**Comprehensive Long-Term Environmental Action Navy (CLEAN) II**
Contract No. N62742-94-D-0048
Contract Task Order No. 0004

## Sampling and Analysis Plan

# Removal Action Design Support and Confirmation Sampling

## Ford Island Pearl Harbor Naval Complex
## Pearl Harbor Naval Complex
## Waikele Branch, Naval Magazine Pearl Harbor
## Iroquois Point
## Naval Radio Transmitting Facility Lualualei
## Former Naval Air Station Barbers Point
## Oahu, Hawaii

Department of the Navy
Pacific Division
Naval Facilities Engineering Command
258 Makalapa Drive, Suite 100
Pearl Harbor, Hawaii 96860-3134

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Prepared for

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**TABLES**

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| °C | degrees Celsius |
| $\mu g/100cm^2$ | micrograms per 100 square centimeters |
| AM | action memorandum |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| CLP | Contract Laboratory Program |
| COC | chain of custody |
| CPR | cardiopulmonary resuscitation |
| CTO | contract task order |
| DOH | Department of Health |
| DON | Department of the Navy |
| DQA | data quality assessment |
| DQAR | data quality assessment report |
| DQI | data quality indicator |
| DQO | data quality objective |
| EBS | environmental baseline survey |
| EDD | Electronic data deliverable |
| EPA | U.S. Environmental Protection Agency |
| EPC | exposure point concentration |
| EQL | estimated quantitation limit |
| GC/MS | gas chromatography |
| H&S | health and safety |
| HSP | health and safety plan |
| IAS | Initial Assessment Study |
| ICP | indirectly coupled argon plasma spectroscopy |
| ID | identification |
| IDW | investigation-derived waste |
| IRP | Installation Restoration Program |
| LCS | Laboratory control sample |
| LCSD | Laboratory control sample duplicate |
| mg/kg | milligram per kilogram |
| MDL | method detection limit |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| MSL | mean sea level |
| MSR | monthly status report |
| NAS | Naval Air Station |
| NEDTS | Navy Environmental Data Transfer Standards |
| NFESC | Naval Facilities Engineering Service Center |
| NPL | National Priorities List |
| NRTF | Naval Radio Transmitting Facility |
| OSHA | Occupational Safety and Health Administration |
| PACNAVFACENGCOM | Pacific Division, Naval Facilities Engineering Command |
| PAH | polycyclic aromatic hydrocarbons |
| PARCC | precision, accuracy, representativeness, comparability, and completeness |
| PCB | polychlorinated biphenyl |
| PHNC | Pearl Harbor Naval Complex |
| PID | photoionization detector |
| PPE | personal protective equipment |
| PRG | preliminary remediation goal |

| | |
|---|---|
| QA | quality assurance |
| QA/QC | quality assurance/quality control |
| QC | quality control |
| RA | removal action |
| RDBMS | relational database management system |
| RI | remedial investigation |
| RL | reporting limit |
| RME | reasonable maximum exposure |
| RPD | relative percent difference |
| RPM | Remedial Project Manager |
| RSE | removal site evaluation |
| SAL | soil action levels |
| SAP | sampling and analysis plan |
| SDG | sample delivery group |
| SI | site investigation |
| SOP | standard operating procedures |
| SOW | statement of work |
| SQL | sample quantitation limits |
| STO | subcontract task order |
| TSCA | Toxic Substance Control Act |
| USDA | United States Department of Agriculture |

# 1. PROJECT DESCRIPTION AND MANAGEMENT

This removal action (RA) was prepared for the Department of the Navy (DON) Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM), under the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Program, Contract N62742-94-D-0048, Contract Task Order 0004. Previous investigations have identified contaminated areas suitable for RAs at six Naval installations on Oahu, Hawaii: Ford Island, Pearl Harbor Naval Complex (PHNC); PHNC; Waikele Branch, Naval Magazine Pearl Harbor (Waikele Branch); Iroquois Point; Building 81, Naval Radio Transmitting Facility (NRTF) Lualualei; and former Drum Crushing Area, former Naval Air Station (NAS) Barbers Point. The RA sites at these installations included in this sampling and analysis (SAP) are slated for excavation and treatment of the soil at an on-site thermal treatment unit to be constructed and operated at former NAS Barbers Point. These sites have been designated as Group B sites.

This SAP outlines the sampling and analysis methods and procedures proposed to support the design efforts and confirmation sampling for RAs at the Group B sites. This document also includes elements of a quality assurance plan summarizing the policies and procedures that will be implemented to attain the data quality objectives (DQOs) specified for the project. The site-specific health and safety plan (HSP) has been prepared under a separate cover (Earth Tech 2001e).

Table 1-1 demonstrates how this SAP addresses the quality assurance project plan (QAPP) elements currently required by the U.S. Environmental Protection Agency (EPA) QA/R-5 guidance document (EPA 2001).

**Table 1-1: Comparison of SAP to EPA Required QAPP Elements**

| EPA QA/R-5 QAPP ELEMENT | | REMOVAL ACTION SAMPLING AND ANALYSIS PLAN SECTION | |
|---|---|---|---|
| A1 | Title and Approval Sheet | Title and Approval Sheet | |
| A2 | Table of Contents | Table of Contents | |
| A3 | Distribution List | Distribution List | |
| A4 | Project/Task Organization | 1.4 | Project Organization |
| A5 | Problem Definition/Background | 1.1 | Problem Definition and Background |
| A6 | Project/Task Description | 1.2 | Project Description |
| A7 | Quality Objectives and Criteria | 1.3 | Quality Objectives and Criteria |
| A8 | Special Training/Certification | 1.5 | Special Training and Certification |
| A9 | Documents and Records | 1.6 | Documents and Records |
| B1 | Sampling Process Design | 2.1 | Sampling Process Design |
| B2 | Sampling Methods | 2.2 | Sampling Methods |
| B3 | Sample Handling and Custody | 2.3 | Sample Handling and Custody |
| B4 | Analytical Methods | 2.4 | Analytical Methods |
| B5 | Quality Control | 2.5 | Quality Control |
| B6 | Instrument/Equipment Testing, Inspection, and Maintenance | 2.6 | Equipment Testing, Inspection, and Maintenance |
| B7 | Instrument/Equipment Calibration and Frequency | 2.7 | Instrument Calibration and Frequency |
| B8 | Inspection/Acceptance of Supplies and Consumables | 2.8 | Inspection and Acceptance of Supplies and Consumables |
| B9 | Non-direct Measurements | 2.9 | Non-Direct Measurements |
| B10 | Data Management | 2.10 | Data Management |

**Table 1-1: Comparison of SAP to EPA Required QAPP Elements (Continued)**

| EPA QA/R-5 QAPP ELEMENT | | REMOVAL ACTION SAMPLING AND ANALYSIS PLAN SECTION | |
|---|---|---|---|
| C1 | Assessment and Response Actions | 3.1 | Assessment and Response Actions |
| C2 | Reports to Management | 3.2 | Reports to Management |
| D1 | Data Review, Verification, and Validation | 4.1 | Data Review, Verification, and Validation |
| D2 | Validation and Verification Methods | | |
| D3 | Reconciliation with User Requirements | 4.2 | Reconciliation with User Requirements |

## 1.1 PROBLEM DEFINITION AND BACKGROUND

### 1.1.1 Purpose of the Investigation

The field effort described in this SAP has two purposes:

(1) Conduct pre-excavation sampling to define the vertical and lateral extent of contamination at Group B sites

(2) Conduct confirmation sampling following RA activities at Group B sites

Preliminary sampling has been completed at all Group B sites; pre-excavation sampling is required to further delineate contamination prior to soil excavation and treatment. The exception to this is the contaminated soil at NRTF Lualualei (Building 81), which has already been fully delineated; as a result, no pre-excavation sampling for that installation is included in this SAP. Confirmation sampling at the PHNC sites will be addressed under a separate project (Earth Tech, Inc. [Earth Tech] 2000b) and is not included in this SAP. A summary of the Group B sites and their associated RA activities is presented in Table 1-2.

**Table 1-2: Group B Sites, Field Activities**

| Installation | Sites | Field Activities | |
|---|---|---|---|
| | | Pre-Excavation Sampling | Confirmation Sampling |
| Ford Island PHNC | 23 | X | X |
| PHNC | 3 | X | N/A |
| Waikele | 2 | X | X |
| Iroquois Point | 1 | X | X |
| NRTF Lualualei | 1 | N/A | X |
| Former NAS Barbers Point | 1 | X | X |

*Notes:*
N/A = not applicable

**Pre-Excavation Sampling.** Group B sites will be sampled to further delineate the lateral and vertical extent of contamination. Initial soil samples will be collected using a direct-push rig at 2 feet, 4 feet, and 6 feet below ground surface (bgs), at the same locations where contamination was previously encountered, to define the vertical extent of contamination. The decision of which samples will be analyzed by the laboratory will be based on review of the results of the initial sampling.

Additional soil samples will then be collected using a direct push rig in a “step-out” fashion to delineate the lateral and vertical extent of contamination. Samples will be collected at 5- to 10-foot lateral intervals from the initial contaminated area. Samples will be collected at the surface, 2 feet, 4 feet, and 6 feet bgs; the decision whether to analyze the samples collected will be based on review of the results of the initial sampling.

If necessary, additional 5- to 10-foot lateral interval locations will be selected following review of the previous sampling results. Vertical sampling will be conducted consistent with the approach presented above. Samples will be collected until results from each site indicate that contaminant levels are below the screening levels.

**Confirmation Sampling.** Confirmation sampling will be conducted to ensure that excavation cleanup criteria have been met. The general sampling approach for post-excavation confirmation consists of plotting a 10-foot grid across the excavated area and collecting one sample from each grid location. Samples from sidewalls will also be collected.

### 1.1.2 Problem to be Solved

Group B sites contain contaminants of concern necessitating removal and treatment, as identified in the action memorandum (AM) Addendum (DON 2001). Contamination related to former operations at the Group B sites consists primarily of polychlorinated biphenyls (PCBs) associated with former transformers, but also polycyclic aromatic hydrocarbons [PAHs] at the former NAS Barbers Point and NRTF Lualualei sites. Soils at the former Drum Crushing Area contain 1,1-Dichloro-2,2-bis(p-chlorophenyl)ethane (4,4'-DDD), dichlorodiphenyldichloroethylene (4,4'-DDE), 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane (4,4'-DDT), alpha-chlordane, gamma-chlordane, heptachlor epoxide, and arsenic concentrations greater than the regulatory criteria. Sampling and analysis for this project is intended to solve the following problems: (1) to characterize the extent of contamination at each site prior to removal activities; and (2) to ensure that residual contaminant levels following excavation meet the established cleanup criteria.

### 1.1.3 Facility Background

This SAP addresses Group B sites located at six Naval installations throughout Oahu, Hawaii: Ford Island PHNC, PHNC, Waikele Branch, Iroquois Point, NRTF Lualualei, and former NAS Barbers Point. This section includes a description of each installation; specific Group B sites are discussed in Section 1.1.4. Figures in Appendix A provide the location and sampling locations for each site.

#### *1.1.3.1 Ford Island PHNC*

Ford Island, Pearl Harbor Naval Complex, is located on Oahu, Hawaii. Figures depicting the 23 transformer sites at Ford Island are included in Appendix A (Figures A-1 through A-23).

Initial military development of Pearl Harbor and Ford Island occurred between 1912 and 1919. Naval Air Station (NAS) Ford Island and Army Air Station (AAS) Luke Field were established on Ford Island in 1917. The Army and Navy shared a single unpaved runway. Hangar and support facilities associated with the AAS and NAS were located on the southwest and southeast sides of the island, respectively. In addition, housing structures were located on the northwest shore and the northeast tip of the island.

The Ford Island underwent considerable development and expansion in the 1930s and 1940s. During the 1930s, areas along the east and north shores were filled with material dredged from the harbor channel. The central portion of the island was cleared and paved for installation of a 4,000-foot runway, and all but two of the AAS hangars were demolished in favor of open aircraft parking areas, maintenance facilities, and larger hangars. During this period, an underground storage tank (UST) farm was installed in the east-central portion of the island, and an aviation gas pipeline system was installed to distribute fuel from the tank farm to locations throughout the island. Ordnance was stored in bunkers on the north and east sides of the island.

Prior to and during World War II, Ford Island provided moorage and support to most of the Pacific Fleet and was home of the NAS Ford Island. Use of Ford Island as a military air station ceased with the advent of jet aircraft. Pearl Harbor Naval Station assumed ownership of the island when the NAS was deactivated in 1962, and the airfield was leased to the State of Hawaii, Department of Transportation, for limited use by civilian aircraft. The airfield has been inactive since mid-1999, when the state opened Kalaeola Airport (at former NAS Barbers Point). Currently, Ford Island provides housing and recreational facilities for Navy personnel.

#### *1.1.3.2 PHNC*

PHNC is located on the island of Oahu, Hawaii, about 4 miles west of the city of Honolulu, on the east side of Pearl Harbor. The Waipio and Pearl City Peninsulas separate the harbor into three lochs: West Loch, Middle Loch, and Southeast Loch. Figures depicting the PHNC sites are included in Appendix A (Figures A-24 through A-27).

#### *1.1.3.3 WAIKELE BRANCH*

Waikele Branch, a part of Naval Magazine Pearl Harbor, is located on the island of Oahu, Hawaii, about 4 miles west of the city of Honolulu, on the east side of Pearl Harbor. Figures depicting the Waikele Branch sites are included in Appendix A (Figures A-28 through A-30).

#### *1.1.3.4 IROQUOIS POINT*

Iroquois Point is located on Oahu, Hawaii, about 4 miles west of the city of Honolulu, on the east side of Pearl Harbor. Figures depicting the Iroquois Point sites are included in Appendix A (Figures A-31 and A-32).

#### *1.1.3.5 NRTF LUALUALEI*

Naval Radio Transmitting Facility (NRTF) Lualualei is located on Oahu, Hawaii. Figures depicting Building 81 are included in Appendix A (Figures A-33 and A-34). Figure A-34 provides confirmation sampling locations for PCBs only. All other contaminants of concern are collocated with the PCBs. Total petroleum hydrocarbon (TPH)-diesel (-d) and TPH–motor oil (-o) will only be sampled for concentrations present in soil following excavation of PCBs and benzo(a)pyrene remediation.

#### *1.1.3.6 FORMER NAS BARBERS POINT*

Former NAS Barbers Point is situated on 3,723 acres along the southern coastal plain of Oahu, 13 miles west of Honolulu. The facility is bordered by Campbell Industrial Park to the west, the City of Kapolei to the north, Ewa Beach residential communities to the east, and the Pacific Ocean to the south. Figures depicting the former Drum Crushing Area are included in Appendix A (Figures A-35 and A-36).

### 1.1.4 Site Description

Site histories and contaminant levels for each of the 31 Group B sites are presented in this section. Sites are grouped by their respective installation. Site locations maps are provided in Appendix A.

#### *1.1.4.1 FORD ISLAND PHNC*

Available historic records indicate PCBs were present in the dielectric fluid used in many of the former and existing transformers on Ford Island. The PCB-containing fluids may have been released to concrete surfaces or surface soil by leaking directly from the transformers, or during regular transformer testing and maintenance. During operation of the transformers, periodic sampling was required to test the dielectric properties of the transformer fluid. All of the active transformers on Ford Island have been replaced or retrofilled with non-PCB-containing dielectric fluid.

Fifty-five transformer sites were investigated between December 1999 and June 2000 to evaluate the impact of PCB-contaminated dielectric fluid that may have been released to surface soil and concrete surfaces. The 55 transformers were sampled in January, March, and April 2000 (Earth Tech 2001a). A minimum of three sampling locations within each type of medium (surface soil, soil beneath asphalt, and concrete) was located within 15 feet of each existing or former transformer location. Surface soil samples were collected as composites to increase sample coverage. Twenty-three of the 55 transformers had sample results that exceeded screening levels. The screening criterion is included in Appendix B. A summary of the 23 sites is presented in Table 1-3.

**Table 1-3: Ford Island PHNC Sites**

| Transformer | Description | Maximum PCB Concentration (mg/kg) |
|---|---|---|
| TA-01 | Transformer TA-01 is located in Building S286. The shoreline lies to the northeast. This site is covered with asphalt; therefore, the asphalt layer was removed at the sample location prior to collection of the surface soil samples. | 140 |
| TC-04 | Transformer TC-04 is located in Building S257. The immediate surroundings are grass, old asphalt and gravel. | 2.24 |
| TC-06D | Transformer TC-06D is located on an elevated concrete pad with concrete pavement and grass surrounding it. | 15.1 |
| TC-07D | Transformer TC-07D is located in Building S258. Grass and concrete pavement surround it. | 24.9 |
| TD-01 | Transformer TD-01 is located near Wasp Boulevard and is surrounded by concrete pavement and grass. | 29.6 |
| TD-02 | Transformer TD-02 is pad-mounted and fenced. It is located adjacent to Building 169 and is surrounded by grass. | 12.9 |
| TD-03 | Transformer TD-03 is pad-mounted and located adjacent to Building 164. Ranger Loop road is nearby. There is grass on the northeast side of the transformer. | 31.9 |
| TD-05 | Transformer TD-05 is located in Building 176 near Wasp Boulevard. There are sections of grass and a concrete sidewalk adjacent to the transformer. | 23.9 |
| TD-07 | Transformer TD-07 is located in Building 175 near Wasp Boulevard. There are sections of grass and a concrete sidewalk adjacent to the building. | 347 |
| TF-01 | Transformer TF-01 is pad-mounted and located adjacent to Building 77 and Hornet Avenue. It is surrounded by grass and concrete pavement. | 1.85 |
| TF-01D | Transformer TF-01D is located adjacent to Building 77 and Hornet Avenue. It is surrounded by grass. | 7.05 |
| TF-04 | Transformer TF-04 is located in Building 208, adjacent to Liscome Bay Street and Hornet Avenue. There is grass southwest of the transformer. Samples were collected from three areas outside of the concrete pad and gravel areas. | 4.98 |
| TF-05 | Transformer TF-05 is located in Building S295. There is a concrete sidewalk to the east, and grass to the south and west. | 36.7 |
| TF-07 | Transformer TF-07 is pad-mounted and located adjacent to Building 37. It is surrounded by both grass and concrete. | 2.48 |
| TF-08 | Transformer TF-08 is pad-mounted and surrounded by grass. | 41.0 |
| TF-09 | Transformer TF-09 is located in Building S99. It is surrounded by concrete pavement. | 46.4 |
| TF-17 | Transformer TF-17 is located in Building 75 adjacent to Gannet Street. Gravel and a concrete sidewalk surround it. | 4.0 |
| TF-18 | Transformer TF-18 is pad-mounted and fenced. It is adjacent to Building 87 and Lexington Boulevard. A concrete driveway is located northeast, and there is grass to the southwest. | 43.2 |
| TG-01 | Transformer TG-01 is located in Building S253 adjacent to Yorktown Boulevard. Grass surrounds the transformer on the north, east, and south sides. | 56.7 |
| TG-03 | Transformer TG-03 is located in Building S254. A concrete slab lies to the west and north, grass lies to the north and east, and Yorktown Boulevard is located south of the transformer. | 32.2 |
| TG-06 | Transformer TG-06 is pad-mounted and adjacent to Building 453. There is asphalt to the west and grass to the north. | 3.62 |
| TI-03 | Transformer TI-03 is located in Building S251 adjacent to Lexington Boulevard. A concrete slab is located south and southwest of the building. There is grass surrounding the concrete slab. | 1.04 |
| TI-04D | Transformer TI-04D is located adjacent to Langley Avenue and surrounded by concrete. There is grass beyond the concrete. | 40.0 |

*Notes:*
mg/kg = milligram per kilogram
PCB = Polychlorinated biphenyl

#### *1.1.4.2 PHNC*

Past investigations have identified PCB-contaminated soil and surficial concrete at six PHNC transformer sites: TF-06, TC-01, TF-10, E-09, TD-10, and D-02. Concrete wipe and sediment sampling will be performed in accordance with CTO 0039's work plan (Earth Tech 2000b) in the drainage structures and manholes concurrently with other CTO 0004 sampling events to complete the scope of the original RA conducted under CTO 0039. In addition, pre-excavation delineation is proposed at D-02, TC-01, and E-09 and is discussed below. Confined space entry is required for this sampling and documentation is discussed in Appendix C of the HSP.

**D-02.** Excavation and sampling of PCB-contaminated soils occurred between April and September 2001. PCB-contaminated soil, ranging from 1.3 milligrams per kilograms (mg/kg) to 17 mg/kg total PCBs and 2 feet bgs to 7 feet bgs, remain at the site at fourteen sample locations. Pending approval, it is expected that these soils will remain in place with the institution of land use controls. In November 2001, D-02 was temporarily backfilled. Prior to backfilling, the excavation floor and sidewalls were backfilled with a 10-mil poly liner (to separate the PCB-contaminated soil from the clean backfill), 6 inches of backfill, and a geotextile filter to promote proper drainage.

The following activities are planned to complete the RA at D-02: (1) pre-delineate the extent of contamination; (2) remove and treat the PCB-contaminated former transformer pad, and excavate and treat PCB-contaminated soil underlying the pad; (3) remove and treat PCB-contaminated sediment from underneath the sidewalk (which resulted from the spreading of PCB-contaminated soils during a water main break at the site); (4) collect wipe samples from a manhole; and 5) restore the site to its original condition.

**TC-01.** Excavation and sampling of PCB-contaminated soils occurred between December 2000 and September 2001. PCB-contaminated soil with a concentration of 9,100 mg/kg remains at location 3 at a depth of 6 feet bgs. In November 2001, TC-01 was temporarily backfilled. Prior to backfilling, the transformer pad excavation sidewall and location 3 were lined with a 10-mil poly liner to separate PCB-contaminated soils from clean backfill. Soils underlying the transformer pad are expected to contain PCBs.

The following activities are planned to complete the RA at TC-01: (1) pre-delineate the extent of PCB contamination (concrete coring will be necessary); (2) remove and treat the PCB-contaminated transformer pad and excavate and treat PCB-contaminated soil underlying the pad; (3) remove temporary backfill and continue to excavate and treat PCB-contaminated soil from location 3; (4) collect wipe samples from utility manhole; (5) restore the site to its original condition.

**E-09.** RA activities have not started at E-09. The following activities are planned to complete the RA at E-09: (1) pre-delineate the extent of contamination; (2) remove and treat PCB-contaminated soil; (3) sample the concrete transformer pad and clean if PCB concentrations exceed the clean up goal of 10 micrograms per 100 square centimeters ($\mu g/100cm^2$); (4) collect wipe samples from one drainage structure and one utility manhole; and 5) restore the site to its original condition.

#### *1.1.4.3 WAIKELE BRANCH*

Historic records indicate PCBs were present in the dielectric fluid used in many of the former and existing transformers at the facility. The PCB-containing fluids may have been released to concrete surfaces or surface soil by leaking directly from the transformers, or during regular transformer testing and maintenance. Periodic sampling was required to test the dielectric properties of the transformer fluid. Eight transformer sites were investigated to evaluate the impact of PCB-containing dielectric fluid that may have been released to surface soil and concrete surfaces. Maximum concentrations of PCBs at two sites ranged from 0.91 mg/kg to 20.9 mg/kg (Earth Tech 2001b). Two transformer sites at Waikele Branch are recommended for further action: Transformer S-61 and S-127.

**Transformer S-61.** Transformer S-61 is a pad-mounted transformer located on a concrete slab in a fenced-in area adjacent to a generator northeast of Former Building 17. The site has three electrical transformers of unknown capacities and one electrical transformer with a capacity of 150 kilovolt-amps. Twelve soil samples were collected. The laboratory personnel were directed to composite the samples into six soil samples prior to analysis. A maximum surface soil sample concentration of 20.9 mg/kg was reported, which is above the screening level of 1 mg/kg.

**Transformer S-127.** Transformer S-127 is a pad-mounted transformer located on a concrete slab in a fenced-in area west of Building 125. There is one transformer at the site, with a capacity of 160 Kilovolt amps. Twelve soil samples were collected. The laboratory personnel were directed to composite the samples into six soil samples prior to analysis. A maximum surface soil sample concentration of 0.909 mg/kg was reported, which is just below the screening level of 1 mg/kg. A maximum concrete wipe sample concentration of 618 $\mu g/100cm^2$ was reported.

Although the soil sample concentrations did not exceed screening levels, the site was recommended for a RA because the concentrations are based on composite samples. Composite samples are a combination of two soil samples, so since the PCB average was 0.909 mg/kg it is possible that one of the two samples was above the screening level of 1 mg/kg. PCBs were detected in concrete wipe samples at levels that exceed the high-occupancy screening level of 10 $\mu g/100cm^2$.

#### 1.1.4.4 IROQUOIS POINT

PCB-containing fluids may have been released to concrete surfaces or surface soil by leaking directly from the transformers, or during regular transformer testing and maintenance. Periodic sampling was required to test the dielectric properties of the transformer fluid. Twenty-nine transformer sites at Iroquois Point were investigated to evaluate the impact of PCB-containing dielectric fluid that may have been released to surface soil and concrete surfaces. PCB concentrations exceeding the initial screening level of 1 mg/kg in soil were found at only one transformer location, Transformer I-4. Four surface soil samples and two duplicate-samples were collected adjacent to the concrete pad of Transformer I-4. The maximum concentration of PCBs detected was 53 mg/kg (Earth Tech 2001d). It was also recommended that the concrete pad at this location be removed to facilitate the removal of PCB-contaminated soil, although results of concrete wipe samples did not exceed the screening level criteria for concrete (10 $\mu g/100cm^2$).

#### 1.1.4.5 NRTF LUALUALEI

Maintenance activities prior to 1977 resulted in the release of PCBs into the environment. PCB-containing fluids may have been released to concrete surfaces or surface soil by leaking directly from the transformers, or during regular transformer testing and maintenance. A transformer with PCB-containing dielectric fluid was mounted on a concrete pad on the northeastern end of Building 81. PCB-containing dielectric fluid was reportedly discarded on the soil near the transformer during routine maintenance. The PCB-containing transformer was removed and replaced with a non-PCB-containing transformer (Earth Tech 2001c). In addition to PCBs, TPH-d, TPH-o, and PAHs, specifically benzo(a)pyrene, were identified as contaminants due to the presence of underground storage tanks, aboveground storage tanks and generators at the site.

Building 81 is recommended for a RA because PCBs and benzo(a)pyrene were detected at levels exceeding the Toxic Substance Control Act (TSCA) high-occupancy screening level of 1 mg/kg and the EPA industrial preliminary remediation goal (PRG) of 0.29 mg/kg, respectively. A maximum surface soil PCB concentration of 377 mg/kg and a maximum surface soil benzo(a)pyrene concentration of 0.61 mg/kg were detected at this site.

#### *1.1.4.6 Former NAS Barbers Point*

The former Drum Crushing Area is located immediately west of the sanitary landfill pit at former NAS Barbers Point. The sanitary landfill pit occupies approximately 33 acres west of the main airstrip near the western base boundary. The former Drum Crushing Area was reportedly used for pesticide rinsing operations described in the Naval Engineering and Environmental Support Activity (NEESA), Initial Assessment Study (IAS) (NEESA 1983). There is no information available regarding the specific activities conducted, the number of drums crushed, quantities of waste material generated, or the years of operation. A wood and metal platform on a scaffolding approximately 10 feet high, several shelves containing miscellaneous solid wastes, and a transformer remain at the site.

Contaminants of concern at the former Drum Crushing Area include 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, gamma-chlordane, heptachlor epoxide, and arsenic.

### 1.1.5 Physical Setting

#### *1.1.5.1 Geology*

Basaltic shield volcanoes rising from the floor of the Pacific Ocean form the island of Oahu, which is characterized by four major geomorphic provinces, including the Koolau Range, Waianae Range, Schofield Plateau, and coastal plain (Stearns 1985). The Koolau and Waianae Ranges are the eroded remnants of the large, elongated shield volcanoes that have lost most of the original shield outlines and are now long narrow ridges shaped largely by erosion.

##### 1.1.5.1.1 Ford Island PHNC

Ford Island lies within the Pearl Harbor basin and is flanked on the east by the Aliamanu, Salt Lake, and Makalapa vents of the Honolulu series Salt Lake volcanics. These vents on the western flank of the Koolau shield are approximately 1.5 miles from Ford Island (Wentworth 1951). Pearl Harbor is located where the Koolau shield abuts the Waianae shield. The Pearl Harbor basin is a drowned river system with its several tributaries forming today's Pearl Harbor lochs (Stearns 1985). Pearl Harbor is the result of several geologic processes, including sea level fluctuations (transgressive and regressive shorelines), stream erosion, alluvial deposits, and volcanism. The Halawa, Moanalua, Waikele, and Wahiawa Streams cut deep canyons in the hard basalt of the Koolau Range before flowing into Pearl Harbor. These tributaries, as well as the rising and falling sea levels, deposited alternating beds of limestone, tuff, alluvium, and marine clays (Stearns 1985).

