehicle maintenance operations for mobility equipment in Building 903. The separator was removed and replaced with a new sediment trap in 1991. The location of the original separator was located based on as-built drawings of the facility.

A Phase I investigation was conducted at SWMU 35 and results at three soil boring locations indicated that there has been no release from the SWMU. NFA is recommended for SWMU 35.

4.8.1 SWMU Description

Unit Type: Unknown
Period of Operation: April 1986 to April 1991
Current Status: Inactive
Disposition of Unit: No longer present
Source of Waste: Building 903
Major Operations: Corrosion control and vehicle maintenance
Construction Material: Steel
Physical Condition: Unknown; RFA noted oil stains adjacent to the unit
Oil/Total Capacity: 50 gal.
Historic Releases: Potential overflow on the basis of staining around O/WS

4.8.2 Investigation Results

Geology and Hydrogeology

The near-surface soils at SWMU 35 consist of very damp reddish-yellow fine-grained sand with silt. Groundwater was not encountered; however, on the basis of groundwater measurements at a nearby site (SWMU 34) it is estimated to be approximately 5 ft bgl. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

Six samples were collected at three locations around SWMU 35 and were analyzed for TRPH by EPA 418.1M. Figure 4.8-1 presents the Phase I sampling locations and results. Results showed low levels of TRPH, with a maximum detected result of 21.4 mg/kg at location 35-03 as shown in Table 4.8-1.

4.8.3 Conclusions

TRPH results from samples collected around the SWMU are well below the release criterion and indicate that there has been no historic release from SWMU 35.

4.8.4 Recommendations

SWMU 35 is recommended for NFA. Holloman AFB will prepare a Class 3 permit modification to achieve NFA status.

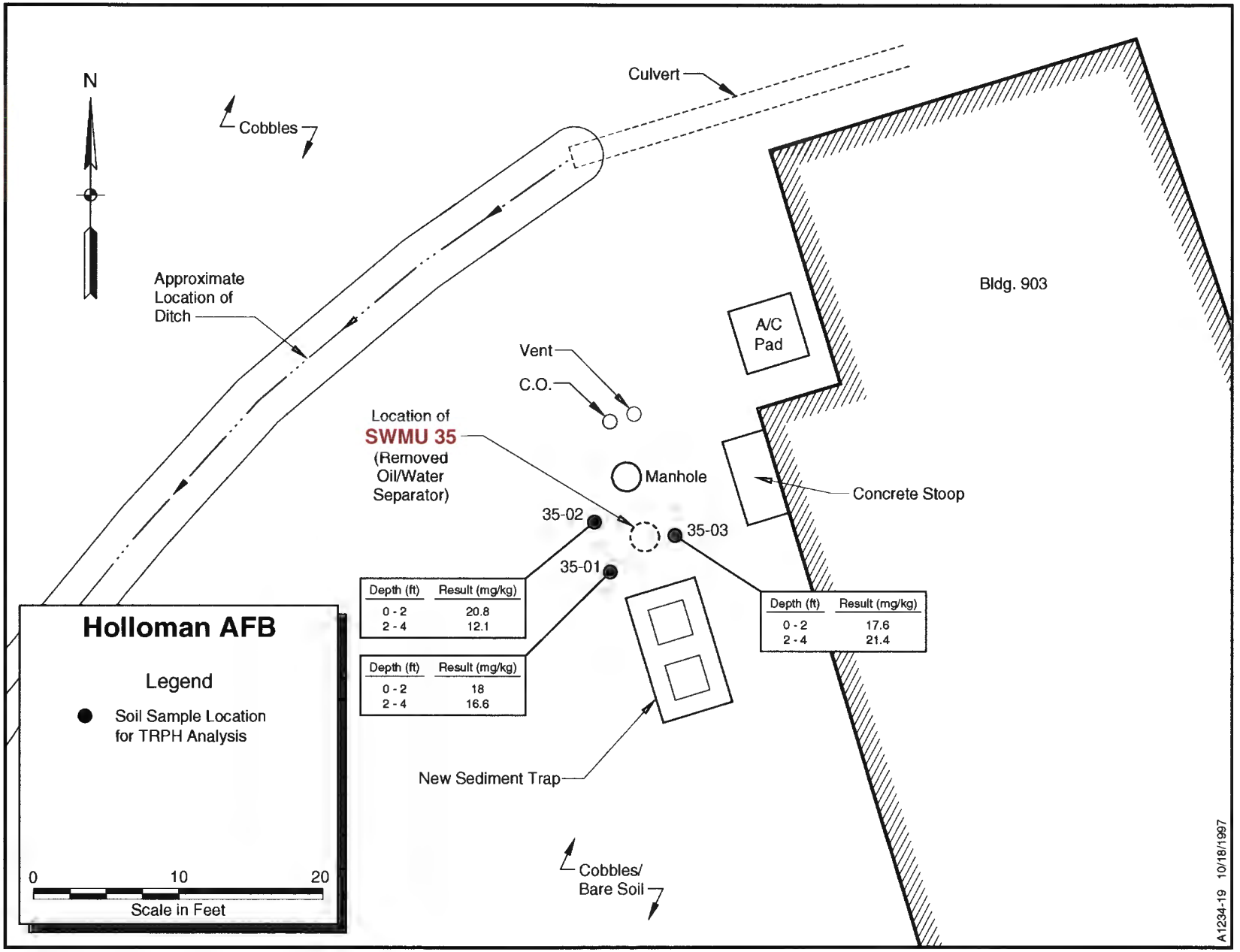

Figure 4.8-1. SWMU 35 - Building 903 O/WS Sample Locations and Phase I TRPH Results

Table 4.8-1
TRPH Results for Soil at SWMU 35

Location	Depth (ft) Top	Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Bottom	TRPH (mg/kg)
35-01	0	2	18	35-03	0	2	17.6/17.1
	2	4	16.6		2	4	<1.4
35-02	0	2	20.8 (< RL)				
	2	4	12.1				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit, ≈30 mg/kg.
( ) = Result from fixed analytical laboratory.

Section 5
PHASE I/II INVESTIGATION RESULTS

This section presents the Phase I and II investigation results for the 15 SWMUs that were determined to have shown a release during the Phase I investigation. Samples were collected during Phase I at the surface and below the O/WS to adequately determine if a release had occurred as an overflow or from the bottom of the unit. Of these SWMUs, 4 are recommended for NFA because the risk-based screen or risk assessment showed no risk to human health. For the remaining 11 SWMUs, a CNFA is recommended. The condition of NFA is the remediation of vadose zone soils greater than the Base-specific TRPH cleanup level of 1000-mg/kg for all SWMUs. An additional condition for NFA for 4 of the SWMUs is to mitigate the O/WS leak. At SWMU 27, the LNAPL at the site will be removed as a condition of NFA.

A list of the Phase I/II SWMUs and a summary of the results and recommendations at each site are provided in Table 5-1. The locations of each SWMU are shown in Figure 5-1. Each of the site investigations are presented in a consistent manner beginning with a summary of the results and recommendations, followed by subsections describing each SWMU; the geological and chemical results; the risk-based screen and risk assessment results; conclusions; and recommendations. Background descriptions were compiled from information gathered in the RFA and the Table 3 literature search (conducted prior to writing the *Table 3 RFI Work Plan*, Radian, 1994a), and is augmented from additional information discovered during the RFI. Photographs of the investigated SWMUs are provided in Appendix E. The groundwater flow directions were estimated from data in the *29 Sites RI Report* (Radian, 1992a).

The data are presented in a consistent manner for the each of the SWMUs. Immediately following the text for each section, the data are presented graphically in three ways:

- **Sample Locations and Phase I TRPH Results**—The initial figure shows the Phase I and Phase II soil and groundwater sampling locations for the SWMU. The samples collected for characterization of the release are highlighted in blue. If only groundwater was analyzed for characterization at a location, then only the outside of the symbol was colored blue. The Phase I TRPH results are presented in an isometric inset (or result boxes for some SWMUs) in this figure and show the actual depth sampled and associated TRPH result.

- **TRPH Concentrations by Depth Interval**—The second figure presents a three-dimensional view of the TRPH results by depth interval and is used to define extent of the release. In this figure, the maximum TRPH concentration per interval is shown.

- **Maximum TRPH Concentrations/ Extent of Elevated TRPH Results/ Vadose Zone Soil to be Remediated**—The final figure shows the maximum TRPH concentration per sample location and the extent of contamination determined in the field (TRPH > 100 mg/kg). Additionally, where appropriate, the vadose zone soil to be remediated (TRPH > 1000 mg/kg) is contoured in the figure. Although maximum saturated and unsaturated soil results are shown, the

soil to be remediated reflects contouring of only unsaturated, vadose zone soil. The figure provides a cross section across the site that contains the lithology, the vertical extent of contamination, the location of the groundwater table, and the volume of soil to be remediated.

A consistent color scheme is used between the first two figures. Green represents TRPH results less than 100 mg/kg, blue shows TRPH results between 100 and 1000 mg/kg, and orange identifies TRPH results above 1000 mg/kg.

The following analytical data are presented in tables following the figures:

- TRPH results for soil (field and fixed analytical laboratories);
- Summary analytical results for soil;
- COC analytical results for soil (for SWMUs with COCs); and
- Summary analytical results for groundwater.

Uncensored (J-flag) data are presented in the analytical results. Although the J-flag data is only an estimated concentration because the result is below the reporting limit, it is presented in the tables because all data is used in the risk-based screening process. In a few instances, the maximum site result was J-flagged and exceeded the EPA Region III RBC (i.e., the RBC is below the reporting limit). As described in Section 3, a risk assessment was performed at all sites that failed the risk-based screen, and all data, including J-flag data, was used to evaluate risk.

While referring to the analytical data, also note that the VOCs results (SW8260) are given in µg/kg (ppb), and the SVOCs and metals results are presented in mg/kg (ppm).

Table 5-1
Investigation Summary for Phase I/II SWMUs

SWMU[a]	Soil					Groundwater		Special Considerations	Current Operation	RFI Recommendations
	Release to Soil?	Type of Release	Maximum TRPH (mg/kg)	Risk-Based Screen COCs[b]	Risk Assessment Results	Release in Groundwater?	Chemicals Detected in Groundwater			
1	Yes	Overflow	>1000	Benzo(a)pyrene, Mercury, Thallium	Risk within acceptable range.	Yes	VOCs and metals	Elevated TRPH results east of the SWMU are the result of previous asphalt paving activities.	In use	NFA[d]
7	Yes	Subsurface	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use as sediment trap	NFA[e]
11	Yes	Overflow	>1000	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Cadmium, Indeno(1,2,3-cd)pyrene	Risk within acceptable range.	Yes	VOCs, SVOCs, and metals	Interviews with personnel in Building 292 during the investigation indicated that above-ground tanks were located in the parking lot. These may be a potential distinct source.	Replaced with new O/WS	NFA[d]
12&13	Yes	Overflow	>1000	Benzo(a)pyrene	Risk within acceptable range.	Yes	VOCs, SVOCs, and metals	None	Replaced with new O/WS	NFA[d]
14	Yes	Subsurface	>1000[c]	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use	NFA[f]
16	Yes	Overflow	100 - 1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use	NFA
23	Yes	Subsurface	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	None	In use as sediment trap	NFA[e]
27	Yes	Overflow	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	Free-product lense	Abandoned and filled with sand	NFA[e]

Table 5-1
(Continued)

SWMU[a]	Soil					Groundwater		Special Considerations	Current Operation	RFI Recommen-dations
	Release to Soil?	Type of Release	Maximum TRPH (mg/kg)	Risk-Based Screen COCs[b]	Risk Assessment Results	Release in Ground-water?	Chemicals Detected in Groundwater			
28	Yes	Overflow/ subsurface	>1000	No COCs	NA	Yes	VOCs, SVOCs, and metals	Release from SWMU 29 may affect results near SWMU 28.	Removed and replaced with new O/WS	NFA[d]
31	Yes	Subsurface	>1000	No COCs	NA	Yes	VOCs and metals	None	In use/ unknown	NFA[e]
34	Yes	Overflow/ runoff	100 - 1000	Beryllium, Cadmium	Risk within acceptable range.	Yes	VOCs and metals	None	In use as sediment trap	NFA
37	Yes	Overflow	100 - 1000	No COCs	NA	No	NS	None	In use	NFA
38	Yes	Subsurface/ overflow	100 - 1000	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene	Risk within acceptable range.	No	NS	Potential point sources or spills related to AGE machinery.	In use/ unknown	NFA
41	Yes	Overflow	>1000	No COCs	NA	No	NS	None	In use as sediment trap	NFA[e]

COC = Chemical of concern.
NA = Not applicable.
NFA = No further action.
NS = Not sampled.
SVOC = Semivolatile organic compound.
SWMU = Solid waste management unit.
TRPH = Total recoverable petroleum hydrocarbons.
VOC = Volatile organic compound.

[a] All SWMUs are oil/water separators. Their associated building numbers are given in each subsection and are on the sample location figures.
[b] Arsenic was detected at levels above the EPA Region III risk-based concentration at all SWMUs except 11, 16, 27, and 31. However, all arsenic results were below the background upper tolerance limit. It was therefore eliminated as a COC.
[c] All soils with TRPH > 1000 mg/kg are below the water table.
[d] The original recommendation was conditional NFA. The TRPH-contaminated soils were removed during the Phase 2 Basewide POL project in 1996; therefore, the current recommendation is NFA.
[e] The original recommendation was conditional NFA. The oil/water separator and TRPH-contaminated soils were removed during the Phase 2 Basewide POL project; therefore, the current recommendation is NFA.
[f] The original recommendation was conditional NFA. The oil/water separator was taken out of service as part of the Phase 2 Basewide POL project; therefore, the current recommendation is NFA.

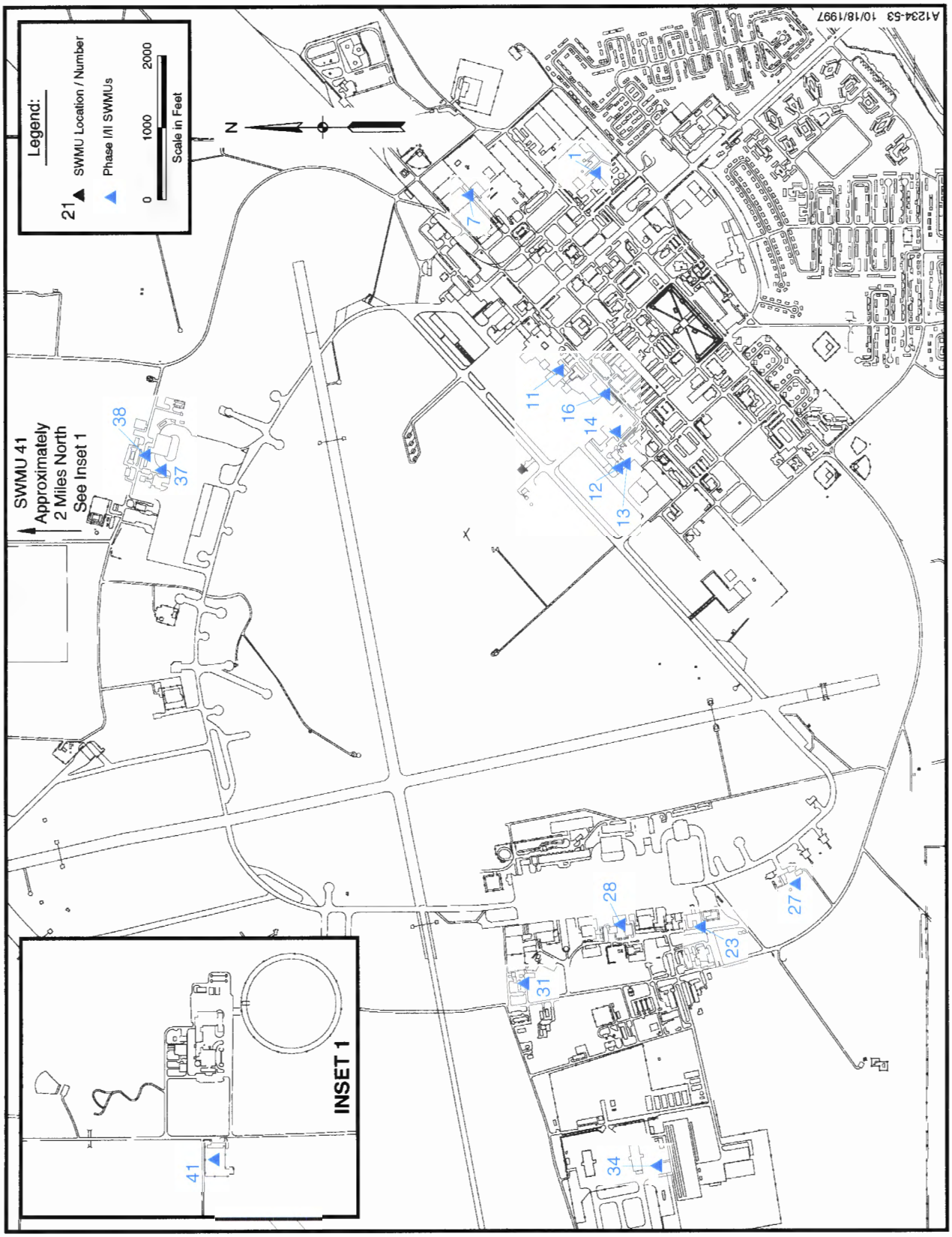

Figure 5-1. Location of the Phase I/II SWMUs

5.1 SWMU 1—Building 55 O/WS

SWMU 1, the Building 55 O/WS, services the washrack near Building 56. The washrack is also known as IRP Site SD-15 and has recently undergone a PA/SI as part of that program. Only the area immediately southwest of the washrack was included in this investigation as part of SWMU 1. The washrack is known to have overflowed numerous times since its installation in 1984. The O/WS was reported to have overflowed, as well.

To investigate whether a release had occurred from the separator, SWMU 1 was investigated under the Table 3 RFI. Phase I soil samples were collected in accordance to the work plan, and it was determined that a surface release had occurred from the SWMU. Additional soil and groundwater samples were then collected in order to define the nature and extent of the release. Elevated levels of TRPH concentrations were found between the washrack and the separator and to the west of the separator. Although TRPH results are elevated to the south and east of the O/WS as well, site geology based on boring logs and an excavation at the site suggest that these detections are not SWMU related. The 0- to 2-ft zone that was sampled appears to be related to previous asphalt paving activities.

The risk-based screen identified benzo(a)-pyrene, mercury, and thallium as COCs from the release and, therefore, a site-specific risk assessment was completed. The risk assessment showed that both the carcinogenic and non-carcinogenic risks at the site are within acceptable ranges. The recommendation for this SWMU is CNFA with the condition of NFA being remediation of vadose zone soils with TRPH concentrations greater than 1000 mg/kg.

5.1.1 SWMU Description

Unit Type: Three-chamber O/WS
Period of Operation: March 1984 to present
Current Status: Active
Disposition of Unit: Continued use until new washrack is installed
Source of Waste: Washrack
Major Operations: Washing paving and grounds equipment
Construction Material: Fiberglass
Physical Condition: History of clogging problems
Oil/Total Capacity: 50 gal./850 gal.
Historic Releases: August 1992—overflow of washrack and O/WS

5.1.2 SWMU Investigation and Results

Geology and Hydrogeology

Generally, the lithology around SWMU 1 consists of gravelly sand at the surface with silty sand and sandy silt at depth. West and south of the separator, the first 0 to 2 ft bgl consistently exhibits the coarser grained texture. This surface material is not native to Holloman AFB and is interpreted as road-base fill material. Groundwater occurs at 3 ft bgl, and the groundwater flow direction is estimated to be to the south-southwest. Details of the geology at SWMU 1 are presented in Appendix F.

Because utility repairs at the site, an excavation was dug through the surface sediments, allowing detailed stratigraphy to be examined at a location south of the separator. The excavation showed a sharp lithologic contact sloping from 16 and 20 in. bgl across the trench. This contact shows a distinct separation between dark-colored, gravelly material (fill) and native silty sand. The significance of this lithology is discussed in the Phase II results and conclusions below.

Phase I Investigation

As shown in Figure 5.1-1, seven locations were sampled during Phase I for TRPH analysis by EPA 418.1M. Four locations were situated around the O/WS and the remaining three were

placed next to the washrack and in low areas where runoff may collect. At each location, samples were collected from the surface and from a depth near the bottom of the separator. Figure 5.1-1 shows the sampling horizons and the associated Phase I TRPH results across the site.

TRPH concentrations at all of the Phase I borings were detected above the 100-mg/kg release criterion. These results indicated that a release had occurred from SWMU 1. Given the historic knowledge of the SWMU and the elevated results detected in the surface soil around the SWMU, it was determined that the predominant release mechanism was overtopping of the separator. To investigate the release further, a Phase II investigation was initiated.

Phase II Investigation

Extent—Using the iterative step-out approach described in the work plan (Radian, 1994a), the extent of the release was investigated. The Phase II sampling locations are highlighted in Figure 5.1-1, and the magnitude and extent of TRPH results are shown in Figure 5.1-2. All TRPH results are given in Table 5.1-1. The extent of the release was bounded to the north and west by samples showing TRPH results less than 100 mg/kg. To the south and southeast, however, sampling was curtailed prior to falling below the 100-mg/kg release criterion because geologic data suggested that TRPH detected in the horizon being sampled was not related to the SWMU.

The maximum detected TRPH results for each location at SWMU 1 is shown in Figure 5.1-3. On the basis of data collected during the investigation, elevated levels of TRPH from the surface material south of the separator are not related to the release from the separator. Figures 5.1-4 and 5.1-5 show a photograph taken from an excavation south of the SWMU that supports this conclusion. Both the photograph and boring log data discussed earlier show a distinct contact to be present between dark, gravelly road-base fill material and the native subsurface soil. TRPH results are most likely elevated in the fill material because of heavy oils and asphalt mixed with the road-base. This material is manmade and was likely applied over the site prior to paving activities.

Further evidence that the release from SWMU 1 is confined to the north and west of the separator was gathered during the literature search in October 1993. Pooled water was observed to the west of the O/WS near locations 01-05 and 01-06 (see photograph in Appendix E). Figure 5.1-3 shows the estimated lateral and vertical extent of elevated TRPH concentrations related to the release at SWMU 1. The extent of vadose zone soil having TRPH greater than 1000 mg/kg is also presented in the figure.

Nature—Eight samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals to characterize the nature of the release. All detected results for the nature samples are listed in Table 5.1-2. The data indicate that low levels of toluene are present in four samples; isolated detections of ethyl benzene, xylenes, acetone, methylene chloride, and carbon disulfide occur in other samples across the site. Benzo(a)pyrene, mercury, and thallium, however, were the only constituents that were detected at levels of concern at the site, as shown in Table 5.1-3.

Groundwater—To define constituent concentrations in the groundwater, samples were collected from three locations around the SWMU. One location was collected upgradient of the separator (01-14), one was collected inside the area of elevated soil constituent concentrations (01-04), and one location was collected downgradient of the release (01-20). The analytical results for groundwater are presented in Table 5.1-4. TRPH in groundwater exceeded the 10-

mg/L release criterion next to the SWMU at location 01-04, indicating constituents have been released to the groundwater. Downgradient from the SWMU at location 01-20 TRPH was not detected in the groundwater. Specific volatile organic compound (VOC) and semivolatile organic compound (SVOC) analytes, however, were not detected above reporting limits in either sample. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.1.3 Risk-Based Screen Results

Three constituents, benzo(a)pyrene, mercury, and thallium, were identified as COCs for the release at SWMU 1 during the risk-based screen. Table 5.1-3 shows the analytical results for the COCs. Further evaluation of risk was necessary to determine if these constituents pose a risk to human health using site-specific parameters in the evaluation.

The risk-based screen compared the maximum site results with residential risk-based concentrations following EPA Region III screening guidance to identify sites that may pose a risk to human health. The screen incorporates very conservative parameters, and exceedence of the RBCs indicates that a site-specific risk assessment is required to make conclusions on human-health risk at SWMU 1. Complete screen results and the toxicity values used are contained in Appendix C; the results of the risk assessment are provided in the next subsection.

5.1.4 Risk Assessment Results

A site-specific risk assessment was performed on the three constituents—benzo(a)-pyrene, mercury, and thallium—that were identified as COCs. The complete exposure pathways considered at SWMU 1 are incidental ingestion of contaminated soil, dermal contact with contaminated soil, and inhalation of fugitive dust for future construction workers. Average and reasonable maximum exposure concentrations were evaluated for both carcinogenic and noncarcinogenic risk for the dermal contact and ingestion pathways. Appendix D provides detailed rationale for exposure scenario selection and shows the risk calculations for each analyte.

The overall average and reasonable maximum carcinogenic risks for excavation workers at SWMU 1 are $2x10^{-10}$ and $5x10^{-10}$, respectively. The average and reasonable maximum noncarcinogenic hazard indices for the excavation worker scenario are 0.03 and 0.70, respectively. Both the carcinogenic and noncarcinogenic risk levels are within their respective acceptable ranges. Based on these results, adverse health effects are unlikely from the release at SWMU 1.

5.1.5 Conclusions

The results from the investigation of the SWMU indicate that a surface release has occurred at this site. The Phase II investigation defined the extent of the release by TRPH in the field, and the nature was defined by laboratory analysis. The elevated TRPH levels to the south of the O/WS are not related to a release from the SWMU but rather to the road-base fill material in that area. The extent of elevated TRPH levels in the groundwater was confined to the area adjacent to the separator.

The volume of SWMU-related vadose zone soil exceeding 1000 mg/kg is approximately 110 cubic yards; this area will require remediation to comply with the Base-specific TRPH cleanup level.

Although benzo(a)pyrene, mercury, and thallium exceeded the risk-based screening criteria, upon further evaluation in a site-specific risk assessment, it was concluded that risk levels are within acceptable ranges and adverse health effects are unlikely.

5.1.6 Recommendations

SWMU 1 was recommended for conditional NFA. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 1 was remediated under the Phase 2 Basewide POL project. Approximately 372 cubic yards of TPH-contaminated soil was excavated and disposed. Confirmation samples ranged from not-detected to 98 mg/kg. A more detailed account of field activities can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997*. SWMU 1 was recommended for NFA in the above report and subsequently approved for NFA by NMED. In addition, since SWMU 1 is active, it will be managed in accordance with *Guidance on Management of Oil/Water Separators*, developed by Air Combat Command to insure proper maintenance and quarterly inspections. Therefore, SWMU 1 is recommended for NFA.

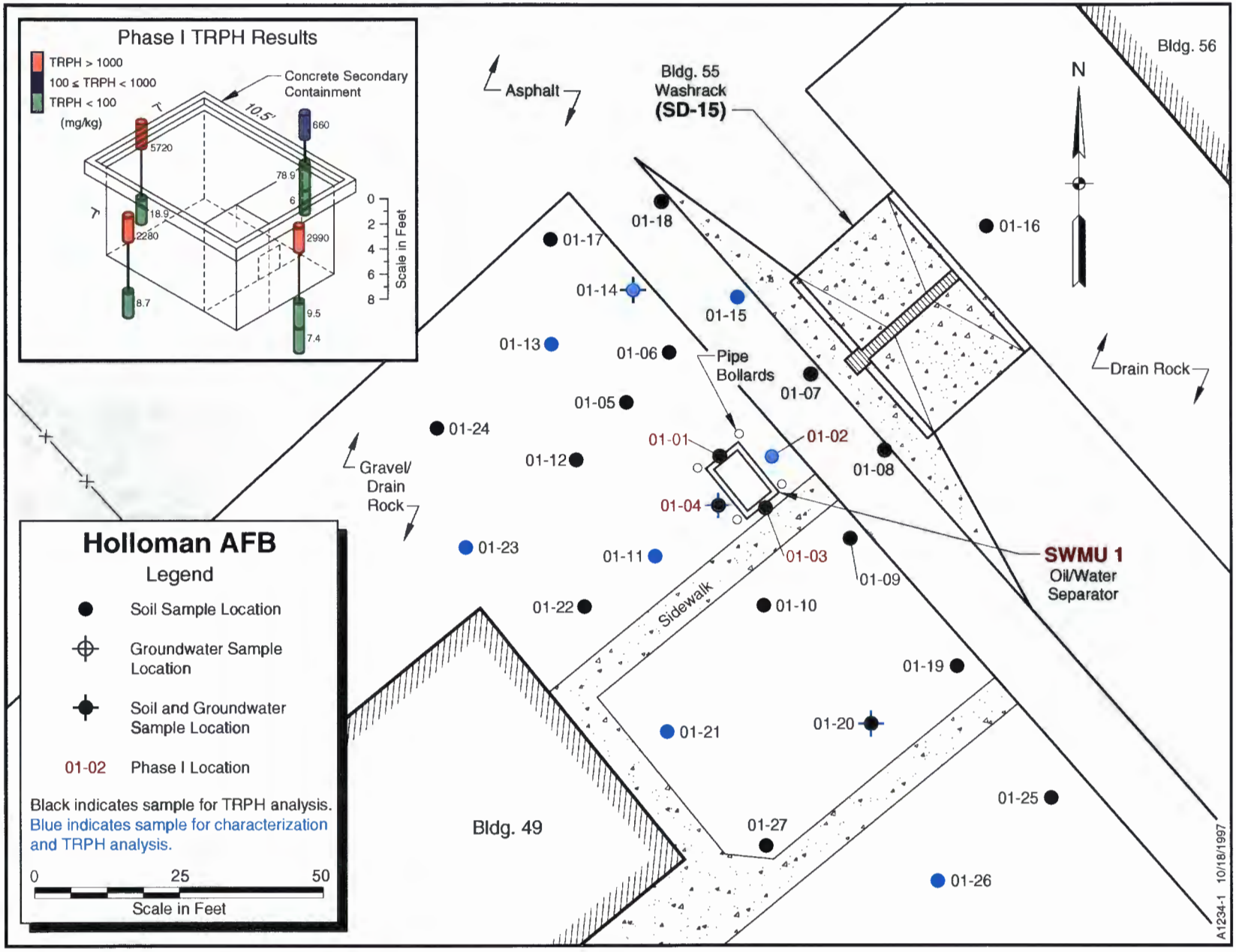

Figure 5.1-1. SWMU 1 - Building 55 O/WS Sample Locations and Phase I TRPH Results

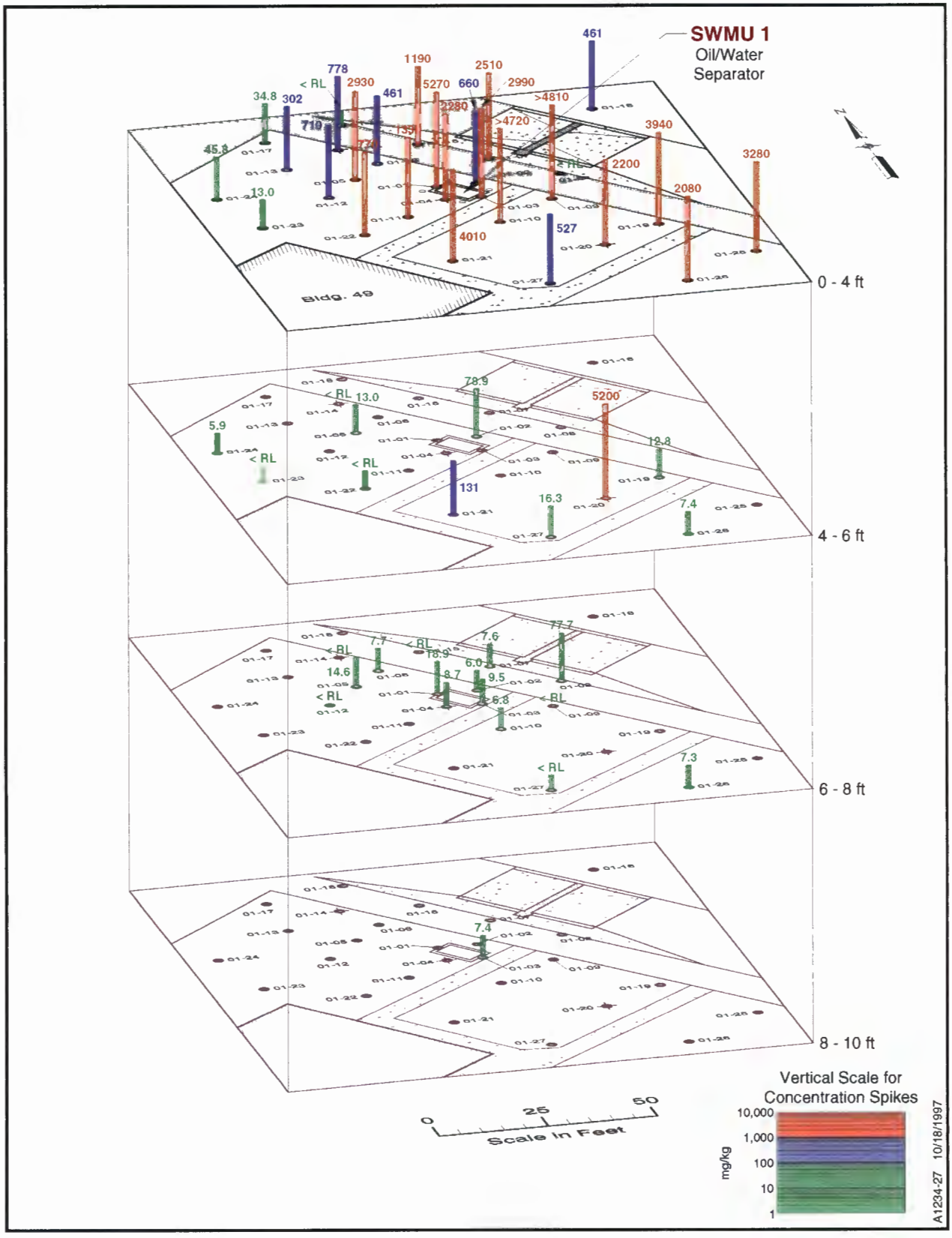

Figure 5.1-2. SWMU 1 - TRPH Concentrations by Depth Interval

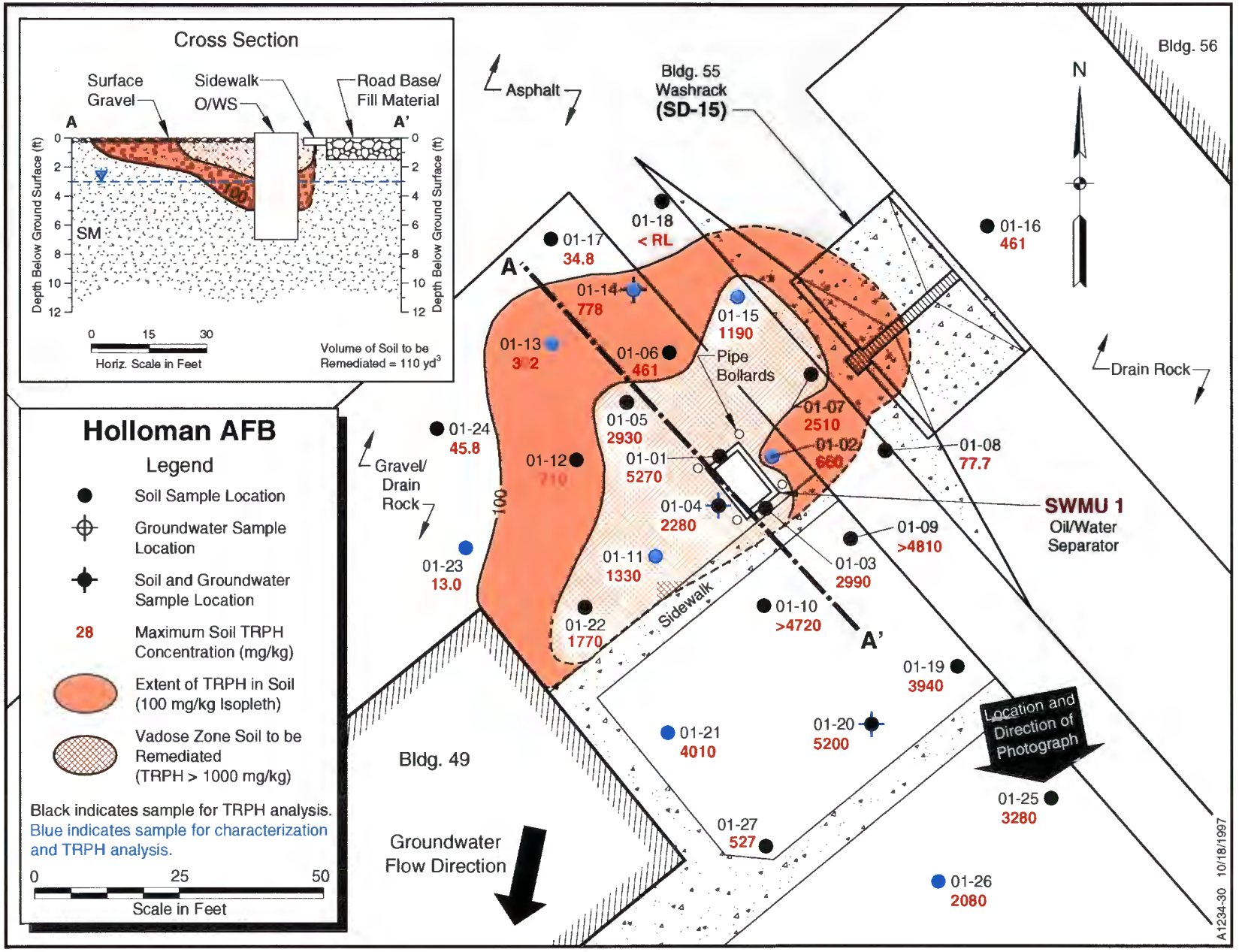

Figure 5.1-3. SWMU 1 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Figure 5.1-4. Photograph Showing Location of Excavation and Visible Layer of Road-Base Fill Material

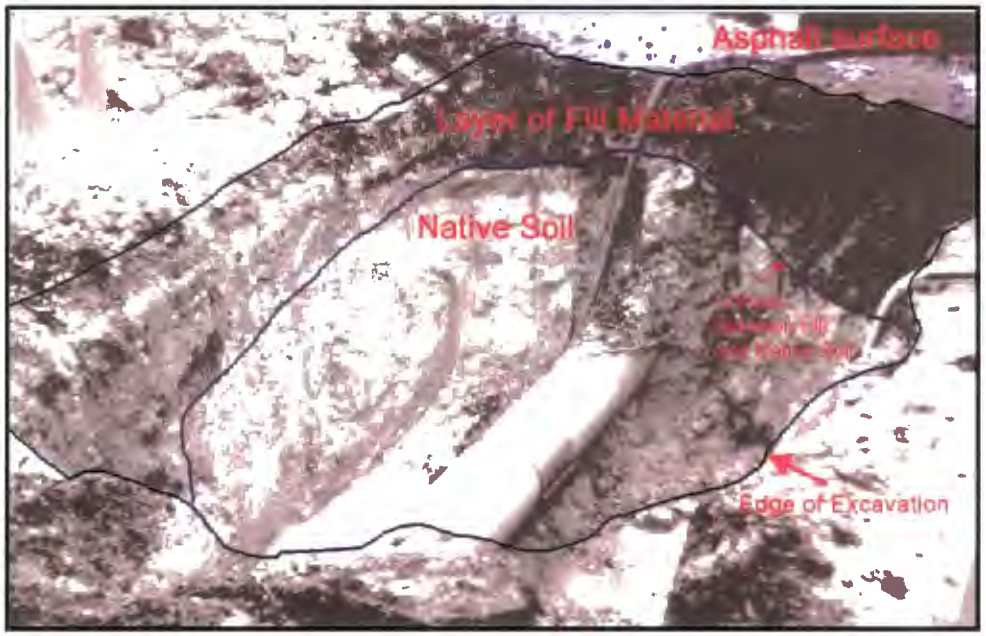

Figure 5.1-5. Interpretation of Stratigraphy Showing Layer of Road-Base Fill Material and Underlying Native Soil

Table 5.1-1
TRPH Results for Soil at SWMU 1

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)		Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	
01-01	0	2	5270		01-13	0	2	302	(192)
	6	8	18.9		01-14	0	2	778	
01-02 [a]	0	2	660	(1880)		4	6	< RL	
	4	6	78.9			6	8	< RL	(< RL)
	6	8	6	(< RL)	01-15	0.5	2	1190	(1890)
	6	8	< RL			6	8	< RL	
01-03	0	2	2990		01-16	0	2	461	
	6	8	9.5	(< RL)	01-17	0	2	34.8	
	8	10	7.4		01-18	0.5	2	< RL	
01-04	0	2	2280	(2100)	01-19	0	2	3940	
	6	8	8.7	(< RL)		4	6	12.8	
01-05	0.5	2	2930		01-20	0	2	2200/1720	
	2	4	32.4/15.7			4	6	5200	
	4	6	13		01-21	0	2	4010	(6900)
	6	8	14.6/17.6			4	6	131	
01-06	0.5	2	461		01-22	0	2	1770	
	6	8	7.7			4	6	< RL/< RL	
01-07	0.5	2	2510		01-23	0	2	13	(274)
	6	8	7.6			4	6	< RL	
01-08	0.5	2	< RL		01-24	0	2	45.8	
	6	8	77.7			4	6	5.9	
01-09	0	2	> 4810		01-25	0	2	3280	
	6	8	< RL		01-26	0	2	2080/1590	(6800)
01-10	0	2	> 4720/> 4720			4	6	7.4	
	2	4	851			6	8	7.3	
	6	8	6.8		01-27	0	2	527	
01-11	0	2	1330	(602)		4	6	16.3	
	2.9	4	< RL	(< RL)		6	8	< RL	
01-12	0	2	710						
	6	8	< RL						

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.
> = Result greater than value. Additional dilutions not performed.

[a] Location 01-02, 6- to 8-ft interval sampled two times on different days.

Table 5.1-2
Summary Analytical Results for Soil at SWMU 1

Location ID		01-02						01-11	
Beg. Depth - End Depth (ft)		0-2		4-6		6-8		0-2	
SW6010 (mg/kg)	Barium	26.6	(1.19)	8.31	(1.28)	2.16	(1.32)	24	(1.1)
	Beryllium	< RL	(0.238)	< RL	(0.255)	< RL	(0.264)	< RL	(0.22)
	Cadmium	< RL	(0.594)	< RL	(0.638)	< RL	(0.661)	< RL	(0.551)
	Chromium	3.42	(1.19)	1.72	(1.28)	3.54	(1.32)	3.36	(1.1)
	Cobalt	< RL	(1.19)	< RL	(1.28)	< RL	(1.32)	< RL	(1.1)
	Copper	3.73	(2.38)	< RL	(2.55)	< RL	(2.64)	3.27	(2.2)
	Silver	< RL	(1.19)	< RL	(1.28)	< RL	(1.32)	< RL	(1.1)
	Vanadium	6.24	(2.38)	3.24	(2.55)	2.71	(2.64)	4.7	(2.2)
	Zinc	22.4	(2.38)	2.96	(2.55)	< RL	(2.64)	12.8	(2.2)
SW7041 (mg/kg)	Antimony	< RL	(0.594)	< RL	(0.638)	< RL	(0.661)	< RL	(0.551)
SW7060 (mg/kg)	Arsenic	1.18	(0.594)	< RL	(0.638)	0.78	(0.661)	1.1	(0.551)
SW7421 (mg/kg)	Lead	8.28	(0.594)	< RL	(0.638)	< RL	(0.661)	6.17	(0.551)
SW7471 (mg/kg)	Mercury	0.0332	(0.0238)	< RL	(0.0255)	< RL	(0.0264)	< RL	(0.022)
SW7740 (mg/kg)	Selenium	< RL	(0.594)	< RL	(0.638)	< RL	(0.661)	< RL	(0.551)
SW7841 (mg/kg)	Thallium	< RL	(0.594)	0.677	(0.638)	< RL	(0.661)	< RL	(0.551)
SW8260 (µg/kg)	1,4-Dichlorobenzene	ND	(5.94)	ND	(6.38)	< RL	(6.61)	ND	(5.51)
	2-Butanone	< RL	(119)	< RL	(128)	< RL	(132)	ND	(110)
	Acetone	276	(119)	< RL	(128)	< RL	(132)	< RL	(110)
	Benzene	ND	(5.94)	ND	(6.38)	ND	(6.61)	< RL	(5.51)
	Carbon disulfide	ND	(5.94)	< RL	(6.38)	8.73	(6.61)	ND	(5.51)
	Ethyl benzene	ND	(5.94)	ND	(6.38)	ND	(6.61)	ND	(5.51)
	Methylene chloride	< RL	(23.8)	< RL	(25.5)	< RL	(26.4)	< RL	(22)
	Toluene	< RL	(5.94)	< RL	(6.38)	< RL	(6.61)	19.1	(5.51)
	Total xylenes	ND	(5.94)	ND	(6.38)	ND	(6.61)	ND	(5.51)
	Vinyl acetate	ND	(59.4)	ND	(63.8)	< RL	(66.1)	ND	(55.1)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	Chrysene	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	Dibenzofuran	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	Fluoranthene	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	Naphthalene	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	Phenanthrene	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	Pyrene	< RL	(0.784)	< RL	(0.421)	ND	(0.436)	ND	(0.364)
	Benzo(a)anthracene	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	Benzo(a)pyrene	< RL	(0.784)	< RL	(0.421)	ND	(0.436)	ND	(0.364)
	bis(2-Ethylhexyl)phthalate	< RL	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)
	di-n-Butylphthalate	< RL	(0.784)	< RL	(0.421)	< RL	(0.436)	< RL	(0.364)
	Indeno(1,2,3-cd)pyrene	ND	(0.784)	ND	(0.421)	ND	(0.436)	ND	(0.364)

Table 5.1-2
(Continued)

Location ID		01-11		01-13		01-14		01-15	
Beg. Depth - End Depth (ft)		2.9-4		0-2		6-8		0.5-2	
SW6010 (mg/kg)	Barium	4.8	(1.39)	18.3	(1.21)	13.3	(1.33)	27.8	(1.13)
	Beryllium	< RL	(0.279)	< RL	(0.242)	< RL	(0.266)	< RL	(0.226)
	Cadmium	< RL	(0.697)	< RL	(0.605)	< RL	(0.666)	< RL	(0.566)
	Chromium	< RL	(1.39)	3.32	(1.21)	2.88	(1.33)	4.1	(1.13)
	Cobalt	< RL	(1.39)	< RL	(1.21)	< RL	(1.33)	1.27	(1.13)
	Copper	< RL	(1.39)	< RL	(2.42)	< RL	(2.66)	< RL	(2.26)
	Silver	< RL	(1.39)	< RL	(1.21)	< RL	(1.33)	< RL	(1.13)
	Vanadium	< RL	(2.79)	4.2	(2.42)	6.47	(2.66)	6.56	(2.26)
	Zinc	< RL	(2.79)	15.4	(2.42)	6.07	(2.66)	12.7	(2.26)
SW7041 (mg/kg)	Antimony	< RL	(0.697)	< RL	(0.605)	1.66	(0.666)	1.14	(0.566)
SW7060 (mg/kg)	Arsenic	< RL	(0.697)	< RL	(0.605)	< RL	(0.666)	1.55	(0.566)
SW7421 (mg/kg)	Lead	< RL	(0.697)	5.79	(0.605)	0.905	(0.666)	3.4	(0.566)
SW7471 (mg/kg)	Mercury	< RL	(0.0279)	2.37	(0.0242)	< RL	(0.0266)	< RL	(0.0226)
SW7740 (mg/kg)	Selenium	< RL	(0.697)	< RL	(0.605)	< RL	(0.666)	0.622	(0.566)
SW7841 (mg/kg)	Thallium	< RL	(0.697)	< RL	(0.605)	< RL	(0.666)	< RL	(0.566)
SW8260 (µg/kg)	1,4-Dichlorobenzene	ND	(6.97)	ND	(6.05)	ND	(6.66)	< RL	(5.66)
	2-Butanone	ND	(139)	ND	(121)	ND	(133)	ND	(113)
	Acetone	ND	(139)	138	(121)	186	(133)	< RL	(113)
	Benzene	ND	(6.97)	ND	(6.05)	ND	(6.66)	ND	(5.66)
	Carbon disulfide	ND	(6.97)	ND	(6.05)	ND	(6.66)	ND	(5.66)
	Ethyl benzene	ND	(6.97)	ND	(6.05)	ND	(6.66)	ND	(5.66)
	Methylene chloride	< RL	(27.9)	24.3	(24.2)	31.3	(26.6)	< RL	(22.6)
	Toluene	ND	(6.97)	< RL	(6.05)	< RL	(6.66)	7.47	(5.66)
	Total xylenes	ND	(6.97)	ND	(6.05)	ND	(6.66)	ND	(5.66)
	Vinyl acetate	ND	(69.7)	ND	(60.5)	ND	(66.6)	ND	(56.6)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Chrysene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Dibenzofuran	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Fluoranthene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Naphthalene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Phenanthrene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Pyrene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Benzo(a)anthracene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	Benzo(a)pyrene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)
	bis(2-Ethylhexyl)phthalate	ND	(0.46)	< RL	(0.4)	ND	(0.439)	ND	(0.373)
	di-n-Butylphthalate	< RL	(0.46)	< RL	(0.4)	< RL	(0.439)	< RL	(0.373)
	Indeno(1,2,3-cd)pyrene	ND	(0.46)	ND	(0.4)	ND	(0.439)	ND	(0.373)

Table 5.1-2
(Continued)

Location ID		01-21		01-23		01-26	
Beg. Depth - End Depth (ft)		0-2		0-2		0-2	
SW6010 (mg/kg)	Barium	23.9	(1.38)	33.3	(1.13)	20.6	(1.21)
	Beryllium	< RL	(0.276)	0.359	(0.226)	< RL	(0.241)
	Cadmium	< RL	(0.69)	< RL	(0.564)	< RL	(0.603)
	Chromium	3.75	(1.38)	7.47	(1.13)	2.69	(1.21)
	Cobalt	< RL	(1.38)	2.45	(1.13)	< RL	(1.21)
	Copper	< RL	(2.76)	5.36	(2.26)	< RL	(2.41)
	Silver	< RL	(1.38)	< RL	(1.13)	< RL	(1.21)
	Vanadium	6.54	(2.76)	8.76	(2.26)	7.26	(2.41)
	Zinc	15.6	(2.76)	39.3	(2.26)	8.55	(2.41)
SW7041 (mg/kg)	Antimony	< RL	(0.69)	< RL	(0.564)	< RL	(0.603)
SW7060 (mg/kg)	Arsenic	1.21	(0.69)	1.57	(0.564)	0.856	(0.603)
SW7421 (mg/kg)	Lead	2.48	(0.69)	18	(0.564)	5.48	(0.603)
SW7471 (mg/kg)	Mercury	< RL	(0.0276)	< RL	(0.0226)	< RL	(0.0241)
SW7740 (mg/kg)	Selenium	< RL	(0.69)	< RL	(0.564)	< RL	(0.603)
SW7841 (mg/kg)	Thallium	< RL	(0.69)	< RL	(0.564)	< RL	(0.603)
SW8260 (µg/kg)	1,4-Dichlorobenzene	ND	(6.9)	ND	(5.64)	ND	(1510)
	2-Butanone	< RL	(138)	< RL	(113)	< RL	(30200)
	Acetone	172	(138)	735	(564)	< RL	(30200)
	Benzene	< RL	(6.9)	ND	(5.64)	ND	(1510)
	Carbon disulfide	ND	(6.9)	ND	(5.64)	< RL	(1510)
	Ethyl benzene	< RL	(6.9)	ND	(5.64)	7580	(1510)
	Methylene chloride	< RL	(27.6)	< RL	(22.6)	< RL	(6030)
	Toluene	14.2	(6.9)	< RL	(5.64)	8120	(1510)
	Total xylenes	21.2	(6.9)	< RL	(5.64)	31600	(1510)
	Vinyl acetate	ND	(69)	ND	(56.4)	ND	(15100)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.637)	ND	(0.372)	0.434	(0.398)
	Chrysene	ND	(0.637)	ND	(0.372)	< RL	(0.398)
	Dibenzofuran	ND	(0.637)	ND	(0.372)	< RL	(0.398)
	Fluoranthene	ND	(0.637)	< RL	(0.372)	ND	(0.398)
	Naphthalene	ND	(0.637)	< RL	(0.372)	< RL	(0.398)
	Phenanthrene	< RL	(0.637)	< RL	(0.372)	< RL	(0.398)
	Pyrene	< RL	(0.637)	0.779	(0.372)	< RL	(0.398)
	Benzo(a)anthracene	ND	(0.637)	ND	(0.372)	< RL	(0.398)
	Benzo(a)pyrene	ND	(0.637)	< RL	(0.372)	ND	(0.398)
	bis(2-Ethylhexyl)phthalate	< RL	(0.637)	< RL	(0.372)	ND	(0.398)
	di-n-Butylphthalate	< RL	(0.637)	< RL	(0.372)	< RL	(0.398)
	Indeno(1,2,3-cd)pyrene	ND	(0.637)	< RL	(0.372)	ND	(0.398)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.1-3
Analytical Results for Chemicals of Concern for Soil at SWMU 1[a]

Location ID			01-02			01-11	01-13
Beg. Depth - End Depth (ft)			0-2	4-6	6-8	2.9-4	0-2
SW7471 (mg/kg)	Mercury	[2.3464, -0.001][b]	0.0332 J (0.0230)	< RL (0.0255)	0.0066 J (0.0264)	0.12 J (0.0279	2.37 (0.0242)
SW7841 (mg/kg)	Thallium	[0.6257, 0.16]	0.4870 J (0.5940)	0.6770 (0.6380)	0.5690 J (0.6610)	0.293 J (0.697)	0.387 J (0.605)
SW8270 (mg/kg)	Benzo(a)pyrene	[8.75E-02][c]	0.114 J (0.784)	0.0927 J (0.421)	ND (0.436)	ND (0.46)	ND (0.4)
Location ID			01-14	01-15	01-21	01-23	01-26
Beg. Depth - End Depth (ft)			6-8	0.5-2	0-2	0-2	0-2
SW7471 (mg/kg)	Mercury	[2.3464, -0.001][b]	0.011 J (0.0266)	0.0218 J (0.0226)	0.0069 J (0.0276)	0.0102 J (0.0226)	0.0108 J (0.0241)
SW7841 (mg/kg)	Thallium	[0.6257, 0.16]	0.519 J (0.666)	0.0339 J (0.566)	0.179 J (0.69)	0.293 J (0.564)	< RL (0.603)
SW8270 (mg/kg)	Benzo(a)pyrene	[8.75E-02][c]	ND (0.439)	ND (0.373)	ND (0.637)	0.216 J (0.372)	ND (0.398)

Note—This table presents the analytical results used in the risk-based screen and risk assessment. The J-flag data are estimated concentrations, since the result is below the reporting limit.

J = Result is less than the reporting limit
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit. Negative instrument response.
( ) = Reporting limit.

[a] Shading highlights results greater than the EPA Region III RBC used in the risk-based screen.
[b] [RBC, UTL] = EPA Region III residential risk-based concentrations, 95% upper tolerance limit background concentration.
[c] [RBC] = EPA Region III residential risk-based concentration.

Table 5.1-4
Summary Analytical Results for Groundwater at SWMU 1

Location ID		01-04		01-14		01-20	
E418.1 (mg/L)	TRPH	< RL	(1)	NA		5.78	(1.6)
E418.1M (mg/L)	TRPH	19	(5)	< RL	(5)	NA	
SW6010 (mg/L)	Barium	0.025	(0.01)	NA		0.017	(0.01)
	Beryllium	< RL	(0.002)	NA		< RL	(0.002)
	Cadmium	< RL	(0.005)	NA		< RL	(0.005)
	Chromium	< RL	(0.01)	NA		< RL	(0.01)
	Cobalt	< RL	(0.01)	NA		< RL	(0.01)
	Copper	< RL	(0.02)	NA		< RL	(0.02)
	Vanadium	< RL	(0.02)	NA		< RL	(0.02)
	Zinc	< RL	(0.02)	NA		< RL	(0.02)
SW7041 (mg/L)	Antimony	0.0106	(0.005)	NA		< RL	(0.005)
SW7060 (mg/L)	Arsenic	< RL	(0.004)	NA		0.0128	(0.004)
SW7421 (mg/L)	Lead	< RL	(0.003)	NA		< RL	(0.003)
SW7740 (mg/L)	Selenium	< RL	(0.005)	NA		< RL	(0.005)
SW7841 (mg/L)	Thallium	< RL	(0.002)	NA		< RL	(0.002)
SW8260 (μg/L)	1,4-Dichlorobenzene	< RL	(5)	NA		ND	(5)
	2-Butanone	< RL	(100)	NA		ND	(100)
	Acetone	ND	(100)	NA		< RL	(100)
	Methylene chloride	< RL	(20)	NA		< RL	(20)
	Vinyl acetate	< RL	(50)	NA		< RL	(50)

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).
NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.2 SWMU 7—Building 198 O/WS

SWMU 7 services the vehicle maintenance area in Building 198. The O/WS has been in service since before 1960. It was converted to a sediment trap in 1991 when a new O/WS was installed.

To investigate whether a release had occurred, SWMU 7 was investigated under the Table 3 RFI. Phase I soil samples were collected in accordance to the work plan, and it was determined that a release had occurred from the SWMU. Additional soil and groundwater samples were then collected to define the nature and extent of the release. The details of the Phase I/II investigation and their results are provided in the following subsections.

The Phase I/II investigation showed that a subsurface release had occurred from the separator that was confined to the area directly north and west of the separator. Since the risk-based screen did not identify any COCs, CNFA was recommended for SWMU 7 with the condition of NFA being remediation of vadose zone soils greater than 1000 mg/kg and mitigation of the O/WS leak.

5.2.1 SWMU Description

Unit Type: Two-chamber O/WS
Period of Operation: Pre-1960 to present
Current Status: Active
Disposition of Unit: Converted to a sediment trap in 1991; continued use
Source of Waste: Building 198
Major Operations: Vehicle maintenance
Construction Material: Concrete
Physical Condition: Concrete in good condition
Oil/Total Capacity: 100 gal./350 gal.
Historic Releases: None known

5.2.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand and sandy silt to approximately 10 ft bgl. In each of the borings, between 10 and 11 ft bgl, the soil grades rapidly to a very hard silty clay. Groundwater occurs at 7 ft bgl, and the groundwater flow direction is interpreted to be to the south-southwest. The bottom of the O/WS is approximately 0.5 ft above the groundwater table. Greenish-gray staining was noted beginning at 7 ft bgl, just below the bottom of the O/WS, extending to approximately 14.5 ft bgl. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.2-1, five locations were sampled during Phase I for TRPH by EPA 418.1M. At each location, samples were collected from the surface and from near the bottom of the separator. At locations 07-04 and -05, samples were also collected from lower depths (8 to 10 ft and 15.5 to 16 ft, respectively) to define the extent of the release further. Figure 5.2-1 shows the sampling horizons and the associated Phase I TRPH results.

Since TRPH concentrations at two of the Phase I borings were detected above the 100-mg/kg release criterion, it was determined that a release had occurred from the SWMU. Given the higher TRPH concentrations between 6 and 8 ft, the release pathway at the separator was determined to most likely be leakage from the separator chamber or piping. The detection of a release triggered a Phase II investigation.

Phase II Investigation

Extent—The extent of the release was investigated using the iterative step-out approach described in the work plan (Radian, 1994a). The Phase II sampling locations are also highlighted in Figure 5.2-1. The magnitude of TRPH results at each horizon is shown in Figure 5.2-2. As suggested by the Phase I results and by what is seen in the Phase II data, the highest concentrations are located in the subsurface between 6 and

8 ft, extending to the west of the O/WS. Samples collected from within the sandy clay horizon (> 12 ft bgl) exhibited lower TRPH results as shown in Figure 5.2-2. All field TRPH results are provided in Table 5.2-1.

Using the maximum detected TRPH result at each boring, the areal extent of elevated TRPH values above the 100-mg/kg criterion was determined. This is shown in Figure 5.2-3. The extent of vadose zone soil having TRPH concentrations greater than 1000 mg/kg is also shown.

Nature—To characterize the nature of the release, four samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.2-2. The data indicate that dichlorobenzenes, ethyl benzene, total xylenes, benzoic acid, and naphthalene were detected at concentrations above the reporting limit within the TRPH-contaminated soils. The highest concentration was observed at location 07-04, which had a TRPH concentration of 11,400 mg/kg. None of the soil constituents were above the RBCs (screening levels).

Groundwater—To define constituent concentrations in the groundwater, samples were collected from four locations around the SWMU. One location was collected upgradient of the SWMU (07-10), two locations were collected inside the area of elevated soil constituent concentrations (07-04 and 07-08), and one location was collected downgradient of the release (07-12). The analytical results for groundwater are presented in Table 5.2-3. TRPH results for groundwater were greater than the 10-mg/L release criterion at one location—07-08. The other groundwater results were below the release criterion. Ethyl benzene, toluene, total xylenes, and carbon disulfide were observed at elevated concentrations in groundwater at location 07-04. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.2.3 Risk-Based Screen Results

The risk-based screen indicated that none of the COPCs exceeded the screening criteria for this SWMU. Complete screen results and the toxicity values used are contained in Appendix C. On the basis of the screen, there is no risk to human health from the release at SWMU 7.

