PROPOSED REMEDIAL ACTION PLAN for SITE 1 SOIL

NAVAL AIR STATION JOINT RESERVE BASE Willow Grove, Pennsylvania

Engineering Field Activity Northeast
Naval Facilities Engineering Command

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TETRA TECH NUS, INC.

Department of the Navy

Proposed Remedial Action Plan for Site 1 Soil

NAS JRB Willow Grove
Willow Grove, Pennsylvania

SEPTEMBER 2004

NAVY ANNOUNCES PROPOSED REMEDIAL ACTION PLAN

The purpose of this **Proposed Plan** is to present the preferred alternative for remedial action at Site 1 Soil – The Privet Road Compound at the Naval Air Station Joint Reserve Base (NAS JRB) Willow Grove in Horsham Township, Pennsylvania. This Proposed Plan recommends that no further action be taken to address the soil at the Privet Road Compound. This Proposed Plan provides background information and the rationale for choosing the preferred alternative.

This Proposed Plan is issued by the Navy, the lead agency for the **Installation Restoration Program (IRP)** and **Superfund** activities at the NAS JRB Willow Grove facility, and by the U.S. Environmental Protection Agency (EPA). The Navy and EPA, in consultation with the Pennsylvania Department of Environmental Protection (PADEP), a support agency for Superfund activities, will make a final decision on the remedial approach for Site 1 after reviewing and considering all information submitted during the 30-day **Public Comment Period**. The Navy and EPA, along with PADEP, may modify the preferred remedy in the Proposed Plan, based on new information or public comments. Therefore, the public is encouraged to review and comment on the remedy presented in this Proposed Plan.

The Navy is issuing this Proposed Plan as part of its public participation responsibilities under Sections 113(k), 117(a), and 121(f) of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** and Section 300.430(f)(2) of Title 40 of the Code of Federal Regulations known as the **National Oil and Hazardous Substances Polluti n Contingency Plan (NCP)**.

This Proposed Plan summarizes the findings of the Site 1 – Privet Road Compound **Remedial Investigation (RI)** report, outlines the alternatives detailed in the second phase RI, summarizes the soil removal action performed in 1999, identifies the cleanup alternative preferred by the Navy and EPA and, explains the reasons for this preference. In addition, this Proposed Plan explains how the public can participate in the decision-making process and provides addresses for the appropriate Navy contacts.

PUBLIC MEETING

A public meeting to discuss this Proposed Plan will be held on Wednesday, October 6, 2004 at 6:00 PM in Building 1 at NAS JRB Willow Grove, Route 611 and Horsham Roads, Horsham, Pennsylvania. The meeting date will also be published in the *Intelligencer* newspaper.

The Proposed Plan also summarizes information from other documents that are contained in the **Administrative Record** file for this site. The Administrative Record file is available at the Navy's **Information Repository** located at the Information Desk of the Horsham Township Municipal Building, 1025 Horsham Road, Horsham, Pennsylvania. The Navy invites the public to review the available materials and to comment on this Proposed Plan during the public comment period.

NOTE: A glossary of relevant technical and regulatory terms is provided at the end of this Proposed Plan. Terms included in the Glossary are initially indicated in **boldface** within the Proposed Plan.

SITE BACKGROUND

NAS JRB Willow Grove is located in Horsham Township, Montgomery County in southeastern Pennsylvania, approximately 20 miles north of the city of Philadelphia (Figure 1). The base occupies approximately 1,000 acres of flat to slightly rolling terrain and is generally bounded by State Route 611 to the east, State Route 463 to the southwest and Keith Valley Road to the north.

The Privet Road Compound (Figures 2 and 3) is a fenced area that is approximately one half of an acre in size located north of the Base Bowling Alley, adjacent to Privet Road and the Air Reserve and Pennsylvania Air National Guard facilities. The compound was constructed to serve as a transfer station for wastes after closure of the Ninth Street Landfill in 1967. The compound operated between 1967 and 1975 and was used as an open disposal area where appreciable quantities of waste were burned and buried. The compound was also used to store several **Polychlorinated Biphenyl (PCB)**-containing electrical transformers. Use of the site as a transfer station and for transformer storage resulted in the contamination of soil.

Previous work at NAS JRB Willow Grove includes the **Pr liminary Assessment (PA), Site Investigation (SI)**, the first and second phase RI and a soil removal action. The PA identified 16 sites, seven at the Air Reserve Facility in 1984 and nine at the Naval Air Station in 1986. One additional site was added to the program in 1988. SI work was performed on 12 of the 17 sites and Remedial Investigation/**Feasibility Study (RI/FS)** activities have subsequently been completed or are underway at eight sites. Phase I RI activities were completed for four sites. The Phase I RI characterized the physical and chemical nature of these four sites and identified data gaps requiring further study. Recommendations for further investigation included in the Phase I RI were incorporated into subsequent discussions among the Navy and regulatory agencies for additional work and led to the Phase II activities that were reported in the Phase II RI report. Shortly there after, the Navy performed a soil removal action for PCB contaminated soils at Site 1.

The Phase II RI report for NAS JRB Willow Grove (Draft), Volume I was reviewed by the regulatory community as well as by members of the Willow Grove **Restoration Advisory Board (RAB)**. In order to allow public involvement in the decision making process, a 30 day public comment period was set between September 16, 1998 and October 17, 1998. Community members of NAS JRB's RAB were given a copy of the Action Memorandum, which contains an analysis of removal alternatives and their costs, during a meeting held on September 16, 1998.

A copy of the Action Memorandum was also available for public review at the Navy's Information Repository located at the Information Desk of the Horsham Township Municipal Building, 1025 Horsham Road, Horsham, Pennsylvania. The Navy invited the public to submit comments directly to the Navy Facilities Engineering Command, Northern Division, Code 1821/JLC, Lester, Pennsylvania.

SITE CHARACTERISTICS

Due to leakage from PCB-containing transformers stored in the vicinity of the present bowling alley at Site 1, there existed an area of soil contaminated with PCBs at the surface (0 to 6 inches) and shallow subsurface (6 to 12 inches). Limited migration of PCBs was occurring, as evidenced by only one detection in surface water sediment receiving drainage from the site. No impact on site groundwater was noted.

As a result of these findings and in agreement with PADEP and EPA, the Navy performed a soil removal action. Soil excavation and off site disposal was selected as the remediation solution to comply with the Department of the Navy's guidance 99-02 regarding land use controls (LUCs). The guidance states that the long-term cost associated with maintaining LUCs should be weighed against the additional cleanup cost required for an unrestricted land use scenario. In this case, since the area of contamination was small and localized, it made economic sense to remediate the soils to a level of one **Part Per Million (ppm** - approximately one part PCB per million parts soil) for PCBs, thereby eliminating the need for long term LUCs. This approach was also found to be favorable as it insured that the land could be used for potential future uses without restrictions, thereby removing the need for any long-term maintenance or monitoring.