Surface soil types on Ford Island are generally classified as silty sands or sandy silts with varying amounts of gravel, owing to the high degree of development and the associated usage of fill material throughout the island. Ford Island itself is classified as coral outcrop United States Department of Agriculture, Soil Conservation Service ([USDA SCS] 1972), which consists of coral or cemented calcareous sand. The rising and falling sea levels, punctuated by stream erosion and artificial filling, deposited a variety of material in the Pearl Harbor area. These deposits consist of coralline material, alluvial deposits, lagoonal deposits, volcanic material, and fill and may be intermixed in places (Munro 1981). The coralline debris deposits include gravelly clays; recemented limestone; mixtures of gravel with silt and clay; coral, sand, and clay lenses, and reef-related components. The consolidated lagoonal sediments primarily consist of soft silts and lean clays. The weathered volcanics consist of weathered tuff and primarily include brown to dark gray-brown stiff clays and silts. The fill material consists of mixtures of gravels, sands, silts, and clays, and is thickest around areas of construction or where the shoreline has been reclaimed.

#### 1.1.5.1.2 PHNC

Pearl Harbor has a complicated geologic history, but essentially consists of drowned river valley sediments interbedded with coral and pyroclastic material. The formation of three Pearl Harbor lochs is related to the repeated downcutting of a coalescing network of stream valleys into coral reef plateaus and volcanic strata. As sea levels fluctuated and rebounded to their present-day level, the stream valley was submerged forming the present Pearl Harbor. This thick sequence of Tertiary and Pleistocene strata (approximately 1,000 feet) is underlain by the basal Koolau Volcanic Series.

Pearl Harbor soils consist of poorly drained soils on nearly level coastal plains. These soils developed in alluvium overlying organic material. Pearl Harbor soils are geographically associated with Hanalei, Kaloko, and Keaau soils. Hanalei soils consist of poorly drained soils on bottom lands developed in alluvium derived from basic igneous rock. Kaloko soils are poorly drained soils developed in alluvium derived from basic igneous rock; the alluvium has been deposited over marshy lagoon deposits. Keaau soils are poorly drained soils that were developed in alluvium deposited over reef limestone or consolidated coral sand. In addition, some of the land making up Pearl Harbor is fill land. Fill land consists of areas filled with material dredged from the ocean or hauled from nearby areas, garbage, and general material from other sources. Fill land is dominantly composed of packed, but unconsolidated, angular gravel and sand intermixed with varying proportions of silt and clay.

#### 1.1.5.1.3 Waikele Branch

Waikele Branch lies within the Schofield Plateau, and was formed by deposits of ash, lava, and slide debris from the flank of the Waianae Volcano. Waikele and Kipapa streams cut deeply into the south end of the Schofield Plateau in the facility area, exposing geologic units of unconsolidated deposits, consolidated deposits (both noncalcareous), and Koolau volcanic rock. The plateau structure is Koolau basalt overlain by deep red, silty clay soil. Streambeds are covered by coarse, subangular, permeable, and slightly weathered alluvium that is older than the upper level topsoil. An abandoned borehole located 600 feet south of the confluence of the Waikele and Kipapa streams penetrated 130 feet of unconsolidated and consolidated deposits overlying the basalt. Facility soils are either alluvial deposits or have been formed in place by basalt rock weathering.

Major soil types are Haleiwa Silty Clay and Rock Land (Foote et al. 1972). Haleiwa Silty Clay is classified as well-drained, dark-brown soil on nearly level alluvial fans and in drainage ways. It occurs in the stream valleys of the Waikele Branch facility. Few gravel and sand lenses occur in the subsoil; the depth to the bedrock is more than 5 feet; and permeability is moderate. Rock Land consists of areas with 25 to 90 percent exposed rock; it occurs in the gulch walls of the Waikele Branch facility. Among the rocks are soils only a few inches deep (DON 1989).

#### 1.1.5.1.4 Iroquois Point

Most of the Pearl Harbor land area lies within the southern coastal plain of Oahu. It was formed through a history of rising and falling sea levels, erosion and deposition of alluvial material, and deposition of pyroclastic ash. Regionally, the coastal deposits, or caprock, consist of coralline limestone, alluvium, colluvium, and mud flow and lagoon deposits. Locally, well-cemented sandstone or conglomerate may be found incorporating sand- and gravel-sized fragments of volcanic rock within a matrix of calcareous beach sand called “beach rock.” This caprock extends from the surface or near-surface to a depth of 300 feet or more. The western side of the harbor, which includes the Iroquois Point and Puuloa Housing Areas, comprises limestone reef material known as the Ewa Plain. Volcanic basalt and younger volcanic tuffs form most of the rock material underlying the area.

Soils in the area consist primarily of the Mamala stony silty clay loam and coral outcrops. The Mamala stony silty clay loam is a shallow, well-drained soil formed from alluvium on coral limestone. Stones (volcanic) and coral fragments are common in the surface layer and the profile. These soils are moderately permeable, and runoff is slow to medium. The coral outcrop consists of coral and calcareous sand exposed along the coastal plains. Coral outcrop occupies 80 to 90 percent of the area, while the remaining 10 to 20 percent consists of a thin friable soil in cracks and depressions within the coral outcrop. On the basis of lithologic information from shallow soil borings augered during the site investigation (SI), the soils present in the Iroquois Point and Puuloa Housing Areas generally range in thickness from 3 to 8 inches.

#### 1.1.5.1.5 NRTF Lualualei

The stratigraphy of Lualualei Valley consists of a thick sequence of calcareous and noncalcareous sedimentary rocks overlying basalts of the Waianae Volcanic series. The sedimentary sequence is thickest near the center of the valley; the youngest strata are unconsolidated, noncalcareous alluvial deposits derived from weathered volcanics or Pleistocene alluvium. The underlying calcareous sedimentary strata include coralline limestones and detrital limestones composed of broken shell fragments and beach sands. The basal Waianae Volcanic series, which include lower, middle, and upper basalt members with a total thickness of more than 6,000 feet, are exposed northwest and southeast of the facility. NRTF Lualualei is generally level; elevations range between 10 and 100 feet above mean sea level (MSL) (Earth Tech 1998b).

Soils in the Lualualei area are included in the Lualualei-Fill/Land-Ewa Soil Association, an assemblage of well-drained, fine-textured soils that occur in drainages and on alluvial fans in nearly level to moderately sloping layers. Surficial soils at the three transformer locations consist of 20 to 50 inches of silty clay loam, which is representative of the soils surrounding Building 81. These surface soils overlie coralline limestone (Earth Tech 1998b).

#### 1.1.5.1.6 Former NAS Barbers Point

The geologic units beneath former NAS Barbers Point consist of recent-age unconsolidated sediments, Pleistocene-aged limestone, locally known as "caprock," and Tertiary-to-early-Pleistocene volcanic rock. Only the Pleistocene caprock, ranging up to 1,000 feet thick at former NAS Barbers Point, is relevant to cleanup activities at the former Drum Crushing Area. The upper 100 feet of caprock comprises marine sediment, mainly coralline reef limestone with minor layers of shell fragment limestone and beach sands.

Former NAS Barbers Point has little to no significant soil cover. The limestone is typically hard to very hard and highly competent in the upper vadose zone. Hardness and competency generally decrease with depth. In the capillary fringe, the limestone is moderately to highly friable. This decrease in strength is most likely a result of solution features. In some borings, sands and sandy gravels were encountered at depths corresponding to the most prevalent development of solution features. These materials likely represent unconsolidated fill material within karst dissolution voids (Ogden 1999).

### *1.1.5.2 Hydrogeology*

Oahu has a deep basal groundwater body floating on, displacing, and existing in dynamic equilibrium with salt water saturating the highly permeable basalt of the island base. The basal groundwater originates primarily as rainwater percolating into the island from higher elevations and migrating seaward through the basalt until it meets the relatively impermeable caprock that overlaps the seaward margins of the basal rock (RCO 1997).

#### 1.1.5.2.1 Ford Island PHNC

Ford Island is located in the Honolulu–Pearl Harbor basal groundwater aquifer area. The shallow groundwater beneath Ford Island is considered nonpotable and not hydraulically connected to the basal aquifer of Oahu. The source of shallow Ford Island groundwater is believed to originate from infiltration of precipitation combined with intrusion of seawater. As a result, the shallow groundwater is generally brackish and is therefore, not regarded as a potential drinking water source.

There are two types of groundwater in the Pearl Harbor area: a shallow, predominantly caprock system overlying a deep basal aquifer.

The caprock aquifer occurs from the water table to the first underlying aquitard and is approximately 16 feet thick. It is considered an unconfined aquifer since no overlying, laterally extensive confining unit has been identified. It may, however, be semiconfined in places because of the occurrence of clay and silt layers that are of limited lateral extent. The caprock aquifer lies within the weathered volcanic material, lagoonal deposits, and coralline debris. This aquifer is brackish (i.e., with a chloride content of 250–1,000 mg/L) and is considered to be ecologically important, not suitable for drinking, is irreplaceable, and highly vulnerable to contamination (Earth Tech 1998a).

The deep, underlying aquifer is characterized as a confined basal aquifer contained in basalt baserock. The basal aquifer characteristics are the same as the overlying groundwater, except that it is moderately vulnerable to contamination.

#### 1.1.5.2.2 PHNC

The Honolulu-Pearl Harbor Basal Water Body is the regional aquifer of the Peal Harbor area. This aquifer is composed of thinly bedded, overlapping Koolau lava flows with high horizontal permeability. Overlying the permeable lava flows is a sequence of interbedded sedimentary and volcanic units called the caprock. Caprock water is largely separate the deeper basal groundwater, occurring above and frequently within caprock sediments and extending from the ocean edge to about a mile inland. This type of groundwater is usually interconnected with the ocean and as a result is commonly brackish to salty.

The anticipated depth to groundwater ranges from 5 to 14 feet bgs. Groundwater levels are significantly affected by the tides, with fluctuations of 1 to 2 feet per tidal pulse.

#### 1.1.5.2.3 Waikele Branch

The Waikele Branch environmental baseline survey (EBS) reported, based on limited data for the Waikele region, that the underlying Koolau volcanics generally bear water with a head of 20 to 29 feet above MSL. Foundation borings from other studies indicate water levels approximating stream elevation (about 75 to 80 feet above MSL). Surface water may migrate through basalt outcrops and into the groundwater. Flow direction is uncertain but is likely to the south. Groundwater resources beneath the facility are categorized as belonging to the Waipahu Aquifer System of the Pearl Harbor Aquifer Sector (Mink and Lau 1990). One basal aquifer (fresh water in contact with seawater) is present beneath the facility. The aquifer is classified as unconfined (where the water table is the upper surface of the saturated aquifer) and occurs in flank deposits (horizontally extensive lavas). The aquifer is listed as a currently used source of drinking water, having fresh salinity (<250 mg/L chloride), and being irreplaceable and highly vulnerable to contamination (Mink and Lau 1990). This aquifer is not used to irrigate agricultural products downgradient of the site.

The facility is located above the Underground Injection Control (UIC) line (State of Hawaii Department of Health [DOH] 1983).

#### 1.1.5.2.4 Iroquois Point

The Iroquois Point and Puuloa Housing Areas overlie the Waipahu System of the Pearl Harbor Aquifer Sector. In this area, a caprock confines the basal aquifer under artesian conditions. The groundwater has an artesian head of 15 to 20 feet. The potentiometric surface of groundwater in the basal aquifer ranges in depth from 50 to 750 feet below bgs (Earth Tech 1997).

Groundwater is also found in the overlying caprock at shallower depths. This unconfined groundwater has an elevation of about sea level and is recharged by leakage from the underlying Koolau volcanics and percolating surface water. This shallow groundwater discharges into Pearl Harbor. During the SI, soil borings encountered groundwater consistently at a depth of approximately 3.5 feet.

The Iroquois Point and Puuloa Housing Areas lie in the region defined by the State of Hawaii UIC Program as not having groundwater considered to be a potential source of drinking water.

#### 1.1.5.2.5 NRTF Lualualei

Groundwater at NRTF Lualualei exists within a shallow unconfined aquifer. Depth to groundwater at Building 81 is projected to be approximately 60 feet bgs (OHM 1997), with a gradient of approximately 1 foot per mile southwest. Approximately 100 private water wells located near the facility, the majority used for irrigation purposes, have been abandoned. The closest well is approximately 1 mile south of NRTF Lualualei. The closest public water supply wells are approximately 3 miles north of the site, at elevations greater than 400 feet above MSL (HLA 1989).

#### 1.1.5.2.6 Former NAS Barbers Point

The shallow groundwater beneath former NAS Barbers Point is perched and occurs within the caprock. The caprock consists of alternating layers of permeable marine sedimentary rock and alluvial deposits that overlie the basal volcanic aquifer. Caprock water is largely separate from the deeper basal groundwater, occurring above and frequently within caprock sediments and extending from the ocean edge to approximately 1 mile inland (Wentworth 1951). This type of groundwater is usually interconnected with the ocean and therefore has high concentrations of total dissolved solids. Depth to groundwater within the limestone aquifer ranges from about 52 feet bgs along the northern base boundary to 0 feet bgs (sea level) at the coast.

### 1.1.6 Summary of Previous Investigations

This section discusses previous investigations conducted at each of the six installations associated with the Group B sites.

#### *1.1.6.1 Ford Island PHNC*

The following investigations have been conducted at Ford Island PHNC:

- **IAS of Pearl Harbor, 1983.** An IAS was conducted in 1983 at 30 potentially contaminated sites at PHNC. The assessment of sites was based on past hazardous waste storage operations and disposal practices. The study concluded that three sites warrant further investigation to assess potential long-term impacts to human health or the environment. Sampling was not included in the IAS (NEESA 1983).
- **Remedial Investigation (RI), 2000.** A RI was conducted between December 1999 and June 2000 to evaluate the impact of PCB-containing dielectric fluid that may have been released to surface soil and concrete surfaces. The objectives of this investigation were to characterize the nature and extent of PCB contamination in surface soil and on concrete surfaces within unrestricted areas surrounding 55 transformer sites, asses the potential risks to human and ecological receptors associated with contamination, and recommend further action as necessary to protect human health and the environment and achieve site closure requirements

for Ford Island (Earth Tech 2001a). The Group B sites at Ford Island PHNC were identified during this investigation.

- **AM Addendum, 2001.** An AM addendum was prepared in 2001 documenting the recommendation for a RA of PCB-contaminated soil and concrete at Group B sites. The addendum referenced two previous AMs: 1) Polychlorinated Biphenyl Removal Action at Various Transformer Sites Within the Naval Computer and Telecommunications Area Master station, Pacific (NCTAMS PAC), Hawaii, August 18, 1999 (DON 1999); 2) Treatment of Contaminated Soil, NCTAMS PAC; former Naval Air Station (NAS) Barbers Point; and Pearl Harbor Naval Complex (PHNC), October 3, 2000 (DON 2000). The referenced action memoranda documented the Navy's decision to excavate (DON 1999) and treat (DON 2000) contaminated soils and concrete from PCB transformer sites. The AM for treatment of contaminated soils presents information regarding treatment and final disposal of the treated media in a coral pit near the treatment area at former NAS Barbers Point, Oahu, Hawaii (DON 2001).

PHNC, including Ford Island, was placed on the National Priorities List (NPL) on October 14, 1992, with a Hazard Ranking Score of 70.82. No Group B transformer locations were included in the scoring.

#### *1.1.6.2 PHNC*

The following investigations have been conducted at PHNC:

- **Initial Investigations conducted by PACNAVFACENGCOM, 1990 and 1991**. An Initial Investigation was conducted by PACNAVFACENGCOM in 1990 and 1991. Seven of nine transformer sites were included in an SI of 20 transformer stations conducted under contract to PACNAVFACENGCOM. The other two sites were investigated by the PWC Environmental/Industrial Laboratory and its contract laboratory Anacon (ERCE 1991).
- **SI, 1990 and 1991**. A SI was conducted in 1990 and 1991 at seven potentially contaminated sites (ERCE 1991). Both soil and wipe samples were collected and analyzed for total PCBs by Aroclor. The overall objective of the SI was to assess each site for the presence of PCB contamination and make a preliminary determination on whether the detected PCBs were present at levels that would pose a potential threat to human health or the environment. The SI was not intended to characterize either the lateral or vertical extent of PCB contamination. The results of the analyses indicated that Aroclor 1260 was the only PCB detected in any of the soil or wipe samples.
- **Removal Site Evaluation (RSE) in November and December of 1995.** An RSE at each of the nine sites was performed between November and December of 1995 in accordance with the Site Evaluation Field Sampling Plan. Sampling activities conducted during the RSE involved the collection of surface soil, sediment, subsurface soil samples, and wipe samples. The RSE was performed to obtain data of sufficient quality and quantity to characterize PCB contamination at each site, assess the potential risk posed by the PCB contamination, and obtain site-specific information to aid in the design and evaluation of remedial alternatives. In general, the analytical results of the RSEs indicated that contamination of building surfaces, surface soil, and shallow subsurface soil exists at each of the sites. The RSE results are presented in the PHNC EE/CA (Ogden 1996).
- **AM, 2000.** An AM was prepared in 2000 to request and document approval of a non-time critical RA at nine transformer sites at PHNC (Earth Tech 2000c). The RA recommended excavation of the surface and shallow subsurface soil and cleanup outside concrete contaminated at nine PHNC transformer sites. The RA will be the final action at the nine transformer sites.

- **AM Addendum, 2001.** An AM addendum was prepared in 2001 documenting the recommendation for a RA of PCB-contaminated soil and concrete at Group B sites. The addendum referenced two previous AMs: 1) Polychlorinated Biphenyl Removal Action at Various Transformer Sites Within the Naval Computer and Telecommunications Area Master station, Pacific (NCTAMS PAC), Hawaii, August 18, 1999 (DON 1999); 2) Treatment of Contaminated Soil, NCTAMS PAC; former Naval Air Station (NAS) Barbers Point; and Pearl Harbor Naval Complex (PHNC), October 3, 2000 (DON 2000). The referenced action memoranda documented the Navy's decision to excavate (DON 1999) and treat (DON 2000) contaminated soils and concrete from PCB transformer sites. The AM for treatment of contaminated soils presents information regarding treatment and final disposal of the treated media in a coral pit near the treatment area at former NAS Barbers Point, Oahu, Hawaii (DON 2001).

Pearl Harbor Naval Complex, was placed on the NPL on October 14, 1992, with a Hazard Ranking Score of 70.82. No transformer locations in Group B were included in the scoring.

#### 1.1.6.3 WAIKELE BRANCH

The following investigations have been conducted at Waikele Branch:

- **IAS of Pearl Harbor, 1983.** An IAS was conducted in 1983 at 30 potentially contaminated sites at PHNC, including Waikele Branch. The assessment of sites was based on past hazardous waste storage operations and disposal practices. The study concluded that three sites warrant further investigation to assess potential long-term impacts to human health or the environment. Sampling was not included in the IAS (NEESA 1983).
- **Final EBS, 1999.** Waikele Branch was included in an EBS consisting of (1) a review of literature and public/Navy records to document incidents or facility operations that may have affected the environmental condition of the facility, (2) interviews with military and civilian personnel who might have knowledge of current of past facility operations that may have affected the environmental condition of the facility, (3) environmental survey/site reconnaissance of the areas within facility boundaries, (4) drilling and sampling, and (5) laboratory analysis of soil and wipe samples (Masa Fujioka 1999).
- **Site Investigation Report, 2001.** A site investigation conducted between April and June 2000 characterized environmental conditions and defined the nature of contamination by analyzing geological, chemical, and physical data from the areas that were identified in the final EBS as warranting further assessment. The sites investigated include the transformer sites (Earth Tech 2001b).
- **AM Addendum, 2001.** An AM addendum was prepared in 2001 documenting the recommendation for a RA of PCB-contaminated soil and concrete at Group B sites. The addendum referenced two previous AMs: 1) Polychlorinated Biphenyl Removal Action at Various Transformer Sites Within the Naval Computer and Telecommunications Area Master station, Pacific (NCTAMS PAC), Hawaii, August 18, 1999 (DON 1999); 2) Treatment of Contaminated Soil, NCTAMS PAC; former Naval Air Station (NAS) Barbers Point; and Pearl Harbor Naval Complex (PHNC), October 3, 2000 (DON 2000). The referenced action memoranda documented the Navy's decision to excavate (DON 1999) and treat (DON 2000) contaminated soils and concrete from PCB transformer sites. The AM for treatment of contaminated soils presents information regarding treatment and final disposal of the treated media in a coral pit near the treatment area at former NAS Barbers Point, Oahu, Hawaii (DON 2001).

Waikele Branch has not been placed on the NPL.

#### 1.1.6.4 IROQUOIS POINT

The following investigations have been conducted at Iroquois Point:

- **IAS of Pearl Harbor, 1983.** An IAS was conducted in 1983 at 30 potentially contaminated sites at PHNC, including Iroquois Point. The assessment of sites was based on past hazardous waste storage operations and disposal practices. The study concluded that three sites warranted further investigation to assess potential long-term impacts to human health or the environment. Sampling was not included in the IAS (NEESA 1983).
- **EBS, 2000.** An EBS was conducted in 2000 that documented the environmental condition of real property of the Iroquois Point and Puuloa Housing Areas (Earth Tech 2000a). The EBS consisted of a records search, interviews, and visual site inspections to identify potential contaminant release sites. The results of the EBS indicated that 31 electrical transformer sites required additional evaluation (Masa Fujioka 1999).
- **Draft SI, 2001.** The draft SI for Iroquois Point and Puuloa Housing Areas, conducted in November and December 2000, characterized the environmental conditions and defined the nature of contamination by analyzing geological, chemical, and physical data in those areas identified in the EBS as warranting further investigation. It was determined that of the 34 sites investigated, the only site requiring a further response action was Transformer I-4. This finding was based on estimated risks to human health from exposure to PCBs in the soil (Earth Tech 2001d).
- **AM Addendum, 2001.** An AM addendum was prepared in 2001 documenting the recommendation for a RA of PCB-contaminated soil and concrete at Group B sites. The addendum referenced two previous AMs: 1) Polychlorinated Biphenyl Removal Action at Various Transformer Sites Within the Naval Computer and Telecommunications Area Master station, Pacific (NCTAMS PAC), Hawaii, August 18, 1999 (DON 1999); 2) Treatment of Contaminated Soil, NCTAMS PAC; former Naval Air Station (NAS) Barbers Point; and Pearl Harbor Naval Complex (PHNC), October 3, 2000 (DON 2000). The referenced action memoranda documented the Navy's decision to excavate (DON 1999) and treat (DON 2000) contaminated soils and concrete from PCB transformer sites. The AM for treatment of contaminated soils presents information regarding treatment and final disposal of the treated media in a coral pit near the treatment area at former NAS Barbers Point, Oahu, Hawaii (DON 2001).

PHNC, including the Iroquois Point and Puuloa Housing Areas, was placed on the NPL on October 14, 1992, with a Hazard Ranking Score of 70,82. Group B sites were not included in the scoring.

#### 1.1.6.5 NRTF LUALUALEI

The following investigations were conducted at NRTF Lualualei:

- **UST Record of Closure, 1997.** During the 1997 UST upgrade procedure prepared by OHM Remediation Services (OHM 1997), PCB concentrations up to 110 mg/kg (OHM 1997) were detected in 700 cubic yards of overburden soil generated during the removal of the three 25,000-gallon USTs. Although no evidence of spills or leaks had been observed, the proximity of the former day tank to the contaminated UST area, as well as the former accessibility for facility personnel to dispose of other types of waste oil into the day tank, suggest that contamination at the site may extend to the day tank area. During the UST upgrade procedure, the trenches for the pipelines leading to the day tank were sampled. The samples were analyzed, and the results indicated elevated concentrations of TPH-d, TPH-o, and PAHs. The 700 cubic yards of contaminated overburden soil were transferred to a plastic-lined stockpile northwest of the former UST location.

- **RSE Work Plan, 1999**. A RSE work plan (Earth Tech 1999) was developed in May 1999 to delineate the nature and extent of PCB-contaminated soil and petroleum products. This document provides detailed background information for Building 81, summarizes field tasks proposed to implement the RSE, provides the technical approach to characterization sampling, and explains the approach for evaluating the potential risk at the site by comparing the analytical results to screening criteria.
- **RSE, 2001.** A RSE was conducted at Building 81 in January through October 2000. The purpose of the RSE for Building 81 were to (1) delineate the nature and extent of soil contamination based on previously established screening criteria; (2) present a risk evaluation based on site contaminants; and (3) propose a response action based on appropriate cleanup criteria (Earth Tech 2001c). The RSE determined that the presence of PCBs and benzo(a)pyrene in the surface soil posed a risk to human health and had the potential to migrate under various weather conditions. PCBs were detected at a maximum concentration of 377 mg/kg (Earth Tech and Tetra Tech, 2000). A RA was recommended to remove PCB- and benzo(a)pyrene-contaminated soil from Building 81.
- **AM Addendum, 2001.** An AM addendum was prepared in 2001 documenting the recommendation for a RA of PCB-contaminated soil and concrete at Group B sites. The addendum referenced two previous AMs: 1) Polychlorinated Biphenyl Removal Action at Various Transformer Sites Within the Naval Computer and Telecommunications Area Master station, Pacific (NCTAMS PAC), Hawaii, August 18, 1999 (DON 1999); 2) Treatment of Contaminated Soil, NCTAMS PAC; former Naval Air Station (NAS) Barbers Point; and Pearl Harbor Naval Complex (PHNC), October 3, 2000 (DON 2000). The referenced action memoranda documented the Navy's decision to excavate (DON 1999) and treat (DON 2000) contaminated soils and concrete from PCB transformer sites. The AM for treatment of contaminated soils presents information regarding treatment and final disposal of the treated media in a coral pit near the treatment area at former NAS Barbers Point, Oahu, Hawaii (DON 2001).

NRTF Lualualei was placed on the NPL on May 31, 1994, with a Hazard Ranking Score of 50. No transformer locations were included in the scoring.

#### *1.1.6.6 Former NAS Barbers Point*

The following investigations were conducted at former NAS Barbers Point related to the former Drum Crushing Area:

- **NEESA IAS, 1983.** The intent of the IAS was to identify potential threats to human health or the environment posed by past storage, handling, or disposal of hazardous substances. The findings of the IAS included identification of the following nine areas of potential concern at former NAS Barbers Point: Coral Sea Road Coral Pit; Ordy Pond; Sanitary Landfill (including the former Drum Crushing Area); Plating Facility (Building 117); Abandoned Underground Storage Tank; Coral Pit 1; Coral Pit 2; Coral Pit 3; and Dry Wells (NEESA 1983).
- **EBS.** A basewide EBS was conducted in 1994 to develop environmental documentation to assist in planning and executing the closure of former NAS Barbers Point. The EBS identified 47 potentially contaminated points of interest and also investigated three sites previously identified under the Installation Restoration Program (IRP). The former Drum Crushing Area is located within IRP 03 (Earth Tech 1998).
- **RI for Base Realignment and Closure (BRAC) Activities, Sanitary Landfill, NAS Barbers Point.** A RI was conducted at the Sanitary Landfill from October 1994 through January 1995 to assess whether environmental contamination is present within soils and

groundwater at levels that pose a risk to human health and/or the environment. The RI was submitted in December 1999. The purpose of the report was to provide analytical information to aid in decision-making related to environmental status and potential reuse of the property. The RI concluded that should future development or construction activities occur, leading to an increase in site use, it would be necessary to further delineate the extent of pesticide contamination at the former Drum Crushing Area, through a follow-up RI or a RA. Metals and organochlorine pesticides were detected in surface soil samples; therefore, the RI recommended that additional analytical information be collected, to establish an appropriate cleanup goal to protect ecological receptors (DON 2000).

- **AM, 2001.** The AM documented the recommendation and approval of the excavation, treatment, and disposal of contaminated soil from the former Drum Crushing Area. The action is recommended as a time-critical RA because of the imminent threat to human health. Soils in the former Drum Crushing Area contain 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, gamma-chlordane, heptachlor epoxide, and arsenic concentrations greater than the regulatory criteria.

### 1.1.7 Principal Decision Makers

Principal decision makers include the Navy, regulatory agencies, and the public. Data collected during the pre-excavation sampling will be used to determine the lateral and vertical extent of soil to be excavated. Data collected during confirmation sampling will be used to assess the completion of the RA.

