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2.3 ZONE 3, SITES 32/36

2.3.1 Introduction

2.3.1.1 Site Location and Description

Site 32/36 encompasses Buildings 113 (Site 32) and 119 (Site 36) in the center of the base in the area known as the Industrial Shop/Parking Area and designated as Zone 3 (Figure 2.3-1). Much of the site is paved or covered by buildings. Newfields Ditch, a stormwater drainage swale, passes through the open area between Buildings 113 and 119. The ditch drains to the northeast and discharges into Hodgsons Brook.

2.3.1.2 Site History and Contaminant Sources

Building 113 was used between 1955 and 1991 primarily for aircraft munitions systems and avionics maintenance, including vapor degreasing operations. A 1,200-gal UST was located near the northeastern corner of the building. The UST received waste TCE from degreasing operations conducted inside Building 113 from 1956 to 1968. Sometime after 1977, the UST was filled with sand. In 1988, when the UST was excavated and removed, an underground overflow discharge pipe associated with the UST was discovered. The soil and groundwater contamination at this site is believed to be primarily a result of the historic use of the TCE tank and releases from the UST overflow pipe.

Jet engine and engine accessory maintenance was performed in Building 119 between 1956 and 1990. Before 1971, waste from the building, including fuel and TCE, was disposed at a fire training area (Site 8). From 1971 to 1990, these wastes were either drummed and stored in a designated drum storage area onsite for contractor removal or were piped to Building 226 (Site 35, industrial waste treatment plant) for treatment. An underground sewer line located along Dover Avenue, north of Building 119, transported the wastes between buildings. A break in the line between the two buildings resulted in a release of contaminants. During the early stages of investigations at Building 119, it was observed that the soil surrounding the drum storage area and oil rack behind the building was visibly stained, apparently from former waste spills.

In 1983, an IRP Phase 1 Problem Identification/Records Search was conducted at Pease AFB, and the study identified Site 32/36 as a potential source for the release of TCE into the environment. A remedial investigation was conducted at Site 32/36 in three stages from 1984 through 1993.

2.3.1.3 Summary of Site Characteristics

<u>Topography</u>

Zone 3, which includes the Site 32/36 area, is of relatively low relief, with the runway and parking apron being located along the high point (approximately 80 ft MSL). Site 32/36 occupies approximately 10.5 acres within Zone 3. The area surrounding Buildings 113 and 119 is flat, except for a relatively steep slope (40% slope) behind Building 119 and along Dover Avenue.

<u>Geology/Hydrogeology</u>

Zone 3 is underlain primarily by bedrock belonging to the Kittery Formation with contact between the Kittery Formation and the younger Eliot Formation at the northwestern edge of Zone 3, between Sites 31 and 33. The Kittery Formation consists of massive to banded quartzite with phyllitic quartzite interbeds. The Eliot Formation is composed primarily of interbedded phyllite and metagraywacke.

The surficial materials observed across Zone 3 are subdivided into five stratigraphic units: fill, upper sand, marine clay and silt, lower sand, and glacial till. In general, overburden thickness varies widely across the zone, being thinnest around areas of bedrock highs and thickest in areas of bedrock lows. Overburden deposits reach a maximum thickness of 80 ft near the western margin of the aircraft parking apron.

Fill deposits in Zone 3 are generally dominated by sand and gravel; however, silty and clayey soils were locally incorporated into fill. The fill matrix has a composition identical to the upper sand from which it was usually derived. The thickness of the upper sand unit typically varies between 5 and 10 ft throughout Zone 3. In most areas, it is difficult to distinguish between undisturbed upper sand deposits and fill consisting of reworked upper sand. Across Zone 3, the marine clay and silt unit is widespread, but laterally discontinuous. The thickness of the marine clay and silt varies from absent to 27 ft. Marine clay and silt units consist predominantly of clayey facies. Evaluation of lithologic logs and grain size data throughout the zone suggests that the lower sand and the glacial till may be treated as a single unit texturally and hydrologically. In Zone 3, the lower sand/glacial till unit is typically thicker and more laterally continuous than the overlying units. It has a maximum observed thickness of 80 ft at the western margin of the aircraft parking apron.

Two hydrologic regimes or water-bearing zones have been identified in the overburden at Zone 3: the unconfined water table and the deeper, semiconfined water-bearing unit. Although both of these hydrologic regimes may occur in more than one stratigraphic unit, in general the unconfined water table occurs in the upper sand and the semiconfined unit occurs in the lower sand/glacial till. Depth to water ranges between 0 and 9.5 ft bgs across Zone 3. The saturated thickness of the overburden in Zone 3 ranges from 0 to approximately 60 ft. Water levels are highest in areas where sandy soils exist and where groundwater recharge is highest.

The bedrock is divided into shallow and deep hydrostratigraphic units. Groundwater elevation in the shallow bedrock range from approximately 70 to 40 ft MSL. The underlying deep bedrock is the basal hydrogeologic unit. Groundwater elevation in the deep bedrock range from approximately 60 to 20 ft MSL.

The predominant groundwater flow is southeast to east for overburden groundwater units, east to southeast for shallow bedrock groundwater units, and southeast for the deep bedrock. Groundwater contours for the upper sand, lower sand/glacial till, and shallow bedrock in Zone 3 (including the Site 32/36 area) are shown in Figures 2.3-2 through 2.3-4 respectively.

Surface Water

Pease AFB is located on a peninsula within the Piscataqua River Drainage basin. Drainage is radially away from the peninsula toward Great Bay to the west, Little Bay to the northwest and north, and the Piscataqua River to the east. The surface water hydrology of Zone 3 may be characterized as consisting of general settings, or areas, each with different surface hydrology: the paved and storm-drained aircraft parking apron and other paved areas where runoff predominates; the relatively well-drained areas immediately adjacent to the aircraft parking apron; the poorly drained wetlands; and three major surface drainage ditches—McIntyre Brook, Grafton Ditch, and Newfields Ditch.

Surface water runoff in the Site 32/36 area is controlled by a network of storm water drainage ditches and storm sewers. The local drainage ditches and storm sewers converge, channeling all the site storm water into Newfields Ditch. The surface water in Newfields Ditch flows generally toward the east through a series of ditches and culverts and empties into the Piscataqua River at Portsmouth via Hodgsons Brook and North Mill Pond.

Areas of Contamination

An RI report for Site 32/36 was completed in June 1992 (Weston 1992). The Site 32/36 RI documented the presence of contamination in soil and groundwater in the areas surrounding the site. The conceptual model of Site 32/36 presented in the RI report included the following components:

- Potential sources identified at the Site 32/36 included the former waste TCE UST and overflow pipe at Building 113, the drum storage/oil rack area at Building 119, the area of stained soil and stressed vegetation at the eastern corner of Building 119, the wastewater pipeline break adjacent to the northwest corner of Building 119, and an area at the northwestern corner of Building 113.
- The source with the highest concentrations and the greatest potential for release of contaminants in the subsurface was the former waste TCE UST and overflow pipe source area associated with Building 113.
- TCE and four of its degradation products were the predominant compounds detected in soil at the location of the former waste TCE UST and at the end of the overflow pipe, near the delineated wetlands.
- Aromatic hydrocarbons (AHCs) and polynuclear aromatic hydrocarbons (PAHs) and metals were the predominant compounds detected in the soil near the drum storage area and oil rack at Building 119, along with lower concentrations of TCE and its degradation products.
- The highest concentrations of halogenated hydrocarbons (HHCs) in soils at Building 113 generally occurred in depressions of the marine clay and silt surface below the former location of the overflow pipe. The greatest lateral extent of contamination in unsaturated soil was found at the 6- to 10-ft depth, generally where the top of the marine clay and silt unit occurs.
- Data indicated that halogenated solvents migrated through the marine clay and silt to the lower sand below the source area at Building 113.
- Soil sampling data from Building 119 suggested that the vertical extent of AHCs was limited to the upper sand unit and the top of the marine clay and silt unit. The highest level of AHCs was encountered along the top of the marine clay and silt unit at the groundwater table.
- The extent of PAH migration at Building 119 appeared to be limited because of these compounds' strong sorptive properties. The highest PAH concentrations were detected near the ground surface (0 to 2 ft), with concentrations decreasing quickly with depth. The probable transport mechanism of PAHs was identified as erosion with surface runoff carrying PAH-contaminated soil particles downslope and into Newfields Ditch.
- HHCs were detected in groundwater and primarily consist of TCE and its degradation products. The highest concentration of TCE occurred in the lower sand and shallow bedrock aquifers near the location of the former waste TCE UST at Building 113.
- HHCs were detected in the lower sand aquifer for at least 1,500 ft in the downgradient direction (east) and at least 2,000 ft downgradient (southeast) in the shallow bedrock aquifer.
- The presence in the groundwater of relatively high concentrations of HHCs such as TCE and 1,2-dichloroethene (DCE), which have densities greater than that of water, suggest that these compounds may exist as dense nonaqueous-phase liquid (DNAPL). Free-phase DNAPL was not observed in any of the Site 32/36 borings or monitor wells. It is likely that DNAPL exists only as a residual in soil pore spaces and bedrock fractures rather than as pools as a result of the relatively complex stratigraphy that occurs in the site area.
- The ratios of TCE to its breakdown products in the soil and groundwater correspond to the ratios expected during the anaerobic biodegradation of TCE.

Technical Impracticability Zone

The first draft of the Site 32 Technical Impracticability (TI) Evaluation Report was completed in March 1994 and finalized in July 1995. The objective of that report was to provide the technical basis for the TI determination at Site 32/36. The TI Evaluation Report concluded that complete groundwater restoration to applicable or relevant and appropriate standards at Site 32 in a reasonable time frame was not feasible under any remedial scenario. It recommended isolation of the Site 32 source area to prevent continued migration of contaminated groundwater. In addition, it defined the TI Zone as the spatial extent of groundwater to be captured by the hydraulic containment system at Site 32. The boundary of the TI Zone is shown in Figure 2.3-5.

The basis for determination of technical impracticability at Site 32 is as follows:

- Complex overburden stratigraphy exists at the site with an upper sand unit, a marine clay and silt unit with sand layers and lenses, and a highly heterogeneous lower sand/glacial till unit that may or may not include a basal gravel layer. Shallow fractured bedrock exists at the site and is also heterogeneous in degree of fracturing and yield. These geologic constraints critically limit the ability to locate the DNAPL and to restore the aquifer.

- DNAPL product or residual is highly suspected to exist in the lower sand, glacial till, and shallow fractured bedrock at Site 32 because of the high concentrations of soluble halogenated compounds (near the solubility limit) detected in the groundwater in these water-bearing units. Multiple attempts to locate DNAPL pools in the overburden or bedrock have been unsuccessful. Removal of DNAPL pools would be very difficult because their locations are unknown. Residual DNAPL, being an immiscible liquid held in soil pores or rock fractures by capillary forces, is particularly difficult to remediate because it does not migrate through the aquifer in response to hydraulic forces.

- Much of the contamination at Site 32/36 is in relatively low-permeability overburden materials (lower sand/glacial till). Groundwater extraction has been shown by the groundwater treatment plant (GWTP) interim remedial measure (IRM) implemented in February 1991 to be difficult and impractical in the lower sand/glacial till flow unit because of the low yield of the extraction wells in this water-bearing unit.

- Groundwater extraction rates in the relatively high-permeability shallow fractured bedrock would be limited due to the potential for settlement of the buildings in the vicinity of Site 32. Shallow fractured bedrock groundwater extraction rates within the source area are typically low, less than 1 gpm. While sufficient for hydraulic containment into the shallow fractured bedrock, pumping at these rates in the shallow fractured bedrock alone will not contain lower sand source area groundwater.

- Excavation and removal of contaminated soil would not likely provide complete removal of the DNAPL because it appears to be present in the shallow fractured bedrock as well as in the soil.

2.3.2 ROD Summary and Remedial Objectives

RODs identify the RAOs that define the scope and purpose of the cleanup action. After the remedial action has been implemented, the RAOs effectively serve as the baseline against which monitoring or performance data are measured.

The results of the human health and ecological risk assessments revealed that contaminants in the Site 32/36 source area soil do not pose unacceptable risks to human or ecological receptors under current or future exposure pathways selected for the site, except for lead and copper at the former drum storage area at Site 36, which contributed 90% of the total hazard indices that exceeded benchmark values. Due to the uncertainties associated with the ecological risk assessment, RAOs for ecological risk were not developed. Because some of the contaminants in Site 32/36 source area soil could leach to groundwater at concentrations that may present an unacceptable human health risk, the following source control objective was developed:

- To reduce the migration of contaminants from Site 32/36 source area soil and groundwater such that groundwater outside the TI Zone will attain all chemical-specific groundwater standards within the 30-year reasonable time frame for groundwater restoration.

RAOs for the mitigation of contaminants that have migrated to surface water and sediment from the Site 32/36 source area and dissolved phase contaminants in groundwater beyond the boundary of the TI Zone are addressed in the Zone 3 ROD.

2.3.3 Standards Assessment (ARARs)

Because the RAO for the Site 32 source area is to contain the source in-place to prevent continued migration of source area groundwater, cleanup levels have not been established nor are they required for Site 32. Instead, treatment goals (ARARs) were established using criteria specified in the New Hampshire Groundwater Protection Rules, Env-Ws 410 for the treatment of groundwater extracted as part of the Site 32 hydraulic containment system. Env-Ws 410 rules were superceded by Env.Wm-1403 in February 1999. The changes in regulatory standards made by Env-Wm 1403 have no negative effect on the selection and current protectiveness of the treatment system at Site 32, as the treatment system discharges already meet the new standards (Bechtel 1999). Additionally, no new state or federal laws have been enacted which may call into question the selection and protectiveness of the implemented remedy for Site 32. The treatment goals for extracted groundwater are presented in Table 2.3-1.

