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Technical Memorandum

Date	16 April 2012
To	David Jadhon, USACE Alaska District
CC	Donald Aide, 673 CES/CEANR
From	Jill Ladegard, Jacobs Engineering Group Inc.
Subject	**Final F-22 Weapons Release Shop SVE Installation and Stockpile Construction**

Introduction

This Technical Memorandum describes the field activities conducted by Jacobs Engineering Group Inc. (Jacobs), on behalf of the U.S. Army Corps of Engineers (USACE), during the 2011 non-time-critical removal action at the F-22 Weapons Release Shop (Building 17720). The goal of the non-time-critical removal action is to implement the selected removal alternative as described in the *F-22 Weapons Release Shop Engineering Evaluation and Cost Analysis* (EE/CA) (USACE 2011c) in preparation for the proposed 2012 building construction at the F-22 Weapons Release Shop area.

The selected EE/CA alternative, Minimal Excavation and In Situ Treatment (Alternative 6), utilizes soil vapor extraction (SVE) technology to address previously identified tetrachloroethylene (PCE), trichloroethylene (TCE), and diesel-range organics (DRO) above Alaska Department of Environmental Conservation (ADEC) Title 18 Alaska Administrative Code (AAC) 75 migration to groundwater cleanup criteria (ADEC 2008) while providing protection for construction workers at the proposed building footprint/SVE extraction system (F-22 Weapons Release Shop site). Work was conducted in accordance with the *2011 Soil Vapor Extraction System Design and Construction Work Plan Addendum* (USACE 2011b).

Previous Investigations

Four prior investigations were performed to identify the nature and extent of contamination at the F-22 Weapons Release Shop area. The first investigation was performed during the initial *Foundation Study HTRW Survey* prepared in February 2010 for the USACE (USACE 2010b). As part of this effort, samples were collected and analyzed for volatile organic

compounds (VOC) and fuel-related compounds. Seven borings were drilled at the Building 17720 expansion site. Seasonal frost was encountered in all borings to a depth of approximately 2.5 feet below ground surface (bgs). VOC and DRO exceedances were detected in subsurface soils. A second drilling and sampling event was performed in July 2010 to further delineate the extent of contamination within the proposed construction area. Since contaminant boundaries were not defined during the second drilling event, a third investigation was performed in September 2010. During the third investigation, samples were collected from depths greater than 19 feet to determine the vertical extent of contamination. Refusal was encountered at depths of 21.5 feet, 31.5 feet, and 47 feet. Groundwater was not encountered in the borings and no visual evidence of chemical contamination was observed. Boring and sampling locations for all four events are presented in the 2011 EE/CA (USACE 2011c).

During these three sampling events, 46 soil samples were collected and analyzed for gasoline-range organics (GRO), DRO, residual-range organics (RRO), VOCs, Toxicity Characteristic Leaching Procedure (TCLP) VOCs, polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), Resource Conservation and Recovery Act (RCRA) metals, and hexavalent chromium. The following contaminants were detected at concentrations above ADEC cleanup levels (ADEC 2008) and site background levels: benzo(a)pyrene, DRO, PCE, and TCE.

A final drilling investigation was performed in order to define the nature and extent of contamination present at the site during development of the 2011 EE/CA (USACE 2011c). The investigation was performed in December 2010 and included the analysis of surface soil, subsurface soil, groundwater, and soil vapor samples, as summarized below:

- A total of 91 subsurface soil samples were analyzed for GRO, DRO, RCRA metals, VOCs, and PAHs. Sample results were compared to Method Two migration to groundwater cleanup levels for the under 40-inch zone (ADEC 2008). Subsurface exceedances were found in 33 samples for DRO, PAHs, and VOCs.
- A total of 15 surface soil samples were analyzed for GRO, DRO, RRO, RCRA metals, PCBs, pesticides, VOCs, and PAHs. Sample results were compared to the most stringent Method Two soil cleanup levels for direct contact or inhalation, under 40-inch zone (ADEC 2008). DRO, RRO, and PAH exceedances were identified in these samples and were attributed to asphalt along the surface of the site.

- A total of 10 groundwater grab samples were analyzed for GRO, DRO, RCRA metals, VOCs, and PAHs and were compared to 18 AAC 75 Table C Groundwater Cleanup Levels (ADEC 2008). A single exceedance for DRO was identified and attributed to an underground storage tank at Building 17724.
- A total of six soil gas samples were collected from three soil gas sampling points within the proposed construction footprint and two sampling points below the floor slab of Building 17720. All soil gas samples were analyzed for VOCs by EPA Method TO-15 (full scan) (EPA 1999) and the results were compared to the applicable ADEC soil gas target levels for a commercial scenario (ADEC 2008). Of the samples collected, two exceeded the shallow soil gas target level for TCE, and two exceeded the deep soil gas target level for TCE.

Contamination identified during the EE/CA investigation and previous investigations indicated that approximately 13,000 cubic yards (cy) of TCE- and PCE-contaminated soil and approximately 250 cy of DRO-contaminated soil lies within the F-22 Weapons Release Shop area. Soil contamination extends to a depth of 35 feet bgs within the proposed building footprint and to a depth of 58 feet bgs within the 2011 excavation outline at the site as shown in Figure 2.

Project Location

Field activities associated with the non-time-critical removal action occurred at two separate locations: the F-22 Weapons Release Shop and the ventilated stockpile areas (Figure 1).

The proposed building footprint/SVE extraction system (Figure 2) is located on Joint Base Elmendorf-Richardson (JBER-Elmendorf) along Talley Avenue to the west of Building 17720. The F-22 Weapons Release Shop area is bounded by Building 17724 to the west, Building 16718 to the south, and Building 17736 to the north. Prior to 2011 fieldwork, the F-22 Weapons Release Shop area consisted of an approximately 20,000-square foot open area, a small storage building (Building 17722), an access road to Building 17736, and a loading dock for Building 17720. Building 17722 was demolished during site activities. Records concerning the demolition are provided in Attachment 4.

The ventilated stockpile area (Figure 6), constructed to treat PCE- and TCE-contaminated soil removed from the F-22 Weapons Release Shop area, is located within the JBER-Elmendorf landfill area LF007 approximately 500 yards to the northeast of the intersection of Arctic Warrior Drive and Vandenburg Avenue. The ventilated stockpile construction

boundaries are defined by a University of Fairbanks (UAF) fenced research area to the north, lightly wooded areas to the east and west, and a gravel access road to the south.

Soils/Hydrology/Geology

During the 2011 excavation of soil from the F-22 Weapons Release Shop area, field observations found soils consisting of sand and gravel fill to approximately 3 to 5 feet bgs with a discontinuous layer of sandy silt present approximately 3 to 5 feet bgs overlaying gravel with silt and cobbles or sand with silt, gravel, cobbles, and trace boulders to the depth excavated. General regional soil conditions for the area are described in the 2011 EE/CA (USACE 2011c). The discontinuous layer of sandy silt appears to represent a relic land surface from pre-development of the site and coincides with a thin pulverized asphalt layer in the northern portion of the excavation. Areas where utilities were installed appear to have been backfilled with excavation spoils.

Groundwater in the area was encountered at approximately 58 feet bgs near the northwest corner of Building 16718 during advancement of SVE well boring VW-7.

Site Security

The F-22 Weapons Release Shop area is located within the flight line on JBER-Elmendorf. A temporary construction gate was placed in the flight line fence near the northeast corner of Building 17720 to facilitate transportation of excavated soil. Installation of the gate was coordinated with JBER Security Forces who were provided a key to the lock. JBER Security Forces also assigned a number (28.5) to the gate in accordance with the existing gate numbering system. The existing and newly constructed gates to the SVE system and soil excavation location were kept closed and locked during construction activities unless personnel were posted to monitor the gates when construction traffic was entering and exiting the site. Equipment, materials, and waste were consolidated and staged onsite during the field effort.

Project Approach

Implementation of EE/CA Alternative 6 included excavation of PCE-, TCE-, and DRO-contaminated soil from the F-22 Weapons Release Shop area and installation of an SVE

system. A ventilated stockpile was constructed to treat PCE- and TCE-contaminated soil using ex situ methods. Removed soil containing DRO was transported to Alaska Soil Recycling (ASR) for thermal treatment. Pre-mobilization activities for the project consisted of site layout, utility locates, dig permitting, and a coordination meeting with facilities managers. Equipment and personnel mobilized on 11 July 2011 to begin fieldwork. Two field crews were utilized to allow for concurrent activities at the F-22 Weapons Release Shop area (excavation and SVE system installation) and the ventilated stockpile site. Pre- and post-construction samples were collected at both locations to document conditions before and after fieldwork. Sampling activities and analytical results are described later in this report.