SUMMARY OF SITE RISKS

As part of the Phase II RI, a human health risk assessment and an ecological risk assessment were performed for Site 1. After the soil removal action, human health and ecological risk assessments were repeated based on analytical data obtained from post-excavation soil sampling.

WHAT IS A HUMAN HEALTH RISK ASSESSMENT AND HOW IS IT CALCULATED?

A human health risk assessment estimates the baseline risk, an estimate of the likelihood of health problems occurring if no cleanup action is taken at a site. To estimate the baseline risk at a site, the Navy performs the following four-step process:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In **Step 1**, the Navy looks at the concentrations of contaminants found at a site as well as past scientific studies describing the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help the Navy to determine which contaminants are most likely to pose threats to human health.

In **Step 2**, the Navy considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency (how often) and length of exposure. Using this information, the Navy calculates a "reasonable maximum exposure" (RME) scenario that portrays the highest level of human exposure that could reasonably be expected to occur.

In **Step 3**, the Navy uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. The Navy considers two types of risk: (1) cancer risk and (2) noncancer risk. The likelihood of any kind of cancer resulting from a contaminated site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people who could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than normally would be expected from all other causes. For noncancer health effects, the Navy calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which noncancer health effects are no longer predicted.

In **Step 4**, the Navy determines whether site risks are great enough to cause health problems for people at or near the site. The results of the three previous steps are combined, evaluated, and summarized. The Navy adds up the potential risks from the individual contaminants and exposure pathways and calculates a total site risk.

Summary of Human Health Risk Assessment

A screening level human health risk evaluation was performed as part of the Phase II Remedial Investigation. Surface soil concentrations were compared to residential Region 3 EPA **Risk-based concentrations (RBC)** to be protective of all receptors exposed to surface soil. Subsurface soil concentrations were compared to industrial RBCs since, generally, only industrial receptors are expected to be exposed to subsurface soils during excavation or construction activities. Using the RBC screening approach, a chemical was eliminated from consideration as a chemical of potential concern (COPC) at the site if the maximum detected concentration was less than the RBC screening value, at a cancer risk level of 1×10^{-6} or a non-cancer **Hazard Quotient (HQ)** of 0.1, or if site concentrations were not significantly greater than background (inorganics only). The screening level human health risk evaluation indicated potential risks in surface and subsurface soils above acceptable levels. A summary of the selected COPCs is presented in Table 1.

The potential receptors included current occupational workers, current adolescent and adult trespassers, future excavation workers, future recreational children, and future residents. The risk evaluation assumed that potential human receptors would be exposed to COPCs at Site 1 via incidental ingestion, dermal contact, and inhalation of fugitive dusts from soil.

The quantitative risk assessment evaluated each potential receptor under a **reasonable maximum exposure (RME)** and a less conservative **central tendency exposure (CTE)** scenario. RME incorporates input parameters into the exposure scenarios that are protective of 90 or 95 percent of the population, and CTE incorporates input parameters that are representative of an average or median exposure scenario.

Excess lifetime cancer risks were determined for each receptor by multiplying a daily dose with the chemical-specific cancer slope factor. Cancer slope factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. EPA's maximum acceptable carcinogen risk range for site-related exposure is $1x\ 10^{-6}$ to 1×10^{-4}.

Non-carcinogenic risks are presented in the form of a HQ and **Hazard Index (HI),** which are determined by dividing the daily dose by the published reference doses (RfDs). RfDs have been developed by EPA and represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. An HQ less than or equal to 1.0 indicates that a receptor's dose of a single contaminant is less than the RfD, and that adverse non-carcinogenic effects from that chemical are unlikely. The HQs for each COPC that the receptor is assumed to be exposed to via a specific pathway are summed to yield the HI for that pathway. A total HI is then calculated for each receptor by summing the pathway-specific HIs.

The results of the pre-soil removal action risk assessment showed the estimated RME carcinogenic risks for the current occupational worker (1.20×10^{-4}) and future resident (4.34×10^{-4}) exceeded the EPA's acceptable risk range of $1x\ 10^{-6}$ to 1×10^{-4}. The principle COPCs contributing to this cancer risk were arsenic, total PCBs, and benzo(a)pyrene in surface soil.

Potential non-carcinogenic risks under the current and future scenarios were below a HI of 1.0, except under the future residential child scenario which only slightly exceeded the acceptable level with a RME HI of 2.28 and a CTE HI of 1.35. The principle COPC contributing to the non-carcinogenic risk was iron in surface soil.

In June of 1999 the Navy performed a soil removal action for PCB-contaminated soil followed by subsequent confirmatory sampling to ensure all soils containing PCBs in excess of one ppm (parts per million) were removed. The carcinogenic human health risk assessment was recalculated using the confirmatory sampling results to demonstrate that human health risk was reduced.

After accounting for the PCB-contaminated soil removal, the revised calculated RME carcinogenic risks for the current occupational worker (2.79×10^{-5}), current trespasser (5.48×10^{-6}), future recreational child (1.03×10^{-6}), future excavation worker (5.18×10^{-7}), and future resident (1.15×10^{-4}) were all less than or approximately equal to the EPA's maximum guideline carcinogenic risk range. Table 2 lists the estimated RME and CTE carcinogenic risks for current occupational workers, current trespassers, future recreational children, future excavation workers, and future adult residents after PCB-contaminated soils were removed.

The non-carcinogenic human health risk assessment was recalculated post-excavation using the confirmatory sampling results. However for the non-carcinogenic risk estimate, there was little difference in the total risk under each exposure scenario from the pre-soil removal scenario results because iron was the principle COPC. Again only the future residential child scenario slightly exceeded the acceptable level of 1.0 with a RME HI of 2.28 and a CTE HI of 1.35. Iron is the main contributor to the non-carcinogenic risks for the future residential child to surface soil exposure and is a natural component of soils. Since there is uncertainty associated with the oral RfD for iron, then risks from iron exposure may be overestimated. Iron is also considered to be an essential nutrient. Therefore, iron in surface soil is not considered to pose a potential threat to human health and is not a site-related soil constituent. Table 3 lists the estimated RME and CTE non-carcinogenic risks for current occupational workers, current adult and adolescent trespassers, future recreational children, future recreational children, future excavation workers, and future adult residents after PCB-contaminated soils were removed.