2.3.4 Remedial Actions/Systems

Following completion of the RI report (Weston 1992), revised draft final FS (Weston 1993), and FS addendum No. 1 (Weston 1995), the preferred remedial alternative was described in the revised final Site 32/36 proposed plan and in the ROD for Site 32/36 (Weston 1995). The Air Force's preferred alternative for remediation at Site 32/36 is source control and includes the following components.

- Isolation of the overburden source area or DNAPL zone at Site 32 using a vertical barrier.
- Extraction of groundwater from within and below the vertical barrier and onsite treatment of contaminated groundwater. Discharge of the treated groundwater by offsite (on base) subsurface re-injection trenches or land application.
- Long-term groundwater and treatment system monitoring.
- Excavation and offsite disposal of Site 36 VOC- and metals-contaminated soil.
- Establishment of a TI zone within which cleanup to ARARs is not considered technically feasible based on a TI determination.
- Placement of restrictions on use of groundwater and regulation of excavation activities within the Site 32 TI zone. No cleanup goals are established for Site 32 area soil consistent with the determination of TI for this area.

2.3.5 Remedial Action/System Performance Summary

All six of the required remedial action components have been completed or are installed and operating as designed. The completed actions at Site 32/36 include contaminated soil removal in 1990 and 1996, installation of sheetpiling down to the top of bedrock (isolating groundwater in the source area), and installation of a groundwater hydraulic containment system. A TI zone has also been established and will require periodic reevaluation to determine the appropriateness of the boundary compared with contamination levels. Monitoring, groundwater extraction from the source area, and enforcement of institutional controls are ongoing.

As part of the Stage 3B field investigations in 1990 at Site 32/36, the overflow pipe and contaminated soil near the waste TCE UST were excavated. A total of approximately 315 cubic yards (yd^3) of contaminated soil was removed along with the overflow pipe. In addition to the excavation, a pilot groundwater extraction and treatment system was constructed to recover and treat contaminated groundwater from the lower sand and was later modified to extract groundwater from fractured bedrock to provide some control of the migration of contaminated groundwater at the site (Weston 1995). This pilot plant operated from March 1991 through June 1995.

It was concluded that complete groundwater restoration to applicable or relevant and appropriate requirements (ARARs) at Site 32, in a reasonable time frame, was not feasible under any remedial scenario (Weston 1995). The TI evaluation report recommended isolation of the Site 32/36 source area to prevent continued migration of contaminated groundwater.

As part of the ongoing remedial action, groundwater is extracted from seven wells inside the containment area (sheetpiling). Three wells (32-5024, 32-5267, and 32-5268) are screened in the overburden, and four wells (32-6073, 32-6074, 32-6134, and 32-6141) are screened in the fractured, shallow bedrock. The groundwater extraction well configuration is shown in Figure 2.3-6, and the flow diagram for the groundwater extraction/ treatment system is shown in Figure 2.3-7. The influent concentrations to the Site 32 GWTP have significantly decreased from the initial TCE concentration of 130,000 μg/L. Current influent concentrations for TCE range from 9,300 to 31,000 μg/L.

The Site 32 GWTP has two granular-activated carbon (GAC) units operating in series (Figure 2.3-8). The systems are operated in a manner so that if any of the treatment goals are exceeded in the monthly samples collected from the primary GAC unit, the primary unit will be taken off line, and the carbon will be replaced. The secondary unit will become the primary unit, and a reserve clean unit will become the secondary unit.

The primary GAC unit at Site 32 had breakthrough four times during the first year of operation: March 1997, June 1997, October 1997, and February 1998. The secondary GAC unit prevented release of contaminants in excess of treatment standards. As the contaminant concentration in the plant influent has decreased, the length of the time to breakthrough of the primary GAC unit increases. The average time to breakthrough of the primary GAC unit is approximately 100 days.

Wells in the vicinity of the groundwater extraction wells are monitored in accordance with the *Site 32/36 Long-Term Monitoring Plan* (Bechtel 1997a), and the process flow from the extraction wells and the treatment plant are monitored in accordance with the *Site 32 System Startup and System Long-Term Monitoring Plan* (Bechtel 1997b). Use of groundwater and excavations in the vicinity of Site 32 are restricted and will continue to be restricted by the Air Force.

The plume associated with the contamination at Site 32/36 has significantly higher concentrations of TCE as compared with the rest of Zone 3. The Site 32/36 plume boundary has changed little from the previous delineations performed in the Zone 3 Remedial Investigation and the Site 32 TI Evaluation. The current delineation extends further eastward than previous delineations to encompass wells 6033 and 6031 which contain levels of TCE and cis-1,2-DCE at levels approximately equal to the cleanup goals. The concentrations of TCE and cis-1,2-DCE have not increased at these wells, in fact, the concentrations have decreased slightly; however, the wells were not included in previous plume delineations.

The Site 32 system is currently meeting its main objective of providing hydraulic containment of the Site 32 source area. Additionally, the Site 32 system is preventing migration of contaminants beyond the TI boundary. By virtue of the hydraulic containment process, a secondary effect of contaminant removal occurs at Site 32.

Areas of Noncompliance

The treatment goals for the Site 32 groundwater are being met. The goal of hydraulically containing the source area is being met (see Figures 2.3-2 through 2.3-4). There are no known areas of noncompliance.

2.3.6 Statement of Protection of Human Health and the Environment

The Air Force affirms that the remedy at Site 32/36 remains protective of human health and the environment. The remedy is cost-effective, complies with ARARs and TI objectives, and controls mobility, and/or volume of hazardous substances. Additionally, the remediation utilizes the secondary effect of containment (groundwater extraction and treatment) to reduce toxicity and volume of hazardous substances.

The Site 32/36 remedial activities have and continue to permanently reduce the risks to human health and environment by eliminating, reducing, or controlling exposures to human and environmental receptors through source area soil removals, source containment, removal of groundwater contaminants as a result of hydraulic containment efforts, and natural attenuation. The principal threats at Site 32/36 are human contact with contaminated groundwater. Access to groundwater is restricted through the land use control provisions of the Pease Long-Term Lease. Selected removal of contaminated soil has reduced a source of groundwater contamination. Containment of the Site 32 source area through isolation of source area, using a vertical barrier, and extraction/treatment of contaminated groundwater has, and will continue to, reduce the concentration of groundwater contaminants thus reducing the potential for human and ecological exposure to contaminated media.

2.3.7 Recommendations

Annual evaluation of system operation and environmental monitoring should continue and be used as a means of identifying opportunities to optimize both the operation of the system (either to accelerate contaminant removal or to increase cost-effectiveness) and refine long-term monitoring activities.

2.3.8 References

Bechtel (Bechtel Environmental, Inc.), 1997a. *Site 32/36 Long-Term Monitoring Plan, Pease AFB*, New Hampshire. February.

Bechtel, 1997b. *Site 32 System Startup and System Long-Term Monitoring Plan, Pease AFB, New Hampshire.* February.

Bechtel, 1999. *Zone 3 1998 Annual Report, Pease AFB, New Hampshire.* August.

Weston (Roy F. Weston, Inc.), 1992. *Installation Restoration Program, IRP Site 32/36 Remedial Investigation Report Draft Final, Pease AFB, New Hampshire.* June.

Weston, 1993. *Site 32/36 Pilot GWTP IRM at Pease AFB, New Hampshire. Letter Report.* November.

Weston, 1993. *Installation Restoration Program, Stage 3C, Revised Draft Final Site 32/36 Feasibility Study, Pease AFB, New Hampshire.* October.

Weston, 1995. *Installation Restoration Program, Revised Site 32 Technical Impracticability Evaluation Report, Pease AFB, New Hampshire.* July.

Weston, 1995. *Installation Restoration Program, Record of Decision for Site 32/36, Pease AFB, New Hampshire.* September.

Weston, 1995. *Installation Restoration Program, Revised Final Site 32/36 Feasibility Study Addendum No. 1, Pease AFB, NH.* July.

Weston, 1995. *Installation Restoration Program, Record of Decision for Zone 3, Pease AFB, NH.* September.

Table 2.3-1
Extracted Groundwater Treatment Goals
Site 32, Building 113

Compound	Treatment goal (µg/L)[a]	Compound	Treatment goal (µg/L)[a]
VOCs			
Benzene	5	Ethylbenzene	700
Chlorobenzene	100	Isopropylbenzene	89.1 [c]
Chloromethane	3 [b]	Tetrachloroethene	5
1,2-Dichlorobenzene	600	Toluene	1,000
1,3-Dichlorobenzene	600	1,2,4-Trichlorobenzene	70
1,4-Dichlorobenzene	75	1,1,1-Trichloroethane	200
Dichlorodifluoromethane	1,000 [b]	Trichloroethene	5
1,1-Dichloroethane	81 [b]	Trichlorofluoromethane	2,000 [b]
1,1-Dichloroethene	7	1,2,4-Trimethylbenzene	70
Cis-1,2-Dichloroethene	70	Vinyl chloride	2
Trans-1,2-Dichloroethene	100	Xylenes (total)	10,000
SVOCs			
Acenaphthene	2,190 [c]	2-Methylnaphthalene	13.4 [c]
Benzoic acid	28,000 [b]	4-Methylphenol	350 [b]
Bis(2-ethylhexyl) phthalate	6	Naphthalene	20 [b]
Dimethyl phthalate	313,000	4-Nitrophenol	60 [d]
Di-n-butyl phthalate	3,650 [c]	Pentachlorophenol	1
2,4-Dimethylphenol	730 [c]		
Inorganics			
Arsenic	50	Manganese	1,500 [e]
Barium	2,000	Mercury	2
Beryllium	4	Nickel	100
Boron	620 [b]	Potassium	35,000 [b]
Chromium	100	Selenium	50
Copper	1,300	Vanadium	20 [d]
Lead	15	Zinc	2,000 [d]

Source: Site 32/36 ROD (Weston 1995f)

[a] Value presented is an MCL unless otherwise noted.
[b] New Hampshire Department of Public Health Services.
[c] Concentration based on cancer risk of 10^{-6} or hazard index of 1.
[d] EPA Lifetime Health Advisory.
[e] State of New Hampshire ambient water quality criteria.

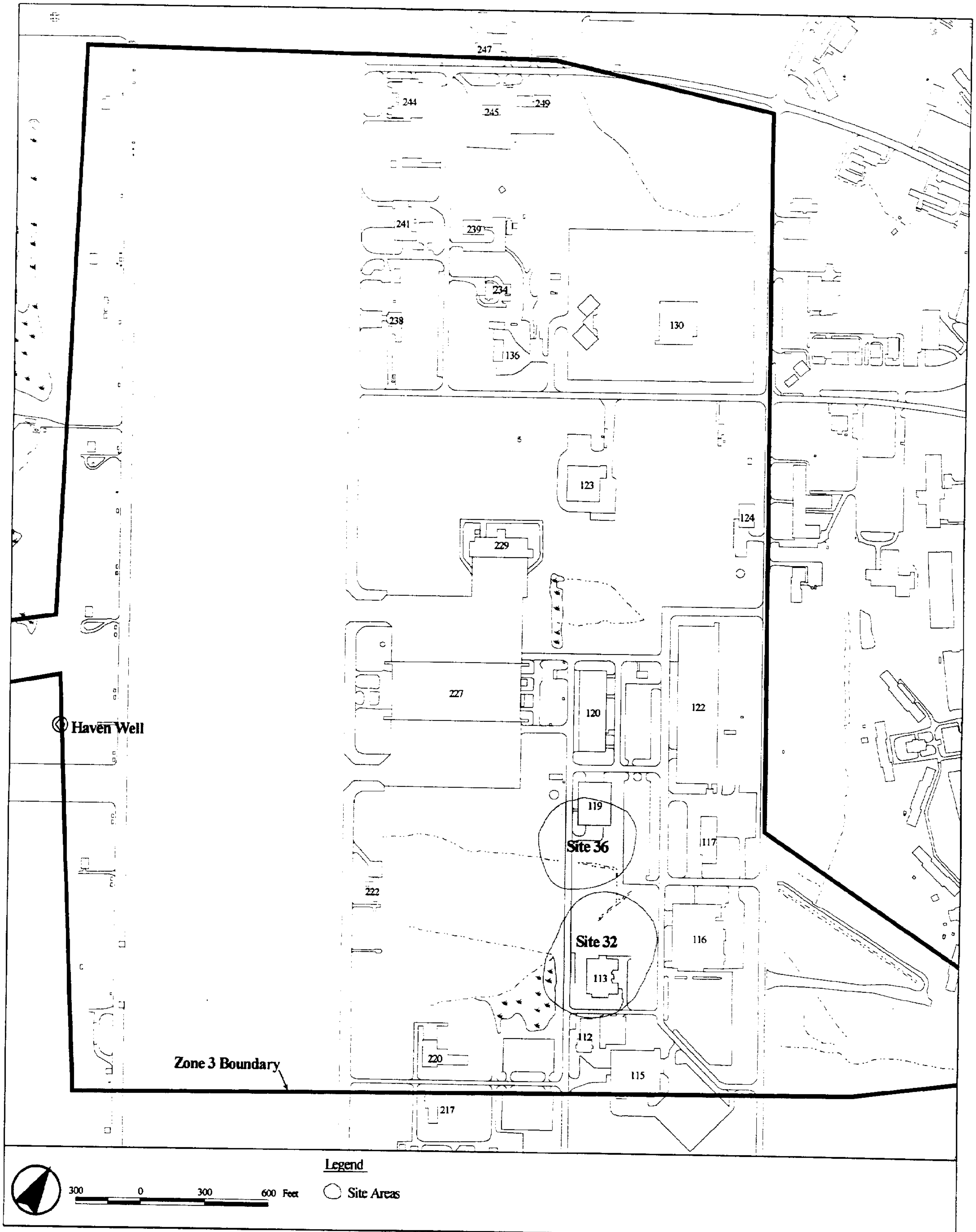

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Figure 2.3-1
Sites 32/36, Zone 3