5.2.4 Conclusions

The results from the investigation of the SWMU indicate that a subsurface release has likely occurred at this site. The extent of the release was confined to a small area west and north of the SWMU as defined by TRPH analysis. The extent of elevated constituent concentrations in the groundwater was determined to be confined to the TRPH-contaminated soils. The nature of the release was defined by laboratory analysis.

TRPH concentrations were found in the soil at levels that exceed the Base-specific cleanup level; the volume of vadose zone soil requiring remediation is approximately 2.7 cubic yards. No constituents were detected at levels above the RBCs; therefore, the release at SWMU 7 does not pose a risk to human health.

5.2.5 Recommendations

SWMU 7 was recommended for conditional NFA. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 7 was removed and remediated in 1996 under the Phase 2 Basewide POL project. No soil with TPH in excess of 1000 mg/kg was found during the removal of SWMU 7. Confirmation samples ranged from 22 mg/kg to 420 mg/kg. A more detailed account can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997*. SWMU 7 was recommended for NFA in the

above report and subsequently approved for NFA by NMED. Therefore, SWMU 7 is recommended for NFA.

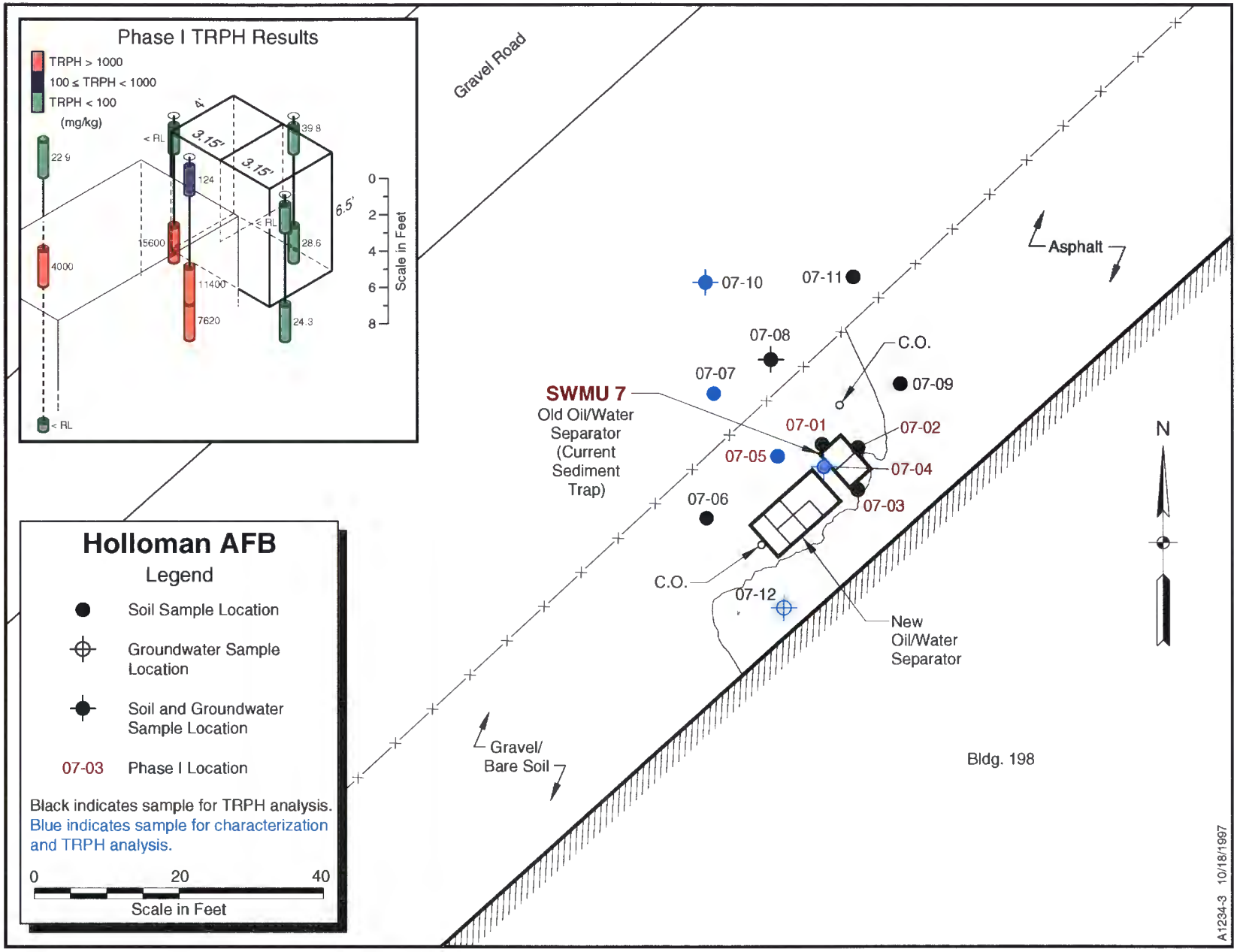

Figure 5.2-1. SWMU 7 - Building 198 O/WS Sample Locations and Phase I TRPH Results

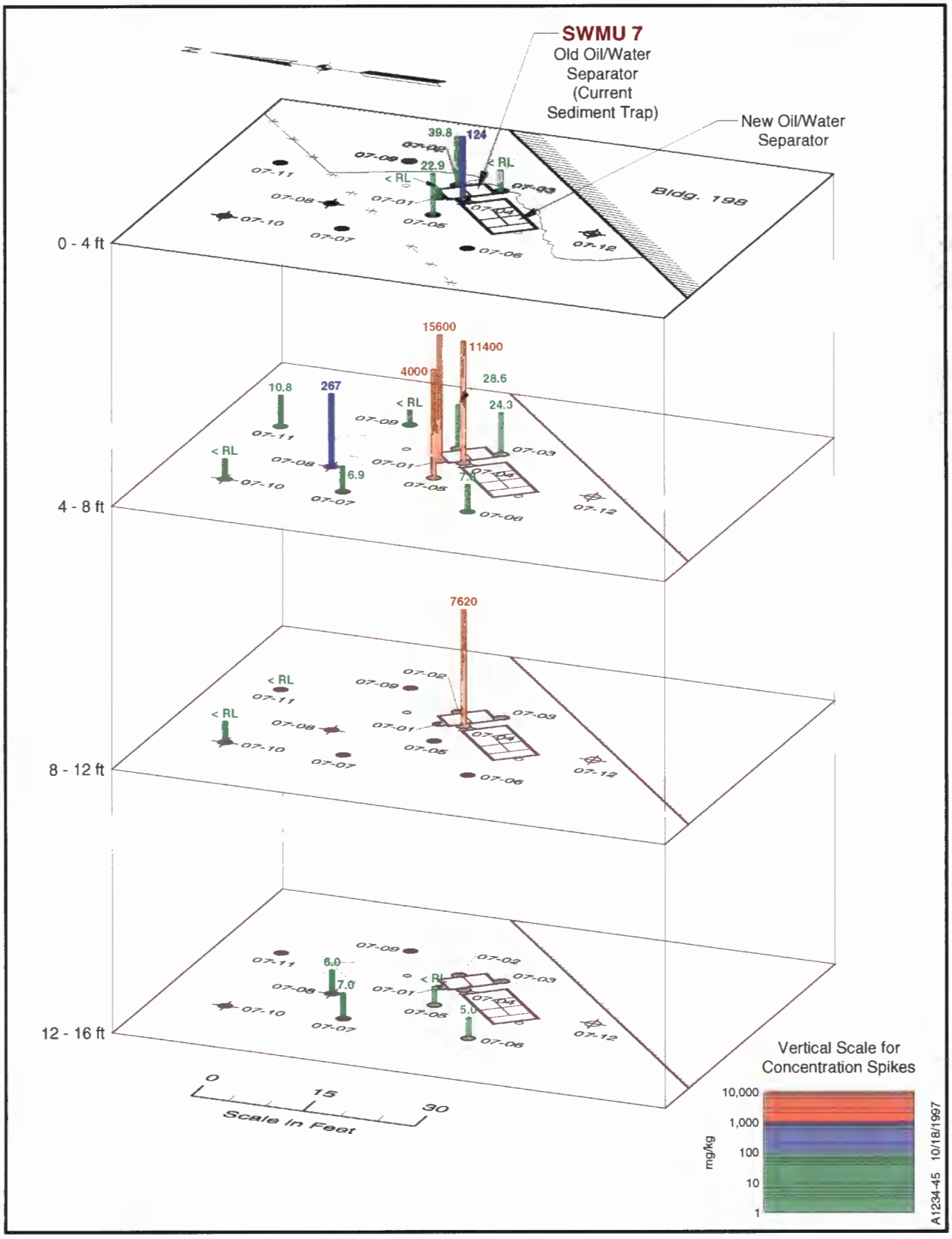

Figure 5.2-2. SWMU 7 - TRPH Concentrations by Depth Interval

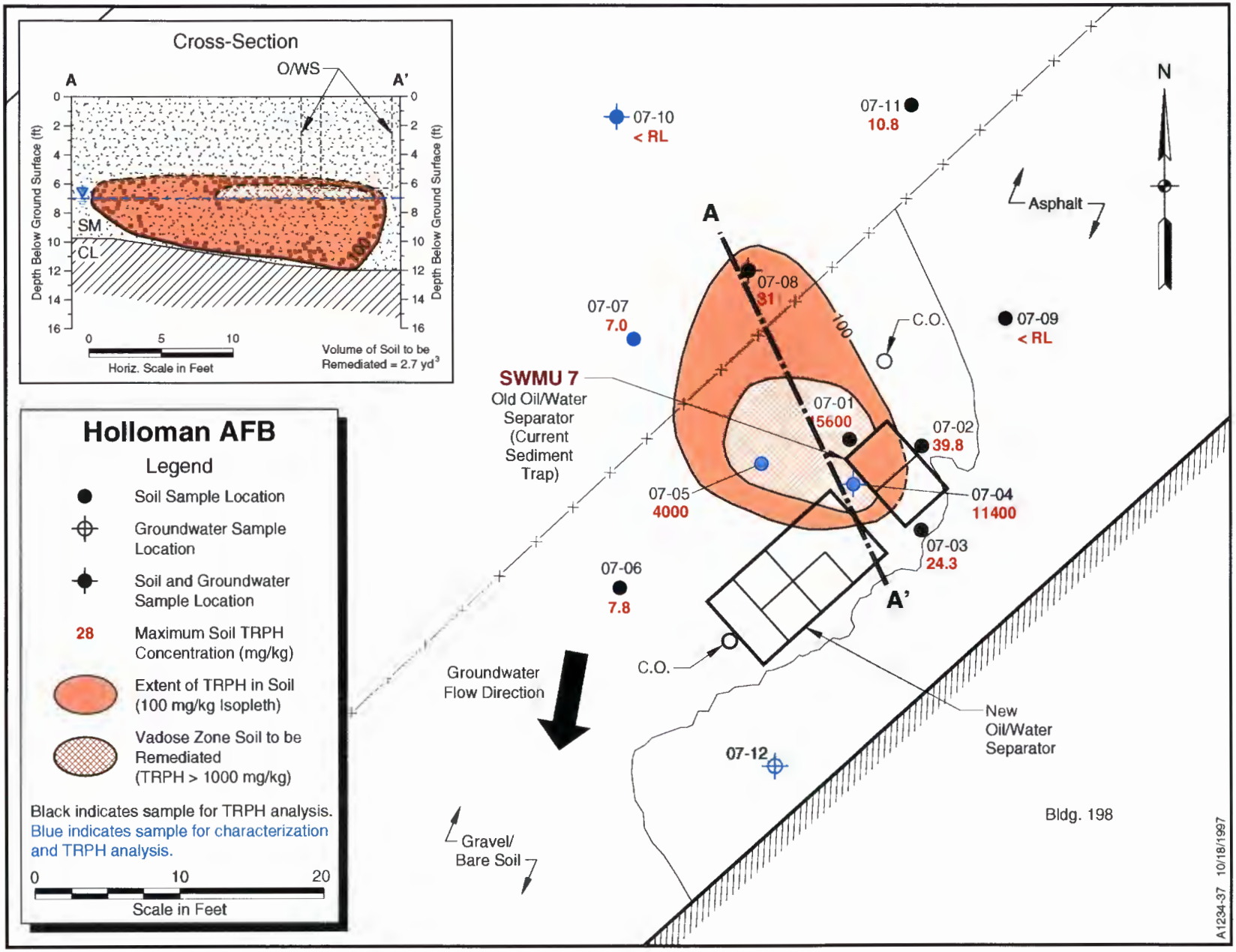

Figure 5.2-3. SWMU 7 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.2-1
TRPH Results for Soil at SWMU 7

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)		Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	
07-01	0.5	2	< RL		07-06	6	8	7.8	
	6	8	15600	(16800)		15	15.5	5	
07-02	0.5	2	39.8		07-07	6	8	6.9	
	6	8	28.6/27.1	(< RL)		12	14	7	(< RL)
07-03	0.5	2	< RL		07-08	6	8	267/311	
	6	8	24.3			13	14	6	
07-04	0.5	2	124		07-09	6	8	< RL	
	6	8	11400		07-10	6	8	< RL	(< RL)
	8	10	7620	(5960)		8	10	< RL	
07-05	0	2	22.9	(< RL)	07-11	6	8	10.8	
	6	8	4000	(3550)		9.5	10	< RL/8.8	
	15.5	16	< RL						

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

Table 5.2-2
Summary Analytical Results for Soil at SWMU 7

Location ID		07-04		07-05		07-07		07-10	
Beg. Depth - End Depth (ft)		0-2	8-10	0-2		12-14		6-8	
SW6010 (mg/kg)	Barium	27.5 (1.18)	17.4 (1.34)	14.5 (1.32)		42.2 (1.22)		< RL (1.33)	
	Beryllium	< RL (0.237)	< RL (0.269)	< RL (0.264)		0.259 (0.243)		< RL (0.267)	
	Cadmium	< RL (0.592)	< RL (0.673)	< RL (0.659)		< RL (0.608)		< RL (0.667)	
	Chromium	2.05 (1.18)	2.15 (1.34)	< RL (1.32)		2.95 (1.22)		< RL (1.33)	
	Cobalt	< RL (1.18)	< RL (1.34)	< RL (1.32)		1.31 (1.22)		< RL (1.33)	
	Copper	< RL (2.37)	< RL (2.69)	< RL (2.64)		< RL (2.43)		< RL (2.67)	
	Silver	< RL (1.18)	< RL (1.34)	< RL (1.32)		< RL (1.22)		< RL (1.33)	
	Vanadium	5.52 (2.37)	4.35 (2.69)	3.41 (2.64)		9.12 (2.43)		< RL (2.67)	
	Zinc	9.14 (2.37)	3.82 (2.69)	2.69 (2.64)		10.2 (2.43)		< RL (2.67)	
SW7041 (mg/kg)	Antimony	< RL (0.592)	< RL (0.673)	< RL (0.659)		0.814 (0.608)		< RL (0.667)	
SW7060 (mg/kg)	Arsenic	0.818 (0.592)	< RL (0.673)	0.659 (0.659)		1.23 (0.608)		< RL (0.667)	
SW7421 (mg/kg)	Lead	0.936 (0.592)	< RL (0.673)	< RL (0.659)		1.59 (0.608)		1.6 (0.667)	
SW7471 (mg/kg)	Mercury	< RL (0.0237)	< RL (0.0269)	< RL (0.0264)		< RL (0.0243)		< RL (0.0267)	
SW7740 (mg/kg)	Selenium	< RL (0.592)	< RL (0.673)	< RL (0.659)		< RL (0.608)		< RL (0.667)	
SW7841 (mg/kg)	Thallium	< RL (0.592)	< RL (0.673)	< RL (0.659)		< RL (0.608)		< RL (0.667)	
SW8260 (µg/kg)	1,2-Dichlorobenzene	< RL (5.92)	13600 (4200)	ND (6.59)		ND (6.08)		ND (6.67)	
	1,2-Dichloroethane	ND (5.92)	< RL (4200)	ND (6.59)		ND (6.08)		ND (6.67)	
	1,3-Dichlorobenzene	< RL (5.92)	ND (4200)	ND (6.59)		ND (6.08)		ND (6.67)	
	1,4-Dichlorobenzene	< RL (5.92)	5380 (4200)	ND (6.59)		ND (6.08)		ND (6.67)	
	2-Butanone	< RL (118)	ND (84100)	< RL (132)		ND (122)		ND (133)	
	Acetone	483 (237)	< RL (84100)	581 (132)		1220 (608)		< RL (133)	
	Ethyl benzene	ND (5.92)	49700 (4200)	ND (6.59)		ND (6.08)		ND (6.67)	
	Methylene chloride	< RL (23.7)	ND (16800)	< RL (26.4)		< RL (24.3)		< RL (26.7)	
	Toluene	6.99 (5.92)	< RL (4200)	9.88 (6.59)		< RL (6.08)		< RL (6.67)	
	Total xylenes	ND (5.92)	131000 (4200)	< RL (6.59)		ND (6.08)		ND (6.67)	
	Trichloroethene	ND (5.92)	< RL (4200)	ND (6.59)		ND (6.08)		ND (6.67)	
	Vinyl acetate	ND (59.2)	ND (42100)	< RL (65.9)		ND (60.8)		ND (66.7)	

Table 5.2-2
(Continued)

Location ID		07-04				07-05		07-07		07-10	
Beg. Depth - End Depth (ft)		0-2		8-10		0-2		12-14		6-8	
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	2-Methylphenol	ND	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	4-Methylphenol	ND	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	Benzoic acid	ND	(1.9)	17.2	(2.15)	ND	(2.11)	ND	(1.94)	ND	(1.6)
	Benzyl alcohol	ND	(0.782)	< RL	(0.888)	ND	(0.87)	ND	(0.802)	ND	(0.66)
	Butylbenzylphthalate	ND	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	Dibenzofuran	ND	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	Fluoranthene	< RL	(0.391)	ND	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	Fluorene	ND	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	Naphthalene	ND	(0.391)	0.577	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	Phenanthrene	< RL	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	Pyrene	< RL	(0.391)	< RL	(0.444)	ND	(0.435)	ND	(0.401)	ND	(0.33)
	di-n-Butylphthalate	< RL	(0.391)	< RL	(0.444)	< RL	(0.435)	ND	(0.401)	< RL	(0.33)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.2-3
Summary Analytical Results for Groundwater at SWMU 7

Location ID		07-04		07-08		07-10		07-12	
E418.1 (mg/L)	TRPH	1.93	(0.4)	NA		< RL	(0.4)	< RL	(0.4)
E418.1M (mg/L)	TRPH	< RL	(5)	134	(50)	< RL	(5)	< RL	(5)
SW6010 (mg/L)	Barium	< RL	(0.01)	NA		< RL	(0.01)	0.011	(0.01)
	Beryllium	< RL	(0.002)	NA		< RL	(0.002)	< RL	(0.002)
	Chromium	< RL	(0.01)	NA		< RL	(0.01)	< RL	(0.01)
	Silver	0.015	(0.01)	NA		0.016	(0.01)	0.016	(0.01)
	Zinc	< RL	(0.02)	NA		< RL	(0.02)	< RL	(0.02)
SW7041 (mg/L)	Antimony	< RL	(0.005)	NA		0.0062	(0.005)	0.0127	(0.005)
SW7060 (mg/L)	Arsenic	< RL	(0.004)	NA		< RL	(0.004)	< RL	(0.004)
SW7421 (mg/L)	Lead	< RL	(0.003)	NA		< RL	(0.003)	0.0068	(0.003)
SW7740 (mg/L)	Selenium	< RL	(0.005)	NA		< RL	(0.005)	< RL	(0.005)
SW7841 (mg/L)	Thallium	< RL	(0.002)	NA		< RL	(0.002)	< RL	(0.002)
SW8260 (μg/L)	1,2-Dichlorobenzene	ND	(5)	NA		ND	(5)	< RL	(5)
	1,3-Dichlorobenzene	ND	(5)	NA		ND	(5)	< RL	(5)
	1,4-Dichlorobenzene	ND	(5)	NA		< RL	(5)	< RL	(5)
	2-Butanone	< RL	(100)	NA		ND	(100)	< RL	(100)
	Acetone	< RL	(100)	NA		ND	(100)	< RL	(100)
	Benzene	< RL	(5)	NA		ND	(5)	ND	(5)
	Carbon disulfide	31.2	(5)	NA		ND	(5)	ND	(5)
	Ethyl benzene	34.4	(5)	NA		ND	(5)	ND	(5)
	Methylene chloride	< RL	(20)	NA		25.3	(20)	< RL	(20)
	Toluene	33.7	(5)	NA		ND	(5)	ND	(5)
	Total xylenes	111	(5)	NA		ND	(5)	ND	(5)
	Vinyl acetate	ND	(50)	NA		ND	(50)	< RL	(50)
SW8270 (mg/L)	Naphthalene	< RL	(0.01)	NA		ND	(0.01)	ND	(0.01)

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).

NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Not analyzed.

5.3 SWMU 11—Building 300 O/WS

SWMU 11 serviced the jet engine maintenance area in Building 300. This SWMU was removed and replaced in 1991 with a new sediment trap. Interviews with personnel in Building 292 during the investigation indicated that aboveground storage tanks were located in an adjacent parking lot for an unspecified period of time in the past. These may represent a potentially distinct source.

To investigate whether a release had occurred, SWMU 11 was investigated under the Table 3 RFI. Samples were collected on four sides of the new sediment trap at three horizons ranging from the surface to 8 ft. Since the original unit had been removed, the samples were collected outside or below the backfill area. During the Phase I investigation, it was determined that a surface release had occurred at this SWMU, and a Phase II investigation was triggered to determine the nature and extent of the release.

Phase II sampling was continued until the extent of SWMU-related contamination had been defined. Elevated TRPH levels were found in a parking area near the SWMU, but are not apparently related to SWMU 11. Upon fixed laboratory analysis, cadmium and several petroleum hydrocarbons were detected in samples at levels above the screening criteria. A site-specific risk assessment was performed to evaluate risk further. It showed that concentrations of the COCs would not pose significant risk to human health. Remediation of the contaminated vadose zone soils exceeding the Base-specific cleanup level related to SWMU 11 is recommended as the condition for NFA at SWMU 11.

5.3.1 SWMU Description

Unit Type: Unknown
Period of Operation: 1977 to 1991
Current Status: Inactive
Disposition of Unit: No longer present
Source of Waste: Building 300
Major Operations: Engine maintenance
Construction Material: Concrete
Physical Condition: Unknown
Historic Releases: None known

5.3.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand with gravel and sandy silt to approximately 12 ft bgl. Groundwater occurs at 3.5 to 4 ft bgl, and the groundwater flow direction in this portion of the Base is know to vary from the south to southwest. The O/WS is no longer present and the depth of the previous unit is unknown. Gray staining was noted beginning at 4 ft bgl extending to approximately 7.5 ft bgl near the separator. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.3-1, samples were collected at four locations at three horizons from the surface to a depth of 8 ft during the Phase I investigation. Samples were analyzed in the field for TRPH by EPA 418.1M. The isometric diagram in Figure 5.3-1 shows the sampled intervals and their associated Phase I TRPH results.

Soil samples at three of the Phase I locations exceeded the 100-mg/kg TRPH release criterion. The maximum TRPH concentration of 2200 mg/kg was detected at location 11-04. It was determined in the field that a release had occurred, most likely from an overflow of the separator or a surface spill. From the Phase I results, a Phase II investigation was triggered.

Phase II Investigation

Extent—The iterative step-out approach described in the work plan (Radian, 1994a) was used to investigate the extent of the release. Phase II sampling locations are depicted in Figure 5.3-1. TRPH results for all sample locations and horizons are shown in Figure 5.3-2 and presented in Table 5.3-1. Locations 11-09 and 11-10 had TRPH concentrations above 1000 mg/kg that are related to a release from SWMU 11. Samples from locations 11-17, 11-20, 11-21, and 11-22, however, show an abrupt increase in TRPH concentrations that appear to be unrelated to SWMU 11. These levels are likely associated with the aboveground storage tanks that were reportedly present in the nearby parking area in the past. Extent of TRPH contamination south of location 11-22 was not further delineated because it was believed that elevated TRPH in this area could not be related to a release from SWMU 11.

The areal extent of TRPH contamination for the SWMU-related area was determined using the maximum detected concentrations at each sample location. Figure 5.3-3 shows this area.

Nature—To characterize the nature of the release, 10 samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.3-2. Locations 11-02, -04, and -10 show elevated levels of benzene, toluene, ethyl benzene, xylenes (BTEX) and other VOC constituents. The sample collected at location 11-05 had elevated levels of several SVOC constituents. The data indicated that only benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and cadmium were present at levels greater than EPA Region III RBCs (see Table 5.3-3). Although other constituents were detected, no other organics or inorganics were detected at levels of concern in any of the sample locations or intervals.

Groundwater—To define constituent concentrations in groundwater, samples were initially collected from three locations around SWMU 11. One groundwater sample exceeded the 10-mg/L release criterion for TRPH in groundwater, and additional step-out locations were necessary to define extent. Analytical results show elevated levels of VOCs and SVOCs at location 11-04. The constituent concentrations decrease downgradient of the SWMU (location 11-10) to near or below the reporting limits, further defining the extent of the release in groundwater. Complete analytical results for groundwater are shown in Table 5.3-4. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.3.3 Risk-Based Screen Results

The risk-based screen indicated that benzo(a)pyrene, benzo(a)anthracene, benzo(b)-fluoranthene, indeno(1,2,3-cd)pyrene, and cadmium were present at levels above the screening criteria and are therefore considered COCs for the release at SWMU 11. Further evaluation of risk was necessary to determine if these constituents pose a risk to human health for the site.

The risk-based screen compared the maximum site results with residential RBCs following EPA Region III screening guidance to identify sites that may pose a risk to human health. The screen incorporates very conservative parameters, and an exceedence of the RBCs indicates that a site-specific risk assessment is required to make conclusions on human-health risk at SWMU 11.

Both the output from the risk-based screen and the toxicity values used are presented in Appendix C. The risk assessment is discussed in Section 5.3.4.

5.3.4 Risk Assessment Results

A site-specific risk assessment was performed on the constituents that exceeded COC screening criteria. Carinogenic and noncarcinogenic risks for construction workers at SWMU 11 were calculated based on dermal contact and incidental ingestion of contaminated soil. Inhalation of fugitive dust was also considered but it was not included in the calculation of the overal risk numbers because the pathway was determined to not contribute significantly to risk under safe working conditions. Appendix D provides detailed rationale for exposure scenario selection and shows the risk calculations for each analyte.

The average and reasonable maximum carcinogenic risks at SWMU 11 are $2x10^{-9}$ and $5x10^{-9}$, respectively. Average and reasonable maximum noncarcinogenic hazard indices are 0.03 and 0.36, respectively. These risk levels are within acceptable ranges; therefore, adverse health effects from the release at SWMU 11 are unlikely.

5.3.5 Conclusions

The results from the investigation of SWMU 11 indicate that a release occurred from the separator formerly located in this area. TRPH concentrations were found in soil that exceed the 1000-mg/kg cleanup level in two distinct areas. The first area appears to be from a release at SWMU 11. The second area of TRPH contamination is located approximately 100 ft south of the original SWMU but is not related to the SWMU. The SWMU-related area of contamination exceeding 1000 mg/kg TRPH is approximately 48 cubic yards and will require remediation to comply with the Base-specific cleanup level. The extent of the release delineated by TRPH in the field, and the nature was defined by laboratory analysis. The extent of elevated constituent concentrations in groundwater were confined to the extent of TRPH-contaminated soils.

Cadmium and several petroleum hydrocarbons exceeded the risk-based screen and were further evaluated in a site-specific risk assessment where it was concluded that there is no significant human health risk at the site.

5.3.6 Recommendations

SWMU 11 was recommended for conditional NFA, the condition being the excavation of TPH-contaminated soil in excess of 1000 mg/kg. SWMU 11 was removed in 1991. Approximately 168 cubic yards of soil were excavated under the Phase 2 Basewide POL project in 1996. However, no soil in excess of 1000 mg/kg TPH was found during excavation activities. Confirmation samples ranged from 35 mg/kg to 180 mg/kg, excluding the sample taken from the base of the excavation (below water table) (1900 mg/kg). However, per our agreement with NMED, only vadose soils with TPH in excess of 1000 mg/kg require excavation. SWMU 11 was recommended for NFA in the above report and subsequently approved for NFA by NMED. Therefore this site is recommended for NFA. A more detailed description of field activities at SWMU 11 can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.*

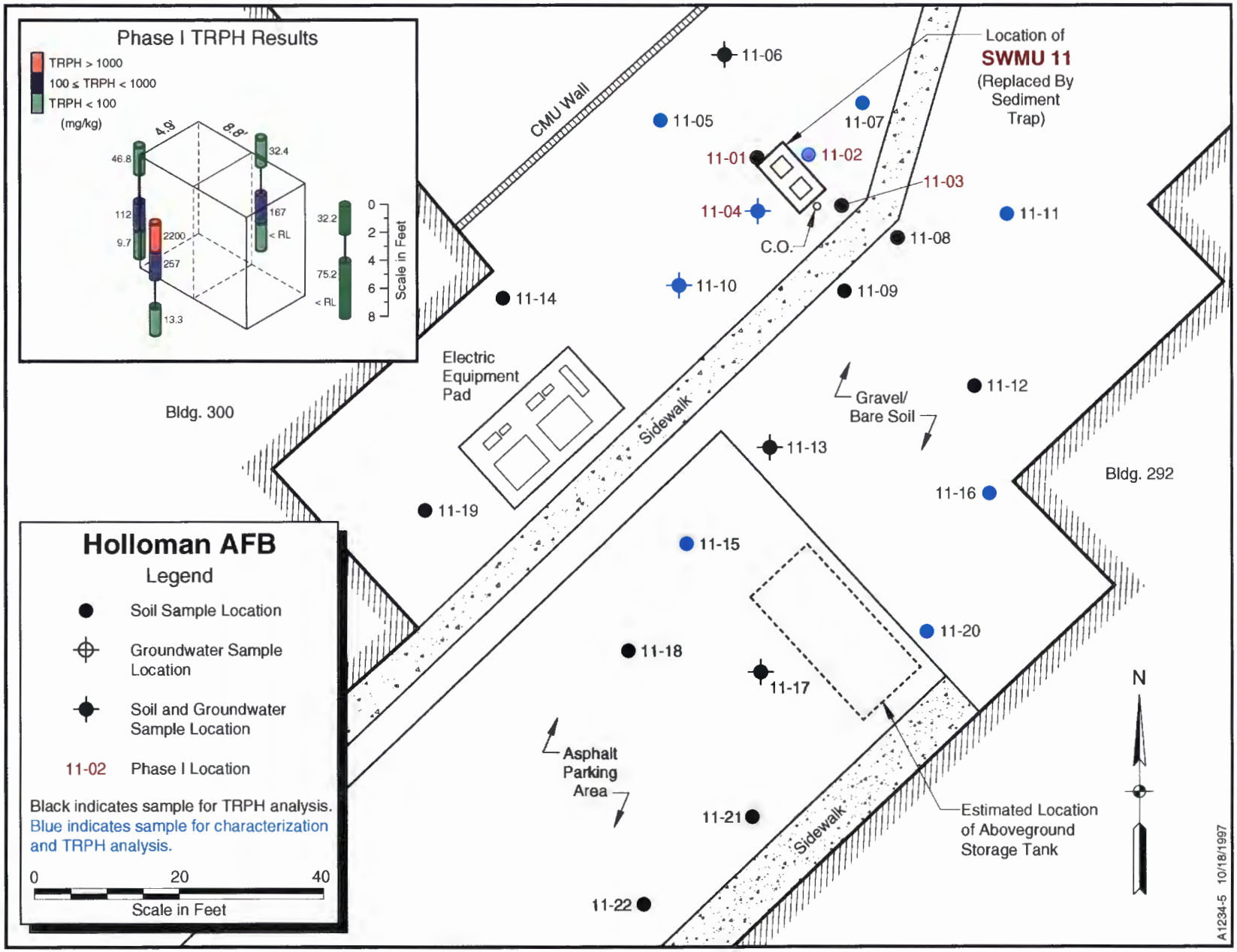

Figure 5.3-1. SWMU 11 - Building 300 O/WS Sample Locations and Phase I TRPH Results

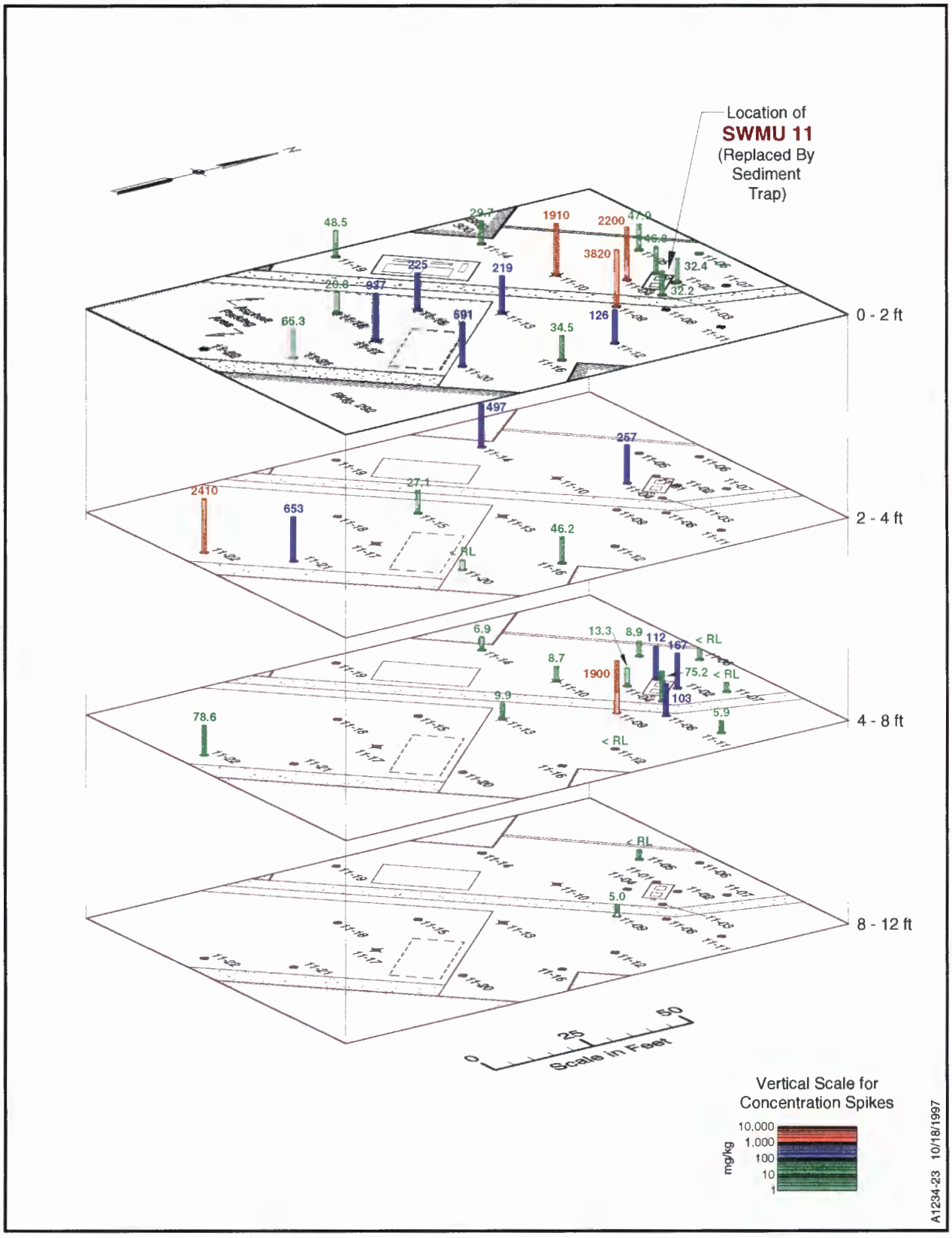

Figure 5.3-2. SWMU 11 - TRPH Concentrations by Depth Interval

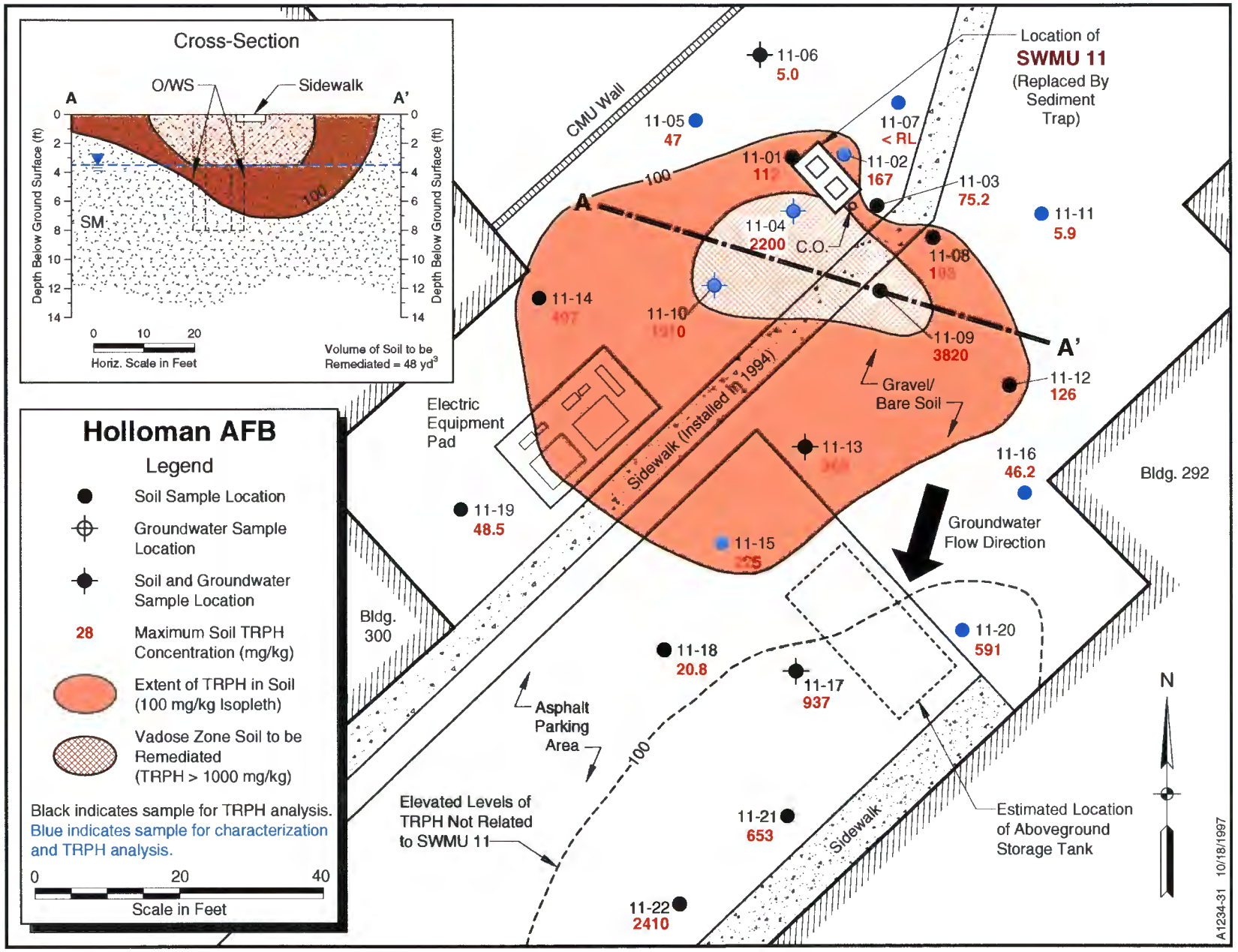

Figure 5.3-3. SWMU 11 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.3-1
TRPH Results for Soil at SWMU 11

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
11-01	0	2	46.8
	4	6	112
	6	8	9.7
11-02	0	2	32.4
	4	6	167
	6	8	< RL
11-03	0	2	32.2
	4	6	75.2
	6	8	< RL
11-04	0	2	2200/1640
	2	4	257
	6	8	13.3
11-05	0	2	47 (91.3)
	4	6	8.9
	10	12	< RL (39.8)
11-06	4	6	< RL
	6	8	5
11-07	4	6	< RL (77.6)
11-08	4	6	103
	6	8	< RL
11-09	0	2	3820
	4	6	1900/3820
	8	10	5
11-10	0	2	1910 (1750)
	4	6	8.7
	6	8	6/7.9
11-11	4	6	< RL (< RL)
	6	8	5.9
11-12	0	2	126
	4	6	< RL
11-13	0	2	219/369
	4	6	9.9
11-14	0	2	29.7/37.4
	2	4	497
	7.5	8	6.9
11-15	0	2	225 (338)
	2	4	27.1
11-16	0	2	34.5 (31.6)
	2	4	46.2
11-17	0	2	937
11-18	0	2	20.8
11-19	0	2	48.5
11-20	0	2	591
	2	4	< RL
11-21	0.5	2	65.3
	2	4	653
11-22	2	4	2410
	4	6	78.6

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

Table 5.3-2
Summary Analytical Results for Soil at SWMU 11

Location ID		11-02		11-04		11-05			
Beg. Depth - End Depth (ft)		4-6		0-2		0-2		10-12	
SW6010 (mg/kg)	Barium	26.2	(1.28)	24.5	(1.1)	37.1	(1.1)	22.1	(1.3)
	Beryllium	< RL	(0.256)	< RL	(0.221)	< RL	(0.22)	< RL	(0.261)
	Cadmium	< RL	(0.639)	< RL	(0.552)	0.618	(0.549)	< RL	(0.653)
	Chromium	4.76	(1.28)	6.36	(1.1)	6.32	(1.1)	< RL	(1.3)
	Cobalt	< RL	(1.28)	< RL	(1.1)	1.11	(1.1)	< RL	(1.3)
	Copper	4.22	(2.56)	3.01	(2.21)	7.32	(2.2)	< RL	(2.61)
	Silver	< RL	(1.28)	< RL	(1.1)	< RL	(1.1)	< RL	(1.3)
	Vanadium	5.32	(2.56)	5.52	(2.21)	5.04	(2.2)	2.72	(2.61)
	Zinc	32.7	(2.56)	14.6	(2.21)	24.8	(2.2)	< RL	(2.61)
SW7041 (mg/kg)	Antimony	< RL	(0.639)	< RL	(0.552)	< RL	(0.549)	< RL	(0.653)
SW7060 (mg/kg)	Arsenic	2.94	(0.639)	1.81	(0.552)	2.86	(0.549)	0.783	(0.653)
SW7421 (mg/kg)	Lead	21.2	(0.639)	23.6	(0.552)	19.1	(0.549)	< RL	(0.653)
SW7471 (mg/kg)	Mercury	< RL	(0.0256)	< RL	(0.0221)	< RL	(0.022)	< RL	(0.0261)
SW7740 (mg/kg)	Selenium	< RL	(0.639)	< RL	(0.552)	< RL	(0.549)	< RL	(0.653)
SW7841 (mg/kg)	Thallium	< RL	(0.639)	< RL	(0.552)	< RL	(0.549)	< RL	(0.653)
SW8260 (µg/kg)	1,1-Dichloroethane	ND	(6.39)	17.5	(5.52)	ND	(5.49)	ND	(6.53)
	1,1-Dichloroethene	< RL	(6.39)	ND	(5.52)	ND	(5.49)	ND	(6.53)
	1,2-Dichlorobenzene	419	(32)	1770	(345)	ND	(5.49)	ND	(6.53)
	1,2-Dichloroethane	< RL	(6.39)	ND	(5.52)	ND	(5.49)	< RL	(6.53)
	1,2-Dichloropropane	ND	(6.39)	ND	(5.52)	ND	(5.49)	ND	(6.53)
	1,3-Dichlorobenzene	20.3	(6.39)	77.8	(5.52)	ND	(5.49)	ND	(6.53)
	1,4-Dichlorobenzene	125	(6.39)	1110	(27.6)	ND	(5.49)	ND	(6.53)
	2-Butanone	< RL	(128)	978	(552)	ND	(110)	< RL	(130)
	2-Chloroethylvinyl ether	ND	(6.39)	< RL	(5.52)	ND	(5.49)	ND	(6.53)
	Acetone	< RL	(128)	886	(552)	126	(110)	< RL	(130)
	Benzene	< RL	(6.39)	34.4	(5.52)	ND	(5.49)	ND	(6.53)
	Bromodichloromethane	ND	(6.39)	< RL	(5.52)	ND	(5.49)	ND	(6.53)
	Carbon disulfide	< RL	(6.39)	106	(5.52)	ND	(5.49)	ND	(6.53)
	Chlorobenzene	6.52	(6.39)	56.4	(5.52)	ND	(5.49)	ND	(6.53)
	Ethyl benzene	111	(6.39)	85400	(6900)	< RL	(5.49)	ND	(6.53)
	Methylene chloride	< RL	(25.6)	< RL	(22.1)	23.6	(22)	< RL	(26.1)
	Styrene	< RL	(6.39)	ND	(5.52)	ND	(5.49)	ND	(6.53)
	Tetrachloroethene	< RL	(6.39)	ND	(5.52)	ND	(5.49)	ND	(6.53)
	Toluene	< RL	(6.39)	756	(27.6)	< RL	(5.49)	< RL	(6.53)
	Total xylenes	130	(6.39)	202000	(6900)	< RL	(5.49)	< RL	(6.53)
	Trichloroethene	< RL	(6.39)	5880	(345)	ND	(5.49)	ND	(6.53)
	Vinyl acetate	ND	(63.9)	908	(276)	ND	(54.9)	81.2	(65.3)
	Vinyl chloride	< RL	(6.39)	ND	(5.52)	ND	(5.49)	ND	(6.53)
	cis-1,2-Dichloroethene	< RL	(6.39)	15.4	(5.52)	ND	(5.49)	ND	(6.53)
	trans-1,2-Dichloroethene	< RL	(6.39)	< RL	(5.52)	ND	(5.49)	ND	(6.53)

Table 5.3-2
(Continued)

Location ID		11-02		11-04		11-05			
Beg. Depth - End Depth (ft)		4-6		0-2		0-2		10-12	
SW8270 (mg/kg)	1,2-Dichlorobenzene	< RL	(0.422)	< RL	(0.364)	ND	(0.362)	ND	(0.431)
	1,4-Dichlorobenzene	< RL	(0.422)	< RL	(0.364)	ND	(0.362)	ND	(0.431)
	2-Methylnaphthalene	ND	(0.422)	ND	(0.364)	ND	(0.362)	ND	(0.431)
	4-Methylphenol	ND	(0.422)	ND	(0.364)	ND	(0.362)	ND	(0.431)
	Acenaphthene	< RL	(0.422)	ND	(0.364)	1.95	(0.362)	ND	(0.431)
	Anthracene	ND	(0.422)	ND	(0.364)	2.62	(0.362)	ND	(0.431)
	Benzoic acid	ND	(2.05)	ND	(1.77)	ND	(1.76)	ND	(2.09)
	Benzyl alcohol	ND	(0.844)	ND	(0.728)	ND	(0.724)	ND	(0.862)
	Chrysene	ND	(0.422)	ND	(0.364)	3.11	(0.362)	ND	(0.431)
	Dibenzofuran	< RL	(0.422)	ND	(0.364)	1.4	(0.362)	ND	(0.431)
	Fluoranthene	< RL	(0.422)	< RL	(0.364)	9.88	(0.362)	ND	(0.431)
	Fluorene	< RL	(0.422)	ND	(0.364)	2.14	(0.362)	ND	(0.431)
	Naphthalene	< RL	(0.422)	ND	(0.364)	< RL	(0.362)	ND	(0.431)
	Phenanthrene	< RL	(0.422)	< RL	(0.364)	8.94	(0.362)	ND	(0.431)
	Pyrene	< RL	(0.422)	< RL	(0.364)	7.46	(0.362)	< RL	(0.431)
	Benzo(a)anthracene	ND	(0.422)	< RL	(0.364)	3.74	(0.362)	ND	(0.431)
	Benzo(a)pyrene	ND	(0.422)	ND	(0.364)	1.9	(0.362)	ND	(0.431)
	Benzo(b)fluoranthene	ND	(0.422)	ND	(0.364)	1.58	(0.362)	ND	(0.431)
	Benzo(g,h,i)perylene	ND	(0.422)	ND	(0.364)	0.384	(0.362)	ND	(0.431)
	Benzo(k)fluoranthene	ND	(0.422)	ND	(0.364)	0.457	(0.362)	ND	(0.431)
	bis(2-Ethylhexyl)phthalate	ND	(0.422)	ND	(0.364)	ND	(0.362)	ND	(0.431)
	di-n-Butylphthalate	< RL	(0.422)	< RL	(0.364)	< RL	(0.362)	< RL	(0.431)
	Dibenz(a,h)anthracene	ND	(0.422)	ND	(0.364)	< RL	(0.362)	ND	(0.431)
	Indeno(1,2,3-cd)pyrene	ND	(0.422)	ND	(0.364)	1.96	(0.362)	ND	(0.431)

Table 5.3-2
(Continued)

Location ID		11-07		11-10		11-11		11-15	
Beg. Depth - End Depth (ft)		4-6		0-2		4-6		0-2	
SW6010 (mg/kg)	Barium	11.3	(1.36)	18.8	(1.22)	11.7	(1.44)	70.8	(1.16)
	Beryllium	< RL	(0.273)	< RL	(0.244)	< RL	(0.289)	0.365	(0.231)
	Cadmium	< RL	(0.682)	< RL	(0.611)	< RL	(0.722)	< RL	(0.578)
	Chromium	< RL	(1.36)	2.8	(1.22)	< RL	(1.44)	9.91	(1.16)
	Cobalt	< RL	(1.36)	< RL	(1.22)	< RL	(1.44)	3.47	(1.16)
	Copper	< RL	(2.73)	< RL	(2.44)	< RL	(2.89)	9.85	(2.31)
	Silver	< RL	(1.36)	< RL	(1.22)	< RL	(1.44)	< RL	(1.16)
	Vanadium	4.24	(2.73)	6.18	(2.44)	3.47	(2.89)	12.2	(2.31)
	Zinc	< RL	(2.73)	10.5	(2.44)	< RL	(2.89)	41.2	(2.31)
SW7041 (mg/kg)	Antimony	1.32	(0.682)	< RL	(0.611)	< RL	(0.722)	< RL	(0.578)
SW7060 (mg/kg)	Arsenic	0.941	(0.682)	1.23	(0.611)	1.53	(0.722)	2.28	(0.578)
SW7421 (mg/kg)	Lead	< RL	(0.682)	3.28	(0.611)	< RL	(0.722)	10.8	(0.578)
SW7471 (mg/kg)	Mercury	< RL	(0.0273)	< RL	(0.0244)	< RL	(0.0289)	< RL	(0.0231)
SW7740 (mg/kg)	Selenium	< RL	(0.682)	< RL	(0.611)	< RL	(0.722)	< RL	(0.578)
SW7841 (mg/kg)	Thallium	< RL	(0.682)	< RL	(0.611)	< RL	(0.722)	< RL	(0.578)
SW8260 (µg/kg)	1,1-Dichloroethane	ND	(6.82)	ND	(6.11)	ND	(7.22)	ND	(5.78)
	1,1-Dichloroethene	ND	(6.82)	ND	(6.11)	ND	(7.22)	ND	(5.78)
	1,2-Dichlorobenzene	ND	(6.82)	ND	(6.11)	ND	(7.22)	ND	(5.78)
	1,2-Dichloroethane	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	1,2-Dichloropropane	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	1,3-Dichlorobenzene	ND	(6.82)	6.72	(6.11)	ND	(7.22)	ND	(5.78)
	1,4-Dichlorobenzene	ND	(6.82)	20.2	(6.11)	ND	(7.22)	ND	(5.78)
	2-Butanone	< RL	(136)	< RL	(122)	< RL	(144)	< RL	(116)
	2-Chloroethylvinyl ether	ND	(6.82)	ND	(6.11)	ND	(7.22)	ND	(5.78)
	Acetone	< RL	(136)	566	(122)	289	(144)	< RL	(116)
	Benzene	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	Bromodichloromethane	ND	(6.82)	ND	(6.11)	ND	(7.22)	ND	(5.78)
	Carbon disulfide	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	Chlorobenzene	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	Ethyl benzene	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	Methylene chloride	< RL	(27.3)	< RL	(24.4)	< RL	(28.9)	29.2	(23.1)
	Styrene	ND	(6.82)	ND	(6.11)	ND	(7.22)	ND	(5.78)
	Tetrachloroethene	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	Toluene	< RL	(6.82)	9.05	(6.11)	< RL	(7.22)	ND	(5.78)
	Total xylenes	ND	(6.82)	7.82	(6.11)	ND	(7.22)	ND	(5.78)
	Trichloroethene	ND	(6.82)	52.9	(6.11)	ND	(7.22)	ND	(5.78)
	Vinyl acetate	ND	(68.2)	ND	(61.1)	ND	(72.2)	ND	(57.8)
	Vinyl chloride	ND	(6.82)	ND	(6.11)	ND	(7.22)	ND	(5.78)
	cis-1,2-Dichloroethene	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)
	trans-1,2-Dichloroethene	ND	(6.82)	< RL	(6.11)	ND	(7.22)	ND	(5.78)

Table 5.3-2
(Continued)

Location ID		11-07		11-10		11-11		11-15	
Beg. Depth - End Depth (ft)		4-6		0-2		4-6		0-2	
SW8270 (mg/kg)	1,2-Dichlorobenzene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	1,4-Dichlorobenzene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	2-Methylnaphthalene	ND	(0.45)	0.798	(0.403)	ND	(0.477)	ND	(0.382)
	4-Methylphenol	ND	(0.45)	< RL	(0.403)	ND	(0.477)	ND	(0.382)
	Acenaphthene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Anthracene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Benzoic acid	ND	(2.18)	4.82	(1.96)	ND	(2.31)	ND	(1.85)
	Benzyl alcohol	ND	(0.9)	< RL	(0.807)	ND	(0.954)	ND	(0.763)
	Chrysene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Dibenzofuran	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Fluoranthene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Fluorene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Naphthalene	ND	(0.45)	1.61	(0.403)	ND	(0.477)	ND	(0.382)
	Phenanthrene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Pyrene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Benzo(a)anthracene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Benzo(a)pyrene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Benzo(b)fluoranthene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Benzo(g,h,i)perylene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Benzo(k)fluoranthene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	bis(2-Ethylhexyl)phthalate	ND	(0.45)	0.524	(0.403)	ND	(0.477)	ND	(0.382)
	di-n-Butylphthalate	< RL	(0.45)	< RL	(0.403)	< RL	(0.477)	< RL	(0.382)
	Dibenz(a,h)anthracene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)
	Indeno(1,2,3-cd)pyrene	ND	(0.45)	ND	(0.403)	ND	(0.477)	ND	(0.382)

Table 5.3-2
(Continued)

Location ID		11-16		11-20	
Beg. Depth - End Depth (ft)		0-2		0-2	
SW6010 (mg/kg)	Barium	66.4	(1.03)	470	(1.12)
	Beryllium	< RL	(0.206)	1.2	(0.225)
	Cadmium	< RL	(0.515)	5.98	(0.562)
	Chromium	6.19	(1.03)	59.5	(1.12)
	Cobalt	1.42	(1.03)	13.5	(1.12)
	Copper	3.93	(2.06)	42.3	(2.25)
	Silver	< RL	(1.03)	< RL	(1.12)
	Vanadium	8.38	(2.06)	69.8	(2.25)
	Zinc	25	(2.06)	289	(2.25)
SW7041 (mg/kg)	Antimony	2.01	(0.515)	< RL	(0.562)
SW7060 (mg/kg)	Arsenic	1.22	(0.515)	1.74	(0.562)
SW7421 (mg/kg)	Lead	6.61	(0.515)	27	(0.562)
SW7471 (mg/kg)	Mercury	< RL	(0.0206)	< RL	(0.0225)
SW7740 (mg/kg)	Selenium	< RL	(0.515)	< RL	(0.562)
SW7841 (mg/kg)	Thallium	< RL	(0.515)	< RL	(0.562)
SW8260 (µg/kg)	1,1-Dichloroethane	ND	(5.15)	ND	(5.62)
	1,1-Dichloroethene	ND	(5.15)	ND	(5.62)
	1,2-Dichlorobenzene	ND	(5.15)	ND	(5.62)
	1,2-Dichloroethane	ND	(5.15)	ND	(5.62)
	1,2-Dichloropropane	ND	(5.15)	ND	(5.62)
	1,3-Dichlorobenzene	ND	(5.15)	ND	(5.62)
	1,4-Dichlorobenzene	ND	(5.15)	ND	(5.62)
	2-Butanone	ND	(103)	ND	(112)
	2-Chloroethylvinyl ether	ND	(5.15)	ND	(5.62)
	Acetone	< RL	(103)	< RL	(112)
	Benzene	ND	(5.15)	ND	(5.62)
	Bromodichloromethane	ND	(5.15)	ND	(5.62)
	Carbon disulfide	ND	(5.15)	ND	(5.62)
	Chlorobenzene	ND	(5.15)	ND	(5.62)
	Ethyl benzene	ND	(5.15)	ND	(5.62)
	Methylene chloride	23.3	(20.6)	24.7	(22.5)
	Styrene	ND	(5.15)	ND	(5.62)
	Tetrachloroethene	ND	(5.15)	ND	(5.62)
	Toluene	ND	(5.15)	< RL	(5.62)
	Total xylenes	ND	(5.15)	< RL	(5.62)
	Trichloroethene	ND	(5.15)	ND	(5.62)
	Vinyl acetate	ND	(51.5)	ND	(22.5)
	Vinyl chloride	ND	(5.15)	ND	(5.62)
	cis-1,2-Dichloroethene	ND	(5.15)	ND	(5.62)
	trans-1,2-Dichloroethene	ND	(5.15)	ND	(5.62)

Table 5.3-2
(Continued)

Location ID		11-16		11-20	
Beg. Depth - End Depth (ft)		0-2		0-2	
SW8270 (mg/kg)	1,2-Dichlorobenzene	ND	(0.34)	ND	(0.371)
	1,4-Dichlorobenzene	ND	(0.34)	ND	(0.371)
	2-Methylnaphthalene	ND	(0.34)	ND	(0.371)
	4-Methylphenol	ND	(0.34)	ND	(0.371)
	Acenaphthene	ND	(0.34)	ND	(0.371)
	Anthracene	ND	(0.34)	ND	(0.371)
	Benzoic acid	ND	(1.65)	ND	(1.8)
	Benzyl alcohol	ND	(0.68)	ND	(0.742)
	Chrysene	ND	(0.34)	ND	(0.371)
	Dibenzofuran	ND	(0.34)	ND	(0.371)
	Fluoranthene	ND	(0.34)	< RL	(0.371)
	Fluorene	ND	(0.34)	ND	(0.371)
	Naphthalene	ND	(0.34)	ND	(0.371)
	Phenanthrene	ND	(0.34)	ND	(0.371)
	Pyrene	ND	(0.34)	< RL	(0.371)
	Benzo(a)anthracene	ND	(0.34)	ND	(0.371)
	Benzo(a)pyrene	ND	(0.34)	ND	(0.371)
	Benzo(b)fluoranthene	ND	(0.34)	ND	(0.371)
	Benzo(g,h,i)perylene	ND	(0.34)	ND	(0.371)
	Benzo(k)fluoranthene	ND	(0.34)	ND	(0.371)
	bis(2-Ethylhexyl)phthalate	ND	(0.34)	ND	(0.371)
	di-n-Butylphthalate	0.581	(0.34)	< RL	(0.371)
	Dibenz(a,h)anthracene	ND	(0.34)	ND	(0.371)
	Indeno(1,2,3-cd)pyrene	ND	(0.34)	ND	(0.371)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.3-3
Analytical Results for Chemicals of Concern for Soil at SWMU 11[a]

Location ID			11-02		11-04		11-05		11-05		11-07	
Beg. Depth - End Depth (ft)			4-6		0-2		0-2		10-12		4-6	
SW6010 (mg/kg)	Cadmium	[3.91, 0.56][b]	0.238 J	(0.639)	0.374 J	(0.552)	0.618	(0.549)	0.0431 J	(0.653)	0.0218 J	(0.682)
SW8270 (mg/kg)	Benzo(a)anthracene	[8.75E-01][c]	ND	(0.422)	0.158 J	(0.364)	3.74	(0.362)	ND	(0.431)	ND	(0.45)
	Benzo(a)pyrene	[8.75E-02]	ND	(0.422)	ND	(0.364)	1.9	(0.362)	ND	(0.431)	ND	(0.45)
	Benzo(b)fluoranthene	[8.75E-01]	ND	(0.422)	ND	(0.364)	1.58	(0.362)	ND	(0.431)	ND	(0.45)
	Indeno(1,2,3-cd)pyrene	[8.75E-01]	ND	(0.422)	ND	(0.364)	1.96	(0.362)	ND	(0.431)	ND	(0.45)
Location ID			11-10		11-11		11-15		11-16		11-20	
Beg. Depth - End Depth (ft)			0-2		4-6		0-2		0-2		0-2	
SW6010 (mg/kg)	Cadmium	[3.91, 0.56][b]	0.131 J	(0.611)	0.0217 J	(0.722)	0.407 J	(0.578)	0.413 J	(0.515)	5.98	(0.562)
SW8270 (mg/kg)	Benzo(a)anthracene	[8.75E-01][c]	ND	(0.403)	ND	(0.477)	ND	(0.382)	ND	(0.34)	ND	(0.371)
	Benzo(a)pyrene	[8.75E-02]	ND	(0.403)	ND	(0.477)	ND	(0.382)	ND	(0.34)	ND	(0.371)
	Benzo(b)fluoranthene	[8.75E-01]	ND	(0.403)	ND	(0.477)	ND	(0.382)	ND	(0.34)	ND	(0.371)
	Indeno(1,2,3-cd)pyrene	[8.75E-01]	ND	(0.403)	ND	(0.477)	ND	(0.382)	ND	(0.34)	ND	(0.371)

Note—This table presents the analytical results used in the risk-based screen and risk assessment. The J-flag data are estimated concentrations, since the result is below the reporting limit.