Soil containing PCBs was removed from the site. Therefore, notable site-related contamination no longer exists and no source exists. Recalculating the human health risks after PCB-contaminated soils were removed found that the site soils no longer pose a threat to current or reasonably anticipated future human receptors.

Summary of Ecological Risk Assessment

A screening-level ecological risk assessment (ERA) was performed to characterize the potential risks from site-related contaminants to ecological receptors that inhabit the installation. All analytes detected in surface soil samples collected during the 1991 Phase I and 1997 Phase II sampling activities were assessed in this investigation. However, calcium, magnesium, potassium, and sodium were excluded in the screening process since they are essential nutrients that are toxic only at extremely high concentrations.

Initial screening levels for soil organisms consisted of primarily EPA Region 3 Biological Technical Assistance Group (BTAG) screening levels, Oak Ridge National Laboratory surface soil screening levels, and Dutch "B" levels that represent ecological toxicity endpoints.

Aluminum, arsenic, cadmium, chromium, copper, lead, manganese, mercury, thallium, vanadium, and zinc were retained as inorganic COPCs in soil since their maximum concentrations exceeded screening levels. Aroclor 1260, total PCBs, total

WHAT IS AN ECOLOGICAL RISK ASSESSMENT AND HOW IS IT CALCULATED?

An ecological risk assessment evaluates the potential adverse effects human activities have on the plants and animals that make up ecosystems. The ecological risk assessment process follows a phased approach similar to the human health risk assessment. The risk assessment results are used to help determine what measures, if any, are necessary to protect plants and animals.

Ecological risk assessment includes three steps:

Step 1: Problem Formulation
Step 2: Analysis
Step 3: Risk Characterization

The problem formulation includes:

- Compiling and reviewing existing information on the site habitat, plants, and animals that are present
- Evaluating how plants and animals may be exposed
- Identifying and evaluating area(s) where site-related chemicals may be found
- Evaluating potential movement of chemicals in the environment
- Evaluating routes of exposure (for example, ingestion)
- Identifying receptors (plants and animals that could be exposed)
- Identifying exposure media (soil, air, water)
- Developing how the risk will be measured for all complete pathways (determining the risk where plants and/or animals can be exposed to chemicals)

In **Step 2**, the potential exposures to plants and animals are estimated and the concentrations of chemicals at which an effect may occur are evaluated.

In **Step 3**, all of the information identified in the first two steps are used to estimate the risk to plants and animals. Also included is an evaluation of the uncertainties (potential degree of error) that are associated with the predicted risk evaluation and their effects on the conclusions that have been made.

PAHs, and pyrene were retained as organic COPCs in soils since their maximum concentrations exceeded screening levels. In addition, 1,2,4-trichlorobenzene, 2-methylnaphthalene, and the VOCs acetone and choloform were retained as organic COPCs since no screening levels were available. Table 4 shows the results of the selection of COPCs in surface soil.

In accordance with EPA and Navy policy, and as per discussions with Region 3 BTAG personnel, a portion of Step 3 of the eight-step ERA process was included in the assessment. Step 3a involves the consideration of factors such as background data (mainly for inorganics), toxicological evaluation of COPCs, frequency of detection, and comparisons of COPCs to alternate guidelines.

Almost all of the COPCs were eliminated as chemicals of concern (COCs) in the risk management phase of the assessment for one or more reasons, including low frequency of detection, maximum concentrations comparable to or below background (primarily inorganics), or alternative guidelines and spatial analysis of detection. PCBs were determined to be present at high enough concentrations in soils, and with sufficiently high frequencies of detection, to pose potential risks to terrestrial receptors. Therefore, PCBs were selected as the only COC in soil.

The site is located in a commercial-type area of the base; terrestrial habitat on the site is minimal and of poor quality. Hence, significant use of the site by ecological receptors is unlikely and would prevent any substantial exposure to soil contaminants.

Despite the low level of ecological risk posed by site soils, in June of 1999 the Navy performed a soil removal action for PCB-contaminated soil. Subsequent confirmatory sampling was performed to ensure all soils containing PCBs in excess of 1 ppm were removed. Due to this combination of mitigating factors and the fact that PCB-contaminated soils have been removed, potential for ecological impacts from site-related contaminants is negligible. Therefore, no further action of site soils is necessary to ensure protection of the environment.

COMMUNITY PARTICIPATION

Community acceptance of the preferred alternative will be evaluated at the conclusion of the public comment period and will be described in the Record of Decision. Public comments on this Proposed Plan will help address state acceptance and community acceptance.

The Navy solicits written comments from the community on the Proposed Plan for the Privet Road Compound. The Navy has set a public comment period from September 27, 2004 through October 27, 2004 to encourage public participation in the decision process for the Privet Road Compound.

The Navy will hold a public meeting during the comment period. At the public meeting, the Navy, with input from EPA, will present the Proposed Plan; answer questions, and solicit both oral and written questions. **The public meeting is scheduled for 6:00 p.m. on Wednesday, Octob r 6, 2004 and will be held in Building 1 at NAS JRB Willow Grove.** Access to the facility for the RAB meeting will be through the NAS JRB (Navy) main gate, located on Easton Road (Route 611). Parking for the RAB meeting will be available behind (west of) Building 1, which is across the traffic circle just inside the Navy's main gate. Directions to Building 1 will be provided by the uniformed guard at the gate.

Comments received during the public comment period will be summarized and responses will be provided in the Responsiveness Summary section of the **Record of Decision (ROD)**. The ROD is the document that will present the Navy's decision for Site 1 soils.

To send written comments, or to obtain further information, contact:

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Willow Grove Pa., 19090
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For further information, contact:

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Email: Bradford.Lisa@epa.gov

Please note that all comments must be submitted and postmarked on or before October 27, 2004.

TERMS USED IN THE PROPOSED PLAN

Administrative Record: An official compilation of site-related documents, data, reports, and other information that are considered important to the status of and decisions made relative to a Superfund site. The public has access to this material.

Carcinogenic: A type of risk resulting from exposure to chemicals that may cause cancer in one or more organs.

Comment Period: A time for the public to review and comment on various documents and actions taken, either by the Navy, EPA, or PADEP. A minimum 30-day comment period is held to allow community members to review the Administrative Record and review and comment on the Proposed Plan.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The Act created a trust fund, known as the Superfund, to investigate and clean up abandoned or uncontrolled hazardous substance facilities.

Central Tendency Exposure (CTE): Human health risk assessment calculation approach using average, 50^{th} percentile, receptor risk behavior patterns to estimate a realistic expectation of receptor risk.

Feasibility Study (FS): Report identifying and evaluating alternatives for addressing the contamination present at a site or group of sites.