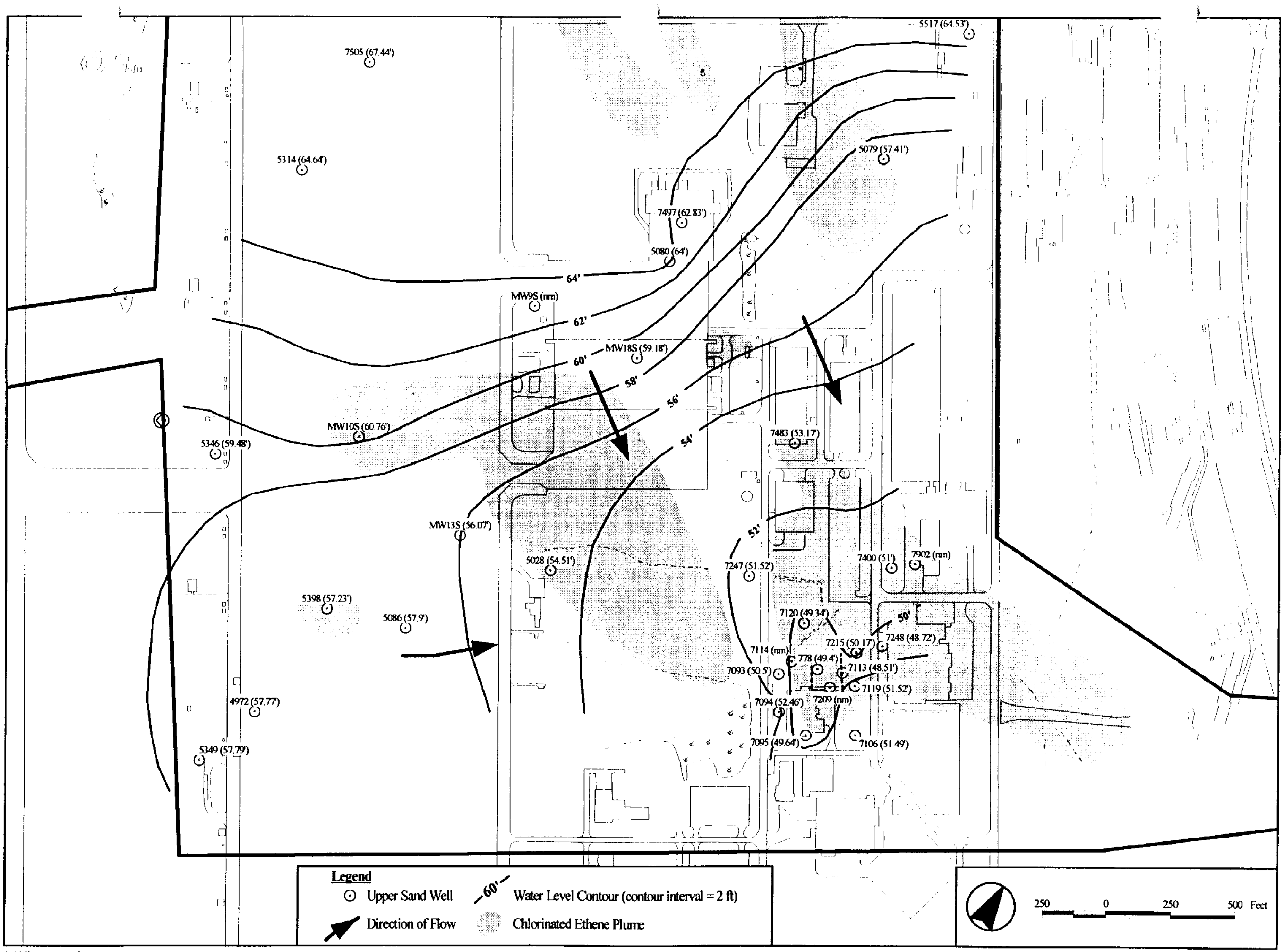

Figure 2.3-2 Zone 3 Upper Sand Water Levels -- March 1999

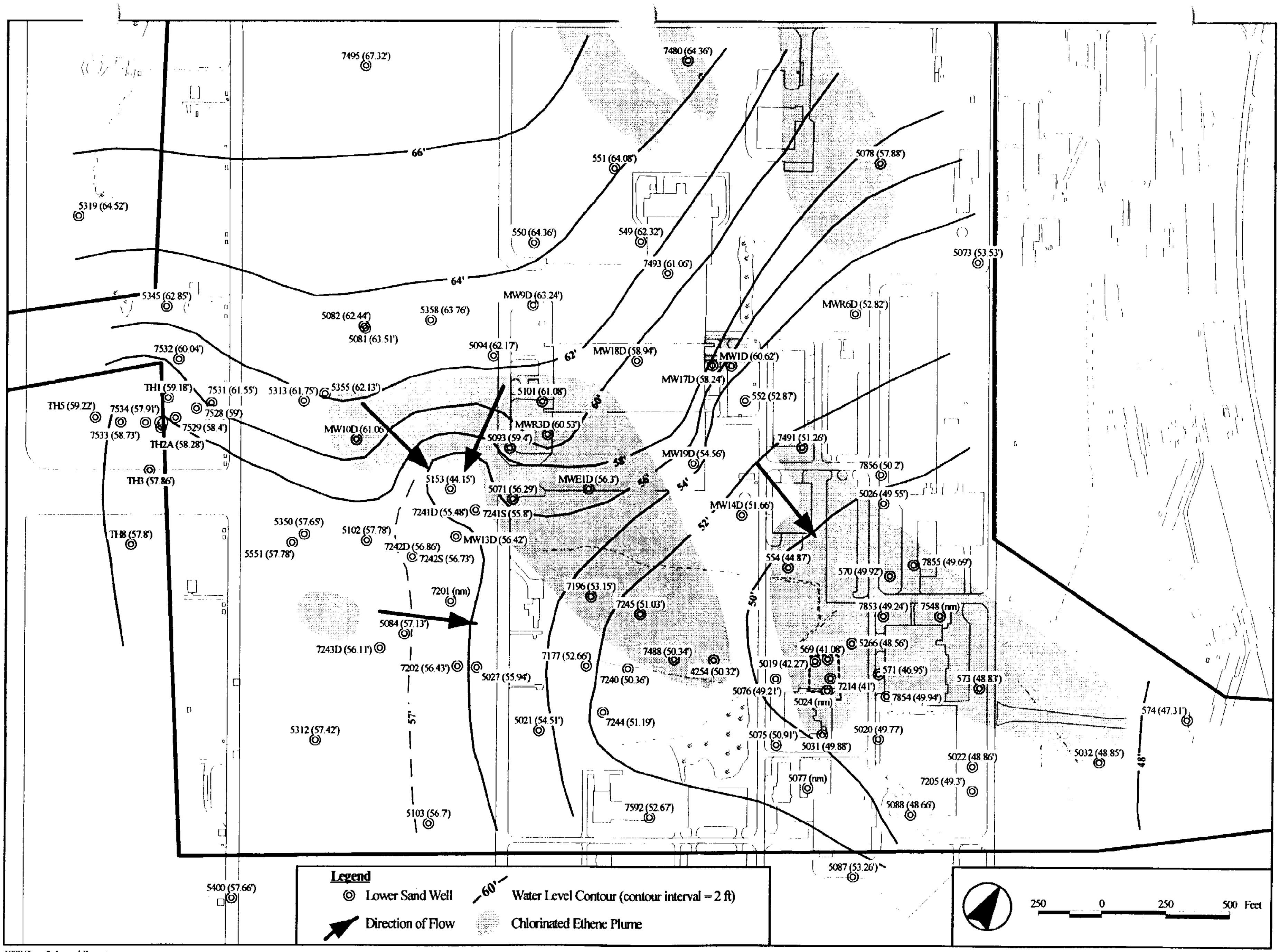

Figure 2.3-3 Zone 3 Lower Sand Water Levels – March 1999

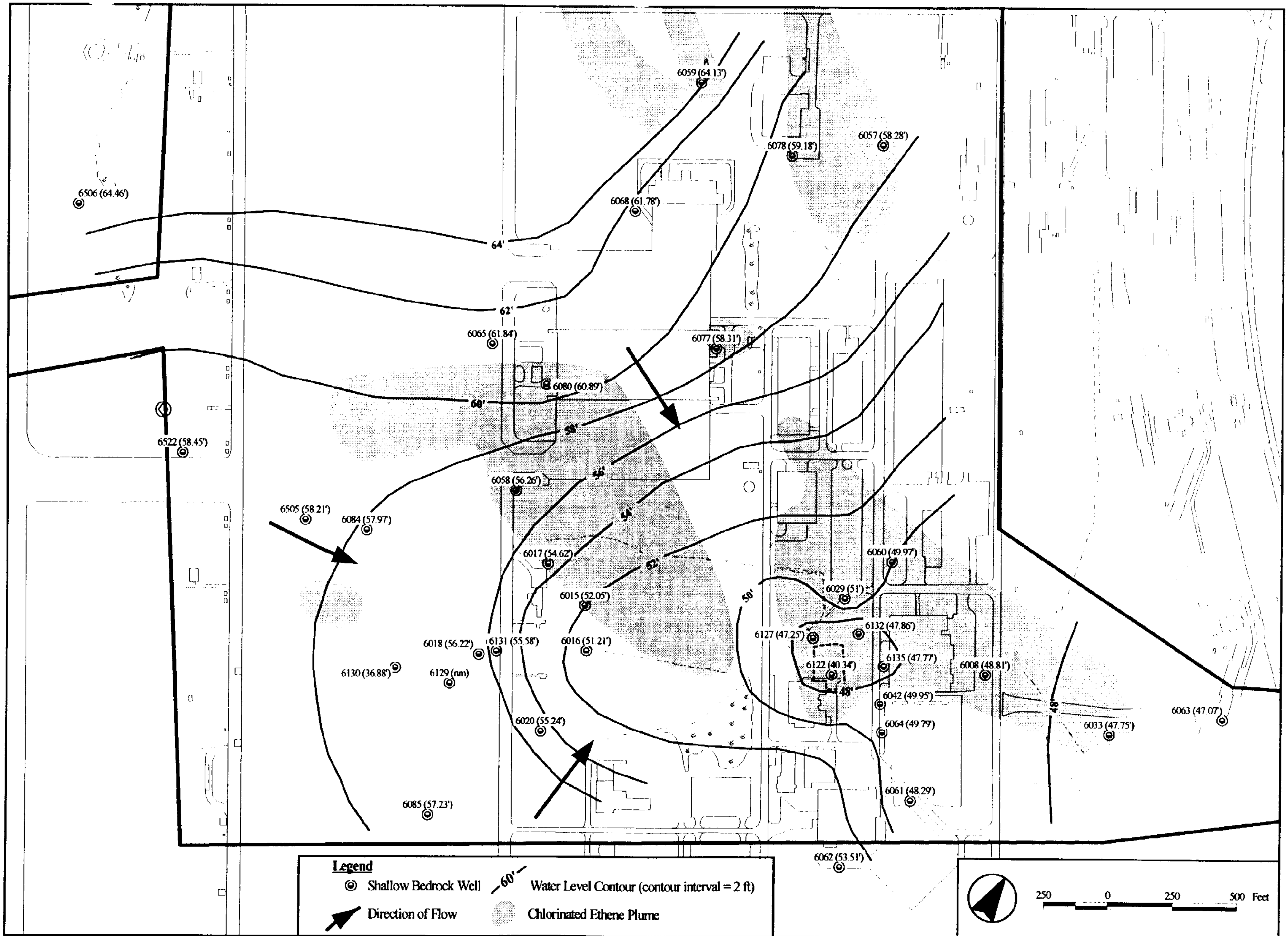

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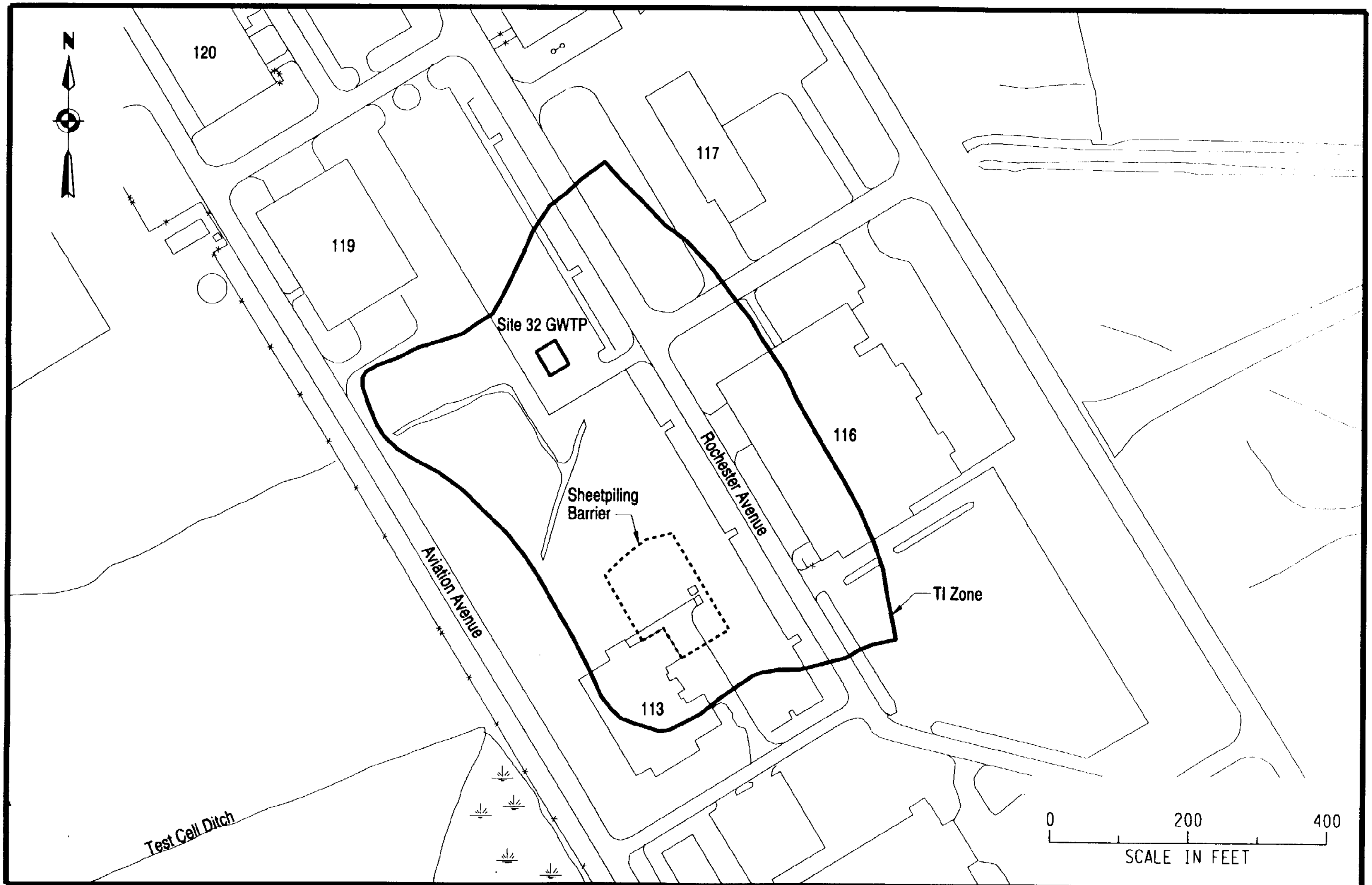
Figure 2.3-4 Zone 3 Shallow Bedrock Water Levels – March 1999



O:/22696/003/32FIG9.DCN

Figure 2.3-5
Site 32 TI Zone
Pease AFB, New Hampshire

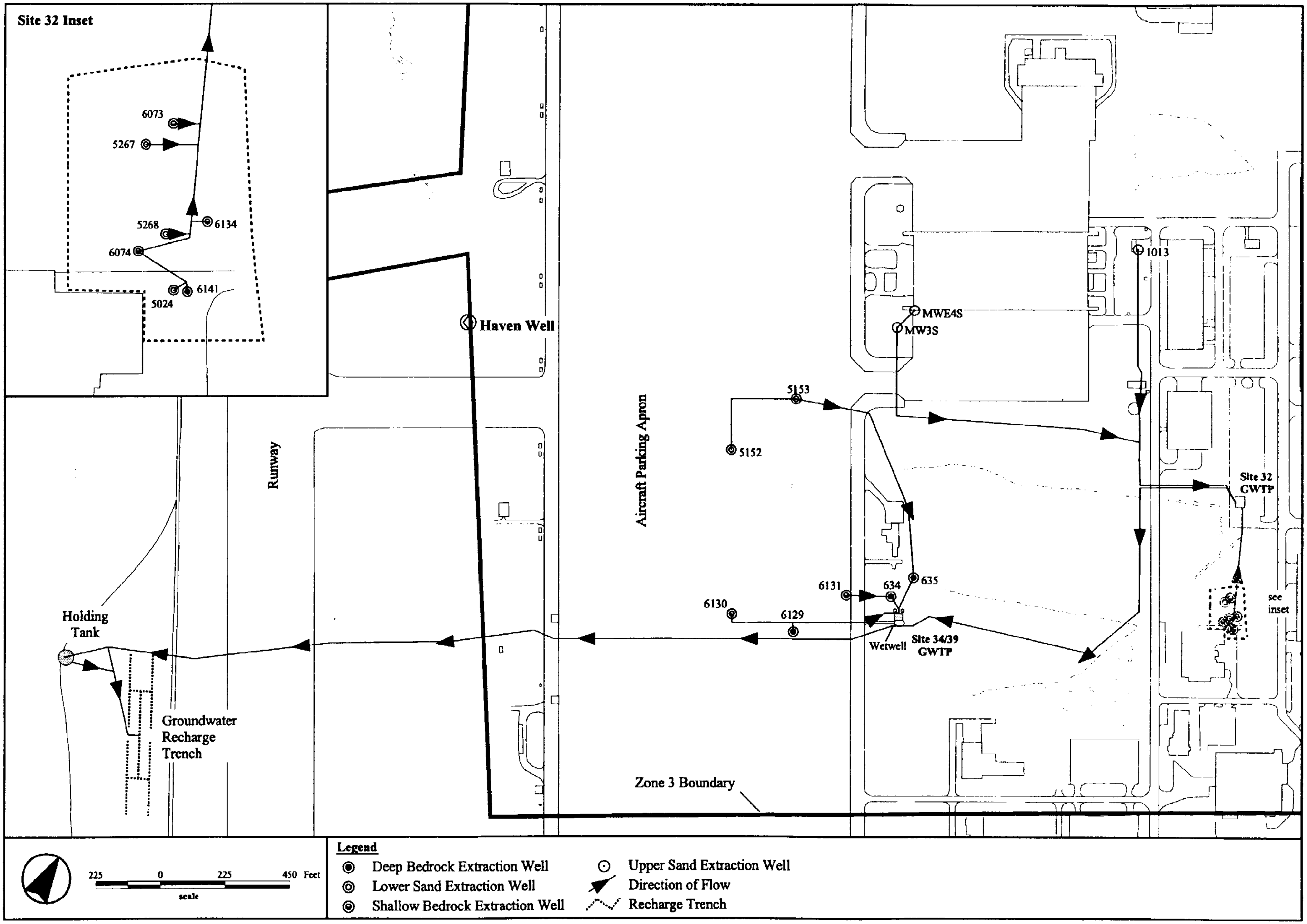


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Figure 2.3-6
Layout of Zone 3 Treatment Systems
Zone 3, Pease AFB, NH

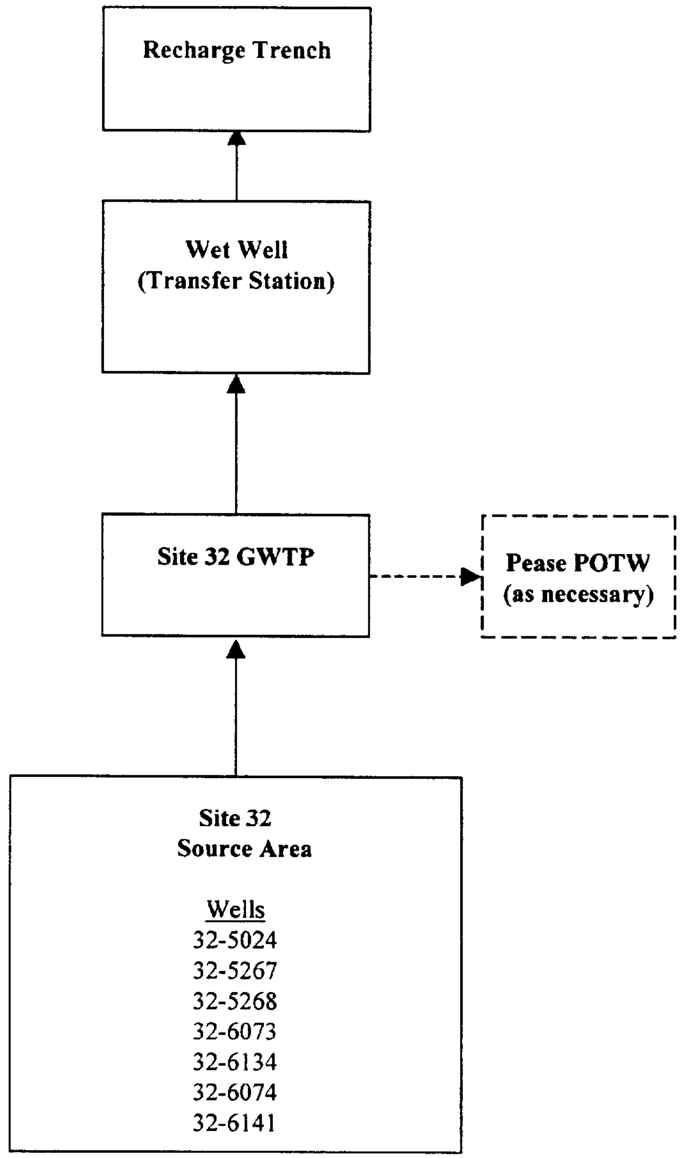
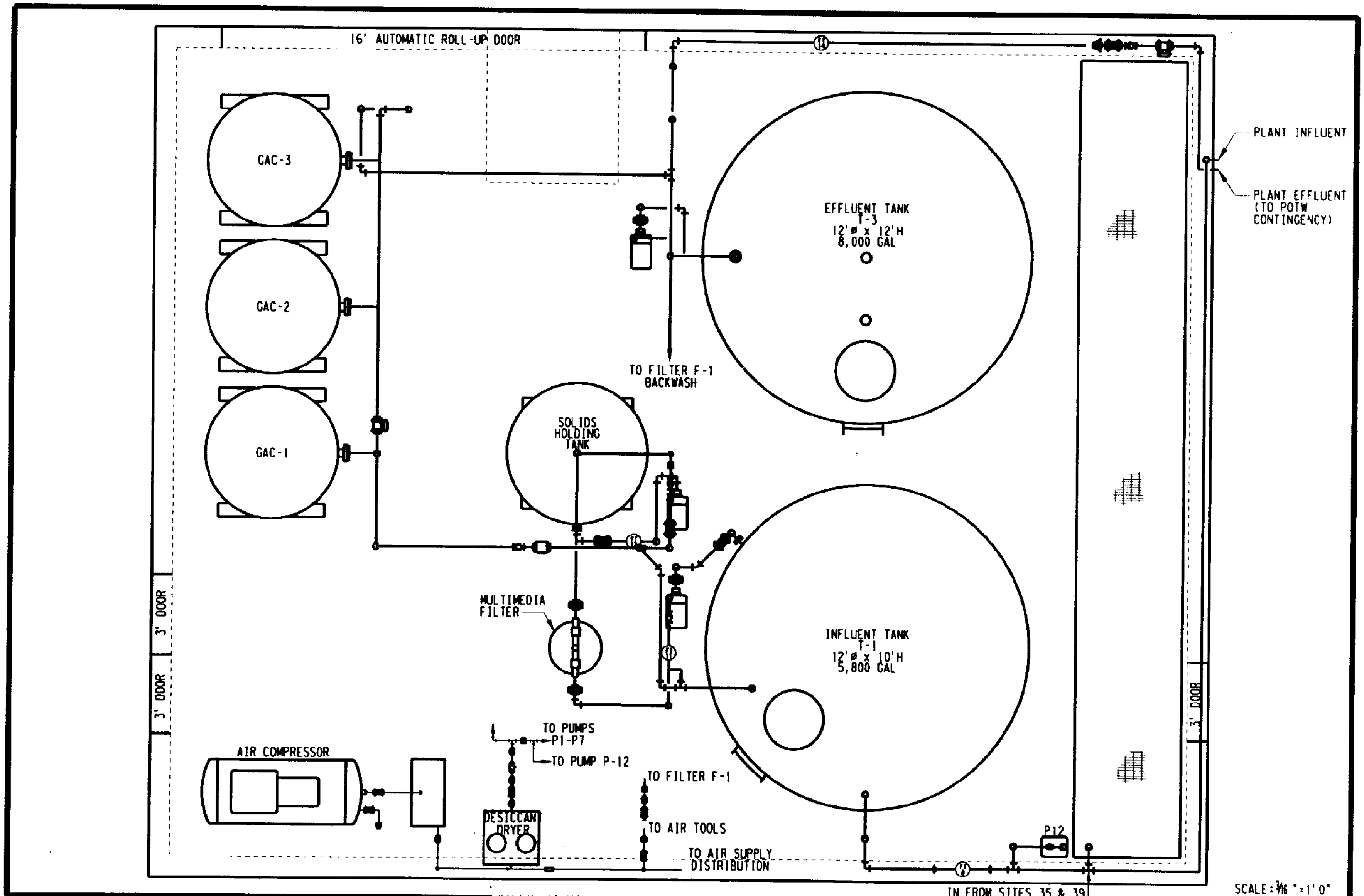


Figure 2.3-7 Flow of Site 32 Groundwater Extraction System
Pease AFB, NH



SCALE: 3/16" = 1'0"

0:/22696/003/32FIG2-3.DGN

Figure 2.3-8
Site 32 Groundwater Treatment System
Pease AFB, NH

2.4 ZONE 3, SITES 34/39

2.4.1 Introduction

2.4.1.1 Site Location and Description

Zone 3 is located in the center of Pease AFB and consists of multiple individual sites as discussed in paragraph 2.4.1.2 below. The Zone 3 layout is provided in Figure 2.4-1. The remedial approach is groundwater extraction and treatment for source area remediation and migration control. Source area remediation and plume migration control, along with natural attenuation of contaminated groundwater, will restore groundwater to Zone 3 groundwater cleanup goals specified in the Zone 3 ROD. The natural attenuation component of the Zone 3 remedy includes the down gradient portion of Site 32 contaminated groundwater plume [i.e., that area of contaminated groundwater outside the Site 32 Technical Impracticability (TI) boundary]. As stated in the Zone 3 ROD, in the event that natural attentuation of the Site 32/36 dissolved phase plume outside the TI boundary does not meet expectations, additional remedial measures will be implemented.