Soil Excavation

Soil with concentrations of PCE, TCE, and DRO above ADEC migration to groundwater cleanup criteria was excavated from the F-22 Weapons Release Shop area following installation of vacuum wells and vapor monitoring points. Approximately 2,200 cy of PCE- and TCE-contaminated soil and 180 cy of DRO–contaminated soil were removed (Figure 3). Excavated soil with concentrations of PCE and TCE above ADEC cleanup levels was transported to the ventilated stockpile in end-dump trucks with bed covers for ex situ treatment, while soil with concentrations of DRO above ADEC cleanup levels was transported to ASR for thermal treatment. Excavated soil was sampled to characterize waste and evaluate potential worker exposure. Sampling results are presented later in this report.

A staged excavation plan for soil removal allowed concurrent excavation, trenching, and installation of SVE header piping. Heavy construction equipment was kept out of the excavation, simplifying decontamination of construction equipment, and reducing the risk for transferring contaminated soil from the excavation to surrounding areas. Excavation did not extend to soil with analytical results reporting concentrations of PCE and TCE below ADEC migration to groundwater cleanup criteria. Approximate excavation depths within the F-22 Weapons Release Shop area are summarized below and in Figure 3:

- 3 feet bgs where pavement upgrades are proposed
- 3 to 5 feet bgs where DRO contamination was present
- 7 feet on the east side of Building 17720 where an isolated area of PCE- and TCE-contaminated soil was identified

- 11 feet bgs where building foundations are proposed
- 15 feet bgs where a conflicting fire hydrant tied in to the existing 18-inch asbestos-concrete water main.

A pulverized asphalt layer approximately 2 to 6 inches thick was encountered at 2 to 3 feet bgs in the northeastern corner of the F-22 Weapons Release Shop area. The asphalt layer may extend to the north and west of the excavation over an area of approximately 500 square feet (Figure 2). The location of this asphalt layer coincides with previously identified DRO, RRO, and PAHs above ADEC migration to groundwater cleanup levels reported in the upper 4 feet of soil during previous investigation activities discussed in the EE/CA (USACE 2011c). No evidence of a fuel release was found during excavation. Remnants of the pulverized asphalt layer located outside of the final excavation boundaries to the north and west are not likely to present a significant risk of DRO, RRO, and PAH migration to groundwater as constituents of asphalt exhibit low mobility in soil.

The excavation and SVE trenching was backfilled with non-frost susceptible material from the JBER-Elmendorf borrow pit to approximately three feet bgs in accordance with correspondence from the USACE. Edges of the excavation were sloped from existing grade to final elevations to prevent erosion and mitigate safety hazards. The access road across the western portion of the site was backfilled to the pre-excavation surface elevation to provide access to Buildings 17720 and 17736. Post-construction layout at the F-22 Weapons Release Shop area is shown in Figure 2. Snow fencing installed at the southern end of the area defines access to the re-habilitated access road that transects the site.

SVE System Installation

The SVE system (Figure 2) was installed to remediate the remaining contaminated soil with PCE and TCE to concentrations below ADEC cleanup levels. The SVE system will volatilize PCE and TCE from soil and vent it to the atmosphere. SVE system construction consisted of installation of nine vacuum wells, three vapor monitoring point clusters, SVE header piping, and a blower building to remove PCE and TCE from soils beneath the F-22 Weapons Release Shop area. Vacuum wells and monitoring points were installed with down-hole hammer drilling methods and were composed of 2-inch polyvinyl chloride (PVC) v-screen piping and $^{3}/_{8}$-inch diameter low-density polyethylene tubing, respectively. Approximately 503

feet of drilling was advanced to install the vacuum wells and vapor monitoring point clusters. Vapor extraction well construction details are provided in Figure 4. SVE header lines were connected to the SVE blower located in a pre-fabricated building placed near the northwest corner of Building 17720. Final site layout and the SVE system location are shown on Figure 2.

Vacuum wells and monitoring points were installed in accordance with depths and design details indicated in the Work Plan Addendum (USACE 2011b). Vacuum wells and monitoring points were installed to the depths indicated in Table 1 and Table 2, respectively. Vapor extraction well construction details are provided in Figure 4. Each vapor monitoring point cluster consisted of three screened intervals separated by bentonite plugs to allow development of a vertical soil gas profile for contaminants of concern (COC).

Table 1
Vapor Extraction Well Installation Details

Well Number	Top of Screen (feet bgs)	Constructed Bottom of Screen (feet bgs)	SVE Header Piping Diameter (inches)	Design Bottom of Screen (feet bgs)
VW-1	3.5	29.5	2	30
VW-2	5.0	20.0	2	20
VW-3	4.75	42.25	3	41.5
VW-4	4.5	40.5	3	40
VW-5	5.25	41.25	2	40
VW-6	10.5	42.25	3	41.5
VW-7	3.75	59.75	3	60
VW-8	4.5	50.5	3	50
VW-9	5.25	31.25	3	30

Note:
All depths are referenced to the ground surface prior to excavation and are approximated to the nearest 0.25 feet.

Table 2
Vapor Monitoring Point Clusters

Screened Intervals	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)
Upper	6.0	7.0
Middle	25.5	26.5
Lower	49.0	50.0

Note:
All depths are referenced to the ground surface prior to excavation and are approximated to the nearest 0.25 feet.
Depths are typical for each monitoring point location.

SVE header piping was connected to vacuum wells with a rubber fitting and hose clamps and consisted of 2-inch or 3-inch high-density polyethylene (HDPE) pipe with hot-welded joints between fittings and pipe sections. Table 1 provides header pipe diameter for each vapor extraction well. Two-inch rigid foam insulation was placed on the top and sides of completed SVE headers and capped with 3 inches of concrete (Figure 5). The two-inch rigid insulation was used in place of heat trace to provide thermal insulation. Locate wires were placed on each header pipe to allow future utility locating. A break in the concrete cap was left where headers crossed the proposed building foundation to avoid conflict with future construction at the F-22 Weapons Release Shop area.

Due to an existing electrical outlet, the SVE blower building was placed at least 36 inches away from the northwest corner of Building 17720 in accordance with the JBER electrical code. Electrical service to the blower building was connected to an existing transformer on the east side of Building 17720 in accordance with JBER-Elmendorf electrical code. Power consumption is monitored at an electrical meter mounted on the exterior of the SVE blower building.

The SVE system will be operated for 2 years in accordance with the Operations and Maintenance Manual (currently under development) and with the Work Plan Addendum (USACE 2011b). When the system is shutdown, SVE headers, vacuum wells, and vapor monitoring points will be filled with grout and abandoned in place, and above-ground components will be removed.

Ventilated Stockpile Construction

The ventilated stockpile was constructed near the LF007 landfill area, south of a UAF research plot (Figure 6). The stockpile has a footprint of approximately 90 feet by 120 feet with the long axis oriented north-south. Brush was cleared from a strip along the eastern side of the area to facilitate stockpile construction.

The stockpile liner and embankment were constructed in accordance with the Work Plan Addendum and ADEC guidance on temporary stockpile construction (USACE 2011b; ADEC 2008). Twenty-foot wide 60-mil HDPE sheets welded together form the bottom liner for the stockpile. Liner seams were inspected for leaks before soil was placed in the stockpile. The stockpile base was sloped to drain toward a low point near the southwest corner of the stockpile, and a 10-inch diameter sump was installed at the low point to allow removal of water following construction. Slotted two-inch PVC pipes were placed on approximate 12-foot centers across the bottom of the stockpile. The slotted PVC piping was connected via a 4-inch diameter HDPE header to a 1.5-horsepower vacuum blower in a skid-mounted blower building placed on the west side of the stockpile (Figure 7).

Soil was sloped up from the inside edge of the approximately 24-inch tall berm at approximately a 1:1 slope. The completed height of soil in the stockpile is approximately 8 feet above the prepared base.

Once soil placement in the stockpile was complete, nine perforated four-inch diameter pipes were placed across the top of the stockpile on approximately 12-foot centers to provide an inlet for recovery air as the blower pulls air with volatilized PCE and TCE from the soil. The stockpile was covered with a 20-mil HDPE liner anchored by clean soil placed around the perimeter. A netting cover was placed over the top liner and anchored with attached sandbags in accordance with ADEC guidance for temporary stockpile construction (ADEC 2008). A temporary chain-link fence was constructed around the stockpile and blower building with two locking gates allowing access to a transformer, the blower building, and the stockpile. Layout of the ventilated stockpile is shown in Figure 7. The ventilated stockpile will be operated for 2 years in accordance with the Operations and Maintenance Manual (currently under development) and the Work Plan Addendum (USACE 2011b). After 2 years

the ventilated stockpile will be removed, post-construction samples will be collected, and the area will be re-vegetated.

Sampling Activities

Sampling was performed at the F-22 Weapons Release Shop and ventilated stockpile areas to evaluate pre- and post-construction conditions, determine the potential for worker exposure, characterize waste soil and stockpile leachate, evaluate soil gas from existing soil vapor wells prior to construction, and to evaluate SVE system performance from soil vapor monitoring point clusters and SVE blower systems. Air monitoring was conducted during construction.