Hazard Index (HI): The sum of chemical-specific Hazard Quotients. An HI greater than 1 is associated with an increased level of concern about adverse non-cancer health effects.

Hazard Quotient (HQ): A comparison of the level of exposure to a substance in contact with the body per unit time to a chemical-specific Reference Dose to evaluate potential non-cancer health effects. Exceedence of an HQ of 1 is associated with an increased level of concern about adverse non-cancer health effects.

Information Repository: A file containing information, technical reports, and reference documents regarding an NPL site. This file is usually maintained in a place with easy public access, such as a library.

Installation Restoration Program (IRP): Navy program to restore old waste sites for reuse and to protect human health and the environment.

Noncarcinogenic: A type of risk resulting from the exposure to chemicals that may cause systemic human health effects.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The purpose of the NCP is to provide the organizational structure and procedures for preparing and responding to discharges of oil and releases of hazardous substances, pollutants, or contaminants.

National Priorities List (NPL): This list, compiled by EPA pursuant to CERCLA Section 105, identifies the uncontrolled or abandoned hazardous substance releases in the United States that are priorities for long-term remedial evaluation and response.

Part Per Million (ppm): A measure of concentration of a contaminant substance in site media (like soil or groundwater). One ppm is equivalent to one part of the contaminant substance in one million parts of contaminated site media. This unit of measurement is also referred to as milligram per kilogram (mg/kg).

Polychlorinated Biphenyls (PCBs): Class of chlorinated aromatic compounds (typically used as cooling fluids in electrical transformers) which are strongly adsorbed on solid particles.

Pr liminary Assessment (PA): Preliminary investigation usually consisting of review of available data and information of a site, interviews, and a non-sampling site visit to observe areas of potential waste disposal and migration pathways.

Proposed Plan: A public participation requirement of CERCLA and the NCP in which the lead agency summarizes the preferred cleanup strategy and rationale. This agency also reviews the alternatives presented in the detailed analysis of the feasibility study, if prepared. The Proposed Plan may be prepared either as a fact sheet or as a separate document. In either case, it must actively solicit public comment on all alternatives under consideration.

Reasonable Maximum Exposure (RME): Human health risk assessment calculation approach using 90th percentile receptor risk behavior patterns to estimate a conservative expectation of receptor risk.

Record of Decision (ROD): An official public document that explains which cleanup alternative(s) will be used at NPL sites. The ROD is based on information and technical analysis generated during the RI/FS and consideration of public comments and community concerns. The ROD is a legal document and explains the remedy selection process and is issued by the Navy following the public comment period.

Remedial Investigation (RI): Study that determines the nature and extent of contamination at a site.

Restoration Advisory Board (RAB): An advisory group for the restoration process with members from the public, the Navy, and the regulatory agencies. The purpose of the RAB is to gain effective input from stakeholders on cleanup activities and increase installation responsiveness to the community's environmental restoration concerns.

Risk Based Concentrations (RBC): Risk-based concentrations established by EPA Region III and associated with specific levels of risk. These concentrations have been developed for both industrial and residential scenarios and incorporate both the ingestion and inhalation pathways.

Site Inspection (SI): Sampling investigation with the goal of identifying potential sources of contamination, types of contaminants, and potential migration of contaminants. The SI is conducted prior to the RI.

Superfund: The program operated under the legislative authority of CERCLA and the Superfund Amendment and Reauthorization Act (SARA) that funds and carries out EPA solid waste, emergency, and long-term removal and remedial activities. These activities include investigating sites for inclusion on the NPL, determining their priority, and conducting and/or supervising the cleanup and other remedial actions.

FOR FURTHER INFORMATION

MAILING LIST

If you did not receive this Proposed Plan in the mail and wish to be placed on the mailing list for future information pertaining to this site, please fill out, detach, and mail this form to:

Commanding Officer
NAS JRB Willow Grove
Bldg 78, Environmental Division
Attn: James Edmond
Willow Grove, PA 19090

Name: _____
Affiliation: _____

Address: _____
Phone: ( )_____

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TABLES

Table 1
Summmary of Chemicals of Potential Concern Evaluated in the Human Health Risk Assessment
Site 1 - NASJRB Willow Grov

Substance	Frequency of Site-Related Detection	Minimum Range of Positive Detections for Site		Maximum Range of Positive Detections for Site	Representative Concentration	Units
Surface Soil						
1,2,3,4,6,7,8-HPCDD	6/6	0.0647	-	0.136	0.13	ug/kg
1,2,3,4,6,7,8-HPCDF	6/6	0.0048	-	0.321	0.236	ug/kg
1,2,3,4,7,8,9-HPCDF	5/6	0.0063	-	0.19	0.19	ug/kg
1,2,3,4,7,8-HXCDD	4/6	0.0015	-	0.0021	0.0019	ug/kg
1,2,3,4,7,8-HXCDF	6/6	0.0026	-	0.374	0.374	ug/kg
1,2,3,6,7,8-HXCDD	5/6	0.0017	-	0.0051	0.00505	ug/kg
1,2,3,6,7,8-HXCDF	5/6	0.0017	-	0.0248	0.0179	ug/kg
1,2,3,7,8,9-HXCDD	6/6	0.0027	-	0.0129	0.0109	ug/kg
1,2,3,7,8,9-HXCDF	3/6	0.00055	-	0.009	0.009	ug/kg
1,2,3,7,8-PECDF	4/6	0.003	-	0.0049	0.00431	ug/kg
2,3,4,6,7,8-HXCDF	6/6	0.0011	-	0.0136	0.011	ug/kg
2,3,4,7,8-PECDF	5/6	0.0023	-	0.0142	0.0116	ug/kg
2,3,7,8-tetrachlorodibenzofuran	5/6	0.0015	-	0.0076	0.00677	ug/kg
octachlorodibenzo-p-dioxin	6/6	4.58	-	15.59	12.2	ug/kg
octachlorodibenzofuran	6/6	0.009	-	0.815	0.636	ug/kg
aluminum	13/13	9470	-	22000	18200	mg/kg
arsenic	13/13	2	-	16.2	9.52	mg/kg
cadmium	5/13	1.6	-	5.8	2.55	mg/kg
iron	13/13	18600	-	33300	27300	mg/kg
dieldrin	1/13	77	-	77	77	ug/kg
total pcbs	54/64	550	-	230000	52700	ug/kg
benz(a)anthracene	3/6	35	-	1300	1300	ug/kg
benzo(a)pyrene	3/6	40	-	1200	1200	ug/kg
benzo(b)fluoranthene	2/6	440	-	1500	1500	ug/kg
benzo(k)fluoranthene	2/6	260	-	770	589	ug/kg
chrysene	3/6	52	-	1400	1400	ug/kg
dibenz(a,h)anthracene	2/6	43	-	290	252	ug/kg
indeno(1,2,3-cd)pyrene	2/6	160	-	1100	944	ug/kg
Subsurface Soil						
aluminum	59/59	5910	-	24500	16000	mg/kg
arsenic	45/59	0.9	-	16	5.29	mg/kg
iron	59/59	12900	-	35400	25400	mg/kg
pcbs (tot. all)	19/84	11	-	5800	302	ug/kg