2.4.1.2 Site History and Contaminant Sources

The following provides a discussion of each of the Zone 3 sites.

<u>Site 32/36</u>

Please see Section 2.3 of this report.

<u>Site 33</u>

Site 33 consists of the Aircraft Maintenance Squadron hangar (Building 229). Operations in the building included cleaning and repairing aircraft fuel systems and tanks. In 1964, an oil/water separator was installed to receive wastes from the building floor drains. Activities of concern at the site include past use of TCE and a possible fuel/oil spill near the building. The principal area of concern is the former location of the oil/water separator and associated sump in the southwestern corner of the building. These items were removed in October 1991.

In May 1996, 235.27 tons of soil was excavated and removed from the west of Building 229. Additional information of the removal is included in the *Zone 3 Remedial Action Report* (Bechtel 1998a).

<u>Site 34</u>

The JETC (Building 222) was constructed in the late 1960s and was operated by the Air Force from 1970 to 1990. The JETC was used to test the performance of jet engines over complete power ranges, including engine idle, military power, and afterburner. Water flow rates generated during a test could range from 10 to 100 gpm, with a single test using 3,000 gal or more of water. Liquid generated from activities at the JETC potentially contained polynuclear aromatic hydrocarbons (PAHs), fuel, hydraulic fluid, and solvents.

Before 1989, waste liquid from Building 222 drained directly to the Test Cell Ditch, which forms the uppermost section of Grafton Ditch. In 1989, the test cell bay effluent was discharged to an oil/water separator prior to its discharge to the Test Cell Ditch, while the effluent from the exhaust stack was discharged directly to the Test Cell Ditch. After modification of the test cell in December 1989, only the effluent from the washdown of the intake stack and the building storm water drains discharged to the Test Cell Ditch. The rest of the effluent was containerized for disposal. Other sources of contamination at Site 34 are the former locations of the 5,000-gal UST that was used to store jet fuel, the oil/water separator, and two No. 2 heating fuel USTs. All the USTs at Site 34 were removed in September 1992.

Site 35

Building 226, referred to as the Industrial Wastewater Treatment Plant, was built in 1956 to house a dissolved air flotation water treatment system. The system operated from 1956 to 1975, processing aircraft washwater and wastewater from Buildings 119 and 227. During this period, treated water was discharged to the sanitary sewer system. In 1973, an oil/water separator was installed next to Building 226 to replace the dissolved air flotation system. Beginning in 1974, wastewater that passed through the oil/water separator was discharged into the storm sewer system. In 1989, the oil/water separator discharge was rerouted to the base sanitary sewer system. Building 226 was removed in 1992, and the building foundation was removed in the spring of 1993 and then paved over. A concrete recovery extraction well (CREW) was installed in the southeastern corner of the foundation excavation to allow for potential free product recovery. A performance test was conducted on CREW 35-1013 in May 1995. Further information regarding this test may be found in the *Technical Memorandum - Site 35 CREW Performance Test* (Weston 1995).

In addition to the oil/water separator, areas of concern at Site 35 include the former 15,000-gal UST and the Hazardous Material Storage Area. The UST was used to store solvents and was located next to the oil/water separator between Buildings 226 and 227. The UST, along with the oil/water separator, was removed in October 1991. The Hazardous Material Storage Area was used for temporary drum storage between 1982 and 1990 and was located on the asphalt area between Building 226 and Dover Avenue.

The *Zone 3 ROD* (Weston 1995) specified that groundwater would be pumped from Site 35 as part of the selected remedy for Zone 3. Pumping from concrete recovery and extraction well began in June 1997, and the extracted groundwater is treated at the Site 32 GWTP and is discharged at a groundwater recharge trench on the western side of the base runway.

Site 38

Site 38 consists of several maintenance shops (Building 120) that were used for a variety of purposes when the base was in operation. The shops include a sheet metal shop, paint shop, welding shop, battery shop, and a nondestructive testing area. The sources of contamination at Site 38 were the drum storage area and the floor drain pipeline adjacent to the eastern corner of the building.

In April 1997, excavation of contaminated soil was performed on the northwestern and southeastern sides of Building 120 (Bechtel 1998b). A total of 418.22 tons of soil was removed from the site.

Site 39

Site 39 (Building 227) includes the largest hangar at Pease AFB, which served as a major maintenance area for aircraft. The hangar was used for a variety of general maintenance activities, including degreasing, paint stripping, minor repairs, and washdown of aircraft. The northern quarter of the hangar housed a wash rack area and a hazardous waste storage area (HWSA) for 55-gal drums. The floor drains in that area were connected to the Building 226 Industrial Wastewater Treatment Plant (1956 to 1974) and later, to the oil/water separator (1974 to 1991). From 1956 to 1974, the floor drains for the other sections of the building (along with the roof drains) connected directly into the Flightline storm sewer system, which discharges into McIntyre Brook. In 1974, a low-flow bypass line was constructed to connect these drains with the Building 226 oil/water separator. From 1974 to 1991, wastewater from the Building 227 floor drains emptied into the Flightline storm sewers only during rainstorms when the wastewater was highly diluted. The soil and groundwater adjacent to and underneath the building are the primary areas of concern. Contaminant sources are suspected to be (1) solvent, oil, and fuel spills on the floors or outside the building and (2) wastewater discharged to the Flightline storm sewers from the building drainage system.

Site 73

Please see Section 4.2 of this report.

2.4.1.3 Summary of Site Characteristics

Topography

Zone 3, which includes Site 34/39, is of relatively low relief, with the runway and parking apron being located along the high point. Much of the original topography has been altered by construction, and locally steep embankments occur adjacent to roadways and buildings.

Geology/Hydrogeology

The bedrock surface beneath the JETC is irregular, probably as a result of preglacial preferential erosion. Overall, the bedrock ranges from highs of 0 ft bgs (outcrop approximately 15 ft northeast of Building 222) to lows of greater than 45 ft bgs. A bedrock high located under Building 222 is bordered on the east and west by steep-sided, broad valleys. Another bedrock high exists east-northeast of Building 222. The upper few inches to approximately 1-ft thickness of bedrock at the JETC was found to be weathered and highly fractured.

The uppermost surfacial materials observed in the Site 34/39 area are recent swamp (i.e., bog or marsh) deposits. These deposits are especially common over the marine clay and silt unit, and accumulate in the poorly drained areas only. The thickness of the swamp or peat deposits varies between 1 and 2 ft. Locally, these low-lying surfacial units have been modified by the Air Force using draining or cut and fill practices. Also present at the surface are fill materials. Unconsolidated sand fill at Site 34/39 ranged in thickness from 6 to 8 ft bgs; in places it was present from the ground surface to bedrock. The youngest glacial overburden unit at Site 34/39 is the upper sand. In places, the upper sand is difficult to distinguish from the fill—or where the marine clay and silt unit is absent, from the lower sand unit (stratigraphic unit that typically undelies the marine clay and silt unit). The marine clay and silt ranges in thickness from 0 to 22 ft and varies in texture from a dark gray, plastic clay with minor very thin interbeds of silty material to well-laminated, interbedded, fine sands, silts, and clays. The lower sand consists of a poorly sorted, silty sand, with some medium gravel and sand. The lower sand was absent only in the vicinity of the bedrock high near Building 222, where, in the absence of the marine clay and silt, granular deposits were considered part of the upper sand unit. The glacial till was found onsite as a more loosely compacted till located near bedrock lows. At some locations, an interval of well-sorted gravel underlies the glacial till and was sometimes field-identified as weathered bedrock.

The three hydrogeologic units that have been identified and evaluated for the Site 34/39 area are overburden, shallow bedrock and till, and deep bedrock. The saturated overburden deposits include fill material but not glacial till. The shallow bedrock and glacial till are a highly weathered and/or fractured interval of crystalline rock that extends from the base of the lower glacial sand to the top of the competent bedrock. Its thickness is typically 10 to 20 ft. The deep bedrock is generally competent bedrock beneath the shallow bedrock. Groundwater flow is primarily in unweathered fractures.

Surface Water

Pease AFB is located on a peninsula within the Piscataqua River drainage basin. Drainage is radially away from the peninsula, toward Great Bay to the west, Little Bay to the northwest and north, and the Piscataqua River to the east. A surface drainage divide is located along the northeastern side of the aircraft parking apron, with runoff to the northeast of the divide draining toward the Piscataqua River and runoff southwest of the divide draining toward Great Bay. Great Bay, Little Bay, and the Piscataqua River are all tidally influenced and are, consequently, subjected to semidiurnal variations in water levels.

The headwaters of Grafton Ditch are at the JETC (Building 222) ditch. This ditch discharges into a storm water pipe that runs parallel to Dover Avenue to its point of discharge east of the intersection of Dover Avenue and Grafton Road. Additional storm water runoff is collected in a series of storm water drains that discharge to Grafton Ditch east of Grafton Road. Beyond this point, Grafton Ditch is linear and channelized as it flows through a forested area before intersecting the natural channels of a stream that was formerly referred to as Harveys Creek. Grafton Ditch crosses under Interstate 95 and joins Newfields Ditch and North Mill Pond, eventually discharging into the Piscataqua River.

Areas of Contamination

Sites 33 and 35

Samples from wells monitoring the Upper Sand unit contained HHCs at Site 35, but samples from Site 33 did not. AHCs were detected at both sites. The Site 35 source was a former UST and an oil/water separator, and the source at Site 33 was from drains and nonpoint sources. The contamination from each source area extends to the southeast in the direction of groundwater flow.

Site 34

The primary source areas for groundwater contamination at Site 34 are the USTs associated with the JETC. Soil contamination was identified in four distinct areas at the JETC: the JP-4 Tank Area, the Fuel Oil Tank/Waste Fuel Separator Area, the manhole area, and the holding (septic) tanks area. The USTs were installed in the bedrock surface and primarily contained JP-4. In 1991, all the USTs were removed. The PAH contamination, which resulted from leaks in the USTs, is predominantly in the bedrock water-bearing units. The maximum delineated extent of the groundwater plume is approximately 600 ft down gradient to the southeast. Detected organic contamination consists of three groups of compounds: aromatic VOCs, chlorinated VOCs, and PAHs (SVOCs). Metals concentrations in subsurface soil present above established background levels (arsenic, chromium, nickel, and sodium) were found to coincide with areas of organic contamination and interpreted as additives in JP-4 fuel and fuel (heating) oil used at the JETC. Barium and lead concentrations detected in surface soil above background levels were not attributed to the JETC source area or JETC activities.

Site 32/36/38 Plume

The primary sources of contamination at Site 32/36 are a former waste TCE tank and associated overflow pipe at the northern corner of Building 113, a former drum storage area and wash rack at the edge of the southern parking area of Building 119, and an area of possible past waste solvent discharge at the northeastern edge of Building 119. A hazardous materials storage area was located at Site 38, and HHC and AHC contamination was released to the Upper Sand unit. The resulting groundwater plume from all three sites primarily consists of HHCs, specifically TCE and its associated degradation compounds cis-1,2-dichloroethene (DCE), and vinyl chloride. The contaminant plume resulting from Sites 32, 36, and 38 has significantly higher concentrations of TCE compared with the rest of Zone 3.

The Site 32/36/38 plume is contained within all five identified hydrostratigraphic units: Upper Sand, Marine Clay and Silt, Lower Sand, Shallow Bedrock, and Deep Bedrock. The extent of contamination in the Upper Sand unit is relatively limited since the contaminants are primarily migrating downward from the source area. In the Lower Sand, Shallow Bedrock, and Deep Bedrock, the contaminant plume is consistent with the horizontal groundwater flow direction to the east. The furthermost down gradient plume extent is in the fractured bedrock, 1,500 ft east-northeast of the source. Additional information concerning Sites 32/36 can be found in Section 2.3 of this report.

Site 39

At Site 39, most of the contamination was identified in soils covered by concrete or asphalt paving. The contamination included HHCs, BTEX, and PAHs. The two source areas at Site 39 are at the northern and southern corners of Building 227. The Site 39 HHC groundwater plume extends from the source areas approximately 1,400 ft south and southwest from Building 227 beneath the Parking Apron. Most of the contamination occurs in the lower sand unit. The HHC concentrations in the plume extending beneath the Parking Apron are relatively low (3 to 10 μg/L). This low-concentration area of the plume extending out southwesterly from Building 227 and toward the Haven Well was most likely the result of TCE-contaminated discharge to the storm sewer at Building 227. Additionally, groundwater pumping from the Haven Well influences the direction of groundwater movement in the Flightline area, providing a potential pathway for groundwater contaminant migration toward the Haven Well from the Flightline area. The storm sewer leaked solvents to the groundwater under the Flightline Parking Apron. The storm sewer passes within 100 ft of the Haven Well before discharging into McIntyre Brook.

Contaminants were also detected in surface water and sediments at Newfields Ditch and Upper Grafton Ditch. The primary contaminants detected were pesticides, HHCs, aromatic hydrocarbons, PAHs, and metals. All segments of the surface water drainageways appeared to be affected although, in general, the concentration and number of contaminants decreased downstream from the identified source areas.

Site 73

Please see Section 4.2 of this report.

2.4.2 ROD Summary and Remedial Objectives

RODs identify the RAOs which define the scope and purpose of the cleanup action. After the remedial action has been implemented, the RAOs effectively serve as the baseline against which monitoring or performance data are measured.