Samples were collected following methods provided in Appendix B of the Post Wide Work Plan (USACE 2010a). Samples were assigned a unique identification number corresponding to the location, type, and depth of the sample as described in the Work Plan Addendum (USACE 2011b). Samples were placed in a chilled cooler for soil and water samples, or into a laboratory-provided shipping container for soil gas summa canisters and were shipped to Columbia Analytical Services, Inc.; a laboratory certified under the Environmental Laboratory Accreditation Program (ELAP), following strict chain of custody procedures.

Estimated and actual sample quantities from the construction phase of the project are summarized in Table 3 with a description of the analytical method and sampling purpose. Complete sample analytical data and quality control information can be found in the Data Quality Assessment (Attachment A).

Table 3
Analytical Sampling Quantities and Methods

Estimated Quantity	Quantity Collected	Parameter	Analytical Method	Purpose
Soil				
10	10	DRO	AK102	Excavation surface evaluation for worker exposure
15	15	VOC	SW8260	Excavation surface evaluation for worker exposure
5	1	DRO/VOC	AK102/ SW8260	Samples of opportunity
5	5	DRO	AK102	Excavated soil waste characterization
25	25	VOC	SW8260	Excavated soil waste characterization using RCRA 20-times rule[1]
5	14	TCLP/VOC	SW1311/ 8260	Excavated soil waste characterization for samples failing RCRA 20-times rule[1]
15	18	DRO/VOC	AK102/ SW8260	Pre-activity condition of disturbed areas and roadways
12	14	DRO/VOC	AK102/ SW8260	Post-activity condition of disturbed areas and roadways
Water (Investigation-Derived Wastewater)				
1	0	DRO	AK102	Waste characterization of investigation-derived wastewater
0	1	DRO, RRO, VOC, Metals, PAH	AK102, AK103, SW8260, SW6020/7470, and SW8270 SIM	Waste characterization of leachate from stockpile
4	0	VOC	SW8260	Waste characterization of investigation-derived wastewater and any leachate/runoff from excavations, stockpiles, or rinsate
Soil Gas				
10	10	VOC	TO-15	Spring soil vapor sampling
8	8	VOC	TO-15	Spring ambient air sampling

Note:
[1] Comparison to 40 CFR 261.24 toxicity characteristic criteria for D039 and D040.

Soil Sampling and Analytical Results

Soil samples were collected to evaluate pre- and post-construction conditions, potential construction worker exposure, and to characterize waste.

Pre-Construction and Post-Construction Results

Pre- and post-construction samples were collected to characterize areas where COCs may have spread during construction. A total of 18 pre-construction samples were collected before beginning field activities, and 14 post-construction samples were collected from the same locations following construction. Four pre-construction sample locations were not sampled for post-construction conditions as they are located beneath the ventilated stockpile and will be sampled once the stockpile is removed. Locations of pre- and post-construction samples are shown in Figure 8 and Figure 9 for the F-22 Weapons Release Shop and the ventilated stockpile areas, respectively.

Pre- and post-construction samples were collected from the following locations:

- Truck exit pad locations
- Haul truck access at the excavation, including soil along the edge of pavement
- Off-road haul truck access to the ventilated stockpile
- Beneath the ventilated stockpile

Three pre-construction samples from the SVE system location and two pre-construction samples from the ventilated stockpile location reported concentrations of DRO exceeding the ADEC migration to groundwater cleanup criteria. Thirteen of eighteen pre-construction samples did not report concentrations of DRO exceeding ADEC migration to groundwater cleanup criteria. Seventeen of eighteen pre-construction samples did not detect concentrations of PCE or TCE above laboratory detection limits. One sample, 11-FTR-F22-SO-0_5-PR-41, reported a TCE concentration of 0.028 mg/kg but did not detect a concentration of PCE.

Three post-construction samples from the SVE system installation and excavation locations reported concentrations of DRO exceeding the ADEC migration to groundwater cleanup criteria. These samples were in the locations where pre-construction samples reported concentrations of DRO exceeding ADEC migration to groundwater cleanup criteria. Post-

construction samples did not detect concentrations of PCE or TCE above laboratory detection limits. Sample location 11-FTR-F22-SO-0_5-PR-41 was not sampled for post-construction as it was located beneath the ventilated stockpile and will be sampled after removal of the stockpile.

Post-excavation samples were collected where DRO was detected above ADEC migration to groundwater cleanup criteria. Although DRO was detected in the post-excavation samples, the detections were likely a result of asphalt debris in the samples and not associated with a fuel release. Detections of DRO above ADEC migration to groundwater cleanup criteria are not likely to present a significant risk to groundwater as constituents of asphalt exhibit low-mobility in soil.

Confirmation Sampling for Worker Exposure Results

Eleven confirmation samples were collected from the final excavation footprint to evaluate potential worker exposure during the construction of the proposed building. The samples were collected and analyzed for DRO, including one sample of opportunity and ten confirmation samples (Table 3). Two samples did not report concentrations of DRO above laboratory detection limits. Nine samples reported concentrations below ADEC ingestion or inhalation cleanup criteria.

Fifteen samples were collected to evaluate the potential for worker exposure to VOCs. Eight samples did not detect PCE above laboratory detection limits. Seven samples detected PCE at concentrations ranging from 0.018 to 0.22 mg/kg. Three samples did not detect TCE above laboratory detection limits. Twelve samples detected TCE at concentrations ranging from 0.021 to 0.46 mg/kg.

Samples where DRO was detected were from the location of a pulverized asphalt layer noted in the excavation. The concentrations of DRO detected are likely a result of asphalt debris in the samples and are below ADEC inhalation and ingestion cleanup criteria. DRO contamination is not likely to present a significant risk to workers as constituents of asphalt exhibit low-mobility in soil. The analytical results for DRO contamination are comparable to site characterization samples reported in the EE/CA (USACE 2011c).

Waste Characterization

Waste characterization samples were collected at a rate of at least one sample per 100 cy of soil excavated in accordance with the Work Plan Addendum (USACE 2011b).

Thirty waste characterization samples were collected. Five were analyzed for DRO and 25 were analyzed for VOCs. Samples analyzed for DRO detected concentrations ranging from 43 to 3,800 mg/kg. Fourteen samples analyzed for VOCs did not detect PCE above laboratory detection limits. Eleven samples analyzed for VOCs reported concentrations of PCE ranging from 0.014 to 0.085 mg/kg. Eleven samples analyzed for VOCs did not detect TCE above laboratory detection limits. Fourteen samples analyzed for VOCs reported concentrations of TCE ranging from 0.026 to 0.62 mg/kg.

Fourteen TCLP samples were collected. TCLP soil samples did not detect concentrations of the analytes. Waste characterization and TCLP soil sample results indicate that the soil is nonhazardous when compared to the values shown in Table 4. Analytical results for waste characterization and worker exposure are comparable to site characterization samples reported in the EE/CA (USACE 2011c).

Table 4
Disposal Criteria and Facilities

Material Description	Criteria	Destination
TCE- and PCE-contaminated soils	TCLP results: TCE ≤ 0.5 mg/L PCE ≤ 0.7 mg/L	Onsite ex situ ventilated stockpile
RCRA hazardous waste-containing soils	TCLP results: TCE ≥ 0.5 mg/L PCE ≥ 0.7 mg/L	Subtitle C Landfill CWM NW, Arlington
petroleum, oil, and lubricates-contaminated soil	DRO ≥12,500 mg/kg GRO ≥1,400 mg/kg RRO ≥13,700 mg/kg	Alaska Soil Recycling, Anchorage
Nonregulated solid waste	Nonhazardous waste, including construction debris and household items	Anchorage Regional Landfill
Personal protective equipment	Nonhazardous waste	Subtitle D Landfill WMI Columbia Ridge

Investigation-derived wastewater was sampled to evaluate disposal options. A sample of the containerized water was tested for VOCs, DRO, RRO, PAHs, and metals. Analytical results

indicated that COCs were below ADEC drinking water cleanup criteria and that the wastewater could be processed by one of the two granular-activated carbon (GAC) water treatment systems located on JBER.

Soil Gas Sampling and Analytical Results

Soil gas samples collected from vapor monitoring points prior to construction at the F-22 Weapons Release Shop area were analyzed for VOCs by EPA Method TO-15. Two samples did not detect PCE above laboratory detection limits. Three samples detected PCE ranging from 0.53 to 0.71 micrograms per cubic meter (µg/m^3) and were below ADEC residential soil gas screening levels. Five samples detected PCE ranging from 42 to 490 µg/m^3 and were above ADEC residential soil gas screening levels. Two samples did not detect TCE above laboratory detection limits. One sample detected TCE at 0.82 µg/m^3 and was below ADEC residential soil gas screening levels. Seven samples detected TCE ranging from 5.1 to 2400 µg/m^3 and were above ADEC residential soil gas screening levels.