J = Result is less than the reporting limit.
ND = Analyte not detected. No instrument response.
( ) = Reporting limit.

[a] Shading highlights results greater than the EPA Region III RBC used in the risk-based screen.
[b] [RBC, UTL] = EPA Region III residential risk-based concentrations, 95% upper tolerance limit background concentration.
[c] [RBC] = EPA Region III residential risk-based concentration.

Table 5.3-4
Summary Analytical Results for Groundwater at SWMU 11

Location ID		11-04		11-06		11-10		11-13		11-17	
E418.1 (mg/L)	TRPH	< RL	(0.4)	NA		2.41	(0.4)	NA		NA	
E418.1M (mg/L)	TRPH	< RL	(5)	< RL	(5)	13.3	(5)	31.8	(5)	< RL	(5)
SW6010 (mg/L)	Barium	0.017	(0.01)	NA		0.018	(0.01)	NA		NA	
	Beryllium	< RL	(0.002)	NA		< RL	(0.002)	NA		NA	
	Cadmium	< RL	(0.005)	NA		< RL	(0.005)	NA		NA	
	Chromium	< RL	(0.01)	NA		< RL	(0.01)	NA		NA	
	Cobalt	< RL	(0.01)	NA		< RL	(0.01)	NA		NA	
	Copper	< RL	(0.02)	NA		< RL	(0.02)	NA		NA	
	Vanadium	0.038	(0.02)	NA		< RL	(0.02)	NA		NA	
	Zinc	0.037	(0.02)	NA		0.02	(0.02)	NA		NA	
SW7041 (mg/L)	Antimony	0.006	(0.005)	NA		< RL	(0.005)	NA		NA	
SW7060 (mg/L)	Arsenic	0.0075	(0.004)	NA		0.0097	(0.004)	NA		NA	
SW7421 (mg/L)	Lead	< RL	(0.003)	NA		< RL	(0.003)	NA		NA	
SW7740 (mg/L)	Selenium	< RL	(0.005)	NA		< RL	(0.005)	NA		NA	
SW8260 (µg/L)	1,2-Dichlorobenzene	274	(5)	NA		ND	(5)	NA		NA	
	1,3-Dichlorobenzene	9.6	(5)	NA		ND	(5)	NA		NA	
	1,4-Dichlorobenzene	90	(5)	NA		ND	(5)	NA		NA	
	2-Butanone	< RL	(100)	NA		2.9	(0)	NA		NA	
	Acetone	< RL	(100)	NA		< RL	(100)	NA		NA	
	Benzene	< RL	(5)	NA		ND	(5)	NA		NA	
	Chlorobenzene	< RL	(5)	NA		ND	(5)	NA		NA	
	Ethyl benzene	178	(5)	NA		ND	(5)	NA		NA	
	Methylene chloride	< RL	(20)	NA		< RL	(20)	NA		NA	
	Toluene	22.6	(5)	NA		< RL	(5)	NA		NA	
	Total xylenes	2540	(5)	NA		ND	(5)	NA		NA	
	Trichloroethene	151	(5)	NA		6.2	(5)	NA		NA	
	Vinyl acetate	< RL	(50)	NA		ND	(50)	NA		NA	
	cis-1,2-Dichloroethene	8.1	(5)	NA		ND	(5)	NA		NA	
	trans-1,2-Dichloroethene	< RL	(5)	NA		ND	(5)	NA		NA	
SW8270 (mg/L)	1,2-Dichlorobenzene	0.0173	(0.01)	NA		ND	(0.01)	NA		NA	
	1,4-Dichlorobenzene	< RL	(0.01)	NA		ND	(0.01)	NA		NA	
	2,4-Dimethylphenol	< RL	(0.01)	NA		ND	(0.01)	NA		NA	
	2-Methylphenol	0.0108	(0.01)	NA		ND	(0.01)	NA		NA	
	4-Methylphenol	< RL	(0.01)	NA		ND	(0.01)	NA		NA	
	Naphthalene	< RL	(0.01)	NA		ND	(0.01)	NA		NA	
	bis(2-Ethylhexyl)phthalate	ND	(0.01)	NA		< RL	(0.01)	NA		NA	

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).

NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.4 SWMUs 12 and 13—Buildings 304 and 304A O/WSs

SWMUs 12 and 13 service the vehicle maintenance areas in Building 304. These O/WSs were removed and replaced with a new O/WS in 1993. Concrete covers the site where the old O/WSs were located and the surrounding area including the new O/WS.

To investigate whether a release had occurred, SWMUs 12 and 13 were investigated under the Table 3 RFI. Samples were collected in four locations in the area where the two units were located. Since the units have been removed, the samples were collected outside or below the backfill area. Because an overflow from the O/WSs is known to have collected in a low area approximately 60 ft away and may have run into a drainage ditch. During the Phase I investigation, it was determined that a release had occurred from the SWMU and ponding in nearby overflow areas had also caused releases of constituents to the soil. Additional soil and groundwater samples were then collected in all directions to determine the nature and extent of the release.

Upon fixed laboratory analysis for characterization, benzo(a)pyrene was detected in one sample at a level above the RBC. Risk associated with elevated levels of this analyte was further evaluated in a site-specific risk assessment. The risk assessment showed that potential risk at this site is well below acceptable levels. The recommendation for SWMUs 12 and 13 is conditional no further action. The condition of NFA is the remediation of vadose zone soils that exceed the TRPH cleanup level.

5.4.1 SWMU Description

Unit Type: Single-chamber O/WS with separate oil storage tank
Period of Operation (12;13): February 1980 to 1993; 1982 to 1993
Current Status: Inactive
Disposition of Units: Removed in 1993
Source of Waste: Buildings 304 and 304A
Major Operations: Vehicle maintenance
Construction Material: Steel
Physical Condition: Steel in good condition (at time of removal)
Oil/Total Capacity (12;13): 20 gal./35 gal.; 15 gal./25 gal.
Historic Releases: Periodic overflows of both O/WSs; visible soil contamination below concrete

5.4.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand with gravel and sandy silt to approximately 10 ft bgl. In two borings pushed to 12 ft bgl, the soil grades rapidly to a sandy clay between 10 and 11 ft bgl. Gray to very dark gray staining was noted beginning at the surface extending to approximately 9.5 ft bgl near the separator. At location 12-05, staining was noted only to 6.5 ft bgl. The depth to groundwater is highly variable across the site. In the eastern portion of the site, near the new O/WS, groundwater occurs at a depth of approximately 6 ft bgl. However, farther to the west near the northwestern corner of Building 304A, the depth to groundwater is only 3 ft bgl. This is interpreted to be the result of very localized mounding caused by groundwater recharge near the corner of the building. As noted during the field investigation, this is an area where water collects and there is often standing water. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.4-1, samples were collected at 10 locations at multiple horizons from the surface to a depth of 12 ft bgl during the Phase I investigation. Samples were analyzed in the field for TRPH by EPA 418.1M. Samples 12-01, -02, -03, and -04 were taken in the immediate vicinity of SWMUs 12 and 13. The remaining

Phase I samples were taken south and west of along the drainage ditch. Figure 5.4-1 shows the sampling horizons and the associated Phase I TRPH results.

Soil samples at seven of the Phase I locations exceeded the 100-mg/kg TRPH release criterion. The maximum TRPH value occurred at location 12-04 near the original O/WSs; location 12-06, situated in the drainage ditch where the runoff was thought to collect, also contained elevated levels of TRPH. It was determined that a surface release had occurred. On the basis of results from Phase I, a Phase II investigation was triggered.

Phase II Investigation

Extent—The iterative step-out approach described in the work plan (Radian, 1994a) was used to investigate the extent of the release. The Phase II sampling locations are depicted in Figure 5.4-1 and in Table 5.4-1. The TRPH results for all sample locations and horizons are shown in Figure 5.4-2. The highest TRPH concentrations are located in two distinct areas. The first area is situated at the former location of the removed O/WSs. This area is covered by concrete and is bounded on the northeast by Building 304. An additional area of elevated TRPH concentrations is located southwest of the SWMU near a low area where runoff has reportedly collected.

The step-out approach was followed until the extent of TRPH below the 100-mg/kg release criterion was defined at both areas. The areal extent of TRPH contamination for both areas was determined using the maximum detected concentrations at each sample location. Figure 5.4-3 shows these areas.

Nature—To characterize the nature of the release, 10 samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.4-2. 2-butanone, acetone, carbon disulfide, methylene chloride, toluene, 2-methylnaphthalene, and vinyl acetate were the only organic analytes detected above the reporting limit. The data indicated, however, that only benzo(a)pyrene was present (in one sample) at a level above the RBC. Table 5.4-3 shows analytical results that are greater than EPA Region III RBCs. No other constituents were detected at levels of concern in any of the sample locations or intervals.

Groundwater—To ensure that SWMUs 12 and 13 are not contributing additional contamination to the groundwater, samples were collected from four locations. None of the groundwater samples exceeded the 10-mg/L release criterion for TRPH in groundwater. Naphthalene was the only organic constituent at the site detected above the reporting limit at a concentration of 0.022 mg/L (see Table 5.4-4). However, naphthalene was not detected at locations downgradient of the O/WS. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.4.3 Risk-Based Screen Results

The risk-based screen indicated that benzo(a)pyrene was present at a level greater than the RBC at one sampling location (see Table 5.4-3). Further evaluation of risk was necessary to determine if the COC poses a risk to human health for this SWMU.

The risk-based screen compared the maximum site results with EPA Region III residential RBCs to identify sites that may pose a risk to human health. The screen incorporates veryconservative parameters, and an exceedence of the RBCs indicates that a site-specific risk assessment is required to make conclusions on human health risk at this SWMU. The results of the risk-based screen are contained in Appendix C. The results of the risk assessment are discussed in Section 5.4.4.

5.4.4 Risk Assessment Results

Benzo(a)pyrene is the only COC identified at SWMUs 12 and 13. Incidental ingestion of soil contaminated with benzo(a)pyrene was evaluated to determine the average and reasonable maximum carcinogenic risks for workers excavating at these SWMUs. This evaluation showed an average and reasonable maximum carcinogenic risk of $1x10^{-10}$ and $3x10^{-10}$, respectively. The risk values are well below the Superfund target risk range of 10^{-6} to 10^{-4} and are unlikely to cause adverse health effects. Hazard indices were not calculated for SWMUs 12 and 13 because no noncarcinogens were identified as COCs.

Appendix D shows detailed methodology for the risk assessment, including exposure pathway identification rationale and carinogenic risk calculations.

5.4.5 Conclusions

The results from the investigation of SWMUs 12 and 13 indicate that a release occurred from the separators formerly located in this area. Because TRPH exceeding the release criterion were found in the drainage ditch and runoff collection area, it is likely that past releases have been carried to these locations by surface water runoff.

TRPH concentrations were found in soil that exceed the 1000-mg/kg cleanup level in two distinct areas. The first area and the areas surrounding it are covered by concrete. Because there is no exposure route, the source has been removed, and the release is confined to the area around the units. NFA is recommended for this area. The second area of TRPH contamination is located approximately 30 ft southwest of the original SWMUs. The volume in this area exceeding 1000 mg/kg of TRPH is approximately 10.7 cubic yards.

The nature of the release was defined by laboratory analysis. The release appears to have had a minimal impact on groundwater at SWMUs 12 and 13. Benzo(a)pyrene in the soils exceeded the risk-based screening criteria and was further evaluated in a site-specific risk assessment. The risk assessment showed that the potential carcinogenic risk at the site was well below the target risk range.

5.4.6 Recommendations

CNFA was recommended for SWMUs 12 and 13. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. Approximately 250 cubic yards of TPH-contaminated soil were excavated. However, analytical results indicated that the stockpiled soil contained less than 1000 mg/kg TPH and therefore no soil required offsite disposal. Confirmation samples ranged from not-detected to 37 mg/kg. A more detailed account of the remediation can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997.* SWMUs 12 and 13 were recommended for NFA in the above report and subsequently approved for NFA by NMED. Therefore, SWMUs 12 and 13 are recommended for NFA.

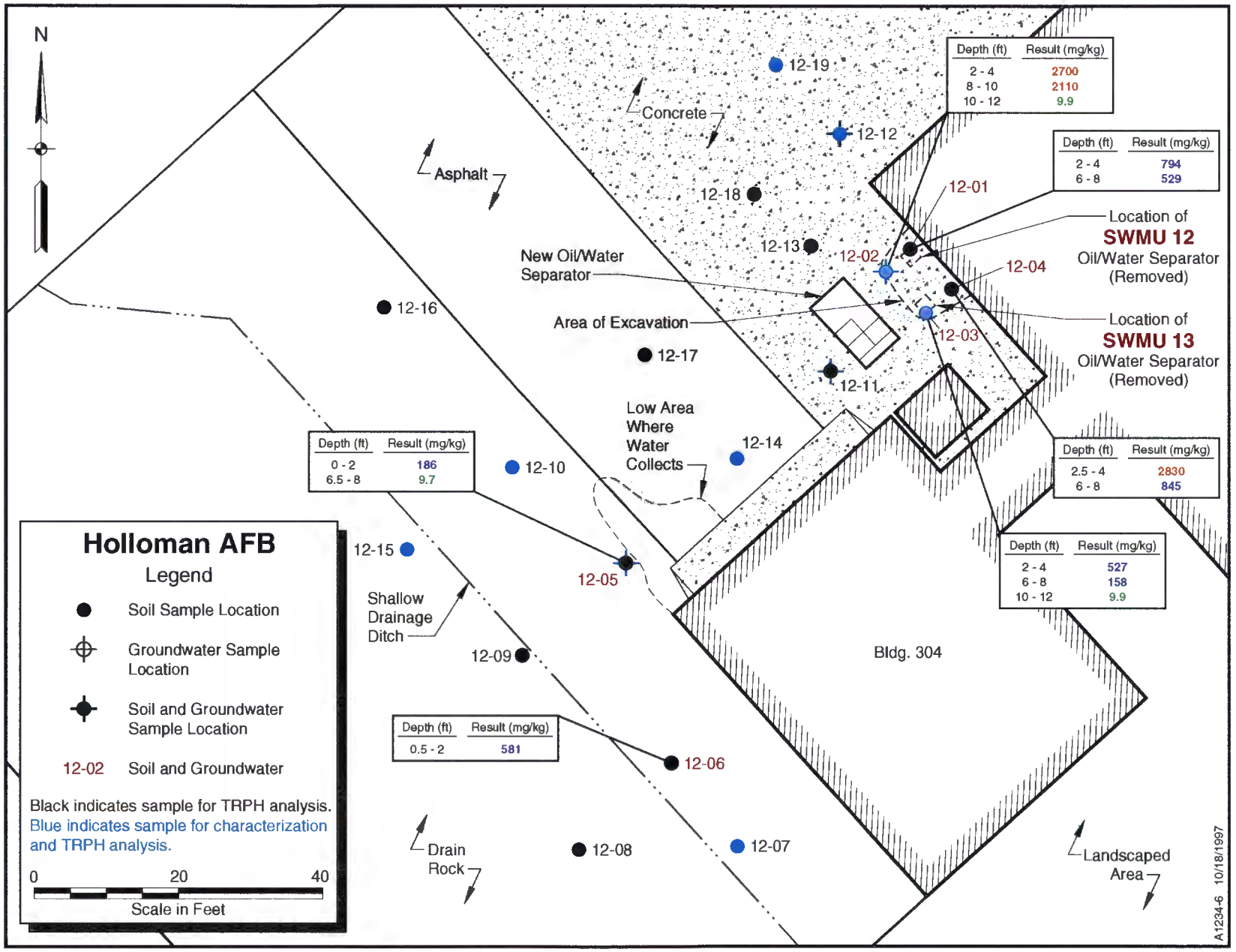

Figure 5.4-1. SWMUs 12 & 13 - Buildings 304 and 304A O/WS Sample Locations and Phase I TRPH Results

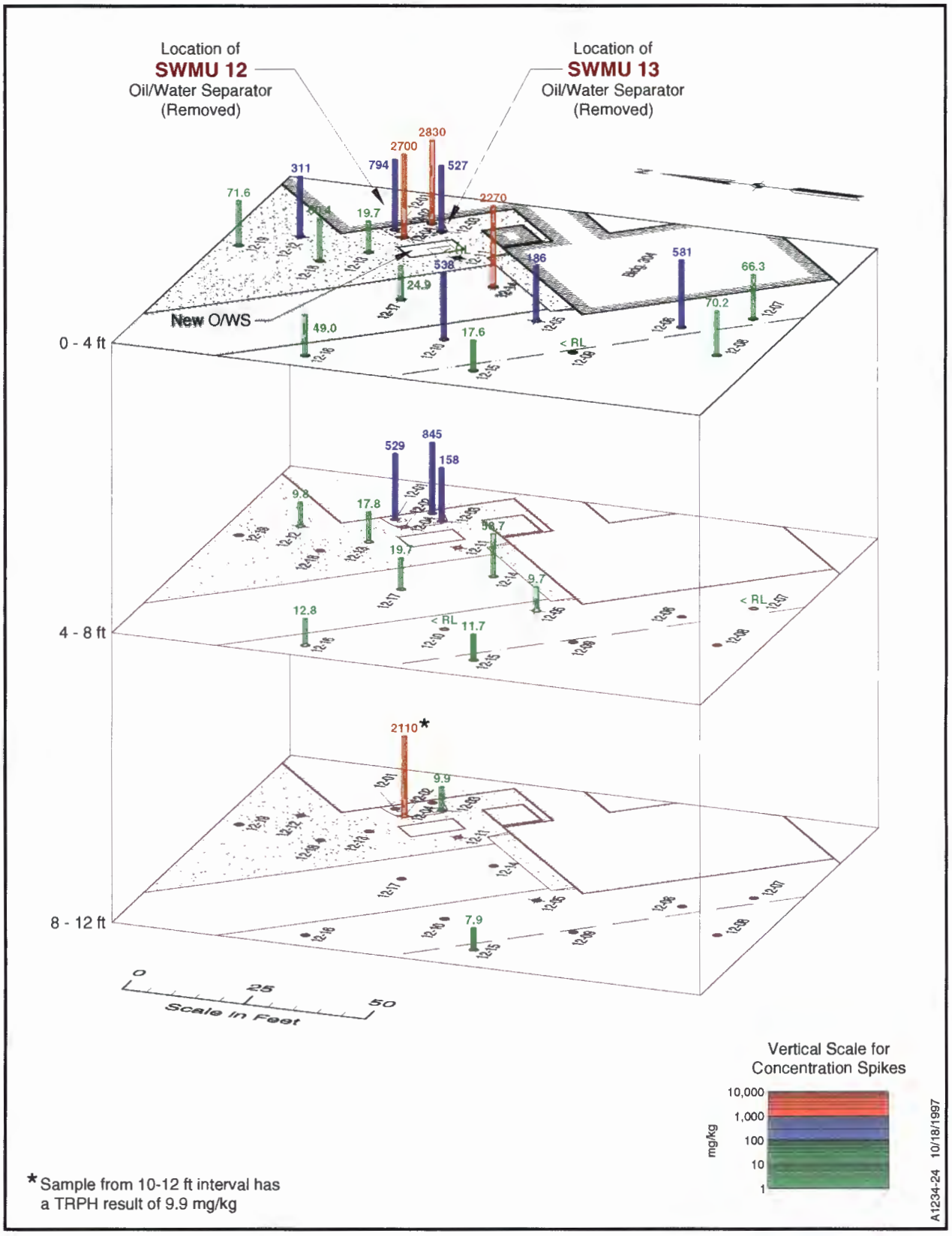

Figure 5.4-2. SWMUs 12 & 13 - TRPH Concentrations by Depth Interval

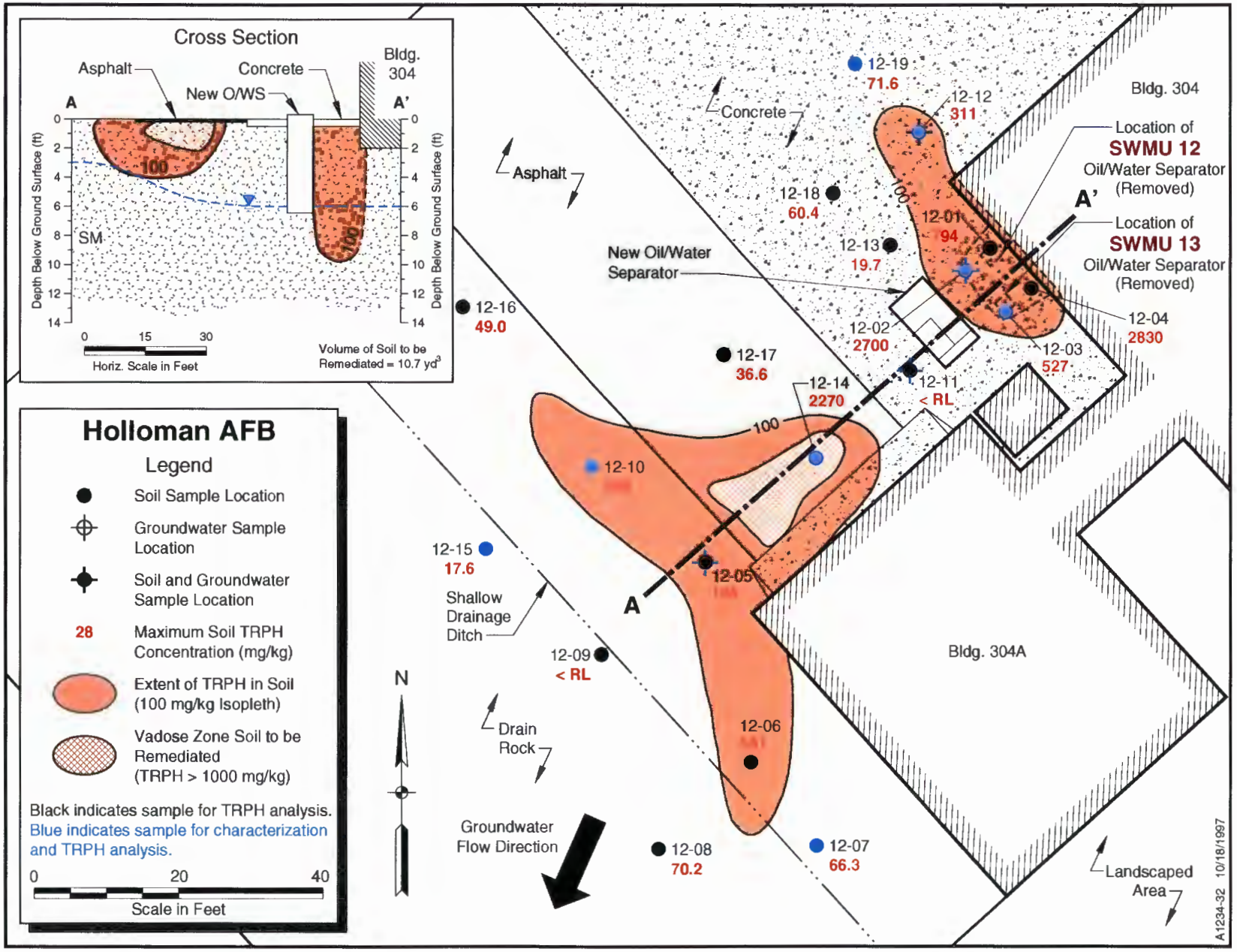

Figure 5.4-3. SWMUs 12 & 13 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.4-1
TRPH Results for Soil at SWMUs 12 and 13

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)		Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	
12-01	2	4	794		12-11	0.5	2	< RL	
	6	8	529		12-12	0	2	311	(5160)
12-02	2	4	2700			6	8	9.8	(< RL)
	8	10	2110	(1560)	12-13	0	2	19.7	
	10	12	9.9	(< RL)		2	4	7.9	
12-03	2	4	527/502			6	8	17.8	
	6	8	158		12-14	0	2	2270	(465)
	10	12	9.9			4	6	15.6	
12-04	2.5	4	2830	(2110)		6	8	58.7	
	6	8	845		12-15	0	2	17.6	(< RL)
12-05	0	2	186			4	6	11.7/15.8	
	6.5	8	9.7			10	12	7.9	
12-06	0.5	2	581		12-16	0	2	49	
12-07	0	2	66.3	(< RL)		4	6	7.8	
	3.5	4	< RL			6	8	12.8	
	4.9	6	< RL		12-17	0	2	24.9/36.6	
12-08	0	2	70.2			4	6	19.7	
12-09	0.6	2	< RL			6	8	< RL	
12-10	0	2	538	(467)	12-18	0	2	60.4/45.5	
	6.7	8	< RL		12-19	0	2	71.6	(< RL)

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

Table 5.4-2
Summary of Analytical Results for Soil at SWMUs 12 and 13

Location ID		12-02		12-02		12-03		12-07	
Beg. Depth - End Depth (ft)		10-12		2-4		6-8		0-2	
SW6010 (mg/kg)	Barium	35.6	(1.25)	51	(1.13)	1.61	(1.43)	15.2	(1.23)
	Beryllium	< RL	(0.25)	< RL	(0.226)	< RL	(0.287)	< RL	(0.247)
	Cadmium	< RL	(0.624)	< RL	(0.564)	< RL	(0.717)	< RL	(0.617)
	Chromium	2.92	(1.25)	6.32	(1.13)	< RL	(1.43)	2.33	(1.23)
	Cobalt	< RL	(1.25)	1.69	(1.13)	< RL	(1.43)	< RL	(1.23)
	Copper	< RL	(2.5)	6.28	(2.26)	< RL	(2.87)	< RL	(2.47)
	Silver	< RL	(1.25)	< RL	(1.13)	< RL	(1.43)	< RL	(1.23)
	Vanadium	7.66	(2.5)	10.5	(2.26)	< RL	(2.87)	5.06	(2.47)
	Zinc	5.84	(2.5)	17.8	(2.26)	< RL	(2.87)	10.7	(2.47)
SW7041 (mg/kg)	Antimony	< RL	(0.624)	< RL	(0.564)	< RL	(0.717)	< RL	(0.617)
SW7060 (mg/kg)	Arsenic	0.861	(0.624)	1.17	(0.564)	0.976	(0.717)	< RL	(0.617)
SW7421 (mg/kg)	Lead	0.762	(0.624)	5.55	(0.564)	< RL	(0.717)	4.98	(0.617)
SW7471 (mg/kg)	Mercury	< RL	(0.025)	0.0226	(0.0226)	< RL	(0.0287)	< RL	(0.0247)
SW7740 (mg/kg)	Selenium	< RL	(0.624)	< RL	(0.564)	< RL	(0.717)	< RL	(0.617)
SW7841 (mg/kg)	Thallium	< RL	(0.624)	< RL	(0.564)	< RL	(0.717)	< RL	(0.617)
SW8260 (ug/kg)	2-Butanone	ND	(125)	ND	(113)	< RL	(143)	ND	(123)
	Acetone	ND	(125)	255	(113)	< RL	(143)	< RL	(123)
	Carbon disulfide	ND	(6.24)	ND	(5.64)	13.8	(7.17)	ND	(6.17)
	Chloroform	ND	(6.24)	ND	(5.64)	ND	(7.17)	ND	(6.17)
	Methylene chloride	< RL	(25)	30.9	(22.6)	< RL	(28.7)	ND	(24.7)
	Tetrachloroethene	ND	(6.24)	ND	(5.64)	< RL	(7.17)	ND	(6.17)
	Toluene	ND	(6.24)	ND	(5.64)	< RL	(7.17)	8.52	(6.17)
	Total xylenes	ND	(6.24)	ND	(5.64)	ND	(7.17)	ND	(6.17)
	Vinyl acetate	ND	(25)	ND	(22.6)	ND	(71.7)	ND	(61.7)
	cis-1,3-Dichloropropene	ND	(6.24)	ND	(5.64)	ND	(7.17)	ND	(6.17)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.412)	ND	(0.372)	2.5	(0.473)	ND	(0.407)
	Chrysene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)
	Dibenzofuran	ND	(0.412)	ND	(0.372)	< RL	(0.473)	ND	(0.407)
	Fluoranthene	ND	(0.412)	ND	(0.372)	< RL	(0.473)	ND	(0.407)
	Fluorene	ND	(0.412)	ND	(0.372)	< RL	(0.473)	ND	(0.407)
	Naphthalene	ND	(0.412)	ND	(0.372)	4.99	(0.473)	ND	(0.407)
	Phenanthrene	ND	(0.412)	ND	(0.372)	< RL	(0.473)	ND	(0.407)
	Pyrene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)
	benzo(a)anthracene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)
	benzo(a)pyrene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)
	benzo(b)fluoranthene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)
	benzo(g,h,i)perylene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)
	benzo(k)fluoranthene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)
	di-n-Butylphthalate	< RL	(0.412)	< RL	(0.372)	ND	(0.473)	< RL	(0.407)
	indeno(1,2,3-cd)pyrene	ND	(0.412)	ND	(0.372)	ND	(0.473)	ND	(0.407)

Table 5.4-2
(Continued)

Location ID		12-10		12-12		12-12		12-14	
Beg. Depth - End Depth (ft)		0-2		0-2		6-8		0-2	
SW6010 (mg/kg)	Barium	26.6	(1.25)	3.73	(1.11)	< RL	(1.43)	4	(1.31)
	Beryllium	< RL	(0.25)	< RL	(0.223)	< RL	(0.285)	< RL	(0.262)
	Cadmium	0.67	(0.624)	< RL	(0.557)	< RL	(0.713)	< RL	(0.654)
	Chromium	12.6	(1.25)	5.48	(1.11)	1.75	(1.43)	2.77	(1.31)
	Cobalt	< RL	(1.25)	< RL	(1.11)	< RL	(1.43)	< RL	(1.31)
	Copper	3.41	(2.5)	< RL	(2.23)	< RL	(2.85)	< RL	(2.62)
	Silver	< RL	(1.25)	< RL	(1.11)	< RL	(1.43)	< RL	(1.31)
	Vanadium	3.13	(2.5)	< RL	(2.23)	< RL	(2.85)	< RL	(2.62)
	Zinc	18.2	(2.5)	4.09	(2.23)	< RL	(2.85)	5.9	(2.62)
SW7041 (mg/kg)	Antimony	< RL	(0.624)	< RL	(2.78)	< RL	(3.57)	< RL	(3.27)
SW7060 (mg/kg)	Arsenic	< RL	(0.624)	0.913	(0.557)	< RL	(0.713)	0.995	(0.654)
SW7421 (mg/kg)	Lead	10.8	(0.624)	3.88	(0.557)	< RL	(0.713)	1.35	(0.654)
SW7471 (mg/kg)	Mercury	0.95	(0.025)	< RL	(0.0223)	< RL	(0.0285)	< RL	(0.0262)
SW7740 (mg/kg)	Selenium	< RL	(0.624)	< RL	(0.557)	< RL	(0.713)	< RL	(0.654)
SW7841 (mg/kg)	Thallium	< RL	(0.624)	< RL	(0.557)	< RL	(0.713)	< RL	(0.654)
SW8260 (ug/kg)	2-Butanone	223	(125)	ND	(111)	< RL	(143)	< RL	(131)
	Acetone	381	(125)	< RL	(111)	< RL	(143)	240	(131)
	Carbon disulfide	51.2	(6.24)	ND	(5.57)	ND	(7.13)	< RL	(6.54)
	Chloroform	ND	(6.24)	ND	(5.57)	ND	(7.13)	< RL	(6.54)
	Methylene chloride	< RL	(25)	< RL	(22.3)	< RL	(28.5)	< RL	(26.2)
	Tetrachloroethene	ND	(6.24)	ND	(5.57)	ND	(7.13)	ND	(6.54)
	Toluene	ND	(6.24)	< RL	(5.57)	< RL	(7.13)	< RL	(6.54)
	Total xylenes	ND	(6.24)	< RL	(5.57)	ND	(7.13)	ND	(6.54)
	Vinyl acetate	< RL	(62.4)	ND	(55.7)	ND	(71.3)	106	(65.4)
	cis-1,3-Dichloropropene	< RL	(6.24)	ND	(5.57)	ND	(7.13)	ND	(6.54)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	Chrysene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	Dibenzofuran	ND	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	Fluoranthene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	Fluorene	ND	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	Naphthalene	ND	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	Phenanthrene	ND	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	Pyrene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	benzo(a)anthracene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	benzo(a)pyrene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	benzo(b)fluoranthene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	benzo(g,h,i)perylene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	benzo(k)fluoranthene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)
	di-n-Butylphthalate	< RL	(0.412)	ND	(0.367)	ND	(0.471)	< RL	(0.432)
	indeno(1,2,3-cd)pyrene	< RL	(0.412)	ND	(0.367)	ND	(0.471)	ND	(0.432)

Table 5.4-3
Analytical Results for Chemicals of Concern for Soil at SWMUs 12 and 13[a]

Location ID			12-02		12-02		12-03		12-07		12-10	
Beg. Depth - End Depth (ft)			2-4		10-12		6-8		0-2		0-2	
SW8270 (mg/kg)	Benzo(a)pyrene	[8.75E-02] [b]	ND	(0.372)	ND	(0.412)	ND	(0.473)	ND	(0.407)	0.152 J	(0.412)
Location ID			12-12		12-12		12-14		12-15		12-19	
Beg. Depth - End Depth (ft)			0-2		6-8		0-2		0-2		0-2	
SW8270 (mg/kg)	Benzo(a)pyrene	[8.75E-02] [b]	ND	(0.367)	ND	(0.471)	ND	(0.432)	ND	(0.44)	ND	(0.404)

Note—This table presents the analytical results used in the risk-based screen and risk assessment. The J-flag data are estimated concentrations, since the result is below the reporting limit.

J = Result is less than the reporting limit.
ND = Analyte not detected. No instrument response.
( ) = Reporting limit.

[a] Shading highlights results greater than the EPA Region III RBC used in the risk-based screen.
[b] [RBC] = EPA Region III residential risk-based concentration.

Table 5.4-4
Summary Analytical Results for Groundwater at SWMUs 12 and 13

Location ID		12-02		12-05		12-11		12-12	
E418.1 (mg/L)	TRPH	1.17	(0.4)	< RL	(0.4)	< RL	(0.4)	NA	
E418.1M (mg/L)	TRPH	< RL	(5)	< RL	(5)	< RL	(5)	< RL	(5)
SW6010 (mg/L)	Barium	0.03	(0.01)	0.012	(0.01)	0.012	(0.01)	NA	
	Beryllium	0.009	(0.002)	0.008	(0.002)	0.009	(0.002)	NA	
	Cadmium	< RL	(0.005)	< RL	(0.005)	< RL	(0.005)	NA	
	Chromium	< RL	(0.01)	< RL	(0.01)	< RL	(0.01)	NA	
	Cobalt	< RL	(0.01)	< RL	(0.01)	< RL	(0.01)	NA	
	Copper	< RL	(0.02)	< RL	(0.02)	< RL	(0.02)	NA	
	Silver	< RL	(0.01)	< RL	(0.01)	< RL	(0.01)	NA	
	Vanadium	< RL	(0.02)	0.026	(0.02)	< RL	(0.02)	NA	
	Zinc	< RL	(0.02)	< RL	(0.02)	< RL	(0.02)	NA	
SW7041 (mg/L)	Antimony	0.0097	(0.005)	0.0116	(0.005)	< RL	(0.005)	NA	
SW7060 (mg/L)	Arsenic	0.005	(0.004)	< RL	(0.004)	< RL	(0.004)	NA	
SW7421 (mg/L)	Lead	< RL	(0.003)	< RL	(0.003)	< RL	(0.003)	NA	
SW7740 (mg/L)	Selenium	< RL	(0.005)	< RL	(0.005)	< RL	(0.005)	NA	
SW7841 (mg/L)	Thallium	< RL	(0.002)	< RL	(0.002)	< RL	(0.002)	NA	
SW8260 (µg/L)	2-Butanone	< RL	(100)	ND	(100)	< RL	(100)	NA	
	Acetone	< RL	(100)	< RL	(100)	< RL	(100)	NA	
	Carbon disulfide	ND	(5)	6.6	(5)	ND	(5)	NA	
	Methylene chloride	ND	(20)	< RL	(20)	ND	(20)	NA	
	Tetrachloroethene	< RL	(5)	ND	(5)	ND	(5)	NA	
	Trichloroethene	< RL	(5)	ND	(5)	ND	(5)	NA	
	Vinyl acetate	25.7	(20)	ND	(20)	ND	(20)	NA	
SW8270 (mg/L)	2-Methylnaphthalene	< RL	(0.01)	ND	(0.01)	ND	(0.01)	NA	
	Naphthalene	0.022	(0.01)	ND	(0.01)	ND	(0.01)	NA	

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).
NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.5 SWMU 14—Building 306 O/WS

SWMU 14 services the aircraft washrack near Building 306. Since its installation in 1969, the separator has managed rinsate wastes from the washrack. In 1993, a new lid was added to the O/WS, and the skimmer was adjusted.

To investigate whether a release had occurred, SWMU 14 was investigated under the Table 3 RFI. Phase I soil samples were collected in accordance with the work plan, and it was determined that a release had occurred from the SWMU.

Data from the Phase I investigation showed that a release had occurred in the subsurface; Phase II was conducted to define the lateral and vertical extent of contamination. From the site results, the risk-based screen did not identify any COCs. This SWMU, therefore, is recommended for CNFA where the condition of NFA is mitigation of the O/WS leak to prevent further releases to the subsurface.

5.5.1 SWMU Description

Unit Type: Three-chamber O/WS
Period of Operation: 1969 to present
Current Status: Active
Disposition of Unit: Continued use
Source of Waste: Building 306 washrack
Major Operations: Washing F-4 and T-38 aircraft
Construction Material: Concrete
Physical Condition: Concrete in good condition
Oil/Total Capacity: 650 gal./5300 gal.
Historic Releases: None known

5.5.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a uniform near-surface lithology of silty sand and sandy silt to approximately 9 ft bgl. In each of the borings, between 9 and 11 ft bgl, the soil grades rapidly to a very hard sandy clay. In several borings near the O/WS, gravel was noted and is most likely a compacted fill material from the construction of the O/WS. Groundwater occurs at approximately 5 ft bgl, and the groundwater flow direction in this portion of the Base is known to vary from the south to southwest. The bottom of the O/WS is approximately 4.5 ft below the groundwater table. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.5-1, five locations were sampled during Phase I for TRPH analysis by EPA 418.1M. At each location, samples were collected from the surface and from near the bottom of the separator. At locations 14-01, -02, -03, and 04, samples were also collected from intermediate depths (4 to 6 ft or 6 to 8 ft) because staining and an odor was noted. Figure 5.5-1 shows the sampling horizons and the associated Phase I TRPH results; Table 5.5-1 lists TRPH results at all sampled intervals.

TRPH concentrations at each of the Phase I borings were detected above the 100-mg/kg release criterion, and it was determined that a release had occurred from the SWMU. Given the higher TRPH concentrations between 4 and 8 ft, the release pathway at the separator was determined to most likely be seepage from a leaking O/WS chamber or pipes. Because of the release, a Phase II investigation was triggered.

Phase II Investigation

Extent—The extent of the release was investigated using the iterative step-out approach described in the work plan. The Phase II sampling locations are also highlighted in Figure 5.5-1. The magnitude of TRPH results at each horizon is shown in Figure 5.5-2. As suggested by the Phase I results and by what is seen in the Phase II data, the highest concentrations are located in the subsurface between 4 and 8 ft, extending to the south of the O/WS. Samples collected from

within the sandy clay horizon (>10 ft bgl) exhibited lower TRPH results as shown in Figure 5.5-2. All field TRPH results are provided in Table 5.5-1.

Using the maximum detected TRPH result at each boring, the areal extent of elevated TRPH values above the 100-mg/kg criterion was also determined. This is shown in Figure 5.5-3.

Nature—To characterize the nature of the release, eight samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.5-2. The data indicate that elevated levels of acetone, carbon disulfide, ethyl benzene, tetrachloroethene, and tricholoethene were detected at the site above reporting limits. The highest concentrations were observed near the O/WS. No analytes, however, exceeded the EPA Region III RBCs.

Groundwater—To define constituent concentrations in the groundwater, samples were collected from three locations around the SWMU. One location was collected upgradient of the SWMU (14-06), and two locations, 14-03 and 14-13, were collected inside the area of elevated soil constituent concentrations and downgradient of the release, respectively. The analytical results for groundwater are presented in Table 5.5-3. All TRPH results for groundwater were less than the 10-mg/L release criterion. Significant detections in groundwater include carbon disulfide, chloroethane, BTEX, tetrachloroethene, trichloroethene, and some semivolatile constituents. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.5.3 Risk-Based Screen Results

The results from the risk-based screen for SWMU 14 showed that none of the COPCs exceeded the screening criteria. Complete screen results and the toxicity values used are contained in Appendix C. On the basis of the screen, there is no risk to human health from the release at SWMU 14.

5.5.4 Conclusions

The results from the investigation of SWMU 14 indicate that a subsurface release has likely occurred, since TRPH concentrations were found that exceed the 100-mg/kg criterion. The Phase II investigation delineated the extent of the release with TRPH and defined the nature of the release through laboratory characterization analysis. On the basis of the well-defined constituent levels in soil and the results for groundwater, the extent of contamination in groundwater is confined to the area around the SWMU. From the risk-based screen, the release does not pose a risk to human health. No vadose zone soils exceeded the 1000 mg/kg Base-specific cleanup level.

5.5.5 Recommendations

SWMU 14 was recommended for conditional NFA. The condition of NFA was the remediation of vadose zone soil with greater than 1000 mg/kg TPH. SWMU 14 was taken out of service in 1997 as part of Holloman AFB's Phase 2 Basewide POL project. The unit was replaced with a recirculation unit as part of a pollution prevention unit. No soil with TPH in excess of 1000 mg/kg were detected during the excavation of SWMU 14. Confirmation samples ranged from not-detected to 39 mg/kg. A more detailed account of SWMU 14 activities can be found in the *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico* to be submitted in October 1997. Based on these efforts, SWMU 14 is recommended for NFA.

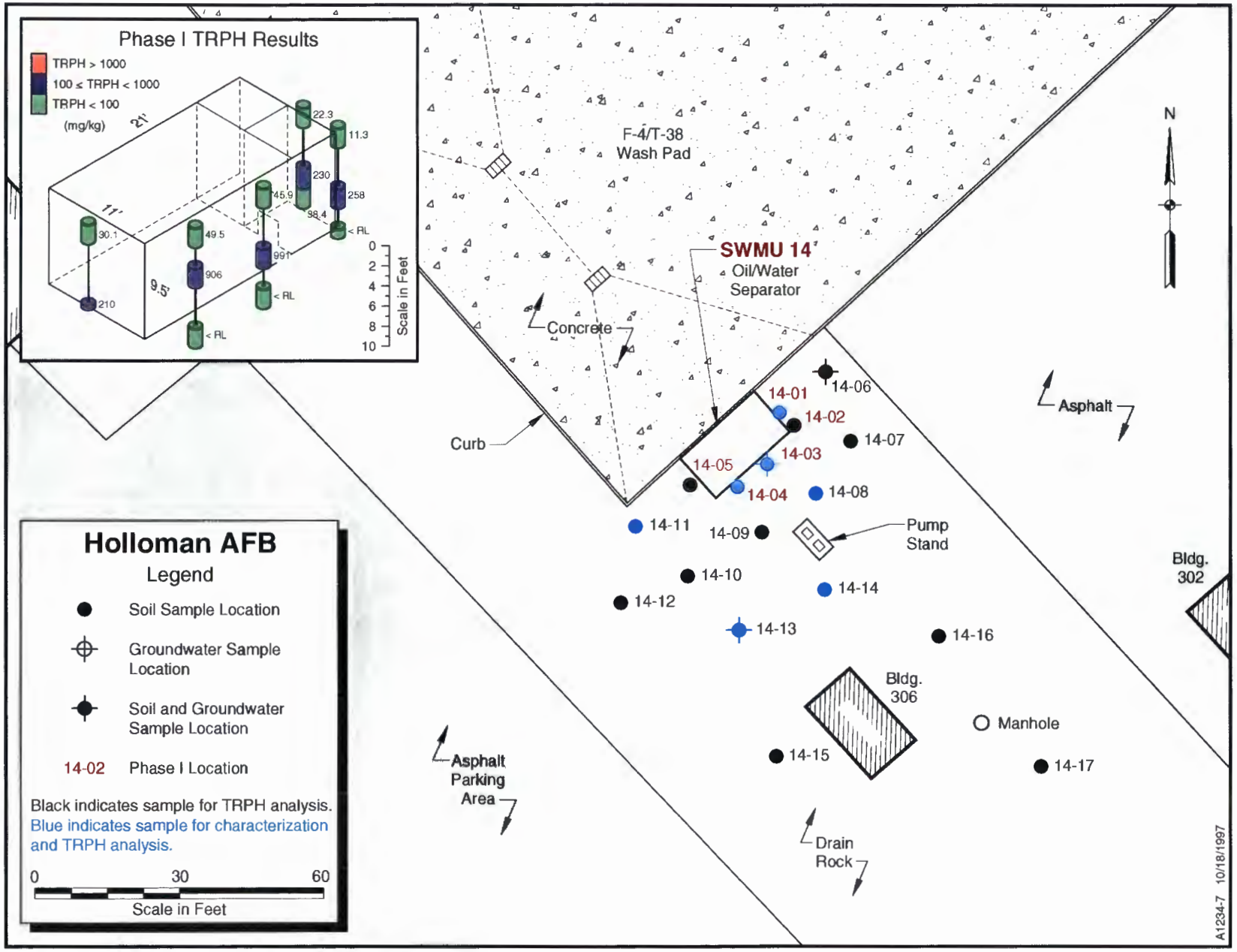

Figure 5.5-1. SWMU 14 - Building 306 O/WS Sample Locations and Phase I TRPH Results

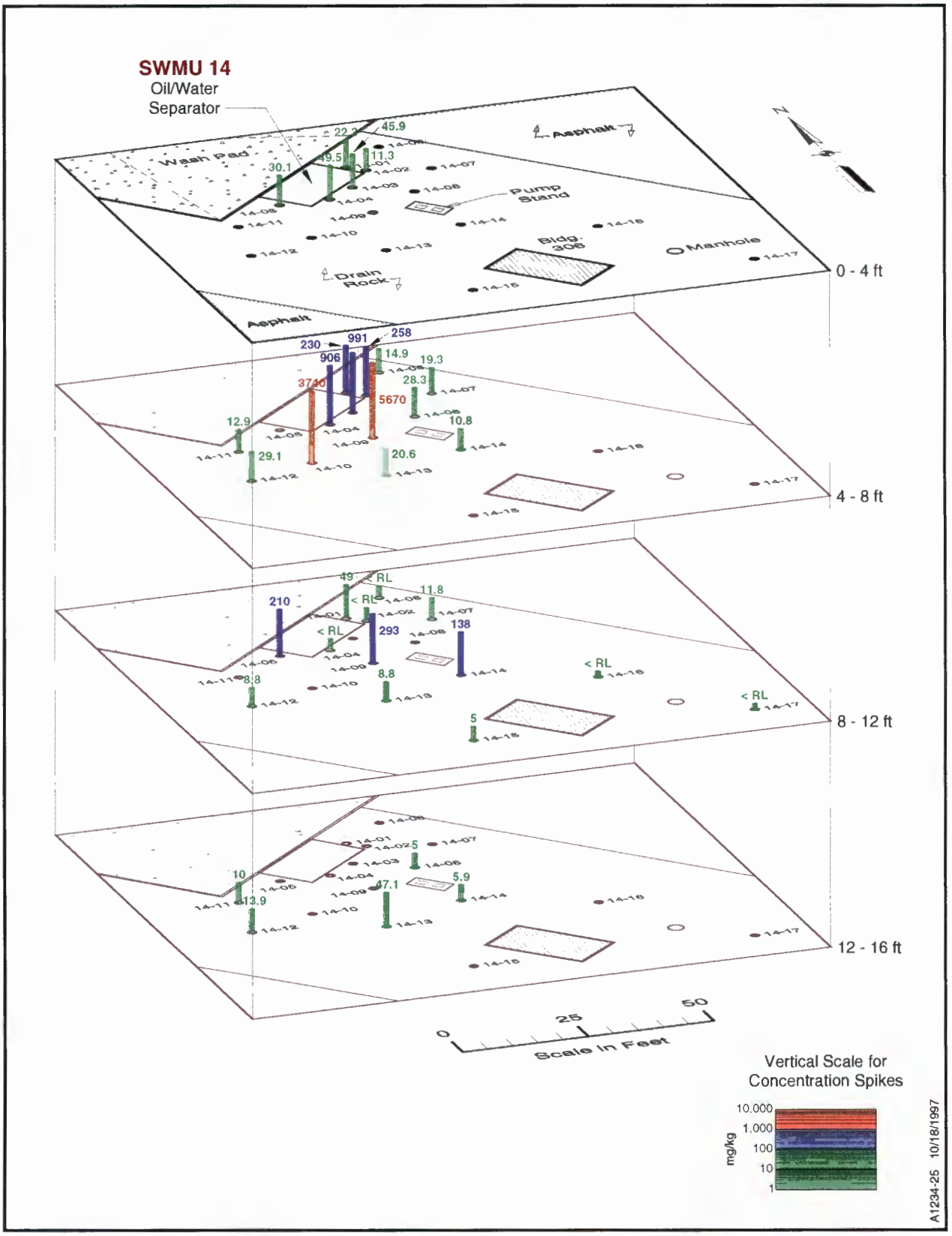

Figure 5.5-2. SWMU 14 - TRPH Concentrations by Depth Interval

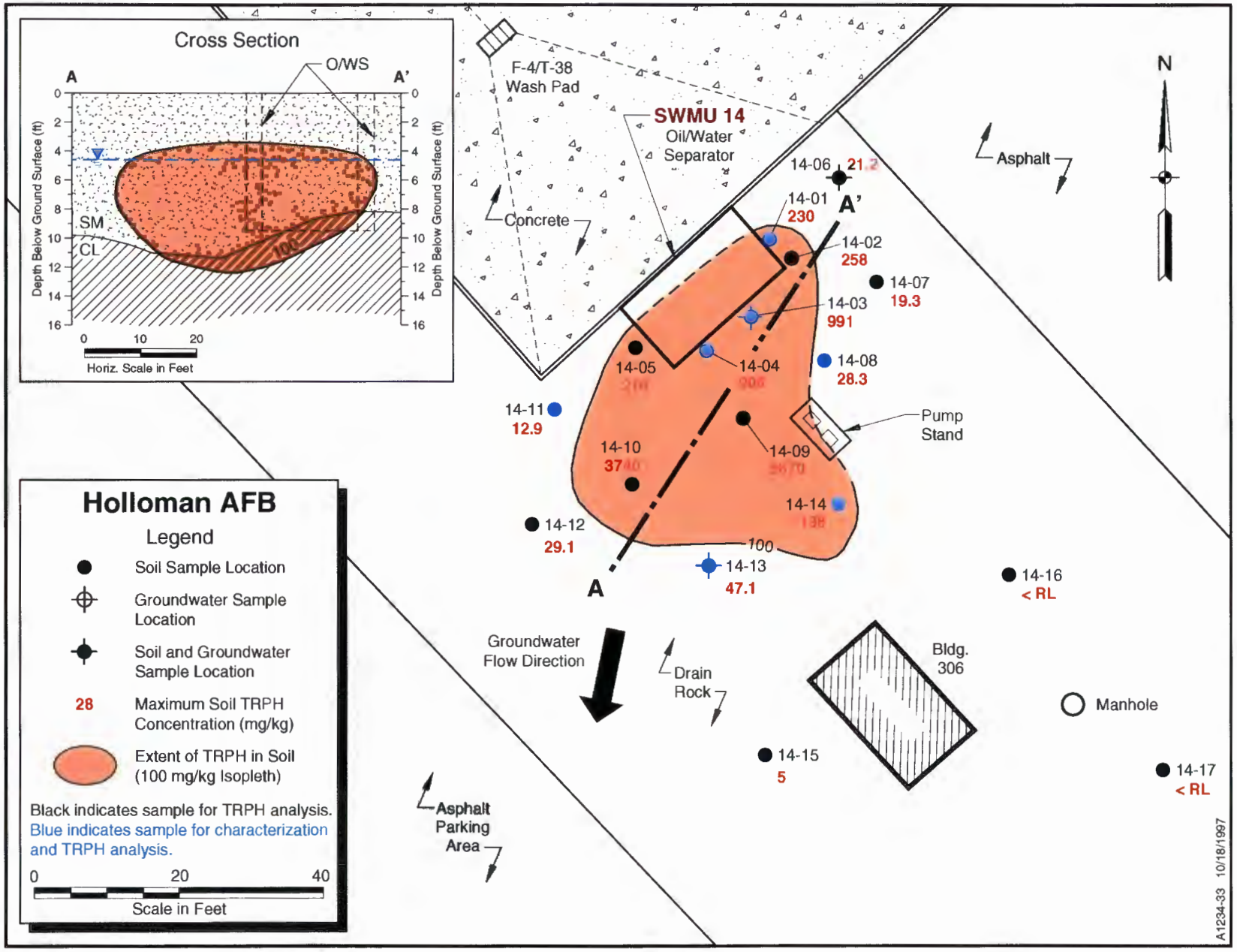

Figure 5.5-3. SWMU 14 - Maximum TRPH Concentrations and Extent of Elevated TRPH Results

Table 5.5-1
TRPH Results for Soil at SWMU 14

Location	Depth (ft) Top	Bottom	TRPH (mg/kg)		Location	Depth (ft) Top	Bottom	TRPH (mg/kg)	
14-01	0	2	22.3		14-09	6	8	5670	
	6	8	230	(241)		11.5	12	293	
	8	10	38.4	(82.8)	14-10	6	8	3740	
	8	10	49	(62.4)	14-11	6	8	12.9	
14-02	0	2	11.3			12	14	10	(52.8)
	6	8	258		14-12	4	6	29.1	
	10	11	< RL			6	8	5.9	
14-03	0	2	45.9			8	10	8.8	
	6	8	991/856			12	13	13.9	
	10	12	< RL		14-13	6	8	20.6	(< RL)
14-04	0	2	49.5			8	10	8.8	
	4	6	906			13	14	47.1	
	10	12	< RL		14-14	6	8	10.8	(< RL)
14-05	0	2	30.1			8	10	138	
	8	8.5	210			10	12	8.7	
14-06	6	8	14.9/21.2			15.5	16	5.9	
	10	12	< RL		14-15	8	10	5	
14-07	6	8	19.3			10	12	< RL	
	10	12	11.8		14-16	8	10	< RL	
14-08	6	8	28.3	(< RL)	14-17	8	10	< RL	
	12	14	5	(43.7)					

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

Table 5.5-2
Summary Analytical Results for Soil at SWMU 14

Location ID		14-01		14-03		14-04		14-08	
Beg. Depth - End Depth (ft)		6-8		6-8		4-6		6-8	
SW6010 (mg/kg)	Barium	22.4	(1.25)	17.8	(1.2)	9.68	(1.26)	19.4	(1.38)
	Beryllium	< RL	(0.249)	< RL	(0.241)	< RL	(0.252)	< RL	(0.276)
	Cadmium	< RL	(0.623)	< RL	(0.602)	< RL	(0.631)	< RL	(0.69)
	Chromium	6.6	(1.25)	2.23	(1.2)	2.11	(1.26)	22.9	(1.38)
	Cobalt	< RL	(1.25)	< RL	(1.2)	< RL	(1.26)	< RL	(1.38)
	Copper	< RL	(2.49)	< RL	(2.41)	< RL	(2.52)	< RL	(2.76)
	Silver	< RL	(1.25)	< RL	(1.2)	< RL	(1.26)	< RL	(1.38)
	Vanadium	5.78	(2.49)	5.73	(2.41)	3.42	(2.52)	7.05	(2.76)
	Zinc	9.86	(2.49)	28.9	(2.41)	7.61	(2.52)	7.83	(2.76)
SW7041 (mg/kg)	Antimony	< RL	(0.623)	< RL	(0.602)	0.65	(0.631)	< RL	(0.69)
SW7060 (mg/kg)	Arsenic	1.13	(0.623)	1.32	(0.602)	1.17	(0.631)	< RL	(0.69)
SW7421 (mg/kg)	Lead	5.54	(0.623)	2.4	(0.602)	2.63	(0.631)	0.8	(0.69)
SW7471 (mg/kg)	Mercury	< RL	(0.0249)	< RL	(0.0241)	< RL	(0.0252)	< RL	(0.0276)
SW7740 (mg/kg)	Selenium	< RL	(0.623)	< RL	(0.602)	< RL	(0.631)	< RL	(0.69)
SW7841 (mg/kg)	Thallium	< RL	(0.623)	< RL	(0.602)	< RL	(0.631)	< RL	(0.69)
SW8260 (µg/kg)	1,2-Dichloroethane	ND	(6.23)	ND	(6.02)	ND	(6.31)	ND	(34.5)
	2-Butanone	< RL	(125)	ND	(120)	< RL	(126)	< RL	(690)
	Acetone	714	(125)	ND	(120)	< RL	(126)	3500	(690)
	Benzene	ND	(6.23)	ND	(6.02)	ND	(6.31)	< RL	(34.5)
	Carbon disulfide	ND	(6.23)	ND	(6.02)	ND	(6.31)	80.7	(34.5)
	Chloroform	ND	(6.23)	ND	(6.02)	ND	(6.31)	40.7	(34.5)
	Ethyl benzene	ND	(6.23)	ND	(6.02)	14.5	(6.31)	193	(34.5)
	Methylene chloride	< RL	(24.9)	< RL	(24.1)	< RL	(25.2)	< RL	(138)
	Tetrachloroethene	ND	(6.23)	ND	(6.02)	ND	(6.31)	388	(34.5)
	Toluene	< RL	(6.23)	< RL	(6.02)	< RL	(6.31)	ND	(34.5)
	Total xylenes	ND	(6.23)	< RL	(6.02)	49	(6.31)	ND	(34.5)
	Trichloroethene	ND	(6.23)	ND	(6.02)	ND	(6.31)	367	(34.5)
	Vinyl acetate	ND	(62.3)	ND	(60.2)	< RL	(63.1)	ND	(345)
SW8270 (mg/kg)	Fluoranthene	ND	(0.411)	< RL	(0.398)	ND	(0.417)	ND	(0.455)
	Pyrene	ND	(0.411)	< RL	(0.398)	ND	(0.417)	ND	(0.455)
	di-n-Butylphthalate	< RL	(0.411)	< RL	(0.398)	< RL	(0.417)	< RL	(0.455)

Table 5.5-2
(Continued)

Location ID		14-08		14-11		14-13		14-14	
Beg. Depth - End Depth (ft)		12-14		12-14		6-8		6-8	
SW6010 (mg/kg)	Barium	25.4	(1.23)	21.4	(1.16)	11.6	(1.41)	7.21	(1.38)
	Beryllium	0.301	(0.245)	0.34	(0.232)	< RL	(0.282)	< RL	(0.275)
	Cadmium	< RL	(0.613)	< RL	(0.581)	< RL	(0.706)	< RL	(0.688)
	Chromium	5.55	(1.23)	5.54	(1.16)	2.26	(1.41)	< RL	(1.38)
	Cobalt	1.66	(1.23)	2.5	(1.16)	< RL	(1.41)	< RL	(1.38)
	Copper	2.47	(2.45)	< RL	(2.32)	< RL	(2.82)	< RL	(2.75)
	Silver	< RL	(1.23)	< RL	(1.16)	< RL	(1.41)	< RL	(1.38)
	Vanadium	11.5	(2.45)	13.6	(2.32)	4.87	(2.82)	3.41	(2.75)
	Zinc	14.5	(2.45)	19.4	(2.32)	4.19	(2.82)	< RL	(2.75)
SW7041 (mg/kg)	Antimony	< RL	(0.613)	< RL	(0.581)	< RL	(0.706)	< RL	(0.688)
SW7060 (mg/kg)	Arsenic	2.69	(0.613)	2.28	(0.581)	1.21	(0.706)	0.866	(0.688)
SW7421 (mg/kg)	Lead	3.18	(0.613)	2.14	(0.581)	1.84	(0.706)	< RL	(0.688)
SW7471 (mg/kg)	Mercury	< RL	(0.0245)	< RL	(0.0232)	< RL	(0.0282)	< RL	(0.0275)
SW7740 (mg/kg)	Selenium	< RL	(0.613)	< RL	(0.581)	< RL	(0.706)	< RL	(0.688)
SW7841 (mg/kg)	Thallium	< RL	(0.613)	< RL	(0.581)	< RL	(0.706)	< RL	(0.688)
SW8260 (µg/kg)	1,2-Dichloroethane	< RL	(6.13)	ND	(5.81)	ND	(7.06)	ND	(6.88)
	2-Butanone	ND	(123)	< RL	(116)	ND	(141)	ND	(138)
	Acetone	< RL	(123)	644	(581)	167	(141)	< RL	(138)
	Benzene	ND	(6.13)	ND	(5.81)	ND	(7.06)	ND	(6.88)
	Carbon disulfide	ND	(6.13)	ND	(5.81)	63.6	(7.06)	ND	(6.88)
	Chloroform	ND	(6.13)	ND	(5.81)	ND	(7.06)	ND	(6.88)
	Ethyl benzene	ND	(6.13)	ND	(5.81)	ND	(7.06)	ND	(6.88)
	Methylene chloride	< RL	(24.5)	< RL	(23.2)	< RL	(28.2)	< RL	(27.5)
	Tetrachloroethene	ND	(6.13)	ND	(5.81)	ND	(7.06)	ND	(6.88)
	Toluene	< RL	(6.13)	< RL	(5.81)	< RL	(7.06)	ND	(6.88)
	Total xylenes	ND	(6.13)	ND	(5.81)	ND	(7.06)	ND	(6.88)
	Trichloroethene	ND	(6.13)	ND	(5.81)	< RL	(7.06)	ND	(6.88)
	Vinyl acetate	< RL	(61.3)	ND	(58.1)	ND	(70.6)	ND	(68.8)
SW8270 (mg/kg)	Fluoranthene	ND	(0.405)	ND	(0.383)	ND	(0.33)	ND	(0.33)
	Pyrene	ND	(0.405)	ND	(0.383)	ND	(0.33)	ND	(0.33)
	di-n-Butylphthalate	< RL	(0.405)	0.413	(0.383)	< RL	(0.33)	< RL	(0.33)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.6 SWMU 16—Building 315 O/WS

SWMU 16 services fuel cell repair operations in Building 315. It has been active since 1969 and manages fuels, oil, and other wastes spilled or washed into the floor drain in Building 315.