### 1.1.8 Technical or Regulatory Standards

Specific regulatory screening levels or cleanup criteria have been established to screen analytical results from the Group B sites. Appendix B presents screening criteria for all contaminants. For planning purposes, the following regulatory criteria will be used at the sites:

<u>Suspected PCB Transformer Release Areas at Ford Island, PHNC, Waikele Branch, and Iroquois Point</u>

- TSCA high-occupancy screening levels

<u>NRTF Lualualei, Building 81</u>

- EPA Region IX PRGs for industrial and residential soils (EPA 2000d)
- State of Hawaii Department of Health (DOH) Tier 1 soil action levels (SALs) (DOH 1995)

<u>Former NAS Barbers Point, former Drum Crushing Area</u>

- EPA Region IX PRGs for industrial and residential soils (EPA 2000d)

EPA Region IX industrial and residential soil PRGs are listed in Appendix B for comparison to project reporting limits required for the field investigation.

## 1.2 PROJECT DESCRIPTION

The following sections discuss the objectives and measurements of the project. Table 1-4 presents a schedule for pre-excavation delineation sampling, excavation, confirmation sampling, and associated reporting at Group B sites.

**Table 1-4: Schedule for Group B Sampling and Reporting**

| Task | Start Date | End Date | Duration[a] |
|---|---|---|---|
| Prepare and submit draft SAP | November 1, 2001 | December 14, 2001 | 44 |
| Review of draft SAP | December 17, 2001 | December 31, 2001 | 14 |
| Prepare and submit final SAP | January 2, 2001 | January 22, 2002 | 21 |
| Conduct pre-excavation delineation sampling | December 17, 2001 | January 29, 2002 | 43 |
| Prepare and submit delineation sampling results[b] | February 5, 2002 | March 6, 2002 | 30 |
| Conduct confirmation sampling | TBS | TBS | TBS |
| Prepare and submit confirmation sampling report | TBS | TBS | TBS |

*Notes:*
[a] = Duration in calendar days
[b] = Results of pre-excavation delineation sampling will be included in a design package amendment
TBS = To be scheduled following selection of a fixed-price remedial action contractor

### 1.2.1 Project Objectives

The field effort described in this SAP has two objectives:

(1) Conduct pre-excavation sampling to define the vertical and lateral extent of contamination at Group B sites

(2) Conduct confirmation sampling following RA activities at Group B sites

Field activities will be conducted in accordance with standard operating procedures (SOPs) established for PACNAVFACENGCOM environmental investigations. References to specific SOPs contained in the *Project Procedures Manual, U.S. Navy PACDIV IRP* (DON 1998) are made in the following sections of the SAP.

#### *1.2.1.1 Pre-excavation Delineation Sampling*

Group B sites will be sampled to further delineate the lateral and vertical extent of contamination. Initial soil samples will be collected using a direct push rig at 2 feet, 4 feet, and 6 feet bgs at the same locations where contamination was previously encountered to define the vertical extent of contamination. The decision as to which of the collected samples will be analyzed by the laboratory will be based on review of the results of the initial sampling. Proposed sampling locations will be cleared by an underground utility clearance subcontractor.

Additional soil samples will then be collected using a direct push rig in a “step-out” fashion to delineate the lateral and vertical extent of contamination. Samples will be collected at 5- to 10-foot lateral intervals from the initial contaminated area. Samples will be collected at the surface, 2 feet, 4 feet, and 6 feet bgs; the decision whether to analyze the samples collected will be based on review of the results of the initial sampling.

If necessary, additional 5- to 10-foot lateral interval locations will be selected following review of the previous sampling results. Vertical sampling will be conducted consistent with the approach presented above. Samples will be collected until results from each site indicate that contaminant levels are below the screening levels.

At site D-02, 15 additional soil borings are estimated to delineate the lateral and vertical extent of PCB contamination. Four borings will be advanced through the former concrete transformer pad at the site. The borings will be advanced to a total depth of 10 feet bgs, and soil samples will be collected from 2-feet, 4-feet, 6-feet, 8-feet, and 10-feet bgs. An additional 11 borings will be advanced throughout the remainder of the site to delineate the extent of contamination left in place following the previous RA completed at the site. Four of these locations will be advanced to a total depth of 6 feet and samples will be collected at 2-feet, 4-feet, and 6-feet bgs. Three of the locations will be advanced to a total depth of 7 feet bgs and samples will be collected at 3-feet, 5-feet, and 7-feet bgs. Two of the locations will be advanced to a total depth of 11 feet bgs and samples will be collected at 7-feet, 9-feet, and 11-feet bgs. One location will be advanced to a total depth of 9 feet bgs and samples will be collected at 5-feet, 7-feet, and 9-feet bgs; and the final location will be advanced to a total depth of 10 feet bgs and samples will be collected at 8-feet and 10-feet bgs. A total of 58 soil samples and duplicate samples is estimated as part of the sampling effort; however, actual samples analyzed by the laboratory will be based on review of the results of the initial sampling areas. For cost estimating purposes, it is assumed that 50 percent of the samples collected will be analyzed.

At site TC-01, five additional soil borings are estimated to delineate the lateral and vertical extent of PCB contamination. Four borings will be advanced through the former concrete transformer pad at the site. The borings will be advanced to a total depth of 10 feet bgs, and soil samples will be collected from 2-feet, 4-feet, 6-feet, 8-feet, and 10-feet bgs. An additional boring will be advanced in the remainder of the site to delineate the extent of contamination left in place following the previous RA completed at the site. The location will be advanced to a total depth of 10 feet bgs and samples will be collected at 6-feet, 8-feet, and 10-feet bgs. A total of 25 soil samples and duplicate samples is estimated as part of the sampling effort; however, actual samples analyzed by the laboratory will be based on review of the results of the initial sampling areas. It is assumed that 50 percent of the samples collected will be analyzed.

The following activities will also be conducted:

- A site-specific HSP (Earth Tech 2001e) will be prepared prior to initiation of field activities.
- Soil samples will be analyzed by an offsite, subcontracted chemical laboratory.
- A subcontractor will validate all routine site chemical data.
- An investigation-derived waste (IDW) disposal plan and an IDW disposal letter will be prepared.

Results of the pre-excavation delineation sampling will be included in an amendment to the design package for the excavation and remediation of Group B sites. The design amendment will include site maps, sample results, estimated excavation boundaries and soil quantities, a data validation summary, and any unusual field conditions encountered.

#### *1.2.1.2 Confirmation Sampling*

The extent of contamination at the Group B sites will have been defined during the pre-excavation delineation sampling; however, confirmation sampling and analysis must be conducted during the RA to ensure that the RA objectives are met and that the action will be a final action. The objectives of the confirmation sampling include: (1) verify that PCB concentrations in soil at the bottom and edges of each excavation are lower than cleanup criteria; and (2) verify that PCB concentrations in concrete are lower than cleanup criteria.

Cleanup criteria established for this project are discussed in Appendix B. The following activities will also be conducted:

- A site-specific health and safety plan will be prepared prior to initiation of field activities.
- Soil samples will be analyzed by an offsite, subcontracted chemical laboratory.

- A subcontractor will validate all routine site chemical data.

Results of the confirmation sampling will be included in a letter report for submittal to the contractor responsible for excavation and treatment. The letter report will include site maps, confirmation results, and a data validation summary report.

### 1.2.2 Project Measurements

Project measurements will primarily consist of laboratory analytical data for surface soil and subsurface soil samples collected from the five areas of concern at the site. Sections 1.2.2.1 through 1.2.2.5 describe the RA sampling program Table 1-5 lists the laboratory analytical methods that will be used to evaluate the RA samples.

**Table 1-5: Laboratory Methods**

| Parameter | Analysis Method No. | Analysis Methodology | Method Reference | Preparation Method No. | Preparation Method |
|---|---|---|---|---|---|
| **Metals (arsenic)** | | | | | |
| Soil | EPA 6010B/7471A | ICP/AA | EPA SW-846 2000c | EPA 3050B | Acid digestion |
| Water | EPA 6010B/7470A | ICP/AA | EPA SW-846 2000c | EPA 3020A | Acid digestion |
| **Organochlorine Pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane (a-,g-), heptachlor epoxide)** | | | | | |
| Soil | EPA 8081A | GC-ECD | EPA SW-846 2000c | EPA 3540C/ 3550B | Sonication extraction |
| Water | EPA 8081A | GC-ECD | EPA SW-846 2000c | EPA 3510C/ 3520C | Separatory-funnel/ Continuous extraction |
| **Polycyclic Aromatic Hydrocarbons (PAHs) (benzo(a)pyrene)** | | | | | |
| Soil | EPA 8270C-SIM | GC/MS-SIM | EPA SW-846 2000c | EPA 3550B | Sonication extraction |
| Water | EPA 8270C-SIM | GC/MS-SIM | EPA SW-846 2000c | EPA 3510C/3520C | Separatory-funnel/ Continuous extraction |
| **Polychlorinated Biphenyls as Aroclors (PCBs)** | | | | | |
| Soil | EPA 8082 | GC-ECD | EPA SW-846 2000c | EPA 3550B | Sonication extraction |
| Water | EPA 8082 | GC-ECD | EPA SW-846 2000c | EPA 3510C/3520C | Separatory-funnel/ Continuous extraction |
| **TPH-extractables as Diesel and Motor Oil (TPH-d and TPH-o)** | | | | | |
| Soil | EPA 8015B | GC/FID | EPA SW-846 2000c | EPA 3550B | Sonication extraction |
| Water | EPA 8015B | GC/FID | EPA SW-846 2000c | EPA 3510C/3520C | Separatory-funnel/ Continuous extraction |

*Notes:*
All analyses will be performed by NFESC-evaluated fixed-base analytical laboratory.
AA = atomic absorption (graphite furnace or mercury analyzer)
EPA = U.S. Environmental Protection Agency
GC-ECD = gas chromatography - electron capture detector
GC-FID = gas chromatography -flame ionization detector
GC/MS = gas chromatography/mass spectrometry
ICP = indirectly coupled argon plasma spectroscopy
NFESC = Naval Facilities Engineering Services Center
SIM = selective ion monitoring for the achievement of low-level reporting limits
SW = solid waste

## 1.3 QUALITY OBJECTIVES AND CRITERIA

The following sections present the DQOs and quality assurance and quality control (QA/QC) requirements identified for the pre-excavation and confirmation sampling activities.

### 1.3.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed through the EPA seven-step DQO process (EPA 2000a, 2000c). The DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. Table 1-6 presents the seven steps of the DQO process. The DQO process presents pre-excavation and confirmation sampling approaches. Pre-excavation delineation sampling will be conducted at Group B sites, with the exception of Building 81 at NRTF Lualualei, where pre-excavation delineation has been completed. Confirmation sampling will be conducted at Group B sites except at PHNC, where confirmation sampling is being conducted under a separate investigation.

**Table 1-6: Data Quality Objectives**

| |
|---|
| STEP 1: State the Problem |
| • **Pre-excavation sampling.** The Navy is proposing to excavate contaminated soil at Group B sites; however, excavation boundaries cannot be specified due to uncertainty regarding the lateral and vertical extent of soil contamination.<br>• **Confirmation sampling.** The concentration of residual contaminants in soil following excavation activities is unknown. |
| STEP 2: Identify the Decisions |
| • **Pre-excavation sampling.** Are the lateral and vertical limits of contamination in soil identified?<br>• **Confirmation sampling.** Do sample results indicate that unacceptable levels of contaminated soil have been removed from the excavation? |
| STEP 3: Identify Inputs to the Decisions |
| • **Pre-excavation sampling.** Analytical data from soil samples collected during previous sampling events, analytical data collected during this sampling event, screening levels, and QA/QC data.<br>• **Confirmation sampling.** Analytical results from pre-excavation sampling, field excavation summaries, field screening results, confirmation sampling results, screening levels, and QA/QC data. |
| STEP 4: Define Study Boundaries |
| • **Pre-excavation sampling.** Sampling will be limited to the Group B sites. Specific boundaries of the sites have not been identified; however, the boundaries are not anticipated to extend beyond 100 feet of the current site locations. Temporal boundaries are estimated at 35 working days for sampling, followed by additional time required for laboratory analysis, data validation, data quality assessment, and evaluation of sample results.<br>• **Confirmation sampling.** Confirmation samples will be collected from completed Group B excavation areas, as identified during the pre-excavation sampling and field screening results. Samples will be collected from between 0 and 6 inches within the floor and sidewalls of each excavation. The temporal boundary is based on the completion of excavation activities, followed by additional time required for laboratory analysis, data validation, data quality assessment, and evaluation of sample results. |
| STEP 5: Develop Decision Rules |
| • **Pre-excavation sampling.** If concentrations in a soil sample exceed the screening levels, then an additional sample will be collected from 2 feet below and 5 to 10 feet laterally from the original location. If concentrations in the samples do not exceed the screening level, then no further sampling will be conducted.<br>• **Confirmation sampling.** If concentrations in the confirmation sample exceed the cleanup level, then additional excavation will be conducted or additional sampling evaluated. If concentrations in the confirmation sample do not exceed the cleanup level, then no further sampling will be conducted. The temporal boundary for confirmation sampling should not exceed 6 months. |

**Table 1-6: Data Quality Objectives (Continued)**

STEP 6: Specify Tolerable Limits on Decision Errors

- **Pre-excavation sampling.** At least five soil samples will be collected at each Group B site using a systematic sampling design to provide sufficient data to evaluate the vertical and lateral extent of contamination. One sample will be collected from 2 feet below the previously identified contaminated area and four surface samples (0 to 0.5 feet bgs) will be collected from 5 to 10 feet laterally. Additional samples will be analyzed based on results of these initial samples. Vertical samples will be collected at 2-foot intervals until sample results are below the screening level, and horizontal samples will be collected at 5-foot intervals. The spacing was selected to provide reasonable coverage at each area, based on a review of existing data.
- **Confirmation sampling.** At least five confirmation samples will be collected at each Group B excavation area following notification that all field screening results are below the cleanup level. Confirmation samples will be collected using a systematic sampling design to provide sufficient data for ensuring residual soils do not contain contaminants at levels greater than the cleanup goal. A 10-foot grid will be placed over the completed excavation and a confirmation sample will be collected from the excavation floor of each grid. A confirmation sample will also be collected from each excavation sidewall. The grid was selected to provide reasonable coverage at each excavation and is consistent with other Navy PCB RAs.
- **Pre-excavation and confirmation sampling.** "One-sample" tests will be used to compare a site population with a fixed value. The most appropriate one-sample statistical test will be selected, based on data characteristics such as data distribution and detection rate. Use of a formal statistical test allows error rates to be controlled and confidence and power goals to be specified, as opposed to simple threshold (point-by-point) comparisons. Decision errors fall into two main categories, based upon the following hypotheses:
  - Null hypothesis (Ho): Concentrations meet or exceed the screening or cleanup level in the soil sample.
  - Alternative hypothesis (Ha): Concentrations do not exceed the screening or cleanup level at the soil sample location.
  - Type 1 Error: Reject Ho. Decide that the concentration in soil at a Group B site does not exceed the screening or cleanup level, when, in fact, it does. There is no consequence for this incorrect decision for pre-excavation sampling since confirmation samples will be collected at the area following soil excavation. The consequence of this incorrect decision for confirmation sampling is a potentially unacceptable risk to human receptors.
  - Type 2 Error: Reject Ha. Decide that the concentration in soil at a Group B site does exceed the screening or cleanup level, when it really does not. The consequence of this incorrect decision is the unnecessary expenditure of resources to further delineate or excavate an area that does not pose an unacceptable risk to receptors.
- Sampling error may occur when the samples are not representative of the true state of the environment at a site. This type of error is minimized by designing sampling locations on a regular grid or methodology that is applied systematically at each Group B site.
- Measurement error includes random and systematic errors associated with sample collection, handling, and preparation, in addition to analytical errors. Measurement error is minimized by following QA/QC procedures and protocol for sample collection, and by using an accredited laboratory for analysis of samples. The quality and reliability of the data are assessed by evaluating data quality indicators (DQIs), which are quantitative and qualitative measures of principal quality attributes (EPA 2001b).

STEP 7: Optimize the Sampling Design

- **Pre-excavation sampling.** Sampling locations are proposed in a systematic method designed to collect the minimal amount of samples while meeting the objective of vertical and lateral characterization. Vertical delineation will be completed by analyzing samples from beneath previously identified contamination only; if no contamination is identified, then no additional samples will be analyzed. A similar methodology will be used for lateral delineation in that samples will be collected at areas adjacent to known contamination only; no additional samples will be analyzed. If more than 3 rounds of lateral sampling are conducted, then the subsequent lateral samples will be collected at 10-foot increments until site contamination has been delineated.
- **Confirmation sampling.** Sampling locations are proposed in a systematic design based on at least 1 confirmation sample for every 100 square feet of excavation floor space. The general area covered by the sampling grid will be determined by the results of the predelineation sampling determined by the results the of previous soil investigation.

*Source: U.S. Environmental Protection Agency 2001b*
*Notes:*
bgs = Below ground surface
EPA = U.S. Environmental Protection Agency
QA/QC = Quality assurance and quality control

### 1.3.2 Project Quality Assurance Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to ensure the attainment of project-specific DQOs. Of these PARCC parameters, precision and accuracy will be evaluated quantitatively through the collection of the QC samples listed in Table 1-7. Precision and accuracy goals for these QC samples are listed in Appendix C.

**Table 1-7: Quality Control Samples for Precision and Accuracy**

| QC Type | Precision | Accuracy | Frequency |
|---|---|---|---|
| Field QC | Field duplicate RPD | Field Blanks | Field Duplicate = 1/10 samples (soil)<br>Field Blank = 1/sampling event<br>Equipment Rinsate = 1/day/piece of equipment<br>Trip Blank = 1/cooler w. VOC samples |
| Laboratory QC | MS/MSD RPD<br>Field Duplicate RPD | MS/MSD %R<br>Method Blanks<br>LCS or Blank Spikes<br>Field Duplicate<br>Surrogate Standards %R<br>Internal Standards %R | MS/MSD = 1/20 samples (soil)<br>Method Blank = 1/20 samples<br>LCS or Blank Spikes = 1/20 samples<br>Field duplicate = 1/10 samples (soil)<br>every sample<br>every sample |

*Notes:*
%R = percent recovery
LCS = laboratory control sample
MS/MSD = matrix spike/matrix spike duplicate
RPD = relative percent difference
VOC = volatile organic compounds

The subsections below detail the objectives relating to each of the PARCC parameters.

#### *1.3.2.1 Precision*

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Precision is expressed quantitatively as the measure of variability of a group of measurements compared to their average value. Analytical precision for a single analyte is expressed as a percentage of difference between results of duplicate samples for the analyte. Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates, comparing the results, and then calculating the variance between the samples, typically as a relative percent difference (RPD). The RPD of the field duplicates is calculated by using the following equation:

$$RPD = \frac{|A - B|}{(A + B)/2} \quad x \quad 100\%$$

where: A = primary sample concentration

B = duplicate sample concentration

Field duplicates will be collected for surface soil and subsurface soil. For field duplicate samples, the goal for precision have been set at 50 percent RPD for PAHs, TPH-diesel (TPH-d), TPH -motor oil (TPH-o), and PCBs; and 35 percent RPD for metals and organochlorine pesticides.

Laboratory analytical precision is evaluated by analyzing matrix spikes (MS) and matrix spike duplicates (MSDs). Analytical precision will be assessed through the analysis of laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs). For this project, MS/MSD samples will be generated for all analyses of soil samples. The results of the analysis of each MS/MSD pair will be used to calculate an RPD for evaluating precision.

General precision control limits for the analytical laboratory, shown as RPDs for MS/MSD, LCS/LCSD, or laboratory duplicate samples, are provided in Appendix C. Data that do not meet the precision criteria listed in Appendix C may be qualified as estimated (i.e., "J") during data validation, as outlined in IRP Procedures II-C, II-E, II-F, and II-I (DON 1998). Due to the RPD calculation, RPDs cannot be calculated in the instance that one or both values are nondetects. In addition, RPDs for trace or low-level results may not be appropriate for evaluation of precision. In these cases, an evaluation will be made during data validation based on comparison of the results with respect to the reporting limit (RL) on the replication. In general, results within ±RL for waters or ±2 RL for soils are considered to indicate acceptable precision for results reported at less than five times the RL.

A summary of precision results will be presented in the sampling letter report to provide an overall assessment of project data precision. The summary will consist of the mean and standard deviation of RPD values for each analytical method, by matrix, for MS/MSDs and field duplicates.

A summary of precision results will be presented to provide an overall assessment of data precision. The summary will consist of the mean and standard deviation of RPD values for each analytical method, by matrix, for MS/MSDs and field duplicates.

#### 1.3.2.2 ACCURACY

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by cross-contamination in the field sampling process, sample preservation, sample handling, matrix sample preparation, analytical techniques, and cross-contamination in the laboratory. A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, LCS or blank spikes, surrogate standards, and method blanks. MS/MSD samples and LCS/LCSD or blank spike samples are analyzed at a frequency of one per batch; a batch of samples is limited to 20 samples. Surrogate standards and internal calibration standards, where applicable, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

Accuracy is expressed as the percent recovery of an analyte that has been added (spiked) to an environmental sample in a known concentration before extraction/analysis. Accuracy is calculated using the following equation:

$$Percent\,\mathrm{Recovery} = \frac{S - C}{T} \; x \; 100$$

where S = Measured spike sample concentration

C = Sample concentration

T = True or actual concentration of the spike

Appendix C presents accuracy goals for the Group B sampling activities based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated based on other QC samples. Table 1-7 presents the samples to be collected for precision and accuracy.

Field blank and equipment blank samples monitor accuracy by detecting potential biases caused by cross-contamination. All field QC sample collection procedures will be documented in field notebooks.

Objectives for reference standards will be based on the type that is analyzed. Appropriate spike and reference standard compounds and concentration levels are specified in the analytical methods. When MS compounds are not specified, they will be selected in a manner such that the range of analytes is fairly represented (in terms of chemical characteristics, retention times, and other appropriate criteria). If the spiking levels for MS and surrogate standards are not provided, the spiking will be conducted at a mid-calibration concentration level.

Laboratory data will meet the accuracy criteria shown in Table 1-7 and Appendix C, which includes internal laboratory and method criteria. Data that do not meet the accuracy criteria listed in Table 1-7 may be qualified as estimated (“J”) or may be rejected (“R”) during data validation, as discussed in IRP Procedures II-C, II-E, II-F, and II-I (DON 1998).

A summary of accuracy results (e.g., a mean and standard deviation of surrogate recovery values for each analytical method, by matrix) may be provided to give an overall assessment of the accuracy.

#### *1.3.2.3 Representativeness*

Representativeness expresses the degree to which sample data accurately and precisely represents the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination. Representativeness of data will also be ensured through established field and laboratory procedures and their consistent application. To aid in evaluating the representativeness of the sample results, field and laboratory blank samples and background samples will be evaluated for the presence of contaminants. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty. Representativeness shall be assessed qualitatively for each matrix (medium), spatially (laterally and vertically), and for each contaminant of concern. The following questions may be asked to assess representativeness:

- Were the appropriate media sampled?
- Were samples collected correctly?
- Were samples collected from appropriate locations?
- Were potential hot spots likely missed?
- Was an appropriate number of samples collected and analyzed?
- May other factors have biased the results?

#### *1.3.2.4 Completeness*

Completeness is a measure of the percentage of project-specific data that is valid. Valid data is obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability are exceeded. Data that is validated and qualified as estimated (“J”) will not be counted against the completeness goal because it is considered usable. Only rejected data (“R”) or data not collected will be counted against the completeness goal. When all data validation is completed, the percent completeness will be calculated by dividing the number of valid sample results by the total number of sample results planned for this investigation. The following equation is used to determine completeness:

$$Completeness(\%C) \quad = \quad \frac{V}{T} \quad x \quad 100$$

where, %C = Percent completeness

V = Number of valid samples

T = Total number of planned samples

Although a quantitative number can be calculated for each analyte, the data user must use this qualitatively to assess whether the investigation objectives can be met with the data obtained. As a guideline, data completeness should be approximately 90 percent for each analyte for all samples.

Data that does not meet the completeness goals suggests the need for resampling and analysis or, at a minimum, suggests that the data set should be used with caution. Data that was planned but not collected should count against the completeness goal, unless it was omitted for a valid reason and is not anticipated to produce a data gap.

As discussed further in Section 4.2, completeness will also be evaluated as part of the data quality assessment process in Section 4 (EPA 2000c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

#### *1.3.2.5 Comparability*

Comparability is a qualitative parameter that expresses the degree of confidence with which one data set can be compared to another data set. Comparability of data will be achieved by consistently following IRP procedures for sampling and field activities, by using the same types of sampling equipment at each site during all phases of the investigation, and by using standard measurement units in reporting analytical data. Laboratory data will be reported in consistent units for each analytical test (mg/kg for the soil confirmation samples). Data will be corrected for percent moisture and will be reported in dry weight.

#### *1.3.2.6 Detection and Quantitation Limits*

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a given sample matrix. RLs are contractually specified maximum quantitation limits for a sample matrix, such as soil or water, and are typically several times the MDL to allow for matrix effects. RLs are set liberally to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower.

Appendix B presents the RLs for the selected analytical methods in comparison to the screening criteria. The purpose of this comparison is to show that the selected analytical methods and associated RLs are capable of quantifying contaminants of concern at or below the applicable screening level. In comparing the RLs to screening criteria, however, it is important to note that actual laboratory quantitation limits may be lower than RLs and that estimates of analyte concentrations down to MDLs can typically be provided in order to allow comparisons to screening levels that are below RLs.

For this project, samples analyzed for metals, PAHs, PCBs, TPH-d, TPH-o, and organochlorine pesticides will be reported as estimated values if concentrations are less than RLs but greater than MDLs. The MDL for each analyte will be listed as the detection limit in the laboratory's electronic data deliverable (EDD). This procedure is being adopted to help ensure that effective comparisons of analyte results to the screening criteria can be performed for certain compounds where the RL is near or below the screening criteria and to ensure that subsequent statistical evaluations of the data will not be biased by high-value nondetect results.

The RLs for soil for this RA are presented in Appendix B and will generally be used for determining whether an analytical method is capable of detecting the analyte of concern at or below the screening level.

## 1.4 PROJECT ORGANIZATION

Table 1-8 presents the responsibilities and contact information for key personnel involved in the field investigation for the Group B sites. In some cases, more than one responsibility has been assigned to a person.