Soil gas samples were collected at the startup of blowers at both the SVE system and ventilated stockpile locations and will be collected as part of the operation of both systems. The results of this testing will be presented in the quarterly reports.

Worker Exposure Air Monitoring Results

Ambient air samples were collected prior to construction at the F-22 Weapons Release Shop area and inside of Building 17720. All PCE and TCE results were below ADEC residential ambient air screening levels. During excavation, stockpile construction, and SVE system installation, the breathing zone was monitored for petroleum hydrocarbons using a photoionization detector (PID) and for PCE and TCE using compound specific Draeger tubes. The highest PID screening result (2.8 parts per million [ppm]) was identified during installation of vapor monitoring point VMP3; during other activities, petroleum hydrocarbon vapors were detected at less than 1 ppm. PCE and TCE were not detected within the Draeger tube detection range of 2 to 300 ppm for PCE and 2 to 250 ppm for TCE.

It is recommended that air monitoring be performed as part of future construction activities when soil is disturbed to depths greater than three feet. Concentrations of petroleum hydrocarbon vapors, PCE, and TCE in the air will vary over time.

SVE System and Ventilated Stockpile Emissions

Estimated emission rates for the SVE system and ventilated stockpile were presented in the Work Plan Addendum, based on the highest soil gas concentrations measured during site investigations in 2010 (USACE 2011b). The estimated combined emission rate of 0.0009 tons per year for the SVE system and ventilated stockpile is less than the permitting threshold of 2 tons per year (18 AAC, Section 50.326), indicating that SVE and ventilated stockpile blower emissions are exempt from permitting. Actual emission rates will be calculated from soil gas sampling results which will be reported in quarterly reports.

Decontamination Procedures

Sampling equipment was decontaminated at each site using the procedures outlined in Appendix B (Section 7.0) of the Post Wide Work Plan (USACE 2010a). The specific protocol for decontamination is summarized in Table 5. Where possible, disposable sampling equipment was used and was placed in a Super Sack® for disposal as investigation-derived waste (IDW). IDW included miscellaneous sampling and site trash, used personal protective equipment, disposable sampling equipment, paper towels, and temporary stockpile liners with incidental levels of contamination. IDW was disposed of by Emerald Alaska, Inc.

Table 5
Summary of Standard Decontamination Protocol for Sampling and Construction Equipment

Step	Description
1	Scrub drilling sampling equipment thoroughly with soft-bristle brushes in a low-sudsing, phosphate-free detergent solution (such as Alconox® or Liquinox®).
2	Rinse drilling sampling equipment by submerging in water from an onsite potable source.
3	Rinse drilling sampling equipment three times with deionized water by spraying inside and outside surfaces thoroughly.
4	Brush loose soil from the beds of end-dump trucks and on the excavator with soft-bristle brushes; sweep into the stockpile while the equipment was in the cell.
5	Brush loose soil from boots and the excavator bucket with soft-bristle brushes while at the F-22 Weapons Release Shop area prior to leaving the excavation.

Note:
The decontamination water generated was retained and disposed of through a JBER GAC water treatment system along with stockpile leachate.

Waste Handling / Disposal

Waste streams generated during the project included soil cuttings, excavated soil, leachate water from the stockpile decontamination water, and IDW. Wastes generated during construction activities are shown in Table 6.

Table 6
Waste Streams

Material Description	Quantity	Destination
PCE/TCE Soil	~ 2,200 cy	Ventilated Stockpile
DRO Soil	~ 180 cy	Alaska Soil Recycling
IDW	(4) 1-cy Super Sacks®	Emerald Alaska, Inc.
Wastewater	~ 550 gallons	JBER GAC water treatment system
Vegetation Debris	~ 33 cy	Anchorage Sand & Gravel (Lucy Pit)
Demolition Debris	57.17 tons	Anchorage Regional Landfill
Asphalt Debris	~ 146 cy	ASRC Pit on JBER-Elmendorf

Soil cuttings from vapor extraction well and vapor monitoring point installations were contained in Super Sacks® and later emptied into the ventilated stockpile. Soil excavated from the F-22 Weapons Release Shop area was transported to the ventilated stockpile in end-dump trucks with bed covers and stockpiled for ex situ SVE treatment.

Wastewater generated from equipment decontamination drilling and leachate from the ventilated stockpile sump were containerized and sampled for VOCs, DRO, RRO, PAHs, and RCRA metals to evaluate appropriate disposal options. Prior to October 2011, wastewater and leachate was processed by the GAC water treatment system located on JBER-Elmendorf. From October through November 2011, leachate was processed by the GAC water treatment systems on JBER-Richardson.

IDW including disposable sampling equipment, used personal protective equipment, and temporary stockpile covers were placed in Super Sacks®. The IDW Super Sacks® were transported offsite and disposed of in accordance with State and Federal regulations. The waste disposal certificate is provided in Attachment 5.

Surveying

Sample locations, excavation extents, and other site features were surveyed by Jacobs using a Leica real-time kinematic (RTK) global positioning system (GPS). The survey was based on control points set from locations surveyed during previous surveys of the F-22 Weapons Release Shop area. A GPS base station was set up on a control point to provide a correction signal to the RTK rover. Locations surveyed by Jacobs were collected to a minimum accuracy of 0.5 meters in accordance with the 2009 Manual for Electronic Deliverables (USACE 2009). The topography of the F-22 Weapons Release Shop area following excavation and backfilling was documented in figures prepared by a licensed surveyor. The surveyor also documented the ventilated stockpile conditions at the end of construction. These figures were electronically distributed to project stakeholders on 29 August 2011 and are included in Attachment 5 along with Jacobs survey data.

Work Plan Deviations

Deviations from the Work Plan Addendum (USACE 2011b) included changes to the excavation sequence, erosion control methods, SVE header construction, SVE blower placement, SVE electrical connection, and ventilated stockpile dimensions.

Excavation of SVE trenches for header installation was completed concurrently with main soil excavation instead of first trenching to install the headers and then completing the removal of soil contaminated with PCE, TCE, and DRO. The deviation limited potential conflicts with SVE headers during soil excavation, prevented difficult access created by excavation equipment that created trenches running across the site, and allowed excavation equipment and dump trucks to operate on existing ground and pavement surfaces which prevented contamination of equipment tracks and wheels.

Operation of construction equipment on existing ground and pavement surfaces allowed removal of a tire wash station from the erosion control plan. Efforts to prevent soil from spilling onto areas outside the excavation included not filling the bucket to over flowing, shaking the bucket while over the excavation to settle the soil, and loading where the excavator could pivot to load the end-dump without moving the tracks.

SVE header piping extending from the west was sloped up to intersect with header piping extending from the south. This simplified header piping construction by requiring a single joint rather than the two joints as indicated in the Work Plan Addendum (USACE 2011b)

The 3-inch thick concrete cap specified to cover the SVE header trench was not placed between the proposed building footers connecting to Building 17720 in order to accommodate future construction activities in the F-22 Weapons Release Shop area.

The SVE blower building was placed 36 inches from Building 17720 instead of 12 inches as shown in the Work Plan Addendum (USACE 2011b). An electrical receptacle is present on the outside of Building 17720 where the SVE blower building was placed. JBER electrical guidelines require at least 36 inches of clearance for an electrical receptacle. Electrical connection of the SVE and stockpile blowers also required placement of additional equipment not included in the Work Plan Addendum, including an electrical meter and shut-off switch.

The final dimensions of the ventilated stockpile were approximately 120 feet north to south and 89 feet east to west to fit field conditions and maintain access to the UAF research plot and a transformer. The perforated and slotted pipe headers were placed on 12-foot centers to accommodate the increase in stockpile length. The Work Plan Addendum specified headers on 10-foot centers.

Health and Safety

The safety program was designed to evaluate, control, and reduce health and safety hazards. The health and safety protocol can be found in Appendix A of the *2010 Post Wide Work Plan* (USACE 2010a) and the *Accident Prevention Plan* (USACE 2011a). Contamination at the F-22 Weapons Release Shop area was expected to be hydrocarbon and solvent compounds. Site workers were required to have current 40-hour Hazardous Waste Operations and Emergency Response training certifications, and/or hold a current 8-hour Hazardous Waste Operations and Emergency Response annual refresher certification. Basic personal protective equipment consisted of safety glasses, a hard hat, safety-toe boots, high-visibility vest, and gloves appropriate for the task. Hearing protection was worn when there was a potential for exposure to noise levels exceeding 85 decibels such as when

working near heavy equipment, the SVE blower unit, or when the U.S. Air Force (USAF) was conducting flight operations. Air monitoring for PCE, TCE, and volatile petroleum hydrocarbons was conducted to monitor for worker exposure. Draeger tubes were used to monitor for PCE and TCE and a PID was used to monitor for volatile petroleum hydrocarbons.