To investigate whether a release had occurred, SWMU 16 was investigated under the Table 3 RFI. Phase I soil samples were collected in accordance with the work plan, and it was determined that a release had occurred from one side of the SWMU. Additional soil and groundwater samples were collected to define the nature and extent of the release.

The highest TRPH hits occurred at the 1- to 2-ft interval, indicating that the release was likely due to an overflow. There were no TRPH concentrations greater than 1000 mg/kg in any of the SWMU 16 samples, and there were no significant detections of analytes in soil or groundwater. The risk-based screen did not identify any COCs, so NFA is recommended for SWMU 16.

5.6.1 SWMU Description

Unit Type: Three-chamber O/WS
Period of Operation: 1969 to present
Current Status: Active
Disposition of Unit: Continued use
Source of Waste: Building 315
Major Operations: Fuel cell repair
Construction Material: Concrete
Physical Condition: Concrete in good condition
Oil/Total Capacity: 160 gal./1000 gal.
Historic Releases: None known

5.6.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand and sandy silt to approximately 12 ft bgl. Groundwater occurs at 7 ft bgl, and the groundwater flow direction in this portion of the Base is know to vary from the south to southwest. The bottom of the O/WS is approximately 1 ft below the groundwater table. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

Four locations were sampled during the Phase I investigation for TRPH analysis by EPA 418.1M as shown in Figure 5.6-1. Each side of the O/WS was sampled at the surface (1 to 2 ft) and near the bottom of the separator (8 to 10 ft). An additional sample was taken at 10 to 12 ft at location 16-04 in order to determine the extent of elevated TRPH. Figure 5.6-1 shows the sampling horizons and the associated Phase I TRPH results.

Soil samples at location 16-04 exceeded the 100-mg/kg TRPH release criterion at the 1- to 2-ft interval and the 8- to 10-ft interval. It was determined using the field analytical results that a release had occurred from the SWMU. Because the TRPH concentrations were higher at the surface than at lower depths, it was determined that the release mechanism was most likely an overflow with infiltration to the lower depths. On the basis of the Phase I TRPH results greater than 100 mg/kg, a Phase II investigation was triggered.

Phase II Investigation

Extent—The iterative step-out approach described in the work plan was used to investigate the extent of the release. The Phase II sampling locations are also shown in Figure 5.6-1. The TRPH results for all sample locations and horizons are shown in Figure 5.6-2. Only one of the additional Phase II sample locations showed TRPH concentrations greater than the 100-mg/kg release criterion (the surface-interval sample at location 16-06).

These data combined with the Phase I results suggest that a release in the form of an overflow has likely occurred at this SWMU. The area affected by the release extends to the south-

west of the O/WS. The areal extent of elevated TRPH values was determined using the maximum detected concentration at each location and is depicted in Figure 5.6-3. All field TRPH results are provided in Table 5.6-1.

Nature—To characterize the nature of the release, six samples were submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.6-2. Low levels of acetone, methylene chloride, and some BTEX constituents as well as di-n-butylphthalate were detected in some of the borings. The data did not indicate that any constituents exceeded the RBCs.

Groundwater—To evaluate the impact the release at SWMU 16 may have on groundwater, samples were collected at three locations around the SWMU. One sample was taken at the same location where the highest TRPH concentration was found in soil. One of the other two samples was taken upgradient and the last was taken downgradient of the release. The analytical results for the groundwater samples are presented in Table 5.6-3. None of the groundwater samples exceeded the 10-mg/L release criterion for TRPH in water. The data show that the only detected organic result in groundwater above the reporting limit is methylene chloride. These results, however, are barely above the reporting limit of 20 µg/L. LNAPL was not detected at any groundwater sampling point or soil boring location.

5.6.3 Risk-Based Screen Results

The risk-based screen indicated that none of the COPCs identified for the site exceeded the screening criteria (see Appendix C for results). On the basis of the screen, there is no risk to human health from the release at SWMU 16.

5.6.4 Conclusions

The results from the investigation of the SWMU indicate that a release in the form of an overflow has likely occurred at this site. TRPH concentrations were found that exceeded the 100-mg/kg release criterion. The Phase II investigation defined the extent of the release using TRPH concentrations. It appears that TRPH contamination has migrated slightly to the southwest. Groundwater does not appear to have been affected by the release from the separator. No concentrations of TRPH were found that exceeded the Base-specific cleanup level. The nature of the release was characterized by laboratory analysis, and from the risk-based screen, no constituents were found to pose a risk to human health.

5.6.5 Recommendations

NFA is recommended for SWMU 16. A Class 3 permit modification request will be submitted to NMED for this purpose. In addition, this unit will be managed according to Holloman AFB's *Guidance on Management of Oil/Water Separators*, developed by Air Combat Command to insure proper maintenance and quarterly inspections.

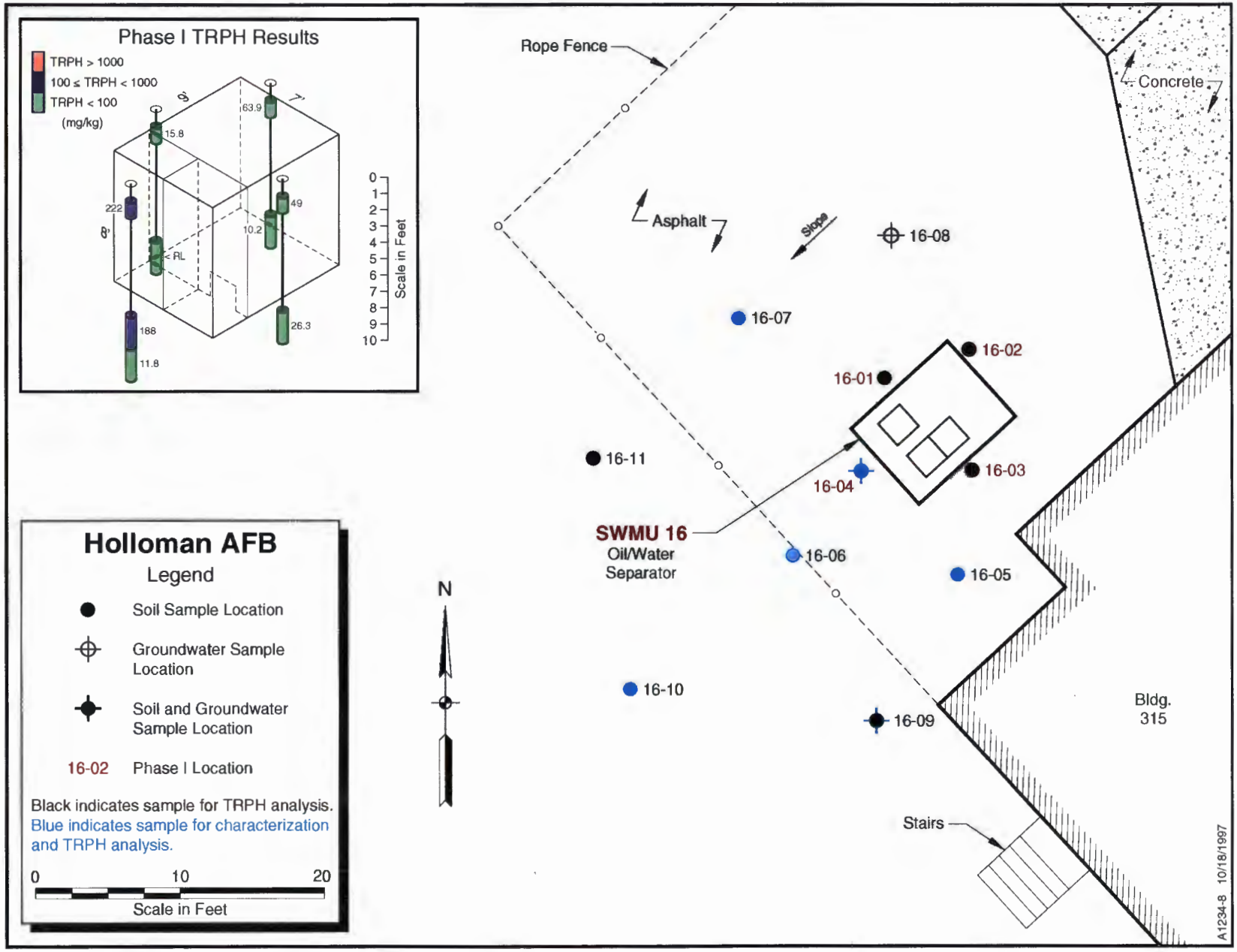

Figure 5.6-1. SWMU 16 - Building 315 O/WS Sample Locations and Phase I TRPH Results

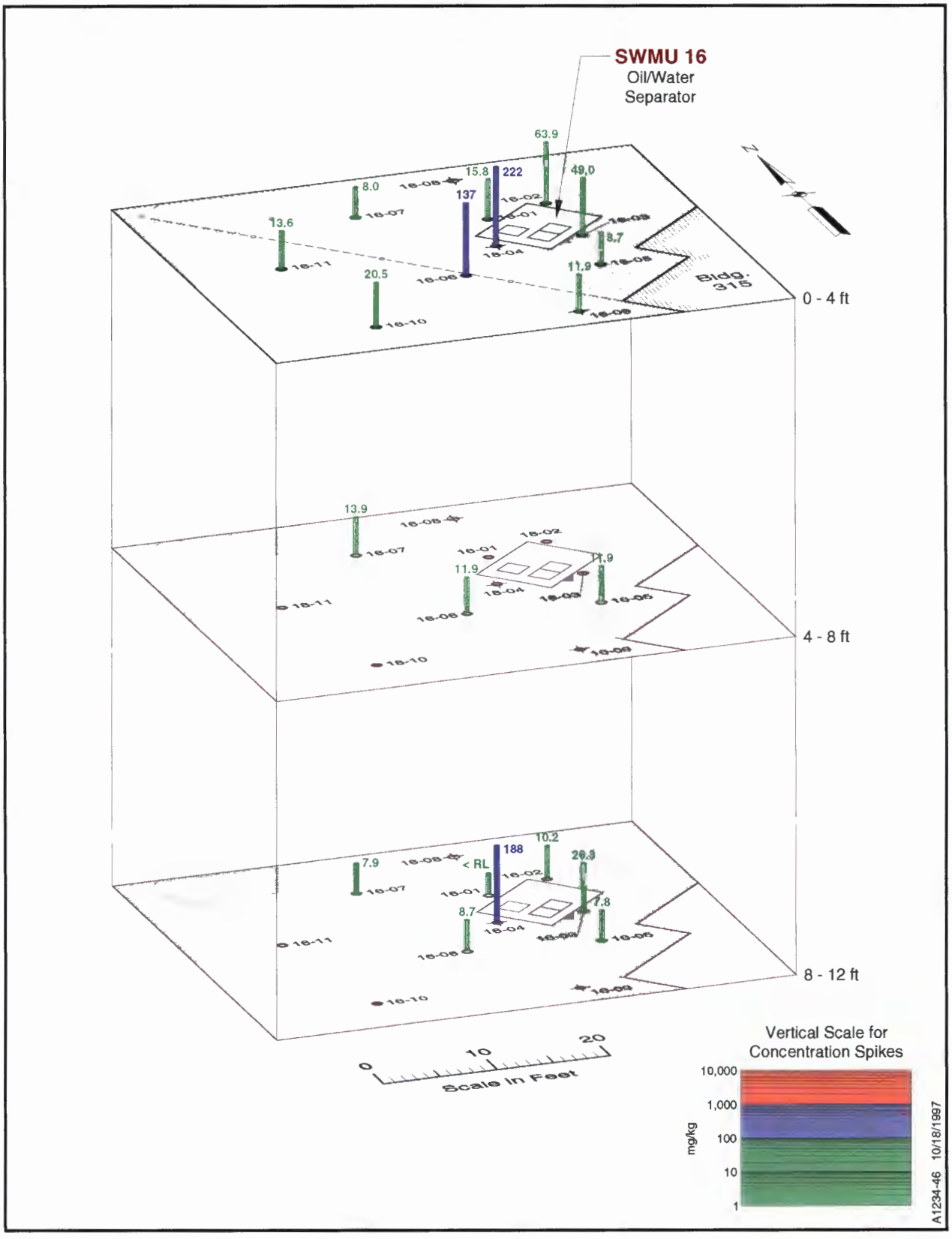

Figure 5.6-2. SWMU 16 - TRPH Concentrations by Depth Interval

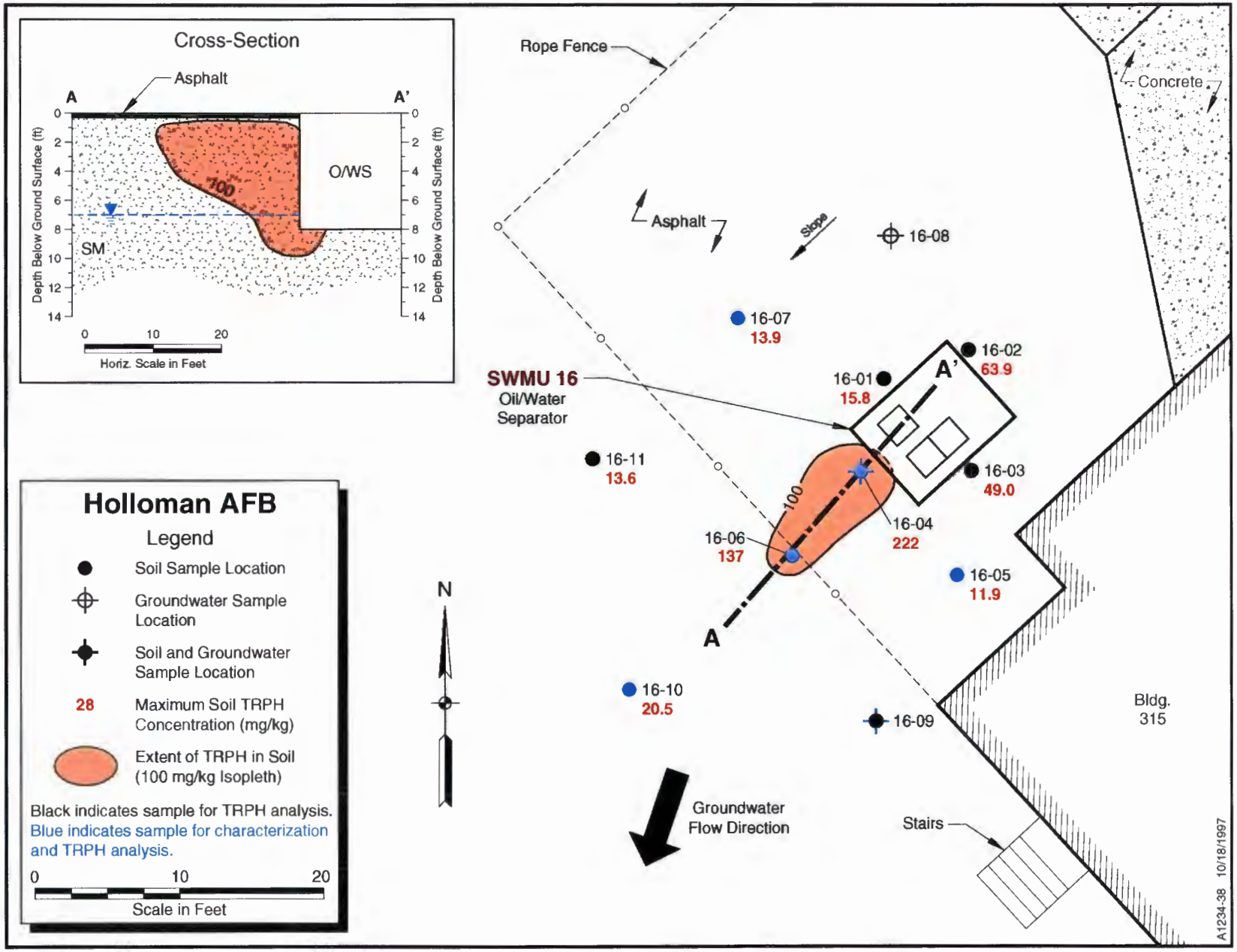

Figure 5.6-3. SWMU 16 - Maximum TRPH Concentrations and Extent of Elevated TRPH Results

Table 5.6-1
TRPH Results for Soil at SWMU 16[a]

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)		Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	
16-01	1	2	15.8		16-06	1	2	137	(200)
	8	10	< RL			4	6	11.9	
16-02	1	2	63.9			8	10	8.7	
	8	10	10.2		16-07	1	2	8	
16-03	1	2	49/42.6			4	6	13.9	(< RL)
	8	10	26.3			8	10	7.9	
16-04	1	2	222		16-09	1	3	11.9/9.7	
	8	10	188	(267)	16-10	1	3	20.5	(41.8)
	10	12	11.8		16-11	1	3	13.6	
16-05	1	2	8.7	(< RL)					
	4	6	11.9						
	8	10	7.8/6.9						

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

[a]Only a groundwater sample was collected at location 16-08.

Table 5.6-2
Summary Analytical Results for Soil at SWMU 16

Location ID		16-04				16-05		16-06		16-07		16-10	
Beg. Depth - End Depth (ft)		1-2		8-10		1-2		1-2		4-6		1-3	
SW6010 (mg/kg)	Barium	22.8	(1.24)	17.1	(1.38)	13.2	(1.31)	16.6	(1.28)	8.92	(1.24)	26.6	(1.24)
	Beryllium	< RL	(0.248)	< RL	(0.276)	< RL	(0.262)	< RL	(0.255)	< RL	(0.248)	< RL	(0.247)
	Cadmium	< RL	(0.621)	< RL	(0.691)	< RL	(0.655)	< RL	(0.638)	< RL	(0.619)	< RL	(0.618)
	Chromium	3.14	(1.24)	2.69	(1.38)	1.56	(1.31)	2.17	(1.28)	< RL	(1.24)	2.69	(1.24)
	Cobalt	1.66	(1.24)	< RL	(1.38)	< RL	(1.31)	< RL	(1.28)	< RL	(1.24)	< RL	(1.24)
	Copper	< RL	(2.48)	< RL	(2.76)	< RL	(2.62)	< RL	(2.55)	< RL	(2.48)	< RL	(2.47)
	Silver	< RL	(1.24)	< RL	(1.38)	< RL	(1.31)	< RL	(1.28)	< RL	(1.24)	1.53	(1.24)
	Vanadium	6.4	(2.48)	5.19	(2.76)	3.41	(2.62)	4.6	(2.55)	< RL	(2.48)	7.08	(2.47)
	Zinc	8.74	(2.48)	8.14	(2.76)	3.67	(2.62)	6.5	(2.55)	3.01	(2.48)	8.05	(2.47)
SW7041 (mg/kg)	Antimony	< RL	(0.621)	0.87	(0.691)	< RL	(0.655)	< RL	(0.638)	< RL	(0.619)	< RL	(0.618)
SW7060 (mg/kg)	Arsenic	0.621	(0.621)	< RL	(0.691)	< RL	(0.655)	0.651	(0.638)	0.619	(0.619)	1	(0.618)
SW7421 (mg/kg)	Lead	1.61	(0.621)	1.5	(0.691)	0.944	(0.655)	1.12	(0.638)	1.11	(0.619)	1.12	(0.618)
SW7471 (mg/kg)	Mercury	< RL	(0.0248)	< RL	(0.0276)	< RL	(0.0262)	< RL	(0.0255)	< RL	(0.0248)	< RL	(0.0247)
SW7740 (mg/kg)	Selenium	< RL	(0.621)	< RL	(0.691)	< RL	(0.655)	< RL	(0.638)	< RL	(0.619)	< RL	(0.618)
SW7841 (mg/kg)	Thallium	< RL	(0.621)	< RL	(0.691)	< RL	(0.655)	< RL	(0.638)	< RL	(0.619)	< RL	(0.618)
SW8260 (µg/kg)	2-Butanone	< RL	(124)	ND	(138)	ND	(131)	ND	(128)	ND	(124)	ND	(124)
	Acetone	< RL	(124)	< RL	(138)	< RL	(131)	231	(128)	< RL	(124)	ND	(124)
	Carbon disulfide	ND	(6.21)	ND	(6.91)	ND	(6.55)	< RL	(6.38)	ND	(6.19)	ND	(6.18)
	Ethyl benzene	ND	(6.21)	ND	(6.91)	ND	(6.55)	< RL	(6.38)	ND	(6.19)	ND	(6.18)
	Methylene chloride	< RL	(24.8)	< RL	(27.6)	34.3	(26.2)	26.7	(25.5)	< RL	(24.8)	26.8	(24.7)
	Toluene	ND	(6.21)	ND	(6.91)	ND	(6.55)	9.32	(6.38)	6.19	(6.19)	ND	(6.18)
	Total xylenes	ND	(6.21)	ND	(6.91)	ND	(6.55)	7.79	(6.38)	< RL	(6.19)	ND	(6.18)
SW8270 (mg/kg)	Butylbenzylphthalate	ND	(0.41)	< RL	(0.456)	ND	(0.432)	ND	(0.421)	ND	(0.408)	ND	(0.408)
	di-n-Butylphthalate	6.2	(0.41)	7.46	(0.456)	6.87	(0.432)	2.27	(0.421)	5.94	(0.408)	< RL	(0.408)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.6-3
Summary Analytical Results for Groundwater at SWMU 16

Location ID		16-04		16-08		16-09	
E418.1 (mg/L)	TRPH	< RL	(0.4)	NA		< RL	(0.4)
E418.1M (mg/L)	TRPH	< RL	(5)	< RL	(5)	< RL	(5)
SW6010 (mg/L)	Barium	< RL	(0.01)	NA		< RL	(0.01)
	Beryllium	< RL	(0.002)	NA		< RL	(0.002)
	Chromium	< RL	(0.01)	NA		< RL	(0.01)
	Silver	0.014	(0.01)	NA		0.015	(0.01)
	Vanadium	< RL	(0.02)	NA		< RL	(0.02)
	Zinc	< RL	(0.02)	NA		< RL	(0.02)
SW7041 (mg/L)	Antimony	< RL	(0.005)	NA		0.0053	(0.005)
SW7060 (mg/L)	Arsenic	0.0041	(0.004)	NA		0.0143	(0.004)
SW7421 (mg/L)	Lead	0.0065	(0.003)	NA		< RL	(0.003)
SW7740 (mg/L)	Selenium	< RL	(0.005)	NA		< RL	(0.005)
SW7841 (mg/L)	Thallium	< RL	(0.002)	NA		< RL	(0.002)
SW8260 (μg/L)	1,2-Dichlorobenzene	< RL	(5)	NA		< RL	(5)
	Acetone	< RL	(100)	NA		< RL	(100)
	Methylene chloride	26.8	(20)	NA		21.7	(20)
	Toluene	< RL	(5)	NA		< RL	(5)
	Vinyl acetate	ND	(50)	NA		< RL	(50)
SW8270 (mg/L)	n-Nitrosodiphenylamine	< RL	(0.01)	NA		ND	(0.01)

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).
NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.7 SWMU 23—Building 800 O/WS

SWMU 23, located at Building 800, services engine and vehicle maintenance areas in Building 806. It operated as an O/WS from 1977 until 1991 when it was replaced with a new O/WS and converted to a sediment trap.

To identify whether a release from the unit had occurred, SWMU 23 was investigated under the Table 3 RFI. During Phase I of the RFI, soil samples collected from two locations in the area immediately adjacent to the SWMU were shown to have TRPH concentrations above the release criterion of 100 mg/kg. From these results, it was determined that a release had occurred. Phase II was conducted to define the nature and extent of the release in the soil and groundwater. The extent of elevated constituents were confined to the area near the O/WS since no TRPH concentrations above 100 mg/kg were detected in the Phase II soil samples. The release appears to be a localized subsurface breach of the O/WS.

No COCs were identified through the risk-based screen; therefore CNFA is recommended for this site. The condition of NFA is remediation of TRPH-contaminated soil in the vadose zone above the 1000-mg/kg cleanup level.

5.7.1 SWMU Description

Unit Type: Two-chamber O/WS
Period of Operation: July 1977 to present
Current Status: Active
Disposition of Unit: Converted to a sediment trap in 1991; continued use
Source of Waste: Building 806
Major Operations: Engine and vehicle maintenance
Construction Material: Concrete
Physical Condition: Concrete in fairly good condition
Oil/Total Capacity: 675 gal./900 gal.
Historic Releases: None known

5.7.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand and sandy silt to approximately 9 ft bgl. In each of the borings, the soil grades rapidly between 9 and 10 ft bgl to a very hard silty clay. Groundwater occurs at 5 ft, and the groundwater flow direction in this portion of the Base is known to vary from the south to southwest. The bottom of the O/WS is approximately 0.5 ft below the groundwater table. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.7-1, samples were collected from four locations during Phase I for analysis of TRPH by EPA 418.1M. At each location, samples were collected from the surface and from near the bottom of the separator. At locations 23-02 and 23-04, samples were also collected from intermediate depths to define vertical extent further. Figure 5.7-1 shows the sampling horizons and the associated TRPH results.

TRPH concentrations at two of the Phase I sampling locations (23-02 and 23-04) were detected above the 100-mg/kg release criterion, and it was determined through field analysis that a release had occurred from the SWMU. TRPH in samples collected from the 6- to 8-ft interval at 23-02 and from the 2- to 4-ft and 4- to 6-ft intervals at 23-04 was also detected above the 1000-mg/kg cleanup level. Given the higher TRPH concentrations between 4 and 8 ft, the release pathway was determined to likely be a leaking O/WS chamber or piping. A Phase II investigation was triggered by these results.

Phase II Investigation

Extent—The extent of the release was investigated in Phase II of the investigation using the iterative step-out approach from the work

plan. The Phase II sampling locations are also shown in Figure 5.7-1. The magnitude of TRPH results at each horizon is shown in Figure 5.7-2. The highest concentrations of TRPH are located in the subsurface between 2- and 8 ft, extending slightly to the west of the O/WS. Samples collected from within the sandy clay horizon (>10 ft bgl) exhibited lower TRPH results, as shown in Figure 5.7-2. All field TRPH results are provided in Table 5.7-1.

Using the maximum detected TRPH result at each boring, a contour map was developed to illustrate the areal extent of TRPH values above the 100-mg/kg release criterion (Figure 5.7-3). The results show the lateral extent to be confined to near the O/WS.

Nature—To characterize the nature of the release, eight samples were submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.7-2. The data indicate that acetone, carbon disulfide, methylene chloride, BTEX, dichlorobenzenes, and some semivolatile organic constituents are present at elevated levels at locations 23-02 and 23-04. Acetone and toluene are present at slightly elevated levels at 23-05. These results correlate fairly well with the Phase I sampling results, which show TRPH concentrations to be highest at locations 23-02 and 23-04.

Groundwater—To define constituent concentrations in the groundwater, samples were collected from three locations around the SWMU (Figure 5.7-1). One sample was collected upgradient of the SWMU (23-08), and two samples, 23-02 and 23-05, were collected inside the area of elevated soil constituent concentrations and downgradient of the release, respectively. The analytical results for groundwater are presented in Table 5.7-3. One sample from location 23-02 contained TRPH concentrations above the 10-mg/L release criterion. TRPH concentrations in the groundwater from 23-05, located approximately 12 ft downgradient of 23-02, were below this level. Elevated concentrations of acetone, carbon disulfide, methylene chloride, and BTEX were detected in groundwater samples; generally, the constituent concentrations are lower in the downgradient sample. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.7.3 Risk-Based Screen Results

The risk-based screen indicated that none of the constituent concentrations exceeded the screening criteria for this SWMU. The results are shown in Appendix C. Therefore, on the basis of the screen, there is no risk to human health from the release at SWMU 23.

5.7.4 Conclusions

The results from Phase I/II investigation at SWMU 23 indicate that a subsurface release has occurred at this site and that TRPH concentrations are above the 1000-mg/kg cleanup level in samples collected from two DPT borings (23-02 and 23-04) located adjacent to the SWMU. Approximately 1.8 cubic yards will require remediation. The Phase II investigation defined the extent of the release to be confined to the area immediately adjacent to the SWMU. The nature of the release was characterized by laboratory analysis. The extent of groundwater contamination was confined to the area around the SWMU. From the risk-based screen, no constituents were found to pose a risk to human health.

5.7.5 Recommendations

SWMU 23 was recommended for conditional NFA, the condition of NFA was the excavation of TPH-contaminated soil. SWMU 23 was removed in January 1996 under the Phase 2 Basewide POL project. Two phases of excavation were conducted at SWMU 23. No TPH in excess of 1000 mg/kg was detected in the excavated soil and therefore no soil required offsite disposal. All

confirmation samples were not-detected for TPH, excluding one sample (1500 mg/kg) taken adjacent to Building 800. No further excavation was possible. As discussed with NMED, in these cases where 80% to 90% of the contaminated soil has been removed and further remediation is not possible, NFA is appropriate. A more detailed account of field activities can be found in the *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico* to be submitted in October 1997. As discussed with NMED, in these cases where 80% to 90% of the contaminated soil has been removed and further remediation is not possible, NFA is appropriate. Therefore, SWMU 23 is recommended for NFA.

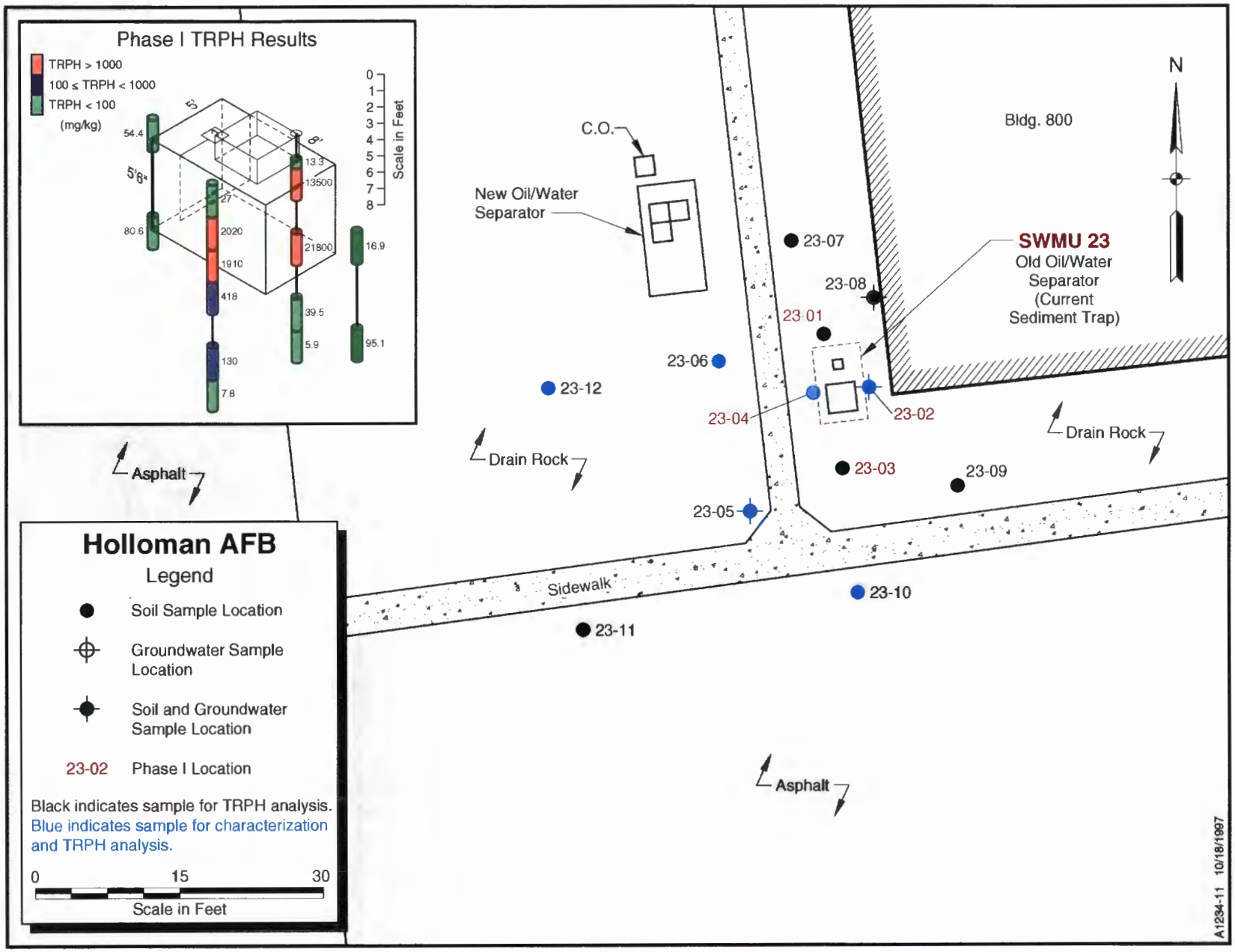

Figure 5.7-1. SWMU 23 - Building 800 O/WS Sample Locations and Phase I TRPH Results

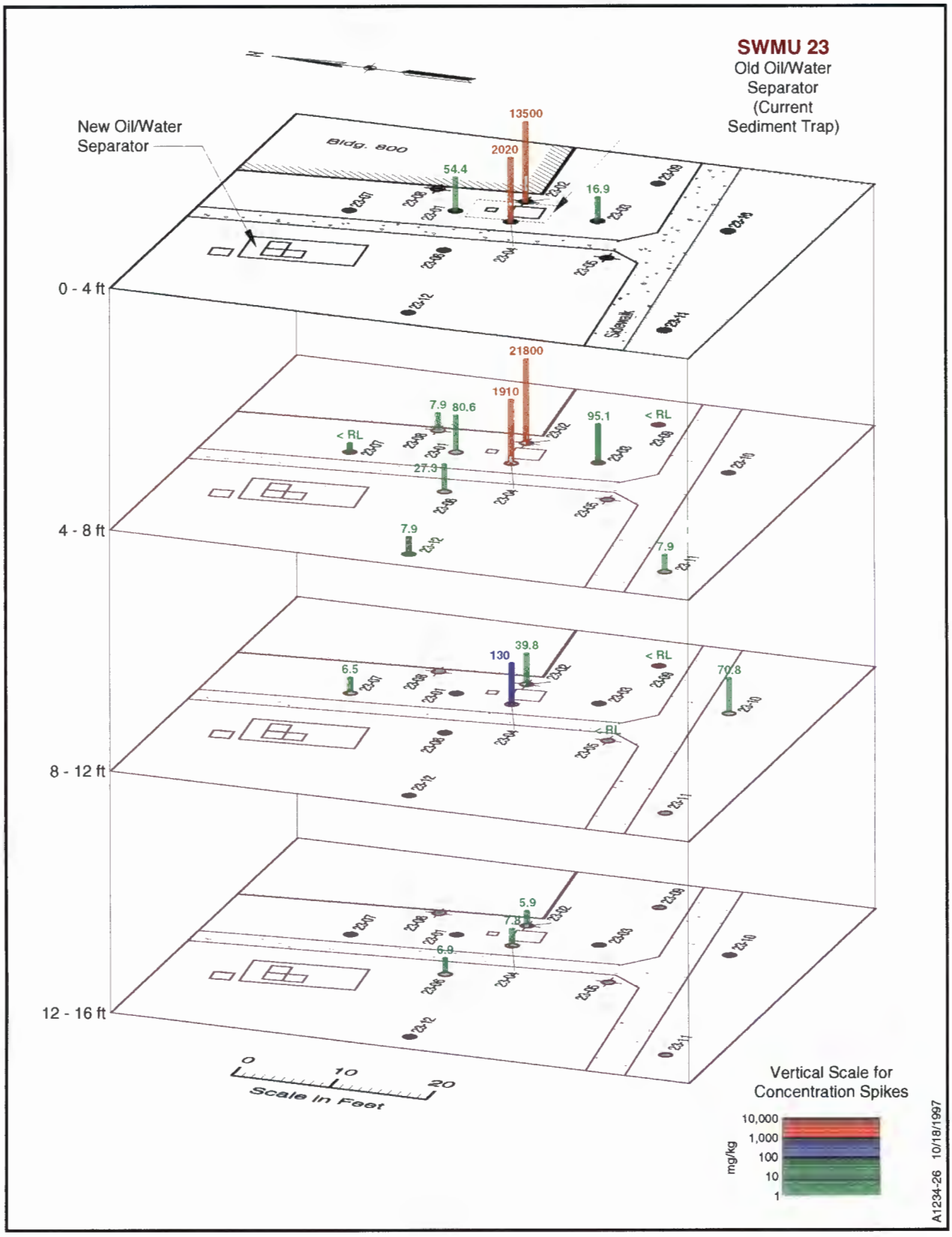

Figure 5.7-2. SWMU 23 - TRPH Concentrations by Depth Interval

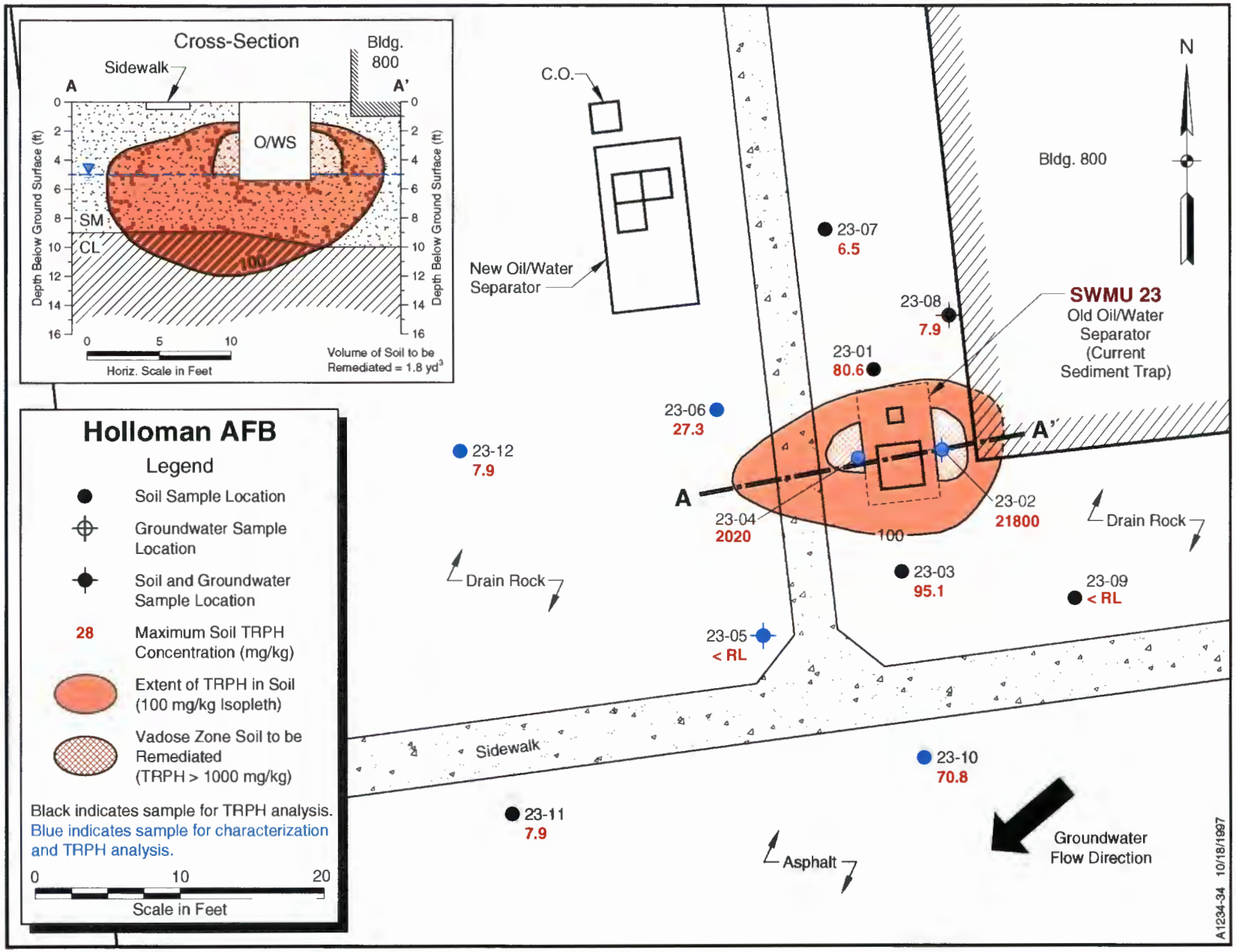

Figure 5.7-3. SWMU 23 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.7-1
TRPH Results for Soil at SWMU 23

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
23-01	0	2	54.4	23-05	7.5	10	< RL (< RL)
	6	8	80.6		11	11.5	< RL
23-02[a]	1.5	2	10.3/13.3	23-06	6	8	27.3
	2	4	13500		12	14	6.9 (50.6)
	6	8	> 11000	23-07	4	6	< RL
	6	8	21800 (23300)		8	10	6.5
	10	12	39.8	23-08	4	6	7.9
	12	14	5.9 (< RL)		6	8	7.9/< RL
23-03	0	2	16.9	23-09	6	8	< RL
	6	8	95.1		8	10	< RL/< RL
23-04	0	2	27	23-10	8	11	70.8 (< RL)
	2	4	2020	23-11	6	8	7.9
	4	6	1910 (12400)	23-12	6	8	7.9 (< RL)
	6	8	418 (268)				
	10	12	130				
	12	14	7.8 (< RL)				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

[a] Location 01-02, 6- to 8-ft interval sampled two times on different days.

Table 5.7-2
Summary Analytical Results for Soil at SWMU 23

Location ID		23-02				23-04			
Beg. Depth - End Depth (ft)		6-8		12-14		4-6		12-14	
SW6010 (mg/kg)	Barium	27.9	(1.27)	34.7	(1.25)	38.9	(1.27)	20.6	(1.24)
	Beryllium	< RL	(0.255)	< RL	(0.25)	< RL	(0.254)	< RL	(0.248)
	Cadmium	< RL	(0.637)	< RL	(0.626)	< RL	(0.636)	< RL	(0.62)
	Chromium	4.88	(1.27)	3.78	(1.25)	5.37	(1.27)	2.42	(1.24)
	Cobalt	1.8	(1.27)	< RL	(1.25)	1.37	(1.27)	< RL	(1.24)
	Copper	< RL	(2.55)	< RL	(2.5)	2.91	(2.54)	< RL	(2.48)
	Silver	< RL	(1.27)	< RL	(1.25)	< RL	(1.27)	< RL	(1.24)
	Vanadium	8.6	(2.55)	7.86	(2.5)	9.07	(2.54)	5.25	(2.48)
	Zinc	8.82	(2.55)	7.98	(2.5)	13.1	(2.54)	6.26	(2.48)
SW7041 (mg/kg)	Antimony	< RL	(0.637)	< RL	(0.626)	< RL	(0.636)	< RL	(0.62)
SW7060 (mg/kg)	Arsenic	< RL	(0.637)	0.651	(0.626)	0.725	(0.636)	< RL	(0.62)
SW7421 (mg/kg)	Lead	3.8	(0.637)	1.86	(0.626)	4.62	(0.636)	1.24	(0.62)
SW7471 (mg/kg)	Mercury	< RL	(0.0255)	< RL	(0.025)	< RL	(0.0254)	< RL	(0.0248)
SW7740 (mg/kg)	Selenium	< RL	(0.637)	< RL	(0.626)	< RL	(0.636)	< RL	(0.62)
SW7841 (mg/kg)	Thallium	< RL	(0.637)	< RL	(0.626)	< RL	(0.636)	< RL	(0.62)
SW8260 (µg/kg)	1,2-Dichlorobenzene	ND	(1590)	< RL	(6.26)	ND	(6.36)	< RL	(6.2)
	1,3-Dichlorobenzene	ND	(1590)	< RL	(6.26)	160	(6.36)	ND	(6.2)
	1,4-Dichlorobenzene	< RL	(1590)	< RL	(6.26)	110	(6.36)	< RL	(6.2)
	2-Butanone	< RL	(31800)	< RL	(125)	< RL	(127)	185	(124)
	Acetone	< RL	(31800)	224	(125)	8640	(127)	287	(124)
	Benzene	< RL	(1590)	ND	(6.26)	< RL	(6.36)	< RL	(6.2)
	Carbon disulfide	4200	(1590)	ND	(6.26)	24.2	(6.36)	ND	(6.2)
	Ethyl benzene	5480	(1590)	ND	(6.26)	78.8	(6.36)	ND	(6.2)
	Methylene chloride	< RL	(6370)	< RL	(25)	< RL	(25.4)	< RL	(24.8)
	Toluene	12300	(1590)	< RL	(6.26)	38.8	(6.36)	< RL	(6.2)
	Total xylenes	13900	(1590)	ND	(6.26)	141	(6.36)	ND	(6.2)
	Vinyl acetate	ND	(15900)	< RL	(62.6)	ND	(63.6)	< RL	(62)
SW8270 (mg/kg)	1,2-Dichlorobenzene	ND	(0.588)	ND	(0.413)	< RL	(0.42)	ND	(0.33)
	1,3-Dichlorobenzene	ND	(0.588)	ND	(0.413)	< RL	(0.42)	ND	(0.33)
	1,4-Dichlorobenzene	ND	(0.588)	ND	(0.413)	< RL	(0.42)	ND	(0.33)
	2-Methylnaphthalene	9.94	(0.588)	ND	(0.413)	3.85	(0.42)	ND	(0.33)
	2-Methylphenol	ND	(0.588)	ND	(0.413)	1.62	(0.42)	ND	(0.33)
	4-Chloro-3-methylphenol	ND	(0.588)	ND	(0.413)	ND	(0.42)	ND	(0.33)
	4-Methylphenol	3.01	(0.588)	ND	(0.413)	0.807	(0.42)	ND	(0.33)
	Acenaphthylene	< RL	(0.588)	ND	(0.413)	ND	(0.42)	ND	(0.33)
	Butylbenzylphthalate	ND	(0.588)	ND	(0.413)	< RL	(0.42)	ND	(0.33)
	Dibenzofuran	ND	(2.85)	ND	(0.413)	< RL	(0.42)	ND	(0.33)
	Dimethylphthalate	< RL	(0.588)	ND	(0.413)	< RL	(0.42)	ND	(0.33)
	Fluoranthene	< RL	(0.588)	ND	(0.413)	ND	(0.42)	ND	(0.33)
	Naphthalene	5.58	(0.588)	ND	(0.413)	2.65	(0.42)	ND	(0.33)
	Phenanthrene	< RL	(0.588)	ND	(0.413)	< RL	(0.42)	ND	(0.33)

Table 5.7-2
(Continued)

Location ID		23-02				23-04			
Beg. Depth - End Depth (ft)		6-8		12-14		4-6		12-14	
SW8270 (mg/kg) (Continued)	Pyrene	< RL	(0.588)	ND	(0.413)	< RL	(0.42)	ND	(0.33)
	bis(2-Ethylhexyl)phthalate	24.2	(0.588)	ND	(0.413)	3.13	(0.42)	ND	(0.33)
	di-n-Butylphthalate	4.3	(0.588)	2.93	(0.413)	0.566	(0.42)	< RL	(0.33)
	di-n-Octylphthalate	< RL	(0.588)	ND	(0.413)	ND	(0.42)	ND	(0.33)

Table 5.7-2
(Continued)

Location ID		23-05		23-06		23-10		23-12	
Beg. Depth - End Depth (ft)		7.5-10		12-14		8-11		6-8	
SW6010 (mg/kg)	Barium	12.4	(1.3)	15.3	(1.18)	6.34	(1.35)	30.4	(1.41)
	Beryllium	< RL	(0.26)	< RL	(0.237)	< RL	(0.27)	< RL	(0.283)
	Cadmium	< RL	(0.649)	< RL	(0.592)	< RL	(0.676)	< RL	(0.707)
	Chromium	2.17	(1.3)	3.42	(1.18)	2.09	(1.35)	3.07	(1.41)
	Cobalt	< RL	(1.3)	< RL	(1.18)	< RL	(1.35)	1.68	(1.41)
	Copper	< RL	(2.6)	< RL	(2.37)	< RL	(2.7)	< RL	(2.83)
	Silver	< RL	(1.3)	< RL	(1.18)	< RL	(1.35)	1.63	(1.41)
	Vanadium	6.95	(2.6)	6.4	(2.37)	3.97	(2.7)	6.78	(2.83)
	Zinc	5.19	(2.6)	4.28	(2.37)	4.38	(2.7)	7.64	(2.83)
SW7041 (mg/kg)	Antimony	1.21	(0.649)	< RL	(0.592)	0.77	(0.676)	1	(0.707)
SW7060 (mg/kg)	Arsenic	< RL	(0.649)	2.03	(0.592)	< RL	(0.676)	0.82	(0.707)
SW7421 (mg/kg)	Lead	0.74	(0.649)	2.62	(0.592)	1.07	(0.676)	1.09	(0.707)
SW7471 (mg/kg)	Mercury	< RL	(0.026)	< RL	(0.0237)	< RL	(0.027)	< RL	(0.0283)
SW7740 (mg/kg)	Selenium	< RL	(0.649)	< RL	(0.592)	< RL	(0.676)	< RL	(0.707)
SW7841 (mg/kg)	Thallium	< RL	(0.649)	< RL	(0.592)	< RL	(0.676)	< RL	(0.707)
SW8260 (µg/kg)	1,2-Dichlorobenzene	ND	(6.49)	< RL	(5.92)	ND	(6.76)	ND	(7.07)
	1,3-Dichlorobenzene	ND	(6.49)	< RL	(5.92)	ND	(6.76)	ND	(7.07)
	1,4-Dichlorobenzene	ND	(6.49)	< RL	(5.92)	ND	(6.76)	ND	(7.07)
	2-Butanone	ND	(130)	< RL	(118)	ND	(135)	ND	(141)
	Acetone	843	(649)	326	(118)	< RL	(135)	1100	(141)
	Benzene	< RL	(6.49)	ND	(5.92)	ND	(6.76)	ND	(7.07)
	Carbon disulfide	16.5	(6.49)	ND	(5.92)	ND	(6.76)	< RL	(7.07)
	Ethyl benzene	< RL	(6.49)	ND	(5.92)	ND	(6.76)	ND	(7.07)
	Methylene chloride	< RL	(26)	< RL	(23.7)	< RL	(27)	< RL	(28.3)
	Toluene	11	(6.49)	< RL	(5.92)	< RL	(6.76)	ND	(7.07)
	Total xylenes	< RL	(6.49)	ND	(5.92)	ND	(6.76)	ND	(7.07)
	Vinyl acetate	< RL	(64.9)	ND	(59.2)	ND	(67.6)	ND	(70.7)
SW8270 (mg/kg)	1,2-Dichlorobenzene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	1,3-Dichlorobenzene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	1,4-Dichlorobenzene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	2-Methylnaphthalene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	2-Methylphenol	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	4-Chloro-3-methylphenol	< RL	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	4-Methylphenol	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	Acenaphthylene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	Butylbenzylphthalate	ND	(0.428)	ND	(0.33)	ND	(0.446)	< RL	(0.467)
	Dibenzofuran	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	Dimethylphthalate	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	Fluoranthene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	Naphthalene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	Phenanthrene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)

Table 5.7-2
(Continued)

Location ID		23-05		23-06		23-10		23-12	
Beg. Depth - End Depth (ft)		7.5-10		12-14		8-11		6-8	
SW8270 (mg/kg) (Continued)	Pyrene	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	bis(2-Ethylhexyl)phthalate	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)
	di-n-Butylphthalate	< RL	(0.428)	< RL	(0.33)	< RL	(0.446)	7.42	(0.467)
	di-n-Octylphthalate	ND	(0.428)	ND	(0.33)	ND	(0.446)	ND	(0.467)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
<RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.7-3
Summary Analytical Results for Groundwater at SWMU 23

Location ID		23-02		23-05		23-08	
E418.1 (mg/L)	TRPH	1490	(160)	1.08	(0.4)	NA	
E418.1M (mg/L)	TRPH	> 1470	(125)	< RL	(5)	< RL	(5)
SW6010 (mg/L)	Barium	< RL	(0.01)	0.01	(0.01)	NA	
	Beryllium	< RL	(0.002)	< RL	(0.002)	NA	
	Cadmium	< RL	(0.005)	< RL	(0.005)	NA	
	Chromium	< RL	(0.01)	< RL	(0.01)	NA	
	Silver	0.02	(0.01)	0.015	(0.01)	NA	
	Vanadium	< RL	(0.02)	0.02	(0.02)	NA	
	Zinc	< RL	(0.02)	< RL	(0.02)	NA	
SW7041 (mg/L)	Antimony	0.0089	(0.005)	< RL	(0.005)	NA	
SW7060 (mg/L)	Arsenic	0.0121	(0.004)	0.0824	(0.004)	NA	
SW7421 (mg/L)	Lead	< RL	(0.003)	< RL	(0.003)	NA	
SW7740 (mg/L)	Selenium	0.0055	(0.005)	< RL	(0.005)	NA	
SW7841 (mg/L)	Thallium	< RL	(0.002)	< RL	(0.002)	NA	
SW8260 (µg/L)	2-Butanone	< RL	(500)	< RL	(100)	NA	
	Acetone	< RL	(500)	1650	(1000)	NA	
	Benzene	59	(25)	9	(5)	NA	
	Carbon disulfide	113	(25)	15.6	(5)	NA	
	Ethyl benzene	104	(25)	28.1	(5)	NA	
	Methylene chloride	1060	(100)	145	(20)	NA	
	Toluene	52.6	(25)	225	(50)	NA	
	Total xylenes	229	(25)	71.8	(5)	NA	
	Vinyl acetate	ND	(50)	59.5	(50)	NA	
SW8270 (mg/L)	4-Methylphenol	ND	(0.01)	< RL	(0.01)	NA	

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).

NA = Not analyzed.
ND = Analyte not detected. No instrument response.
<RL = Result not detected at the reporting limit.
( ) = Reporting limit.
> = Result greater than value. Additional dilutions not performed.

5.8 SWMU 27—Building 810 O/WS

SWMU 27 operated as an O/WS servicing the F-15 engine test cell near Buildings 807 and 810 between 1977 and 1990. In 1990, it was abandoned in conjunction with the closure of Buildings of 807 and 810. Between 1990 and 1994, the SWMU did not receive waste from these buildings, but was open and subject to potential overflow or leaks. To prevent such an occurrence, the unit was filled with sand in 1994.

To confirm reported releases from the unit in 1985 and 1988, SWMU 27 was investigated under the Table 3 RFI. During Phase I of the RFI, soil samples collected from the area immediately adjacent to the SWMU were shown to have TRPH concentrations above the release criterion of 100 mg/kg and above the Base-specific cleanup level of 1000 mg/kg; therefore, it was confirmed that an overflow release had occurred. Phase II sampling was conducted to define the nature and extent of the release in the soil and groundwater. Three areas of soil with TRPH concentrations above the 1000-mg/kg Base-specific cleanup level were identified around the O/WS, and LNAPL was detected on the groundwater.

No COCs were identified in the risk-based screen; therefore CNFA is recommended for this SWMU. The condition of NFA is remediation of the TRPH-contaminated soil and removal of the LNAPL.

5.8.1 SWMU Description

Unit Type: Three-chamber O/WS
Period of Operation: April 1977 to 1990
Current Status: Inactive
Disposition of Unit: Filled with sand and abandoned in place
Source of Waste: Engine test cell
Major Operations: Engine testing and maintenance
Construction Material: Concrete
Physical Condition: Concrete in fairly good condition
Oil/Total Capacity: 520 gal. (Separate oil storage)/400 gal.
Historic Releases: August 1985–overflow of O/WS; contamination extends 1 ft bgl; January 1988–overflow of O/WS; February 1988–discharge pipe from O/WS washed out

5.8.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform subsurface lithology of silty sand and sandy silt to approximately 8 ft bgl. In each of the borings, the soil grades rapidly between 7.5 and 9.5 ft bgl to a very hard sandy clay. Gravelly sand and silt occurs in areas west and south of the SWMU at shallow depths. The topography at these locations is slightly raised and it appears that manmade fill has been added to the site. Soil near a new brick wall constructed at the site has also been disturbed by construction activities. Details of site geology can be seen in the DPT boring logs (Appendix F).

Groundwater occurs at 3 to 4.5 ft bgl and flows to the southwest. The bottom of the O/WS is approximately 1 to 2.5 ft below the groundwater table.

Phase I Investigation

As shown in Figure 5.8-1, samples were collected from 17 locations during Phase I for analysis of TRPH by EPA 418.1M. At locations around the separator, samples were collected from the surface and from near the bottom of the separator, and additional samples were also collected from intermediate depths to define vertical extent further before delineating lateral extent during Phase II. Phase I samples were also collected at the surface in low areas where it was estimated that an overflow might have occurred. Figure

5.8-1 shows the sampling horizons and the associated TRPH results.

TRPH concentrations at 15 of the Phase I sampling locations (Figure 5.8-1) were detected above the 100-mg/kg release criterion, thus confirming that a release had occurred from the SWMU. In addition, TRPH concentrations above 1000 mg/kg were detected at 12 of the Phase I locations. The majority of the samples with elevated TRPH concentrations were detected in the shallow soils, thereby supporting the documented overflow release mechanism. A Phase II investigation was initiated at SWMU 27.

Phase II Investigation

Extent—The extent of the releases was investigated in Phase II of the investigation using the iterative step-out approach outlined in the work plan. The Phase II sampling locations are shown in Figure 5.8-1. The magnitude of TRPH results and lateral extent at each horizon are shown in Figure 5.8-2. From the Phase I/II results, the highest concentrations of TRPH are located in near-surface sediments (between 0 and 2 ft), extending in all directions from the separator. Samples collected from within the sandy clay horizon (>10 ft bgl) exhibited lower TRPH results as shown on Figure 5.8-2. All field TRPH results are provided in Table 5.8-1.

Using the maximum detected TRPH result at each boring, a contour map was developed to illustrate the areal extent of TRPH values above 100 and 1000 mg/kg (Figure 5.8-3). The figure shows that the highest levels of TRPH occur near the SWMU and in two areas to the east and west of the separator, which are low areas relative to the O/WS. The cross section shows two shallow (0 to 2 ft bgl) areas where TRPH concentrations were less than 100 mg/kg. In these locations, manmade fill exists at the surface.

Nature—To characterize the nature of the release, eight samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.8-2. The data indicated that some volatile and semivolatile organic constituents were present at elevated levels within the TRPH-contaminated soils. BTEX constituents were detected at high levels within the soils containing TRPH above the cleanup level (locations 27-01, -04, -11, and -28). These results correlate well with the TRPH results, which show concentrations to be relatively higher at these locations. No organic or inorganic concentrations exceeded the RBC screening levels.