Tabl 2
Summary of Cancer Risks - Aft r Soil Removal
Site 1 - NASJRB Willow Grove

Reasonable Maximum Exposure

Media	Estimated Cancer Risk Current Occupational Worker				Estimated Cancer Risk Current Trespasser				Estimated Cancer Risk Future Recreational Child			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Surface Soil, TOTAL RISK:	7.87E-06	2.01E-05	7.16E-09	2.79E-05	2.60E-06	2.87E-06	5.92E-10	5.48E-06	6.95E-07	3.33E-07	7.90E-11	1.03E-06
Subsurface Soil, TOTAL RISK	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GROUP TOTAL:	**7.87E-06**	**2.01E-05**	**7.16E-09**	**2.79E-05**	**2.60E-06**	**2.87E-06**	**5.92E-10**	**5.48E-06**	**6.95E-07**	**3.33E-07**	**7.90E-11**	**1.03E-06**

Media	Estimated Cancer Risk Future Excavation Worker				Estimated Cancer Risk Future Resident			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Surface Soil, TOTAL RISK:	3.62E-07	9.63E-08	1.03E-10	4.59E-07	7.05E-05	4.41E-05	4.41E-08	1.15E-04
Subsurface Soil, TOTAL RISK	4.73E-08	1.19E-08	2.59E-11	5.92E-08	NA	NA	NA	NA
GROUP TOTAL:	**4.09E-07**	**1.08E-07**	**1.29E-10**	**5.18E-07**	**7.05E-05**	**4.41E-05**	**4.41E-08**	**1.15E-04**

Central Tendency Exposure

Media	Estimated Cancer Risk Current Occupational Worker				Estimated Cancer Risk Current Trespasser				Estimated Cancer Risk Future Recreational Child			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Surface Soil, TOTAL RISK:	2.83E-06	7.22E-06	2.58E-09	1.01E-05	1.72E-07	3.31E-07	7.82E-11	5.03E-07	1.16E-07	1.10E-07	2.63E-11	2.26E-07
Subsurface Soil, TOTAL RISK	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GROUP TOTAL:	**2.83E-06**	**7.22E-06**	**2.58E-09**	**1.01E-05**	**1.72E-07**	**3.31E-07**	**7.82E-11**	**5.0308E-07**	**1.16E-07**	**1.10E-07**	**2.63E-11**	**2.26E-07**

Media	Estimated Cancer Risk Future Excavation Worker				Estimated Cancer Risk Future Resident			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Surface Soil, TOTAL RISK:	1.81E-07	4.81E-08	5.16E-11	2.29E-07	1.13E-05	1.35E-05	1.96E-08	2.49E-05
Subsurface Soil, TOTAL RISK	2.36E-08	5.95E-09	1.29E-11	2.96E-08	NA	NA	NA	NA
GROUP TOTAL:	**2.05E-07**	**5.41E-08**	**6.45E-11**	**2.59E-07**	**1.13E-05**	**1.35E-05**	**1.96E-08**	**2.49E-05**

Notes:
NA – Not Applicable

Table 3
Summary f Non-cancer Risks - After S il Rem val
Site 1 - NASJRB Will w Gr ve

Reasonable Maximum Exposure

Exposure Medium	Estimated Hazard Index Current Occupational Worker				Estimated Hazard Index Current Adult Trespasser				Estimated Hazard Index Current Adolescent Trespasser				Estimated Hazard Index Future Residential Child			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Site 01																
Surface Soil, TOTAL RISK:	7.10E-02	1.19E-01	NT	1.90E-01	1.36E-02	1.14E-02	NT	2.51E-02	2.98E-02	2.95E-02	NT	5.93E-02	1.85E+00	4.25E-01	NT	2.28E+00
Subsurface Soil, TOTAL RISK	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GROUP TOTAL:	7.10E-02	1.19E-01	NT	1.90E-01	1.36E-02	1.14E-02	NT	2.51E-02	2.98E-02	2.95E-02	NT	5.93E-02	1.85E+00	4.25E-01	NT	2.28E+00

Exposure Medium	Estimated Hazard Index Future Recreational Child				Estimated Hazard Index Future Excavation Worker				Estimated Hazard Index Future Residential Adult			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Site 01												
Surface Soil, TOTAL RISK:	2.61E-02	NT	2.08E-06	2.61E-02	8.17E-02	1.43E-02	NT	9.60E-02	1.99E-01	1.67E-01	NT	3.65E-01
Subsurface Soil, TOTAL RISK	NA	NA	NA	NA	6.67E-02	8.37E-03	NT	7.50E-02	NA	NA	NA	NA
GROUP TOTAL:	2.61E-02	NT	2.08E-06	2.61E-02	1.48E-01	2.27E-02	NT	1.71E-01	1.99E-01	1.67E-01	NT	3.65E-01

Central Tendency Exposure

Exposure Medium	Estimated Hazard Index Current Occupational Worker				Estimated Hazard Index Current Adult Trespasser				Estimated Hazard Index Current Adolescent Trespasser				Estimated Hazard Index Future Residential Child			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Site 01																
Surface Soil, TOTAL RISK:	7.10E-02	1.19E-01	NT	1.90E-01	3.41E-03	5.72E-03	NT	9.12E-03	7.45E-03	1.51E-02	NT	2.26E-02	9.27E-01	4.21E-01	NT	1.35E+00
Subsurface Soil, TOTAL RISK	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GROUP TOTAL:	7.10E-02	1.19E-01	NT	1.90E-01	3.41E-03	5.72E-03	NT	9.12E-03	7.45E-03	1.51E-02	NT	2.26E-02	9.27E-01	4.21E-01	NT	1.35E+00