The Air Force's preferred alternative for remediation as stated in the Site 34 Source Area (contaminated soils) ROD (Weston 1993) involved excavation and off-base disposal of contaminated soils. The Air Forces's preferred alternative for remediation as stated in the Zone 3 ROD (Weston 1995) involved the excavation of contaminated soils and sediments, extraction of contaminated groundwater at selected source areas, and natural attenuation of dissolved-phase contaminated plumes including the plume down gradient of Site 32/36. Specifically, the selected remedy for Zone 3 included the following remedial action components:

- Excavation and removal of sediment exceeding cleanup goals from Newfields and Upper Grafton Ditches.
- Excavation and removal of contaminated soil from Site 34 (JETC) and Site 39.
- Treatment/disposal of contaminated soils at an offsite facility.
- Groundwater extraction from Site 34/39 and treatment at the Site 34/39 GWTP.
- Source area groundwater extraction at Sites 35 and 39.
- Protection of the Haven well from groundwater exceeding the MCLs.
- Natural attenuation of the dissolved-phase Zone 3 contaminant plume emanating from Site 34/39 and outside the Site 32 TI boundary.
- Long-term environmental performance monitoring in Zone 3, consisting of groundwater sampling (including water level measurement) and analysis for GMZ maintenance, groundwater extraction system performance monitoring, and process monitoring at both groundwater treatment facilities.

2.4.3 Standards Assessment (ARARs)

Treatment goals for the Site 34/39 groundwater treatment plant are not specified in the Zone 3 ROD. However, treatment goals were established using criteria specified in New Hampshire Groundwater Protection Rules, Env-Ws 410 for treatment of groundwater extracted as part of the Site 34/39 groundwater containment system. The Env-Ws 410 rules were superceded by Env-Wm 1403 in February 1999. The changes in regulatory standards made by Env-Wm 1403 have no negative effect on the selection and current protectiveness of the groundwater extraction system implemented for Zone 3, as the treatment system discharges already meet the new standards (Bechtel 1999b).

Zone 3 groundwater cleanup goals are presented in Table 2.4-1. Soil and sediment cleanup goals for Site 34, Site 39, Upper Newfields Ditch, and Upper Grafton Ditch are presented in Table 2.4-2.

ARARs identified in the Zone 3 ROD remain current, with the exception of New Hampshire Groundwater Protection Rules, Env-Ws 410, which were superceded by Env-Wm 1403 in February 1999. The changes in regulatory standards made by Env-Wm 1403 have no negative effect on the selection and current protectiveness of the groundwater extraction system implemented for Zone 3. Additionally, no new state or federal laws have been enacted that may call into question the selection and protectiveness of the implemented remedy for Zone 3.

2.4.4 Remedial Actions/Systems

Excavation of contaminated soils and sediments as specified in the Zone 3 ROD was completed in 1996. Groundwater recovery and performance monitoring will be ongoing activities at Site 34/39. The main objective of the groundwater recovery is to depress the water table in the vicinity of the Site 34/39 contaminant plume to prevent migration of the plume toward the Haven Well.

Groundwater is extracted from seven wells inside the contaminant plume. Two wells at Site 39 (39-5152 and 39-5153) are screened in the overburden (lower sand), and five wells at Site 34 (34-6129, 34-6130, 34-6131, 34-634, and 34-635) are screened in the bedrock. Based on an optimization of the pumping scheme, it was determined to be only necessary to pump from four of the seven extraction wells at Site 34/39. The wells that are currently used as extraction wells are 39-5153 (lower sand), 34-6130 (bedrock), 34-634 (bedrock), and 34-635 (bedrock). The Site 39 source area extraction system was installed in the spring of 1999 and its performance is currently under evaluation as a part of the startup phase. In addition to the seven extraction wells at Site 32, groundwater from a concrete extraction well (CREW) at Site 35 (35-1013) is also treated by the Site 32 GWTP. The groundwater extraction well configuration is shown in Figure 2.4-2. This extracted groundwater is treated by the Site 34/39 GWTP.

The Site 34/39 GWTP is equipped to receive extracted groundwater from the seven wells inside the Site 34/39 contaminant plume. Layout of the Site 34/39 GWTP is shown in Figure 2.4-3. Water pumped from the extraction wells, typically contaminated with TCE and its daughter products, is directed to an equalization tank. The wastewater is then pumped from the equalization tank to a multimedia filter to remove suspended solids from the waste stream. From the multimedia filter, the flow is directed through two granulated activated carbon (GAC) units operating in series. Both treatment plants contain three GAC units allowing one to be recharged while the other two units are in operation. After the GAC units, the flow is into an effluent tank prior to discharging from the plant.

Flow from the 34/39 treatment plant is directed to a 300-gal wet well adjacent to the Site 34/39 GWTP. Treated groundwater is pumped from the wet well across the Flightline into a 250,000-gal holding tank. From the holding tank, the treated water is gravity fed to a groundwater recharge trench. The recharge trench consists of four 250-ft laterals of perforated PVC pipe installed in the overburden. Additionally, the ability to discharge to the Pease wastewater treatment facility is available as a contingency. Figure 2.4-4 shows the flow of the Site 34/39 groundwater extraction system.

Monitoring of the groundwater quality and water levels has been performed under the guidance of the *Zone 3 System Startup and System Long-Term Monitoring Plan* (Bechtel 1997). Future monitoring, including extraction wells and the treatment system, will be performed under the recently issued *Zone 3 Draft Final Revised Long-Term Monitoring Plan* (Bechtel 1999a).

2.4.5 Remedial Action/System Performance Summary

2.4.5.1 Site 34

A soil removal action was performed in July 1994 to excavate the contaminated overburden. An approximate area of 270 ft by 170 ft—almost 25,900 tons—was excavated to bedrock. Approximately 10,700 tons of potentially contaminated soils were segregated from the excavated soils. This source area removal action provided the basis for no further action on any soil contamination at Site 34. Further information regarding this action may be found in the *Installation Restoration Program, Site 34-FJETC Source Area Remedial Action Report, Pease AFB, New Hampshire*, July 1995 (Metcalf and Eddy 1995).

Contaminated sediment was excavated from Upper Newfields Ditch and Upper Grafton Ditch in September 1996. Approximately 810 tons of contaminated sediment—465 tons from Upper Grafton Ditch and 345 tons from Upper Newfields Ditch—were excavated and disposed of offsite.

Extraction and treatment of contaminated groundwater at Site 34 began in 1997. The Site 34/39 GWTP processed approximately 7.2 million gal with an average flow rate of 23.3 gpm during it's first year of operation (1997 – 1998). The amount of contaminant removed by the Site 34/39 groundwater extraction system was not calculated since the water received by the treatment plant (influent) already meets all of the Zone 3 groundwater cleanup goals.

To protect the Haven Well from a plume of contaminated groundwater being drawn toward it, a pumping restriction of 300 gpm daily average has been placed on it. During the period of March 1997 through April 1998, the Haven well pumped an average of 50 gpm. The highest amount pumped was in June 1997 with an average pumping rate of 126 gpm, and the lowest pumping rate was in March 1998 with an average rate of 23 gpm. The current rate of extraction is well below the maximum allowable amount. As a result, the Haven well has had a minimal impact on the flow of groundwater in Zone 3. Figures 2.4-5 through 2.4-7 clearly show that the groundwater flow is not toward the Haven Well.

2.4.5.2 Site 35

Extraction and treatment of contaminated groundwater at Site 35 began in June 1997. The extracted groundwater is pumped to the Site 32 GWTP. The pumping rate for the Site 35 extraction well (35-1013) is currently approximately 1 gpm.

2.4.5.3 Site 39

A soil removal action was performed in May of 1996. A total of approximately 181 tons of soil was removed and disposed of at a RCRA disposal facility. The Zone 3 ROD specifically mandated RCRA disposal for the soils generated by the excavation activities for this site (Weston 1995). Although TCE and manganese were suspected contaminants, they were not detected at or above their applicable cleanup levels.

The Site 39 groundwater extraction system became operational in the spring of 1999. The performance of this system is currently under evaluation. The system has not been in operation for a sufficient length of time to determine effectiveness.

2.4.5.4 Zone 3 Groundwater

Groundwater monitoring is performed to evaluate the effectiveness of source area groundwater extraction, hydraulic containment efforts, and natural attenuation in meeting the stated RAOs. General trends in the groundwater quality at Zone 3, as discussed in the *Zone 3 First Year Operations Report* (Bechtel 1998b), indicate declining trends in contaminant levels in Zone 3 groundwater. These declining trends in turn reduce the risks associated with exposure to the groundwater (or surface water into which the contaminated groundwater may discharge). Performance monitoring data that support these findings include the following:

- The contaminant concentrations at several wells down gradient of the Site 32/36 and Site 38 source areas suggest that the remedial approach is impacting the subsurface. The down gradient wells (6135 and 6008) show decreases in TCE concentration with corresponding increases in chloride concentrations. The reduction of TCE concentrations and the increase of chloride in the groundwater down gradient of the source area provide evidence that reductive dehalogenation may be occurring.
- Although TCE levels have remained unchanged at well MW10D (Site 39 source area) for the last two years, chloride concentration is about two times background which suggests that reductive dehalogenation is occurring.

2.4.5.5 Areas of Noncompliance

The treatment goals for the Site 34/39 groundwater are being met. The main objective of the groundwater recovery to depress the water table in the vicinity of the Site 34/39 contaminant plume to prevent migration of the plume toward the Haven Well is being met. The natural attenuation processes are working to reduce contaminant levels in the groundwater. There are no known areas of noncompliance.

2.4.6 Statement of Protection of Human Health and the Environment

The remedy at Zone 3 remains protective of human health and the environment. The remedy is cost-effective, complies with ARARs, and significantly reduces the toxicity, mobility, and/or volume of hazardous substances. Additionally, the remediation utilizes alternative treatment technologies to the maximum extent practicable for this site.

The Site Zone 3 remedial activities have and continue to permanently reduce the risks to human health and environment by eliminating, reducing, or controlling exposures to human and environmental receptors through source removal, source area groundwater extraction, hydraulic containment, and natural attenuation. The principal threats at Zone 3 are human contact with contaminated groundwater. The removal of contaminated soil has eliminated the source of groundwater contamination. Extraction and treatment of contaminated groundwater, along with the natural attenuation process, has and will continue to reduce the concentration of groundwater contaminants thus reducing the potential for human and ecological exposure to contaminated media.

2.4.7 Recommendations

Annual evaluation of system operation and environmental monitoring should continue and be used as a means of identifying opportunities to optimize both the operation of the system (either to accelerate contaminant removal or to increase cost-effectiveness) and refine long-term monitoring activities. The monitoring and evaluation of natural attenuation processes should continue in order to determine effectiveness. In addition, future evaluations (annual reports) should attempt to identify the level of progress toward meeting site- or zone-specific cleanup goals developed during the remedy decision-making process.

2.4.8 References

Bechtel (Bechtel Environmental, Inc.), 1997. *Zone 3 System Startup and System Long-Term Monitoring Plan, Pease AFB, NH.* June.

Bechtel, 1998a. *Zone 3 Excavations Remedial Action Report Draft Final, Pease AFB, NH.* March.

Bechtel, 1998b. *Zone 3 First-Year Operations Report, Pease AFB, NH.* September.

Bechtel, 1999a. *Zone 3 Draft Final Revised Long-Term Monitoring Plan, Pease AFB, NH.* September.

Bechtel, 1999b. *Zone 3 1998 Annual Report, Pease AFB, NH.* August.

Metcalf and Eddy 1995. *Installation Restoration Program, Site 34-JETC Source Area Remedial Action Report, Pease AFB, New Hampshire.* July.

Weston (Roy F. Weston, Inc.), 1993. *Installation Restoration Program, Record of Decision for Site 34, Pease AFB, NH.* September.

Weston, 1995. *Technical Memorandum - Site 34/39 Performance Test, Pease AFB, NH.* October.

Weston, 1995. *Installation Restoration Program, Record of Decision for Zone 3, Pease AFB, NH.* September.

Weston, 1995. *Technical Memorandum – Site 35 CREW Performance Test, , Pease AFB, NH.* October.