Groundwater—To define constituent concentrations in the groundwater, samples were collected from eight locations at the site (Figure 5.8-1). Two samples were collected upgradient of the SWMU (27-23 and 27-12), four samples were collected inside the area of elevated soil constituent concentrations (27-01, -03, -08, and -28), and two samples were collected downgradient of the release (27-27 and 27-14). The analytical results for groundwater are presented in Table 5.8-3. Each of the samples from locations 27-01, -03, -08, and -28 contained TRPH concentrations above the 10-mg/L release criterion. Elevated levels of BTEX and semivolatile constituents were seen within the extent of the release.

LNAPL was detected at locations 27-01, -04, and -28. The apparent product thickness observed at each location is shown in Figure 5.8-3. The LNAPL found at 27-28 is likely a result of the release pooling in the low area at that location.

5.8.3 Risk-Based Screen Results

The risk-based screen indicated that none of the COPCs exceeded the screening criteria for this SWMU; therefore no COCs were identified at this site (see Appendix C). On the basis of the

screen, there is no risk to human health from the release at SWMU 27.

5.8.4 Conclusions

The results from the Phase I/II investigation at SWMU 27 indicate that a substantial surface release has occurred at this site. The results of the Phase I/II investigation indicate that TRPH concentrations are above the 1000-mg/kg cleanup level in samples across the site. The Phase II investigation defined the extent of the release to be a large area on all sides of the SWMU, and the estimated volume of soil above the cleanup level is 540 cubic yards. LNAPL was found in two areas within the release. The extent of elevated constituents in the groundwater is confined to areas containing TRPH-contaminated soils.

The nature of the release was characterized by laboratory analysis. From the risk-based screen, no constituents were found to pose risk to human health.

5.8.5 Recommendations

CNFA was recommended for SWMU 27. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 27 was removed and remediated as part of Holloman AFB's Phase 2 Basewide POL project in April 1996. Approximately 3726 cubic yards of TPH-contaminated soil were excavated and disposed. No LNAPL was found during the excavation. Confirmation samples ranged from not-detected to 32 mg/kg. SWMU 27 was subsequently approved for NFA by NMED in September 1997. Further details regarding the remediation of SWMU 27 can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997*. Based on the discussed remediation, SWMU 27 is recommended for NFA.

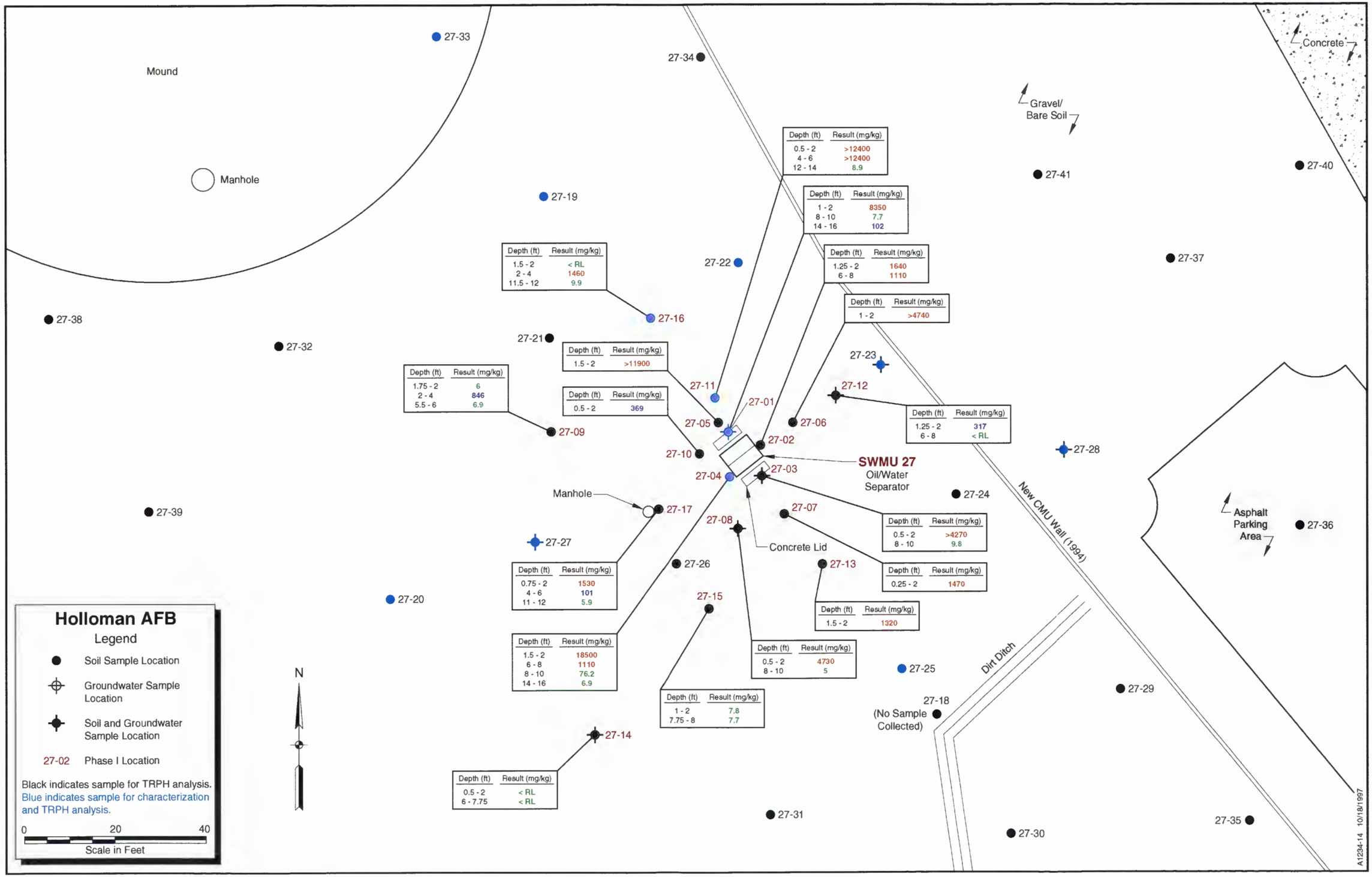

Figure 5.8-1. SWMU 27 - Building 810 O/WS Sample Locations and Phase I TRPH Results

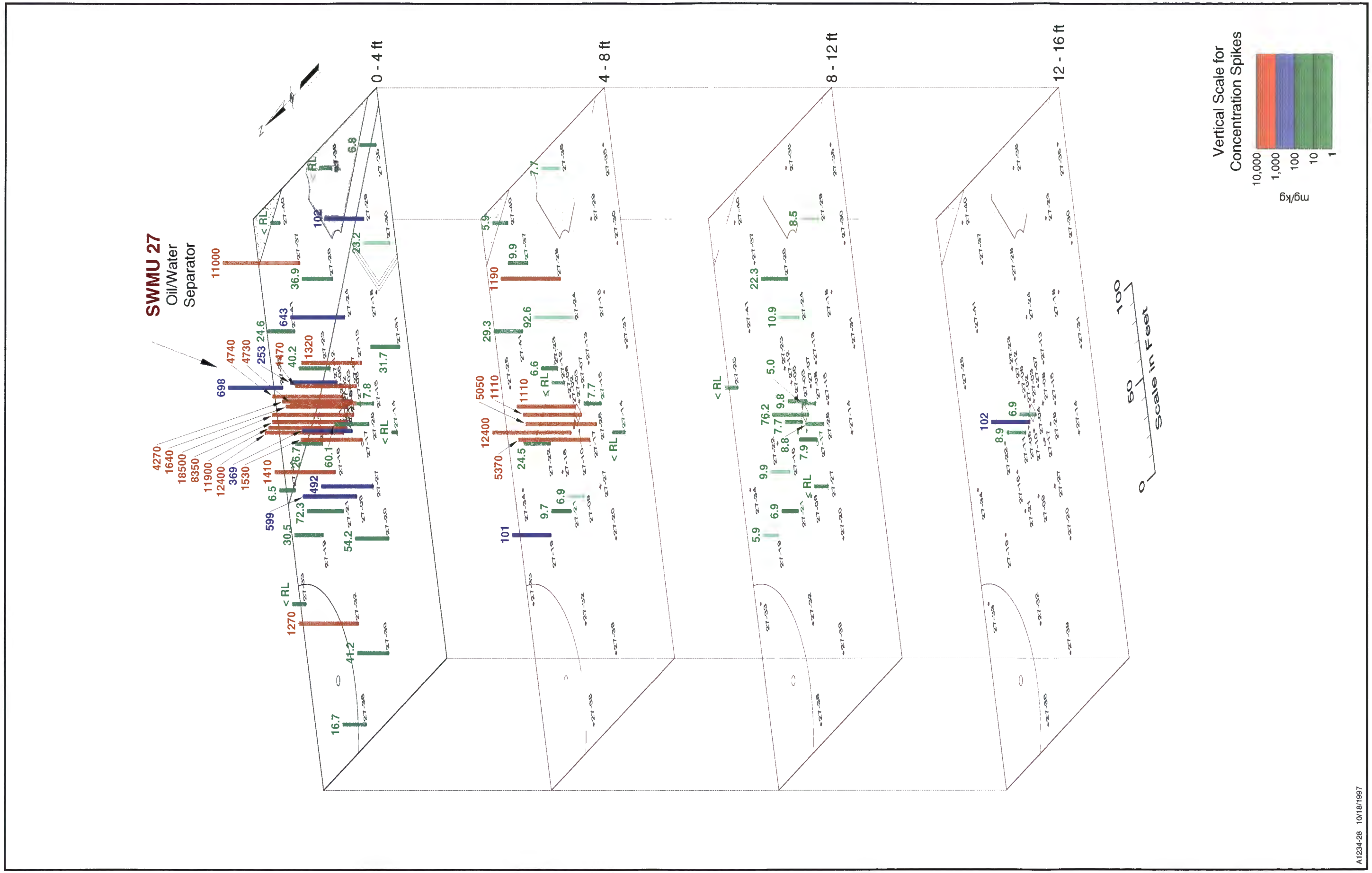

Figure 5.8-2. SWMU 27 - TRPH Concentrations by Depth Interval

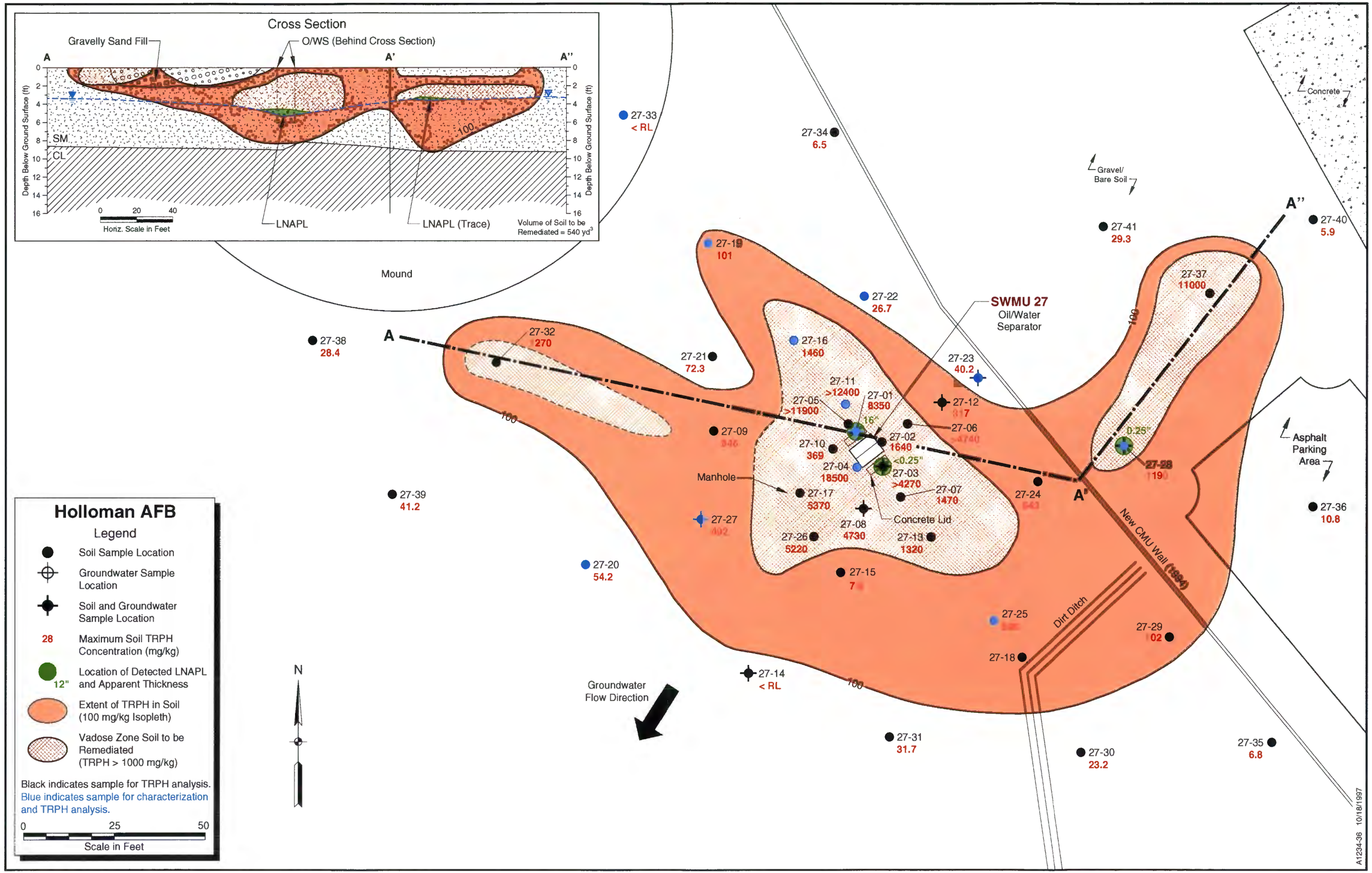

Figure 5.8-3. SWMU 27 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.8-1
TRPH Results for Soil at SWMU 27[a]

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
27-01	1	2	8350	27-21	0	2	72.3
	8	10	7.7		4	6	9.7
	14	16	102		10	12	6.9
27-02	1.25	2	1640 (1220)	27-22	0	2	26.7
	6	8	1110/1050		4	6	24.5
27-03	0.5	2	> 4270		6	8	8.6 (44.4)
	8	10	9.8	27-23	0	2	30.7 (50.6)
27-04	1.5	2	18500		2	4	6.9
	6	8	1110		6	8	6.6
	8	10	76.2	27-24	0	2	643
	14	16	6.9 (< RL)		4	6	92.6
27-05	1.5	2	> 11,900		8	10	10.9
27-06	1	2	> 4740	27-25	0	2	15.8 (94.2)
27-07	0.25	2	1470		2	4	698
27-08	0.5	2	4730 (2280)		8	10	< RL
	8	10	5 (< RL)	27-26	0	2	60.1
27-09	1.75	2	6		4	6	5050/5220
	2	4	599/846		11	12	8.8
	5.5	6	6.9	27-27	0	2	38.4
27-10	0.5	2	369		2	4	492 (113)
27-11	0.5	2	> 12,400		9	10	< RL
	4	6	> 12,400	27-28	0	2	36.9/47.1
	12	14	8.9		4	6	1190 (705)
27-12	1.25	2	253/317		6	8	489
	6	8	< RL		10	12	22.3
27-13	1.5	2	1320	27-29	0	2	37
27-14	0.5	2	< RL		2	4	102
	6	7.75	< RL		9.5	10	8.5
27-15	1	2	7.8	27-30	0	2	23.2
	7.75	8	7.7		2	4	5.7
27-16	1.5	2	< RL	27-31	0	2	31.7
	2	4	1410/1460		2	4	15.8
	11.5	12	9.9	27-32	0	2	1270
27-17	0.75	2	1530/1180		2	4	10.7
	4	6	5370/3170	27-33	2	4	< RL (< RL)
	10	12	7.9	27-34	2	4	6.5
27-19	0	2	30.5	27-35	2	4	6.8
	4	6	101/89.5 (50.7/74.5)	27-36	2	4	< RL
	11	12	5.9		4	6	7.7/10.8
27-20	0	2	54.2 (38.6)				

Table 5.8-1
(Continued)

Location	Depth (ft)		TRPH (mg/kg)	Location	Depth (ft)		TRPH (mg/kg)
	Top	Bottom			Top	Bottom	
27-37	0	2	99	27-40	2	4	< RL
	2	4	11000		4	6	59
	6	8	9.9	27-41	2	4	24.6
27-38	0	2	16.7/28.4		4	6	29.3
27-39	0	2	41.2				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.
> = Result greater than value. Additonal dilutions not performed.

[a]No sample collected at location 27-18.

Table 5.8-2
Summary Analytical Results for Soil at SWMU 27

Location ID		27-01				27-04			
Beg. Depth - End Depth (ft)		0-2		6-8		0-2		14-16	
SW6010 (mg/kg)	Barium	16	(1.28)	10	(1.3)	26	(1.2)	19.5	(1.21)
	Beryllium	< RL	(0.256)	< RL	(0.259)	< RL	(0.241)	0.324	(0.241)
	Cadmium	< RL	(0.639)	< RL	(0.648)	< RL	(0.602)	< RL	(0.603)
	Chromium	2.86	(1.28)	2.89	(1.3)	5.38	(1.2)	5.55	(1.21)
	Cobalt	< RL	(1.28)	< RL	(1.3)	< RL	(1.2)	1.57	(1.21)
	Copper	< RL	(2.56)	< RL	(2.59)	< RL	(2.41)	< RL	(2.41)
	Silver	< RL	(1.28)	< RL	(1.3)	< RL	(1.2)	< RL	(1.21)
	Vanadium	5.92	(2.56)	3.89	(2.59)	7.93	(2.41)	7.73	(2.41)
	Zinc	9.74	(2.56)	6.07	(2.59)	18.6	(2.41)	15.1	(2.41)
SW7041 (mg/kg)	Antimony	< RL	(0.639)	< RL	(0.648)	< RL	(0.602)	< RL	(0.603)
SW7060 (mg/kg)	Arsenic	1.02	(0.639)	< RL	(0.648)	1.94	(0.602)	1.06	(0.603)
SW7421 (mg/kg)	Lead	3.58	(0.639)	3.11	(0.648)	4.59	(0.602)	5.43	(0.603)
SW7471 (mg/kg)	Mercury	< RL	(0.0256)	< RL	(0.0259)	< RL	(0.0241)	< RL	(0.0241)
SW7740 (mg/kg)	Selenium	< RL	(0.639)	< RL	(0.648)	< RL	(0.602)	< RL	(0.603)
SW7841 (mg/kg)	Thallium	< RL	(0.639)	< RL	(0.648)	< RL	(0.602)	< RL	(0.603)
SW8260 (µg/kg)	1,1-Dichloroethene	ND	(16000)	ND	(3240)	ND	(753)	ND	(6.03)
	2-Butanone	< RL	(320000)	< RL	(64800)	< RL	(15100)	ND	(121)
	2-Chloroethylvinyl ether	ND	(16000)	ND	(3240)	1020	(753)	ND	(6.03)
	2-Hexanone	ND	(160000)	ND	(32400)	ND	(7530)	ND	(60.3)
	Acetone	< RL	(320000)	< RL	(64800)	< RL	(15100)	< RL	(121)
	Benzene	< RL	(16000)	4600	(3240)	1610	(753)	< RL	(6.03)
	Carbon disulfide	ND	(16000)	ND	(3240)	< RL	(753)	ND	(6.03)
	Chlorobenzene	ND	(16000)	ND	(3240)	ND	(753)	ND	(6.03)
	Ethyl benzene	151000	(16000)	47100	(3240)	90600	(3010)	< RL	(6.03)
	Methylene chloride	< RL	(63900)	< RL	(13000)	3430	(3010)	< RL	(24.1)
	Toluene	109000	(16000)	47600	(3240)	65800	(3010)	6.51	(6.03)
	Total xylenes	293000	(16000)	8300	(3240)	171000	(3010)	< RL	(6.03)
	Trichloroethene	ND	(16000)	ND	(3240)	ND	(753)	ND	(6.03)
	Vinyl acetate	ND	(160000)	ND	(32400)	ND	(7530)	ND	(60.3)
	cis-1,2-Dichloroethene	ND	(16000)	ND	(3240)	ND	(753)	ND	(6.03)
SW8270 (mg/kg)	2,4-Dinitrotoluene	ND	(0.33)	ND	(0.33)	ND	(0.398)	ND	(0.33)
	2-Methylnaphthalene	16.5	(0.33)	4.69	(0.33)	22.5	(0.398)	ND	(0.33)
	2-Methylphenol	ND	(0.33)	< RL	(0.33)	ND	(0.398)	ND	(0.33)
	3-Nitroaniline	ND	(1.6)	< RL	(1.6)	ND	(1.93)	ND	(1.6)
	4-Methylphenol	< RL	(0.33)	ND	(0.33)	ND	(0.398)	ND	(0.33)
	4-Nitroaniline	ND	(1.6)	< RL	(1.6)	ND	(1.93)	ND	(1.6)
	Chrysene	< RL	(0.33)	ND	(0.33)	< RL	(0.398)	ND	(0.33)
	Dibenzofuran	0.597	(0.33)	< RL	(0.33)	0.998	(0.398)	ND	(0.33)
	Dimethylphthalate	< RL	(0.33)	< RL	(0.33)	< RL	(0.398)	ND	(0.33)
	Fluoranthene	< RL	(0.33)	< RL	(0.33)	< RL	(0.398)	ND	(0.33)
	Fluorene	< RL	(0.33)	< RL	(0.33)	0.465	(0.398)	ND	(0.33)
	Naphthalene	11.2	(0.33)	1.61	(0.33)	8.31	(0.398)	ND	(0.33)
	Phenanthrene	< RL	(0.33)	< RL	(0.33)	0.486	(0.398)	ND	(0.33)
	Phenol	ND	(0.33)	ND	(0.33)	ND	(0.398)	ND	(0.33)

Table 5.8-2
(Continued)

Location ID		27-01				27-04			
Beg. Depth - End Depth (ft)		0-2		6-8		0-2		14-16	
SW8270 (mg/kg) (Continued)	Pyrene	< RL	(0.33)	< RL	(0.33)	< RL	(0.398)	ND	(0.33)
	bis(2-Ethylhexyl)phthalate	ND	(0.33)	< RL	(0.33)	0.648	(0.398)	ND	(0.33)
	di-n-Butylphthalate	ND	(0.33)	0.376	(0.33)	0.486	(0.398)	0.366	(0.33)
	n-Nitrosodiphenylamine	ND	(0.33)	< RL	(0.33)	ND	(0.398)	ND	(0.33)

Table 5.8-2
(Continued)

Location ID		27-11		27-16		27-19		27-20	
Beg. Depth - End Depth (ft)		0-2		0-2		4-6		0-2	
SW6010 (mg/kg)	Barium	28.8	(1.2)	31	(1.22)	19.3	(1.24)	23.2	(1.27)
	Beryllium	< RL	(0.24)	< RL	(0.243)	< RL	(0.248)	< RL	(0.253)
	Cadmium	< RL	(0.6)	< RL	(0.608)	< RL	(0.619)	< RL	(0.634)
	Chromium	4.24	(1.2)	3.9	(1.22)	2.24	(1.24)	3.98	(1.27)
	Cobalt	1.24	(1.2)	1.26	(1.22)	< RL	(1.24)	< RL	(1.27)
	Copper	4.25	(2.4)	2.72	(2.43)	< RL	(2.48)	< RL	(2.53)
	Silver	< RL	(1.2)	< RL	(1.22)	< RL	(1.24)	< RL	(1.27)
	Vanadium	6.58	(2.4)	8.25	(2.43)	5.63	(2.48)	7.4	(2.53)
	Zinc	22	(2.4)	15.4	(2.43)	6.09	(2.48)	11.2	(2.53)
SW7041 (mg/kg)	Antimony	< RL	(0.6)	< RL	(0.608)	< RL	(0.619)	< RL	(0.634)
SW7060 (mg/kg)	Arsenic	1.78	(0.6)	1.42	(0.608)	< RL	(0.619)	1.38	(0.634)
SW7421 (mg/kg)	Lead	6.81	(0.6)	3.76	(0.608)	0.656	(0.619)	4.78	(0.634)
SW7471 (mg/kg)	Mercury	< RL	(0.024)	< RL	(0.0243)	< RL	(0.0248)	< RL	(0.0253)
SW7740 (mg/kg)	Selenium	< RL	(0.6)	< RL	(0.608)	0.681	(0.619)	< RL	(0.634)
SW7841 (mg/kg)	Thallium	< RL	(0.6)	< RL	(0.608)	< RL	(0.619)	< RL	(0.634)
SW8260 (µg/kg)	1,1-Dichloroethene	ND	(6)	ND	(6.08)	ND	(6.19)	ND	(6.34)
	2-Butanone	< RL	(120)	< RL	(122)	< RL	(124)	ND	(127)
	2-Chloroethylvinyl ether	6.72	(6)	< RL	(6.08)	ND	(6.19)	ND	(6.34)
	2-Hexanone	< RL	(60)	ND	(60.8)	ND	(61.9)	ND	(63.4)
	Acetone	708	(120)	195	(122)	< RL	(124)	< RL	(127)
	Benzene	702	(150)	20.1	(6.08)	11	(6.19)	< RL	(6.34)
	Carbon disulfide	22.3	(6)	10.2	(6.08)	ND	(6.19)	ND	(6.34)
	Chlorobenzene	ND	(6)	ND	(6.08)	ND	(6.19)	ND	(6.34)
	Ethyl benzene	3020	(150)	44.5	(6.08)	23	(6.19)	ND	(6.34)
	Methylene chloride	< RL	(24)	< RL	(24.3)	< RL	(24.8)	< RL	(25.3)
	Toluene	6000	(150)	24.4	(6.08)	7.55	(6.19)	< RL	(6.34)
	Total xylenes	5400	(150)	126	(6.08)	21.9	(6.19)	< RL	(6.34)
	Trichloroethene	ND	(6)	ND	(6.08)	ND	(6.19)	ND	(6.34)
	Vinyl acetate	< RL	(60)	< RL	(60.8)	ND	(24.8)	ND	(63.4)
	cis-1,2-Dichloroethene	< RL	(6)	ND	(6.08)	ND	(6.19)	ND	(6.34)
SW8270 (mg/kg)	2,4-Dinitrotoluene	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	2-Methylnaphthalene	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	2-Methylphenol	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	3-Nitroaniline	ND	(1.6)	ND	(1.6)	ND	(1.98)	ND	(1.6)
	4-Methylphenol	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	4-Nitroaniline	ND	(1.6)	ND	(1.6)	ND	(1.98)	ND	(1.6)
	Chrysene	< RL	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	Dibenzofuran	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	Dimethylphthalate	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	Fluoranthene	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	Fluorene	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	Naphthalene	< RL	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	Phenanthrene	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	Phenol	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)

Table 5.8-2
(Continued)

Location ID		27-11		27-16		27-19		27-20	
Beg. Depth - End Depth (ft)		0-2		0-2		4-6		0-2	
SW8270 (mg/kg) (Continued)	Pyrene	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)
	bis(2-Ethylhexyl)phthalate	0.591	(0.33)	ND	(0.33)	< RL	(0.408)	ND	(0.33)
	di-n-Butylphthalate	0.419	(0.33)	0.426	(0.33)	< RL	(0.408)	0.383	(0.33)
	n-Nitrosodiphenylamine	ND	(0.33)	ND	(0.33)	ND	(0.408)	ND	(0.33)

Table 5.8-2
(Continued)

Location ID		27-22		27-23		27-25		27-27	
Beg. Depth - End Depth (ft)		6-8		0-2		0-2		2-4	
SW6010 (mg/kg)	Barium	3.32	(1.28)	49.6	(1.18)	39.4	(1.19)	11.5	(1.45)
	Beryllium	< RL	(0.256)	0.364	(0.237)	0.241	(0.238)	< RL	(0.29)
	Cadmium	< RL	(0.641)	< RL	(0.592)	< RL	(0.594)	< RL	(0.726)
	Chromium	< RL	(1.28)	6.33	(1.18)	4.9	(1.19)	< RL	(1.45)
	Cobalt	< RL	(1.28)	2.06	(1.18)	1.56	(1.19)	< RL	(1.45)
	Copper	< RL	(2.56)	5.19	(2.37)	3.46	(2.38)	< RL	(2.9)
	Silver	< RL	(1.28)	< RL	(1.18)	< RL	(1.19)	< RL	(1.45)
	Vanadium	< RL	(2.56)	10.7	(2.37)	8.93	(2.38)	3.69	(2.9)
	Zinc	< RL	(2.56)	23.3	(2.37)	16.8	(2.38)	2.9	(2.9)
SW7041 (mg/kg)	Antimony	< RL	(0.641)	< RL	(0.592)	< RL	(0.594)	< RL	(0.726)
SW7060 (mg/kg)	Arsenic	< RL	(0.641)	1.59	(0.592)	1.5	(0.594)	< RL	(0.726)
SW7421 (mg/kg)	Lead	1.02	(0.641)	5.92	(0.592)	5.37	(0.594)	< RL	(0.726)
SW7471 (mg/kg)	Mercury	< RL	(0.0256)	< RL	(0.0237)	< RL	(0.0238)	< RL	(0.029)
SW7740 (mg/kg)	Selenium	< RL	(0.641)	0.592	(0.592)	< RL	(0.594)	< RL	(0.726)
SW7841 (mg/kg)	Thallium	< RL	(0.641)	< RL	(0.592)	< RL	(0.594)	< RL	(0.726)
SW8260 (µg/kg)	1,1-Dichloroethene	ND	(6.41)	ND	(5.92)	< RL	(5.94)	ND	(7.26)
	2-Butanone	ND	(128)	< RL	(118)	< RL	(119)	< RL	(145)
	2-Chloroethylvinyl ether	ND	(6.41)	ND	(5.92)	ND	(5.94)	ND	(7.26)
	2-Hexanone	ND	(64.1)	ND	(59.2)	ND	(59.4)	ND	(72.6)
	Acetone	< RL	(128)	< RL	(118)	137	(119)	< RL	(145)
	Benzene	< RL	(6.41)	< RL	(5.92)	< RL	(5.94)	592	(7.26)
	Carbon disulfide	ND	(6.41)	ND	(5.92)	ND	(5.94)	12.8	(7.26)
	Chlorobenzene	ND	(6.41)	ND	(5.92)	< RL	(5.94)	ND	(7.26)
	Ethyl benzene	ND	(6.41)	< RL	(5.92)	< RL	(5.94)	4140	(7.26)
	Methylene chloride	< RL	(25.6)	< RL	(23.7)	< RL	(23.8)	ND	(29)
	Toluene	< RL	(6.41)	16	(5.92)	17.2	(5.94)	ND	(7.26)
	Total xylenes	ND	(6.41)	7.23	(5.92)	11.9	(5.94)	920	(7.26)
	Trichloroethene	ND	(6.41)	ND	(5.92)	< RL	(5.94)	ND	(7.26)
	Vinyl acetate	ND	(64.1)	ND	(59.2)	ND	(59.4)	164	(29)
	cis-1,2-Dichloroethene	ND	(6.41)	ND	(5.92)	ND	(5.94)	ND	(7.26)
SW8270 (mg/kg)	2,4-Dinitrotoluene	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	2-Methylnaphthalene	ND	(0.33)	ND	(0.33)	ND	(0.33)	0.733	(0.479)
	2-Methylphenol	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	3-Nitroaniline	ND	(1.6)	ND	(1.6)	ND	(1.6)	ND	(2.32)
	4-Methylphenol	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	4-Nitroaniline	ND	(1.6)	ND	(1.6)	ND	(1.6)	ND	(2.32)
	Chrysene	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	Dibenzofuran	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	Dimethylphthalate	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	Fluoranthene	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	Fluorene	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	Naphthalene	ND	(0.33)	ND	(0.33)	ND	(0.33)	< RL	(0.479)
	Phenanthrene	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	Phenol	< RL	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)

Table 5.8-2
(Continued)

Location ID		27-22		27-23		27-25		27-27	
Beg. Depth - End Depth (ft)		6-8		0-2		0-2		2-4	
SW8270 (mg/kg) (Continued)	Pyrene	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	bis(2-Ethylhexyl)phthalate	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)
	di-n-Butylphthalate	< RL	(0.33)	0.363	(0.33)	< RL	(0.33)	< RL	(0.479)
	n-Nitrosodiphenylamine	ND	(0.33)	ND	(0.33)	ND	(0.33)	ND	(0.479)

Table 5.8-2
(Continued)

Location ID		27-28		27-33	
Beg. Depth - End Depth (ft)		4-6		2-4	
SW6010 (mg/kg)	Barium	20.6	(1.19)	38.3	(1.23)
	Beryllium	< RL	(0.238)	0.266	(0.247)
	Cadmium	< RL	(0.594)	< RL	(0.616)
	Chromium	2.59	(1.19)	6.86	(1.23)
	Cobalt	< RL	(1.19)	2.27	(1.23)
	Copper	< RL	(2.38)	5.88	(2.47)
	Silver	< RL	(1.19)	< RL	(1.23)
	Vanadium	7.34	(2.38)	11.3	(2.47)
	Zinc	5.15	(2.38)	20.8	(2.47)
SW7041 (mg/kg)	Antimony	< RL	(0.594)	< RL	(0.616)
SW7060 (mg/kg)	Arsenic	1.13	(0.594)	1.44	(0.616)
SW7421 (mg/kg)	Lead	< RL	(0.594)	3.01	(0.616)
SW7471 (mg/kg)	Mercury	< RL	(0.0238)	< RL	(0.0247)
SW7740 (mg/kg)	Selenium	< RL	(0.594)	1.1	(0.616)
SW7841 (mg/kg)	Thallium	< RL	(0.594)	< RL	(0.616)
SW8260 (µg/kg)	1,1-Dichloroethene	ND	(119)	ND	(6.16)
	2-Butanone	ND	(2380)	ND	(123)
	2-Chloroethylvinyl ether	ND	(119)	ND	(6.16)
	2-Hexanone	ND	(1190)	ND	(61.6)
	Acetone	< RL	(2380)	< RL	(123)
	Benzene	768	(119)	ND	(6.16)
	Carbon disulfide	< RL	(119)	ND	(6.16)
	Chlorobenzene	ND	(119)	ND	(6.16)
	Ethyl benzene	11300	(119)	ND	(6.16)
	Methylene chloride	< RL	(476)	< RL	(24.7)
	Toluene	7680	(119)	< RL	(6.16)
	Total xylenes	21800	(119)	< RL	(6.16)
	Trichloroethene	ND	(119)	ND	(6.16)
	Vinyl acetate	ND	(476)	< RL	(24.7)
	cis-1,2-Dichloroethene	ND	(119)	ND	(6.16)
SW8270 (mg/kg)	2,4-Dinitrotoluene	< RL	(0.392)	ND	(0.407)
	2-Methylnaphthalene	ND	(0.392)	ND	(0.407)
	2-Methylphenol	4.62	(0.392)	ND	(0.407)
	3-Nitroaniline	ND	(1.9)	ND	(1.97)
	4-Methylphenol	ND	(0.392)	ND	(0.407)
	4-Nitroaniline	ND	(1.9)	ND	(1.97)
	Chrysene	ND	(0.392)	ND	(0.407)
	Dibenzofuran	ND	(0.392)	ND	(0.407)
	Dimethylphthalate	ND	(0.392)	ND	(0.407)
	Fluoranthene	ND	(0.392)	ND	(0.407)
	Fluorene	< RL	(0.392)	ND	(0.407)

Table 5.8-2
(Continued)

Location ID		27-28		27-33	
Beg. Depth - End Depth (ft)		4-6		2-4	
SW8270 (mg/kg) (Continued)	Naphthalene	1.77	(0.392)	ND	(0.407)
	Phenanthrene	< RL	(0.392)	ND	(0.407)
	Phenol	ND	(0.392)	ND	(0.407)
	Pyrene	ND	(0.392)	ND	(0.407)
	bis(2-Ethylhexyl)phthalate	< RL	(0.392)	ND	(0.407)
	di-n-Butylphthalate	< RL	(0.392)	< RL	(0.407)
	n-Nitrosodiphenylamine	< RL	(0.392)	ND	(0.407)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.8-3
Summary Analytical Results for Groundwater at SWMU 27

Location ID		27-01[a]		27-03		27-08		27-12	
E418.1 (mg/L)	TRPH	88	(20)	NA		NA		NA	
E418.1M (mg/L)	TRPH	276	(125)	20,600[b]	(5000)	17.7	(5)	9.5	(5)
SW6010 (mg/L)	Barium	0.057	(0.01)	NA		NA		NA	
	Beryllium	0.007	(0.002)	NA		NA		NA	
	Cadmium	< RL	(0.005)	NA		NA		NA	
	Chromium	< RL	(0.01)	NA		NA		NA	
	Cobalt	< RL	(0.01)	NA		NA		NA	
	Copper	< RL	(0.02)	NA		NA		NA	
	Silver	0.01	(0.01)	NA		NA		NA	
	Vanadium	< RL	(0.02)	NA		NA		NA	
	Zinc	< RL	(0.02)	NA		NA		NA	
SW7041 (mg/L)	Antimony	0.0106	(0.005)	NA		NA		NA	
SW7060 (mg/L)	Arsenic	< RL	(0.004)	NA		NA		NA	
SW7421 (mg/L)	Lead	< RL	(0.003)	NA		NA		NA	
SW7740 (mg/L)	Selenium	< RL	(0.005)	NA		NA		NA	
SW7841 (mg/L)	Thallium	< RL	(0.002)	NA		NA		NA	
SW8260 (μg/L)	2-Butanone	ND	(50,000)	NA		NA		NA	
	Acetone	< RL	(50,000)	NA		NA		NA	
	Benzene	15,700	(2500)	NA		NA		NA	
	Ethyl benzene	63,000	(2500)	NA		NA		NA	
	Methylene chloride	ND	(10,000)	NA		NA		NA	
	Toluene	96,100	(2500)	NA		NA		NA	
	Total xylenes	112,000	(5000)	NA		NA		NA	
	Vinyl acetate	ND	(10,000)	NA		NA		NA	
SW8270 (mg/L)	2-Methylnaphthalene	0.202	(0.01)	NA		NA		NA	
	4-Methylphenol	0.336	(0.01)	NA		NA		NA	
	Dibenzofuran	ND	(0.01)	NA		NA		NA	
	Fluoranthene	< RL	(0.01)	NA		NA		NA	
	Naphthalene	0.253	(0.01)	NA		NA		NA	

Table 5.8-3
(Continued)

Location ID		27-14	27-23	27-27	27-28
E418.1 (mg/L)	TRPH	NA	NA	< RL (0.4)	NA
E418.1M (mg/L)	TRPH	< RL (5)	< RL (5)	< RL (5)	205 (50)
SW6010 (mg/L)	Barium	NA	NA	< RL (0.02)	NA
	Beryllium	NA	NA	< RL (0.002)	NA
	Cadmium	NA	NA	< RL (0.005)	NA
	Chromium	NA	NA	< RL (0.01)	NA
	Cobalt	NA	NA	< RL (0.01)	NA
	Copper	NA	NA	< RL (0.02)	NA
	Silver	NA	NA	< RL (0.01)	NA
	Vanadium	NA	NA	< RL (0.02)	NA
	Zinc	NA	NA	< RL (0.02)	NA
SW7041 (mg/L)	Antimony	NA	NA	< RL (0.005)	NA
SW7060 (mg/L)	Arsenic	NA	NA	0.0054 (0.004)	NA
SW7421 (mg/L)	Lead	NA	NA	< RL (0.003)	NA
SW7740 (mg/L)	Selenium	NA	NA	< RL (0.005)	NA
SW7841 (mg/L)	Thallium	NA	NA	< RL (0.002)	NA
SW8260 (µg/L)	2-Butanone	NA	NA	< RL (100)	NA
	Acetone	NA	NA	< RL (100)	NA
	Benzene	NA	NA	542 (5)	NA
	Ethyl benzene	NA	NA	207 (5)	NA
	Methylene chloride	NA	NA	< RL (20)	NA
	Toluene	NA	NA	< RL (5)	NA
	Total xylenes	NA	NA	260 (5)	NA
	Vinyl acetate	NA	NA	< RL (50)	NA
SW8270 (mg/L)	2-Methylnaphthalene	NA	NA	0.0154 (0.01)	NA
	4-Methylphenol	NA	NA	ND (0.01)	NA
	Dibenzofuran	NA	NA	< RL (0.01)	NA
	Fluoranthene	NA	NA	ND (0.01)	NA
	Naphthalene	NA	NA	< RL (0.01)	NA

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).
NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

[a] Sample for SW8260 analysis collected at a later date than the sample for the other analyses.
[b] Sample likely contained free product.

5.9 SWMU 28—Building 822 O/WS

SWMU 28 was in use from 1977 to 1991. During this time, it serviced the AGE washrack at Building 822. The separator was removed and replaced with a new unit in 1991. SWMU 28 was situated where the new O/WS is currently located.

To identify whether a release from the unit had occurred, SWMU 28 was investigated under the Table 3 RFI. During Phase I of the RFI, soil samples collected from the area immediately adjacent to the SWMU were shown to have TRPH concentrations above both the release criterion of 100 mg/kg and the Base-specific cleanup level of 1000 mg/kg. From these results, it was determined that a release from the SWMU had occurred.

The extent of the release at SWMU 28 was delineated to the south and west of the O/WS. No COCs were identified by the risk-based screen; therefore CNFA is recommended for this site. The condition of NFA is remediation of vadose zone soil containing TRPH-contaminated soil in excess of the Base-specific cleanup level.

5.9.1 SWMU Description

Unit Type: Two-chamber O/WS
Period of Operation: 1977 to April 1991
Current Status: Inactive
Disposition of Unit: No longer present
Source of Waste: Washrack
Major Operations: Washing AGE
Construction Material: Concrete
Physical Condition: Unknown
Oil/Total Capacity: 675 gal./900 gal.
Historic Releases: None known

5.9.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand and sandy silt to approximately 9.5 ft bgl. In each of the borings, the soil grades rapidly between 9.5 and 10 ft bgl to a very hard sandy clay. Groundwater occurs at 6 ft bgl and the groundwater flow direction in this portion of the Base is known to vary from the south to southwest. The bottom of the new O/WS is approximately 2.5 ft below the groundwater table. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.9-1, samples were collected from four locations during Phase I for analysis of TRPH by EPA 418.1M. At each location, samples were collected from the surface and from near the bottom of the separator. At locations 28-01 and 28-04, samples were also collected from intermediate depths to define vertical extent further before delineating lateral extent during Phase II. Figure 5.9-1 shows the sampling horizons and the associated TRPH results. The original O/WS was removed and replaced in 1991.

TRPH concentrations were detected above the 100-mg/kg release criterion at each of the Phase I sampling locations. In addition, samples collected at three of the Phase I locations were also above the Base-specific cleanup level of 1000 mg/kg. From these results, it was determined that a release had occurred from the SWMU. The release pathway at the separator was determined to most likely be a combination of seepage from cracks in the separator walls and an overflow surface spill. These results triggered the Phase II investigation.

Phase II Investigation

Extent—The extent of the release was investigated in Phase II of the investigation using the iterative step-out approach from the work plan. The Phase II sampling locations are shown in Figure 5.9-1. The magnitude of TRPH results at each horizon is shown in Figure 5.9-2. The highest concentrations of TRPH were observed at the surface down to 10 ft around and to the west

of the O/WS. Samples collected from within the sandy clay horizon (>10 ft bgl) exhibited lower TRPH results as shown on Figure 5.9-2. All field TRPH results are provided in Table 5.9-1.

Using the maximum detected TRPH result at each boring, the areal extent of elevated TRPH values above the 100-mg/kg criterion was determined. This is shown in Figure 5.9-3. The extent was not fully delineated to the west because of the SWMU 230—Building 828 Fuel Spill. The soil contamination from the fuel spill extends eastward into the road, which is where location 28-14 is situated (see Figure 4.7-2). Additional sampling to the west of location 28-14 would be within the contamination at SWMU 230. The extent of vadose zone soils above the Base-specific cleanup level is also shown in the figure.

Nature—To characterize the nature of the release, eight samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.9-2. Low levels of some volatile and semivolatile constituents were detected in the soil samples; however, no results were above the RBCs.

Groundwater—To define constituent concentrations in the groundwater, grab samples were collected from three locations around the SWMU (Figure 5.9-1). One sample was collected upgradient of the SWMU (28-10) for TRPH analysis. One sample, 28-06, was collected inside the area of elevated soil constituent concentrations, and one sample (28-12) was collected downgradient of the release for characterization. The analytical results for groundwater are presented in Table 5.9-3. No TRPH concentrations above the release criterion of 10 mg/L were detected in any of the samples collected; however, slightly elevated concentrations of BTEX were detected in the sample collected at location 28-06. Low levels of acetone, carbon disulfide, vinyl acetate, 2-methylnaphthalene, and naphthalene were detected. The concentrations of BTEX decreased in the downgradient sample (28-12). LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.9.3 Risk-Based Screen Results

The risk-based screen indicated that none of the constituents exceeded the screening criteria for this SWMU. Appendix C contains the results of the screen. On the basis of the screen, there is no risk to human health from the release at SWMU 28.

5.9.4 Conclusions

The results from Phase I/II investigation at SWMU 28 indicate that historic overflow and subsurface releases have likely occurred at this site and that TRPH concentrations are above the Base-specific cleanup level of 1000 mg/kg. The volume of vadose zone soil affected is approximately 95 cubic yards. The Phase II investigation defined the extent of the release to be confined to the area immediately adjacent to the SWMU extending slightly west and south. The unit was removed in 1991.

The nature of the release was characterized by laboratory analysis. On the basis of the TRPH concentrations at SWMU 28 and the nature of the source, the extent of the release in the groundwater is confined to the area around the separator. No constituents were found to pose risk to human health.

5.9.5 Recommendations

CNFA was recommended for SWMU 28. The condition of NFA was the remediation of the vadose zone soil with greater than 1000 mg/kg TPH. SWMU 28 was remediated as part of Holloman AFB's Phase 2 Basewide POL project. Approximately 200 cubic yards of TPH-contaminated soil were excavated and disposed in January 1996. Further delineation efforts were conducted

in June 1996. Only one sampling point (1200 mg/kg) detected TPH in excess of 1000 mg/kg. A second phase of excavation was conducted in January 1997 resulting in the excavation and disposal of approximately 110 cubic yards of TPH-contaminated soil. All three confirmation samples from the second phase of excavation were not-detected for TPH. Further details can be found in the *Addendum to the Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico* to be submitted in October 1997. Based on the discussed remediation, SWMU 28 is recommended for NFA.

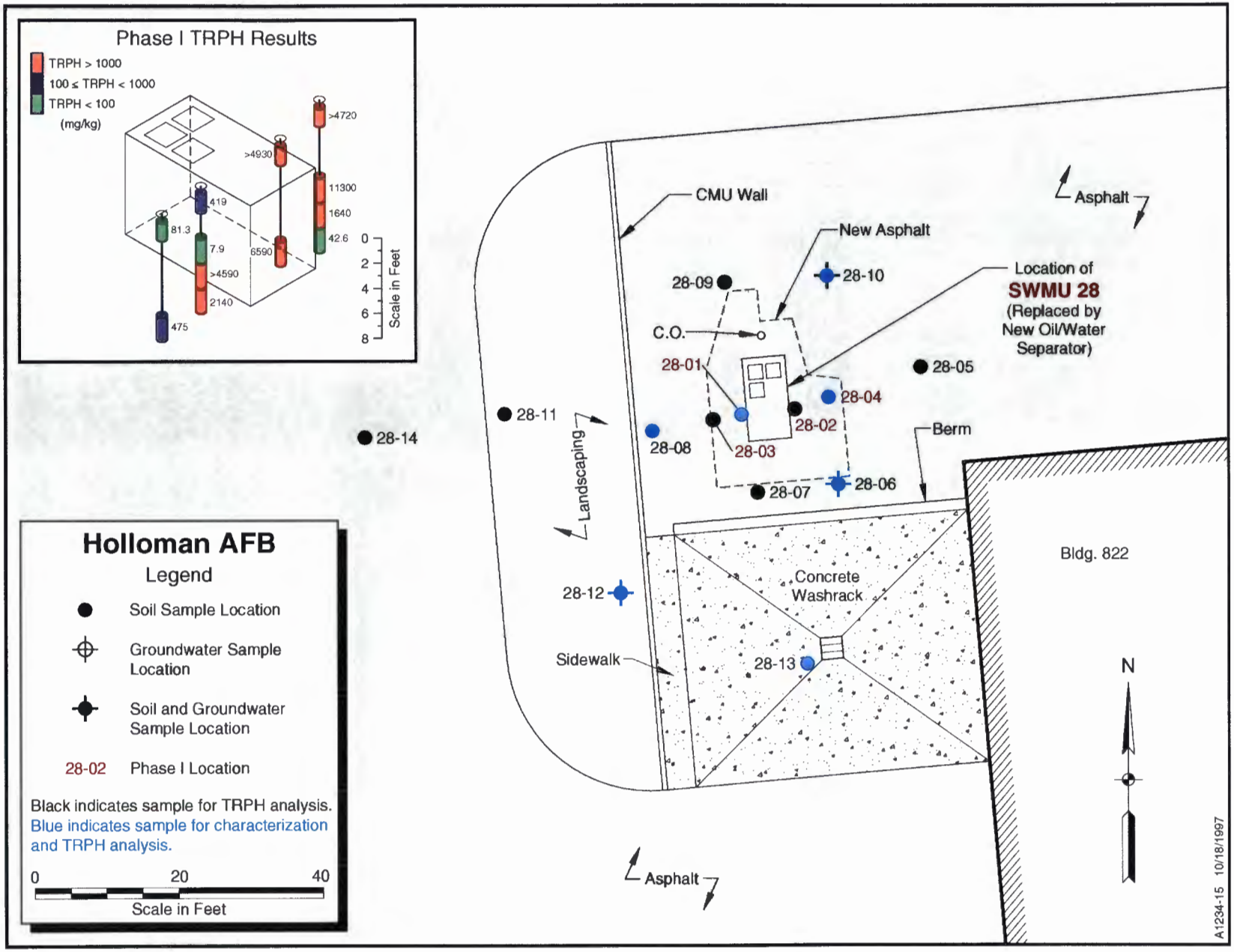

Figure 5.9-1. SWMU 28 - Building 822 O/WS Sample Locations and Phase I TRPH Results

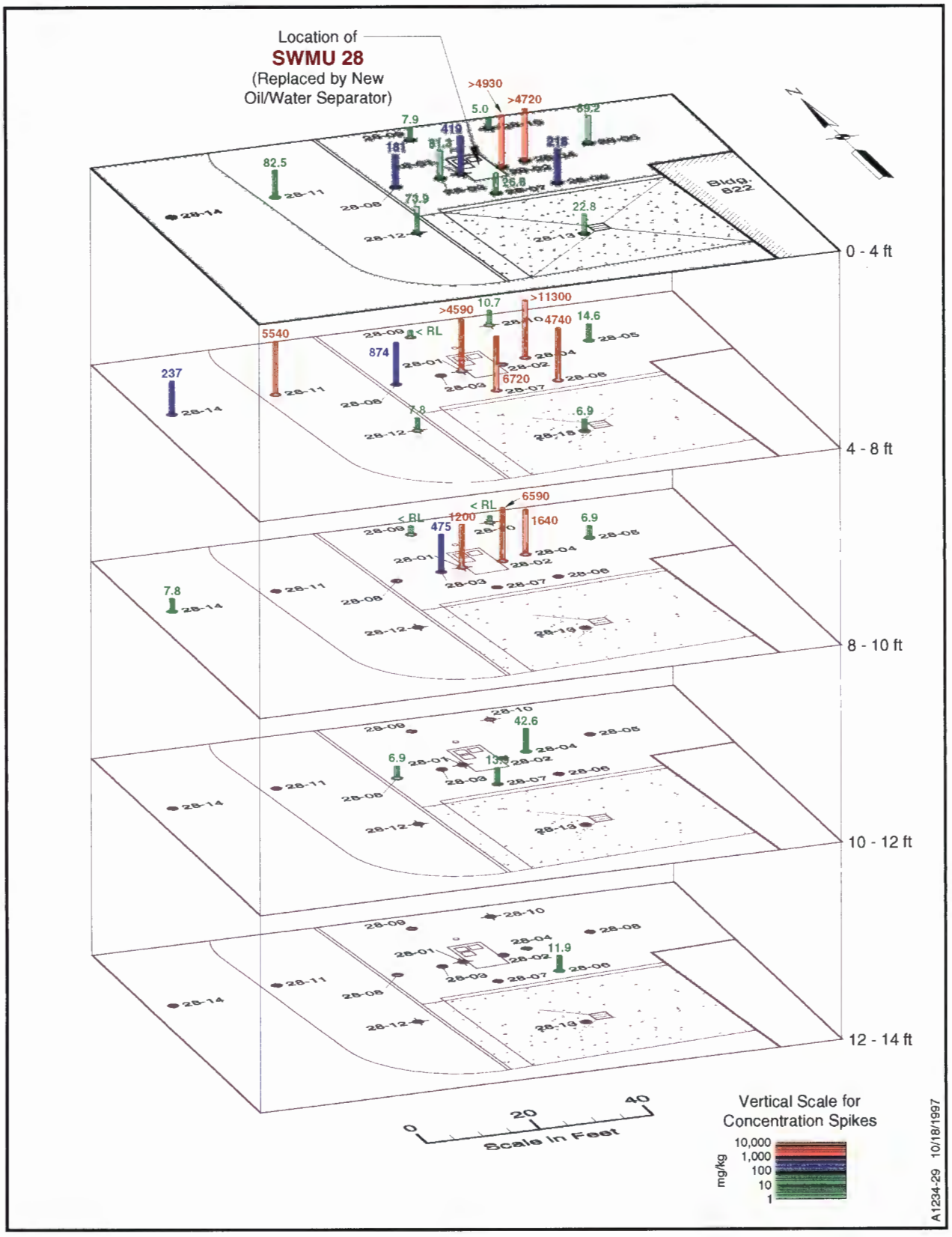

Figure 5.9-2. SWMU 28 - TRPH Concentrations by Depth Interval

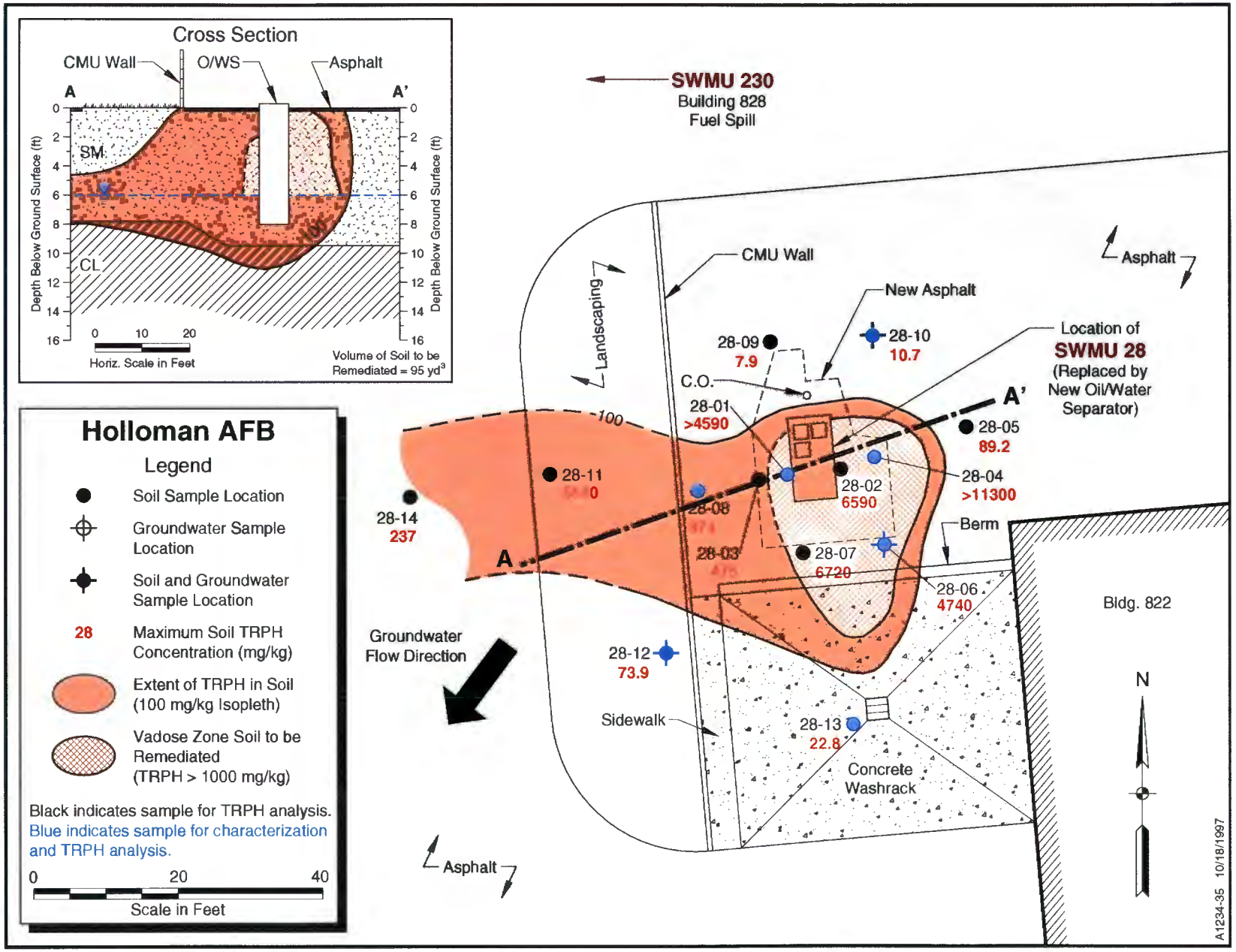

Figure 5.9-3. SWMU 28 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.9-1
TRPH Results for Soil at SMWU 28

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
28-01	0.5	2	419	28-08	0	2	181/101 (186/110)
	4	6	7.9		4	6	874
	6	8	> 4590		10	12	6.9 (< RL)
	8	10	1200/2140	28-09	0	2	7.9
28-02	0.5	2	> 4930		4	6	< RL
	8	10	6590		9.5	10	< RL
28-03	0.5	2	81.3	28-10	0	2	5 (< RL)
	8	10	475		4	6	10.7
28-04	0.5	2	> 4720		9.5	10	< RL
	6	8	> 11,300 (20,600)	28-11	0	2	82.5
	8	10	1640		2	4	6.8
	10	12	42.6 (< RL)		7.2	8	5540
28-05	0	2	89.2	28-12	0	2	73.9 (117)
	4	6	14.6		2	4	14.6
	8	10	6.9		7.7	8	7.8
28-06	0.5	2	218/180 (243)	28-13	0	2	22.8 (< RL)
	4	6	4740		2	4	< RL
	12	14	11.9 (< RL)		6	8	6.9
28-07	0.5	2	26.6/24.3	28-14	6	8	237
	4	6	6720		8	10	7.8
	10	12	13.9				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.
> = Result greater than value. Additional dilutions not performed.