Exposure Medium	Estimated Hazard Index Future Recreational Child				Estimated Hazard Index Future Excavation Worker				Estimated Hazard Index Future Residential Adult			
	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total	Ingestion	Dermal Contact	Inhalation	Total
Site 01												
Surface Soil, TOTAL RISK:	1.31E-02	NT	2.08E-06	1.31E-02	4.09E-02	7.15E-03	NT	4.80E-02	9.93E-02	1.67E-01	NT	2.66E-01
Subsurface Soil, TOTAL RISK	NA	NA	NA	NA	3.33E-02	4.19E-03	NT	3.75E-02	NA	NA	NA	NA
GROUP TOTAL:	1.31E-02	NA	2.08E-06	1.31E-02	7.42E-02	1.13E-02	NT	8.55E-02	9.93E-02	1.67E-01	NT	2.66E-01

Notes:

NA – Not considered applicable
NT – No toxicity factor
NC – No COPC's selected
CTE – Central Tendency Exposure
RME – Reasonable Maximum Exposure

TABLE 4
SELECTION OF PRELIMINARY CONTAMINANTS OF CONCERN FOR SURFACE SOIL
SITE 1 - NASJRB WILLOW GROVE

Contaminant	Frequency of Detection	Range of Detections		Location of Maximum	Screening Level	Hazard Quotient	Selected as PCOC?
		Minimum	Maximum				
Inorganics (mg/kg)							
Aluminum	13/13	9470.00	22000.00	01SB17-0002	1[1]	22000	Yes
Arsenic	13/13	2.00	16.00	01SB11-0002	10[2]	1.6	Yes
Barium	13/13	59.00	129.00	01SB03-0002	412.5[3]	0.3	No
Cadmium	5/13	2.00	6.00	01SB11-0002	3[2]	2.0	Yes
Chromium	13/13	22.00	37.00	01SB16-0002	10[4]	3.7	Yes
Cobalt	13/13	7.00	12.20	01SB16-0002	130[3]	0.1	No
Copper	13/13	13.00	44.00	01SB12-0002	100[2]	0.4	No
Iron	13/13	18600.00	33300.00	01SB17-0002	12[1]	2750	Yes
Lead	13/13	9.00	149.00	01SB11-0002	50[4]	3.0	Yes
Manganese	13/13	166.00	867.00	01SB03-0002	330.00[1]	2.63	Yes
Mercury	5/13	0.14	0.36	01SB07-0002	0.1[4]	3.6	Yes
Nickel	13/13	12.00	20.00	01SB16-0002	30[2]	0.7	No
Silver	1/13	3.00	3.00	01SB07-0002	9.8E-06[1]	3.1E-05	No
Thallium	6/10	0.25	0.45	01SB17-0002	0.001[1]	450	Yes
Vanadium	13/13	27.00	48.00	01SB17-0002	20[4]	2.4	Yes
Zinc	13/13	39.00	200.00	01SB11-0002	50[4]	4.0	Yes
Pesticides/PCBs (ug/kg)							
PCBs (immunoassay)	46/51	550	25000	01SS23	510[3]	49	Yes
PCBs (total)	54/64	550	230000	01SB03-0002	510[3]	451	Yes
Aroclor-1260	11/16	51	230000	01SB03-0002	51[3]	4510	Yes
Dieldrin	1/13	77.00	77.00	01SB10-0002	100[1]	0.77	No
SVOCs (ug/kg)							
1,2,4-trichlorobenzene	1/6	120.00	120.00	01SS25	NA	NA	Yes
2-methylnaphthalene	1/6	130.00	130.00	01SS25	NA	NA	Yes
Acenaphthene	1/6	66.00	66.00	01SS25	100[1]	0.66	No
Anthracene	1/6	250.00	250.00	01SS25	2050[3]	0.1	No
Benzo(a)anthracene	3/6	35.00	1300.00	01SS25	2050[3]	0.6	No
Benzo(a)pyrene	3/6	40.00	1200.00	01SS25	2050[3]	0.6	No
Benzo(b)fluoranthene	2/6	440.00	1500.00	01SS25	2050[3]	0.7	No
Benzo(g,h,i)perylene	2/6	140.00	960.00	01SS25	2050[3]	0.5	No
Benzo(k)fluoranthene	2/6	260.00	770.00	01SS25	2050[3]	0.4	No
Butylbenzylphthalate	2/6	220.00	270.00	01SS26	3005[3]	0.1	No
Chrysene	3/6	52.00	1400.00	01SS25	2050[3]	0.7	No
Di-n-butylphthalate	2/6	91.00	110.00	01SS25	3005[3]	0.04	No
Dibenz(a,h)anthracene	2/6	43.00	290.00	01SS25	2050[3]	0.1	No
Fluoranthene	3/6	53.00	1800.00	01SS25	2050[3]	0.9	No
Fluorene	1/6	65.00	65.00	01SS25	2050[3]	0.03	No
Indeno(1,2,3-cd)pyrene	2/6	160.00	1100.00	01SS25	2050[3]	0.5	No
Naphthalene	1/6	92.00	92.00	01SS25	2050[3]	0.04	No
Phenanthrene	2/6	370.00	1100.00	01SS25	2050[3]	0.5	No