Table 2.4-1
Site 34/39 Groundwater Cleanup Goals
Site 34/39

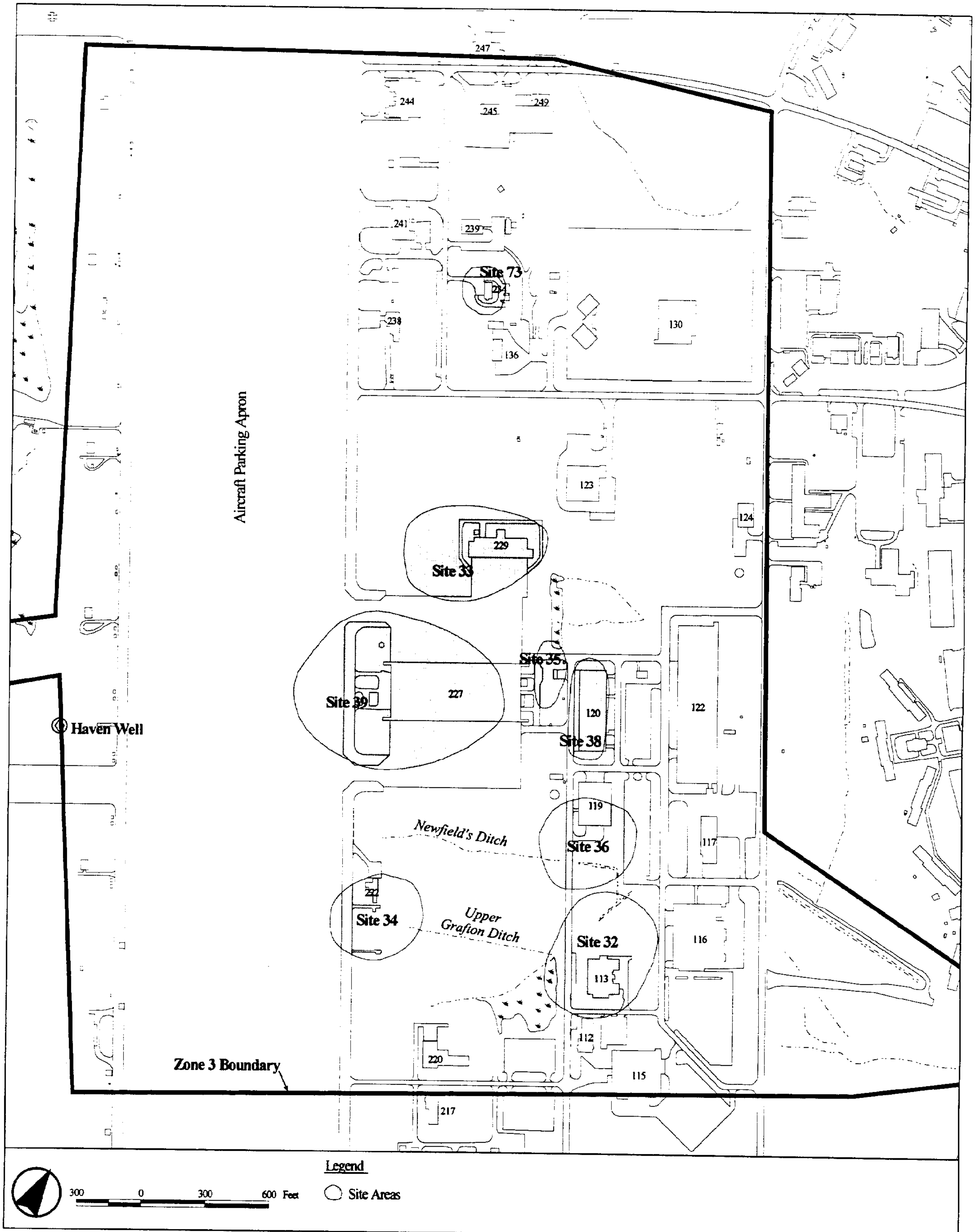
Compound	**Cleanup Goal (μg/L)[a]**
Organics	
Benzene	5
Chlorobenzene	100
Chloromethane	3 [b]
1,1-Dichloroethene	7
1,1-Dichloroethane	5
cis-1,2-Dichloroethene	70
trans-1,2-Dichloroethene	100
Ethylbenzene	700
Tetrachloroethene	5
Toluene	1,000
Trichloroethene	5
Vinyl chloride	2
SVOCs	
Bis(2-ethylhexyl) phthalate	6
2-Methylnaphthalene	13.4 [c]
Naphthalene	20 [b]
Pentachlorophenol	1
Phenanthrene	13.4 [c]
sec-Butylbenzene	7.3 [c]
Inorganics	
Aluminum	393
Arsenic	50
Cadmium	18.3
Chromium	100
Lead	15
Manganese	942
Potassium	35,000 [b]
Vanadium	20 [d]

[a] Value presented is a maximum contaminant level (MCL) unless otherwise noted.
[b] New Hampshire Department of Public Health Services.
[c] Concentration based on cancer risk of 10^{-6} or hazard index of 1.
[d] EPA Lifetime Health Advisory.

Table 2.4-2
Soil and Sediment Cleanup Goals
Site 34/39

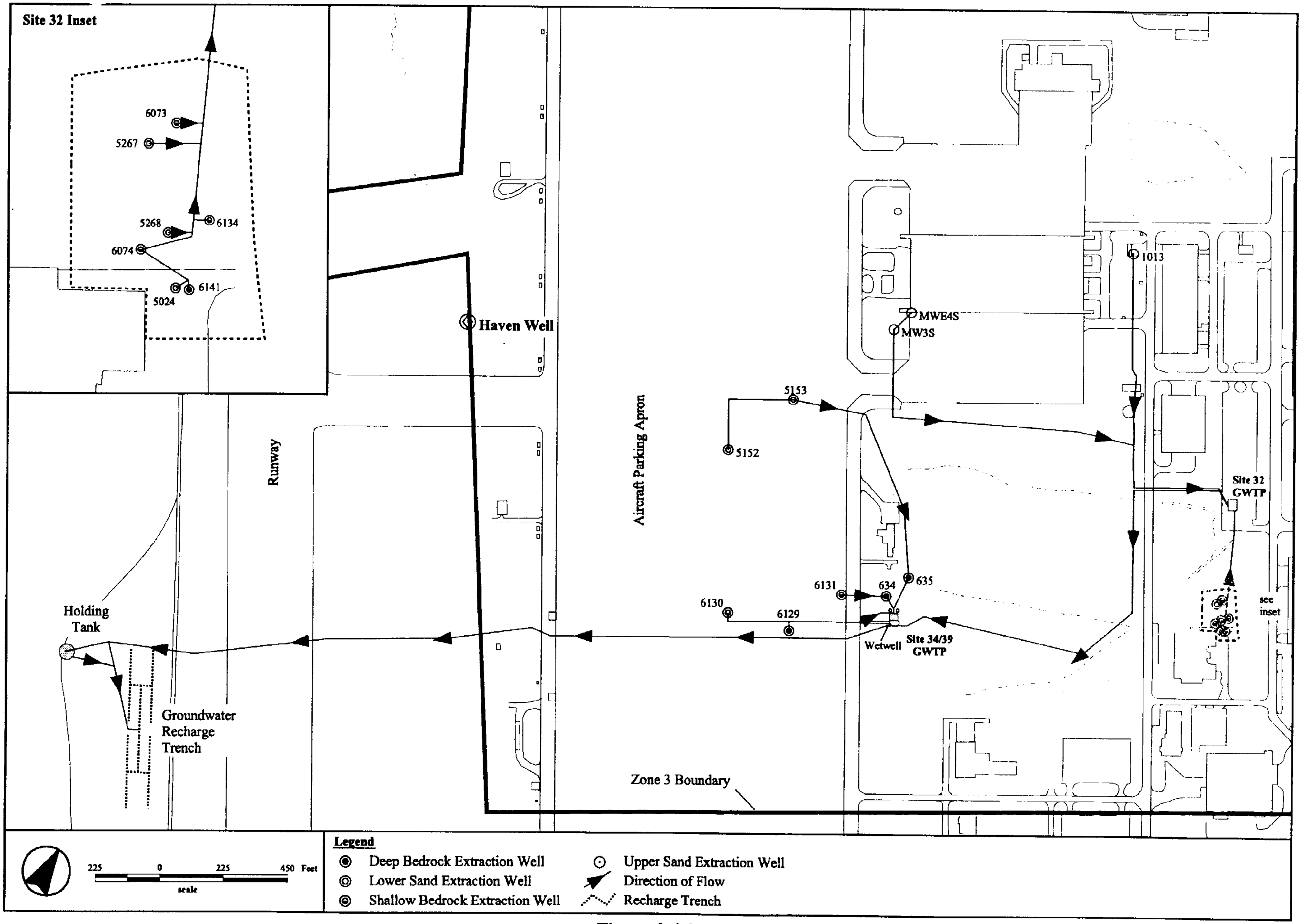
Compound	Cleanup Goal (mg/kg) [a]	Maximum Concentration Detected	Compound	Cleanup Goal (mg/kg) [a]	Maximum Concentration Detected
Organics			***Inorganics***		
Site 34 (soil)					
Total BTEX	1.0 [b]	-- [b]			
TPH	100 [b]	787 [b]			
Site 39 (soil)					
Trichloroethene	0.12 [c]	--- [c]	Manganese	623 [c]	-- [c]
Upper Newfields Ditch (sediment)					
			Arsenic	33 [c]	441 [c]
			Cadmium	5 [c]	12 [c]
			Chromium (total)	80 [c]	97.4 [c]
			Lead	42.1 [c]	304 [c]
			Mercury	0.2 [c]	0.44 [c]
			Nickel	46.7 [c]	139 [c]
			Zinc	120 [c]	659 [c]
Upper Grafton Ditch (sediment)					
Total PAHs	8.94 [c]	103 [c]	Arsenic	33 [c]	48.3 [c]
			Lead	42.1 [c]	119 [c]
			Mercury	0.2 [c]	0.45 [c]

[a] *Source:* Zone 3 and Site 34 RODs.
[b] *Source:* Site 34-JETC Source Area Remedial Action Report.
[c] *Source:* Zone 3 Excavations Remedial Action Report Draft Final.