Daily safety tailgate meetings were conducted for all onsite personnel prior to beginning work. An activity hazard analysis or safe plan of action was developed for each task prior to beginning that task. A Base Civil Engineering Work Clearance Request (dig permit, attached) was obtained and utility locates were performed prior to conducting excavation and intrusive construction activities. Excavations were sloped in accordance with EM-385 and Occupational Safety and Health Administration regulations where access for construction personnel was required. A caisson was used to shore the excavation during removal of the fire hydrant valve.

Conclusions

Implementation of EE/CA Alternative 6 included excavation of PCE-, TCE-, and DRO-contaminated soil from the F-22 Weapons Release Shop area and installation of a SVE system. A ventilated stockpile was constructed to treat approximately 2,200 cy of PCE- and TCE-contaminated soil removed from the F-22 Weapons Release Shop area using ex situ methods. Approximately 180 cy of DRO-contaminated soil was transported to ASR and underwent thermal treatment. The SVE system included approximately 503 feet of down-hole hammer drilling to install nine vacuum wells and three vapor monitoring point clusters. The SVE and ventilated stockpile systems are operational and will run for 2 years.

Sampling was performed at the F-22 Weapons Release Shop and ventilated stockpile areas to evaluate pre- and post-construction conditions, determine the potential for worker exposure, characterize waste soil and stockpile leachate, evaluate soil gas from existing soil vapor wells prior to construction, and to evaluate SVE system performance from soil vapor monitoring point clusters and SVE blower systems. Air monitoring was also performed during construction. Periodic soil gas sampling will monitor the effect of the SVE and ventilated stockpile systems on soil PCE and TCE concentrations and will be documented with

quarterly reports. Underground components of the SVE system were surveyed during construction and will be located by Jacobs before future construction activities begin at the F-22 Weapons Release Shop area. After 2 years of operation, SVE headers, vacuum wells, and vapor monitoring points will be filled with grout, and abandoned in place, and above-ground components will be removed. The ventilated stockpile will be removed, post-construction samples collected, and the area re-vegetated. Final disposal location of the ventilated stockpile soil after completion of remediation activities will be determined at a later time by the USAF.

References

ADEC (Alaska Department of Environmental Conservation). 2011 (April). 18 AAC 50 Air Quality Control.

ADEC. 2010 (May). *Draft Field Sampling Guidance*.

ADEC. 2008 (October). Oil and Other Hazardous Substances Pollution Control. 18 AAC 75.

EPA (U.S. Environmental Protection Agency). 1999 (January). *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. Second Edition Compendium Method TO-15.*

USACE (United States Army Corp of Engineers). 2011a (July) *Soil Vapor Extraction System Design and Construction Work Plan Addendum Appendix G: Accident Prevention Plan,* JBER-Elmendorf, Alaska*.* Prepared by Jacobs Engineering Group Inc.

USACE. 2011b (June) *Soil Vapor Extraction System Design and Construction Work Plan Addendum*, JBER-Elmendorf, Alaska. Prepared by Jacobs Engineering Group Inc.

USACE. 2011b (May*) F-22 Weapons Release Shop Engineering Evaluation and Cost Analysis*, JBER-Elmendorf, Alaska. Prepared by Jacobs Engineering Group Inc.

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USACE. 2010b (September). *Foundation Study HTRW Survey, F-22 Weapons Release Shop F-22 Weapons Release Shop (10-012)*. Elmendorf Air Force Base, Alaska. Prepared by Shannon and Wilson.

USACE. 2009 (October*) Manual for Electronic Deliverables*. Prepared by USACE, Alaska District.

Attachments

Figures

Attachment 1 Data Quality Assessment

Attachment 2 Photograph Log

Attachment 3 Field Logbooks and Field Notes

Attachment 4 Building 17722 Demolition Approval Documents

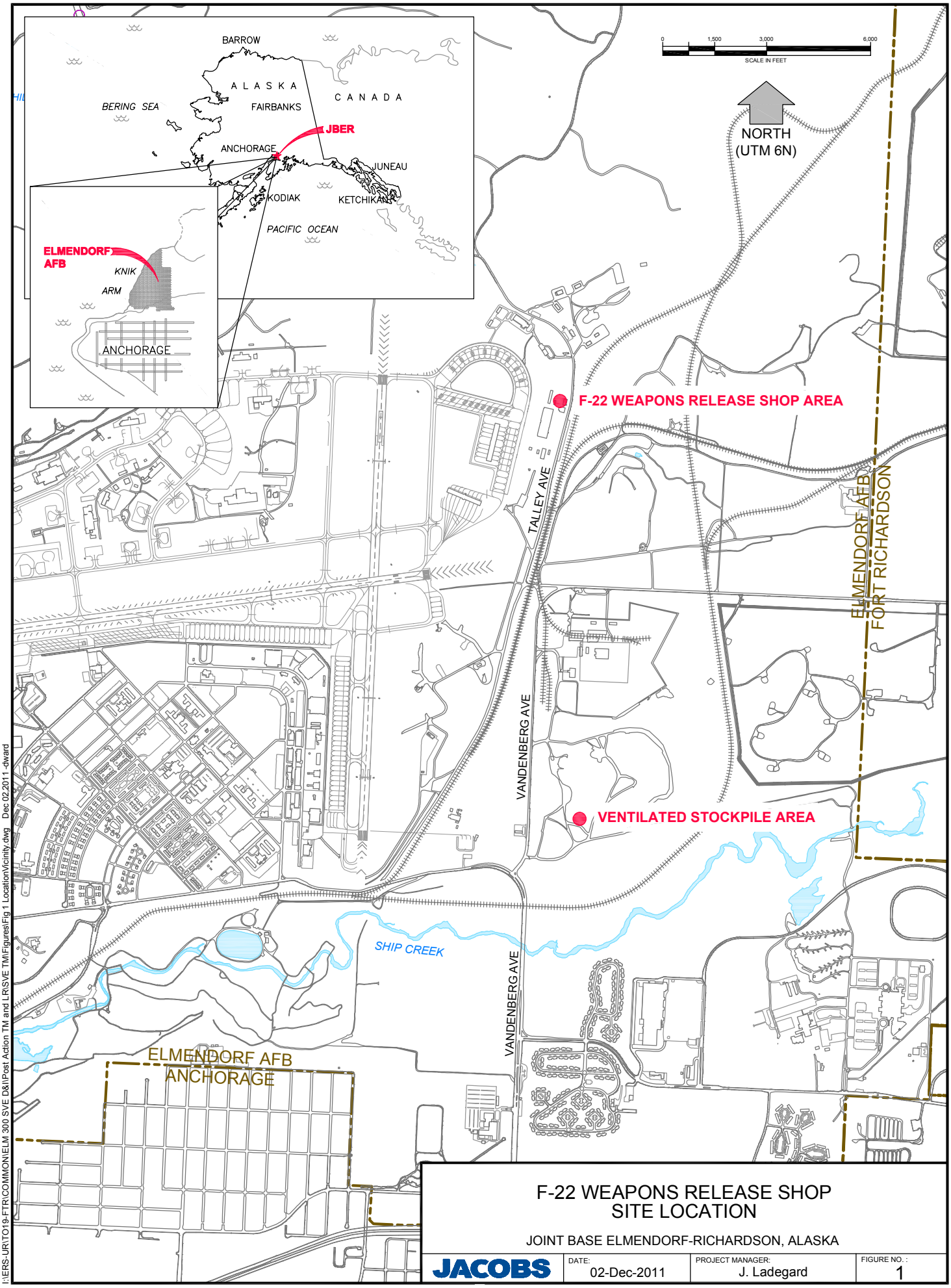
Attachment 5 Waste Disposal Certificate

Attachment 6 Survey Data

Attachment 7 Dig Permits

Attachment 8 Response to Comments

FIGURES



F-22 WEAPONS RELEASE SHOP SITE LOCATION

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE: 02-Dec-2011	PROJECT MANAGER: J. Ladegard	FIGURE NO.: 1