Table 5.9-2
Summary Analytical Results for Soil at SWMU 28

Location ID		28-01		28-04				28-06	
Beg. Depth - End Depth (ft)		0.5-2		0.5-2		10-12		0.5-2	
SW6010 (mg/kg)	Barium	26.1	(1.24)	11.2	(1.39)	52.4	(1.22)	41.3	(1.23)
	Beryllium	< RL	(0.248)	< RL	(0.278)	0.659	(0.245)	< RL	(0.245)
	Cadmium	< RL	(0.621)	< RL	(0.695)	< RL	(0.613)	< RL	(0.613)
	Chromium	3.14	(1.24)	< RL	(1.39)	14.8	(1.22)	2.55	(1.23)
	Cobalt	< RL	(1.24)	< RL	(1.39)	4.67	(1.22)	< RL	(1.23)
	Copper	3.06	(2.48)	2.95	(2.78)	10.8	(2.45)	3.39	(2.45)
	Silver	< RL	(1.24)	< RL	(1.39)	< RL	(1.22)	< RL	(1.23)
	Vanadium	5.95	(2.48)	3.5	(2.78)	16.9	(2.45)	6.83	(2.45)
	Zinc	13.7	(2.48)	5.19	(2.78)	41.7	(2.45)	11.6	(2.45)
SW7041 (mg/kg)	Antimony	< RL	(0.621)	< RL	(0.695)	1.4	(0.613)	< RL	(0.613)
SW7060 (mg/kg)	Arsenic	0.745	(0.621)	0.723	(0.695)	0.858	(0.613)	1.15	(0.613)
SW7421 (mg/kg)	Lead	3.73	(0.621)	< RL	(0.695)	5.15	(0.613)	9.09	(0.613)
SW7471 (mg/kg)	Mercury	< RL	(0.0248)	< RL	(0.0278)	< RL	(0.0245)	< RL	(0.0245)
SW7740 (mg/kg)	Selenium	< RL	(0.621)	< RL	(0.695)	< RL	(0.613)	< RL	(0.613)
SW7841 (mg/kg)	Thallium	< RL	(0.621)	< RL	(0.695)	< RL	(0.613)	< RL	(0.613)
SW8260 (µg/kg)	2-Butanone	ND	(124)	ND	(139)	< RL	(122)	< RL	(123)
	Acetone	< RL	(124)	< RL	(139)	142	(122)	< RL	(123)
	Carbon disulfide	ND	(6.21)	ND	(6.95)	ND	(6.13)	ND	(6.13)
	Ethyl benzene	ND	(6.21)	< RL	(6.95)	ND	(6.13)	ND	(6.13)
	Methylene chloride	< RL	(24.8)	< RL	(27.8)	32	(24.5)	< RL	(24.5)
	Toluene	ND	(6.21)	< RL	(6.95)	ND	(6.13)	ND	(6.13)
	Total xylenes	ND	(6.21)	17.4	(6.95)	ND	(6.13)	< RL	(6.13)
	Vinyl acetate	ND	(62.1)	ND	(69.5)	ND	(61.3)	ND	(61.3)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.41)	ND	(0.459)	ND	(0.404)	1.2	(0.405)
	Chrysene	ND	(0.41)	ND	(0.459)	ND	(0.404)	< RL	(0.405)
	Diethylphthalate	ND	(0.41)	ND	(0.459)	ND	(0.404)	ND	(0.405)
	Fluoranthene	ND	(0.41)	ND	(0.459)	ND	(0.404)	< RL	(0.405)
	Naphthalene	ND	(0.41)	ND	(0.459)	ND	(0.404)	0.616	(0.405)
	Pyrene	ND	(0.41)	ND	(0.459)	ND	(0.404)	< RL	(0.405)
	Benzo(a)anthracene	ND	(0.41)	ND	(0.459)	ND	(0.404)	< RL	(0.405)
	Benzo(b)fluoranthene	ND	(0.41)	ND	(0.459)	ND	(0.404)	< RL	(0.405)
	bis(2-Ethylhexyl)phthalate	ND	(0.41)	ND	(0.459)	ND	(0.404)	< RL	(0.405)
	di-n-Butylphthalate	0.627	(0.41)	0.674	(0.459)	0.575	(0.404)	< RL	(0.405)

Table 5.9-2
(Continued)

Location ID		28-06		28-08				28-10	
Beg. Depth - End Depth (ft)		12-14		0-2		10-12		0-2	
SW6010 (mg/kg)	Barium	56.1	(1.25)	10.1	(1.34)	30.7	(1.23)	16.4	(1.34)
	Beryllium	0.423	(0.249)	< RL	(0.268)	0.45	(0.245)	< RL	(0.268)
	Cadmium	< RL	(0.623)	< RL	(0.669)	< RL	(0.613)	< RL	(0.671)
	Chromium	8.07	(1.25)	1.54	(1.34)	7.51	(1.23)	1.37	(1.34)
	Cobalt	3.88	(1.25)	< RL	(1.34)	2.86	(1.23)	< RL	(1.34)
	Copper	7.53	(2.49)	< RL	(2.68)	3.73	(2.45)	< RL	(2.68)
	Silver	< RL	(1.25)	< RL	(1.34)	< RL	(1.23)	< RL	(1.34)
	Vanadium	18.2	(2.49)	< RL	(2.68)	13.5	(2.45)	4.97	(2.68)
	Zinc	25.6	(2.49)	5.97	(2.68)	17.8	(2.45)	3.65	(2.68)
SW7041 (mg/kg)	Antimony	< RL	(0.623)	< RL	(0.669)	< RL	(0.613)	1.38	(0.671)
SW7060 (mg/kg)	Arsenic	3.72	(0.623)	0.991	(0.669)	1.57	(0.613)	1.14	(0.671)
SW7421 (mg/kg)	Lead	5.76	(0.623)	1.28	(0.669)	5.44	(0.613)	< RL	(0.671)
SW7471 (mg/kg)	Mercury	< RL	(0.0249)	< RL	(0.0268)	< RL	(0.0245)	< RL	(0.0268)
SW7740 (mg/kg)	Selenium	< RL	(0.623)	0.83	(0.669)	< RL	(0.613)	< RL	(0.671)
SW7841 (mg/kg)	Thallium	< RL	(0.623)	< RL	(0.669)	< RL	(0.613)	< RL	(0.671)
SW8260 (µg/kg)	2-Butanone	ND	(125)	ND	(134)	< RL	(123)	ND	(134)
	Acetone	< RL	(125)	< RL	(134)	1600	(123)	< RL	(134)
	Carbon disulfide	ND	(6.23)	9.64	(6.69)	ND	(6.13)	ND	(6.71)
	Ethyl benzene	ND	(6.23)	ND	(6.69)	ND	(6.13)	ND	(6.71)
	Methylene chloride	27.9	(24.9)	< RL	(26.8)	45.3	(24.5)	40.1	(26.8)
	Toluene	ND	(6.23)	ND	(6.69)	< RL	(6.13)	ND	(6.71)
	Total xylenes	ND	(6.23)	ND	(6.69)	ND	(6.13)	ND	(6.71)
	Vinyl acetate	ND	(62.3)	< RL	(66.9)	ND	(61.3)	ND	(67.1)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	Chrysene	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	Diethylphthalate	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	Fluoranthene	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	Naphthalene	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	Pyrene	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	Benzo(a)anthracene	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	Benzo(b)fluoranthene	ND	(0.411)	ND	(0.442)	ND	(0.405)	ND	(0.443)
	bis(2-Ethylhexyl)phthalate	ND	(0.411)	< RL	(0.442)	ND	(0.405)	ND	(0.443)
	di-n-Butylphthalate	< RL	(0.411)	< RL	(0.442)	0.49	(0.405)	ND	(0.443)

Table 5.9-2
(Continued)

Location ID		28-12		28-13	
Beg. Depth - End Depth (ft)		0-2		0-2	
SW6010 (mg/kg)	Barium	27	(1.19)	40.6	(1.22)
	Beryllium	< RL	(0.239)	< RL	(0.244)
	Cadmium	< RL	(0.597)	< RL	(0.61)
	Chromium	2	(1.19)	3.82	(1.22)
	Cobalt	< RL	(1.19)	< RL	(1.22)
	Copper	< RL	(2.39)	2.6	(2.44)
	Silver	< RL	(1.19)	1.85	(1.22)
	Vanadium	6	(2.39)	8.33	(2.44)
	Zinc	5.79	(2.39)	10.8	(2.44)
SW7041 (mg/kg)	Antimony	< RL	(0.597)	< RL	(0.61)
SW7060 (mg/kg)	Arsenic	0.966	(0.597)	1.11	(0.61)
SW7421 (mg/kg)	Lead	11	(0.597)	2.45	(0.61)
SW7471 (mg/kg)	Mercury	< RL	(0.0239)	< RL	(0.0244)
SW7740 (mg/kg)	Selenium	< RL	(0.597)	< RL	(0.61)
SW7841 (mg/kg)	Thallium	< RL	(0.597)	< RL	(0.61)
SW8260 (µg/kg)	2-Butanone	ND	(119)	134	(122)
	Acetone	179	(119)	395	(122)
	Carbon disulfide	ND	(5.97)	ND	(6.1)
	Ethyl benzene	ND	(5.97)	ND	(6.1)
	Methylene chloride	25.4	(23.9)	< RL	(24.4)
	Toluene	ND	(5.97)	< RL	(6.1)
	Total xylenes	ND	(5.97)	< RL	(6.1)
	Vinyl acetate	ND	(23.9)	160	(24.4)
SW8270 (mg/kg)	2-Methylnaphthalene	ND	(0.394)	ND	(0.402)
	Chrysene	ND	(0.394)	ND	(0.402)
	Diethylphthalate	< RL	(0.394)	ND	(0.402)
	Fluoranthene	ND	(0.394)	ND	(0.402)
	Naphthalene	ND	(0.394)	ND	(0.402)
	Pyrene	ND	(0.394)	ND	(0.402)
	benzo(a)anthracene	ND	(0.394)	ND	(0.402)
	benzo(b)fluoranthene	ND	(0.394)	ND	(0.402)
	bis(2-Ethylhexyl)phthalate	ND	(0.394)	ND	(0.402)
	di-n-Butylphthalate	< RL	(0.394)	4.72	(0.402)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.9-3
Summary Analytical Results for Groundwater at SWMU 28

Location ID		28-06		28-10		28-12	
E418.1 (mg/L)	TRPH	3.56	(0.8)	NA		NA	
E418.1M (mg/L)	TRPH	5.3	(5)	< RL	(5)	< RL	(5)
SW6010 (mg/L)	Barium	0.011	(0.01)	NA		NA	
	Chromium	< RL	(0.01)	NA		NA	
	Cobalt	< RL	(0.01)	NA		NA	
	Copper	< RL	(0.02)	NA		NA	
	Vanadium	< RL	(0.02)	NA		NA	
	Zinc	< RL	(0.02)	NA		NA	
SW7041 (mg/L)	Antimony	< RL	(0.005)	NA		NA	
SW7060 (mg/L)	Arsenic	< RL	(0.004)	NA		NA	
SW7421 (mg/L)	Lead	0.0049	(0.003)	NA		NA	
SW7740 (mg/L)	Selenium	< RL	(0.005)	NA		NA	
SW7841 (mg/L)	Thallium	< RL	(0.002)	NA		NA	
SW8260 (µg/L)	1,1,2-Trichloroethane	< RL	(5)	NA		ND	(5)
	1,1-Dichloroethane	< RL	(5)	NA		ND	(5)
	2-Butanone	< RL	(100)	NA		< RL	(100)
	2-Hexanone	< RL	(50)	NA		ND	(50)
	Acetone	117	(100)	NA		< RL	(100)
	Benzene	1570	(5)	NA		44.5	(5)
	Carbon disulfide	156	(5)	NA		ND	(5)
	Ethyl benzene	1190	(5)	NA		ND	(5)
	Methylene chloride	< RL	(20)	NA		29.5	(20)
	Tetrachloroethene	< RL	(5)	NA		< RL	(5)
	Toluene	5940	(5)	NA		ND	(5)
	Total xylenes	3580	(5)	NA		ND	(5)
	Vinyl acetate	37.4	(20)	NA		ND	(50)
SW8270 (mg/L)	2-Methylnaphthalene	0.0175	(0.01)	NA		ND	(0.025)
	Diethylphthalate	< RL	(0.01)	NA		ND	(0.025)
	Naphthalene	0.0905	(0.01)	NA		ND	(0.025)
	bis(2-Ethylhexyl)phthalate	< RL	(0.01)	NA		ND	(0.025)

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).
NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.10 SWMU 31—Building 855 O/WS

SWMU 31, the Building 855 O/WS, services the washrack near Building 865. A new O/WS was added downstream of this unit in 1991. The separator is operational but receives no influent because the washrack is out of service.

To investigate whether a release had occurred, SWMU 31 was investigated under the Table 3 RFI. Samples were collected on all four sides of the unit at multiple horizons. It was determined that a subsurface release had occurred at this SWMU. Additional soil and groundwater samples were then collected to determine the nature and extent of the release.

None of the Phase II samples exceeded 100 mg/kg of TRPH, indicating that the release was localized to the area immediately surrounding the separator. Upon fixed laboratory analysis for characterization, no specific analytes were detected at levels of concern. Repair of the unit and remediation of the contaminated vadose zone soil are recommended as the conditions for NFA at SWMU 31.

5.10.1 SWMU Description

Unit Type: Two-chamber O/WS
Period of Operation: December 1982 to present
Current Status: Inactive because washrack is out of service
Disposition of Unit: Unknown
Source of Waste: Washrack
Major Operations: Washing mobility equipment
Construction Material: Steel
Physical Condition: Sediment buildup in first chamber; corroded unit and pipes
Oil/Total Capacity: 240 gal./400 gal.
Historic Releases: None known

5.10.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform subsurface lithology of silty sand to approximately 10 ft bgl. Groundwater occurs at 4 ft bgl, and the groundwater flow direction is interpreted to be to the south-southwest. The bottom of the O/WS is approximately 2 ft below the groundwater table. Greenish-gray staining was noted between 2 and 6 ft bgl in borings located immediately adjacent to the SWMU. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.10-1, four locations were sampled at multiple intervals during the Phase I investigation for TRPH analysis by EPA 418.1M. Samples were taken at the surface, below the separator, and at an intermediate interval at locations 31-02, -03, and -04. At location 31-01, samples were taken at the bottom of the separator and at the 3.5- to 4-ft interval. Figure 5.10-1 shows the sampling horizons and the associated Phase I TRPH results.

Soil samples at three of the Phase I locations exceeded the 100-mg/kg TRPH release criterion. It was determined through field analysis that a release had occurred. The highest concentrations were in the 3.5- to 4-ft interval and the 4- to 6-ft interval, indicating that the release was most likely due to a leak at the O/WS. A Phase II investigation was initiated in order to determine the nature and extent of contamination.

Phase II Investigation

Extent—The iterative step-out approach described in the work plan was used to investigate the extent of the release. The Phase II sampling locations are depicted in Figure 5.10-1. The TRPH results for all sample locations and horizons are shown in Figure 5.10-2. The highest TRPH concentrations are located in the

subsurface between 3.5 and 8 ft. Due to the fact that there are no TRPH concentrations above 100 mg/kg at other intervals, the vertical extent of contamination is confined to this horizon. None of the Phase II samples had TRPH concentrations above the 100-mg/kg release criterion, thus the lateral extent of contamination was delineated to the area immediately adjacent to the separator.

The areal extent of TRPH contamination above 100 mg/kg was determined using the maximum detected concentration at each location. Figure 5.10-3 shows this area. All TRPH data are listed in Table 5.10-1.

Nature—To characterize the nature of the release, four samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.10-2. Acetone, toluene, xylene, and some semivolatile organic constituents were detected above reporting limits at location 31-02. The data did not show significant levels of inorganic or organic constituents at any location. All soil results were less than the RBCs.

Groundwater—To define constituent concentrations in the groundwater, samples were collected from three locations around SWMU 31. Table 5.10-3 presents the analytical results. None of the groundwater samples exceeded the 10-mg/L release criterion for TRPH in water, indicating that SWMU 31 is not a contributing source for groundwater contamination. Only low levels of acetone, methylene chloride, and trichloroethene were detected in the groundwater. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.10.3 Risk-Based Screen Results

The risk-based screen indicated that none of the COPCs exceeded the screening criteria for this SWMU. On the basis of the screen, there is no risk to human health from the release at SWMU 31. Both the complete output from the risk-based screen and the toxicity values used are shown in Appendix C.

5.10.4 Conclusions

The results from the investigation of SWMU 31 indicate that a release has occurred from the separator. On the basis of the location of the elevated TRPH, it is likely that this release is due to a leak from the O/WS or associated piping. TRPH concentrations were found in soil that exceed the 1000-mg/kg cleanup level. It is estimated that the volume of soil to be remediated is 0.2 cubic yards. The extent of the release was delineated by TRPH in the concentrations field, and nature was defined by laboratory analysis. From the TRPH results and knowledge of the source, the release has not significantly affected the groundwater. There were no constituents that exceeded the risk-based screening levels.

5.10.5 Recommendations

SWMU 31 was recommended for CNFA. The conditions of NFA were the remediation of the vadose zone soils with greater than 1000 mg/kg TPH and the repair of the separator. SWMU 31 was removed and remediated as part of Holloman AFB's Phase 2 Basewide POL project. Approximately 76 cubic yards of TPH-contaminated soil were excavated and disposed. Confirmation samples ranged from not-detected to 93 mg/kg. Further details can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997*. SWMU 31 was approved for NFA by NMED in September 1997. Therefore, SWMU 31 is recommended for NFA.

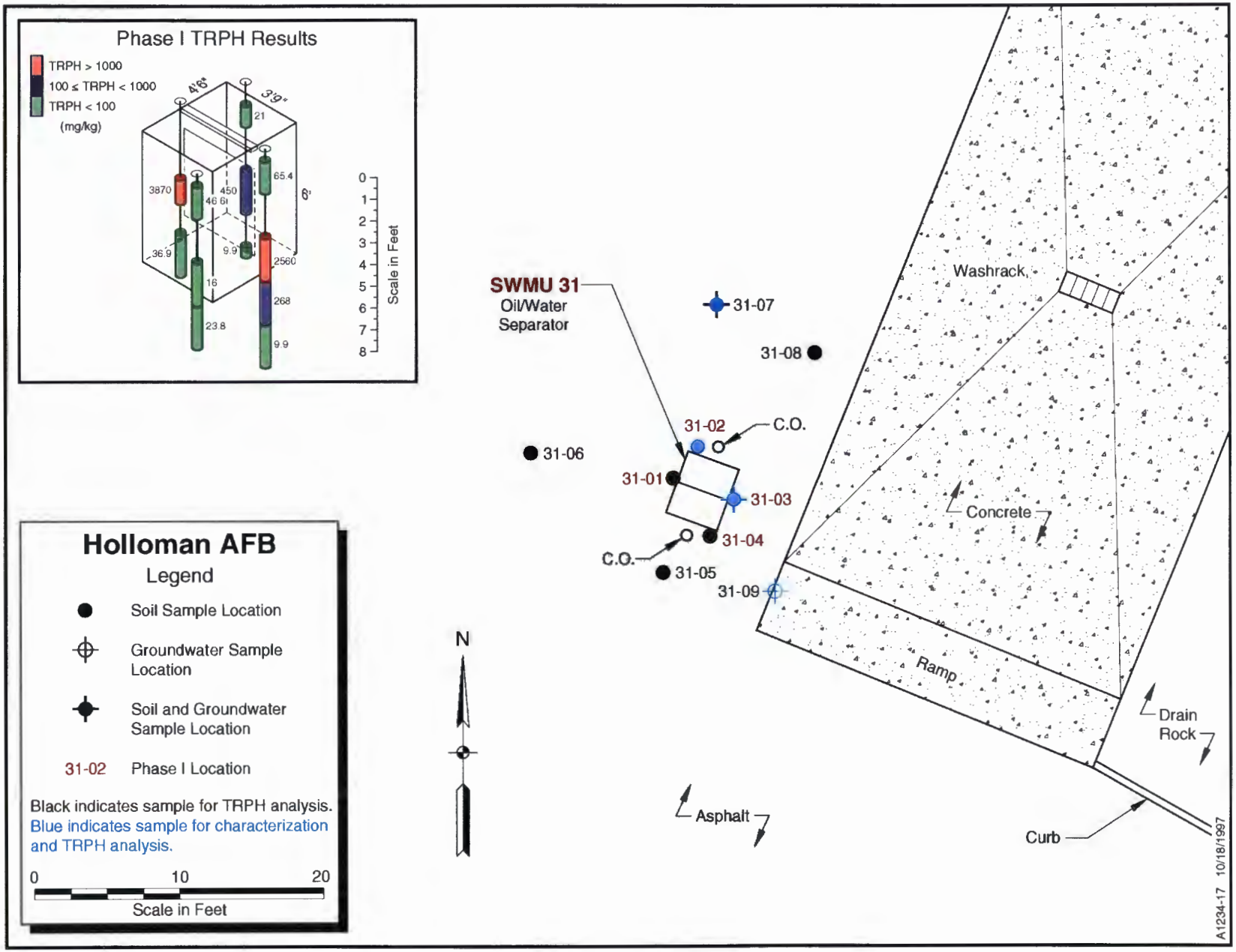

Figure 5.10-1. SWMU 31 - Building 855 O/WS Sample Locations and Phase I TRPH Results

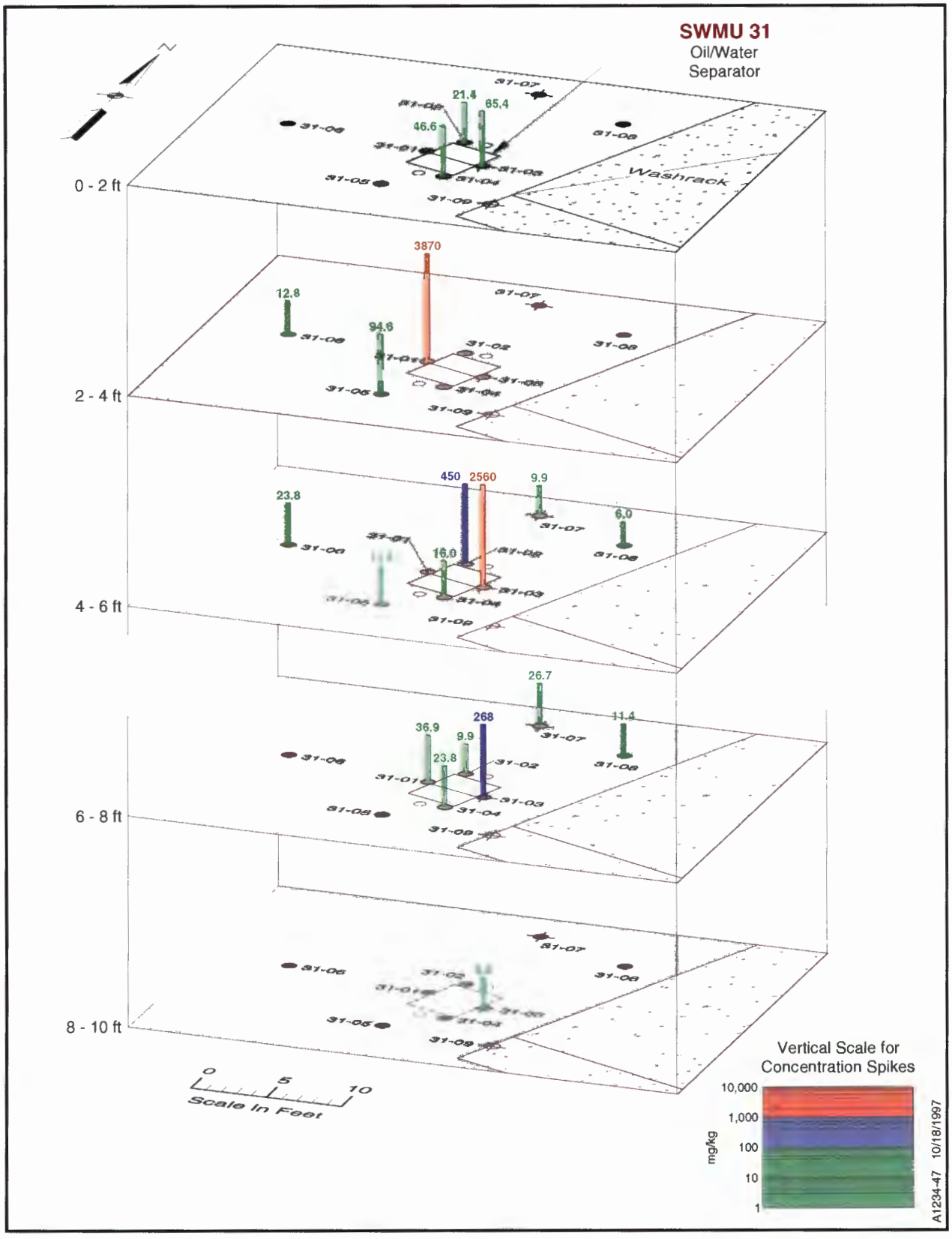

Figure 5.10-2. SWMU 31 - TRPH Concentrations by Depth Interval

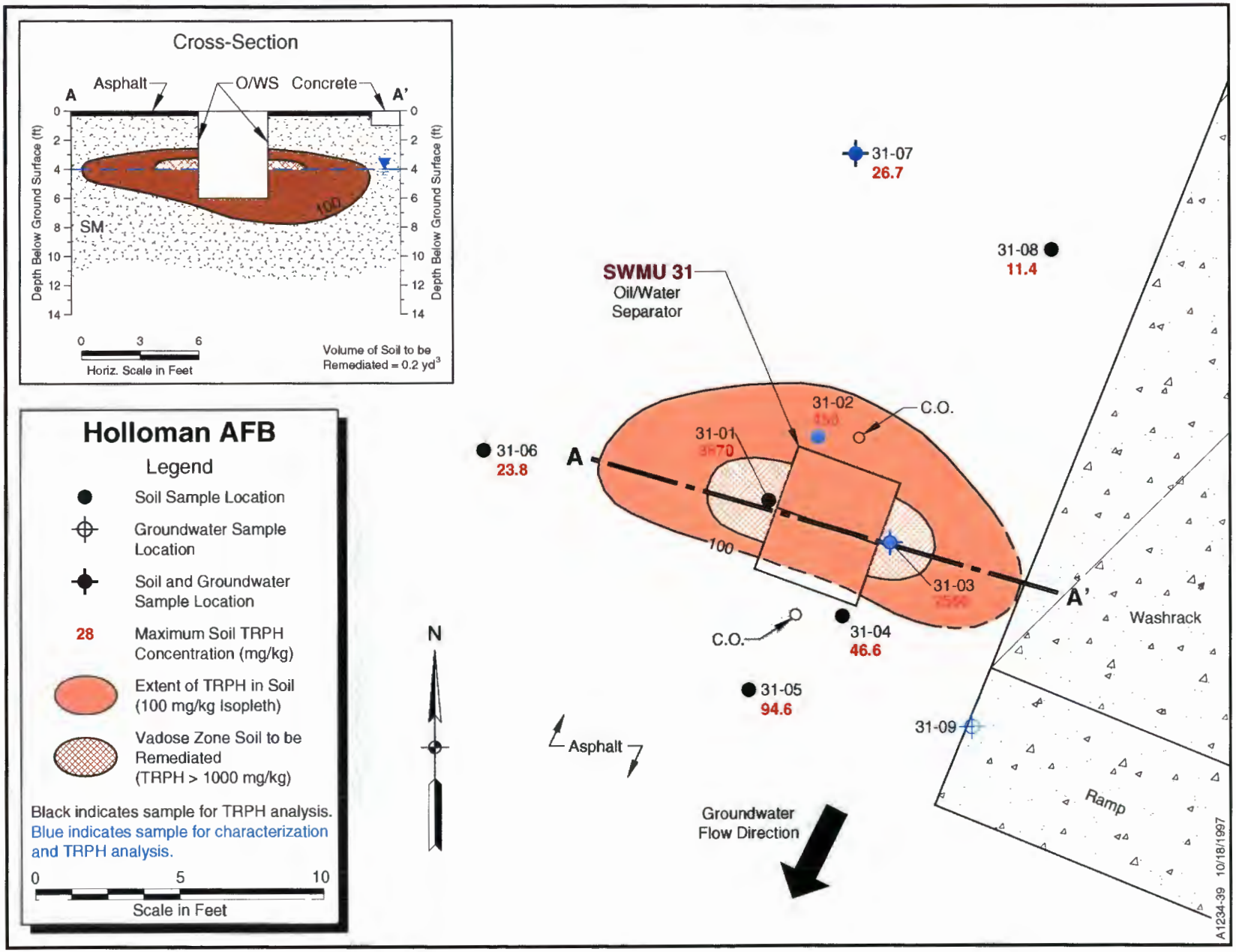

Figure 5.10-3. SWMU 31 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.10-1
TRPH Results for Soil at SWMU 31

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
31-01	3.5	4	3870	31-04	0.5	2	46.6
	6	8	36.9		4	6	16
31-02	1	2	21/4		6	8	23.8
	4	6	450/339	31-05	2	4	94.6
	7.5	8	9.9		4	6	19.8
31-03[a]	0.5	2	65.4	31-06	2	4	12.8
	0.5	2	52.7/52.2		4	6	23.8
	4	6	2560/1310 (818/2740)	31-07	4	6	9.9 (< RL)
	6	8	268		6	8	26.7
	8	10	9.9	31-08	4	6	6
					6	8	11.4

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit ≈ 30 mg/kg.
( ) = Result from fixed analytical laboratory.

[a]Location 31-03, 0.5-2 ft sampled two times on different days.

Table 5.10-2
Summary Analytical Results for Soil at SWMU 31

Location ID		31-02				31-03		31-07	
Beg. Depth - End Depth (ft)		4-6		6-8		4-6		4-6	
SW6010 (mg/kg)	Barium	12.2	(1.38)	14.3	(1.42)	10.8	(1.34)	10.4	(1.28)
	Beryllium	< RL	(0.277)	< RL	(0.284)	< RL	(0.268)	< RL	(0.255)
	Cadmium	< RL	(0.692)	< RL	(0.71)	< RL	(0.671)	< RL	(0.638)
	Chromium	1.69	(1.38)	1.83	(1.42)	< RL	(1.34)	1.44	(1.28)
	Cobalt	< RL	(1.38)	< RL	(1.42)	< RL	(1.34)	< RL	(1.28)
	Copper	< RL	(2.77)	< RL	(2.84)	< RL	(2.68)	< RL	(2.55)
	Vanadium	5.89	(2.77)	4.18	(2.84)	2.74	(2.68)	3.91	(2.55)
	Zinc	5.86	(2.77)	4.62	(2.84)	< RL	(2.68)	3.61	(2.55)
SW7060 (mg/kg)	Arsenic	< RL	(0.692)	< RL	(0.71)	< RL	(0.671)	< RL	(0.638)
SW7421 (mg/kg)	Lead	1.34	(0.692)	< RL	(0.71)	< RL	(0.671)	0.741	(0.638)
SW8260 (µg/kg)	2-Butanone	< RL	(138)	< RL	(142)	< RL	(134)	ND	(128)
	Acetone	528	(138)	374	(142)	< RL	(134)	< RL	(128)
	Ethyl benzene	< RL	(6.92)	ND	(7.1)	ND	(6.71)	ND	(6.38)
	Methylene chloride	< RL	(27.7)	< RL	(28.4)	< RL	(26.8)	< RL	(25.5)
	Toluene	10.4	(6.92)	< RL	(7.1)	< RL	(6.71)	< RL	(6.38)
	Total xylenes	28.8	(6.92)	ND	(7.1)	ND	(6.71)	ND	(6.38)
	Vinyl acetate	ND	(69.2)	< RL	(71)	ND	(67.1)	< RL	(63.8)
SW8270 (mg/kg)	2-Methylnaphthalene	5.02	(0.456)	ND	(0.469)	ND	(0.443)	ND	(0.421)
	Dibenzofuran	< RL	(0.456)	ND	(0.469)	ND	(0.443)	ND	(0.421)
	Fluorene	< RL	(0.456)	ND	(0.469)	ND	(0.443)	ND	(0.421)
	Phenanthrene	0.58	(0.456)	ND	(0.469)	ND	(0.443)	ND	(0.421)
	di-n-Butylphthalate	0.657	(0.456)	2.8	(0.469)	0.603	(0.443)	< RL	(0.421)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.10-3
Summary Analytical Results for Groundwater at SWMU 31

Location ID		31-03		31-07		31-09	
E418.1 (mg/L)	TRPH	< RL	(0.4)	NA		< RL	(0.4)
E418.1M (mg/L)	TRPH	< RL	(5)	< RL	(5)	< RL	(5)
SW6010 (mg/L)	Barium	0.037	(0.01)	NA		0.019	(0.01)
	Beryllium	0.01	(0.002)	NA		< RL	(0.002)
	Cadmium	< RL	(0.005)	NA		< RL	(0.005)
	Chromium	< RL	(0.01)	NA		< RL	(0.01)
	Copper	< RL	(0.02)	NA		< RL	(0.02)
	Silver	< RL	(0.01)	NA		0.016	(0.01)
	Vanadium	0.031	(0.02)	NA		< RL	(0.02)
	Zinc	0.022	(0.02)	NA		< RL	(0.02)
SW7041 (mg/L)	Antimony	< RL	(0.005)	NA		< RL	(0.005)
SW7060 (mg/L)	Arsenic	0.009	(0.004)	NA		0.007	(0.004)
SW7421 (mg/L)	Lead	< RL	(0.003)	NA		0.0035	(0.003)
SW7470 (mg/L)	Mercury	< RL	(0.0002)	NA		< RL	(0.0002)
SW7740 (mg/L)	Selenium	< RL	(0.005)	NA		< RL	(0.005)
SW7841 (mg/L)	Thallium	< RL	(0.002)	NA		< RL	(0.002)
SW8260 (µg/L)	Acetone	< RL	(100)	NA		263	(100)
	Chloroform	< RL	(5)	NA		ND	(5)
	Methylene chloride	< RL	(20)	NA		28.6	(20)
	Trichloroethene	5.3	(5)	NA		ND	(5)

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).

NA = Not analzyed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.11 SWMU 34—Building 902 O/WS

SWMU 34 services the washrack in Bare Base Mobility near Building 902. It operated as an O/WS from 1982 until 1991 when it was replaced with a new O/WS and converted into a sediment trap.

To identify whether a release from the unit had occurred, SWMU 34 was investigated under the Table 3 RFI. During Phase I, one soil sample collected from the area immediately adjacent to the SWMU was shown to have a TRPH concentration above the release criterion of 100 mg/kg; therefore, it was determined that a release had occurred. The data indicate that the release was confined to the surface and at only two locations. Phase II sampling was conducted to define the nature and extent of the release in the soil and groundwater.

Beryllium and cadmium were identified as COCs from the risk-based screen; therefore, a site-specific risk assessment was performed at this SWMU. The results of the risk assessment indicate that there are no health risks above acceptable levels from these constituents. NFA is recommended for SWMU 34.

5.11.1 SWMU Description

Unit Type: Multichamber O/WS
Period of Operation: March 1982 to present
Current Status: Active
Disposition of Unit: Continued use as a sediment trap
Source of Waste: Washrack
Major Operations: Washing mobility equipment, vehicles, AGE, aircraft, fuel trucks
Construction Material: Steel
Physical Condition: Corroded unit and pipes; oil stains on sidewalls
Oil/Total Capacity: 700 gal./1100 gal.
Historic Releases: Overflow of O/WS; 1991—surface spill from collapsed piping between drain and O/WS

5.11.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand and sandy silt. Groundwater occurs at approximately 2.5 to 3 ft bgl, and the groundwater flow direction in this portion of the Base is known to vary from the south to southwest. The bottom of the O/WS is approximately 3 ft below the groundwater table. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.11-1, samples were collected from six locations during Phase I for analysis of TRPH by EPA 418.1M. At all locations, samples were collected from the surface and near the bottom of the separator. At locations 34-03 and 34-06, samples were also collected at intermediate depths to define vertical extent further before delineating lateral extent during Phase II. Figure 5.11-1 shows the sampling horizons and the associated TRPH results.

TRPH concentrations at two of the Phase I sampling locations (34-03 and 34-06) were detected above the 100-mg/kg release criterion. From these results, it was determined that a release had occurred from the SWMU. Given the higher TRPH concentrations in the 0- to 2- ft interval, the release pathway at the separator was determined to be an overflow at the surface. This interpretation is supported by reports of a 1991 surface spill caused by collapsed piping between the drain and O/WS. Since a release had occurred from the SWMU, a Phase II investigation was triggered.

Phase II Investigation

Extent—The extent of the release was investigated in Phase II using the iterative step-out approach described in the work plan. The Phase II sampling locations are shown in Figure 5.11-1. The magnitude of TRPH results at each horizon is

shown in Figure 5.11-2. As suggested by the Phase I results and by what is seen in the Phase II data, the highest concentrations of TRPH are located at the surface between 0 and 2 ft, extending to the south of the O/WS. All field TRPH results are provided in Table 5.11-1. Using the maximum detected TRPH result at each boring, a contour map was developed to illustrate the areal extent of TRPH values above the 100-mg/kg release criterion (Figure 5.11-3).

Nature—To characterize the nature of the release, four samples were also submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.11-2. The data indicate that acetone, methylene chloride, carbon disulfide, and bis(2-ethylhexyl)phthalate are the only organic constituents above the reporting limits at the site (locations 34-03 and -06). All organic constituents, however, are below risk-based concentrations. Inorganic constituents were detected above RBCs as shown in Table 5.11-3 and are discussed in Section 5.11.3.

Groundwater—To define constituent concentrations in the groundwater, samples were collected from two locations around the SWMU (Figure 5.11-1). One sample (34-03) was collected inside the area of elevated soil constituent concentrations. The other (34-06) was collected hydraulically downgradient of the release. The analytical results for groundwater are presented in Table 5.11-4. The results indicate that TRPH concentrations are below the 10-mg/L release criterion at both locations. No organic constituents were detected above the reporting limit in groundwater. LNAPL was not detected at any groundwater sampling point or in any soil boring.

5.11.3 Risk-Based Screen Results

The risk-based screen indicated that beryllium and cadmium were present at levels above the EPA Region III RBCs. Further evaluation of risk was required and a site-specific risk assessment was performed to determine if these constituents pose a risk to human health at SWMU 34.

The risk-based screen compared the maximum site results with residential EPA Region III RBCs to identify sites that may pose a risk to human health. The screen incorporates very conservative parameters, and an exceedance of the RBCs indicates that a site-specific risk assessment is required to make conclusions on human-health risk at SWMU 34. Both the output from the risk-based screen and the toxicity values used are presented in Appendix C. Section 5.11.4 discusses the risk assessment results.

5.11.4 Risk Assessment Results

The COCs—beryllium and cadmium—identified from the risk-based screen were evaluated in a site-specific risk assessment. Pathways evaluated for SWMU 34 included dermal contact, incidental ingestion, and inhalation of fugitive dust for future construction workers. It was determined that the inhalation pathway would not contribute significantly to risk at this SWMU under safe working conditions and, subsequently, was not included in the calculation of risk. Since beryllium is not absorbed dermally, it was evaluated for the ingestion pathway only.

The total average and reasonable maximum carcinogenic risks were calculated to be $2x10^{-10}$ and $3x10^{-10}$, respectively. Cadmium hazard indices included risks from the dermal pathway as well as from the ingestion pathway. The average and reasonable maximum hazard indices for cadmium are 0.06 and 0.96, respectively. Both the carcinogenic risks and the non-carcinogenic hazard indices are within acceptable ranges. Therefore, adverse effects from releases at SWMU 34 are unlikely based on these results.

5.11.5 Conclusions

The results from the Phase I/II investigation at SWMU 34 indicate that a surface release has likely occurred at this site. The results of the Phase I/II investigation indicate TRPH concentrations are above the release criterion of 100 mg/kg in samples collected from the 0- to 2-ft intervals. The Phase II investigation identified the extent of the release to be confined to the upper 2 ft of soil in the area immediately surrounding and to the south of the SWMU. The nature of the release was characterized by laboratory analysis. The release at SWMU 34 did not affect groundwater at the site.

Beryllium and cadmium were identified as COCs through the risk-based screen; therefore, a site-specific risk assessment was performed at this SWMU. Carcinogenic and noncarcinogenic risk results show that releases from this SWMU are unlikely to cause adverse affects to human health.

5.11.6 Recommendations

No further action is recommended for SWMU 34.

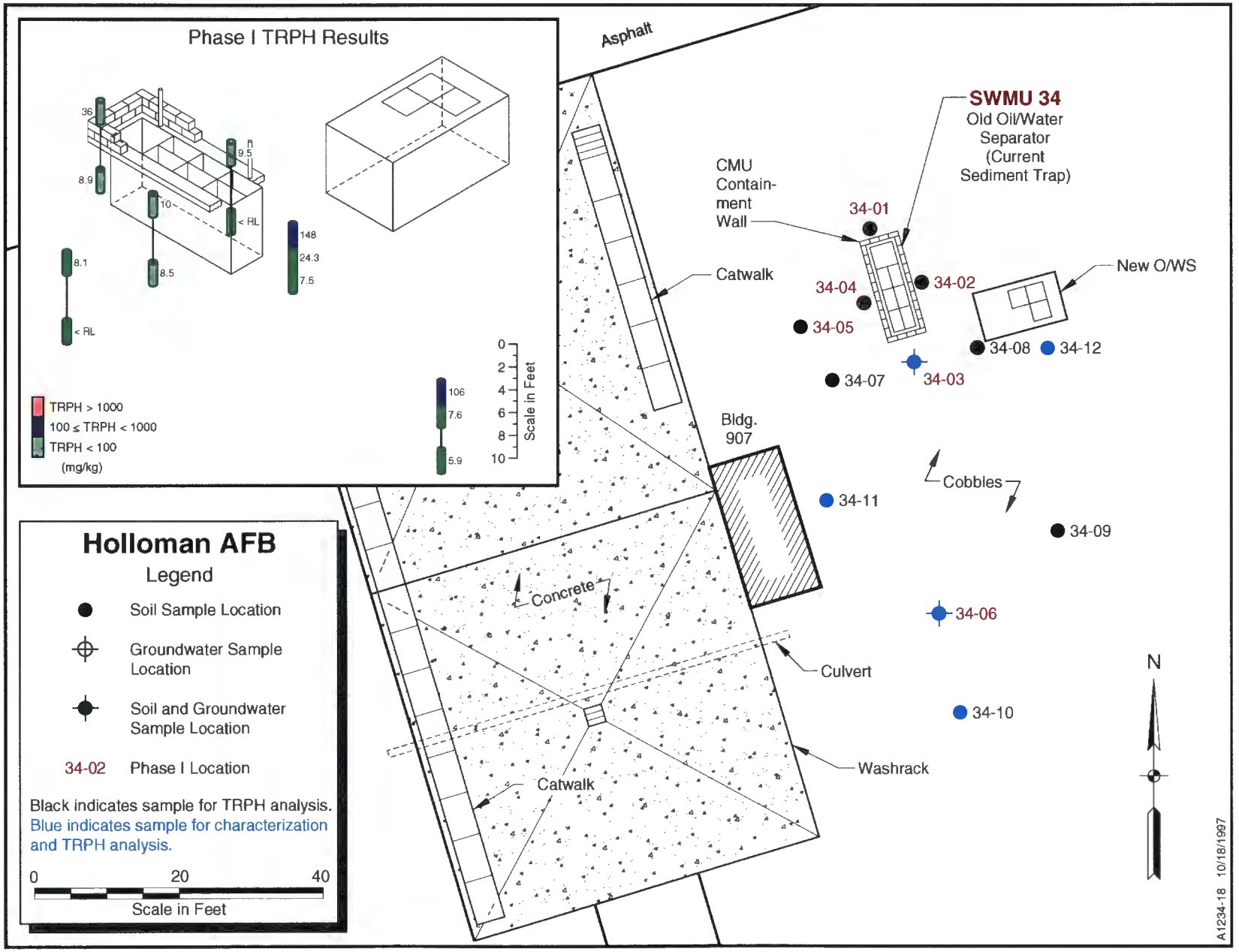

Figure 5.11-1. SWMU 34 - Building 902 O/WS Sample Locations and Phase I TRPH Results

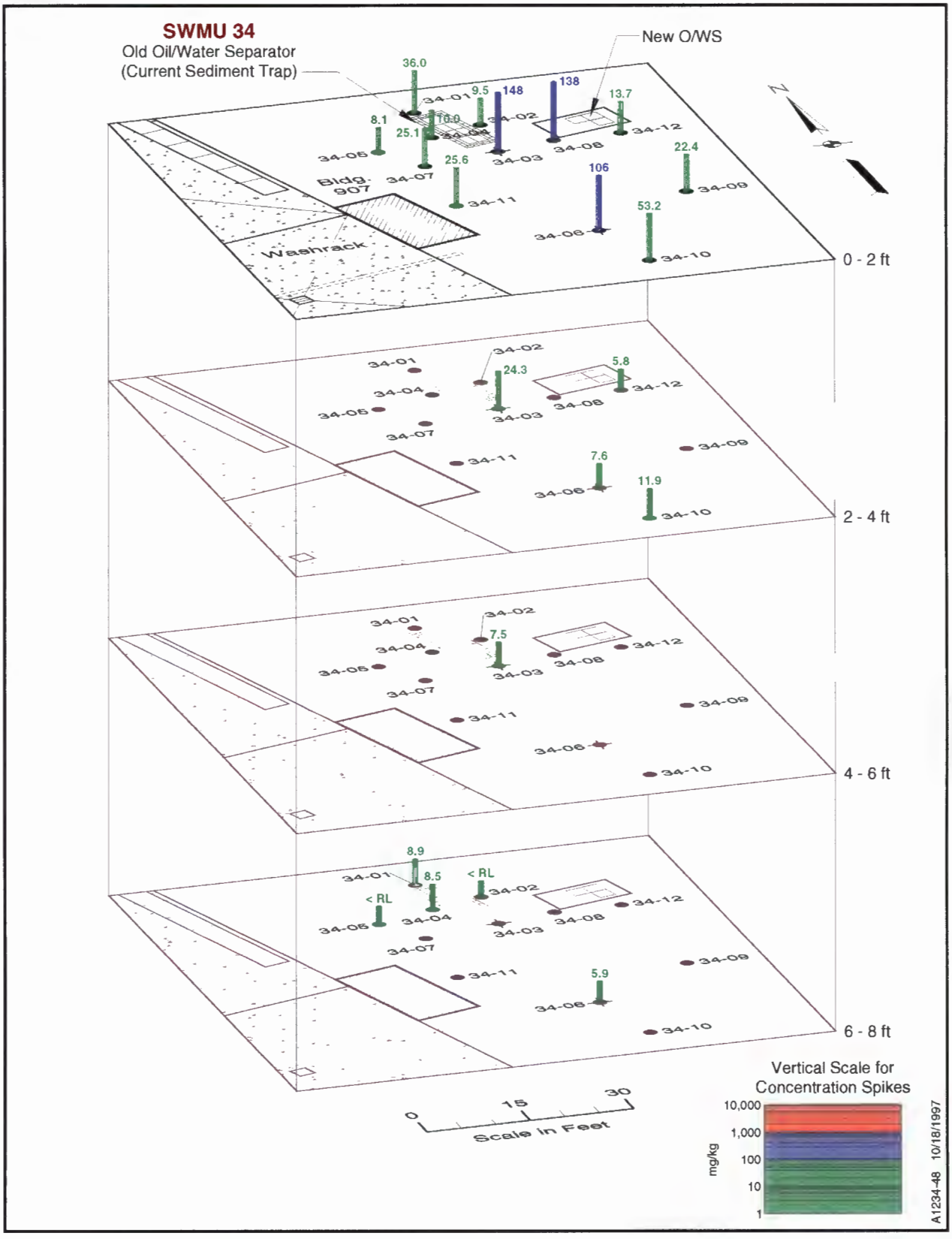

Figure 5.11-2. SWMU 34 - TRPH Concentrations by Depth Interval

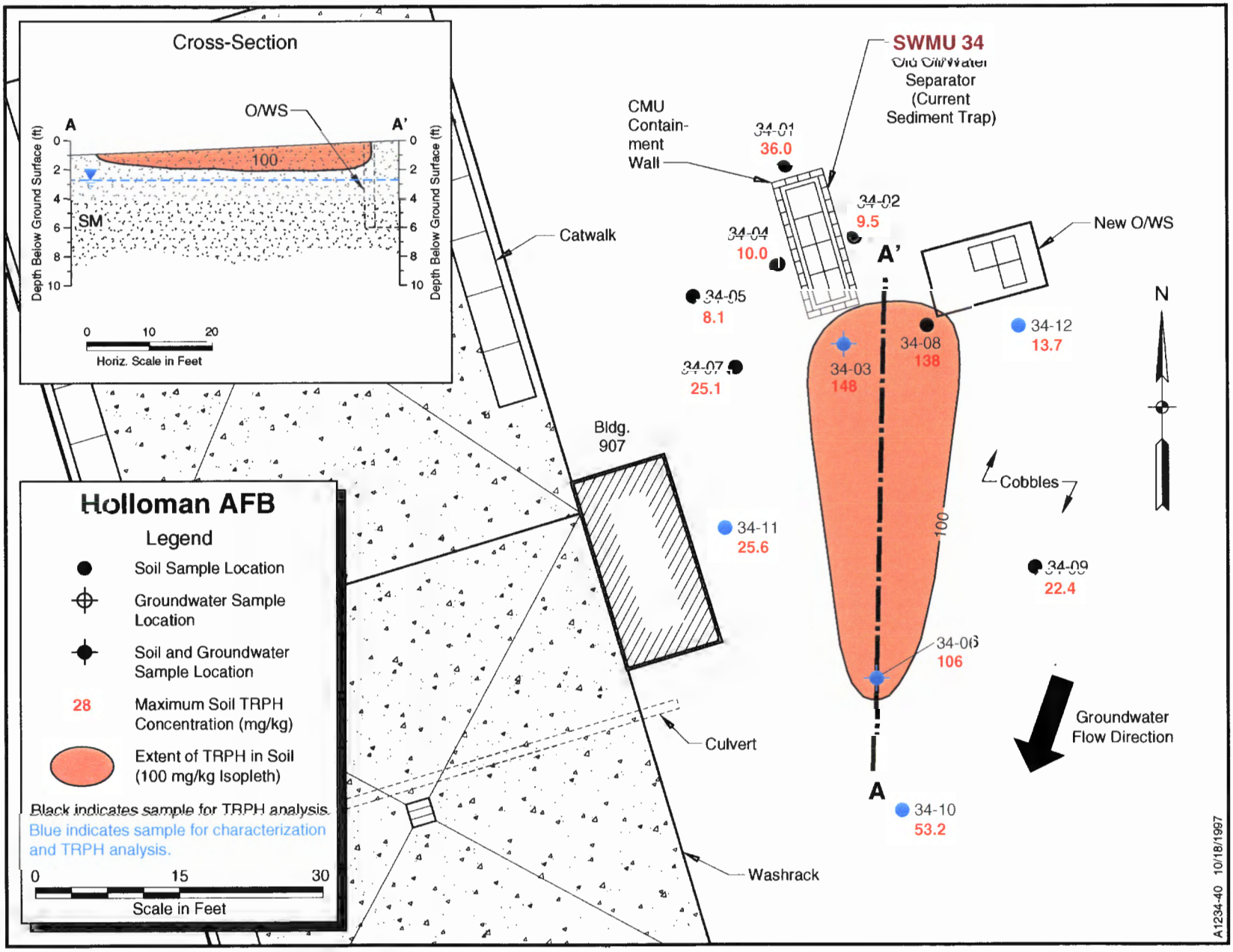

Figure 5.11-3. SWMU 34 - Maximum TRPH Concentrations and Extent of Elevated TRPH Results

Table 5.11-1
TRPH Results for Soil at SWMU 34

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
34-01	0	2	36	34-06	0	2	106 (257)
	6	8	8.9		2	4	7.6/< RL
34-02	0	2	9.5		6	8	5.9
	6	8	< RL	34-07	0	2	25.1
34-03	0	2	148	34-08	0	2	138
	2	4	24.3	34-09	0	2	22.4
	4	6	7.5 (< RL)	34-10	0	2	53.2 (146)
34-04	0	2	10		2	4	11.9
	6	8	8.5	34-11	0	2	25.6 (< RL)
34-05	0	2	8.1	34-12	0	2	13.7 (105)
	6	8	< RL		2	4	5.8

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

Table 5.11-2
Summary Analytical Results for Soil at SWMU 34

Location ID		34-03				34-06		34-10		34-11		34-12	
Beg. Depth - End Depth (ft)		0-2		4-6		0-2		0-2		0-2		0-2	
SW6010 (mg/kg)	Barium	38	(1.25)	26.7	(1.28)	55.9	(1.3)	31.1	(1.33)	23.3	(1.23)	54.1	(1.28)
	Beryllium	0.254	(0.25)	< RL	(0.257)	0.376	(0.259)	< RL	(0.266)	< RL	(0.247)	0.438	(0.256)
	Cadmium	0.808	(0.625)	< RL	(0.642)	9.62	(0.648)	< RL	(0.665)	< RL	(0.617)	< RL	(0.641)
	Chromium	6.66	(1.25)	2.98	(1.28)	10.8	(1.3)	4.4	(1.33)	3.57	(1.23)	9.31	(1.28)
	Cobalt	2.1	(1.25)	< RL	(1.28)	2.48	(1.3)	< RL	(1.33)	1.25	(1.23)	3.63	(1.28)
	Copper	5.98	(2.5)	< RL	(2.57)	11.8	(2.59)	4.51	(2.66)	< RL	(2.47)	12.6	(2.56)
	Silver	< RL	(1.25)	< RL	(1.28)	< RL	(1.3)	< RL	(1.33)	< RL	(1.23)	< RL	(1.28)
	Vanadium	9.89	(2.5)	10.3	(2.57)	12.4	(2.59)	7.33	(2.66)	6.01	(2.47)	11.9	(2.56)
	Zinc	23	(2.5)	6.97	(2.57)	50.8	(2.59)	30.4	(2.66)	12.3	(2.47)	40.8	(2.56)
SW7041 (mg/kg)	Antimony	< RL	(0.625)	< RL	(0.642)	0.713	(0.648)	1.77	(0.665)	< RL	(0.617)	1.42	(0.641)
SW7060 (mg/kg)	Arsenic	1.5	(0.625)	1.9	(0.642)	1.28	(0.648)	1.65	(0.665)	1.26	(0.617)	2.28	(0.641)
SW7421 (mg/kg)	Lead	9.09	(0.625)	1.39	(0.642)	27	(0.648)	7.96	(0.665)	5.26	(0.617)	10.3	(0.641)
SW7471 (mg/kg)	Mercury	< RL	(0.025)	< RL	(0.0257)	< RL	(0.0259)	< RL	(0.0266)	< RL	(0.0247)	< RL	(0.0256)
SW7740 (mg/kg)	Selenium	< RL	(0.625)	< RL	(0.642)	< RL	(0.648)	< RL	(0.665)	< RL	(0.617)	< RL	(0.641)
SW7841 (mg/kg)	Thallium	< RL	(0.625)	< RL	(0.642)	< RL	(0.648)	< RL	(0.665)	< RL	(0.617)	< RL	(0.641)
SW8260 (µg/kg)	1,2-Dichlorobenzene	< RL	(6.25)	ND	(6.42)	ND	(6.48)	ND	(6.65)	ND	(6.17)	ND	(6.41)
	2-Butanone	< RL	(125)	< RL	(128)	< RL	(130)	ND	(133)	ND	(123)	ND	(128)
	Acetone	< RL	(125)	1990	(1280)	< RL	(130)	ND	(133)	ND	(123)	< RL	(128)
	Carbon disulfide	ND	(6.25)	ND	(6.42)	8.04	(6.48)	ND	(6.65)	ND	(6.17)	ND	(6.41)
	Methylene chloride	< RL	(25)	35.6	(25.7)	37.7	(25.9)	< RL	(26.6)	34.1	(24.7)	31.9	(25.6)
	Vinyl acetate	ND	(62.5)	ND	(64.2)	ND	(64.8)	< RL	(66.5)	ND	(61.7)	ND	(64.1)
SW8270 (mg/kg)	bis(2-Ethylhexyl)phthalate	ND	(0.412)	ND	(0.424)	1.37	(0.428)	ND	(0.439)	ND	(0.407)	ND	(0.423)
	di-n-Butylphthalate	0.438	(0.412)	< RL	(0.424)	< RL	(0.428)	< RL	(0.439)	0.551	(0.407)	0.944	(0.423)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.11-3
Analytical Results for Chemicals of Concern for Soil at SWMU 34[a]

Location ID		34-03	34-07	34-08	34-10	34-11	34-12
Dep. Depth - End Depth (ft)		0-2	4-6	0-2	0-2	0-2	0-2
SW6010 (mg/kg)	Beryllium [0.1485, 0.4][b]	0.254 (0.25)	0.0629 J (0.257)	0.376 (0.259)	0.0957 J (0.266)	0.164 J (0.247)	0.438 (0.256)
	Cadmium [3.91, 0.56]	0.808 (0.625)	< RL (0.643)	9.62 (0.648)	0.342 J (0.665)	0.179 J (0.617)	0.573 J (0.641)

Note—This table presents the analytical results used in the risk-based screen and risk assessment. The J-flag data are estimated concentrations, since the result is below the reporting limit.

J = Result is less than the reporting limit.
< RL = Result not detected at the reporting limit. Negative instrument response.
( ) = Reporting limit.

[a] Shading highlights results greater than the EPA Region III RBC used in the risk-based screen.
[b] [RBC, UTL] = EPA Region III residential risk-based concentrations, 95% upper tolerance limit background concentration.

Table 5.11-4
Summary Analytical Results for Groundwater at SWMU 34

Location ID		34-03		34-06	
E418.1 (mg/L)	TRPH	< RL	(1)	< RL	(0.4)
E418.1M (mg/L)	TRPH	< RL	(5)	< RL	(5)
SW6010 (mg/L)	Barium	< RL	(0.01)	< RL	(0.01)
	Beryllium	< RL	(0.002)	0.002	(0.002)
	Cadmium	< RL	(0.005)	< RL	(0.005)
	Chromium	< RL	(0.01)	< RL	(0.01)
	Cobalt	< RL	(0.01)	0.012	(0.01)
	Copper	< RL	(0.02)	< RL	(0.02)
	Silver	< RL	(0.01)	< RL	(0.01)
	Vanadium	< RL	(0.02)	0.063	(0.02)
	Zinc	< RL	(0.02)	0.037	(0.02)
SW7041 (mg/L)	Antimony	< RL	(0.005)	0.0052	(0.005)
SW7060 (mg/L)	Arsenic	0.124	(0.004)	0.0134	(0.004)
SW7421 (mg/L)	Lead	0.0927	(0.003)	< RL	(0.003)
SW7470 (mg/L)	Mercury	< RL	(0.0002)	< RL	(0.0002)
SW7740 (mg/L)	Selenium	< RL	(0.005)	< RL	(0.005)
SW7841 (mg/L)	Thallium	< RL	(0.002)	< RL	(0.002)
SW8260 (μg/L)	Acetone	< RL	(100)	< RL	(100)
	Benzene	< RL	(5)	ND	(5)
	Carbon disulfide	< RL	(5)	ND	(5)
	Ethyl benzene	< RL	(5)	ND	(5)
	Methylene chloride	< RL	(20)	< RL	(20)
	Tetrachloroethene	< RL	(5)	ND	(5)
	Toluene	< RL	(5)	ND	(5)

Note—SW8260 results are in µg/L (ppb); metals and SW8270 results are in mg/L (ppm).
NA = Not analyzed.
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

5.12 SWMU 37—Building 1080 O/WS

SWMU 37 services the aircraft washrack near Building 1080. The separator is still in place for managing rinsate wastes from the washrack.

To identify whether a release from the unit had occurred, SWMU 37 was investigated under the Table 3 RFI. During Phase I of the RFI, two soil samples collected from the area immediately adjacent to the SWMU were shown to have TRPH concentrations above the release criterion of 100 mg/kg; therefore, it was determined that a release had occurred. Phase II sampling was conducted to define the nature and extent of the release in the soil.

The Phase II investigation determined the extent of the release was confined to the surface around the O/WS. No concentrations exceeded the Base-specific cleanup level, and no COCs were identified from the risk-based screen. Therefore, NFA is recommended for SWMU 37.

5.12.1 SWMU Description

Unit Type: Three-chamber O/WS
Period of Operation: 1974 to present
Current Status: Active
Disposition of Unit: Continued use
Source of Waste: Washrack
Major Operations: Washing aircraft and ground equipment
Construction Material: Concrete
Physical Condition: Good
Oil/Total Capacity: 825 gal./5300 gal.
Historic Releases: None known

5.12.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand and sandy silt to 12 ft bgl. Groundwater was not encountered; however, on the basis of the results of previous investigations, it is estimated to be approximately 12 to 16 ft bgl. Details of the site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.12-1, samples were collected from five locations during Phase I for analysis of TRPH by EPA 418.1M. At each location, samples were collected from near the surface and near the bottom of the separator. At locations 37-04 and 37-05, samples were also collected from intermediate depths to define vertical extent further. Figure 5.12-1 shows the sampling horizons and the associated TRPH results.

TRPH concentrations at two of the Phase I sampling locations (37-04 and 37-05) were detected above the 100-mg/kg release criterion. From these results, it was determined that a release had occurred from the SWMU, and a Phase II investigation was initiated to determine the nature and extent of the release. Given the higher TRPH concentrations between 0 and 2 ft bgl, the release pathway at the separator was likely to be an overflow at the surface.

Phase II Investigation

Extent—The extent of the release was investigated in Phase II using the iterative step-out approach from the work plan. The Phase II sampling locations are shown in Figure 5.12-1. The magnitude of TRPH results at each horizon is shown in Figure 5.12-2. The highest concentrations of TRPH are located at the surface between 0 and 2 ft, extending to the north and east of the O/WS. None of the samples showed TRPH concentrations greater than 1000 mg/kg. All field TRPH results are provided in Table 5.12-1. Using the maximum detected TRPH result at each boring, an isopleth of TRPH at 100 mg/kg was drawn to illustrate the areal extent of the release (Figure 5.12-3).

Nature—To characterize the nature of the release, eight samples were submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.12-2. No organic constituents were detected at levels above reporting limits. The organic and inorganic results were below respective RBCs.

Groundwater—Because the depth to groundwater is approximately 12 ft, and substantially below the depth at which any elevated TRPH concentrations were detected, groundwater was not sampled at SWMU 37.

5.12.3 Risk -Based Screen Results

The risk-based screen indicated that none of the COPCs exceeded the screening criteria for this SWMU (see Appendix C for details). On the basis of the screen, there is no risk to human health from the release at SWMU 37.

5.12.4 Conclusions

The results from Phase I/II investigation at SWMU 37 indicate that a surface release has likely occurred at this site. The investigation identified the extent of the release to be confined to the upper 2 ft of soil in the area immediately surrounding and to the east of the SWMU. The nature of the release was characterized by laboratory analysis. No constituents were found to pose risk to human health.