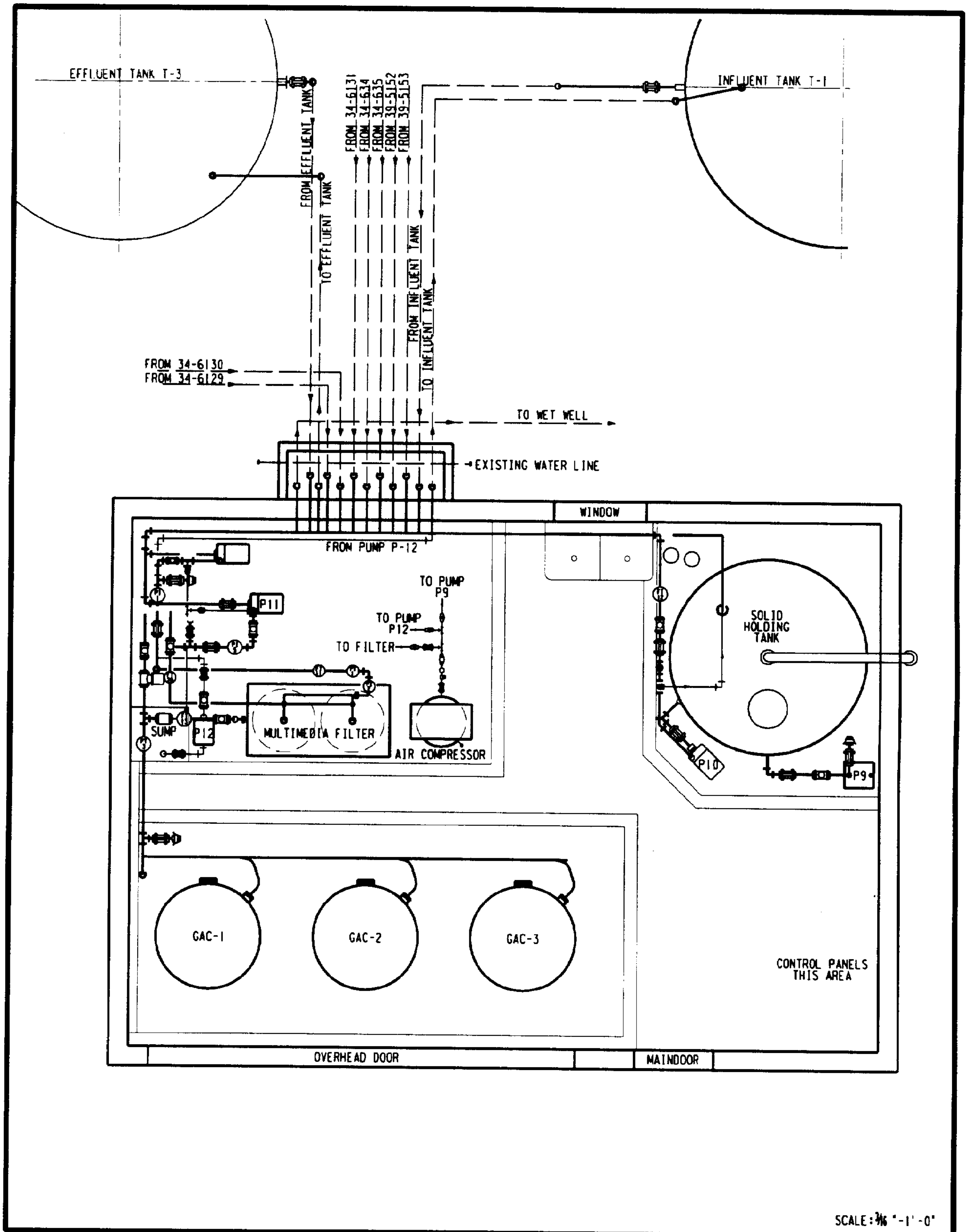
Zone 3 Annual Report.apr

Figure 2.4-1 Zone 3 Base Map
Pease AFB, NH



1998 Zone 3 Annual Report.apr

Figure 2.4-2
Layout of Zone 3 Treatment Systems
Zone 3, Pease AFB, NH



D:/22696/003/34FIG1.DGN

Figure 2.4-3
Site 34/39 Groundwater Treatment System
Pease AFB, NH

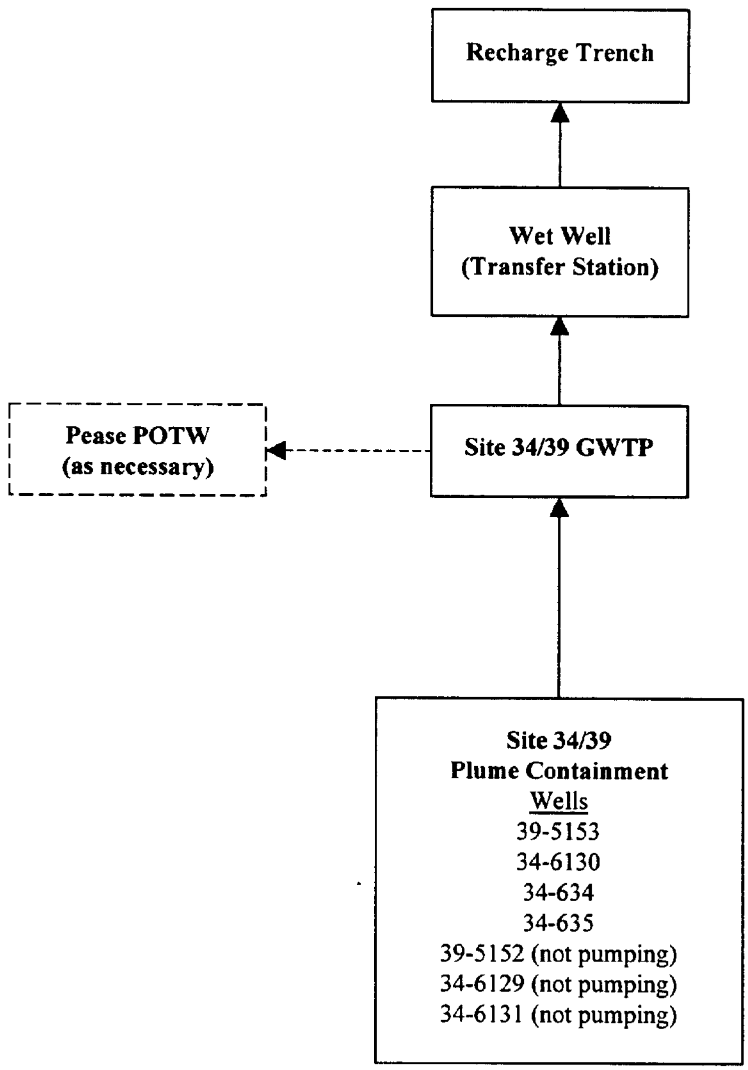
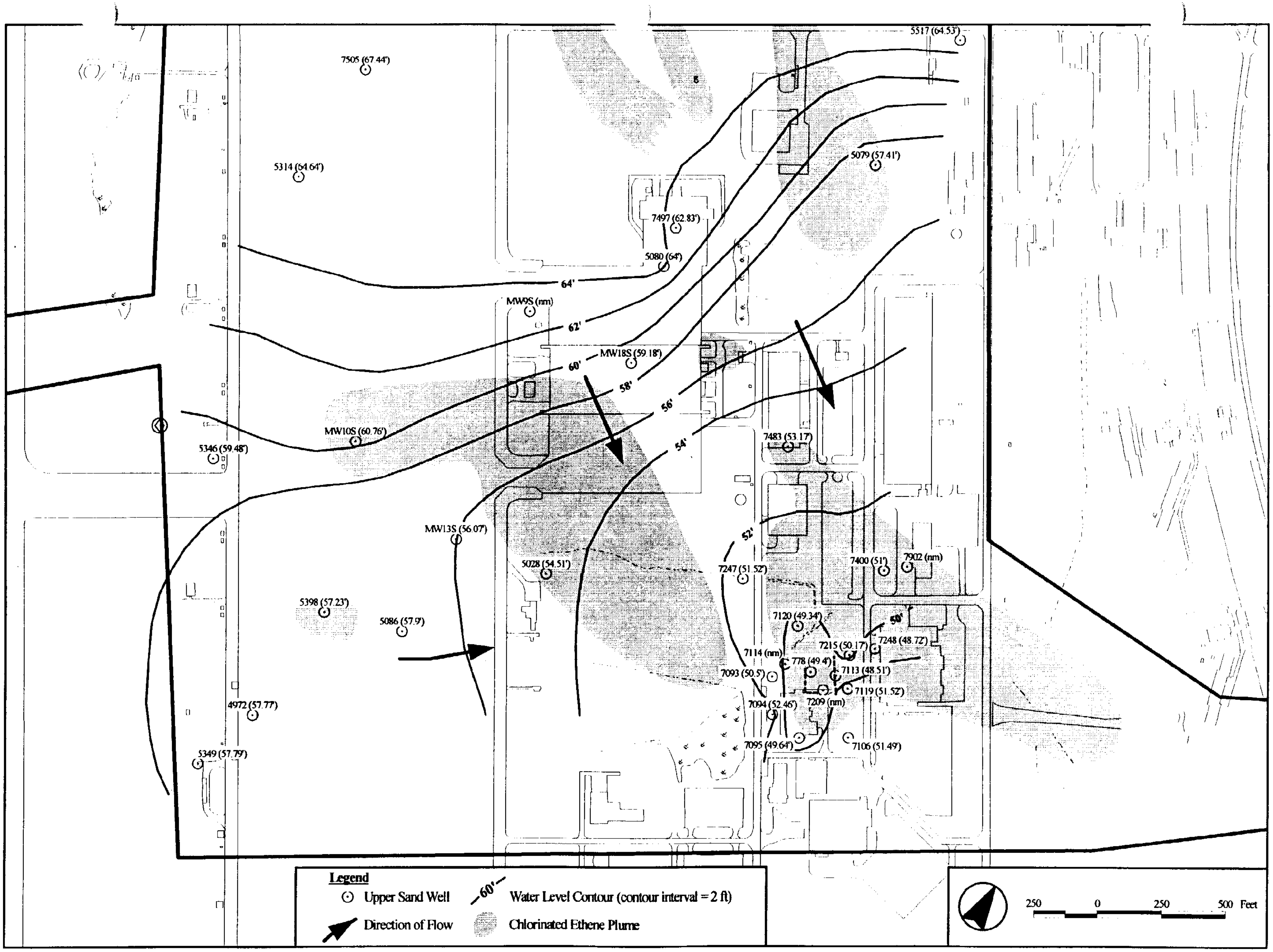


**Figure 2.4-4 Flow of Site 34/39 Groundwater Extraction Systems
Zone 3, Pease AFB, NH**

Site 34-39 Flow Chart.ppt



1998 Zone 3 Annual Report.apr

Figure 2.4-5 Zone 3 Upper Sand Water Levels – March 1999

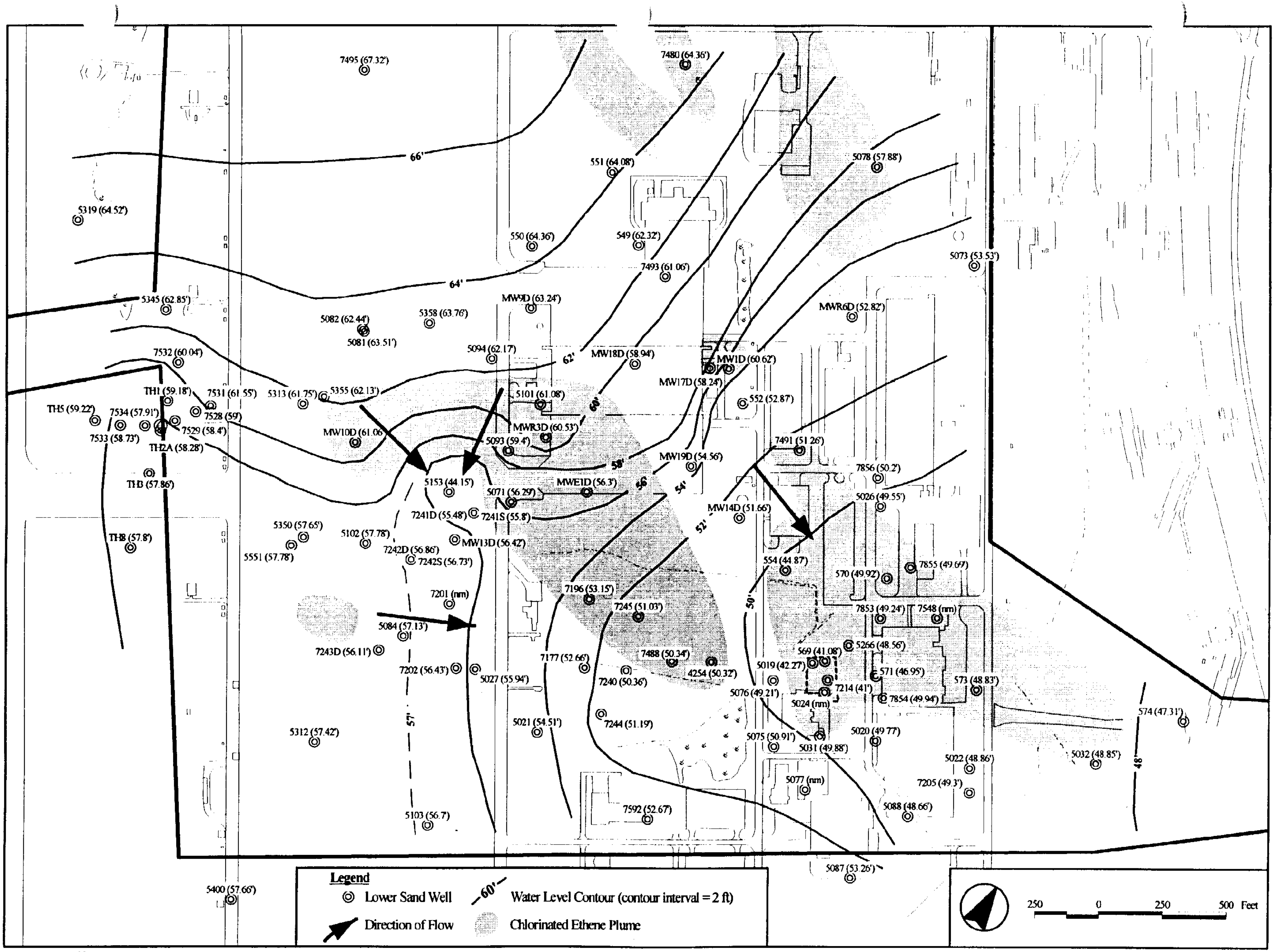
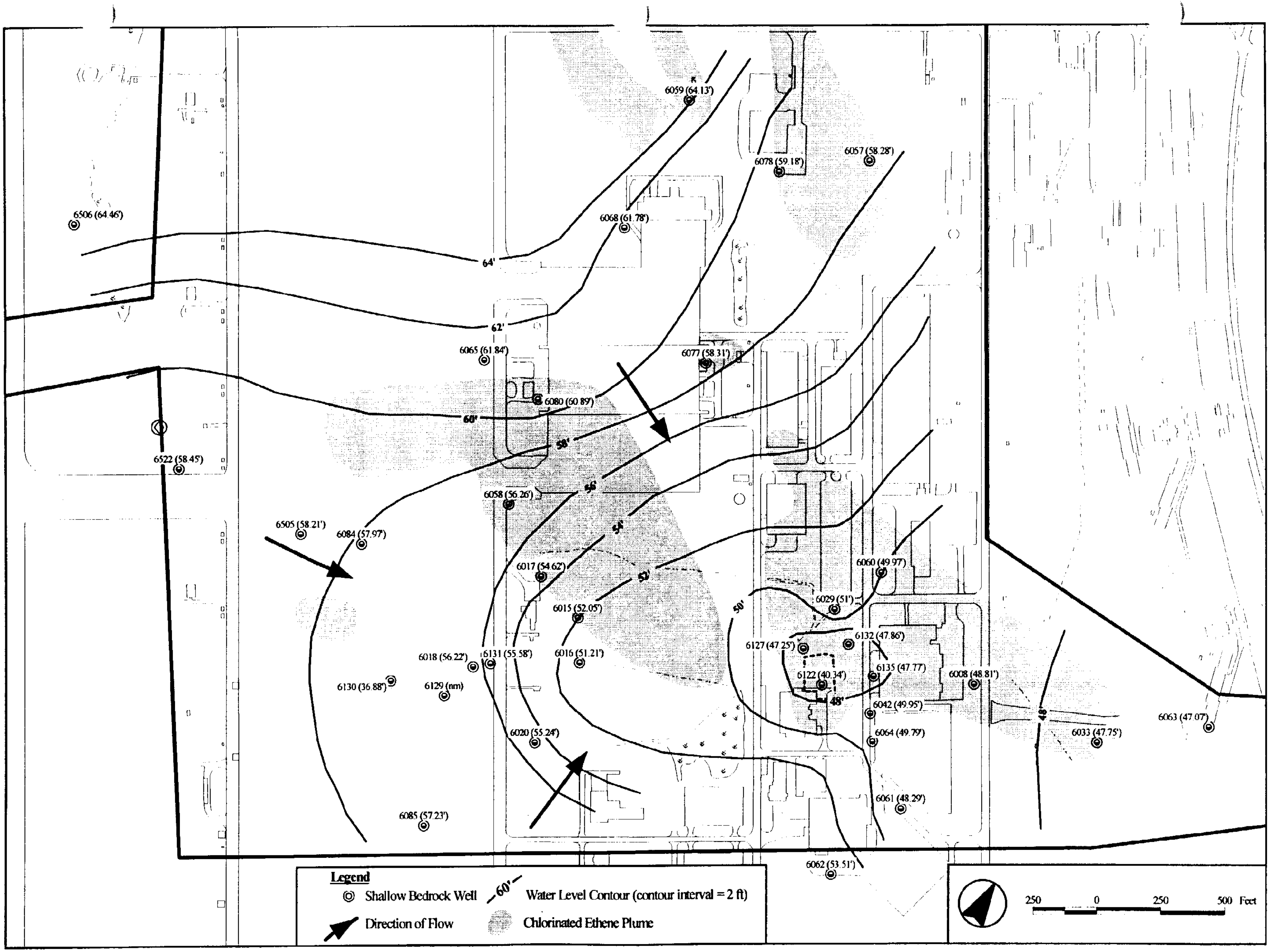


Figure 2.4-6 Zone 3 Lower Sand Water Levels – March 1999



1998 Zone 3 Annual Report.apr

Figure 2.4-7 Zone 3 Shallow Bedrock Water Levels -- March 1999