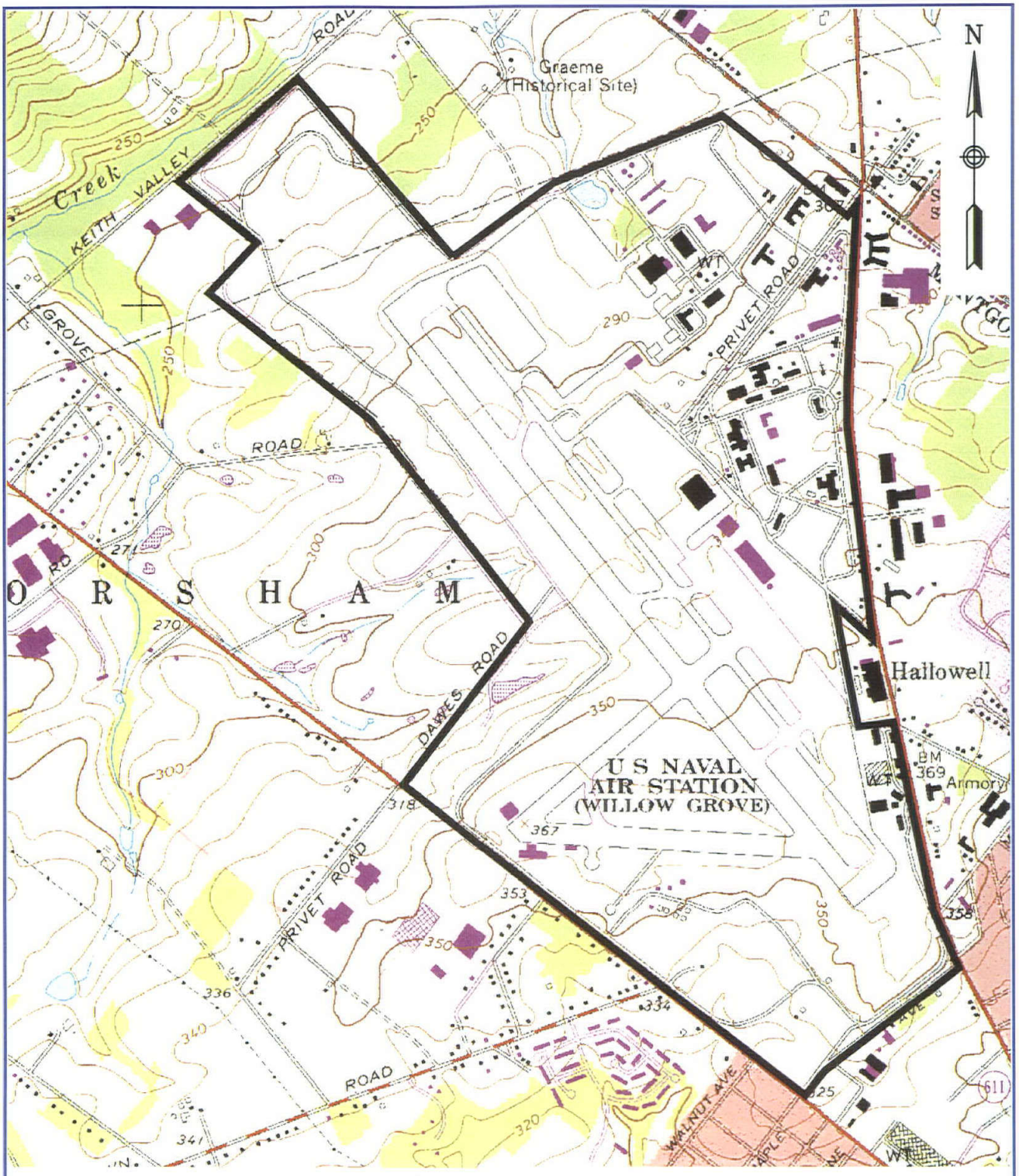
TABLE 4
SELECTION OF PRELIMINARY CONTAMINANTS OF CONCERN FOR SURFACE SOIL
SITE 1 - NASJRB WILLOW GROVE

Contaminant	Frequency of Detection	Range of Detections		Location of Maximum	Screening Level	Hazard Quotient	Selected as PCOC?
		Minimum	Maximum				
Pyrene	3/6	59.00	2500.00	01SS25	2050[3]	1.2	Yes
Total PAHs	3/6	217.5	14,500	01SS25	4,000[5]	3.6	Yes
VOCs (ug/kg)							
Acetone	3/12	4.00	7.00	PRB-7-0002	NA	NA	Yes
Chloroform	1/13	1.00	1.00	PRB-8-0002	NA	NA	Yes
Dioxins/Furans (ug/kg)							
TCDD Toxicity Equivalents	6/6	0.00955	0.0648	01SB19-0002	10	0.01	No

1. Region III BTAG screening level (EPA, 1995)
2. Will and Suter (1995b)
3. Netherlands (1994)
4. ORNL (1996)
5. ERL for sediment (Longetal, 1995)

FIGURES

WillowGrove_2192\1201\2192CM01-1.DWG 05/06/04 MKB PHL



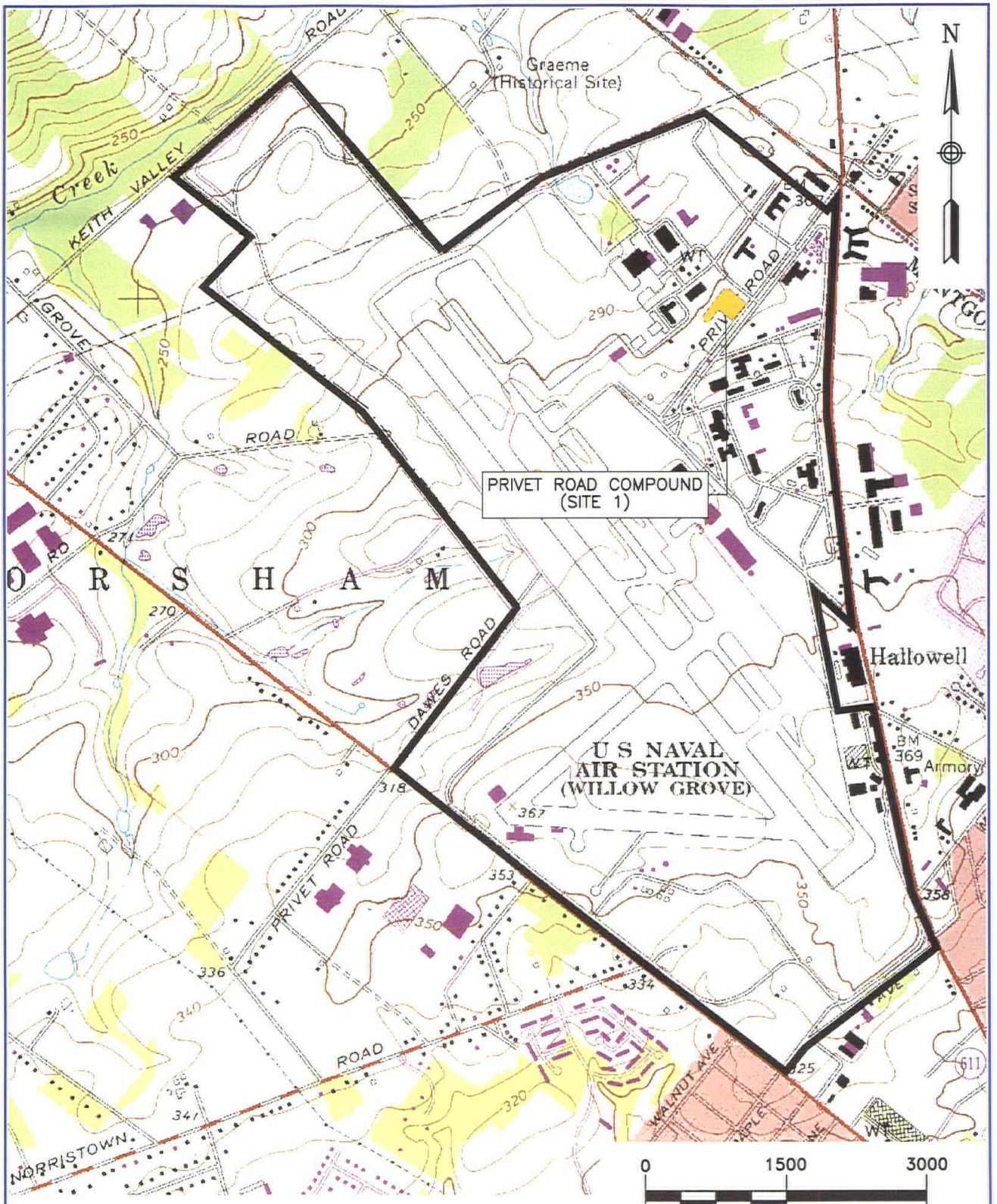
BASE MAP IS A PORTION OF THE AMBLER, PA U.S.G.S. 7.5 MINUTE QUADRANGLE MAP, DATED 1963, PHOTOREVISED IN 1983.