**Table 1-8: Key Personnel, Group B Site Investigation**

| Name | Organization | Role | Responsibilities | Contact Information |
|---|---|---|---|---|
| Janice Fukumoto | Navy | Remedial Project Manager | Responsible for overall project execution and for coordination with base representatives, regulatory agencies, and Navy management.<br>Provides management and technical oversight during data collection. | PACNAVFACENGCOM<br>258 Makalapa Drive, Suite 100<br>Pearl Harbor, Hawaii 96860-3134<br>FukumotoJL@efdpac.nav.fac.navy.mil<br>(808) 472-1424 |
| Leighton Wong | Navy | QA Officer | Responsible for QA issues for all Navy CLEAN work.<br>Provides government oversight of the CLEAN II QA program.<br>Reviews and approves SAP and any significant modifications.<br>Has authority to suspend project activities if Navy quality requirements are not met. | PACNAVFACENGCOM<br>258 Makalapa Drive, Suite 100<br>Pearl Harbor, Hawaii 96860-3134<br>WongLG@efdpac.navfac.navy.mil<br>(808) 472-1417 |
| John Fern | Earth Tech | Technical Director | Ensures that all CLEAN II Program activities are carried out in a consistent manner and accordance with current Navy requirements and CLEAN II Program guidance. Reviews all documents. | Earth Tech, Inc.<br>700 Bishop Street, Suite 900<br>Honolulu, Hawaii 96813<br>JFern@earthtech.com<br>(808) 523-8874 |
| Bob Poll | Earth Tech | Health and Safety (H&S) Manager | Oversees all H&S aspects of the project; performs H&S audits to verify Earth Tech and field subcontractor compliance; reviews SOPs and subcontractor SOWs for H&S considerations; provides H&S oversight and support of field activities; coordinates medical monitoring program and OSHA training; issues site H&S certification letter. | Earth Tech, Inc.<br>100 W. Broadway, Suite 240<br>Long Beach, CA 90802<br>Bpoll@earthtech.com<br>562-951-2242 |

**Table 1-8: Key Personnel, Group B Site Investigation (Continued)**

| Name | Organization | Role | Responsibilities | Contact Information |
|---|---|---|---|---|
| James Romine | Tetra Tech | H&S Manager | Oversees Tetra Tech H&S aspects of the project; provides H&S oversight and support of field activities; coordinates medical monitoring program and OSHA training.<br>Reviews and approves Tetra Tech H&S plan and determines appropriate site control measures and personal protection levels. | Tetra Tech EM Inc.<br>250 West Court St., Suite 200 West<br>Cincinnati, OH 45202<br>(513) 564-8351<br>James.Romine@ttemi.co |
| Ron Boyle | Earth Tech | Contract Task Order (CTO) Manager | Responsible for implementing all activities called out in CTO.<br>Prepares or supervises preparation of SAP.<br>Monitors all field activities to ensure compliance with SAP requirements. | Earth Tech, Inc.<br>700 Bishop Street, Suite 900<br>Honolulu, Hawaii 96813<br>RBoyle@earthtech.com<br>(808) 523-8874 |
| Kim Markillie | Tetra Tech | Subcontract Task Order (STO) Manager | Responsible for implementing all Tetra Tech activities called out in CTO SOW.<br>Prepares or supervises preparation of parts of SAP.<br>Monitors and directs Tetra Tech field activities to ensure compliance with SAP requirements. | Tetra Tech EM Inc.<br>2828 Paa Street, Suite 3080<br>Honolulu, Hawaii 96819<br>Kim.Markillie@ttemi.com<br>(808) 441-6655 |
| Teresa Shinder | Tetra Tech | Field Manager | Directs day-to-day field activities conducted by Tetra Tech and subcontractor personnel.<br>Verifies that field sampling and measurement procedures follow SAP.<br>Provides STO manager with regular field status reports. | Tetra Tech EM, Inc.<br>2828 Paa Street, Suite 3080<br>Honolulu, Hawaii 96819<br>Teresa.Shinder@ttemi.com<br>(808) 441-6645 |
| Joslyn Noonan | Tetra Tech | In-office Field Coordinator | Coordinates directly with Tetra Tech Field Manager regarding sample tracking and laboratory coordination.<br>Summarizes analytical results upon receipt. Coordinates with Tetra Tech Project Chemist regarding any laboratory discrepancies.<br>Provides STO manager with analytical results status reports. | Tetra Tech EM Inc.<br>2828 Paa Street, Suite 3080<br>Honolulu, Hawaii 96819<br>Joslyn.Noonan@ttemi.com<br>(808) 441-6645 |
| Barry Hicks | Tetra Tech | On-Site H&S Coordinator | Conducts safety briefings for Tetra Tech, subcontractor personnel, and site visitors.<br>Can suspend operations that threaten health and safety. | Tetra Tech EM Inc.<br>2828 Paa Street, Suite 3080<br>Honolulu, Hawaii 96819<br>Barry.Hicks@ttemi.com<br>(808) 441-6600 |

**Table 1-8: Key Personnel, Group B Site Investigation (Continued)**

| Name | Organization | Role | Responsibilities | Contact Information |
|---|---|---|---|---|
| Sara Woolley | Tetra Tech | Project Chemist | Oversees analytical QA/QC program. Assists with analytical laboratory procurement; coordinates with analytical laboratory; coordinates with field managers to ensure compliance with field QC requirements; reviews chain-of-custody forms; ensures adherence to analytical plan; coordinates with data validators; and reviews and summarizes data validation reports. | Tetra Tech EM Inc.<br>135 Main Street, Suite 1800<br>San Francisco, CA 94105<br>Sara.Woolley@ttemi.com<br>(415) 222-8311 |
| Susan Gallagher | Tetra Tech | Data Management | Develops, monitors, and maintains project database under guidance of CTO and STO managers.<br>Works with Project Chemist during SAP preparation to resolve sample identification issues. | Tetra Tech EM Inc.<br>135 Main Street, Suite 1800<br>San Francisco, CA 94105<br>Susan.Gallagher@ttemi.com<br>(415) 222-8329 |
| To be determined | Laboratory | Project Manager | Delivers analytical services that meet SAP requirements.<br>Reviews SAP to understand analytical requirements.<br>Works with Project Chemist and field managers to confirm sample delivery schedules and sample analyses.<br>Reviews laboratory data package before delivery to Earth Tech and Tetra Tech. | To be determined |
| Robin Hull | Donaldson Enterprises, Inc. | Utility Clearance Project Manager | Ensures that utility clearance activities are conducted in accordance with SAP requirements and the statement of work.<br>Coordinates subcontractor activities with Earth Tech CTO or Tetra Tech STO manager. | Donaldson Enterprises, Inc.<br>45-1055 Kamehameha Hwy, #202<br>Kaneohe, HI 96744<br>(808) 235-2662 |
| Christina Poma | ESN Pacific | Direct Push Sampling Project Manager | Ensures that direct push sampling activities are conducted in accordance with SAP requirements and the statement of work.<br>Coordinates subcontractor activities with Earth Tech CTO or Tetra Tech STO manager. | ESN Pacific<br>1818 Kahai Street<br>Honolulu, Hawaii 96819<br>tegpacific@aol.com<br>(808) 847-0067 |
| To be determined | Other Subcontractors | Project Managers | Ensures that subcontractor activities are conducted in accordance with SAP requirements and statement of work.<br>Coordinates subcontractor activities with Earth Tech CTO or Tetra Tech STO manager. | To be determined |

## 1.5 SPECIAL TRAINING AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for Earth Tech, Tetra Tech, and other subcontractor personnel working on site.

### 1.5.1 Health and Safety Training

All personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 Code of Federal Regulations (29 CFR) Part 1910.120(e). These requirements include: (1) 40 hours of formal offsite instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training.

Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers CLEAN II health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular," or equivalent.

Copies of field personnel health and safety (H&S) training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are maintained in project files.

Before work begins at a specific hazardous waste project site, Earth Tech and Tetra Tech personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for H&S at a hazardous waste project site
- H&S hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances
- Contents of the site-specific HSP

### 1.5.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites. Training will meet OSHA requirements defined in 29 CFR 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to Earth Tech.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the "Safety Meeting Sign-Off Sheet" before conducting onsite work. A briefing covers the topics described in Section 1.5.1 and is conducted by the Tetra Tech onsite H&S coordinator (OHSC) or other qualified person (Table 1-8).

## 1.6 Documents and Records

Documentation is critical for evaluating the success of any environmental data collection activity. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages.

### 1.6.1 Field Documentation

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in the SAP. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the CTO number, the site name, and the names of subcontractors, the service client, and the project manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken

The field team will also use the various field forms included in Appendix D to record field activities.

### 1.6.2 Summary Data Package

Laboratory subcontractors will prepare summary data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statement of work (SOW) (EPA 1999a, 2000b). The summary data package will consist of a case narrative, copies of all associated chain-of-custody forms, sample results, and QA/QC summaries. The case narrative will include the following information:

- Subcontractor name, project name, CTO number, project order number, sample delivery group (SDG) number, and a table that cross-references client and laboratory sample identification numbers (ID).
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies, including analyses performed without an American Association for Laboratory Accreditation (A2LA)-certified standard.
- Thorough explanation of all instances of manual integration.
- Carbon ranges for TPH for all samples, as needed.
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken.
- Copies of all associated sample receipt notices.

Additional summary data package requirements are outlined in Table 1-9. The laboratory will provide Earth Tech with two copies of the summary data package within 28 days after it receives the last sample in the SDG.

### 1.6.3 Full Data Package

When a full data package is required, the laboratory subcontractor will prepare data packages in accordance with the instructions provided in the EPA CLP statements of work (EPA 1999a, 2000a).

Full data packages will contain all of the information from the summary data package and all associated raw data. Full data package requirements are outlined in Table 1-9. Full data packages are due to Earth Tech within 7 days after the last sample in the SDG is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package.

### Table 1-9: Requirements for Summary and Full Data Packages

| **Requirements for Summary Data Packages – Organic Analysis** | | **Requirements for Summary Data Packages – Inorganic Analysis** | |
|---|---|---|---|
| Section I | Case Narrative | Section I | Case Narrative |
| 1. | Case narrative | 1. | Case narrative |
| 2. | Copies of nonconformance and corrective action forms | 2. | Copies of nonconformance and corrective action forms |
| 3. | Chain-of-custody forms | 3. | Chain-of-custody forms |
| 4. | Copies of sample receipt notices | 4. | Copies of sample receipt notices |
| 5. | Internal tracking documents, as applicable | 5. | Internal tracking documents, as applicable |
| | | | |
| Section II | Sample Results - Form I for the following: | Section II | Sample Results - Form I for the following: |
| 1. | Environmental samples, including dilutions and re-analysis | 1. | Environmental sample including dilutions and re-analysis |
| 2. | Tentatively identified compounds (TIC) (VOC and SVOC only) | | |
| | | | |
| Section III | QA/QC Summaries - Forms II through XI for the following: | Section III | QA/QC Summaries - Forms II through XII for the following: |
| 1. | System monitoring compound and surrogate recoveries (Form II) | 1. | Initial and continuing calibration verifications (Form II) |
| 2. | MS and MSD recoveries and RPDs (Forms I and III) | 2. | RL standard (Form II) |
| 3. | Blank spike or LCS recoveries (Forms I and III-Z) | 3. | Detection limit standard (Form II-Z) |
| 4. | Method blanks (Forms I and IV) | 4. | Method blanks, continuing calibration blanks, and preparation blanks (Form III) |
| 5. | Performance check (Form V) | 5. | Inductively coupled plasma (ICP) interference-check samples (Form IV) |
| 6. | Initial calibrations with retention time information (Form VI) | 6. | MS and post-digestion spikes (Forms V and V-Z) |
| 7. | Continuing calibrations with retention time information (Form VII) | 7. | Sample duplicates (Form VI) |
| 8. | Quantitation limit standard (Form VII-Z) | 8. | LCSs (Form VII) |
| 9. | Internal standard areas and retention times (Form VIII) | 9. | Method of standard additions (Form VIII) |
| 10. | Analytical sequence (Forms VIII-D and VIII-Z) | 10. | ICP serial dilution (Form IX) |
| 11. | Gel permeation chromatography (GPC) calibration (Form IX) | 11. | IDL (Form X) |
| 12. | Single component analyte identification (Form X) | 12. | ICP interelement correction factors (Form XI) |
| 13. | Multicomponent analyte identification (Form X-Z) | 13. | ICP linear working range (Form XII) |
| 14. | Matrix-specific method detection limit (MDL) (Form XI-Z) | | |

**Table 1-9: Requirements for Summary and Full Data Packages (Continued)**

| **Requirements for Full Data Packages -- Organic Analysis** | | **Requirements for Full Data Packages -- Inorganic Analysis** | |
|---|---|---|---|
| Sections I, II, and III | Summary Package | Sections I, II, III | Summary Package |
| | | | |
| Section IV | Sample Raw Data - indicated form, plus all raw data | Section IV | Instrument Raw Data - Sequential measurement readout records for ICP, graphite furnace atomic absorption (GFAA), flame atomic absorption (AA), cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information: |
| 1. | Analytical results, including dilutions and re-analysis (Forms I and X) | 1. | Environmental samples, including dilutions and re-analysis |
| 2. | TICs (Form I — VOA and SVOA only) | 2. | Initial calibration |
| | | 3. | Initial and continuing calibration verifications |
| Section V | QC Raw Data - indicated form, plus all raw data | 4. | Detection limit standards |
| 1. | Method blanks (Form I) | 5. | Method blanks, continuing calibration blanks, and preparation blanks |
| 2. | MS and MSD samples (Form I) | 6. | ICP interference check samples |
| 3. | Blank spikes or LCSs (Form I) | 7. | MS and post-digestion spikes |
| | | 8. | Sample duplicates |
| Section VI | Standard Raw Data - indicated form, plus all raw data | 9. | LCSs |
| 1. | Performance check (Form V) | 10. | Method of standard additions |
| 2. | Initial calibrations, with retention-time information (Form VI) | 11. | ICP serial dilution |
| 3. | Continuing calibrations, with retention-time information (Form VII) | | |
| 4. | Quantitation-limit standard (Form VII-Z) | Section V | Other Raw Data |
| 5. | GPC calibration (Form IX) | 1. | Percent moisture for soil samples |
| | | 2. | Sample digestion, distillation, and preparation logs, as necessary |
| Section VII | Other Raw Data | 3. | Instrument analysis log for each instrument used |
| 1. | Percent moisture for soil samples | 4. | Standard preparation logs, including initial and final concentrations for each standard used |
| 2. | Sample extraction and cleanup logs | 5. | Formula and a sample calculation for the initial calibration |
| 3. | Instrument analysis log for each instrument used (Form VIII-Z) | 6. | Formula and a sample calculation for soil sample results |
| 4. | Standard preparation logs, including initial and final concentrations for each standard used | | |
| 5. | Formula and a sample calculation for the initial calibration | | |
| 6. | Formula and a sample calculation for soil sample results | | |

### 1.6.4 Data Package Format

EDDs are required for all soil analytical results. An automated laboratory information management system must be used to produce the EDD. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDD will correspond exactly to the hard-copy data. No duplicate data will be submitted. EDDs will be delivered in a format compatible with Navy Environmental Data Transfer Standards (NEDTS). Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the chain-of-custody form
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MS, MSDs, blank spikes, or LCSs
- Matrix duplicate results reported for the SDG
- All re-analysis, re-extractions, or dilutions reported for the SDG, including those associated with samples and the specified laboratory QC samples

Electronic and hard-copy data must be retained for a minimum of 3 and 10 years, respectively, after final data have been submitted. The subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained on an electronic data archival system.

### 1.6.5 Reports to be Generated

#### *1.6.5.1 Pre-Excavation Delineation Sampling*

Results of the pre-excavation delineation sampling will be included in an amendment to the design package for the excavation and remediation of Group B sites. The design amendment will include site maps, sample results, estimated excavation boundaries and soil quantities, a data validation summary, and any unusual field conditions encountered.

After IDW disposal related to pre-excavation delineation sampling, a brief report will be prepared that summarizes the disposal program and final disposition of the IDW. Pertinent manifests and disposal documentation will be attached to the report.

#### *1.6.5.2 Confirmation Sampling*

Results of the confirmation sampling will be included in a letter report for submittal to the Navy and contractor responsible for excavation and treatment. The letter report will include site maps, confirmation results, and a data validation summary report.

After disposal of IDW related to confirmation sampling, a brief report will be prepared that summarizes the disposal program and final disposition of the IDW. Pertinent manifests and disposal documentation will be attached to the report.

# 2. DATA GENERATION AND ACQUISITION

## 2.1 SAMPLING PROCESS DESIGN

The soil samples collected during Group B sampling activities will provide (1) the information needed to establish the lateral and vertical extent of contamination, and (2) the information necessary to confirm that soil cleanup criteria have been achieved following excavation activities. Section 2.1.1 presents the rationale for the pre-excavation delineation sampling at Group B sites (with the exception of Building 81 at NRTF Lualualei, where pre-excavation delineation has been completed). Section 2.1.2 presents the confirmation sampling at Group B sites except at PHNC, where confirmation sampling is being conducted under a separate investigation. Sections 2.1.3 to 2.1.5 include information on vegetation clearing, locating underground utilities, and surveying, respectively. Sampling analyses and locations for the pre-excavation delineation sampling is presented in Table 2-1.

All sampling methodologies and procedures will conform to those set forth in the project procedures manual (DON 1998). No major deviations from those procedures have been identified at this time, although the need to modify field activities may arise because of field conditions and observations. Any necessary significant modifications (e.g., changes in equipment or materials, or deletion of a procedural step) will first be discussed with the subcontract task order (STO) and CTO managers, the CLEAN II technical director, and the Navy remedial project manager (RPM). Upon approval, significant modifications and their corresponding justifications will be documented in the summary reports.

### 2.1.1 Pre-Excavation Delineation Sampling

Group B sites will be sampled to further delineate the lateral and vertical extent of contamination. Sampling at Ford Island, PHNC, Waikele Branch, and Iroquois Points will be conducted with direct-push technology; sampling at the former Drum Crushing Area at former NAS Barbers Point will be conducted with a hollow-stem auger drill. No pre-excavation delineation is required at the NRTF Lualualei site. Figures in Appendix A provide the location and sampling locations for each site within Group B (with the exception of Building 81 which shows confirmation sampling locations only).

Initial soil samples will be collected at 2 feet, 4 feet, and 6 feet bgs at the same location where contamination was previously encountered to define the vertical extent of contamination. The decision whether samples will be analyzed by the laboratory will be based on review of the results of the initial sampling.

After initial sampling, soil samples will be collected in a “step-out” fashion to delineate the lateral and vertical extent of contamination. First step-out samples will be collected at 5- to 10-foot lateral intervals from the initial contaminated area. Vertically, step-out samples will be collected at 2-foot intervals. The decision whether to analyze the samples collected will be based on review of the results of the initial sampling.

During the first mobilization of the direct-push sampling rig, samples at the initial locations and those at the first step-out sampling location will be collected. All samples collected during the first mobilization will be sent to the laboratory for analysis and/or holding.

If necessary, a second mobilization of the direct-push sampling rig will perform a second step-out consisting of 5- to 10-foot lateral interval locations following review of the previous sampling results. Vertical sampling will be conducted consistent with the approach presented above. Samples will be collected until results from each site indicate that contaminant concentrations are below the screening levels.

**Table 2-1: Pre-Excavation Delineation Soil Sample Analyses**

| Type of Sample | Sample Depth (feet bgs) | Number of Samples to be Analyzed | Number of Duplicates to be Analyzed | Analyses |
|---|---|---|---|---|
| **Ford Island** | | | | |
| TA-01 | 0-6 | 45 | 5 | PCBs Aroclors |
| TC-04 | 0-6 | 17 | 2 | PCBs Aroclors |
| TC-06D | 0-6 | 28 | 3 | PCBs Aroclors |
| TC-07D | 0-6 | 22 | 2 | PCBs Aroclors |
| TD-01 | 0-6 | 45 | 5 | PCBs Aroclors |
| TD-02 | 0-6 | 45 | 5 | PCBs Aroclors |
| TD-03 | 0-6 | 45 | 5 | PCBs Aroclors |
| TD-05 | 0-6 | 25 | 3 | PCBs Aroclors |
| TD-07 | 0-6 | 28 | 3 | PCBs Aroclors |
| TF-01 & TF-01D | 0-6 | 25 | 3 | PCBs Aroclors |
| TF-04 | 0-6 | 14 | 1 | PCBs Aroclors |
| TF-05 | 0-6 | 52 | 5 | PCBs Aroclors |
| TF-07 | 0-6 | 30 | 3 | PCBs Aroclors |
| TF-08 | 0-6 | 47 | 5 | PCBs Aroclors |
| TF-09 | 0-6 | 27 | 3 | PCBs Aroclors |
| TF-17 | 0-6 | 8 | 1 | PCBs Aroclors |
| TF-18 | 0-6 | 40 | 4 | PCBs Aroclors |
| TG-01 | 0-6 | 37 | 4 | PCBs Aroclors |
| TG-03 | 0-6 | 20 | 2 | PCBs Aroclors |
| TG-06 | 0-6 | 9 | 1 | PCBs Aroclors |
| TI-03 | 0-6 | 17 | 2 | PCBs Aroclors |
| TI-04D | 0-6 | 32 | 3 | PCBs Aroclors |
| **Pearl Harbor Naval Complex** | | | | |
| TC-01 | 0-6 | 23 | 2 | PCBs Aroclors |
| E-09 | 0-6 | 43 | 4 | PCBs Aroclors |
| D-02 | 0-6 | 52 | 5 | PCBs Aroclors |
| **Waikele Branch** | | | | |
| S61 | 0-6 | 39 | 4 | PCBs Aroclors |
| S127 | 0-6 | 10 | 1 | PCBs Aroclors |
| **Iroquois Point** | | | | |
| I-4 | 0-6 | 33 | 3 | PCBs Aroclors |

**Table 2-1: Pre-Excavation Delineation Soil Sample Analyses (Continued)**

| Type of Sample | Sample Depth (feet bgs) | Number of Samples to be Analyzed | Number of Duplicates to be Analyzed | Analyses |
|---|---|---|---|---|
| **Former NAS Barbers Point** | | | | |
| Former Drum Crushing Area | 0-8 | 71 | 7 | Arsenic, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane (a-, g-) and heptachlor epoxide |
| **Building 81, NRTF Lualualei** | | | | |
| Pre-delineation sampling previously conducted. Results of sampling revealed the presence of PCBs, benzo(a)pyrene, TPH-d, and TPH-o. | | | | |

*Notes:*
One equipment rinsate, trip blank, and MS/MSD sample will be collected each day
"included above" indicates that the specified number of quality control samples for each area of concern will be collected from both surface and subsurface soils.
4,4'-DDD = 1,1-Dichloro-2,2-bis(p-chlorophenyl)ethane
4,4'-DDE = dichlorodiphenyldichloroethylene
4,4'-DDT = 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane
bgs = below ground surface
N/A = not applicable
PCBs = polychlorinated biphenyls
TPH = total petroleum hydrocarbons

### 2.1.2 Confirmation Sampling – Group B Sites

Confirmation sampling will be conducted at Group B sites. A grid sampling approach will be used at each site to verify the removal of PCB-contaminated soil after the RA is complete. Discrete samples will be collected from the center of each 10-foot by 10-foot grid plotted at each site (one sample per 100 square feet). A minimum of two samples will be collected per site: one from the excavation bottom and one from each sidewall boundary where contamination was not excavated (may only include one sidewall). Whenever possible, samples will be collected near locations where high levels of contamination were detected during the RA. The estimated number of confirmation samples to be analyzed is presented in Table 2-2.

If analytical results indicate that site cleanup criteria have not been attained, further excavation and sampling will continue until analytical results indicate that site cleanup criteria have been achieved or until excavation is not feasible. Site-specific details such as grid location and estimated number of confirmation samples for Group B sites are shown on the drawings in Appendix F of this document.

**Table 2-2: Confirmation Soil Sample Analyses**

| Type of Sample | Estimated Number of Samples to be Analyzed | Estimated Number of Duplicate Samples to be Analyzed | Analyses |
|---|---|---|---|
| **Ford Island** | | | |
| TA-01 | 26 | 3 | PCBs Aroclors |
| TC-04 | 13 | 1 | PCBs Aroclors |
| TC-06D | 10 | 1 | PCBs Aroclors |
| TC-07D | 9 | 1 | PCBs Aroclors |
| TD-01 | 11 | 1 | PCBs Aroclors |
| TD-02 | 11 | 1 | PCBs Aroclors |

Table 2-2: Confirmation Soil Sample Analyses (Continued)

| Type of Sample | Estimated Number of Samples to be Analyzed | Estimated Number of Duplicate Samples to be Analyzed | Analyses |
|---|---|---|---|
| TD-03 | 14 | 2 | PCBs Aroclors |
| TD-05 | 6 | 1 | PCBs Aroclors |
| TD-07 | 15 | 2 | PCBs Aroclors |
| TF-01 & TF-01D | 12 | 1 | PCBs Aroclors |
| TF-04 | 28 | 3 | PCBs Aroclors |
| TF-05 | 15 | 2 | PCBs Aroclors |
| TF-07 | 13 | 1 | PCBs Aroclors |
| TF-08 | 19 | 2 | PCBs Aroclors |
| TF-09 | 7 | 1 | PCBs Aroclors |
| TF-17 | 6 | 1 | PCBs Aroclors |
| TF-18 | 10 | 1 | PCBs Aroclors |
| TG-01 | 9 | 1 | PCBs Aroclors |
| TG-03 | 9 | 1 | PCBs Aroclors |
| TG-06 | 6 | 1 | PCBs Aroclors |
| TI-03 | 8 | 1 | PCBs Aroclors |
| TI-04D | 15 | 2 | PCBs Aroclors |
| **Waikele Branch** | | | |
| S61 | 15 | 2 | PCBs Aroclors |
| S127 | 9 | 1 | PCBs Aroclors |
| **Iroquois Point** | | | |
| I-4 | 13 | 1 | PCBs Aroclors |
| **NRTF Lualualei** | | | |
| Building 81 | 223 | 22 | PCBs Aroclors, benzo(a)pyrene, TPH-d, and TPH-o |
| **Former NAS Barbers Point** | | | |
| Former Drum Crushing Area | 28 | 3 | Arsenic, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane (a-, g-) and heptachlor epoxide |

*Notes:*
One equipment rinsate, trip blank, and MS/MSD sample will be collected each day
"included above" indicates that the specified number of quality control samples for each area of concern will be collected from both surface and subsurface soils.
4,4'-DDD = 1,1-Dichloro-2,2-bis(p-chlorophenyl)ethane
4,4'-DDE = dichlorodiphenyldichloroethylene
4,4'-DDT = 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane
PCBs = polychlorinated biphenyls
TPH-d = total petroleum hydrocarbons – diesel
TPH-o = total petroleum hydrocarbons – motor oil

### 2.1.3 Surveying

No survey activities will be conducted during this investigation.

### 2.1.4 Underground Utility Survey

Prior to intrusive activities, a subcontracted geophysical surveyor will locate underground utilities using radiodetection and electromagnetic toning survey equipment. Utilities will also be located using information from existing utility maps. The purpose of the survey is to prevent damage to utilities during intrusive activities.

### 2.1.4 Underground Utility Survey

Prior to intrusive activities, a subcontracted geophysical surveyor will locate underground utilities using radiodetection and electromagnetic toning survey equipment. Utilities will also be located using information from existing utility maps. The purpose of the survey is to prevent damage to utilities during intrusive activities.

### 2.1.5 Vegetation Clearing

Prior to sampling, vegetation will be removed at each site, as necessary to prevent interference with sampling and RA procedures.

## 2.2 SAMPLING METHODS

### 2.2.1 Sampling Methods and Equipment

**Surface and Subsurface Soil Sampling.** Soil samples for pre-excavation and confirmation sampling at Group B sites will be collected in accordance with IRP Procedures I-B-1, *Soil Sampling* and I-H, *Direct Push Sampling Techniques* (DON 1998). Vegetation will be cleared away from the surface, and the top 2 inches of soil removed to ensure a representative sample. Soil samples will be collected and placed in stainless steel sleeves with Teflon©–lined caps. Samples will be packed in a cooler at 4 degrees Celsius ($^{o}$C) for shipment to the laboratory. Soil samples will be collected with a direct-push drilling rig at all Group B sites, with the exception of the former Drum Crushing Area at former NAS Barbers Point, which will require use of a hollow-stem auger for sample collection. At PHNC site TC-01, concrete coring will be required prior to direct-push sampling.

Split-spoon samplers will be used to collect direct-push samples in 1.5-inch diameter, 24-inch-long stainless-steel sleeves. Soil samples from the hollow-stem auger borings will be collected with a split-spoon sampler driven by a 140-pound slide hammer with a 30-inch drop interval. The hollow-stem auger split-spoon sampler will be lined with stainless-steel sleeves. Stainless-steel sample tubes will be capped and sealed according to IRP Procedures I-B-1, *Soil Sampling*, and III-F, *Sample Handling, Storage and Shipping Procedures* (DON 1998), respectively. Samples for laboratory analysis will be packed in a cooler at 4 ºC for shipment.

All soil samples will be logged in the field to describe lithology and areas of apparent contamination. Field observations will be noted in the field notebook. Lithologic descriptions will include soil classification information, as listed in IRP Procedure I-E, *Soil and Rock Classification*. All equipment will be decontaminated before each use in accordance with IRP Procedure I-F, *Equipment Decontamination* (DON 1998), and as described in the following section.

**Borehole Abandonment.** Following completion of soil sampling in each soil boring, the borehole shall be properly abandoned. Abandonment will involve placing bentonite chips or pellets from the bottom of the boring to within 0.5 to 2 feet of the ground surface. The remaining portion of the boring will be filled with material to match the original surface, such as topsoil, black patch for asphalt or will be patched with concrete if in a paved area. If material cannot be replaced, it will be treated as IDW, in accordance with IRP Procedure I-A-7, *IDW Management* (DON 1998).

Samples will be labeled according to Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 1998), and placed in insulated coolers with frozen gel packs or ice packs.

### 2.2.2 Decontamination

**Equipment.** All nonconsumable equipment that comes into contact with potentially contaminated soil will be decontaminated in accordance with IRP Procedure I-F, *Equipment Decontamination* (DON 1998). Equipment will be decontaminated by steamcleaning or by a nonphosphate detergent scrub, followed by rinses with fresh water and distilled or deionized water. Decontamination will take place on pallets or on plastic sheeting. Clean equipment will be stored in an uncontaminated area. Equipment stored for an extended period will be covered by plastic sheeting or aluminum foil or replaced in its case.

All consumable equipment (for example, gloves and disposable spoons) and liquid and solid wastes (for example, decontamination water, and soil cuttings) will be treated as potentially hazardous and discarded in accordance with the procedures prescribed in Section 2.2.3 of this report.

**Personnel.** The field team and equipment operator will perform personnel decontamination before leaving the work site at the conclusion of each workday, following procedures described in the HSP (Earth Tech 2001e).

### 2.2.3 Management of Investigation-Derived Waste

Expected IDW includes soil cuttings, decontamination water, disposable field sampling equipment, and PPE. IDW will be staged at a site within each of the six Group B installations in 55-gallon drums, pending review of analytical results and disposal.