5.12.5 Recommendations

NFA is recommended for SWMU 16. A Class 3 permit modification request will be submitted to NMED for this purpose. In addition, this unit will be managed according to Holloman AFB's *Guidance on Management of Oil/Water Separators*, developed by Air Combat Command to insure proper maintenance and quarterly inspections.

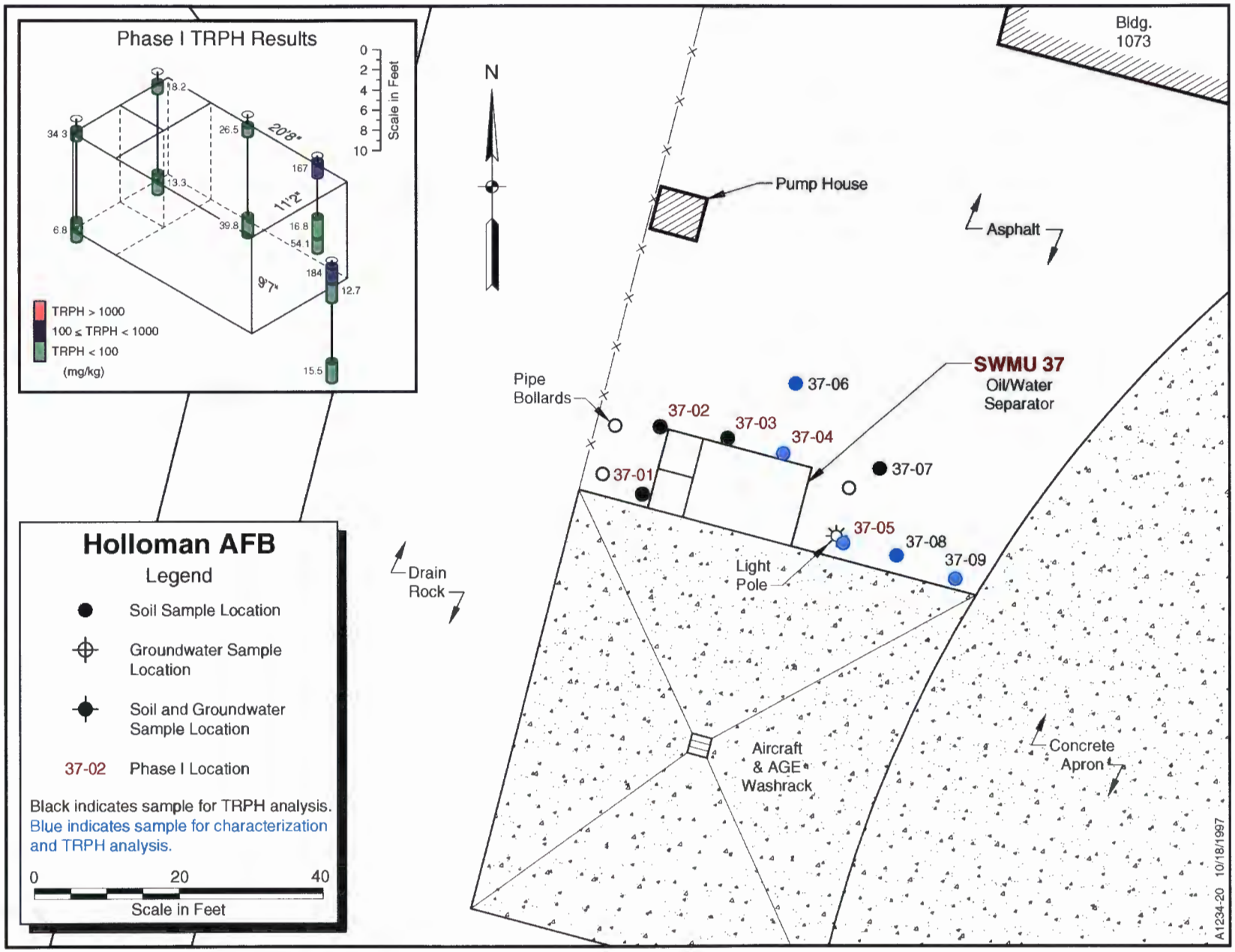

Figure 5.12-1. SWMU 37 - Building 1080 O/WS Sample Locations and Phase I TRPH Results

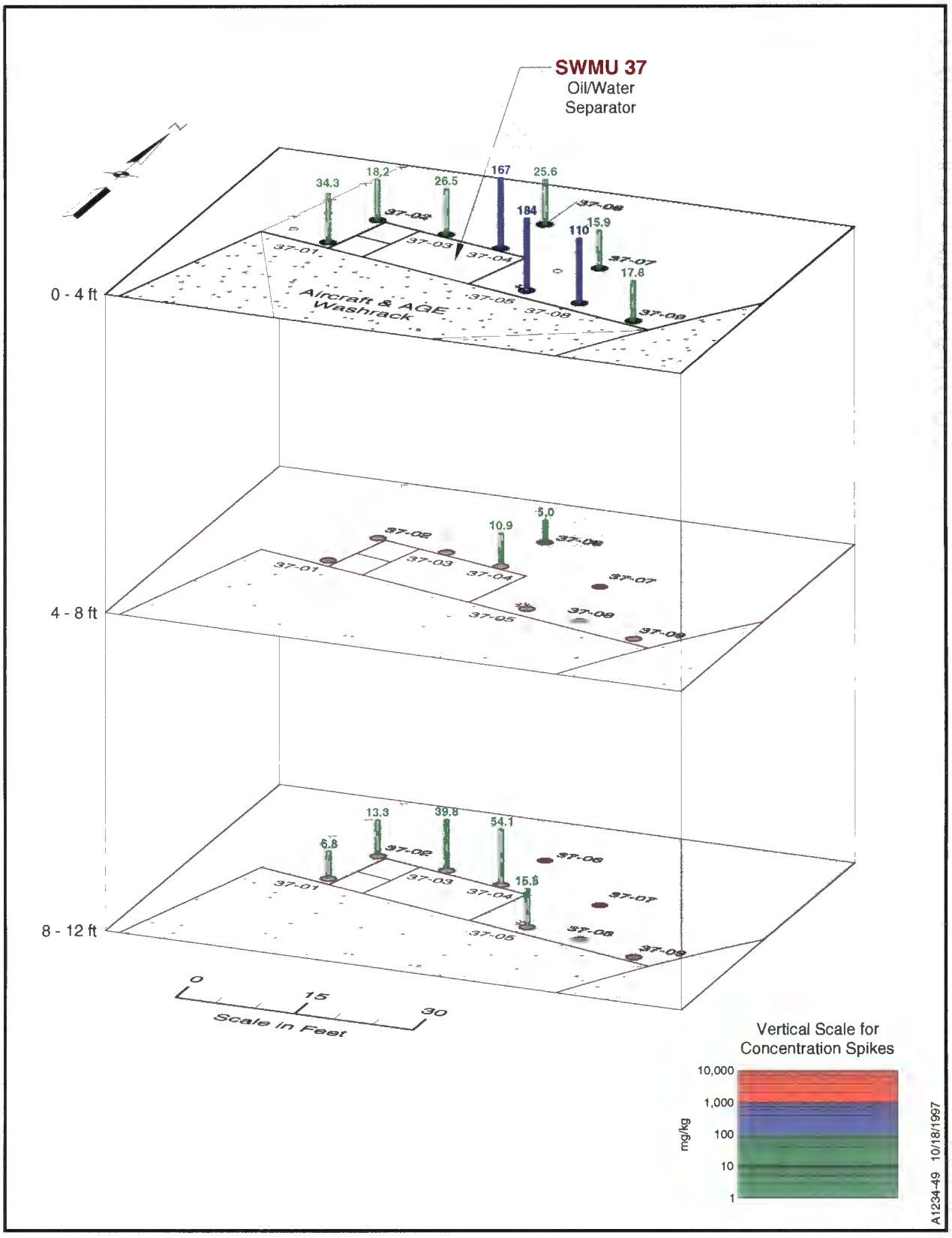

Figure 5.12-2. SWMU 37 - TRPH Concentrations by Depth Interval

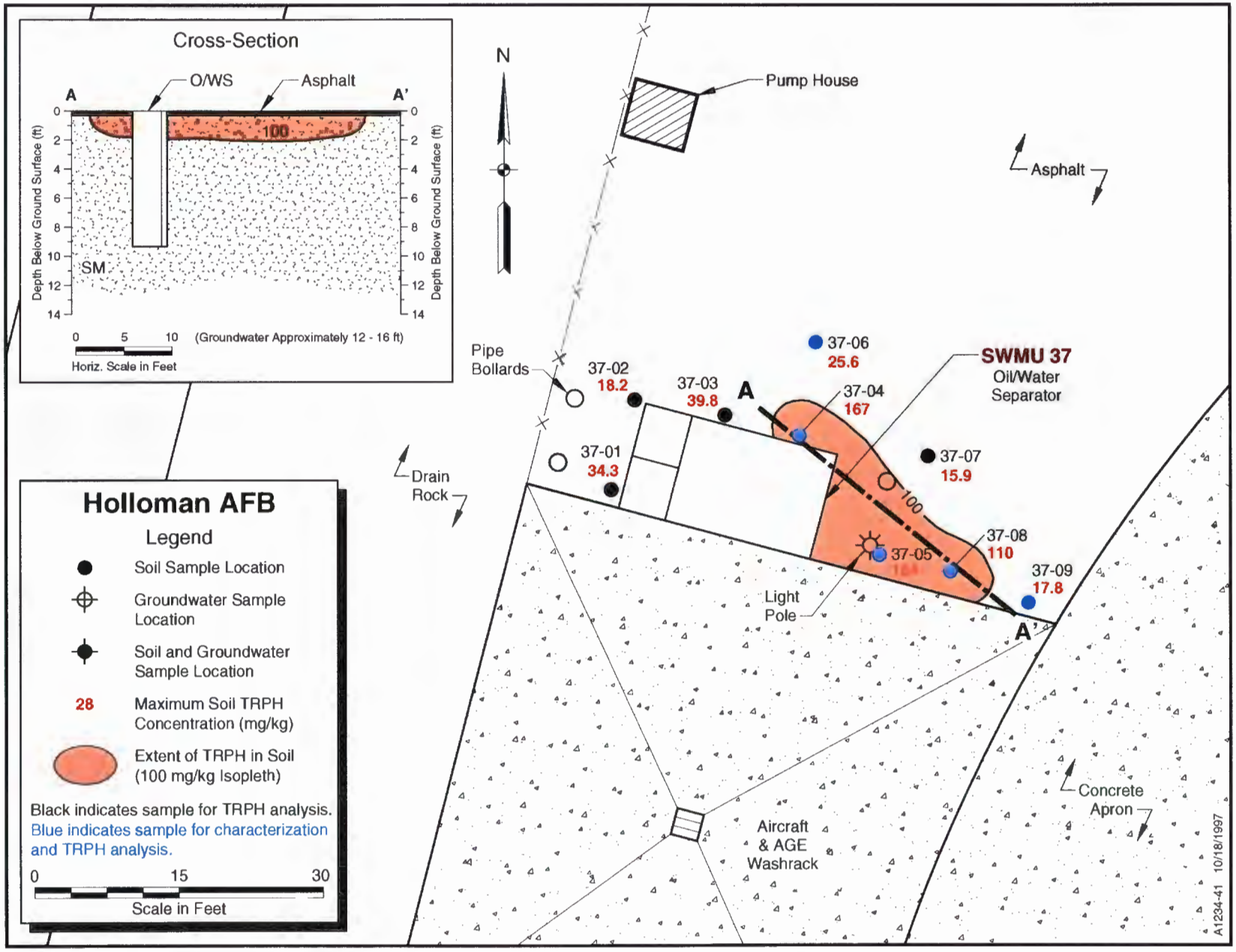

Figure 5.12-3. SWMU 37 - Maximum TRPH Concentrations and Extent of Elevated TRPH Results

Table 5.12-1
TRPH Results for Soil at SWMU 37

Location	Depth (ft)		TRPH (mg/kg)	Location	Depth (ft)		TRPH (mg/kg)	
	Top	Bottom			Top	Bottom		
37-01	1	2	34.3	37-05	0.5	2	184	
	10	12	6.8		2	4	12.7	
37-02	1	2	18.2		10	12	15.5/8.7	(< RL)
	10	12	13.3	37-06	0	2	25.6	(54.1)
37-03	1	2	26.5		4	6	5	
	10	12	39.8	37-07	0	2	15.9	
37-04	0.5	2	167		2	4	13.7	
	6	8	10.9/16.8	37-08	0	2	110	(78.4)
	8	9.5	54.1	37-09	0	2	17.8	(< RL)

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit, ≈ 30 mg/kg.
( ) = Result from fixed analytical laboratory.

5.13 SWMU 38—Building 1080A O/WS

SWMU 38 services AGE maintenance operations in Building 1080. A dry well was installed near the O/WS after 1981 for drainage from the concrete pad near Building 1080, which is used for AGE maintenance. This O/WS was abandoned in place and is inactive.

To investigate whether a release had occurred, SWMU 38 was investigated under the Table 3 RFI. Samples were collected on all four sides of the unit from at least two horizons ranging from the surface to 10 ft. Two additional samples were collected at the dry well below the drain rock fill at the 20- to 22-ft interval. During the Phase I investigation, it was determined that a release had occurred from the separator. In Phase II, additional soil samples were then collected in each direction from the suspected release point to determine the nature and extent of the release. From the results of the investigation, a release most likely occurred at SWMU 38 as an overflow of the O/WS.

Benzo(a) anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were identified as COCs during the risk-based screen. A site-specific risk assessment showed that adverse health effects due to exposure from SWMU 38 are unlikely. No further action is recommended for SWMU 38.

5.13.1 SWMU Description

Unit Type: Single-chamber O/WS
Period of Operation: Pre-1981 to 1991
Current Status: Inactive (uncertain)
Disposition of Unit: Abandoned in place
Source of Waste: Building 1080
Major Operations: AGE maintenance
Construction Material: Concrete
Physical Condition: Good condition
Oil/Total Capacity: 350 gal./1400 gal.
Historic Releases: None known

5.13.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of sandy silt across most of the site. Groundwater was not encountered at the site. However, on the basis of the results of previous investigations at nearby sites (i.e., IRP site FT-31), it is estimated to be approximately 20 ft bgl. Details of site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.13-1, samples were collected on all four sides of the O/WS at two to three different horizons from the surface to a depth of 10 ft. Two additional samples were taken from the dry well at depths of 20 to 22 ft during the Phase I investigation. Samples were analyzed in the field for TRPH by EPA 418.1M. Figure 5.13-1 shows the sampling horizons and the associated Phase I TRPH results.

One of the Phase I samples at location 38-03 had a TRPH concentration greater than the 100-mg/kg release criterion at the 6- to 8-ft interval. None of the other Phase I samples, including the samples near the dry well, exceeded this criterion. From these results, it was determined that a release had occurred. The Phase II investigation was initiated in order to determine the nature and extent of the release.

Phase II Investigation

Extent—The iterative step-out approach described in the work plan was used to investigate the extent of the release. The Phase II sampling locations are also depicted in Figure 5.13-1. The TRPH results for all sample locations and horizons are shown in Figure 5.13-2. Location 38-08 also had TRPH concentrations above 100 mg/kg at the 0- to 2-ft horizon. None of the Phase I or Phase II sample results exceeded the 1000-mg/kg cleanup level. Table 5.13-1 presents all of the TRPH data.

The areal extent of TRPH contamination for the SWMU was determined using the maximum detected concentrations at each sample location. Figure 5.13-3 shows this area.

Nature—To characterize the nature of the release, six samples were submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.13-2. Several SVOCs and a few VOCs were detected at levels above reporting limits, but only benzo(a)pyrene, benzo(a)-anthracene, and benzo(b)fluoranthene were present at levels above the RBCs. Table 5.13-3 summarizes the constituent concentrations above the EPA Region III RBCs.

Groundwater—Because the depth to groundwater is approximately 20 to 25 ft, and substantially below the depth at which any elevated TRPH concentrations were detected, groundwater was not sampled at SWMU 38.

5.13.3 Risk-Based Screen Results

The risk-based screen indicated that benzo(a)pyrene, benzo(a)anthracene, and benzo-(b)fluoranthene were present at levels above the RBCs; these constituents are considered COCs for SWMU 38. Further evaluation of risk in a site-specific risk assessment was necessary to determine if these constituents pose a risk to human health.

The risk-based screen compared the maximum site results with residential RBCs following EPA Region III screening guidance to identify sites that may pose a risk to human health. The screen incorporates very conservative parameters, and an exceedence of the RBCs indicates that a site-specific risk assessment is required to make conclusions on human health risk at SWMU 38. The output from the screen and the toxicity values used are given in Appendix C. The risk assessment is discussed in the following section.

5.13.4 Risk Assessment Results

A site-specific risk assessment was performed for the COCs identified from the risk-based screen. Three SVOCs (benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene) were the only COCs identified at SWMU 38. These constituents were evaluated for carcinogenic risks associated with incidental ingestion of contaminated soil. The total average and reasonable maximum carcinogenic risks are $3x10^{-9}$ and $9x10^{-9}$, respectively. These values are well below the Superfund target risk range of 10^{-6} to 10^{-4}. No noncarcinogenic COCs were identified at SWMU 38 and, therefore, there are no hazard indicies. Adverse health effects due to exposure to the PAHs at the SWMU are unlikely based on these calculations.

Appendix D presents the detailed methodology used for the risk assessment, as well as all supporting calculations.

5.13.5 Conclusions

The results from the investigation of SWMU 38 indicate that a surface release occurred from the O/WS. TRPH concentrations were found in soil that exceed the 100-mg/kg release criterion, but not the 1000-mg/kg Base-specific cleanup level. The extent of the release was delineated, and the nature was defined by laboratory analysis. A few SVOCs exceeded the risk-based screen and were evaluated further in a site-specific risk assessment. The risk assessment showed low risk at the site that was well below acceptable limits.

5.13.6 Recommendations

No further action is recommended at SWMU 38.

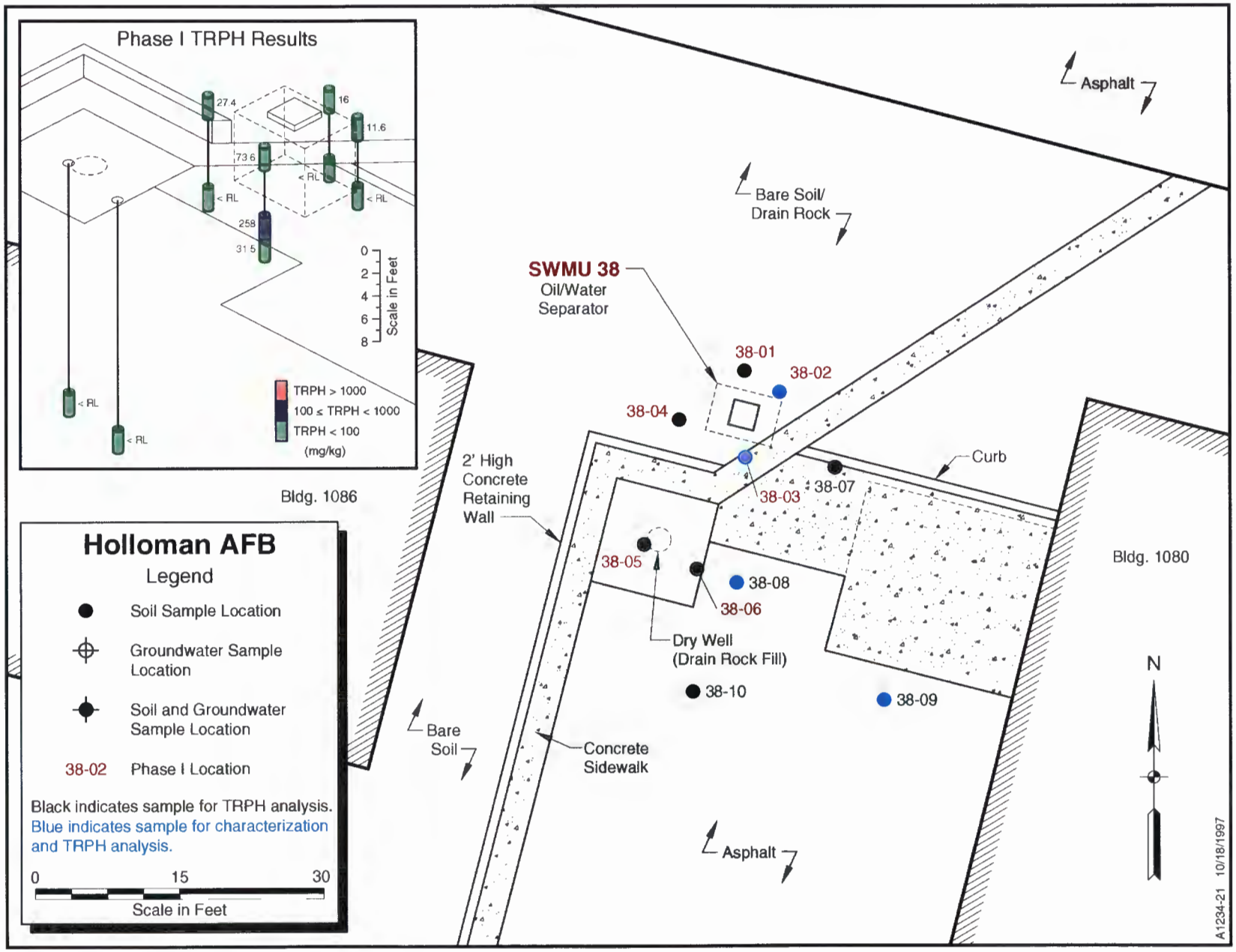

Figure 5.13-1. SWMU 38 - Building 1080A O/WS Sample Locations and Phase I TRPH Results

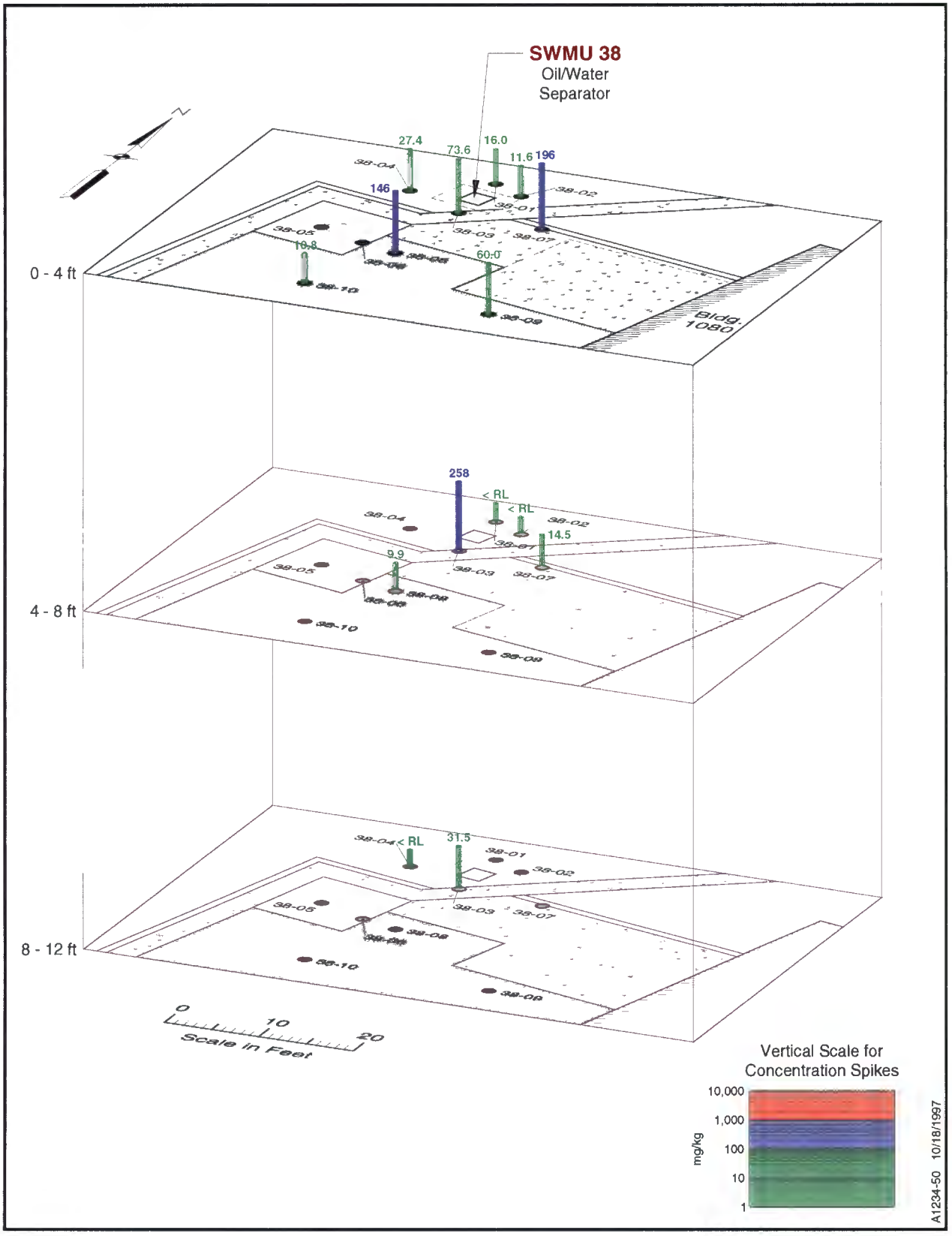

Figure 5.13-2. SWMU 38 - TRPH Concentrations by Depth Interval

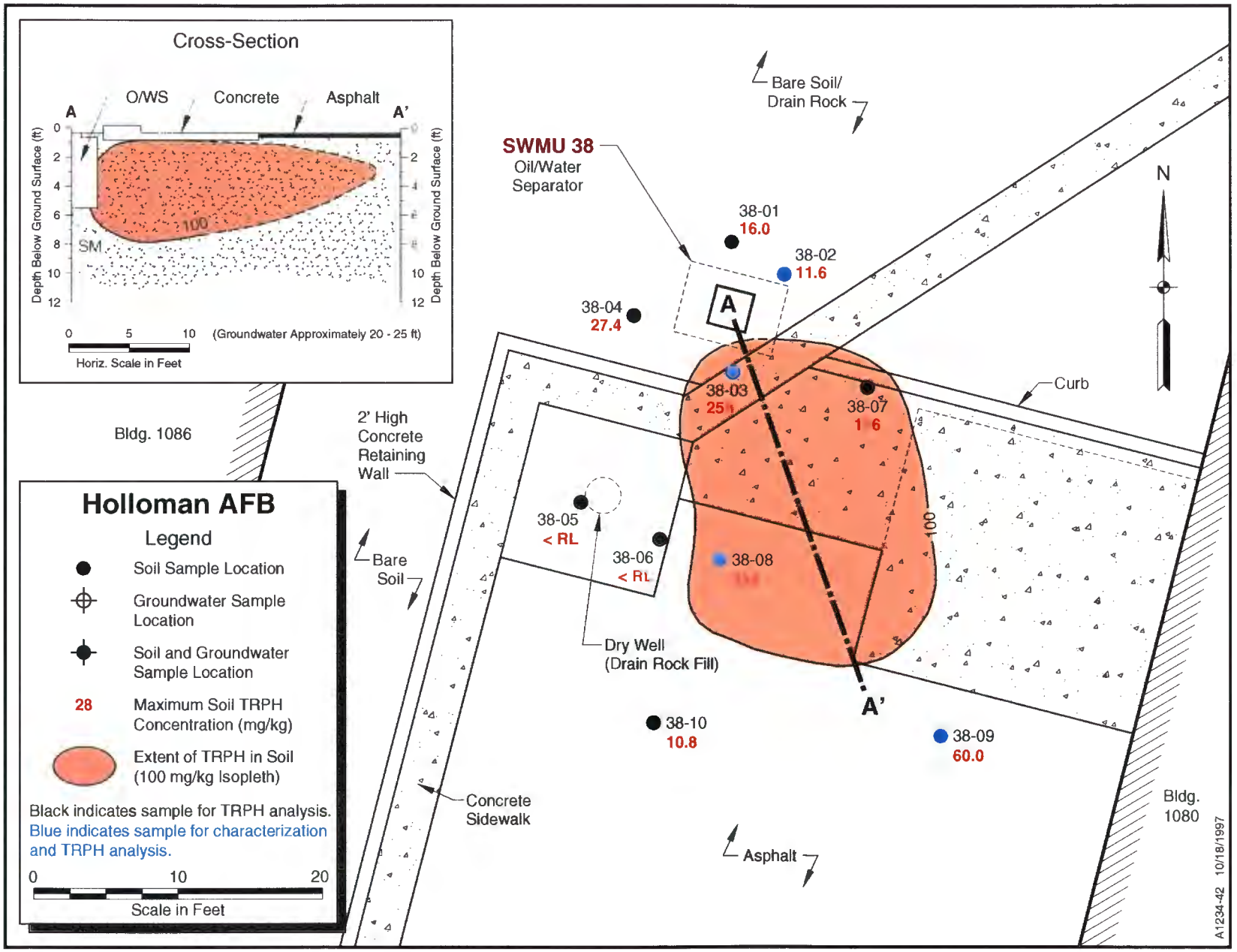

Figure 5.13-3. SWMU 38 - Maximum TRPH Concentrations and Extent of Elevated TRPH Results

Table 5.13-1
TRPH Results for Soil at SWMU 38

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
38-01	0	2	16	38-06	20	22	< RL
	6	8	< RL	38-07	0	2	196
38-02	0	2	11.6		6	8	14.5
	6	8	< RL	38-08	0	2	146/358 (235)
38-03	0	2	73.6		6	8	9.9 (< RL)
	6	8	258	38-09	0	2	6.9 (39.2)
	8	10	31.5		2	4	60
38-04	0	2	27.4 (< RL)	38-10	0	2	6.9
	8	10	< RL		2	4	10.8
38-05	20	22	< RL/< RL				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit (field laboratory = 5 mg/kg, fixed laboratory ≈ 30 mg/kg).
( ) = Result from fixed analytical laboratory.

Table 5.13-2
Summary Analytical Results for Soil at SWMU 38

Location ID		38-02		38-03		38-03		38-08		38-08		38-09	
Beg. Depth - End Depth (ft)		0-2		0-2		6-8		0-2		6-8		0-2	
SW6010 (mg/kg)	Barium	25.4	(1.23)	115	(1.29)	34.2	(1.22)	26.6	(1.23)	24.8	(1.27)	20.8	(1.16)
	Beryllium	< RL	(0.246)	< RL	(0.259)	< RL	(0.244)	< RL	(0.246)	< RL	(0.255)	< RL	(0.232)
	Cadmium	< RL	(0.616)	2.54	(0.647)	< RL	(0.61)	< RL	(0.614)	< RL	(0.637)	< RL	(0.58)
	Chromium	3.16	(1.23)	31.2	(1.29)	6.97	(1.22)	2.6	(1.23)	3.04	(1.27)	2.69	(1.16)
	Cobalt	1.24	(1.23)	1.5	(1.29)	2.2	(1.22)	< RL	(1.23)	< RL	(1.27)	1.34	(1.16)
	Copper	< RL	(2.46)	13.8	(2.59)	7.88	(2.44)	< RL	(2.46)	< RL	(2.55)	< RL	(2.32)
	Silver	< RL	(1.23)	< RL	(1.29)	< RL	(1.22)	< RL	(1.23)	< RL	(1.27)	< RL	(1.16)
	Vanadium	6.53	(2.46)	9.12	(2.59)	6.97	(2.44)	5.81	(2.46)	6.09	(2.55)	6.61	(2.32)
	Zinc	11.4	(1.23)	114	(2.59)	24.4	(2.44)	9.05	(2.46)	8.58	(2.55)	7.83	(2.32)
SW7041 (mg/kg)	Antimony	< RL	(0.616)	< RL	(0.647)	< RL	(0.61)	< RL	(0.614)	< RL	(0.637)	< RL	(0.58)
SW7060 (mg/kg)	Arsenic	< RL	(0.616)	1.16	(0.647)	1.09	(0.61)	1.04	(0.614)	1.04	(0.637)	0.731	(0.58)
SW7421 (mg/kg)	Lead	3.18	(0.616)	124	(0.647)	3.88	(0.61)	1.89	(0.614)	1.49	(0.637)	1.19	(0.58)
SW7471 (mg/kg)	Mercury	< RL	(0.0246)	0.0517	(0.0259)	0.0317	(0.0244)	< RL	(0.0246)	< RL	(0.0255)	< RL	(0.0232)
SW7740 (mg/kg)	Selenium	< RL	(0.616)	< RL	(0.647)	< RL	(0.61)	< RL	(0.614)	< RL	(0.637)	< RL	(0.58)
SW7841 (mg/kg)	Thallium	< RL	(0.616)	< RL	(0.647)	< RL	(0.61)	< RL	(0.614)	< RL	(0.637)	< RL	(0.58)
SW8260 (µg/kg)	2-Butanone	ND	(123)	ND	(129)	ND	(122)	< RL	(123)	< RL	(127)	ND	(116)
	Acetone	148	(123)	< RL	(129)	1270	(122)	< RL	(123)	3310	(127)	306	(116)
	Ethyl benzene	ND	(6.16)	ND	(6.47)	ND	(6.1)	ND	(6.14)	ND	(6.37)	< RL	(5.8)
	Methylene chloride	39.6	(24.6)	35.2	(25.9)	29.4	(24.4)	35.2	(24.6)	47.6	(25.5)	< RL	(23.2)
	Toluene	< RL	(6.16)	ND	(6.47)	7.69	(6.1)	< RL	(6.14)	ND	(6.37)	ND	(5.8)
	Total xylenes	ND	(6.16)	ND	(6.47)	ND	(6.1)	ND	(6.14)	ND	(6.37)	5.92	(5.8)
	Vinyl acetate	ND	(61.6)	ND	(64.7)	ND	(61)	ND	(61.4)	< RL	(63.7)	ND	(23.2)
	cis-1,2-Dichloroethene	ND	(6.16)	< RL	(6.47)	ND	(6.1)	ND	(6.14)	ND	(6.37)	ND	(5.8)
SW8270 (mg/kg)	Chrysene	ND	(0.406)	10.6	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	< RL	(0.383)
	Diethylphthalate	ND	(0.406)	ND	(2.13)	ND	(0.403)	< RL	(0.405)	< RL	(0.42)	0.636	(0.383)
	Fluoranthene	ND	(0.406)	10.2	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	< RL	(0.383)
	Phenanthrene	ND	(0.406)	< RL	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	ND	(0.383)

Table 5.13-2
(Continued)

Location ID		38-02		38-03		38-03		38-08		38-08		38-09	
Beg. Depth - End Depth (ft)		0-2		0-2		6-8		0-2		6-8		0-2	
SW8270 (mg/kg) (Continued)	Pyrene	ND	(0.406)	8.43	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	< RL	(0.383)
	Benzo(a)anthracene	ND	(0.406)	6.49	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	< RL	(0.383)
	Benzo(a)pyrene	ND	(0.406)	4.85	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	< RL	(0.383)
	Benzo(b)fluoranthene	ND	(0.406)	8.69	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	< RL	(0.383)
	Benzo(k)fluoranthene	ND	(0.406)	2.2	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	ND	(0.383)
	bis(2-Ethylhexyl)phthalate	ND	(0.406)	14.5	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	ND	(0.383)
	di-n-Butylphthalate	< RL	(0.406)	ND	(2.13)	< RL	(0.403)	< RL	(0.405)	< RL	(0.42)	ND	(0.383)
	Indeno(1,2,3-cd)pyrene	ND	(0.406)	ND	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	< RL	(0.383)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Table 5.13-3
Analytical Results for Chemicals of Concern for Soil at SWMU 38[a]

Location ID			38-02		38-03		38-03		38-05		38-05		38-01	
Beg. Depth - End Depth (ft)			0-2		0-2		6-8		0-2		6-8		0-2	
SW8270 (mg/kg)	Benzo(a)anthracene	[8.75E-01][b]	ND	(0.406)	6.49	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	0.0421 J	(0.383)
	Benzo(a)pyrene	[8.75E-02]	ND	(0.406)	4.85	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	0.0574 J	(0.383)
	Benzo(b)fluoranthene	[8.75E-01]	ND	(0.406)	8.69	(2.13)	ND	(0.403)	ND	(0.405)	ND	(0.42)	0.0804 J	(0.383)

Note—This table presents the analytical results used in the risk-based screen and risk assessment. The J-flag data are estimated concentrations, since the result is below the reporting limit.
J = Result is less than the reporting limit.
ND = Analyte not detected. No instrument response.
( ) = Reporting limit.

[a] Shading highlights results greater than the EPA Region III RBC used in the risk-based screen.
[b] [RBC] = EPA Region III residential risk-based concentrations.

5.14 SWMU 41—Building 1266 O/WS

SWMU 41 services vehicle maintenance operations and the washrack at Building 1266. It operated as an O/WS from 1987 until 1994 when it was replaced with a new O/WS and converted into a sediment trap. The O/WS has had historic problems with sediment buildup.

To identify whether a release from the unit had occurred, SWMU 41 was investigated under the Table 3 RFI. During Phase I of the RFI, two surface soil samples collected from the area immediately adjacent to the SWMU were shown to have TRPH concentrations above the release criterion of 100 mg/kg and above the Base-specific cleanup level of 1000 mg/kg; therefore, it was determined that a surface release had occurred.

Phase II sampling was conducted to define the nature and extent of the release in the soil. No TRPH concentrations above the 100-mg/kg release criterion were detected in the Phase II soil samples. No COCs were identified from the risk-based screen. CNFA is recommended for this site with the condition of NFA being the remediation of TRPH-contaminated soil.

5.14.1 SWMU Description

Unit Type: Two-chamber O/WS with separate oil tank (tank removed in 1994)

Period of Operation: January 1987 to present

Current Status: Active

Disposition of Unit: Continued use as a sediment trap

Source of Waste: Building 1266 and washrack

Major Operations: Vehicle maintenance and washing vehicles

Construction Material: Steel

Physical Condition: History of overflow problems for the washrack; clogging problems for O/WS

Oil/Total Capacity: 200 gal. (tank)/200 gal.

Historic Releases: Historic overflow from washrack and O/WS reported by personnel at site

5.14.2 SWMU Investigation and Results

Geology and Hydrogeology

DPT boring logs indicate a relatively uniform near-surface lithology of silty sand and sandy silt. Groundwater was not encountered; however, on the basis of results of previous investigations at nearby sites (i.e., IRP site OT-35), it is estimated to be approximately 25 to 30 ft bgl. Details of the site geology can be seen in the DPT boring logs (Appendix F).

Phase I Investigation

As shown in Figure 5.14-1, samples were collected from four locations during Phase I for analysis of TRPH by EPA 418.1M. At each location, samples were collected from the surface and from near the bottom of the separator. At locations 41-03 and 41-04, samples were also collected from intermediate depths to define vertical extent further. Figure 5.14-1 shows the sampling horizons and the associated TRPH results.

TRPH concentrations at all four Phase I sampling locations were detected above the 100-mg/kg release criterion, and therefore, it was determined that a release had occurred from the SWMU. Samples collected from the 0.5- to 2-ft interval at locations 41-01 and 41-04 were also detected above the 1000-mg/kg cleanup level. Given the higher TRPH concentrations between 0.5 and 2 ft bgl, the release pathway at the separator was likely an overflow at the surface. This interpretation is supported by reports that SWMU 41 has historically had problems with sediment buildup. A Phase II investigation was initiated from these results.

Phase II Investigation

Extent—The extent of the release was investigated in Phase II using the iterative stepout

approach described in the work plan. The Phase II sampling locations are shown in Figure 5.14-1. The magnitude of TRPH results at each horizon is shown in Figure 5.14-2. As shown by the Phase I results, the highest concentrations of TRPH are located near the surface to 2 ft and extend to the south of the O/WS. All field TRPH results are provided in Table 5.14-1.

Using the maximum detected TRPH result at each boring, a contour map was developed to illustrate the areal extent of TRPH values above the 100-mg/kg release criterion (Figure 5.14-3).

Nature—To characterize the nature of the release, eight samples were submitted for fixed laboratory analysis by EPA 418.1, SW8260, SW8270, and RCRA metals. All detected results are listed in Table 5.14-2. The data indicate that acetone, ethyl benzene, toluene, xylenes, and di-n-butylphthalate are present at low levels at location 41-04. This correlates well with the Phase I sampling results, which show TRPH concentrations to be highest at location 41-04.

Groundwater—Because the depth to groundwater is approximately 25 to 30 ft and substantially below the depth at which any elevated TRPH concentrations were detected, groundwater was not sampled at SWMU 41.

5.14.3 Risk-Based Screen Results

The risk-based screen indicated that none of the COPCs exceeded the screening criteria for this SWMU. These results are contained in Appendix C. On the basis of the screen results, there is no risk to human health from the release at SWMU 41.

5.14.4 Conclusions

The results from Phase I/II investigation at SWMU 41 indicate that a surface release has likely occurred at this site. Some TRPH concentrations are above the 1000-mg/kg Base-specific cleanup level in samples collected from the 0- to 2-ft interval. Approximately 3.4 cubic yards will require remediation. The Phase II investigation showed the extent of the release is confined to the shallow soil in the area immediately adjacent to the SWMU. The nature of the release was characterized by laboratory analysis. From the risk-based screen, no constituents were found to pose risk to human health at SWMU 41.

5.14.5 Recommendations

SWMU 41 was recommended for CNFA. The condition of NFA was the remediation of TPH-contaminated soil. SWMU 41 was removed as part of Holloman AFB's Phase 2 Basewide POL project. No soil with TPH in excess of 1000 mg/kg was detected during the removal of SWMU 41 and therefore no soil required offsite disposal. Confirmation samples ranged from 72 mg/kg to 320 mg/kg. Further details can be found in the *Final Closure Report for Phase II Remediation of (POL) Contaminated Sites And O/WS And WOT Removals, Holloman Air Force Base, New Mexico, July 1997*. SWMU 41 was approved for NFA by NMED in September 1997. Therefore SWMU 41 is recommended for NFA.

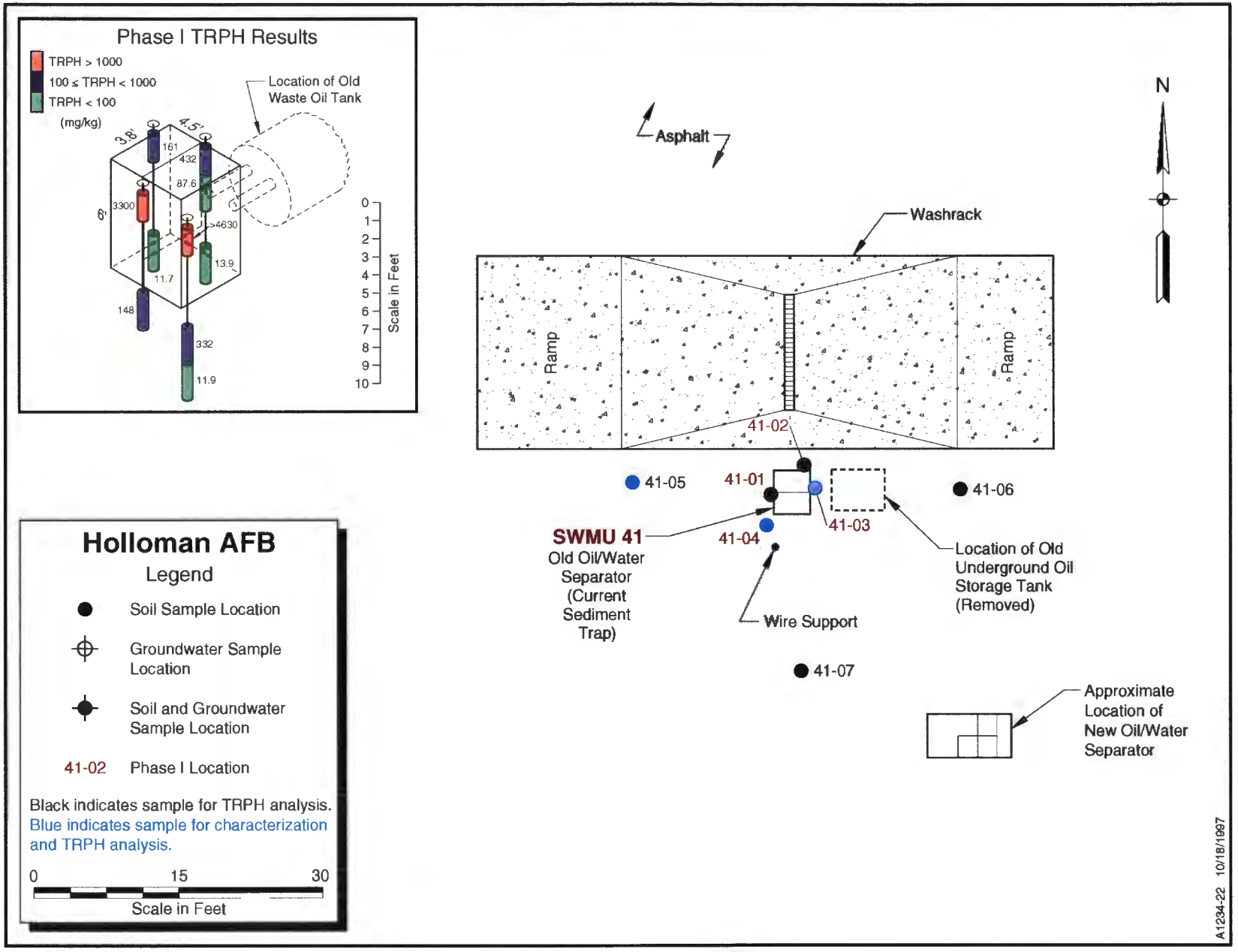

Figure 5.14-1. SWMU 41 - Building 1266 O/WS Sample Locations and Phase I TRPH Results

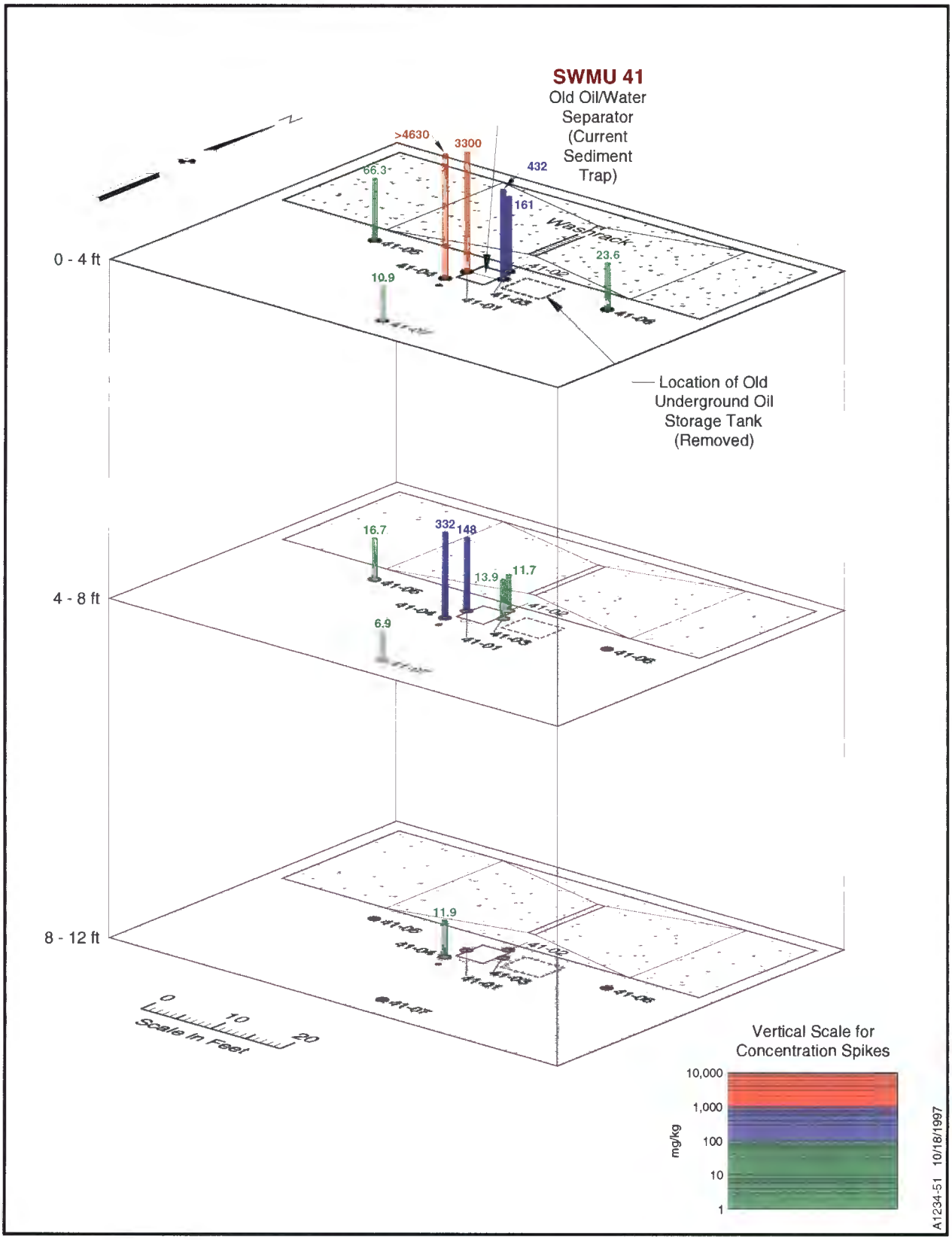

Figure 5.14-2. SWMU 41 - TRPH Concentrations by Depth Interval

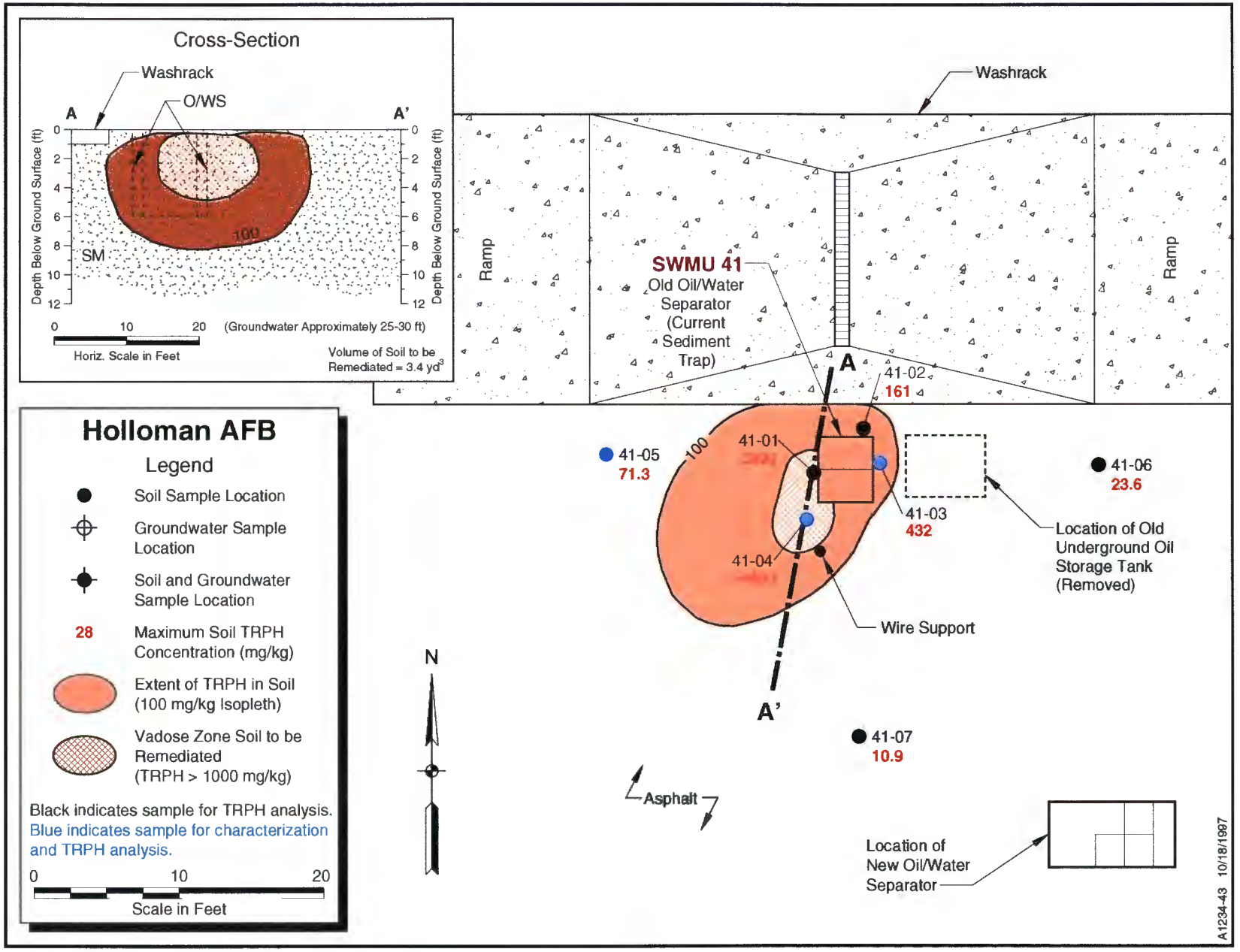

Figure 5.14-3. SWMU 41 - Maximum TRPH Concentrations and Vadose Zone Soil to be Remediated

Table 5.14-1
TRPH Results for Soil at SWMU 41

Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)	Location	Depth (ft) Top	Depth (ft) Bottom	TRPH (mg/kg)
41-01	0.5	2	3300	41-05	0	2	66.3/71.3 (71/74.9)
	6	8	148 (81.6)		6	8	16.7
41-02	0.5	2	161	41-06	0	2	17.7
	6	8	11.7		2	4	23.6
41-03	0.5	2	432	41-07	0	2	10.9
	2	4	87.6		6	8	6.9
	6	8	13.9				
41-04	0.5	2	> 4630				
	6	8	332/115				
	8	10	11.9 (< RL)				

Note—Normal and duplicate results are separated by a "/".
RL = Reporting limit, ≈ 30 mg/kg.
( ) = Result from fixed analytical laboratory.
> = Result greater than value. Additional dilutions not performed.

Table 5.14-2
Summary Analytical Results for Soil at SWMU 41

Location ID		41-03		41-04		41-04		41-05	
Beg. Depth - End Depth (ft)		0-2		0-2		8-10		0-2	
SW6010 (mg/kg)	Barium	16.9	(1.28)	17.6	(1.34)	56.7	(1.26)	27	(1.26)
	Beryllium	< RL	(0.256)	< RL	(0.269)	< RL	(0.253)	< RL	(0.252)
	Cadmium	< RL	(0.64)	< RL	(0.672)	< RL	(0.633)	< RL	(0.631)
	Chromium	1.92	(1.28)	1.9	(1.34)	4.75	(1.26)	< RL	(1.26)
	Cobalt	< RL	(1.28)	< RL	(1.34)	< RL	(1.26)	< RL	(1.26)
	Copper	< RL	(2.56)	< RL	(2.69)	< RL	(2.53)	2.7	(2.52)
	Silver	< RL	(1.28)	< RL	(1.34)	< RL	(1.26)	< RL	(1.26)
	Vanadium	3.79	(2.56)	4.34	(2.69)	7.06	(2.53)	4.75	(2.52)
	Zinc	5.68	(2.56)	7.43	(2.69)	11.2	(2.53)	10.1	(2.52)
SW7041 (mg/kg)	Antimony	< RL	(0.64)	< RL	(0.672)	< RL	(0.633)	< RL	(0.631)
SW7060 (mg/kg)	Arsenic	< RL	(0.64)	< RL	(0.672)	< RL	(0.633)	0.922	(0.631)
SW7421 (mg/kg)	Lead	1.19	(0.64)	1.69	(0.672)	2.78	(0.633)	3.38	(0.631)
SW7740 (mg/kg)	Selenium	< RL	(0.64)	< RL	(0.672)	< RL	(0.633)	< RL	(0.631)
SW7841 (mg/kg)	Thallium	< RL	(0.64)	< RL	(0.672)	< RL	(0.633)	< RL	(0.631)
SW8260 (µg/kg)	2-Butanone	ND	(128)	< RL	(134)	< RL	(126)	ND	(126)
	Acetone	< RL	(128)	290	(134)	239	(126)	< RL	(126)
	Ethyl benzene	ND	(6.4)	9.68	(6.72)	ND	(6.33)	ND	(6.31)
	Methylene chloride	38.8	(25.6)	< RL	(26.9)	< RL	(25.3)	< RL	(25.2)
	Toluene	ND	(6.4)	8.33	(6.72)	ND	(6.33)	< RL	(6.31)
	Total xylenes	ND	(6.4)	16.8	(6.72)	ND	(6.33)	ND	(6.31)
SW8270 (mg/kg)	Butylbenzylphthalate	ND	(0.422)	< RL	(0.444)	ND	(0.418)	ND	(0.417)
	bis(2-Ethylhexyl)phthalate	< RL	(0.422)	ND	(0.444)	< RL	(0.418)	ND	(0.417)
	di-n-Butylphthalate	3.84	(0.422)	1.34	(0.444)	1.91	(0.418)	1.67	(0.417)

Note—SW8260 results are in µg/kg (ppb); metals and SW8270 results are in mg/kg (ppm).
ND = Analyte not detected. No instrument response.
< RL = Result not detected at the reporting limit.
( ) = Reporting limit.

Section 6
SWMU 231 INVESTIGATION RESULTS

SWMU 231, the Incinerator/Landfill, consists of an inactive incinerator used to dispose of unconventional fuels and five waste areas, northwest of the incinerator, where waste (i.e., empty drums, stainless steel piping) was buried. SWMU 231 is also identified as IRP Site LF-58.

To determine whether a release had occurred at SWMU 231, a preliminary assessment and site investigation was conducted in 1993. Soil samples were collected from the area near the incinerator and an electromagnetic survey was conducted to identify potential locations of buried waste. The presence of unconventional fuel constituents were detected in the shallow soil. Five areas of buried waste (Waste Area A through E) were identified.

To delineate the nature and extent of the shallow soil contamination, determine whether a release to soil had occurred at the five waste areas, and determine whether a release to groundwater had occurred, a Phase II RFI was conducted in 1994.

The Phase II RFI determined that the extent of unconventional fuel contamination is limited to the discontinuous, shallow (< 2 ft) purple-stained areas near the inactive incinerator at SWMU 231. Unconventional fuel constituents were also detected within and directly below Waste Area D. Elevated metal concentrations were detected at these locations, as well. Unconventional fuel constituents were not detected in the groundwater beneath the site; however, tetrachloroethene was detected at low concentrations in a monitor well located downgradient of Waste Area B.

The quantitative risk assessment concluded that the site does not pose a threat to human health. The assessment concluded that the site may pose a potential risk to the environment. The potential risk is driven by the ingestion of aluminum by the black-tailed jackrabbit. NFA is recommended for SWMU 231.

6.1 Introduction

SWMU 231 is listed on Table 3 of Holloman AFB's HSWA permit as the Incinerator/ Landfill. Because the IRP began prior to RCRA corrective actions at Holloman AFB, the site was initially identified and investigated under the IRP as LF-58 in 1993. Section 1 of this report discusses of the IRP and RCRA programs at Holloman AFB. Holloman AFB has integrated the two programs to reduce duplicating efforts. This approach has been endorsed by both U.S. EPA Region VI and the New Mexico Environment Department. Therefore, since the site was identified after the HSWA permit was issued, a permit modification request to include IRP LF-58 on Table 3 of the permit was submitted to EPA Region VI in 1993.

The initial investigation at the site in 1993 consisted of a preliminary assessment and site investigation which also served as the Phase I of the RFI. The results of the PA/SI were presented in the *Preliminary Assessment and Site Investigation Report—Investigation of Four Waste Sites, Holloman AFB, NM* (Radian, 1993). The results of the PA/SI indicated that unconventional fuel constituents (aniline, tetrahydrofuran, and unidentified dimethylanilines) were present in the shallow soils. The PA/SI also identified five areas containing buried waste. The site was recommended for further action to define the nature and extent of shallow soil contamination in

the vicinity of the incinerator, determine the presence or absence of soil contamination in the five waste areas, and determine if there has been a release to groundwater. EPA Region VI reviewed the report and concurred with the site recommendations.

To implement the site recommendations, a Phase II RFI was conducted following the approved *Table 3 RFI Work Plan*. This work plan provided technical guidelines to conduct the field investigation and included procedures for the execution of field tasks, health and safety procedures, criteria for data collection, quality assurance/quality control procedures, and requirements for laboratory analysis.

Because the nature of the field activities required to implement Phase II at SWMU 231 were similar to field activities required for the Table 1 Phase II RFI, SWMU 231 was included in that field investigation conducted between October and December of 1994. However, the results are contained in this report.

6.2 Data Quality Objectives and Evaluation Criteria

The objective of the Phase II RFI was to collect the necessary data to determine the nature and extent of shallow soil contamination near the incinerator, determine the presence or absence of contamination at each waste area, and to determine if a release to groundwater had occurred.