QUADRANGLE LOCATION

0 1500 3000

SCALE IN FEET

DRAWN BY MKB DATE 05/06/04	Tetra Tech NUS, Inc.	CONTRACT NO.: 2192	OWNER NO.: CTO 277
CHECKED BY DATE	LOCATION MAP	DRAWING INFORMATION: 2192CM01-1	
REVISED BY DATE	NAS JRB WILLOW GROVE WILLOW GROVE, PENNSYLVANIA	APPROVED BY: DATE	
SCALE AS NOTED		DRAWING NO.: FIGURE 1	REV.

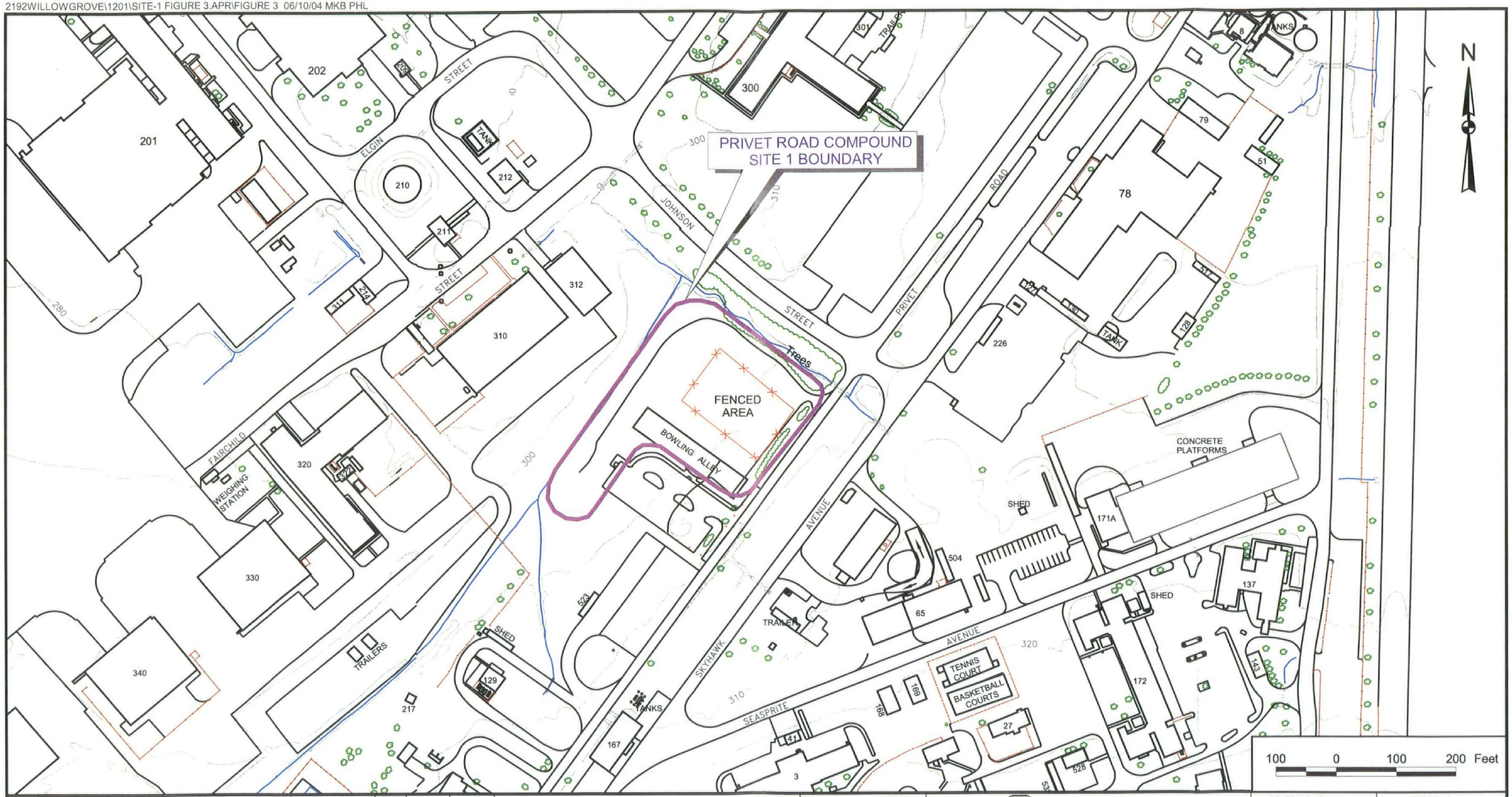


BASE MAP IS A PORTION OF THE AMBLER, PA U.S.G.S. 7.5 MINUTE QUADRANGLE MAP, DATED 1963, PHOTOREVISED IN 1983.

WillowGrove_2192\1201\2192CM01-2.DWG 05/06/04 MKB PHL

DRAWN BY MKB DATE 05/06/04	Tetra Tech NUS, Inc.	CONTRACT NO.: 2192	OWNER NO.: CTO 277
CHECKED BY DATE	LOCATION OF RI SITES SITE 1 – PRIVET ROAD COMPOUND NAS JRB WILLOW GROVE WILLOW GROVE, PENNSYLVANIA	DRAWING INFORMATION: 2192CM01-2	
REVISED BY DATE		APPROVED BY: DATE	
SCALE AS NOTED		DRAWING NO.: FIGURE 2	REV.

2192WILLOWGROVE\1201\SITE-1 FIGURE 3.APR\FIGURE 3 06/10/04 MKB PHL



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MKB	DATE 05/06/04
CHECKED BY ___	DATE 05/06/04
COST/SCHED-AREA	
SCALE AS NOTED	

Tetra Tech NUS, Inc.

SITE FEATURES
NASJRB SITE 1 - PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

CONTRACT NO. 2192	OWNER NO. CTO 003
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. **FIGURE 3**	REV.