All hazardous IDW will be disposed of within 90 calendar days of completing field activities. Soil cuttings may be relocated to the thermal treatment storage area at former NAS Barbers Point for future treatment. The other, nonhazardous IDW will be disposed of in a timely fashion following fieldwork. The classification of IDW will be determined by using site soil sample results where possible, and by collecting samples from IDW containers and conducting analysis in accordance with the SAP where necessary. Depending on suspected contaminants in the areas where wastes originated, the samples will be tested for the following analytes: metals (arsenic), organochlorine pesticides (4,4’-DDD, 4,4’-DDE, 4,4’-DDT, heptachlor epoxide, alpha-chlordane, gamma-chlordane), PAHs (benzo[a]pyrene), PCBs, TPH-d, and TPH-o.

An IDW disposal letter report will be prepared that summarizes analytical data and identifies disposal options. The IDW disposal letter report will include an inventory of all IDW bins, and drums, their contents, and recommendations for disposal and/or further testing and evaluation of potential disposal options. The IDW disposal letter report will be prepared in accordance with the *Generic IDW Screening, Sampling, and Disposal Plan for Various Hawaii Naval Installations* (DON 1995).

After IDW disposal, a brief notification letter will be prepared that summarizes the disposal program and final disposition of the IDW. Pertinent manifests and disposal documentation will be attached to the letter.

### 2.2.4 Sample Containers and Holding Times

The type of sample containers to be used for each analysis, the sample volumes required, the preservation requirements, and the maximum holding times for sample extraction and analysis are presented in Table 2-3.

**Table 2-3: Sample Containers, Preservatives, and Holding Times**

| Parameter | Method Number[a] | Sample Volume | Sample Container[b] | Preservative | Holding Time[c] |
|---|---|---|---|---|---|
| Organic Analyses (Soil) | | | | | |
| Organochlorine Pesticides | EPA 8081A | 8-ounce jar | 6-in sleeve/ 8-oz glass jar | Cool, 4°C | 14 days to extraction /40 days to analysis |
| PAHs | EPA 8270SIM | 8-ounce jar | 6-in sleeve/ 8-oz glass jar | Cool, 4°C | 14 days to extraction /40 days to analysis |
| PCBs | EPA 8082 | 8-ounce jar | 6-in sleeve/ 8-oz glass jar | Cool, 4°C | 14 days to extraction /40 days to analysis |
| TPH-diesel, -oil | EPA 8015B | 8-ounce jar | 6-in sleeve/ 8-oz glass jar | Cool, 4°C | 14 days to extraction /40 days to analysis |
| Inorganic Analyses (Soil) | | | | | |
| Metals | EPA 6010B | 8-ounce jar | G | Cool, 4°C | 6 months |
| Organic Analyses (Water) | | | | | |
| Organochlorine Pesticides | EPA 8081A | 2 @ 1 liter | G | Cool, 4°C | 7 days to extraction/40 days to analysis |
| PAHs | EPA 8270SIM | 2 @ 1 liter | G | Cool, 4°C | 7 days to extraction/40 days to analysis |
| PCBs | EPA 8082 | 2 @ 1 liter | G | Cool, 4°C | 7 days to extraction/40 days to analysis |
| TPH-diesel, -oil | EPA 8015B | 2 @ 1 liter | G | Cool, 4°C | 7 days to extraction/40 days to analysis |
| Inorganic Analyses (Water) | | | | | |
| Metals | EPA 6010B | 1 liter | P | To pH < 2 with $HNO_3$; Cool, 4°C | 180 days |

Notes:
[a] Complete method references are presented in Section 2.4
[b] Container Type: G = amber glass with Teflon®-lined lid; P = polyethylene
[c] "x" days/"y" days refers to the maximum number of days from sampling to extraction/the maximum number of days from extraction to analysis
cc = cubic centimeter
EPA = U.S. Environmental Protection Agency
$HNO_3$ = nitric acid
mL = milliliter
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

## 2.3 SAMPLE HANDLING AND CUSTODY

The following subsections describe sample-handling procedures, including sample identification and labeling, documentation, chain-of-custody (COC), and shipping.

### 2.3.1 Sample Identification

#### *2.3.1.1 EPA ID NUMBER*

To facilitate tracking and storage of data, all samples will be labeled with a five-character sample ID number, referred to as an EPA ID, in accordance with IRP Procedure I-A-9, *Sample Naming,* and IRP Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 1998). An EPA identification number will be assigned to each sample (to facilitate data tracking and storage) as follows:

**TRzzz**

where

**T** Project office ("T" for Tetra Tech)

**R** EPA site letter identification ("R" for Group B sites)

**zzz** Chronological number, starting with 001

For example, the EPA ID number for the 30th sample from the project, where Tetra Tech is the managing office, is TR030. QC samples will be included in the chronological sequence. If a sample is lost during shipping, a replacement sample will be assigned a new EPA ID number. If different containers for the same sample are shipped on different days, a new EPA ID number must be assigned.

#### *2.3.1.2 PROJECT SPECIFIC ID NUMBER*

A contractor-specific sample identification number will be used to provide sample-specific information (for example, location, sequence, matrix, depth). This identification number will be formatted as shown below.

**AA-BB-CC-DDE (depth)**, where:

**AA** Refers to the site location where the sample was collected (refer to Table 2-4)

**BB** Specifies the sample matrix (refer to Table 2-5)

**CC** Specifies the chronological sampling location at the specified site

**DD** Specifies sample number at that location (soil samples collected from the same soil sampling location)

**E** Specifies the type of sample for QC samples (refer to Table 2-6).

**(depth)** Specifies the sample depth interval, in feet bgs

For example, a sample labeled I4-SB-01-02 (2-4) would indicate a subsurface soil sample collected at I4, from the first sample location, sample number two, at a depth of 2 to 4 feet bgs.

**Table 2-4: Sample Identifiers**

| Sample Identifier | Location |
|---|---|
| TA01 | Ford Island |
| TC04 | Ford Island |
| TC06D | Ford Island |
| TC07D | Ford Island |
| TD01 | Ford Island |
| TD02 | Ford Island |
| TD03 | Ford Island |
| TD05 | Ford Island |
| TD07 | Ford Island |
| TF01 & TF01D | Ford Island |
| TF04 | Ford Island |
| TF05 | Ford Island |
| TF07 | Ford Island |
| TF08 | Ford Island |
| TF09 | Ford Island |
| TF17 | Ford Island |
| TF18 | Ford Island |
| TG01 | Ford Island |
| TG03 | Ford Island |
| TG06 | Ford Island |
| TI03 | Ford Island |
| TI04D | Ford Island |
| S61 | Waikele Transformer |
| S127 | Waikele Transformer |
| I4 | Iroquois Point Transformer |
| B81 | Building 81, NRTF Lualualei |
| D02 | Pearl Harbor Naval Complex Transformers |
| E09 | Pearl Harbor Naval Complex Transformers |
| TC01 | Pearl Harbor Naval Complex Transformers |
| DCA | Former Drum Crushing Area |

**Table 2-5: Sample Type and Matrix Identifiers**

| Identifier | Sample Type | Matrix |
|---|---|---|
| SS | Surface soil sample | Soil |
| SB | Subsurface soil sample | Soil |
| QS | Field QC | Soil |
| QW | Field QC | Water |
| WS | Waste | Soil |
| WW | Waste | Water |

**Table 2-6: Field or QC Sample Types**

| Identifier | Field or QC Sample Type | Description |
|---|---|---|
| S | Primary sample | All field samples, except QC samples |
| D | Duplicate sample | Collocate (adjacent locations) |
| ER | Equipment rinsate | Water |
| FB | Field blank | Water |
| TB | Trip blank | Water |
| MS/MSD | Matrix Spike/Matrix Spike Duplicate | Soil or Water |
| C | Confirmation | Soil or Water |

### 2.3.2 Sample Labels

A sample label will be affixed with adhesive backing to all sample containers and covered with clear tape to further secure it to the container and to keep the ink from smearing. The label will be completed with the following information, written in indelible ink, as specified in IRP Procedure I-A-9, *Sample Naming* (DON 1998):

- Project name and location or identifier
- Project number
- EPA ID number
- Date and time of collection
- Analyses to be performed
- Sample collector's initials
- Preservative used (if applicable)

After labeling, each soil sample will be refrigerated or placed in a cooler that contains ice to maintain the sample temperature at or below 4 ºC.

### 2.3.3 Sample Documentation

**Field Documentation.** Records will be kept in accordance with IRP Procedure I-C-1, Section 6.0, *Record Keeping Requirements* (DON 1998). In accordance with IRP Procedure III-D, *Logbooks* (DON 1998), a bound field notebook with consecutively numbered, water-repellent pages will be maintained. The logbook will be clearly labeled with the name of the activity, the person assigned responsibility for maintenance of the logbook, and the beginning and ending dates of the entries. Data forms, including soil boring logs, with predetermined formats for logging field data, will be incorporated into the logbook.

The field logbook will serve as the primary record of field activities. Logbooks should allow a reviewer to reconstruct field events by presenting entries in chronological order and in sufficient detail. The logbook will be maintained in a clean area and used only when outer gloves have been removed.

Entries on the data forms and in the logbook will meet the same requirements. Entries will be made in indelible ink. Information recorded in the logbook will include the following:

- The logbook will reference data maintained in other logs.
- Corrections to entry records will be made by drawing a single line through the incorrect entry, then initialing and dating the change. An explanation is to be included if more than a simple mistake was made.
- Entries will be signed or initialed by the individual making the entry at the end of each day.
- Page numbers will be entered on each logbook page.
- The preparer will send photocopies of completed pages to the STO manager on a weekly basis. The field manager will conduct a daily technical review of the logbook.

**Laboratory Documentation.** The laboratory will provide PACNAVFACENGCOM Level D data packages as described in IRP Procedure II-A, *Data Validation Procedure 1, Presentation* (DON 1998). The packages will include a case summary. The laboratory will also provide data deliverables in a specified electronic format. All laboratory deliverables are due to Earth Tech within 35 days of receipt of the last sample at the laboratory.

### 2.3.4 Chain of Custody Procedures

The COC documentation provides an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The COC record also will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the COC record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- EPA ID number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the COC record will be crossed out. Two copies of the COC forms will be placed in an adhesive plastic pouch and affixed to the inside of each sample cooler. The coolers will then be sealed with waterproof tape and labeled “Fragile,” “This End Up” (or marked with directional arrows pointing up), and other appropriate notices. Custody seals will be placed on coolers according to IRP Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 1998). Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the COC record and the airbill will be retained and filed by field personnel before the containers are shipped.

It is the responsibility of the CLEAN II contractor field team leader to ensure that all samples are handled properly to maintain the integrity of the samples from collection until shipment. These requirements are listed in IRP Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 1998). The COC form serves as an analytical request form and has a space to record the sample upon receipt.

Upon receipt, the laboratory shall sign and retain copies of the air bill. The COC form shall be signed, and the temperature of the samples or cooler upon receipt will be documented on the COC form and the “Sample Condition Upon Receipt” form. If any breakage of a container occurs or any discrepancy is noted between the COC, sample labels, or requested analysis, the sample custodian will notify the laboratory project manager. A nonconformance report will be completed, and the project chemistry support coordinator will be notified within 24 hours. At the time of the notification, the proper corrective action will be decided upon. The sample custodian will enter the information into the laboratory system and send a login confirmation sheet to the project chemistry support coordinator within 48 hours. A declaration of the samples in each SDG will also be sent by the laboratory to the CLEAN II contractor.

### 2.3.5 Sample Shipment

Soil samples will be transferred directly to the laboratory for immediate analysis. All samples will be recorded on the COC forms in accordance with IRP Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 1998). Sample containers will be placed in insulated coolers. Coolers will be chilled with frozen gel packs or ice in double, sealable bags. Samples will be placed in the lower portion of the cooler, and the ice packs will occupy the upper portion of the cooler. Material such as styrofoam pads or bubble wrap will line the top and bottom interior of the cooler (pads may also be placed on the sides at the discretion of field personnel). In the case of liquid samples, an absorbent material will be placed on the bottom of the cooler to help contain any spills. Glass containers will be individually wrapped in bubble-wrap, styrofoam, or other padded material to prevent breakage. Empty spaces between containers will be filled with styrofoam “peanuts” or other appropriate padding material. To prevent leaks, water sample containers will be packed in an upright position—not on their sides or stacked. Ice and gel packs will be replaced at the time of shipment to keep the inside temperature of the cooler as close as possible to 4°C. Samples will be shipped within 24 hours to allow the laboratory to meet holding times for analysis.

The use of a mainland laboratory is anticipated. Field personnel are aware that soil samples shipped from Hawaii to a laboratory in the continental United States are subject to inspection by the U.S. Department of Agriculture (USDA). The CTO or STO manager or field manager will ensure that the required USDA shipment clearance permits are obtained from the laboratory. Field personnel will attach USDA soil permits to the air bill. Sample shipping procedures are described in IRP Procedure III-F, *Sample Handling, Storage, and Shipping Procedures* (DON 1998).

**Nonhazardous Material Shipment.** Samples considered nonhazardous based on previous site sampling results, field-screening results, or visual observations may be shipped as nonhazardous.

## 2.4 ANALYTICAL METHODS

Appendix B presents the analytical methods that will be used to analyze samples the collected samples. Appendix C presents the project QA objectives and control limits for sample analyses established as part of the DQO process (Section 1.3). Appendix B presents the individual target analytes required for this investigation and their associated RLs. The analytical laboratory will attempt to achieve the RLs for all investigative samples collected. If problems occur in achieving the RLs, the laboratory will contact the project chemist immediately and other alternatives will be pursued (such as analyzing an undiluted aliquot and allowing nontarget compound peaks to go off-scale) to achieve acceptable reporting limits. In addition, results below the reporting limit but above the MDL will be reported with appropriate flags to indicate the greater uncertainty associated with those values.

The analytical methods required for this investigation include EPA SW-846 (EPA 2000c) and methods that were used for previous investigations. Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and QA/QC requirements are presented in the following subsections.

### 2.4.1 Selection of Analytical Laboratories

Laboratories for this investigation will be selected from a list of prequalified laboratories developed by Earth Tech and Tetra Tech to support the CLEAN contract. Prequalification streamlines laboratory selection by reducing the need to compile and review detailed bid and qualification packages for each individual investigation. Prequalification also improves program flexibility by allowing analyses to be directed to a number of different capable laboratories with available capacity at the time samples are collected.

The Earth Tech laboratory prequalification and selection process relies on a standard procedure to evaluate and prequalify laboratories for work under the contract and a contractual document that specifies standard requirements for analyses that are routinely conducted. Earth Tech established a basic ordering agreement, incorporating and enforcing the laboratory SOW, with each prequalified laboratory. Individual purchase orders can then be written for specific investigations. These aspects of laboratory selection are further described in the following subsections, along with Earth Tech procedures for selecting laboratories when project-specific analytical methods or QC requirements are not specifically addressed by the laboratory SOW.

#### *2.4.1.1 LABORATORY EVALUATION AND PREQUALIFICATION*

Laboratories working under the CLEAN II contract are evaluated either by the Naval Facilities Engineering Service Center (NFESC) or Earth Tech. These evaluation procedures include the following:

- **Certification and approval**. Laboratories must be currently certified by NFESC for analysis of hazardous materials for each method specified. NFESC approval must be obtained before the laboratory begins work.
- **Audits**. Laboratories must initially and yearly demonstrate their qualifications by submitting to one or more audits by Earth Tech. The audits may consist of (1) onsite review of laboratory facilities, personnel, documentation, and procedures, or (2) offsite review of hard-copy and electronic deliverables, or magnetic tapes. When deficiencies are identified, the laboratory must correct the problem and provide Earth Tech with a written summary of the corrective action that was taken.

Analytical laboratories are periodically reevaluated by verifying that required certifications and approvals are current and auditing the laboratory. If a laboratory fails to meet any of the reevaluation criteria, it is removed from a list of approved and prequalified laboratories.

#### 2.4.1.2 CLEAN LABORATORY STATEMENT OF WORK

The laboratory SOW establishes standard requirements for the analytical methods that are most commonly used under the CLEAN contract. For each method, the laboratory SOW specifies standard method-specific target analyte lists and RLs; QC samples and associated control limits; calibration requirements; and miscellaneous method performance requirements. The laboratory SOW also specifies standard data package requirements, EDD formats, data qualifiers, and delivery schedules. In addition, the laboratory SOW outlines support services (such as providing sample containers, trip blanks, sample coolers, and custody forms and seals) that are expected of laboratories. The laboratory SOW incorporates Navy QA policy, as well as applicable EPA and state QA guidelines, as appropriate.

Earth Tech's laboratory SOW is based on EPA CLP methods for metals, organochlorine pesticides, PAHs, PCBs, TPH-d, and TPH-o. The laboratory SOW also addresses frequently used non-CLP methods for a variety of organic, inorganic, and physical parameters. Non-CLP methods include EPA SW-846 methods; EPA "Methods for Chemical Analysis of Water and Waste" (MCAWW); American Society for Testing and Materials (ASTM) methods; and "Standard Methods for the Examination of Water and Waste Water" published by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Laboratories on Earth Tech's prequalified list can elect to provide all or a portion of the analytical services specified in the laboratory SOW.

As noted above, the laboratory SOW is incorporated into all laboratory subcontracts established for analytical services under CLEAN. As a result, the prequalified laboratories commit to meeting laboratory SOW requirements during the contracting process before they receive samples. Earth Tech and Tetra Tech review and revise the laboratory SOW regularly to incorporate new methods and requirements, modifications or updates to existing methods, changes in Navy QA policy or regulatory requirements, and any other necessary corrections or revisions.

#### 2.4.1.3 LABORATORY SELECTION AND OVERSIGHT

Once project-specific analytical and QA/QC requirements have been determined and documented in the SAP, the project chemist works closely with a procurement specialist to select a laboratory that can meet these requirements. When project-specific analytical and QC requirements are consistent with the laboratory SOW, the project chemist identifies one or more prequalified subcontractor laboratories that are capable of performing the work. As part of this process, the project chemist typically contacts the laboratories to discuss the analytical requirements and project schedule. The project chemist then forwards the name of the recommended laboratory (or laboratories) to the procurement specialist, who issues a purchase order for the work. When analytical requirements are consistent with the laboratory SOWs and multiple prequalified laboratories are capable of performing the work, a specific laboratory is typically selected based on laboratory workload and project schedule considerations.

A similar procedure is followed when project-specific analytical and QC requirements are nonstandard and differ from those specified in the laboratory SOW. The project chemist contacts analytical laboratories, beginning with those on the prequalified list, to discuss the analytical and QA/QC requirements in the SAP and to assess the laboratories' ability to meet the requirements. In many cases, the project chemist works cooperatively with analytical laboratories to develop and refine appropriate QC requirements for nonstandard analyses or matrixes.

If the project chemist is unable to identify one or more prequalified laboratories that can perform the work, additional laboratories are contacted. In general, the additional laboratories must be evaluated as described in Section 2.4.1.1 before they will be allowed to analyze any samples, although some evaluation steps may be waived for certain investigations and circumstances (for example, unusual analytes, urgent project needs, experimental methods, mobile laboratories, or on-site screening analysis). After additional laboratories have been identified, the project chemist forwards their names to the procurement specialist. The procurement specialist prepares a solicitation package, including the project-specific analytical and QC requirements, and submits the package to the laboratories. The procurement specialist, in cooperation with the project chemist and CTO manager, then evaluates the proposals that are received and selects a laboratory that meets the requirements and provides the best value to the Navy. Finally, the procurement specialist issues a purchase order to the selected laboratory that incorporates the project-specific analytical and QA/QC requirements.

After a laboratory has been selected, the project chemist holds a kickoff meeting with the laboratory project manager. The kickoff meeting is held regardless of whether project-specific analytical and QA/QC requirements are consistent with the laboratory SOW or are outside the SOW. The CTO and STO managers, procurement specialist, and other key project and laboratory staff may also be involved in this meeting. The kickoff meeting includes a review of analytical and QC requirements in the SAP, the project schedule, and any other logistical support that the laboratory will be expected to provide.

### 2.4.2 Project Analytical Requirements

For this investigation, analysis of soil samples will be conducted by a certified laboratory. The laboratory will be selected prior to initiation of the field program, based on its ability to meet the project analytical and QC requirements as well as its ability to meet the project schedule. The analytical methods selected for samples from the Group B sites specified for this project are standard EPA methods. The methods are identical to the analytical methods used in previous investigations at these sites and should provide comparable data. All methods are from EPA (2000c) SW-846 *Test Methods for Evaluating Solid Waste*.

This SAP documents project-specific QC requirements for the selected analytical methods. Appendix B presents reporting limits for all target analytes for all analytical methods, and Appendix C presents project-specific precision and accuracy goals for the methods.

## 2.5 QUALITY CONTROL

The quality of field data will be assessed through regular collection and analysis of field QC samples. Laboratory QC samples will also be analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures and analyses are conducted properly and that the quality of the data is known. No deviations from laboratory QC checks specified in Procedure III-A-1, *Laboratory QC Samples* (DON 1998) are intended. Laboratory control samples will be included in all Group B sample analyses. Laboratory QC checks will include the following items:

- Method blanks and reagent blanks
- MS samples
- MSD samples (organic analytes) or sample duplicates (inorganic analytes)
- Surrogates (applicable to organic analyses only)
- Blank spike or LCSs
- Initial and continuing calibration standards (ICSs and CCSs)
- For inorganic analytes, inductively coupled argon plasma spectroscopy (ICP) interference checks and serial dilutions
- For organic analytes, internal standard (IS) area and retention time checks
- For GC/MS analyses, tuning checks
- For GC analyses, second column confirmations
- Other QC requirements stated in the analytical methods to be used

Laboratory acceptance limits are summarized in Appendix C and are based on EPA CLP criteria. These limits may be replaced by laboratory-specific control limits supported by control charts or some other method of statistical process control, as specified in NFESC guidance or the referenced method, if approved by applicable regulatory parties.

### 2.5.1 Field Quality Control Samples

Field QC samples are collected and analyzed to check sampling and analytical precision, accuracy, and representativeness. Field QC samples will be collected in accordance with the guidelines presented by the Navy (NFESC 1999) and IRP Procedure III-B, *Field QC Samples (Water, Soil)* (DON 1998). Table 2-7 provides a summary of the types and frequency of collection of field QC samples.

In addition to the QC samples presented in Table 2-7, one field blank is required for each source of water used for decontamination. These samples will be analyzed for metals (arsenic), organochlorine pesticides, PAHs (benzo[a]pyrene), PCBs, TPH-d, and TPH-o using the methods identified in Table 1-4.

**Table 2-7: Field Quality Control Samples**

| Type of Sample | Collection Rate |
|---|---|
| Field Duplicate | 10% of samples per sampling activity |
| Equipment Rinsate | Minimum of 1 per day |
| Field Blank | Minimum of 1 per day |
| Laboratory QC Samples (MS/MSD) | 5% of samples collected. Triplicate volumes will be collected and submitted. |

*Source: Modified from the NFESC (1999) guidance document, Navy Installation Restoration Chemical Data Quality Manual.*

#### 2.5.1.1 *FIELD DUPLICATES*

Field duplicate samples will be split or collocated samples collected at the same time and from the same source and then submitted as separate samples to the laboratory for analysis. Duplicate samples will be collected at a frequency of 10 percent for soil samples. Both samples will be assigned a unique sample ID number that will not reveal to the laboratory that they are duplicates.

Field duplicates will be evaluated qualitatively to assess the reproducibility of the sample collection procedures. The results of the analyses will be compared to laboratory criteria to assess whether the results demonstrate that the error inherent in the sampling procedures is within the expected analytical error.

#### 2.5.1.2 *MATRIX SPIKE AND MATRIX SPIKE DUPLICATES*

MS/MSD samples will be used to determine the accuracy and precision of the analytical results. MS/MSDs require the collection of an additional volume of soil for laboratory spiking and analysis. Triplicate aliquots of the same sample are prepared in the laboratory, and each aliquot is treated exactly the same throughout the analytical method.

MS/MSD samples will be collected at a frequency of 5 percent for soil. Matrix spike samples measure the efficiency of all the steps in the analytical method in recovering target analytes from an environmental matrix. The percent recoveries will be calculated for each of the spiked analytes and used to evaluate analytical accuracy. For the MS/MSD, spike compounds are added to two of the aliquots at concentrations specified in the method, and accuracy will be determined from the percent recovery of the analyte from the sample matrix. The RPD between spiked samples will be calculated to evaluate precision.

#### 2.5.1.3 *Field Blanks*

A field blank will be collected each day from each water source or vendor to measure potential contamination resulting from the water used in the final rinse in the decontamination process, and from the use of reusable equipment, respectively. Analytes detected in field blanks will be compared to any analytes detected in equipment rinsates and samples. The effect of the presence of the analytes in the field blanks is discussed in Section 4 of this SAP.

#### 2.5.1.4 *Equipment Rinsate Samples*

Equipment rinsate samples demonstrate whether decontamination procedures are effective in removing contaminants from the field sampling equipment. The presence of contamination in equipment rinsate samples indicates that cleaning procedures were not effective, allowing for the possibility of cross-contamination. Equipment rinsate samples will be collected during soil and IDW sampling at a frequency of once per day of sampling. An equipment rinsate is a sample collected after a sampling device is subjected to standard decontamination procedures. Water will be poured over or through the sampling equipment into a sample container and sent to the laboratory for analysis. Analytically certified, organic-free, high performance liquid-chromatography-grade water or its equivalent will be used for organic parameters; deionized or distilled water will be used for inorganic parameters.

Equipment rinsate samples will be sent blind to the laboratory. During data validation, the results for the equipment rinsate samples will be used to qualify data or to evaluate the levels of analytes in the field samples collected on the same day.

### 2.5.2 Laboratory Quality Control Samples

Laboratory QC samples are prepared and analyzed at the laboratory to evaluate the effectiveness of sample preparation and analysis and to assess analytical precision and accuracy. The types of laboratory QC samples that will be used for this project and their required frequencies are discussed in the following sections. Appendix C presents project-specific precision and accuracy goals for these samples.

#### 2.5.2.1 *Method Blanks*

Method blanks are prepared to evaluate whether contamination is originating from the reagents used in sample handling, preparation, or analysis. They are critical in distinguishing between low-level field contamination and laboratory contamination. A method blank consists of laboratory analyte-free water and all of the reagents used in the analytical procedure. It is prepared for every analysis in the same manner as a field sample and is processed through all of the analytical steps. Method blanks will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

#### 2.5.2.2 *Laboratory Control Samples or Blank Spikes*

An LCS, or blank spike, originates in the laboratory as deionized or distilled water that has been spiked with standard reference materials of a known concentration. An LCS is analyzed to verify the accuracy of the calibration standards. These internal QC samples are also used to evaluate laboratory accuracy in the presence of matrix interference for field samples. LCSs are processed through the same analytical procedure as field samples. LCSs will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. If percent recovery results for the LCS or blank spike are outside of the established goals, laboratory-specific protocols will be followed to gauge the usability of the data.

#### 2.5.2.3 *Surrogate Standards*

Surrogate standards consist of known concentrations of nontarget organic analytes that are added to each sample, method blank, and MS/MSD before samples are prepared and analyzed. The surrogate standard measures the efficiency of the analytical method in recovering the target analytes from an environmental sample matrix. Percent recoveries for surrogate compounds are evaluated using laboratory control limits. Surrogate standards provide an indication of laboratory accuracy and matrix effects for every field and QC sample that is analyzed for volatile and extractable organic constituents. Surrogate compounds are used to monitor purge efficiency and analytical performance, whereas surrogates are used in the analysis of extractable organic compounds to monitor the extraction process and analytical performance.

Factors such as matrix interference and high concentrations of analytes may affect surrogate recoveries. The effects of the sample matrix are frequently outside the control of the laboratory and may present unique problems. Laboratory personnel are required to re-extract (when applicable) and re-analyze samples when associated surrogates are outside of control limits. Data from both analyses of the samples in question are reported.

During validation, data will be qualified as estimated for any result that fails to meet surrogate criteria. Data will be qualified as estimated if two or more surrogates from each fraction (base/neutral and acid) are outside the control limits. The tables in Appendix C provide the guidelines for surrogate recovery for analyses that are planned for this project.

#### *2.5.2.4 Internal Standards*

Internal standards are compounds that are added to every standard, method blank, MS/MSD, and sample or sample extract at a known concentration prior to analysis. Internal standards are used as the basis for quantification of gas chromatography/mass spectrometry (GC/MS) target compounds and ensure that the GC/MS sensitivity and response are stable during the analytical run. An internal standard is used to evaluate the efficiency of the sample introduction process and monitors the efficiency of the analytical procedure for each sample matrix encountered. Internal standards are also used in the analysis of organic compounds by GC to monitor retention-time shifts. Validation of internal standards data will be based on EPA protocols presented in guidelines for evaluating organic analyses (EPA 1999b).

### 2.5.3 Additional Laboratory Quality Control Procedures

In addition to the analysis of laboratory QC samples, subcontractor laboratories will conduct the QC procedures discussed in the following sections.