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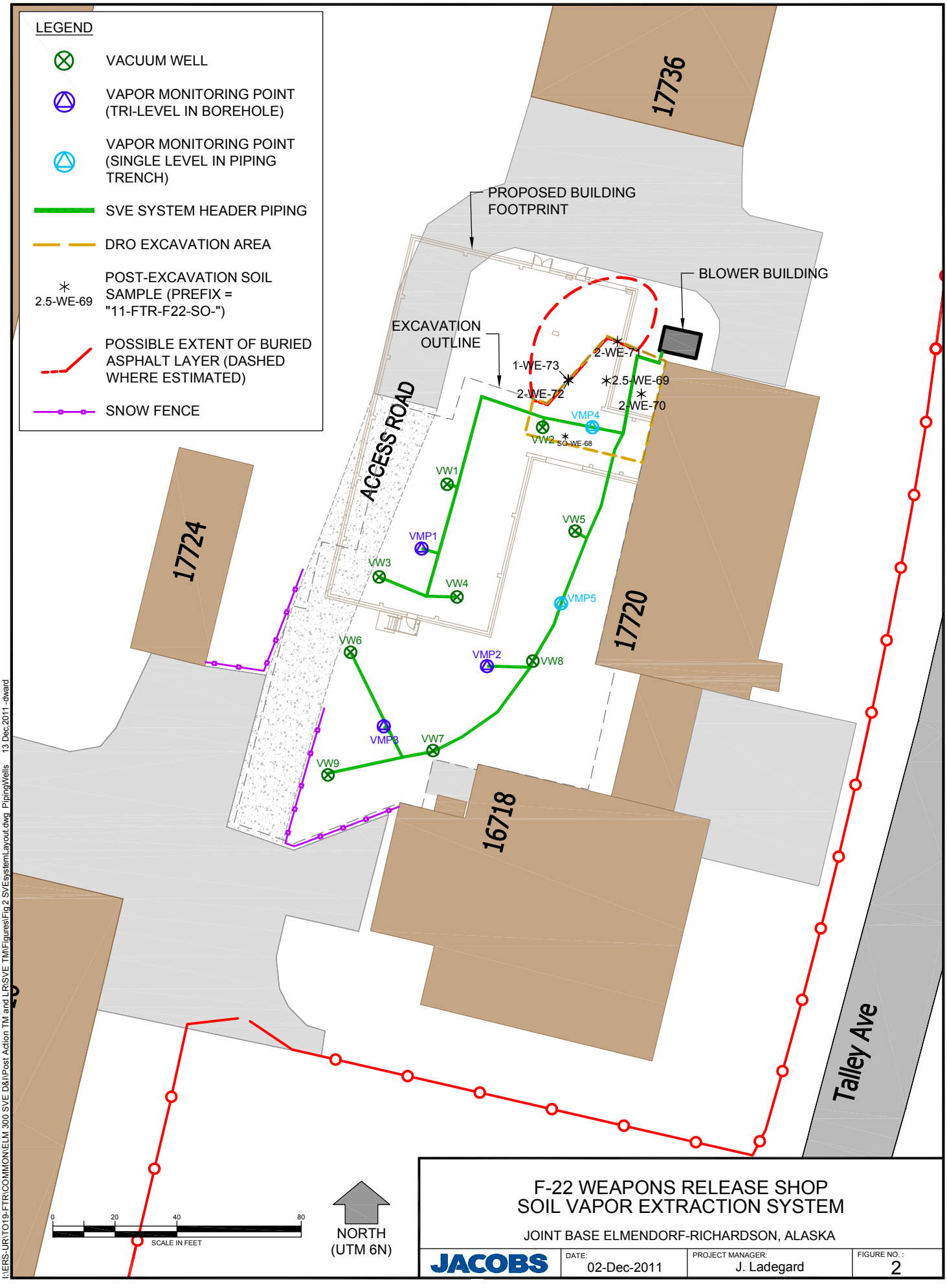
LEGEND
VACUUM WELL
VAPOR MONITORING POINT (TRI-LEVEL IN BOREHOLE)
VAPOR MONITORING POINT (SINGLE LEVEL IN PIPING TRENCH)
SVE SYSTEM HEADER PIPING
DRO EXCAVATION AREA
2.5-WE-69
POST-EXCAVATION SOIL SAMPLE (PREFIX = "11-FTR-F22-SO-")
POSSIBLE EXTENT OF BURIED ASPHALT LAYER (DASHED WHERE ESTIMATED)
SNOW FENCE
17736
PROPOSED BUILDING FOOTPRINT
BLOWER BUILDING
EXCAVATION OUTLINE
1-WE-73
2-WE-71
2-WE-72
2.5-WE-69
2-WE-70
VMP4
VW2
SO-WE-68
ACCESS ROAD
VW1
VW5
VMP1
VW3
VW4
VMP5
17724
17720
VW6
VMP2
VW8
VMP3
VW7
VW9
16718
Talley Ave
0
20
40
80
SCALE IN FEET
NORTH (UTM 6N)
F-22 WEAPONS RELEASE SHOP
SOIL VAPOR EXTRACTION SYSTEM
JOINT BASE ELMENDORF-RICHARDSON, ALASKA
JACOBS
DATE: 02-Dec-2011
PROJECT MANAGER: J. Ladegard
FIGURE NO. : 2
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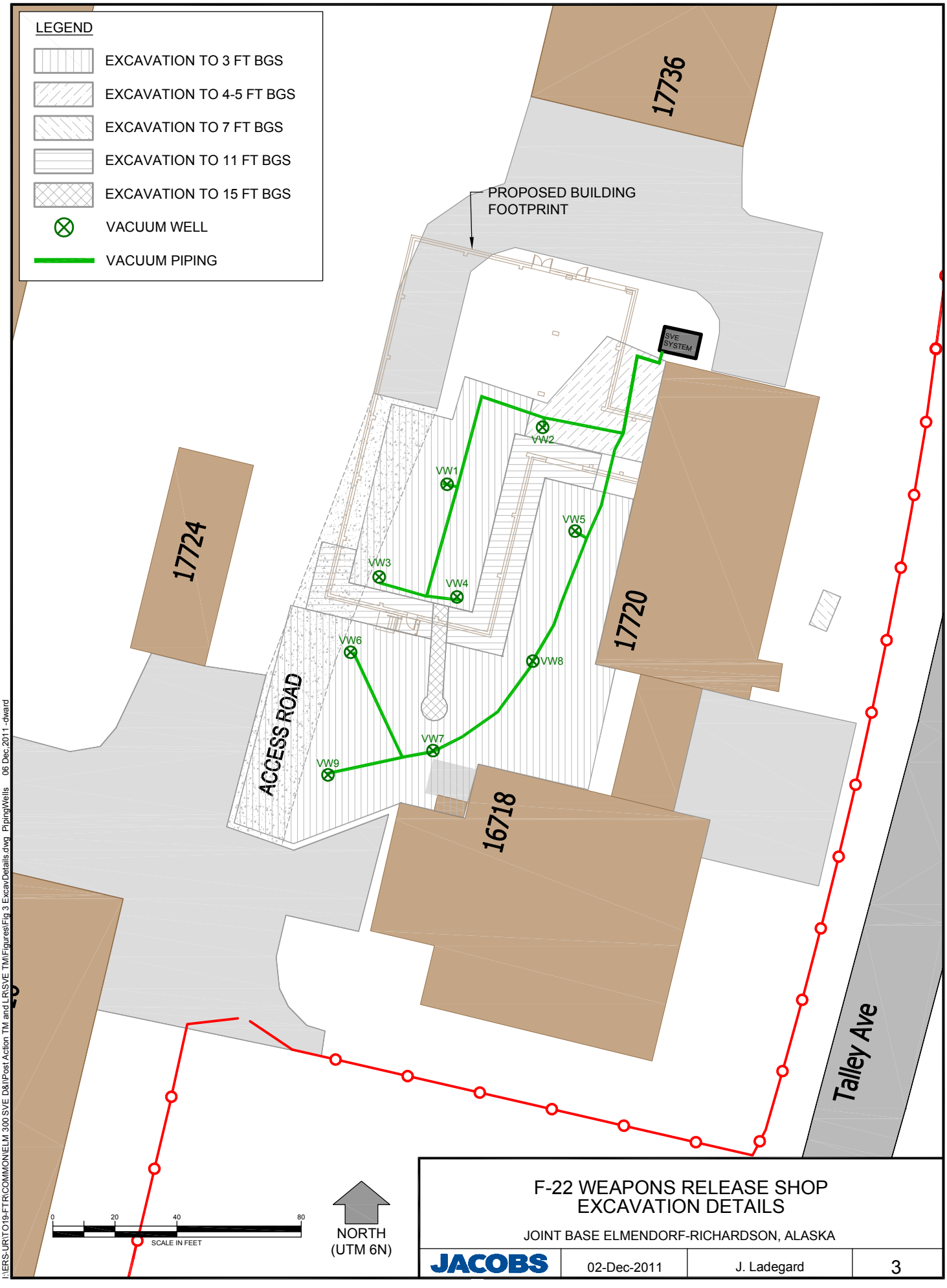