An additional objective of the Phase II RFI was to assess the potential risk to human health and the environment.

To meet these objectives, soil and groundwater samples were collected at SWMU 231 during the Table 1 Phase II field investigation and were analyzed in a fixed laboratory.

Following the field investigation, a QA/QC review of the analytical data indicated that the data are acceptable and defensible. The QA/QC review was presented in the *Table 1 Phase II RFI SQCSR* (Radian, 1995b).

6.2.1 Data Evaluation Criteria

Analytical reporting limits were used to define the extent of contamination for organic compounds. Background upper tolerance limits (UTLs), presented in Appendix B, were used to define the extent of contamination for inorganic compounds. Using these criteria, complete delineation of all elevated levels of constituents was ensured.

6.2.2 Quantitative Risk Assessment

A risk assessment was conducted for SWMU 231 to determine if the site poses a risk to human health or the environment. Exposure pathways and receptors were identified; chemicals of potential concern were selected; and a toxicity assessment was conducted for each chemical of concern. The determination of COPCs is discussed in Appendix B.

6.3 SWMU Description

SWMU 231 is located on a dirt road east of De Zonia Road and several hundred yards west of the Former Unconventional Fuels Storage Area (the current Base equestrian facility). This site consists of an inactive incinerator and surrounding area. An unvegetated area surrounds the incinerator and extends to the north. Five areas of disturbed soils and debris (Waste Areas A through E) are located northwest of the incinerator. The topography of the site is relatively flat. Figure 1-1 shows the location of SWMU 231 at Holloman AFB, and Figure 6-1 shows the layout of the site.

The incinerator, which was operated from 1955 to 1960, is a small (10-ft square) brick structure with a metal roof, a burner, and a 30- to 40-ft-tall stack. The incinerator was used to

dispose of unconventional fuels, including aniline, xylidine, and furfuryl alcohol. These fuels were reportedly transported to the site in tank trucks that parked north of the incinerator at a stainless steel fill pipe which fed a buried line running to the incinerator. Fuel was pumped from the trucks to the incinerator via this line. Approximately 100 ft southwest of the incinerator is another fill line presumably for conventional fuels used to start the burner. The burner was lit using conventional fuel, then a valve was opened exposing the unconventional fuel to the flame. The five areas of disturbed soils were presumably used to dispose of empty drums, stainless steel piping, and other materials used in the transport, storage, and handling of unconventional fuels.

Geology and Hydrogeology

The geology and hydrogeology at SWMU 231 were defined during the Table 1 Phase II RFI. The site lithology consists primarily of silty and clayey sands. Groundwater occurs in silty sands at approximately 30 ft bgl, and flows west to northwest. Details of the geology at SWMU 231 are presented in Appendix F.

An aquifer test was conducted on each of the four monitor wells installed at SWMU 231 to determine the hydraulic conductivity of the aquifer. Using the data gathered during the tests, hydraulic conductivities were calculated using the Bouwer and Rice method (1976). The hydraulic conductivities ranged from 1.1×10^{-7} to 1.7×10^{-6} cm/sec, which is slightly lower than typical values for silty and clayey sands. Logarithmic plots of the results are presented in Appendix F.

6.4 Preliminary Assessment/Site Investigation

A PA/SI was conducted under the IRP for LF-58 in 1993. Several areas of purple-stained soil were noted near the incinerator during the initial site visit. Although the source of this staining is unknown, it may be the result of unconventional fuels that were spilled while unloading tank trucks.

During the PA/SI, three soil borings were drilled near the inactive incinerator. Elevated aniline and metals concentrations were detected in the shallow samples (0 to 2 ft), but were absent in soil samples collected from 20 to 22 and 25 to 27 ft bgl. Sample locations are shown in Figure 6-1.

Two electromagnetic (EM) surveys were conducted at the site to identify locations of buried waste and guide subsequent waste excavation and characterization activities. One survey was conducted across the entire site; a smaller EM survey was conducted in the area of the suspected landfill. Exploratory pits were dug in locations where electromagnetic anomalies were detected. Buried waste was only found in five distinct waste areas. The locations of the five wastes areas (A through E) are shown in Figure 6-1. The size and contents of each waste area are described in Table 6-1.

The results of the PA/SI are presented in the *Preliminary Assessment and Site Investigation Report—Investigation of Four Waste Sites* (Radian, 1993). The report recommended further investigation to:

- Determine the nature and extent of affected soil in the incinerator area;
- Determine whether there is contamination associated with the waste areas; and
- Determine if a release to groundwater has occurred from past site activities.

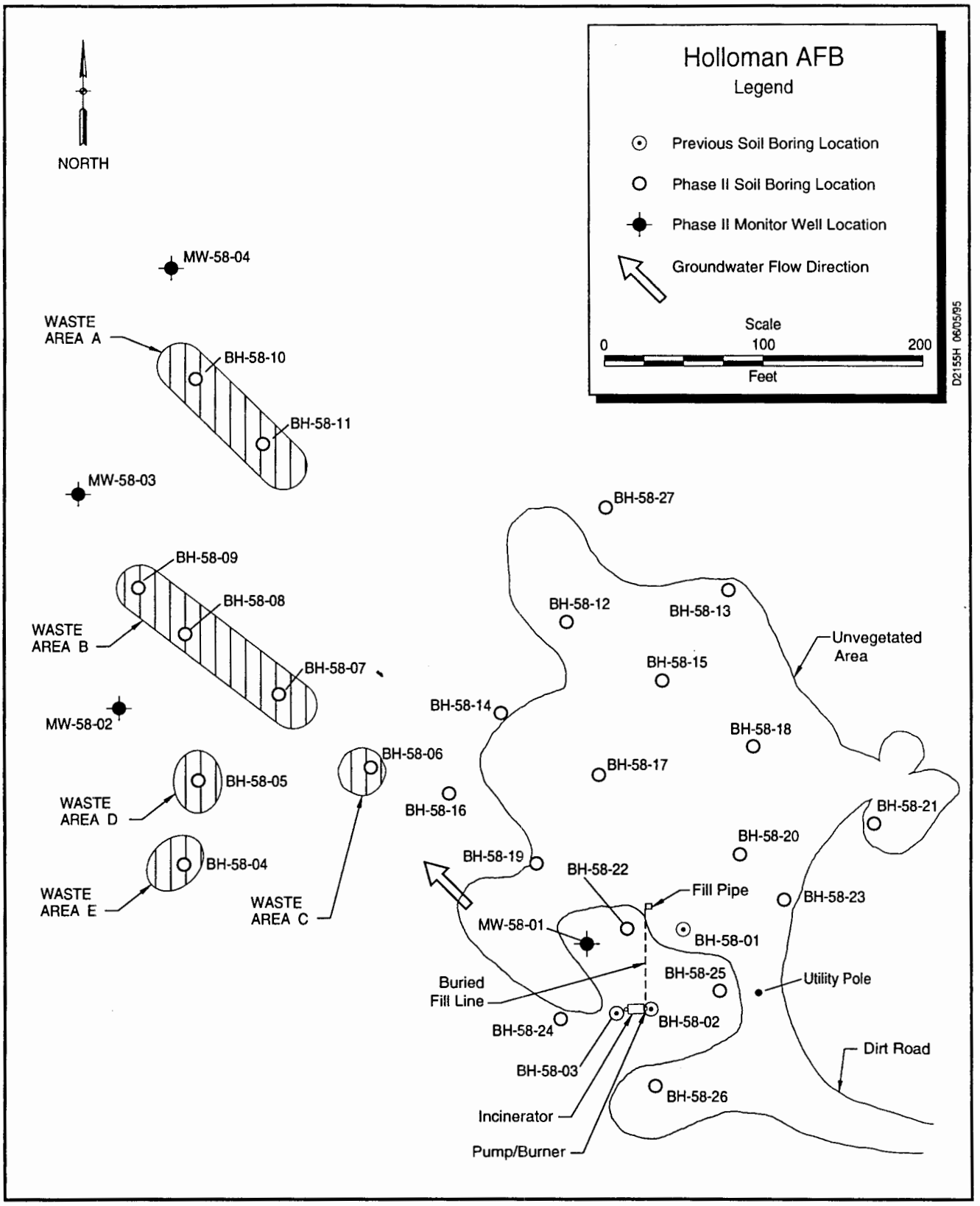

Figure 6-1. SWMU 231 - Soil and Groundwater Sample Locations

Table 6-1
Description of Waste Areas

Waste Area	Waste Area Dimensions (ft)	Contents
A	120 x 30 x 5	Highly deteriorated, rusted drums and other debris. Samples of yellow- and pink-stained soils, soil that looked burned, and friable green crystalline materials were collected for HazCat analysis. All had a neutral pH and were nonoxidizing and nonflammable.
B	150 x 30 x 4	Empty aluminum drums, approximately 55 gal. in capacity and in good condition, with "Acid, Nitric, White, Fuming" or "Acid, Nitric, Red, Fuming" stenciled on the side. The pH of wipe samples from the drums was 7, so the drums appear to have been rinsed out prior to burial.
C	30 x 30 x 4	Metallic debris.
D	50 x 30 x 5	Deteriorated rusted drums. A sample of purple soil found in the pit was collected for HazCat analysis. The sample had a pH of 7 and was nonoxidizing and nonflammable.
E	50 x 30 x 10	Deteriorated, rusted drums and a corrugated metal pipe.

6.5 Phase II RFI

The Phase II RFI was conducted in 1994 at SWMU 231 to further investigate the site and to assess the potential for risk to human health and the environment.

Incinerator Area—To determine horizontal and vertical extent of shallow soil contamination in the area surrounding the incinerator, 16 soil borings were drilled to a depth of 6 ft bgl. The soil borings were located in a grid that covered the entire unvegetated area in the vicinity of the incinerator. Soil samples were collected from the 0- to 0.25-ft interval in nine soil borings (for risk assessment purposes), and from the 0- to 2-ft interval in seven soil borings. Soil samples were collected from the 4- to 6-ft interval in 12 soil borings drilled within the unvegetated area. Soil sample locations are shown in Figure 6-1.

To determine the nature of contamination, all soil samples collected from the incinerator area were analyzed for unconventional fuels (primarily aniline, dimethylanilines, furfuryl alcohol, and tetrahydrofuran). The samples from the 0- to 2-ft interval were analyzed for metals, as well.

Waste Areas—To determine if a release had occurred in the five waste areas, eight soil borings were drilled within the waste areas. To characterize the disturbed soils within each waste area, soil samples were collected and composited from the interval beginning 4 ft above the bottom of the waste area and extending to the bottom of the waste area. Soil samples were also collected directly below each waste area and just above the water table to determine if a release had occurred beneath the waste areas. Soil sample locations are shown in Figure 6-1.

To determine the nature of contamination, soil samples collected from the waste area were analyzed for semivolatile organic compounds, unconventional fuels (primarily aniline, dimethylanilines, furfuryl alcohol, and tetrahydrafuran), and metals.

Groundwater—To determine if a release to groundwater had occurred from past site activities, four monitor wells were installed. One monitor well was installed downgradient of the incinerator, and three wells were installed downgradient of the waste areas. Each well was developed and sampled. Development logs, photos, and groundwater sampling forms are presented in Appendix F. The monitor well locations are shown in Figure 6-1.

To determine the nature of contamination, groundwater samples were analyzed for volatile organic compounds, SVOCs, metals, and unconventional fuels (primarily aniline, dimethylanilines, furfuryl alcohol, and tetrahydrofuran).

Analytical Results

Soil samples collected at SWMU 231 were analyzed for metals using EPA Methods SW6010, SW7041 SW7060, SW7421, and SW7740, and for SVOCs using EPA Method SW8270. Soil samples were also analyzed for unconventional fuels using laboratory-specific SOP-427.

Groundwater samples collected at SWMU 231 were analyzed for metals using EPA Methods SW6010, SW7041, SW7060, SW7421, SW7740, for VOCs using EPA Method SW8240, and for SVOCs using EPA Method SW8270. Groundwater samples were also analyzed for unconventional fuels using laboratory-specific SOP-427.

The analytical results for the incinerator area soils, waste area soils, and groundwater samples are presented in Tables 6-2, 6-3, and 6-4, respectively.

Incinerator Area Soils—Soil borings were drilled on a grid pattern that encompassed the area surrounding the incinerator. The grid pattern was used to ensure that representative samples were collected across the site to adequately define the horizontal extent of affected soils. Several areas of purple-stained soil were noted during field activities. Aniline (18.6 µg/kg), dimethylanilines (ranging from 100 to 4690 µg/kg) and furfuryl alcohol (428 µg/kg) were detected in the 0- to 2-ft sample from soil boring BH-58-20 where purple-stained soils were encountered from 0 to approximately 1 ft bgl. The sample collected from the 4- to 6-ft interval of this soil boring was unstained and did not contain these compounds in detectable concentrations. Unconventional fuels were not detected in the other soil borings which indicates that unconventional fuels contamination is limited to shallow (less than 1 ft bgl) soils in localized areas.

Metals were detected above their background UTLs in the 0- to 2-ft samples collected from soil borings BH-58-15, BH-58-20, and BH-58-21 drilled in the unvegetated area. The metals detected included aluminum, iron, manganese, potassium, and zinc which are not typical constituents of unconventional fuels. Only cobalt and copper were detected at or slightly above their background UTLs in the 0- to 2-ft samples collected from soil borings BH-58-14, BH-58-19, BH-58-24, and BH-58-25 drilled near the edges of the unvegetated area.

Waste Area A Soils—Soil borings BH-58-10 and BH-58-11 were drilled in Waste Area A. No unconventional fuels or SVOCs were detected. No metals concentrations exceeding background UTLs were measured in soil boring BH-58-10. Copper, iron, manganese, vanadium, and zinc were measured above their background UTLs in the 1- to 5-ft sample from soil boring BH-58-11, but not in the 5- to 7-ft sample.

Table 6-2
Analytical Results for Incinerator Area Soils

Location ID		BH-58-12	BH-58-12	BH-58-13	BH-58-14
Beginning Depth - End Depth (ft)		0-0.25	4-6	0-0.25	0-2
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,6-Dimethylaniline	ND (2)	ND (2)	ND (2)	ND (2)
	3,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	3,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	Aniline	ND (9)	ND (10)	ND (9)	ND (10)
	Furfuryl Alcohol	ND (10)	ND (10)	ND (10)	ND (10)
SW6010 (mg/kg)	Aluminum [8764]	NA	NA	NA	7850 (23.9)
	Barium [84.363]	NA	NA	NA	61.6 (2.4)
	Beryllium [0.400]	NA	NA	NA	< DL (0.48)
	Calcium [250,000]	NA	NA	NA	209,000 (47.8)
	Chromium [6.605]	NA	NA	NA	5.6 (2.4)
	Cobalt [2.485]	NA	NA	NA	< DL (2.4)
	Copper [4.844]	NA	NA	NA	6.1 (4.8)
	Iron [6362]	NA	NA	NA	6780 (23.9)
	Magnesium [14656]	NA	NA	NA	5520 (47.8)
	Manganese [146.910]	NA	NA	NA	135 (2.4)
	Nickel [5.612]	NA	NA	NA	< DL (9.6)
	Potassium [2501]	NA	NA	NA	2350 (1190)
	Silver [0.734]	NA	NA	NA	ND (2.4)
	Sodium [5000]	NA	NA	NA	ND (1190)
	Thallium [11.315]	NA	NA	NA	ND (2.4)
	Vanadium [15.460]	NA	NA	NA	13.8 (2.4)
	Zinc [20.246]	NA	NA	NA	18 (4.8)
SW7041 (mg/kg)	Antimony [0.253]	NA	NA	NA	< DL (1)
SW7060 (mg/kg)	Arsenic [6.883]	NA	NA	NA	1.7 (0.6)
SW7421 (mg/kg)	Lead [8.000]	NA	NA	NA	6.1 (6)
SW7740 (mg/kg)	Selenium [10.531]	NA	NA	NA	ND (2.4)

Table 6-2
(Continued)

Location ID		BH-58-14	BH-58-15	BH-58-15	BH-58-16
Beginning Depth - End Depth (ft)		4-6	0-2	4-6	0-0.25
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,6-Dimethylaniline	ND (2)	ND (2)	ND (2)	ND (2)
	3,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	3,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	Aniline	ND (10)	ND (10)	ND (10)	ND (10)
	Furfuryl Alcohol	ND (10)	ND (10)	ND (10)	ND (10)
SW6010 (mg/kg)	Aluminum [8764]	NA	13,700 (24.1)	NA	NA
	Barium [84.363]	NA	108 (2.4)	NA	NA
	Beryllium [0.400]	NA	0.95 (0.48)	NA	NA
	Calcium [250,000]	NA	132,000 (48.2)	NA	NA
	Chromium [6.605]	NA	11.1 (2.4)	NA	NA
	Cobalt [2.485]	NA	5.2 (2.4)	NA	NA
	Copper [4.844]	NA	11.1 (4.8)	NA	NA
	Iron [6362]	NA	12,500 (24.1)	NA	NA
	Magnesium [14656]	NA	12,300 (48.2)	NA	NA
	Manganese [146.910]	NA	317 (2.4)	NA	NA
	Nickel [5.612]	NA	9.7 (9.6)	NA	NA
	Potassium [2501]	NA	4370 (1200)	NA	NA
	Silver [0.734]	NA	ND (2.4)	NA	NA
	Sodium [5000]	NA	< DL (1200)	NA	NA
	Thallium [11.315]	NA	ND (2.4)	NA	NA
	Vanadium [15.460]	NA	15.2 (2.4)	NA	NA
	Zinc [20.246]	NA	40.1 (4.8)	NA	NA
SW7041 (mg/kg)	Antimony [0.253]	NA	< DL (1.2)	NA	NA
SW7060 (mg/kg)	Arsenic [6.883]	NA	2.3 (1.2)	NA	NA
SW7421 (mg/kg)	Lead [8.000]	NA	< DL (6)	NA	NA
SW7740 (mg/kg)	Selenium [10.531]	NA	< DL (0.6)	NA	NA

Table 6-2
(Continued)

Location ID		BH-58-17	BH-58-17	BH-58-18	BH-58-18
Beginning Depth - End Depth (ft)		0-0.25	4-6	0-0.25	4-6
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,6-Dimethylaniline	ND (2)	ND (2)	ND (2)	ND (2)
	3,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	3,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	Aniline	ND (10)	ND (10)	ND (9)	ND (10)
	Furfuryl Alcohol	ND (10)	ND (10)	ND (10)	ND (10)
SW6010 (mg/kg)	Aluminum [8764]	NA	NA	NA	NA
	Barium [84.363]	NA	NA	NA	NA
	Beryllium [0.400]	NA	NA	NA	NA
	Calcium [250,000]	NA	NA	NA	NA
	Chromium [6.605]	NA	NA	NA	NA
	Cobalt [2.485]	NA	NA	NA	NA
	Copper [4.844]	NA	NA	NA	NA
	Iron [6362]	NA	NA	NA	NA
	Magnesium [14656]	NA	NA	NA	NA
	Manganese [146.910]	NA	NA	NA	NA
	Nickel [5.612]	NA	NA	NA	NA
	Potassium [2501]	NA	NA	NA	NA
	Silver [0.734]	NA	NA	NA	NA
	Sodium [5000]	NA	NA	NA	NA
	Thallium [11.315]	NA	NA	NA	NA
	Vanadium [15.460]	NA	NA	NA	NA
	Zinc [20.246]	NA	NA	NA	NA
SW7041 (mg/kg)	Antimony [0.253]	NA	NA	NA	NA
SW7060 (mg/kg)	Arsenic [6.883]	NA	NA	NA	NA
SW7421 (mg/kg)	Lead [8.000]	NA	NA	NA	NA
SW7740 (mg/kg)	Selenium [10.531]	NA	NA	NA	NA

Table 6-2
(Continued)

Location ID		BH-58-19		BH-58-19		BH-58-20		BH-58-20	
Beginning Depth - End Depth (ft)		0-2		4-6		0-2		4-6	
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND	(5)	ND	(5)	4640	(5)	ND	(5)
	2,5-Dimethylaniline	ND	(5)	ND	(5)	4690	(5)	ND	(5)
	2,6-Dimethylaniline	ND	(2)	ND	(2)	110	(2)	ND	(2)
	3,4-Dimethylaniline	ND	(5)	ND	(5)	416	(5)	ND	(5)
	3,5-Dimethylaniline	ND	(5)	ND	(5)	628	(5)	ND	(5)
	Aniline	ND	(10)	ND	(10)	18.6	(9)	ND	(10)
	Furfuryl Alcohol	ND	(10)	ND	(10)	428	(10)	ND	(10)
SW6010 (mg/kg)	Aluminum [8764]	6410	(24.3)	NA		14,000	(10.6)	NA	
	Barium [84.363]	59	(2.4)	NA		103	(1.1)	NA	
	Beryllium [0.400]	0.41 J	(0.49)	NA		0.76	(0.21)	NA	
	Calcium [250,000]	192,000	(48.6)	NA		90,500	(21.2)	NA	
	Chromium [6.605]	4.5	(2.4)	NA		12	(1.1)	NA	
	Cobalt [2.485]	2.6	(2.4)	NA		5.6	(1.1)	NA	
	Copper [4.844]	5.3	(4.9)	NA		12.8	(2.1)	NA	
	Iron [6362]	5950	(24.3)	NA		13,200	(10.6)	NA	
	Magnesium [14656]	5100	(48.6)	NA		10,400	(21.2)	NA	
	Manganese [146.910]	138	(2.4)	NA		345	(1.1)	NA	
	Nickel [5.612]	< DL	(9.7)	NA		10.8	(4.2)	NA	
	Potassium [2501]	1910	(1210)	NA		4630	(1.1)	NA	
	Silver [0.734]	ND	(2.4)	NA		ND	(1.1)	NA	
	Sodium [5000]	< DL	(1210)	NA		< DL	(530)	NA	
	Thallium [11.315]	ND	(2.4)	NA		ND	(1.1)	NA	
	Vanadium [15.460]	7.5	(2.4)	NA		19	(1.1)	NA	
	Zinc [20.246]	19.3	(4.9)	NA		40.1	(2.1)	NA	
SW7041 (mg/kg)	Antimony [0.253]	ND	(1.2)	NA		ND	(1.1)	NA	
SW7060 (mg/kg)	Arsenic [6.883]	1.4	(1.2)	NA		1.1	(0.53)	NA	
SW7421 (mg/kg)	Lead [8.000]	< DL	(2.4)	NA		9.8 J	(10.6)	NA	
SW7740 (mg/kg)	Selenium [10.531]	ND	(1.2)	NA		ND	(0.53)	NA	

Table 6-2
(Continued)

Location ID		BH-58-21	BH-58-22	BH-58-22	BH-58-23
Beginning Depth - End Depth (ft)		0-2	0-0.25	4-6	0-0.25
SOP - 427 (µg/kg)	2,3/2,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,6-Dimethylaniline	ND (2)	ND (2)	ND (2)	ND (2)
	3,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	3,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	Aniline	ND (10)	ND (10)	ND (10)	ND (10)
	Furfuryl Alcohol	ND (10)	ND (10)	ND (10)	ND (10)
SW6010 (mg/kg)	Aluminum [8764]	9560 (23.1)	NA	NA	NA
	Barium [84.363]	84.7 (2.3)	NA	NA	NA
	Beryllium [0.400]	0.51 (0.46)	NA	NA	NA
	Calcium [250,000]	146,000 (46.1)	NA	NA	NA
	Chromium [6.605]	7 (2.3)	NA	NA	NA
	Cobalt [2.485]	3.6 (2.3)	NA	NA	NA
	Copper [4.844]	7.8 (4.6)	NA	NA	NA
	Iron [6362]	8860 (23.1)	NA	NA	NA
	Magnesium [14656]	8030 (46.1)	NA	NA	NA
	Manganese [146.910]	217 (2.3)	NA	NA	NA
	Nickel [5.612]	5.85 J (9.2)	NA	NA	NA
	Potassium [2501]	2860 (1150)	NA	NA	NA
	Silver [0.734]	ND (2.3)	NA	NA	NA
	Sodium [5000]	< DL (1150)	NA	NA	NA
	Thallium [11.315]	ND (2.3)	NA	NA	NA
	Vanadium [15.460]	12 (2.3)	NA	NA	NA
	Zinc [20.246]	26.5 (4.6)	NA	NA	NA
SW7041 (mg/kg)	Antimony [0.253]	ND (1.2)	NA	NA	NA
SW7060 (mg/kg)	Arsenic [6.883]	1.3 (0.58)	NA	NA	NA
SW7421 (mg/kg)	Lead [8.000]	< DL (5.8)	NA	NA	NA
SW7740 (mg/kg)	Selenium [10.531]	< DL (0.58)	NA	NA	NA

Table 6-2
(Continued)

Location ID		BH-58-23	BH-58-24	BH-58-24	BH-58-25
Beginning Depth - End Depth (ft)		4-6	0-2	4-6	0-2
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,6-Dimethylaniline	ND (2)	ND (2)	ND (2)	ND (2)
	3,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	3,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	Aniline	ND (10)	ND (10)	ND (10)	ND (10)
	Furfuryl Alcohol	ND (10)	ND (10)	ND (10)	ND (10)
SW6010 (mg/kg)	Aluminum [8764]	NA	5980 (24.7)	NA	7410 (23.8)
	Barium [84.363]	NA	< DL (2.5)	NA	63.7 (2.4)
	Beryllium [0.400]	NA	0.42 J (0.49)	NA	< DL (0.48)
	Calcium [250,000]	NA	194,000 (49.3)	NA	185,000 (47.7)
	Chromium [6.605]	NA	4.3 (2.5)	NA	5.1 (2.4)
	Cobalt [2.485]	NA	2.9 (2.5)	NA	< DL (2.4)
	Copper [4.844]	NA	5.6 (4.9)	NA	6 (4.8)
	Iron [6362]	NA	5340 (24.7)	NA	6410 (23.8)
	Magnesium [14656]	NA	6500 (49.3)	NA	6510 (47.7)
	Manganese [146.910]	NA	126 (2.5)	NA	145 (2.4)
	Nickel [5.612]	NA	< DL (9.9)	NA	< DL (9.5)
	Potassium [2501]	NA	1870 (1230)	NA	2090 (1190)
	Silver [0.734]	NA	ND (2.5)	NA	ND (2.4)
	Sodium [5000]	NA	2120 (1230)	NA	ND (1190)
	Thallium [11.315]	NA	ND (2.5)	NA	ND (2.4)
	Vanadium [15.460]	NA	5.9 (2.5)	NA	8 (2.4)
	Zinc [20.246]	NA	16.6 (4.9)	NA	19.1 (4.8)
SW7041 (mg/kg)	Antimony [0.253]	NA	ND (1.2)	NA	ND (1.2)
SW7060 (mg/kg)	Arsenic [6.883]	NA	1.4 (1.2)	NA	1.5 (1.2)
SW7421 (mg/kg)	Lead [8.000]	NA	< DL (2.5)	NA	< DL (2.4)
SW7740 (mg/kg)	Selenium [10.531]	NA	ND (1.2)	NA	< DL (1.2)

Table 6-2
(Continued)

Location ID		BH-58-25	BH-58-26	BH-58-26	BH-58-27
Beginning Depth - End Depth (ft)		4-6	0-0.4	4-6	0-0.4
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	2,6-Dimethylaniline	ND (2)	ND (2)	ND (2)	ND (2)
	3,4-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	3,5-Dimethylaniline	ND (5)	ND (5)	ND (5)	ND (5)
	Aniline	ND (10)	ND (10)	ND (10)	ND (10)
	Furfuryl Alcohol	ND (10)	ND (10)	ND (10)	ND (10)
SW6010 (mg/kg)	Aluminum [8764]	NA	NA	NA	NA
	Barium [84.363]	NA	NA	NA	NA
	Beryllium [0.400]	NA	NA	NA	NA
	Calcium [250,000]	NA	NA	NA	NA
	Chromium [6.605]	NA	NA	NA	NA
	Cobalt [2.485]	NA	NA	NA	NA
	Copper [4.844]	NA	NA	NA	NA
	Iron [6362]	NA	NA	NA	NA
	Magnesium [14656]	NA	NA	NA	NA
	Manganese [146.910]	NA	NA	NA	NA
	Nickel [5.612]	NA	NA	NA	NA
	Potassium [2501]	NA	NA	NA	NA
	Silver [0.734]	NA	NA	NA	NA
	Sodium [5000]	NA	NA	NA	NA
	Thallium [11.315]	NA	NA	NA	NA
	Vanadium [15.460]	NA	NA	NA	NA
	Zinc [20.246]	NA	NA	NA	NA
SW7041 (mg/kg)	Antimony [0.253]	NA	NA	NA	NA
SW7060 (mg/kg)	Arsenic [6.883]	NA	NA	NA	NA
SW7421 (mg/kg)	Lead [8.000]	NA	NA	NA	NA
SW7740 (mg/kg)	Selenium [10.531]	NA	NA	NA	NA

< DL = Analyte measured below the detection limit, and the detection limit is less than the background UTL.
J = Estimated concentration, analyte measured below the detection limit.
NA = Not analyzed.
ND = Not detected. No instrument response for analyte or result less than zero.
UTL = Upper tolerance limit.
( ) = Detection limit.
[ ] = 95% UTL background concentration.
Results greater than the background UTLs are shaded.

Table 6-3
Analytical Results for Waste Area Soil Samples

Location ID			BH-58-04		BH-58-04		BH-58-04		BH-58-05	
Beginning Depth - End Depth (ft)			6-10		10-12		27-29		1-5	
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline		ND	(5)	ND	(5)	ND	(6)	ND	(5)
	2,5-Dimethylaniline		ND	(5)	ND	(5)	ND	(6)	ND	(5)
	2,6-Dimethylaniline		ND	(2)	ND	(2)	ND	(2)	ND	(2)
	3,4-Dimethylaniline		ND	(5)	ND	(5)	ND	(6)	ND	(5)
	3,5-Dimethylaniline		ND	(5)	ND	(5)	ND	(6)	ND	(5)
	Aniline		ND	(9)	ND	(10)	ND	(10)	83	(10)
	Furfuryl Alcohol		ND	(10)	ND	(10)	ND	(10)	ND	(10)
SW6010 (mg/kg)	Aluminum	[8767]	3730	(24.6)	5340	(25)	954	(27.2)	7620	(24.3)
	Barium	[84.363]	45.2	(2.5)	59.1	(2.5)	19.3	(2.7)	71.3	(2.4)
	Beryllium	[0.400]	< DL	(0.49)	< DL	(0.5)	ND	(0.54)	< DL	(0.49)
	Calcium	[250,000]	219,000	(49.3)	242,000	(49.9)	223,000	(54.4)	163,000	(48.5)
	Chromium	[6.605]	3.9	(2.5)	4.9	(2.5)	ND	(2.7)	11.3	(2.4)
	Cobalt	[2.485]	1.35	(2.5)	< DL	(2.5)	ND	(2.7)	< DL	(2.4)
	Copper	[4.844]	< DL	(4.9)	3.75	(5)	ND	(5.4)	16.5	(4.9)
	Iron	[6362]	3890	(24.6)	5740	(25)	1150	(27.2)	15,100	(24.3)
	Magnesium	[14656]	2950	(49.3)	3780	(49.9)	712	(54.4)		(48.5)
	Manganese	[146.90]	118	(2.5)	123	(2.5)	18.1	(2.7)	178	(2.4)
	Nickel	[5.612]	< DL	(9.9)	< DL	(10)	ND	(10.9)	< DL	(9.7)
	Potassium	[2501]	< DL	(1230)	< DL	(1250)	< DL	(1360)	2280	(1210)
	Silver	[0.734]	ND	(2.5)	1.1 J	(2.5)	ND	(2.7)	ND	(2.4)
	Sodium	[5000]	< DL	(1230)	1640	(1250)	< DL	(1360)	< DL	(1210)
	Thallium	[11.315]	ND	(2.5)	ND	(5)	ND	(2.7)	ND	(2.4)
	Vanadium	[15.460]	8.2	(2.5)	10.9	(2.5)	< DL	(2.7)	10.7	(2.4)
	Zinc	[20.246]	10.8	(4.9)	15.8	(5)	< DL	(5.4)	41	(4.9)
SW7041 (mg/kg)	Antimony	[0.253]	ND	(1)	ND	(1)	ND	(1)	< DL	(1)
SW7060 (mg/kg)	Arsenic	[6.883]	< DL	(0.62)	< DL	(0.62)	< DL	(0.68)	2.5	(0.61)
SW7421 (mg/kg)	Lead	[8.000]	5	(3.1)	< DL	(6.2)	3.9	(3.4)	7.8	(0.61)
SW7740 (mg/kg)	Selenium	[10.531]	< DL	(6.2)	ND	(6.2)	ND	(2.7)	ND	(2.4)
SW8270 (mg/kg)	2,4-Dimethylphenol		ND	(0.41)	ND	(0.41)	ND	(0.45)	ND	(0.4)
	2-Methylnaphthalene		ND	(0.41)	ND	(0.41)	ND	(0.45)	0.24 J	(0.4)
	Naphthalene		ND	(0.41)	ND	(0.41)	ND	(0.45)	0.057 J	(0.4)

Table 6-3
(Continued)

Location ID		BH-58-05		BH-58-05		BH-58-06		BH-58-06	
Beginning Depth - End Depth (ft)		5-7		27-29		0-4		4-6	
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	110	(5)	ND	(6)	ND	(5)	ND	(5)
	2,5-Dimethylaniline	117	(5)	ND	(6)	ND	(5)	ND	(5)
	2,6-Dimethylaniline	34.4	(2)	ND	(2)	ND	(2)	ND	(2)
	3,4-Dimethylaniline	147	(5)	ND	(6)	ND	(5)	ND	(5)
	3,5-Dimethylaniline	218	(5)	ND	(6)	ND	(5)	ND	(5)
	Aniline	48.8	(10)	ND	(10)	ND	(10)	ND	(10)
	Furfuryl Alcohol	ND	(10)	ND	(10)	ND	(10)	ND	(10)
SW6010 (mg/kg)	Aluminum [8767]	4600	(24.8)	1450	(27.6)	5140	(24.6)	2550	(24.5)
	Barium [84.363]	31.3	(2.5)	27.5	(2.8)	54.7	(2.5)	34.3	(2.4)
	Beryllium [0.400]	1.4 J	(0.5)	ND	(0.55)	0.45 J	(0.49)	< DL	(0.49)
	Calcium [250,000]	209,000	(49.5)	230,000	(55.1)	193,000	(49.3)	224,000	(49)
	Chromium [6.605]	4.1	(2.5)	ND	(2.8)	3.8	(2.5)	< DL	(2.4)
	Cobalt [2.485]	< DL	(2.5)	ND	(2.8)	< DL	(2.5)	< DL	(2.4)
	Copper [4.844]	< DL	(5)	ND	(5.5)	4.9	(4.9)	< DL	(4.9)
	Iron [6362]	5010	(24.8)	1500	(27.6)	6560	(24.6)	2730	(24.5)
	Magnesium [14656]	3240	(49.5)	1170	(55.1)	4780	(49.3)	1960	(49)
	Manganese [146.90]	66.7	(2.5)	102	(2.8)	121	(2.5)	49.5	(2.4)
	Nickel [5.612]	< DL	(9.9)	ND	(11)	6.2 J	(9.9)	< DL	(9.8)
	Potassium [2501]	< DL	(1240)	< DL	(1380)	1570	(1230)	< DL	(1220)
	Silver [0.734]	ND	(2.5)	ND	(2.8)	ND	(2.5)	ND	(2.4)
	Sodium [5000]	1260	(1240)	< DL	(1380)	< DL	(1230)	< DL	(1220)
	Thallium [11.315]	ND	(2.5)	ND	(2.8)	ND	(2.5)	ND	(6.1)
	Vanadium [15.460]	8	(2.5)	2.9	(2.8)	11	(2.5)	7.1	(2.4)
	Zinc [20.246]	11.9	(5)	< DL	(5.5)	16.8	(4.9)	9.1	(4.9)
SW7041 (mg/kg)	Antimony [0.253]	ND	(1)	ND	(1)	ND	(1)	ND	(1)
SW7060 (mg/kg)	Arsenic [6.883]	0.74	(0.62)	< DL	(0.69)	1.2	(0.62)	0.66	(0.61)
SW7421 (mg/kg)	Lead [8.000]	5.3	(3.1)	4.1	(3.4)	< DL	(12.3)	< DL	(2.4)
SW7740 (mg/kg)	Selenium [10.531]	ND	(2.5)	ND	(3.4)	ND	(2.5)	ND	(6.1)
SW8270 (mg/kg)	2,4-Dimethylphenol	ND	(0.41)	ND	(0.45)	ND	(0.41)	ND	(0.4)
	2-Methylnaphthalene	4.1	(0.41)	ND	(0.45)	ND	(0.41)	ND	(0.4)
	Naphthalene	1.5	(0.41)	ND	(0.45)	ND	(0.41)	ND	(0.4)

Table 6-3
(Continued)

Location ID		BH-58-06		BH-58-07		BH-58-07		BH-58-07	
Beginning Depth - End Depth (ft)		28-30		0-4		4-6		28-30	
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	2,5-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	2,6-Dimethylaniline	ND	(2)	ND	(2)	ND	(2)	ND	(2)
	3,4-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	3,5-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	Aniline	ND	(10)	ND	(10)	ND	(10)	ND	(10)
	Furfuryl Alcohol	ND	(10)	ND	(10)	ND	(10)	ND	(10)
SW6010 (mg/kg)	Aluminum [8767]	2330	(25.7)	6710	(24.6)	7480	(23.9)	2950	(26.5)
	Barium [84.363]	71.5	(2.6)	68.4	(2.5)	63.1	(2.4)	35.6	(2.7)
	Beryllium [0.400]	ND	(0.51)	0.44 J	(0.49)	0.57	(0.48)	< DL	(0.53)
	Calcium [250,000]	221,000	(51.3)	175,000	(49.2)	180,000	(47.8)	205,000	(53)
	Chromium [6.605]	< DL	(2.6)	4.9	(2.5)	6	(2.4)	3.5	(2.7)
	Cobalt [2.485]	< DL	(2.6)	3	(2.5)	2.4	(2.4)	ND	(2.7)
	Copper [4.844]	< DL	(5.1)	6.3	(4.9)	< DL	(4.8)	< DL	(5.3)
	Iron [6362]	2600	(25.7)	6410	(24.6)	7080	(23.9)	3000	(26.5)
	Magnesium [14656]	1530	(51.3)	6190	(49.2)	6330	(47.8)	2110	(53)
	Manganese [146.90]	59.6	(2.6)	158	(2.5)	136	(2.4)	56.3	(2.7)
	Nickel [5.612]	< DL	(10.3)	6.2 J	(9.8)	7.5 J	(9.6)	< DL	(10.6)
	Potassium [2501]	< DL	(1280)	2190	(1230)	1960	(1200)	< DL	(1330)
	Silver [0.734]	1.3 J	(2.6)	1.1 J	(2.5)	ND	(2.4)	ND	(2.7)
	Sodium [5000]	< DL	(1280)	< DL	(1230)	< DL	(1200)	< DL	(1330)
	Thallium [11.315]	ND	(2.6)	< DL	(2.5)	ND	(2.4)	ND	(2.7)
	Vanadium [15.460]	5.5	(2.6)	12.4	(2.5)	< DL	(2.4)	5.6	(2.7)
	Zinc [20.246]	7.6	(5.1)	20.3	(4.9)	22	(4.8)	8.9	(5.3)
SW7041 (mg/kg)	Antimony [0.253]	ND	(1)	ND	(1)	ND	(1)	ND	(1)
SW7060 (mg/kg)	Arsenic [6.883]	1.2	(0.64)	1.4	(0.61)	1.5	(0.6)	< DL	(0.66)
SW7421 (mg/kg)	Lead [8.000]	< DL	(6.4)	8.6 J	(12.3)	6.9	(6)	< DL	(1.3)
SW7740 (mg/kg)	Selenium [10.531]	ND	(2.6)	ND	(2.5)	ND	(2.4)	ND	(2.7)
SW8270 (mg/kg)	2,4-Dimethylphenol	ND	(0.42)	ND	(0.41)	ND	(0.39)	ND	(0.44)
	2-Methylnaphthalene	ND	(0.42)	ND	(0.41)	ND	(0.39)	ND	(0.44)
	Naphthalene	ND	(0.42)	ND	(0.41)	ND	(0.39)	ND	(0.44)

Table 6-3
(Continued)

Location ID		BH-58-08		BH-58-08		BH-58-08		BH-58-09	
Beginning Depth - End Depth (ft)		0-4		4-6		28-30		0-4	
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND	(5)	ND	(5)	ND	(6)	ND	(5)
	2,5-Dimethylaniline	ND	(5)	ND	(5)	ND	(6)	ND	(5)
	2,6-Dimethylaniline	ND	(2)	ND	(2)	ND	(2)	ND	(2)
	3,4-Dimethylaniline	ND	(5)	ND	(5)	ND	(6)	ND	(5)
	3,5-Dimethylaniline	ND	(5)	ND	(5)	ND	(6)	ND	(5)
	Aniline	ND	(10)	ND	(10)	ND	(10)	ND	(10)
	Furfuryl Alcohol	ND	(10)	ND	(10)	ND	(10)	ND	(10)
SW6010 (mg/kg)	Aluminum [8767]	11,200	(11.5)	2920	(25.1)	1190	(28.6)	11,600	(23.5)
	Barium [84.363]	98.4	(1.1)	32.4	(2.5)	28.1	(2.9)	106	(2.3)
	Beryllium [0.400]	0.62	(0.23)	< DL	(0.5)	ND	(0.57)	0.57	(0.47)
	Calcium [250,000]	101,000	(23)	222,000	(50.3)	243,000	(57.2)	156,000	(47)
	Chromium [6.605]	9.6	(1.1)	< DL	(2.5)	ND	(2.9)	9.5	(2.3)
	Cobalt [2.485]	4.1	(1.1)	< DL	(2.5)	ND	(2.9)	3.3	(2.3)
	Copper [4.844]	9.4	(2.3)	< DL	(5)	ND	(5.7)	9.4	(4.7)
	Iron [6362]	10,000	(11.5)	3110	(25.1)	1410	(28.6)	10,800	(23.5)
	Magnesium [14656]	10,200	(23)	2460	(50.3)	933	(57.2)	9580	(47)
	Manganese [146.90]	253	(1.1)	54.1	(2.5)	17	(2.9)	268	(2.3)
	Nickel [5.612]	9.5	(4.6)	< DL	(10.1)	ND	(11.4)	7.4 J	(9.4)
	Potassium [2501]	3830	(575)	< DL	(1260)	< DL	(1430)	3690	(1170)
	Silver [0.734]	ND	(1.1)	ND	(2.5)	< DL	(2.9)	ND	(2.3)
	Sodium [5000]	1580	(575)	< DL	(1260)	< DL	(1430)	< DL	(1170)
	Thallium [11.315]	ND	(1.1)	ND	(6.3)	ND	(2.9)	ND	(2.3)
	Vanadium [15.460]	15.4	(1.1)	8.3	(2.5)	< DL	(2.9)	17.1	(2.3)
	Zinc [20.246]	31.7	(2.3)	11	(5)	< DL	(5.7)	32.8	(4.7)
SW7041 (mg/kg)	Antimony [0.253]	ND	(1)	ND	(1)	ND	(1)	< DL	(1)
SW7060 (mg/kg)	Arsenic [6.883]	1.7	(1.1)	< DL	(0.63)	< DL	(0.72)	2.6	(1.2)
SW7421 (mg/kg)	Lead [8.000]	9.4 J	(11.5)	< DL	(3.1)	< DL	(1.4)	5.3	(0.59)
SW7740 (mg/kg)	Selenium [10.531]	ND	(2.3)	ND	(6.3)	ND	(2.9)	ND	(2.3)
SW8270 (mg/kg)	2,4-Dimethylphenol	ND	(0.38)	ND	(0.41)	ND	(0.47)	ND	(0.39)
	2-Methylnaphthalene	ND	(0.38)	ND	(0.41)	ND	(0.47)	ND	(0.39)
	Naphthalene	ND	(0.38)	ND	(0.41)	ND	(0.47)	ND	(0.39)

Table 6-3
(Continued)

Location ID		BH-58-09		BH-58-09		BH-58-10		BH-58-10	
Beginning Depth - End Depth (ft)		4-6		27-29		1-5		5-7	
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	2,5-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	2,6-Dimethylaniline	ND	(2)	ND	(2)	ND	(2)	ND	(2)
	3,4-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	3,5-Dimethylaniline	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	Aniline	ND	(10)	ND	(10)	ND	(10)	ND	(10)
	Furfuryl Alcohol	ND	(10)	ND	(10)	ND	(10)	ND	(10)
SW6010 (mg/kg)	Aluminum [8767]	9540	(23)	4810	(24.9)	7370	(24.1)	6270	(24.3)
	Barium [84.363]	69.2	(2.3)	58.9	(2.5)	60.5	(2.4)	55.9	(2.4)
	Beryllium [0.400]	0.56	(0.46)	ND	(0.5)	< DL	(0.48)	< DL	(0.49)
	Calcium [250,000]	170,000	(46.1)	157,000	(49.7)	189,000	(48.2)	186,000	(48.6)
	Chromium [6.605]	10.9	(2.3)	3.7	(2.5)	5.7	(2.4)	5.2	(2.4)
	Cobalt [2.485]	3.5	(2.3)	ND	(2.5)	< DL	(2.4)	< DL	(2.4)
	Copper [4.844]	< DL	(4.6)	< DL	(5)	< DL	(4.8)	< DL	(4.9)
	Iron [6362]	8890	(23)	5130	(24.9)	6280	(24.1)	5640	(24.3)
	Magnesium [14656]	5730	(46.1)	3630	(49.7)	6110	(48.2)	5570	(48.6)
	Manganese [146.90]	162	(2.3)	80	(2.5)	127	(2.4)	112	(2.4)
	Nickel [5.612]	5.9 J	(9.2)	ND	(9.9)	< DL	(9.6)	< DL	(9.7)
	Potassium [2501]	2350	(1150)	< DL	(1240)	2050	(1200)	1760	(1220)
	Silver [0.734]	ND	(2.3)	ND	(2.5)	ND	(2.4)	ND	(2.4)
	Sodium [5000]	< DL	(1150)	1470	(1240)	< DL	(1200)	< DL	(1220)
	Thallium [11.315]	ND	(2.3)	ND	(2.5)	ND	(2.4)	ND	(2.4)
	Vanadium [15.460]	16.3	(2.3)	8.4	(2.5)	13.9	(2.4)	11.7	(2.4)
	Zinc [20.246]	23.7	(4.6)	10.7	(5)	18.2	(4.8)	17.4	(4.9)
SW7041 (mg/kg)	Antimony [0.253]	< DL	(1)	< DL	(1)	ND	(1)	< DL	(1)
SW7060 (mg/kg)	Arsenic [6.883]	1.9	(0.58)	1.3	(0.62)	1.7	(0.6)	1.4	(0.61)
SW7421 (mg/kg)	Lead [8.000]	5.4	(1.2)	5.3	(3.1)	7.3	(3)	6.8	(6.1)
SW7740 (mg/kg)	Selenium [10.531]	ND	(2.3)	ND	(2.5)	< DL	(3)	ND	(3)
SW8270 (mg/kg)	2,4-Dimethylphenol	ND	(0.38)	ND	(0.41)	ND	(0.4)	ND	(0.4)
	2-Methylnaphthalene	ND	(0.38)	ND	(0.41)	ND	(0.4)	ND	(0.4)
	Naphthalene	ND	(0.38)	ND	(0.41)	ND	(0.4)	ND	(0.4)

Table 6-3
(Continued)

Location ID			BH-58-10		BH-58-11		BH-58-11		BH-58-11	
Beginning Depth - End Depth (ft)			27-29		1-5		5-7		27-29	
SOP-427 (µg/kg)	2,3/2,4-Dimethylaniline		ND	(6)	ND	(5)	ND	(5)	ND	(6)
	2,5-Dimethylaniline		ND	(6)	ND	(5)	ND	(5)	ND	(6)
	2,6-Dimethylaniline		ND	(2)	ND	(2)	ND	(2)	ND	(2)
	3,4-Dimethylaniline		ND	(6)	ND	(5)	ND	(5)	ND	(6)
	3,5-Dimethylaniline		ND	(6)	ND	(5)	ND	(5)	ND	(6)
	Aniline		ND	(10)	ND	(10)	ND	(10)	ND	(10)
	Furfuryl Alcohol		ND	(10)	ND	(10)	ND	(10)	ND	(10)
SW6010 (mg/kg)	Aluminum	[8767]	4950	(26.9)	6790	(22.6)	4580	(24.4)	1610	(27.7)
	Barium	[84.363]	61.3	(2.7)	60.3	(2.3)	38.5	(2.4)	25.8	(2.8)
	Beryllium	[0.400]	ND	(0.54)	< DL	(0.45)	ND	(0.49)	ND	(0.55)
	Calcium	[250,000]	219,000	(53.8)	171,000	(45.1)	231,000	(48.8)	244,000	(55.4)
	Chromium	[6.605]	3.5	(2.7)	6.1	(2.3)	3	(2.4)	ND	(2.8)
	Cobalt	[2.485]	< DL	(2.7)	< DL	(2.3)	ND	(2.4)	ND	(2.8)
	Copper	[4.844]	ND	(5.4)	7.5	(4.5)	< DL	(4.9)	ND	(5.5)
	Iron	[6362]	4240	(26.9)	10,000	(22.6)	4030	(24.4)	1850	(27.7)
	Magnesium	[14656]	2820	(53.8)	5600	(45.1)	3460	(48.8)	1020	(55.4)
	Manganese	[146.90]	44.4	(2.7)	159	(2.3)	56	(2.4)	16.7	(2.8)
	Nickel	[5.612]	ND	(10.8)	< DL	(9)	ND	(9.8)	ND	(11.1)
	Potassium	[2501]	< DL	(1350)	2010	(1130)	1220	(1220)	< DL	(1380)
	Silver	[0.734]	ND	(2.7)	ND	(2.3)	ND	(2.4)	ND	(2.8)
	Sodium	[5000]	< DL	(1350)	< DL	(1130)	ND	(1220)	< DL	(1380)
	Thallium	[11.315]	ND	(2.7)	ND	(2.3)	ND	(2.4)	ND	(2.8)
	Vanadium	[15.460]	7.9	(2.7)	22.9	(2.3)	10.4	(2.4)	3.1	(2.8)
	Zinc	[20.246]	9.5	(5.4)	48.8	(4.5)	14.9	(4.9)	< DL	(5.5)
SW7041 (mg/kg)	Antimony	[0.253]	ND	(1)	< DL	(1)	ND	(1)	ND	(1)
SW7060 (mg/kg)	Arsenic	[6.883]	< DL	(0.67)	1.4	(0.56)	0.63	(0.61)	< DL	(0.69)
SW7421 (mg/kg)	Lead	[8.000]	4.1	(3.4)	5.7	(1.1)	5	(3)	4.2	(3.5)
SW7740 (mg/kg)	Selenium	[10.531]	ND	(2.7)	ND	(2.3)	< DL	(3)	ND	(2.8)
SW8270 (mg/kg)	2,4-Dimethylphenol		ND	(0.44)	ND	(0.37)	0.056 J	(0.4)	0.069 J	(0.46)
	2-Methylnaphthalene		ND	(0.44)	ND	(0.37)	ND	(0.4)	ND	(0.46)
	Naphthalene		ND	(0.44)	ND	(0.37)	ND	(0.4)	ND	(0.46)

< DL = Analyte measured below the detection limit, and the detection limit is less than the background UTL.
J = Estimated concentration, analyte measured below the detection limit.
NA = Not analyzed.
ND = Not detected. No instrument response for analyte or result less than zero.
UTL = Upper tolerance limit.
( ) = Detection limit.
[ ] = 95% UTL background concentration.
Results greater than the background UTLs are shaded.

Table 6-4
Analytical Results for SWMU 231 Groundwater Samples

Location ID			MW-58-01		MW-58-02		MW-58-03		MW-58-04	
SW6010 (mg/L)	Aluminum	[NV]	1.6	(0.2)	0.75	(0.2)	0.57	(0.2)	< DL	(0.2)
	Barium	[0.48]	0.027	(0.02)	0.034	(0.02)	<DL	(0.02)	0.027	(0.02)
	Calcium	[NV]	758	(0.4)	928	(0.4)	926	(0.4)	952	(0.4)
	Chromium	[0.096]	ND	(0.02)	ND	(0.02)	< DL	(0.02)	ND	(0.02)
	Cobalt	[0.02]	ND	(0.02)	ND	(0.02)	< DL	(0.02)	ND	(0.02)
	Copper	[0.0386]	< DL	(0.04)	ND	(0.04)	0.14	(0.04)	0.041	(0.04)
	Iron	[NV]	1.2	(0.2)	0.66	(0.2)	0.5	(0.2)	< DL	(0.2)
	Magnesium	[NV]	472	(0.4)	549	(0.4)	594	(0.4)	475	(0.4)
	Manganese	[NV]	0.027	(0.02)	0.028	(0.02)	0.023	(0.02)	0.15	(0.02)
	Potassium	[NV]	< DL	(10)	< DL	(10)	< DL	(10)	< DL	(10)
	Sodium	[NV]	1400	(10)	1740	(10)	1950	(10)	1230	(10)
	Vanadium	[0.2]	< DL	(0.02)	< DL	(0.02)	< DL	(0.02)	< DL	(0.02)
SW7060 (mg/L)	Arsenic	[0.0723]	< DL	(0.01)	< DL	(0.01)	< DL	(0.01)	< DL	(0.005)
SW7421 (mg/L)	Lead	[0.0199]	ND	(0.02)	ND	(0.05)	ND	(0.05)	< DL	(0.01)
SW7740 (mg/L)	Selenium	[0.0793]	< DL	(0.01)	< DL	(0.01)	< DL	(0.025)	< DL	(0.01)
SW8240 (µg/L)	Acetone		ND	(10)	8.9 J b	(10)	4.7 J b	(10)	2.7 J b	(10)
	Benzene		1.6 J b	(5)	0.76 J b	(5)	0.7 J b	(5)	0.16 J b	(5)
	Chloroform		ND	(5)	ND	(5)	0.16 J	(5)	ND	(5)
	Methylene chloride		0.99 J B	(5)	1.3 J B	(5)	1.6 J B	(5)	0.9 J B	(5)
	Tetrachloroethene		ND	(5)	ND	(5)	8.8	(5)	ND	(5)
	Toluene		0.45 J b	(5)	ND	(5)	0.19 J b	(5)	0.43 J b	(5)
	Total xylenes		1.1 J b	(5)	0.4 J b	(5)	0.52 J b	(5)	1 J b	(5)
	Trichloroethene		ND	(5)	ND	(5)	0.62 J	(5)	ND	(5)
SW8270 (mg/L)	N-Nitrosodimethylamine		ND	(0.01)	ND	(0.01)	0.009 J	(0.01)	ND	(0.01)

b = Reported analyte concentration cannot be distinguished from field blank concentrations.
B = Reported analyte concentration may be due to analytical background (or noise) from the laboratory.
< DL = Analyte measured below the detection limit, and the detection limit is less than the background UTL.
J = Estimated concentration, analyte measured below the detection limit.
ND = Not detected. No instrument response for analyte or result less than zero.
NV = No UTL calculated for this analyte.
UTL = Upper tolerance limit.
( ) = Detection limit.
[ ] = 95% UTL background concentration.

Waste Area B Soils—Soil borings BH-58-07, BH-58-08, and BH-58-09 were drilled in Waste Area B. No unconventional fuels or SVOCs were detected. Metals, including beryllium (ranging from < DL to 0.62 mg/kg), were measured above their background UTLs in the composite samples (0 to 4 ft) . Fewer analytes and generally lower concentrations were detected in the samples collected directly below the waste area (4 to 6 ft). Metals concentrations above their background UTLs were not detected near the groundwater table.

Waste Area C Soils—Soil boring BH-58-06 was drilled in Waste Area C. No unconventional fuels or SVOCs were detected. No metals concentrations exceeding their background UTLs were measured with the exception of copper (4.9 mg/kg) in the 0- to 4-ft sample interval.

Waste Area D Soils—Soil boring 58-BH-05 was drilled in Waste Area D. Aniline was detected in the 1- to 5-ft composite sample interval (83 µg/kg), the 5- to 7-ft sample interval (48.4 µg/kg), but not the sample interval directly above the water table (27 to 29 ft). Dimethylanilines (ranging from 34.4 to 218 µg/kg) were detected only in the 5- to 7-ft sample interval. 2-Methylnaphthalene (4.1 mg/kg) and naphthalene (1.5 mg/kg) were also detected in this sample interval. Chromium (11.3 mg/kg), copper (16.5 mg/kg), iron (15,100 mg/kg), manganese (178 mg/kg), and zinc (41 mg/kg) were detected above their background UTLs in the 1- to 5-ft sample interval only.

Waste Area E Soils—Soil boring BH-58-04 was drilled in Waste Area E. No unconventional fuels or SVOCs were detected. No metals concentrations exceeding background UTLs were measured.

Groundwater—Unconventional fuel constituents were not detected in the groundwater samples collected from the four monitor wells installed at SWMU 231. Tetrachloroethene (8.8 µg/L) was detected in monitor well BH-58-03, located downgradient of Waste Area B, at levels slightly above the detection limit of 5 µg/L. Several other analytes were found at estimated levels below detection limits in this sample. Acetone, methylene chloride, and BTEX constituents were measured below detection limits in each sample. There were no metals concentrations detected above background UTLs in the samples.

Risk Assessment Results

A quantitative risk assessment was conducted to determine the risk posed by SWMU 231 to human health and the environment. The risk assessment consisted of four basic steps: 1) data analysis and selection of chemicals of concern; 2) identification of exposure pathways and receptors; 3) toxicity assessment of each contaminant; and 4) quantification of potential carcinogenic, noncarcinogenic, and ecological risks. The results are summarized in this section. A detailed description the risk assessment is contained in Appendix G.

Human Health Risks—The human health risks evaluated for this site were nearby work exposure, hypothetical future construction worker exposure, and recreational user (horseback rider) exposure.

Generally, total carcinogenic risk of 10^{-6} for each contaminant is considered acceptable. This is equivalent to a one-in-one-million excess cancer risk from exposure to that chemical at the site. A cumulative total (sum of risk from all chemicals) must be between 10^{-4} and 10^{-6}. The carcinogenic risk values estimated for SWMU 231 are presented in Table 6-5. The carcinogenic risk values were within the acceptable range, suggesting that carcinogenic effects are not likely to result from exposure at the site.

For a noncarcinogenic risk to be acceptable, the sum of the Hazard Index (HI) should not exceed a value of 1. The HI is the ratio of the daily chemical intake to a reference dose (the acceptable dose). The noncarcinogenic risk values estimated for SWMU 231 are presented in Table 6-5, as well. The noncarcinogenic risk values did not exceed an HI of 1, suggesting systemic human health risks are not likely to result from exposure at the site.

Ecological Risks—Ecological risk was evaluated for the site using an ecological quotient (EQ). The EQ estimates the potential ecological risks associated with the chemicals of concern primarily through the ingestion of soil and/or contaminated plants. An EQ of less than 1 indicates a low probability of adverse effects, an EQ between 1 and 10 indicates that there is a possibility of adverse ecological effects.

The EQ for the site was calculated at a value of 1.2, which suggests there is a possibility of adverse ecological effects to the black-tailed jackrabbit, selected as the indicator species. The possible ecological risk is driven mainly by the ingestion of aluminum (EQ of 0.8).

6.6 Conclusions

The extent of unconventional fuels contamination in the soil at SWMU 231 is limited to two areas: 1) the discontinuous, shallow (< 2 ft) purple-stained areas near the incinerator and 2) the soils within and directly below Waste Area D. Metal concentrations above their UTLs are also present in these two areas. However, these metals are not typical constituents of unconventional fuels and may be naturally occurring at the site.

Groundwater data from SWMU 231 indicates that the presence of unconventional fuels in the soil has not affected the groundwater quality beneath the site. With the exception of tetrachloroethene in one sample, concentrations of VOCs, SVOCs, and metals were not measured above detection limits.

The quantitative risk assessment conducted for SWMU 231 concluded that the site does not pose an unacceptable risk to human health and may pose a potential risk to the environment. However, the ecological risk is driven by the ingestion of aluminum which may not be related to the release at SWMU 231.

6.7 Recommendations

NFA is recommended for SWMU 231. A Class 3 permit modification request will be completed by Holloman AFB to achieve NFA status.

Table 6-5
Summary of Estimated Human Health Risk

Exposure Scenario	Estimated Carcinogenic Risk		Estimated Noncarcinogenic Hazard Indices	
	Average	Reasonable Maximum	Average	Reasonable Maximum
Nearby Worker	2×10^{-13}	3×10^{-13}	2×10^{-6}	3×10^{-6}
Hypothetical Future Construction Worker	1×10^{-7}	2×10^{-7}	0.3	0.5
Recreational User—Child	2×10^{-7}	9×10^{-7}	0.04	0.2
Recreational User—Adult	2×10^{-7}	3×10^{-6}	0.02	0.2

Section 7
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