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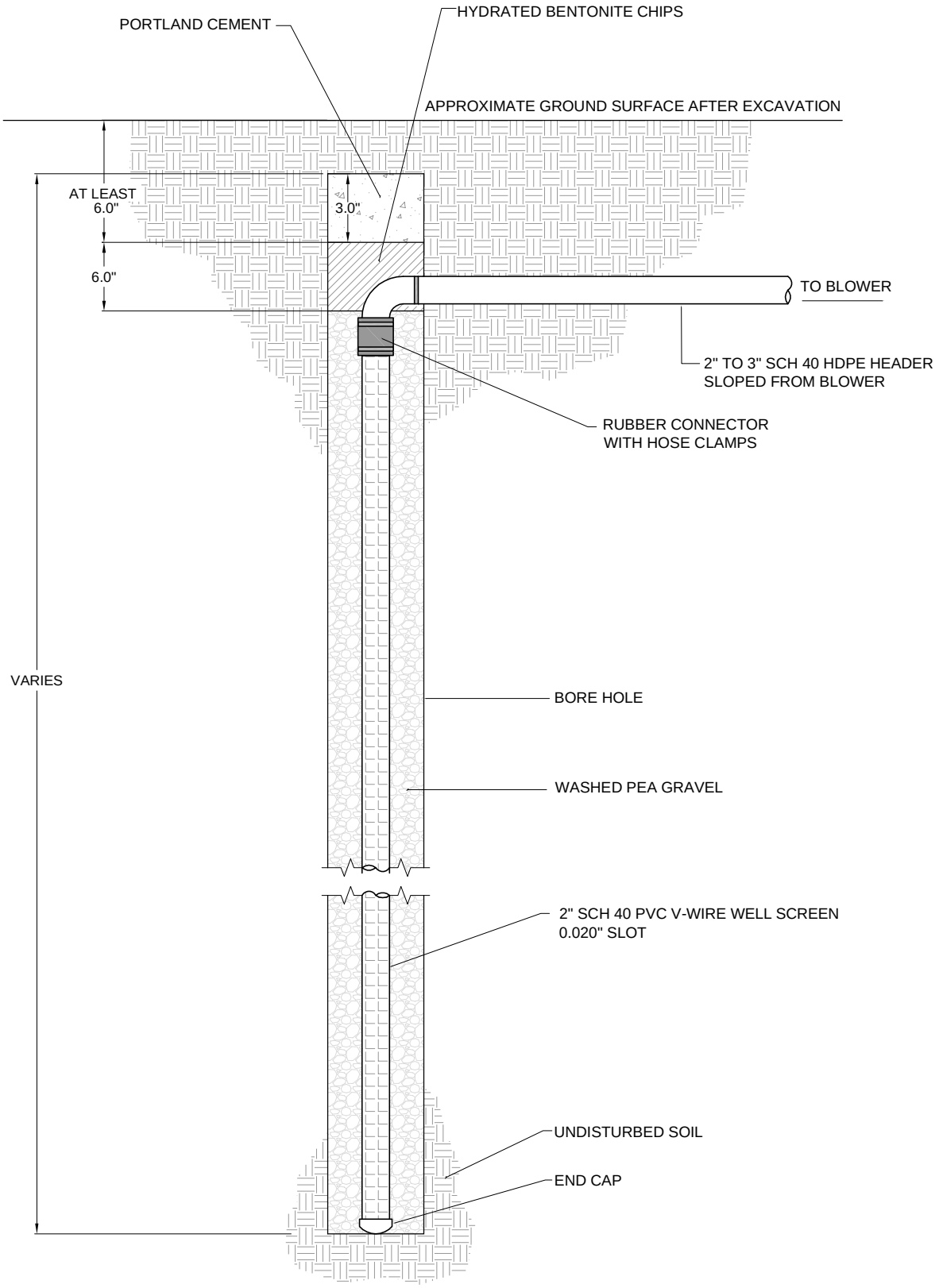
F-22 WEAPONS RELEASE SHOP EXCAVATION DETAILS

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	02-Dec-2011	J. Ladegard	3



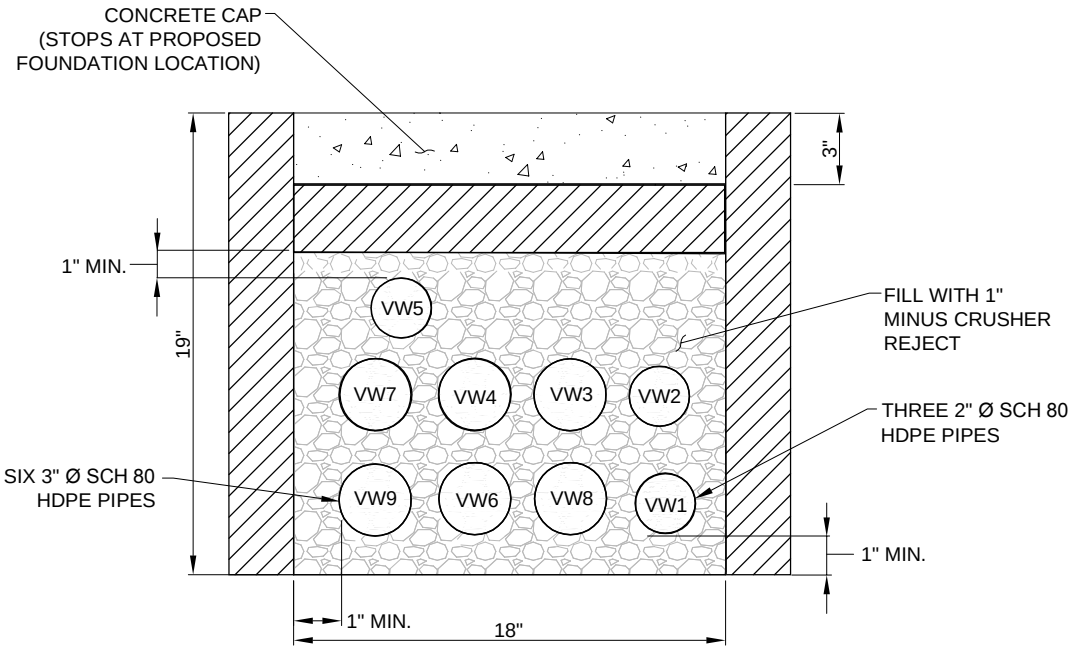
SECTION - VENT WELL
NOT TO SCALE

VAPOR EXTRACTION WELL DETAILS

JBER-ELMENDORF, ALASKA

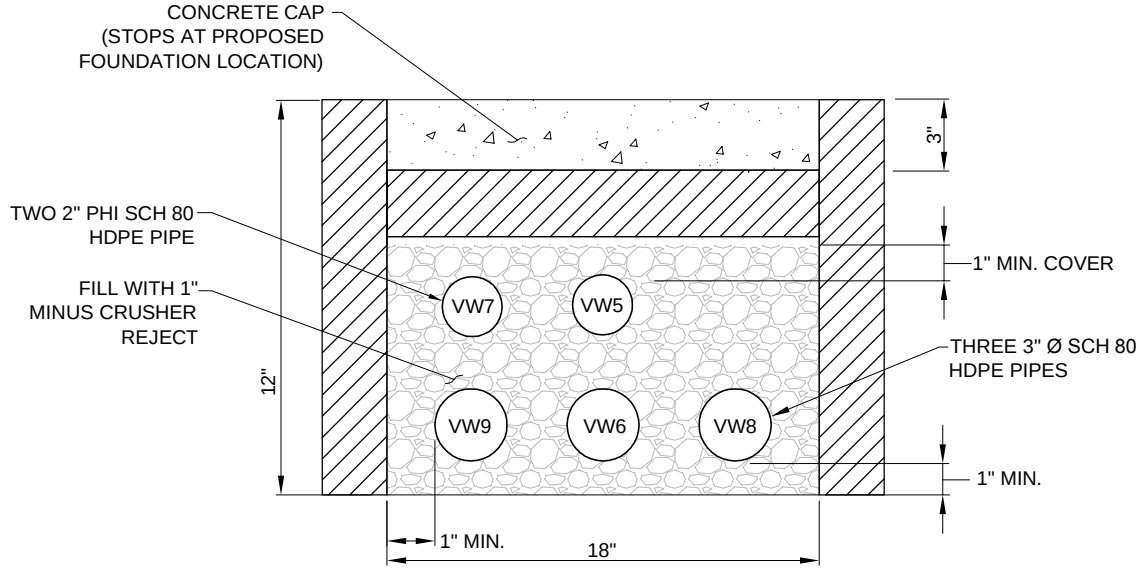
JACOBS	DATE: 6 December 2011	PROJECT MANAGER: J. Ladegard	FIGURE NO. : 4

G:\Autocad\ERS-UR05F51904\SVE Design Doc\Vacuum Well Details.dwg 2-4 VacWellAboveScrCnnct 07 Dec.2011 - tiedemam



NORTHERN FOOTING PENETRATION FACING NORTH

NOT TO SCALE



SOUTHERN FOOTING PENETRATION FACING SOUTH

NOT TO SCALE

LEGEND:

2" INSULATION

FOUNDATION PENETRATION DETAILS FOR THE SVE HEATING NETWORK

JBER-ELMENDORF, ALASKA

JACOBS	DATE: 5 December 2011	PROJECT MANAGER: J. Ladegard	FIGURE NO. : 5

G:\Autocad\ERS-UR\05F51904\2011 TM\Fig 5 FoundationPenetration.dwg Penetrations 07 Dec.2011 tiedemam

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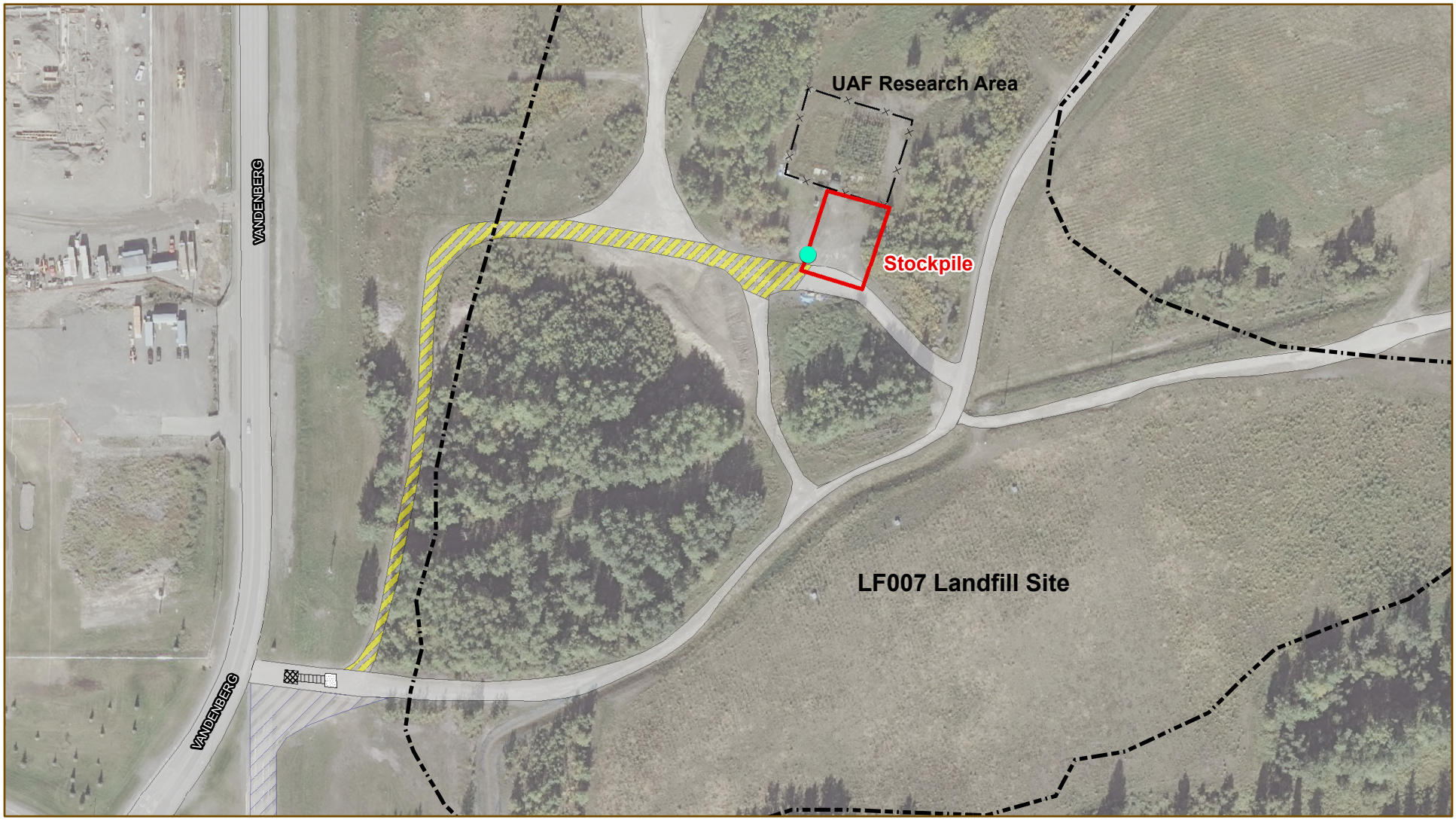

Stockpile Features
- Gravel Pad
- Cattle Guard
- Rock Pad
- Stockpile
- Stockpile Sump

Other Boundaries
- LF007 Landfill Site
- UAF Area (permanently fenced)

Roads
- Abandoned
- Improved
- Not Improved

Coordinate System: AK State Plane Zone 4
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US

N

0 100 200 400
Feet

VENTILATED STOCKPILE LOCATION

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	13-Dec-2011	J. Ladegard	6

N

0 12.5 25 50

Feet

Contour Interval = 1 foot

Coordinate System: AK State Plane Zone 4
Projection: Transverse Mercator
Datum: North American 1983

Units: Foot US
Vertical Datum: Not Specified

F-22 WEAPONS RELEASE SHOP VENTILATED STOCKPILE LAYOUT

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
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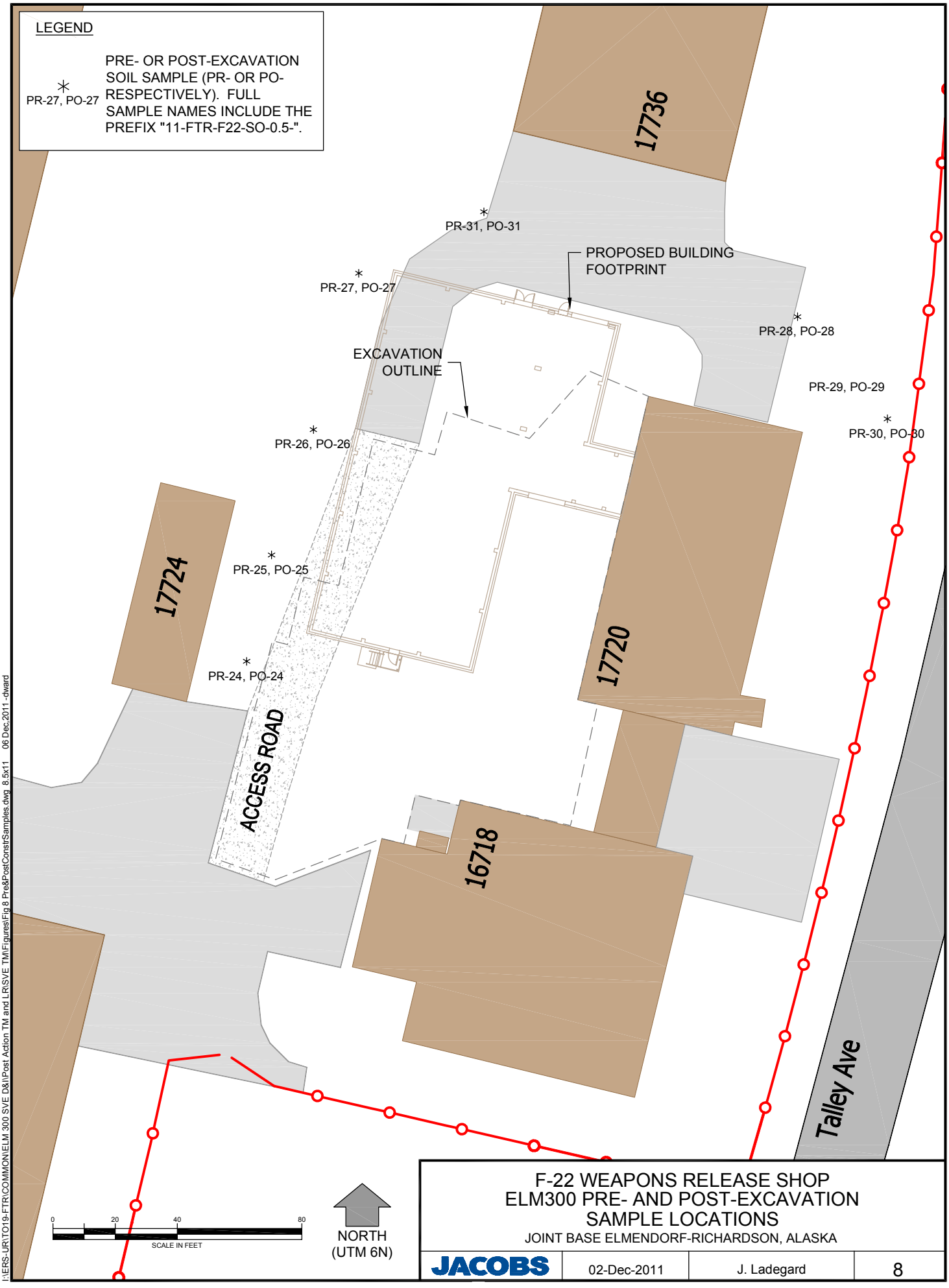

F-22 WEAPONS RELEASE SHOP
ELM300 PRE- AND POST-EXCAVATION SAMPLE LOCATIONS
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	02-Dec-2011	J. Ladegard	8

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N

0 75 150 300

Feet

Coordinate System: AK State Plane Zone 4
Projection: Transverse Mercator

Datum: North American 1983
Units: Foot US

F-22 WEAPONS RELEASE SHOP STOCKPILE PRE- AND POST-CONSTRUCTION SOIL SAMPLES

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO:
	06-Dec-2011	J. Ladegard	9

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