#### *2.5.3.1 Method Detection Limit Studies*

The MDL is the minimum concentration of a compound that can be measured and reported. The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL takes into account sample matrix and preparation. The subcontractor laboratory will demonstrate the MDLs for all analyses except inorganic analyses and physical properties test methods.

MDL studies will be conducted annually for soil matrices, or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than required quantitation limits. The replicates will be extracted and analyzed in the same manner as routine samples. If multiple instruments are used, each will be included in the MDL study. The MDLs reported will be representative of the least sensitive instrument.

#### *2.5.3.2 Sample Quantitation Limits*

Sample quantitation limits (SQLs), also referred to as practical quantitation limits, are RLs adjusted for the characteristics of individual samples. The RLs presented in Appendix B are chemical-specific levels that a laboratory should be able to routinely detect and quantitate in a given sample matrix. The RL is usually defined in the analytical method or in laboratory method documentation. The SQL takes into account changes in the preparation and analytical methodology that may alter the ability to detect an analyte, including changes such as use of a smaller sample aliquot or dilution of the sample extract.

Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.

#### 2.5.3.3 CONTROL CHARTS

Control charts document data quality in graphic form for specific method parameters such as surrogates and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in determining whether analytical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. Although they are not required, Earth Tech and Tetra Tech recommend that subcontractor laboratories maintain control charts for organic and inorganic analyses. At a minimum, method-blank surrogate recoveries and blank spike recoveries should be charted for all organic methods. Blank spike recoveries should be charted for inorganic methods. Control charts should be updated monthly.

## 2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

### 2.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in (1) the equipment manufacturer's literature or operating manual, or (2) IRP procedures that describe equipment operation associated with particular applications of the instrument. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A hydraulic direct-push rig and drill rig will be used for sampling. The subcontractor will be required to provide detailed written procedures for inspecting, maintaining, and servicing the rig and will keep them on site. At a minimum, these procedures should address standard maintenance items.

### 2.6.2 Maintenance of Laboratory Equipment

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected from the Group B sites. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory's QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures, the frequency and type of maintenance performed, and procedures for documenting maintenance activities.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

## 2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Laboratory equipment calibration procedures and frequencies will follow the requirements in the reference method in Section 2.4.2 of this SAP. Qualified analysts will calibrate laboratory equipment and document the procedures and results in a logbook.

The laboratory will obtain calibration standards from the EPA repository or commercial vendors for both inorganic and organic compounds and analytes. Stock solutions for surrogate parameters and other inorganic mixes will be made from reagent-grade chemicals or as specified in the analytical method. Stock standards will also be used to make intermediate standards that will be used to prepare calibration standards. Special attention will be paid to expiration dating, proper labeling, proper refrigeration, and freedom from contamination. Documentation on receipt, mixing, and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Additional specific handling and documentation requirements for the use of standards may be provided in subcontractor laboratory QA plans.

## 2.8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The CTO and STO managers have primary responsibility for identifying the types and quantities of supplies and consumables needed to complete CLEAN projects and are also responsible for determining acceptance criteria for these items.

Supplies and consumables can be received either at CLEAN contractor offices or at the work site. When supplies are received at an office, the CTO or STO manager or field manager will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order and the item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar. When supplies are received, the field manager will inspect all items against the acceptance criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in *Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers* (EPA 1992).

Table 2-8 lists the acceptance criteria for common supplies and consumables used to ensure the quality of these items.

**Table 2-8: Acceptance Criteria for Common Supplies and Consumables**

| Supplies and Consumables | Minimum Acceptance Criteria |
|---|---|
| Water Sample Containers – glass | Glass containers, certified from the manufacturer for pesticide/PCB, and metals analyses. Each case of containers will include a Certificate of Assurance or a Certificate of Analysis verifying that the containers conform to the manufacturer's performance-based specifications. |
| Water Sample Containers – plastic | Pre-cleaned with independent laboratory analysis (Class 3000); high-density polyethylene; leak proof and break proof. |
| Soil Samples Containers – glass | Glass containers, certified from the manufacturer for pesticide/PCB, and metals analyses. Each case of containers will include a Certificate of Assurance or a Certificate of Analysis verifying that the containers conform to the manufacturer's performance-based specifications. |
| Water Sample Preservatives – organic | Sample preservatives will be at least pesticide-grade or equivalent. |
| Water Sample Preservatives – inorganic | Sample preservatives for metals will be at least trace-metal grade or equivalent. Sample preservatives for other inorganic analyses will be at least Certified Grade or equivalent. |
| Decontamination Water – deionized/potable | Deionized water, and if necessary potable water, will be analyzed via field blanks for possible contamination. Field blanks will be analyzed once per sampling event for each water source. |
| Reagents | Reagents used for organic analysis will be at least pesticide-grade or equivalent. Reagents for inorganic analysis will be at least ACS certified grade or equivalent. Reagents for metals analysis will be at least trace-metal grade or equivalent. |

*Notes:*
ACS = American Chemical Society
PCB = polychlorinated biphenyl

## 2.9 NON-DIRECT MEASUREMENTS

No data for project implementation or decision-making will be obtained from nondirect measurement sources.

## 2.10 DATA MANAGEMENT

Field and analytical data collected from this project are critical to site characterization efforts, development of the conceptual site model, risk evaluation, and selection of remedial actions to protect human health. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into an electronic database. The database contains data for (1) summarizing observations on contamination and geologic conditions, (2) preparing reports and graphics, and (3) transmitting in an electronic format compatible with NEDTS. The database will also be used with geographic information systems (GIS). The following sections describe the data tracking procedures, data pathways, and overall data management strategy for the sites.

### 2.10.1 Data-Tracking Procedures

To assist data tracking and adherence to the SAP, field or office personnel will track samples using a spreadsheet or database. An example of a typical COC tracking system is shown in Appendix D.

All data that are generated in support of the Group B sampling will be tracked through a database created by Earth Tech. Earth Tech will prepare a control/cross-reference database, and download the electronic chain-of-custody data into a relational database management system (RDBMS). Information related to the receipt and delivery of samples, project order fulfillment, and invoicing for laboratory and validation tasks is stored in the system. All data are filed according to the document control number. Receipt of hard copy data will also be tracked in RDBMS.

### 2.10.2 Data Pathways

Data are generated from three primary pathways at the sites—data derived from field activities, laboratory analytical data, and validated data. Data from all three pathways must be entered into RDBMS. To evaluate whether the data have been accurately loaded into the database in a timely manner, data pathways must be established and well documented.

Handwritten data (e.g., chain-of-custody forms, field data, field notes) will be entered into the RDBMS. Data generated during field activities are recorded using field forms (Appendix D). These forms are reviewed for completeness and accuracy by the project chemist or field manager.

Data generated during laboratory analysis are recorded in hardcopy and in EDDs after the samples have been analyzed. The laboratory will send the hardcopy and EDDs records to the project chemist. The project chemist reviews the data deliverable for completeness, accuracy, and format. After the format has been approved, the electronic data are manipulated and downloaded into the database. Data entry personnel will then update RDBMS with the total number of samples received and number of days required to receive the data.

A minimum of one hard copy will be delivered from the laboratory to the project chemist, the CTO manager, the STO manager, and the data validators. Preliminary QC checks will verify the consistency of EDD format, run data loading and translation programs, fix errors and anomalies reported by the translation programs, verify successful loading and translations, and download data for users. PACNAVFACENGCOM will receive a copy of the laboratory data on CD-ROM in the form of data tables generated from the RDBMS.

After validation, the project chemist reviews the data for accuracy and the data qualifiers will be loaded into the RDBMS. Additional data not supplied from the laboratory will also be loaded into the RDBMS.

Early in a project, electronic laboratory data will be checked against the hard copy data for the entire SDG. Later, if no problems have been encountered, a small portion of data in the RDBMS for each analytical method will be checked against the hard copy version to ensure that data types match. Data validators who enter validation qualifiers for each result will be tasked to check hard copy results against the results in the electronic version.

Computer files will be backed up daily to prevent loss of information. Hard copy data will be stored in secure areas, while electronic data will be stored in password-protected files with read-only access to users without authorization to edit the data. The data will be stored for a period of 10 years after the close of the contract.

### 2.10.3 Data Management Strategy

Chemical data will be summarized and then screened against the comparison criteria listed in Appendix B. The database for the Group B sites will be updated weekly. The data consist of chemical and field data from Navy contractors, entered into an Oracle (Version 7.3) database. The database can be used to generate reports using available computer-aided drafting and design and contouring software. All electronic data from this database will be transmitted in a format compatible with NEDTS.

To satisfy long-term data management goals, the data will be loaded into the database at Earth Tech for storage, further manipulation, and retrieval after the off-site laboratory and field reports are reviewed and validated. The database will be used to provide data for chemical and geologic analysis and for preparing reports and graphic representations of the data. Additional data acquired from field activities are recorded on field forms (Appendix D) that are reviewed for completeness and accuracy by the project chemist or field manager. Hard copies of forms, data, and chain-of-custody forms are filed in a secure storage area according to project and document control numbers. Laboratory data packages and reports will be archived at Earth Tech or Navy offices. Laboratories that generated the data will archive hard-copy data for a minimum of 10 years after the close of the contract.

# 3. ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported.

Overall responsibility for implementation and monitoring of the Earth Tech QA program resides with the CLEAN II technical director. The CLEAN II technical director and the CTO manager will be responsible for reviewing the technical contents of all submittals required under this project. The QA activities applicable to this CTO are described in the *Project Procedures Manual (*DON 1998) and Earth Tech SOPs (Earth Tech 1996) and included in Appendix E. The Earth Tech Peer Review Program, as outlined in the SOPs, will be followed during this project.

## 3.1 ASSESSMENT AND RESPONSE ACTION

Earth Tech, Tetra Tech, and the Navy will oversee environmental data collection using the assessment and audit activities described below. Any problems encountered during an assessment of field investigation or laboratory activities will require appropriate corrective action to ensure that the problems are resolved. This section describes the types of assessments that may be completed; Earth Tech's, Tetra Tech's, and the Navy responsibilities for conducting the assessments; and corrective action procedures to address problems identified during an assessment.

### 3.1.1 Field Assessments

The CLEAN II technical director or his designee will conduct at least one field audit. The findings of the field audit will be compiled in an audit report and submitted to the CTO manager (and technical director, if not performing the audit). The CTO manager will address the findings within 10 days of receiving the audit report. Both the auditor and technical director will review the response to the audit findings to determine whether the responses are adequate. If during the audit, it is determined that a procedure is being performed in a manner that may cause harm to the field crew or render the data unusable, the field auditor has the authority to stop work until the issue has been adequately resolved. Items to be examined during the field audit include:

- Availability of project plans such as the SAP and HSP
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling, and shipping procedures
- Sampling equipment decontamination
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)
- Health and safety procedures

The frequency of field audits is described below:

- Field System Audits: One or more field system audits will be completed, depending on the size and complexity of the project and the experience of the personnel.
- Field Performance Audits: One or more audits will be completed, depending on the size and complexity of the project and the experience of the personnel.

### 3.1.2 Laboratory Assessments

As described in Section 2.4.1, NFESC and Earth Tech conduct assessments of all laboratories that analyze samples collected under the CLEAN II contract. These assessments include (1) reviews of laboratory certifications, (2) laboratory audits. Laboratory audits may consist of an on-site review of laboratory facilities, personnel, documentation, and procedures, or an off-site evaluation of the ability of the laboratory's data management system to meet contract requirements. Earth Tech also conducts project-specific laboratory assessments when an approved laboratory has been selected for nonroutine analyses or when a laboratory that is not on the approved list must be used.

The Navy may audit any laboratory that will analyze samples on this project. The Navy QA officer will determine the need for these audits, and typically will conduct any such audits before samples are submitted to the laboratory for analysis.

### 3.1.3 Assessment Responsibilities

Personnel conducting assessments will be independent of the activity being evaluated. The CLEAN II technical director will select the appropriate personnel to conduct each assessment and will assign them responsibilities and deadlines for completing the assessment. These personnel may include the CLEAN II technical director, project chemist, or senior technical staff with relevant expertise and assessment experience.

When an assessment is planned, the CLEAN II technical director selects a lead assessor who is responsible for:

- Selecting and preparing the assessment team
- Preparing an assessment plan
- Coordinating and scheduling the assessment with the project team, subcontractor, or other organization being evaluated
- Participating in the assessment
- Coordinating preparation and issuance of assessment reports and corrective action request forms
- Evaluating responses and resulting corrective actions.

After the assessment is completed, the lead assessor will submit an audit report to the Navy QA officer and RPM and to the CLEAN II technical director, CTO manager, and project chemist; other personnel may be included in the distribution as appropriate. Assessment findings will also be included in the data quality assessment report (DQAR) for the project (Section 3.2.2).

The Navy QA officer is responsible for coordinating audits that may be conducted by Navy personnel under this project. Audit preparation, completion, and reporting responsibilities for Navy auditors would be similar to those described above.

### 3.1.4 Field Corrective Action Procedures

An effective QA program requires prompt and thorough correction of nonconformance conditions affecting quality. Rapid and effective corrective action minimizes the possibility of questionable data or documentation.

If problems with either laboratory or field procedures occur, or if problems of noncompliance are noted during the laboratory, field system, or performance audits, corrective actions will be implemented. All QA problems and corrective actions will be documented to provide a complete record of QA activities and to help identify needed long-term corrective actions.

In the event that a corrective action is required due to improper field technique, the CTO manager, field manager, and project chemist will be notified. The CTO manager, field manager, and the project chemist will meet to discuss the appropriate steps to resolve the problem, and will use the following list:

- Determine when and how the problem developed
- Assign responsibility for problem investigation and documentation
- Determine the corrective action to eliminate the problem
- Design a schedule for completion of the corrective action
- Assign responsibility for implementing the corrective action
- Document and verify that the corrective action has eliminated the problem
- Notify the Navy of the problem and the corrective action taken

### 3.1.5 Laboratory Corrective Action Procedures

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs: control limits are exceeded, method QC requirements are not met, or sample-holding times are exceeded. The laboratory will report out-of-control situations to the project chemist within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the project chemist. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

## 3.2 Reports to Management

Effective management of environmental data collection requires (1) timely assessment and review of all activities and (2) open communication, interaction, and feedback among all project participants. Earth Tech and Tetra Tech will use the reports described below to address any project-specific quality issues and to facilitate timely communication of these issues.

### 3.2.1 Project Monthly Status Report

The Earth Tech CTO manager and Tetra Tech STO manager will prepare a monthly status report (MSR) to be submitted to the CLEAN program manager and the Navy RPM. Monthly status reports address project-specific quality issues and facilitate their timely communication. The MSR will include the following quality-related information:

- Project status
- Instrument, equipment, or procedural problems that affect quality and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

If appropriate, similar information from project subcontractors will be obtained and incorporated in the MSR.

### 3.2.2 Data Quality Assessment Report

A DQAR will be included with the summary reports generated during these activities. The DQAR will include a summary and evaluation of QA/QC activities, including any field or laboratory assessments, completed during the Group B sampling. The DQAR will also indicate the location and duration of storage for the complete data packages. Particular emphasis will be placed on determining whether project DQOs were met and whether data are of adequate quality to support required decisions.

# 4. DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs for the project.

## 4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Validation and verification of the data generated during field and laboratory activities are essential to obtaining data of defensible and acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

### 4.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called "outliers." A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

### 4.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

### 4.1.3 Laboratory Data Validation

An independent third-party contractor will validate all laboratory data in accordance with current EPA national functional guidelines (EPA 1994, 1999b). The data validation strategy will be consistent with Navy guidelines. For this project, 10 percent of the data will undergo NFESC Level D validation and 90 percent of the data will undergo NFESC Level C validation. Data validation requirements are detailed in IRP Procedure II, *Data Validation Procedures* (DON 1998).

## 4.2 RECONCILIATION WITH USER REQUIREMENTS

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in Section 4.1, the data must be further evaluated to determine whether DQOs have been met. To the extent possible, the EPA data quality assessment (DQA) process will be followed to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's "Guidance for Data Quality Assessment, Practical Methods for Data Analysis" (2000b). The DQA process includes five steps: (1) review the DQOs and sampling design; (2) conduct a preliminary data review; (3) select a statistical test; (4) verify the assumptions of the statistical test; and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative in nature, data quality and data usability will be systematically assessed. This assessment will include:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives
- A review of project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and quantitation limits (Appendix B) to determine whether acceptance criteria have been met
- A review of project-specific DQOs to determine whether they have been achieved by the data collected
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

The DQAR report for the project will discuss any potential impacts of these reviews on data usability and will clearly define any limitations associated with the data.

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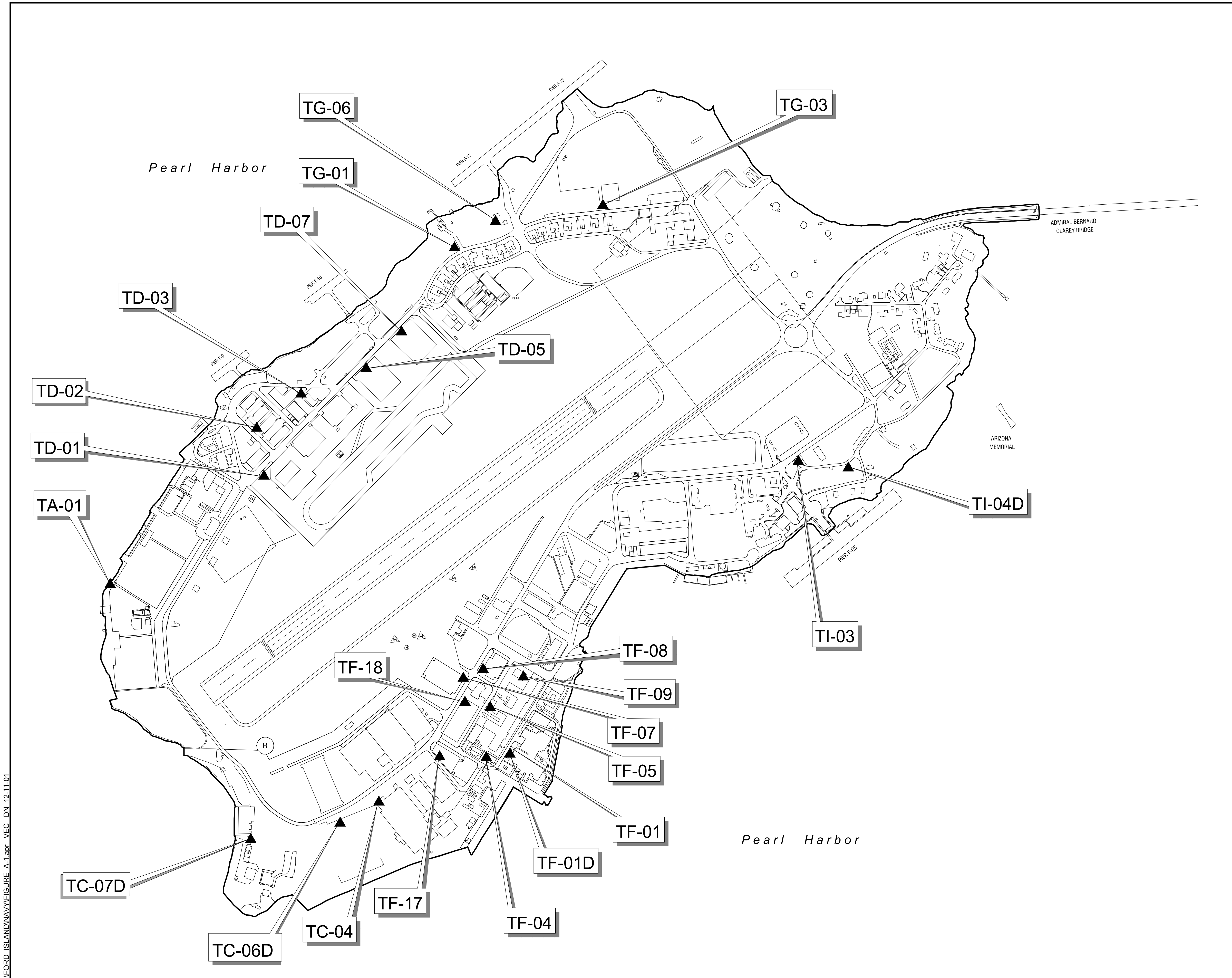
# Appendix A
# Figures




**LEGEND**

▲ TD-01 — Transformer Location and Designation

**SOURCES**

1. Towill, R.M. Corp. 1999.
2. ControlPoint Surveying, Inc. August 2000.

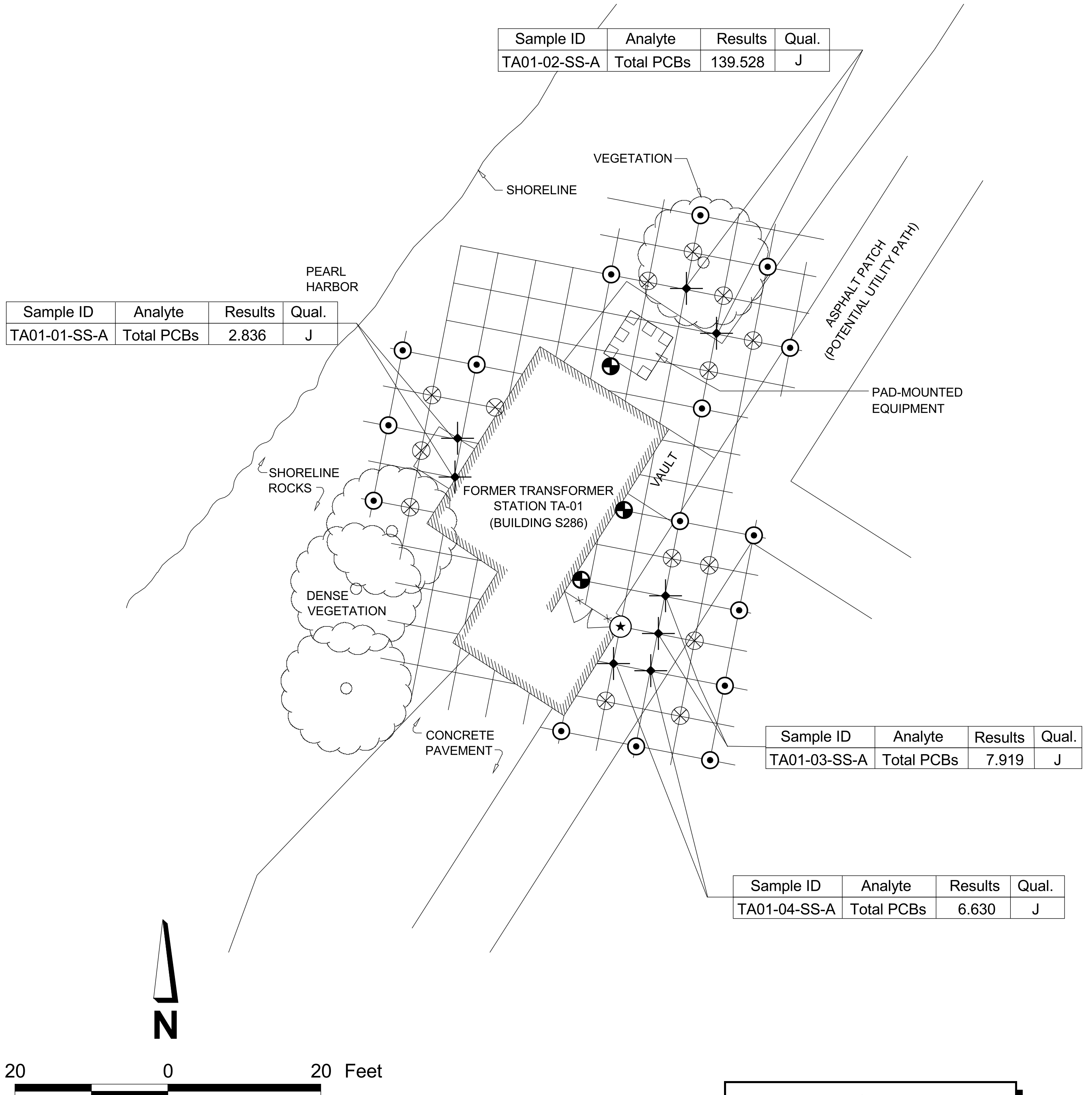
N

700 0 700

Scale in Feet

O:\FORD ISLAND\NAVY\FIGURE A-1.apr VEC DN 12-11-01

**Figure A-1**
**Facility Location Map**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TA01-02-SS-A | Total PCBs | 139.528 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TA01-01-SS-A | Total PCBs | 2.836 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TA01-03-SS-A | Total PCBs | 7.919 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TA01-04-SS-A | Total PCBs | 6.630 | J |

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**LEGEND**

- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

**Figure A-2**
**Proposed Pre-excavation Sample Location Map**
**Transformer TA-01**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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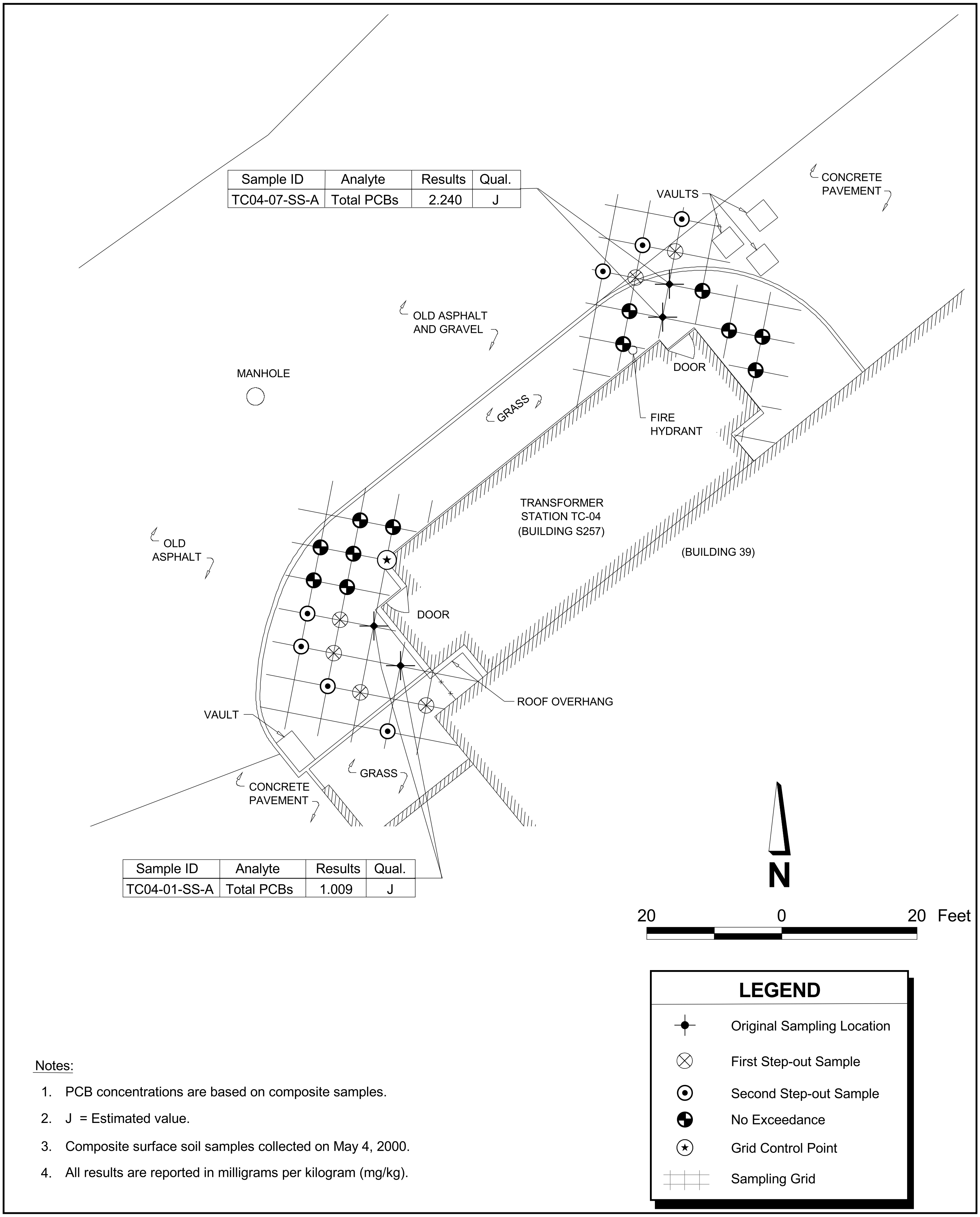


Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-3**
**Proposed Pre-excavation Sample Location Map**
**Transformer TC-04**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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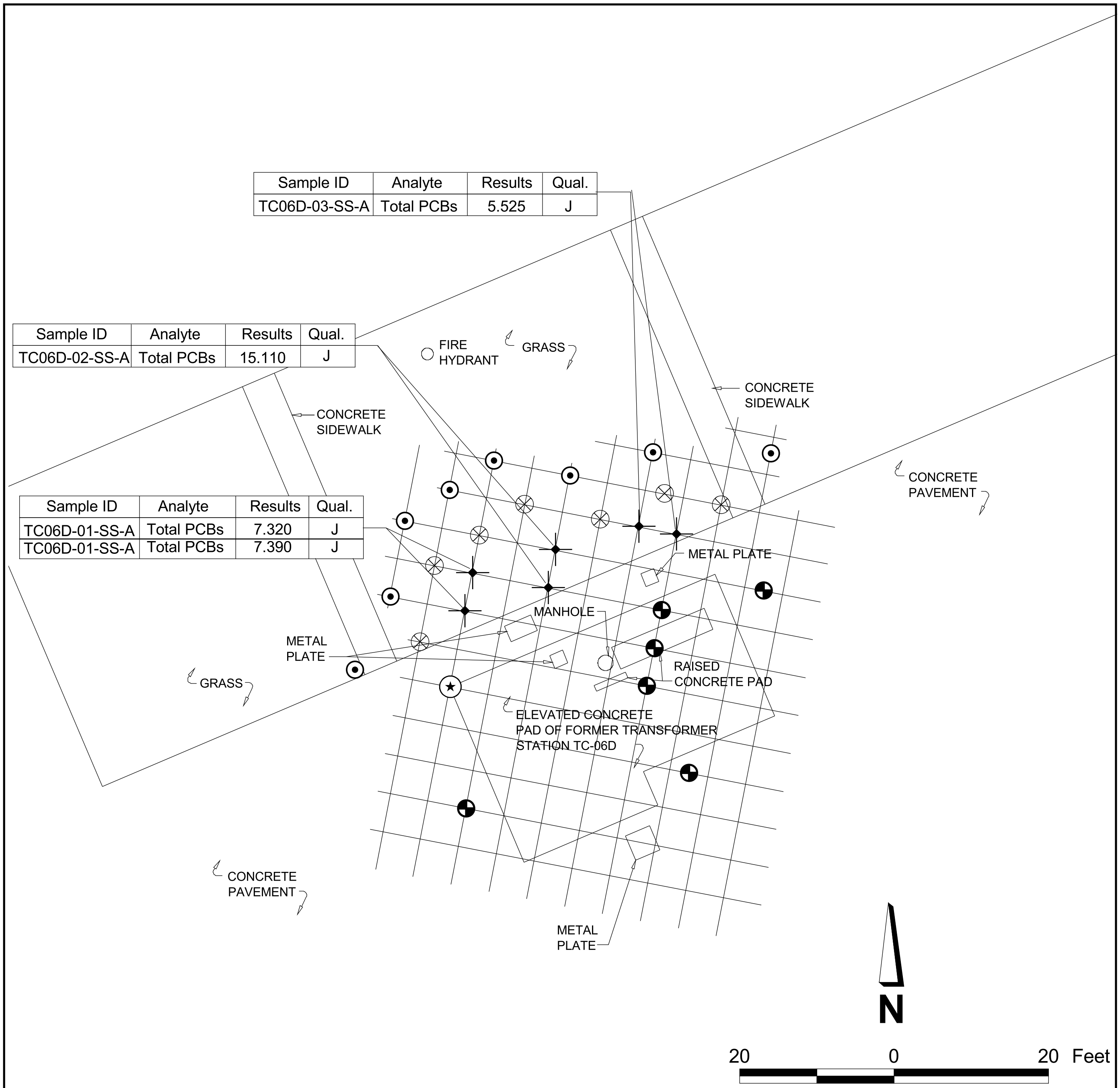


**LEGEND**

- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-4**
**Proposed Pre-excavation Sample Location Map**
**Transformer TC-06D**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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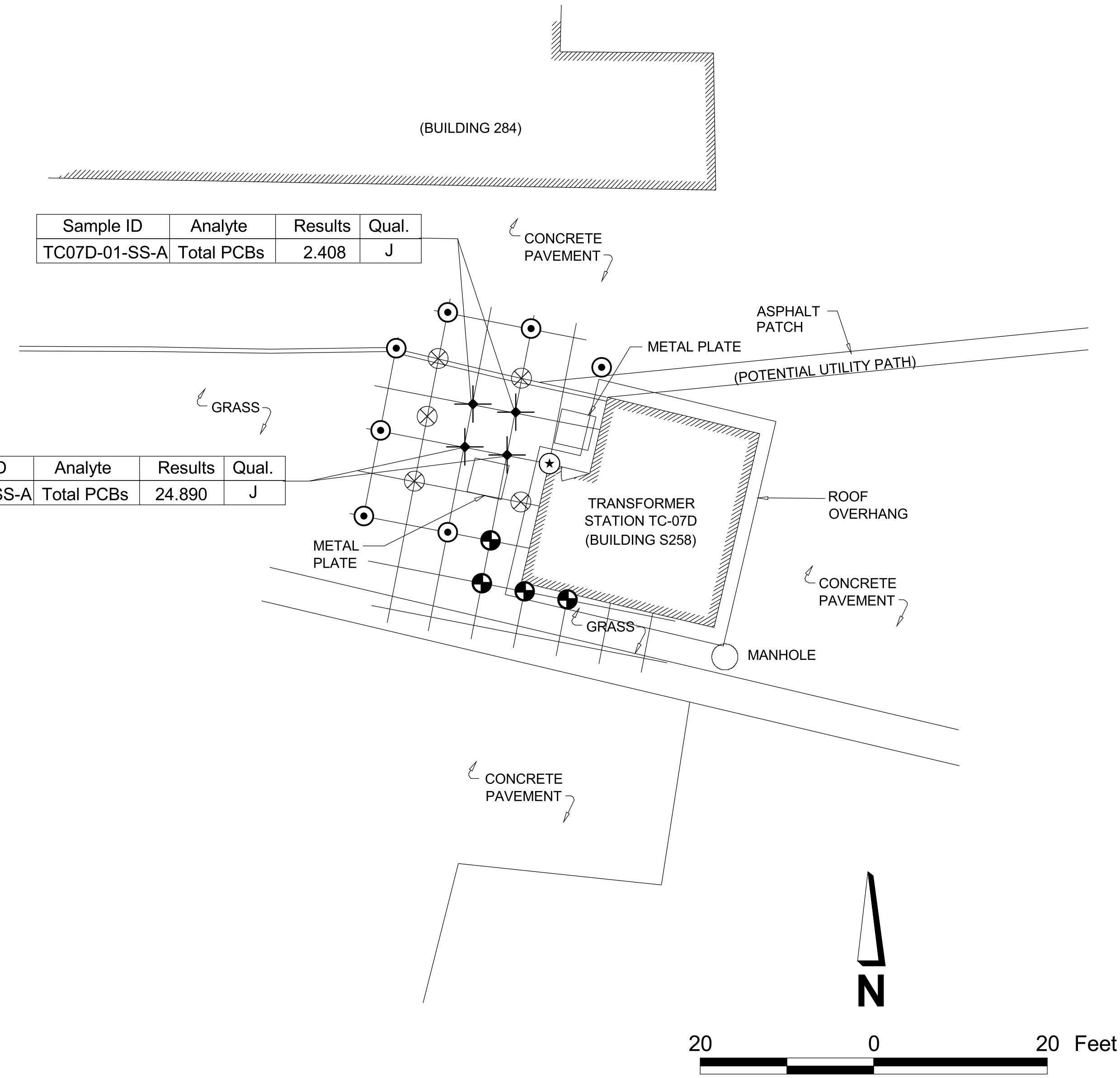


| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TC07D-01-SS-A | Total PCBs | 2.408 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TC07D-02-SS-A | Total PCBs | 24.890 | J |

**LEGEND**

- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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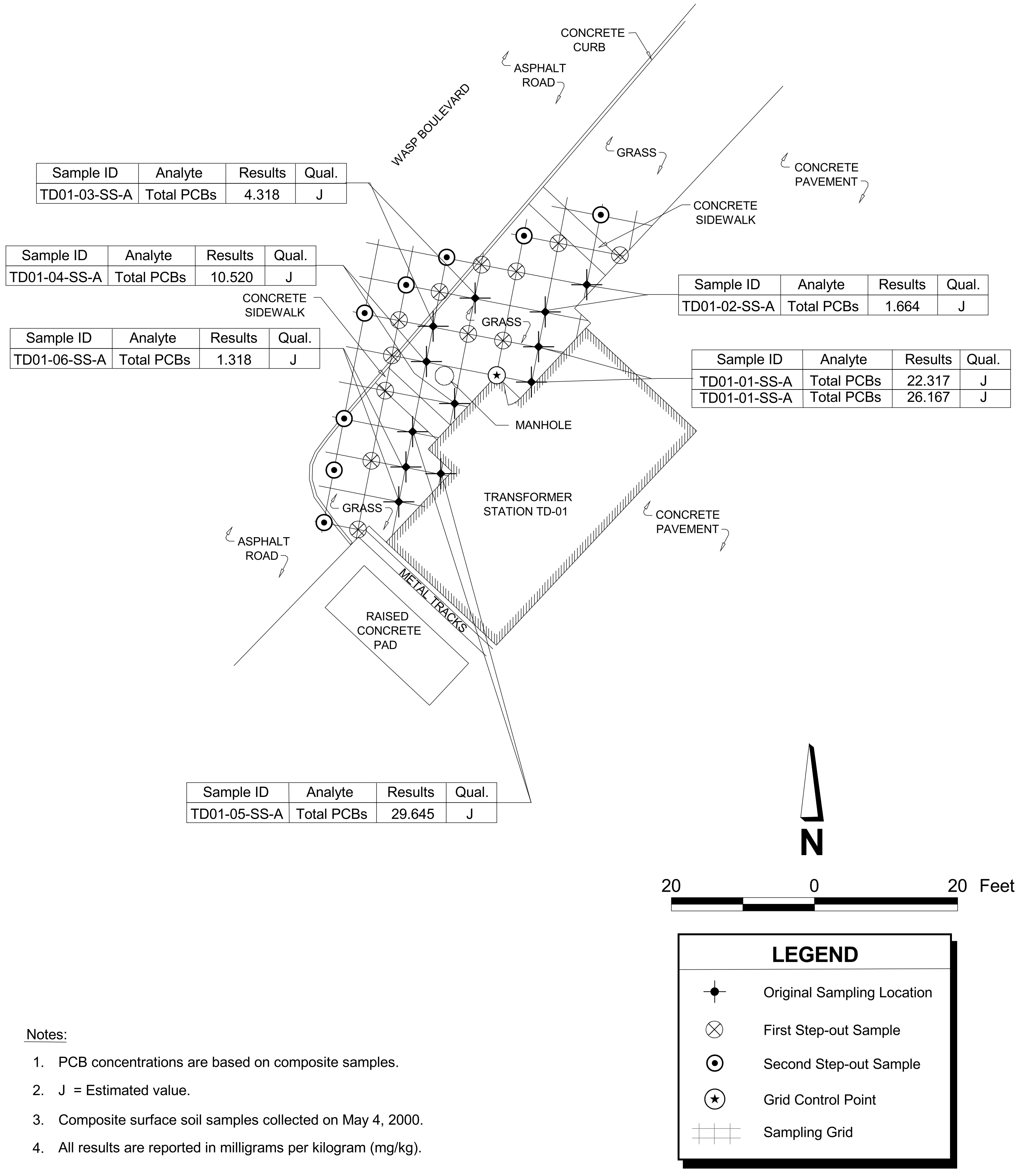
**Figure A-5**
**Proposed Pre-excavation Sample Location Map**
**Transformer TC-07D**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD01-03-SS-A | Total PCBs | 4.318 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD01-04-SS-A | Total PCBs | 10.520 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD01-06-SS-A | Total PCBs | 1.318 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD01-02-SS-A | Total PCBs | 1.664 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD01-01-SS-A | Total PCBs | 22.317 | J |
| TD01-01-SS-A | Total PCBs | 26.167 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD01-05-SS-A | Total PCBs | 29.645 | J |

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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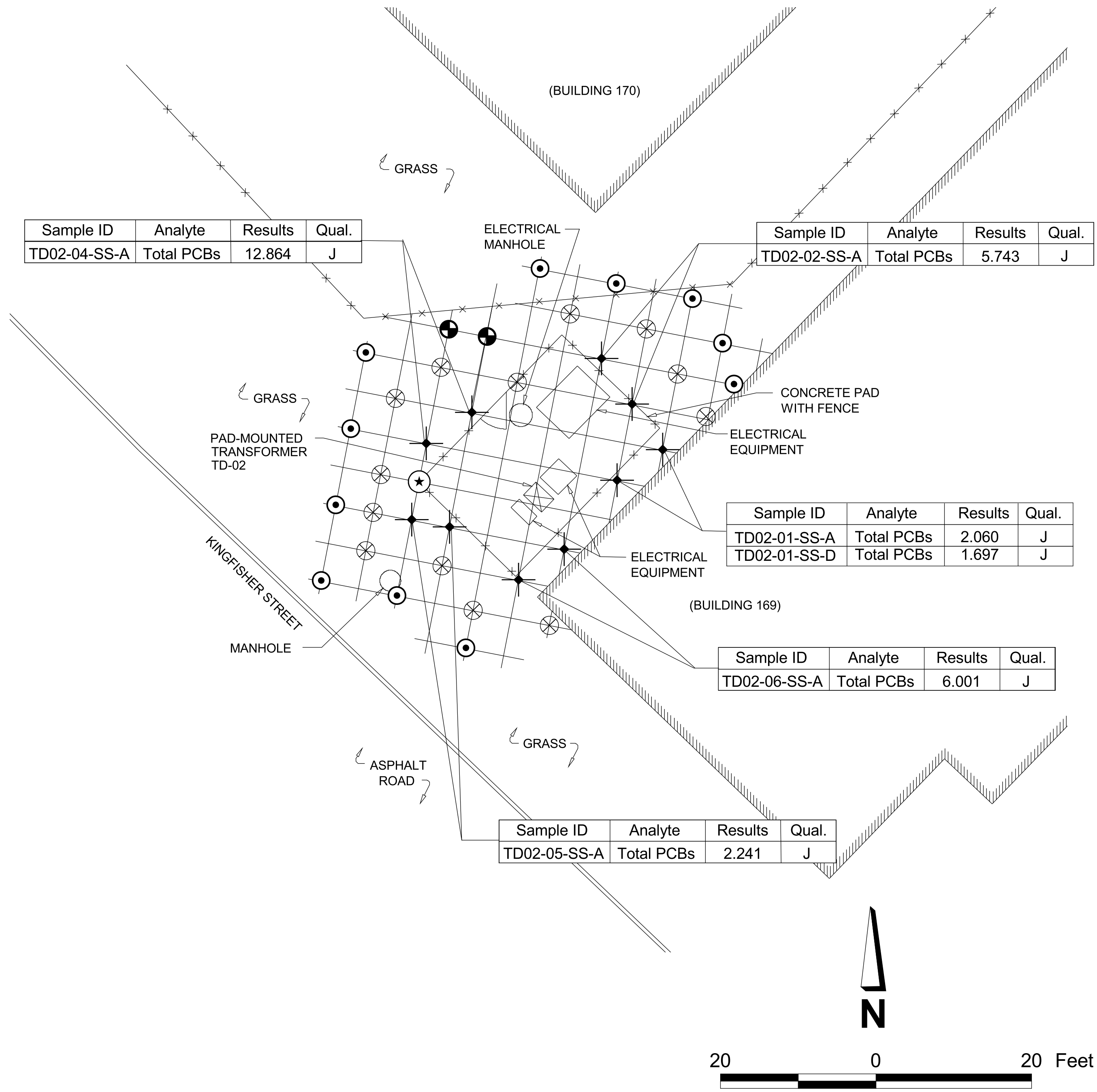
**Figure A-6**
**Proposed Pre-excavation Sample Location Map**
**Transformer TD-01**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD02-04-SS-A | Total PCBs | 12.864 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD02-02-SS-A | Total PCBs | 5.743 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD02-01-SS-A | Total PCBs | 2.060 | J |
| TD02-01-SS-D | Total PCBs | 1.697 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD02-06-SS-A | Total PCBs | 6.001 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD02-05-SS-A | Total PCBs | 2.241 | J |

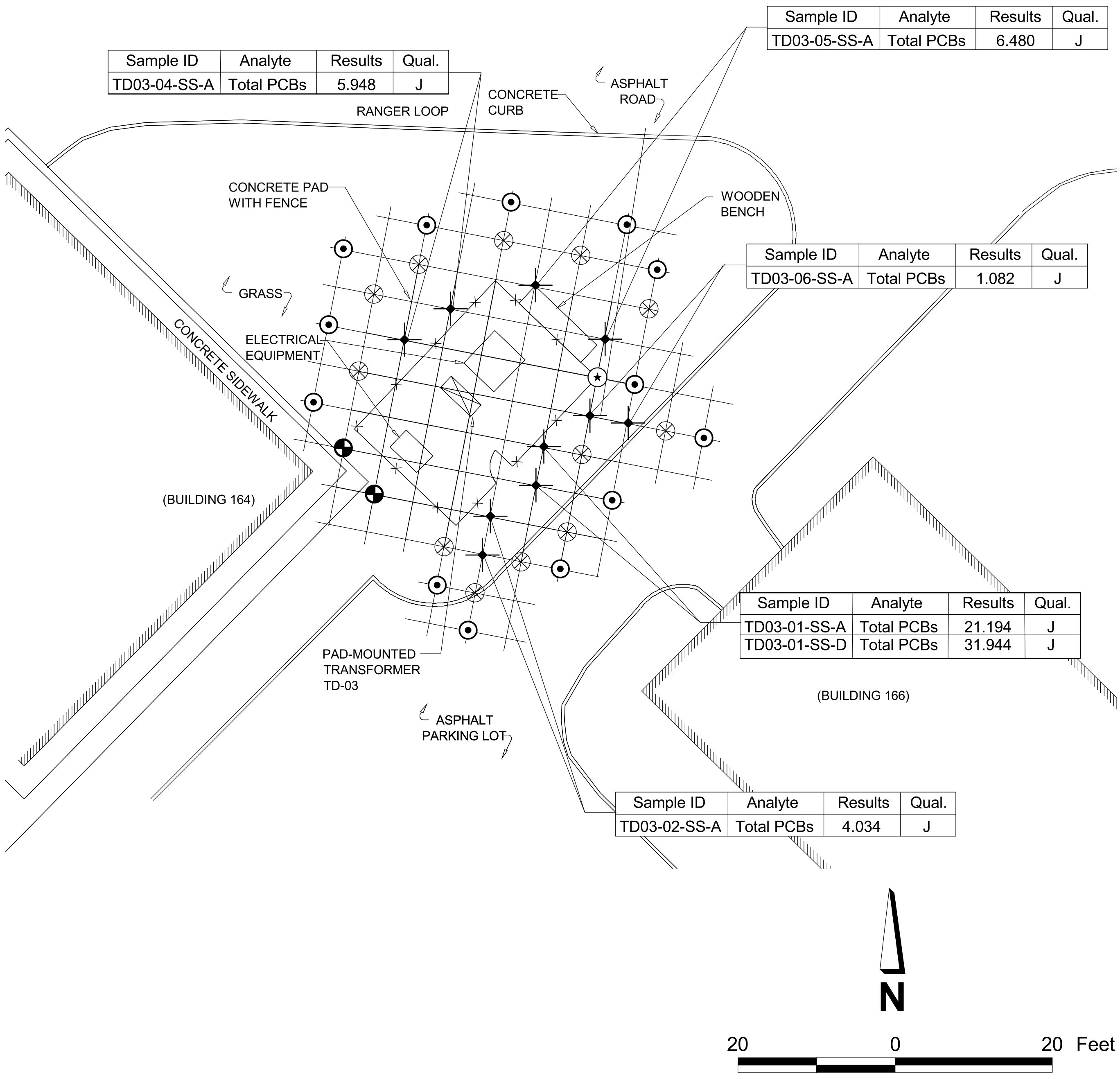
**LEGEND**

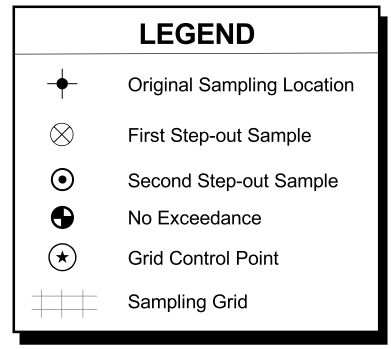
- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-7**
**Proposed Pre-excavation Sample Location Map**
**Transformer TD-02**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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**Figure A-8**
**Proposed Pre-excavation Sample Location Map**
**Transformer TD-03**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

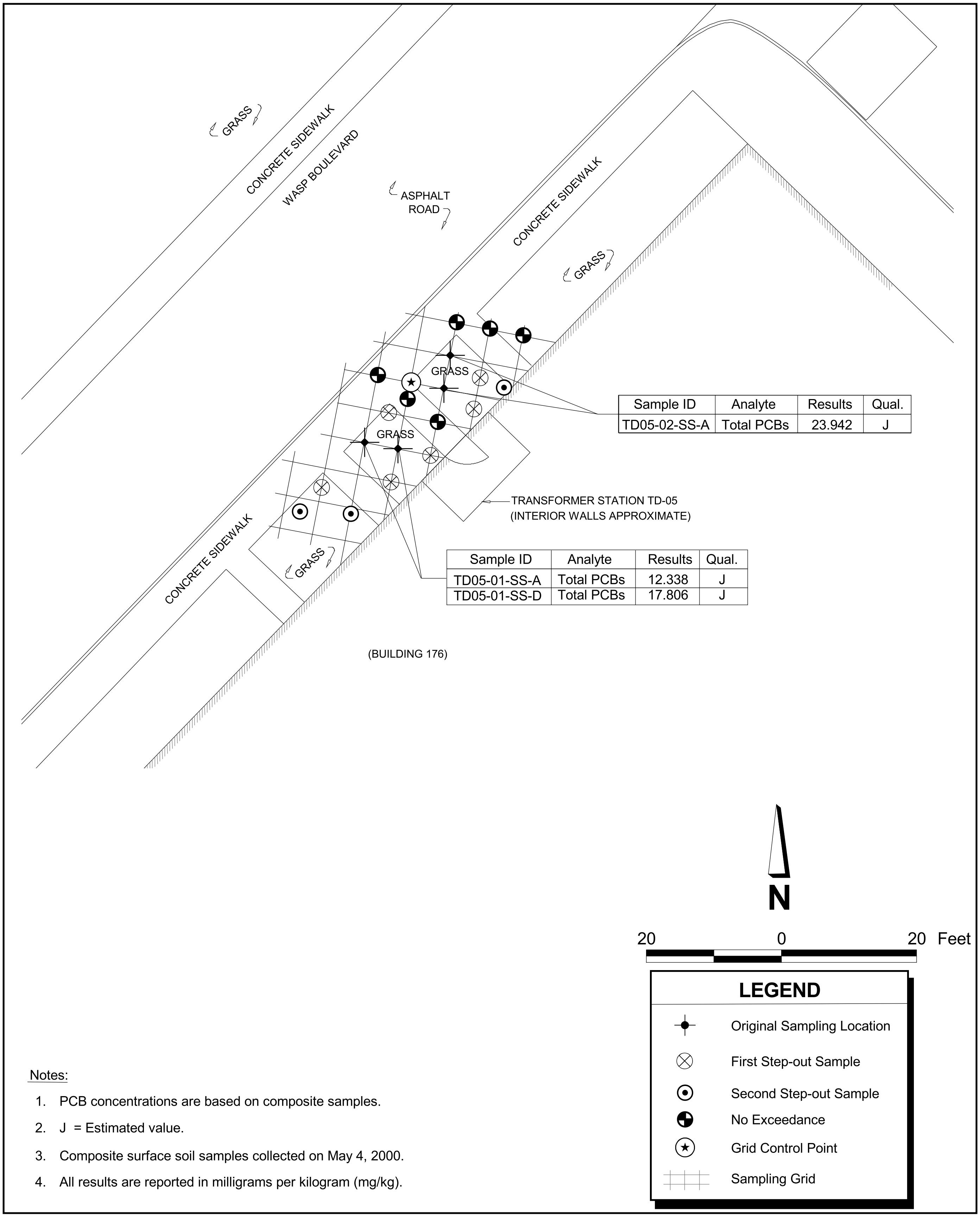


**Figure A-9**
**Proposed Pre-excavation Sample Location Map**
**Transformer TD-05**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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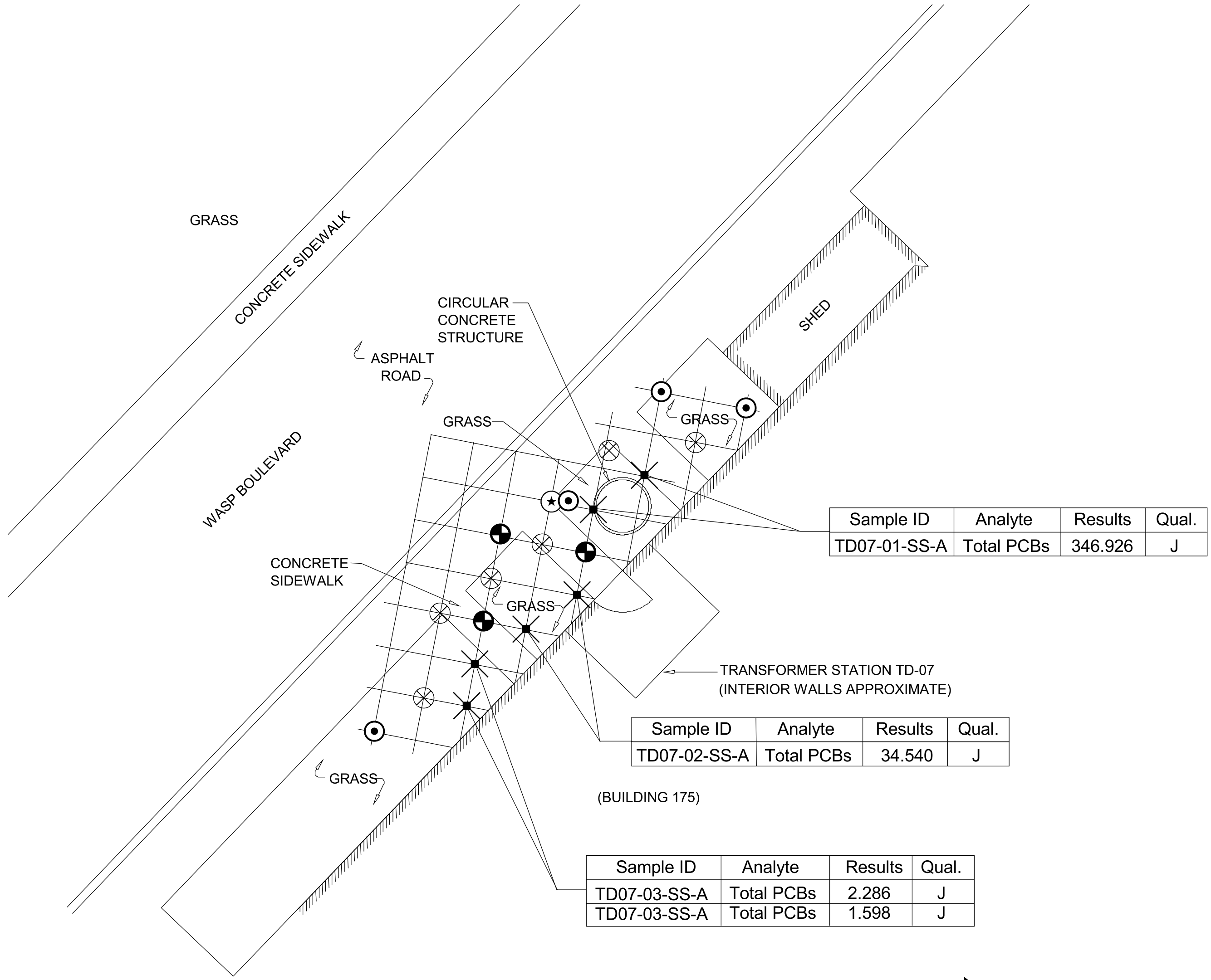
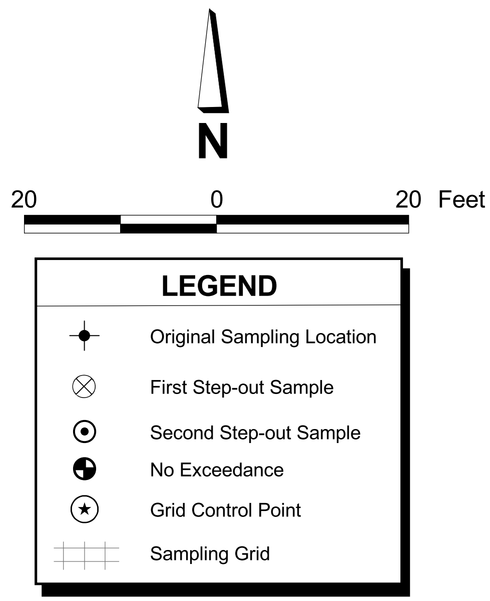



| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD07-01-SS-A | Total PCBs | 346.926 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD07-02-SS-A | Total PCBs | 34.540 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TD07-03-SS-A | Total PCBs | 2.286 | J |
| TD07-03-SS-A | Total PCBs | 1.598 | J |




Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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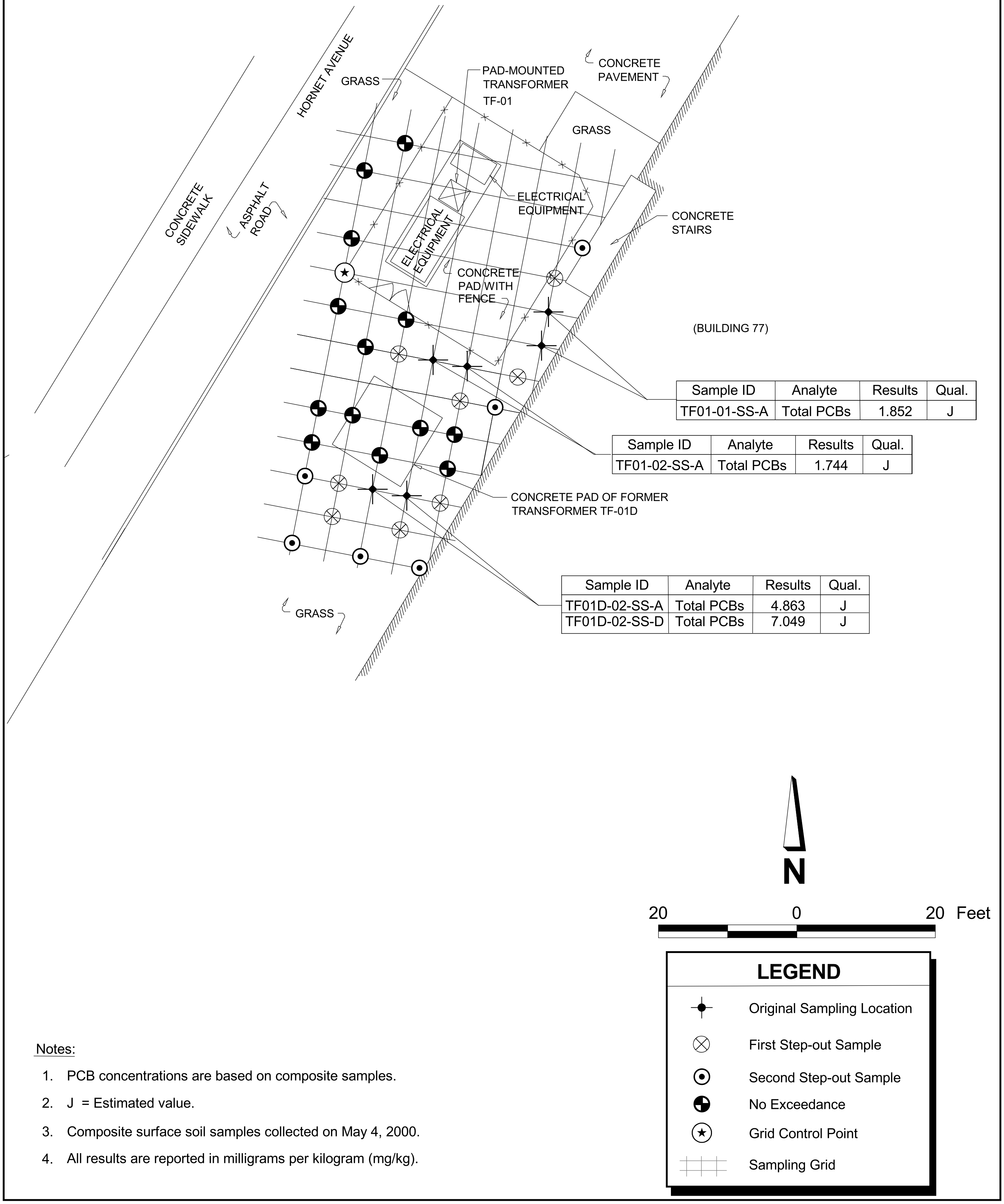
**Figure A-10**
**Proposed Pre-excavation Sample Location Map**
**Transformer TD-07**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF01-01-SS-A | Total PCBs | 1.852 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF01-02-SS-A | Total PCBs | 1.744 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF01D-02-SS-A | Total PCBs | 4.863 | J |
| TF01D-02-SS-D | Total PCBs | 7.049 | J |

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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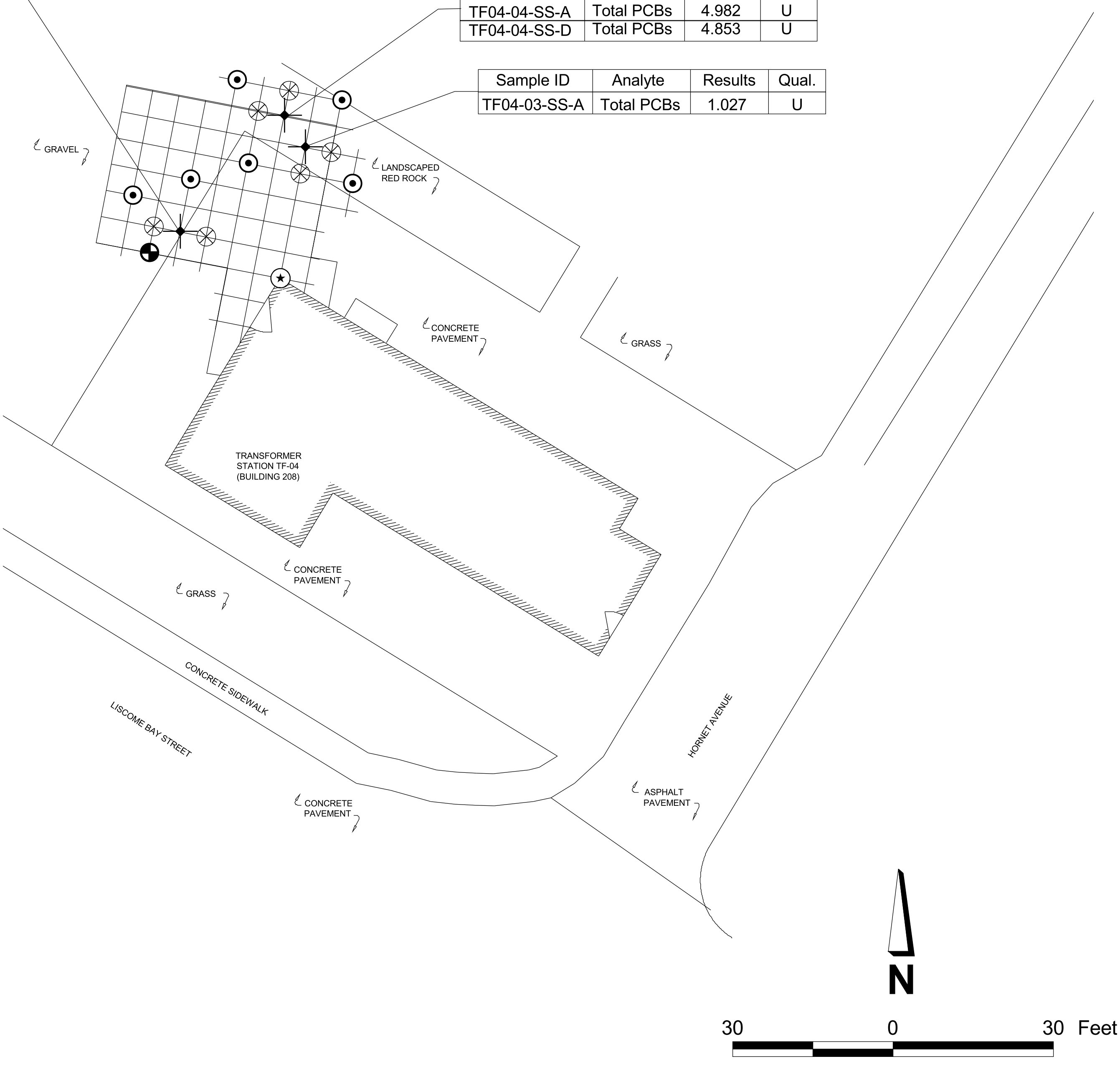
**Figure A-11**
**Proposed Pre-excavation Sample Location Map**
**Transformer TF-01 & TF-01D**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF04-01-SS-A | Total PCBs | 1.022 | U |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF04-04-SS-A | Total PCBs | 4.982 | U |
| TF04-04-SS-D | Total PCBs | 4.853 | U |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF04-03-SS-A | Total PCBs | 1.027 | U |




**LEGEND**

- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

Notes:

1. PCB concentrations are based on composite samples.
2. U = Analyte not detected at or above posted method detection limit.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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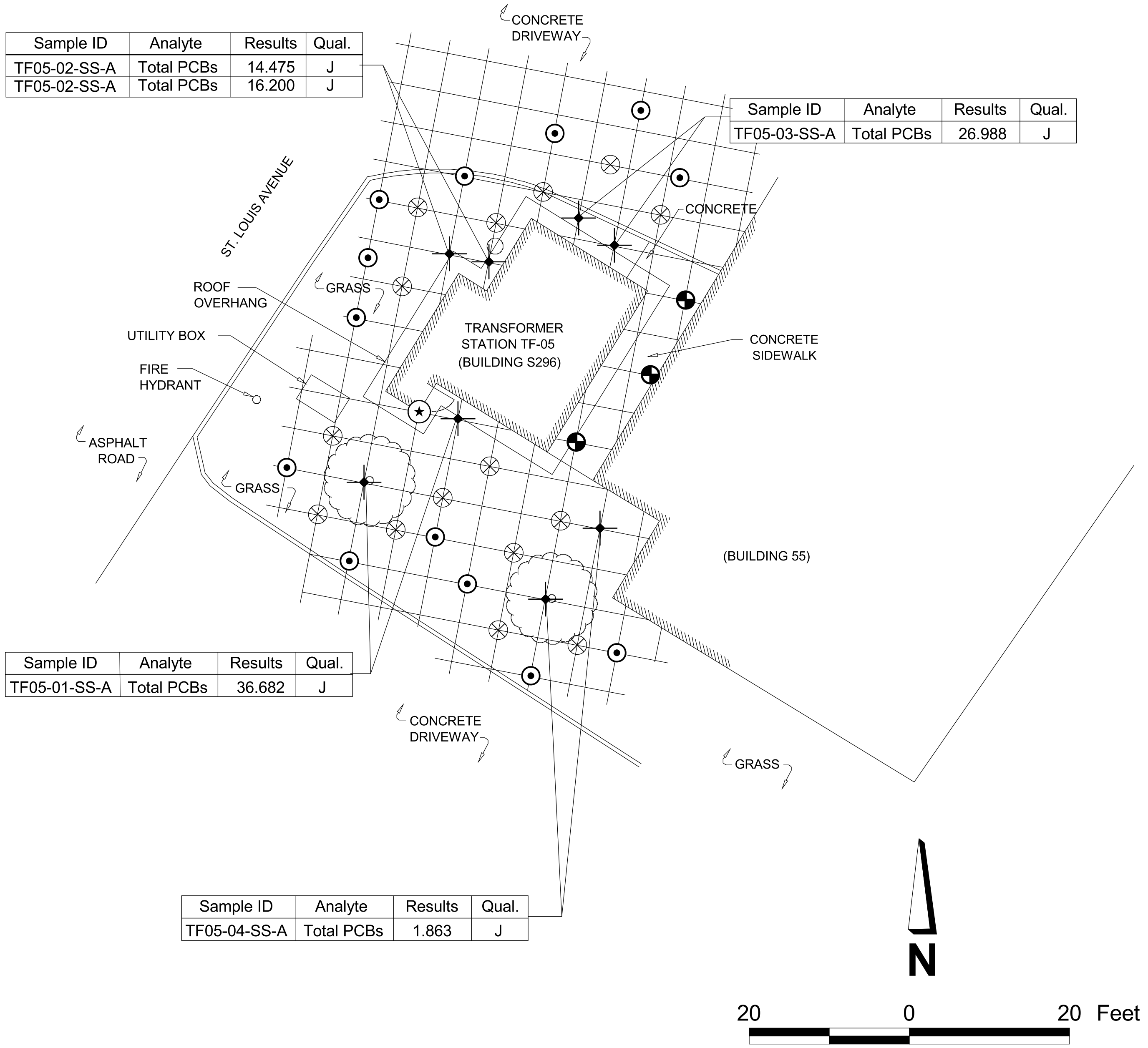
**Figure A-12**
**Proposed Pre-excavation Sample Location Map**
**Transformer TF-04**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF05-02-SS-A | Total PCBs | 14.475 | J |
| TF05-02-SS-A | Total PCBs | 16.200 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF05-03-SS-A | Total PCBs | 26.988 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF05-01-SS-A | Total PCBs | 36.682 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF05-04-SS-A | Total PCBs | 1.863 | J |

**LEGEND**

- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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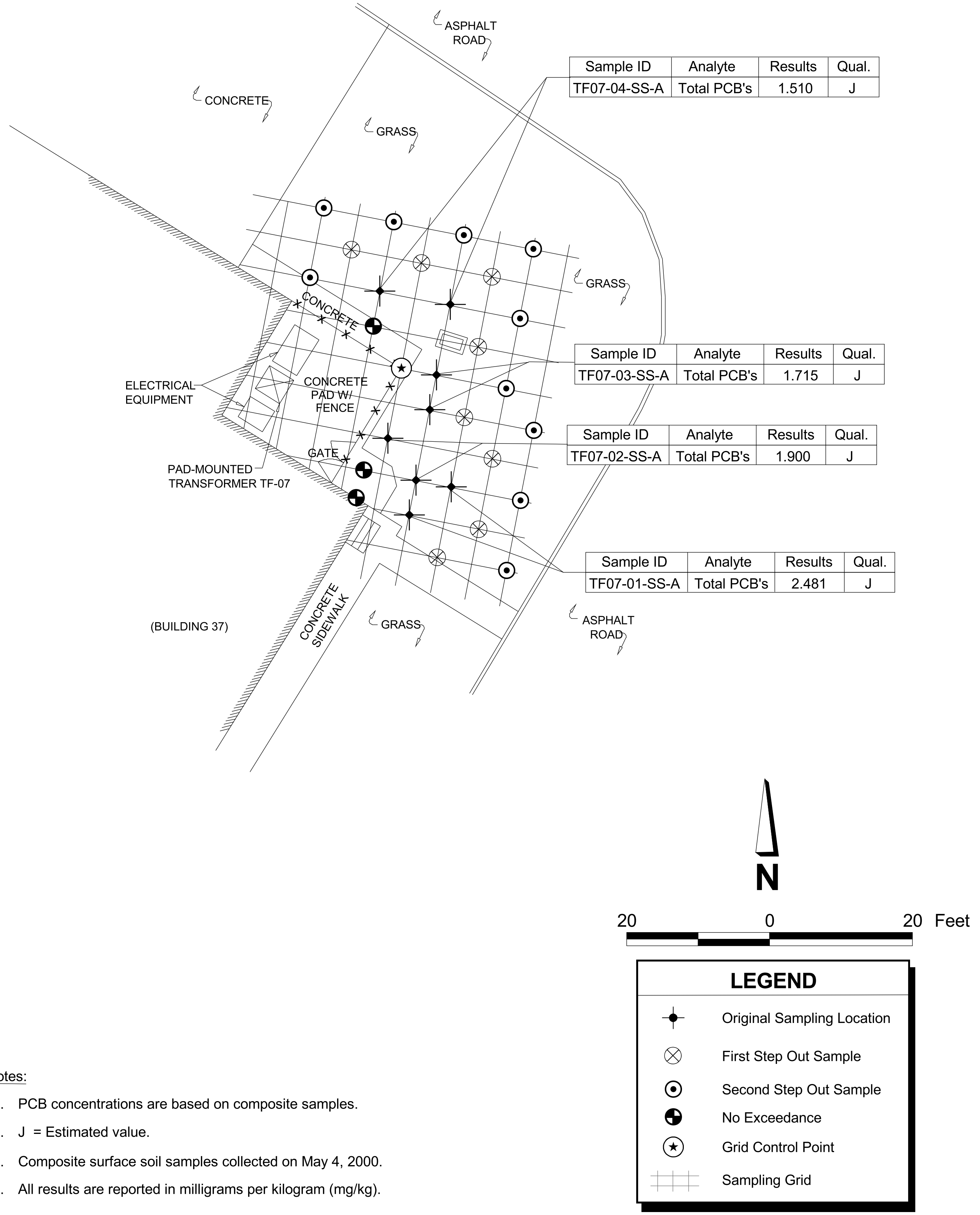
**Figure A-13**
**Proposed Pre-Excavation Sample Location Map**
**Transformer TF-05**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF07-04-SS-A | Total PCB's | 1.510 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF07-03-SS-A | Total PCB's | 1.715 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF07-02-SS-A | Total PCB's | 1.900 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF07-01-SS-A | Total PCB's | 2.481 | J |

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-14**
**Proposed Pre-excavation Sample Location Map**
**Transformer TF-07**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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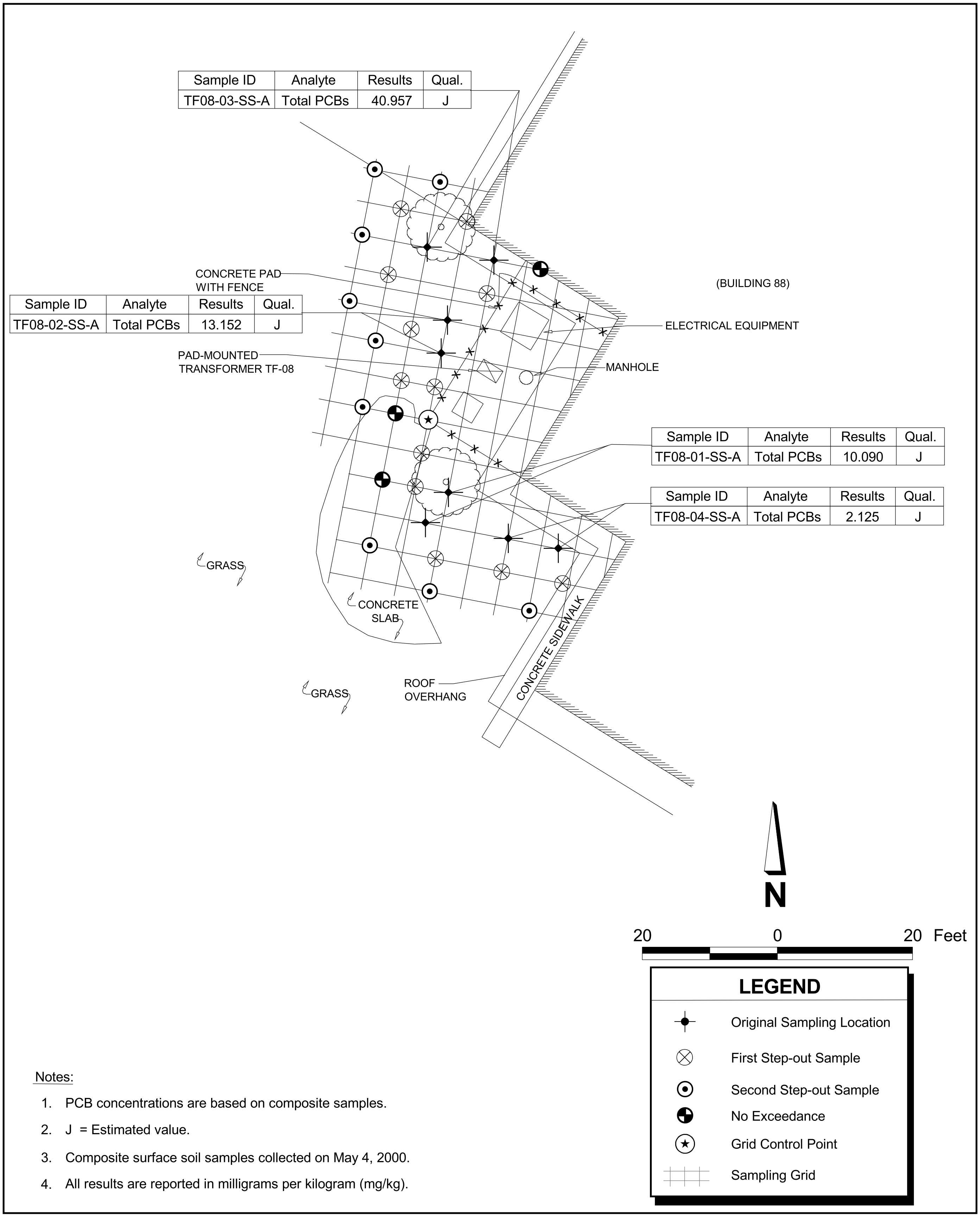


Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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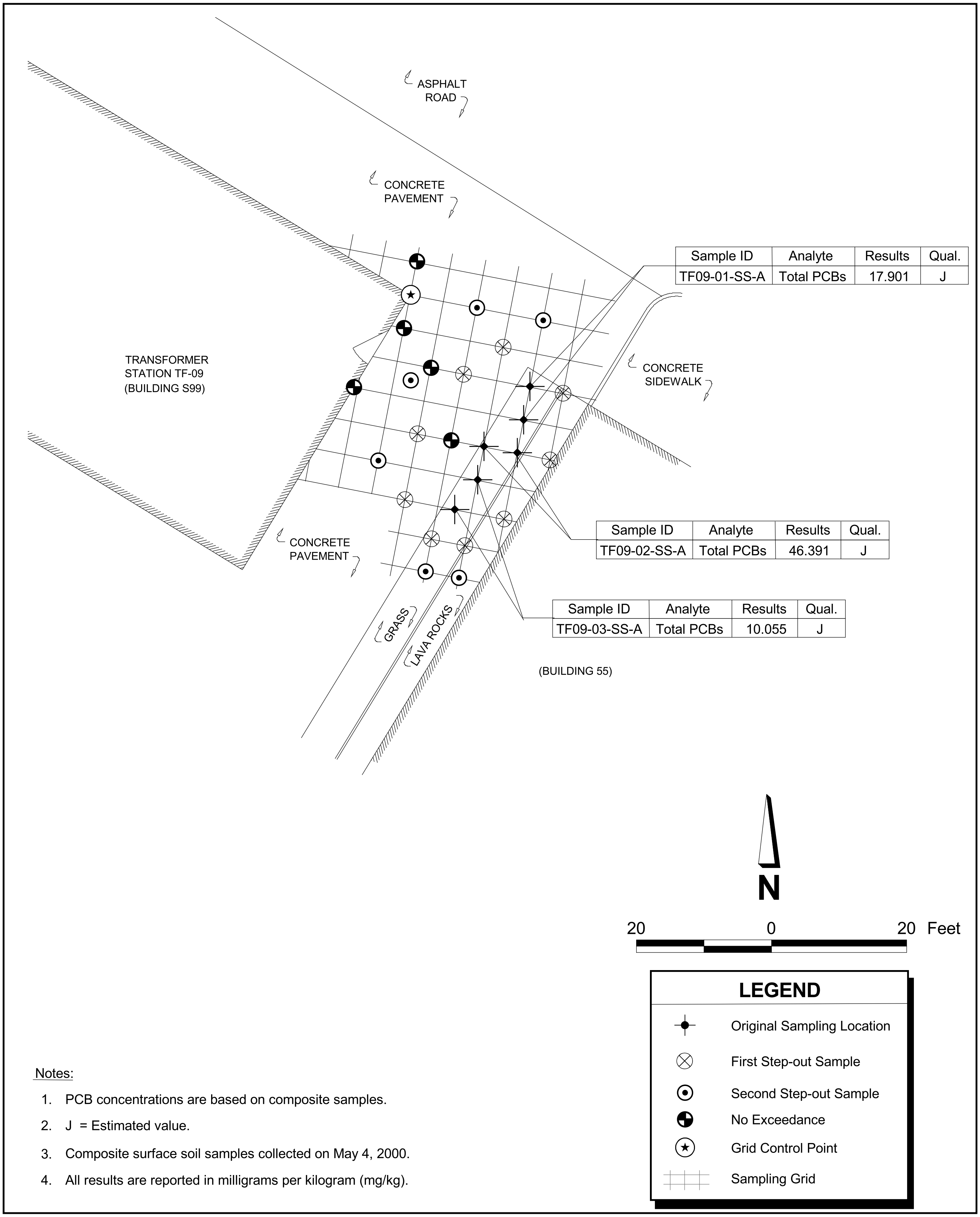
**Figure A-15**
**Proposed Pre-excavation Sample Location Map**
**Transformer TF-08**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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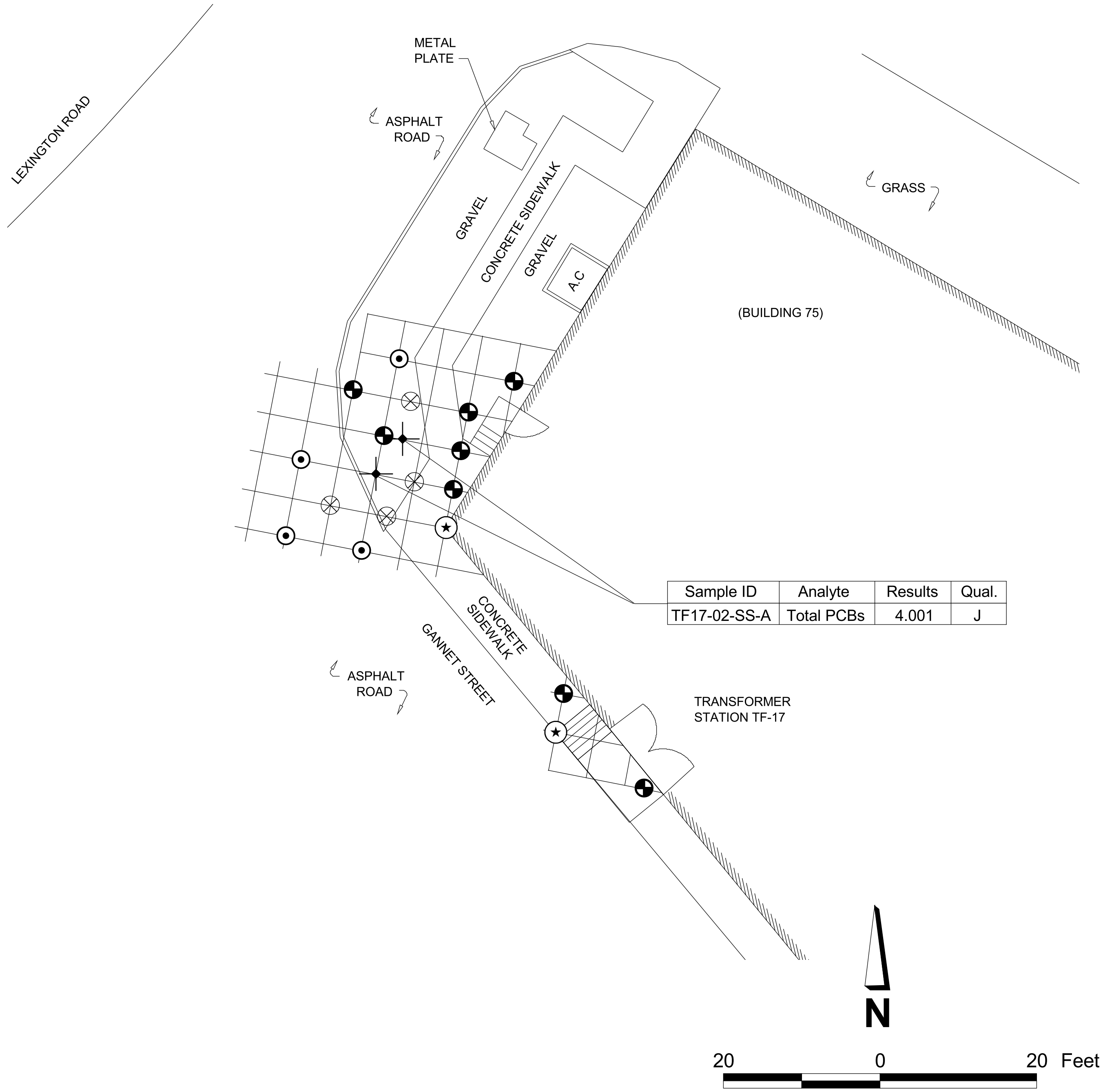
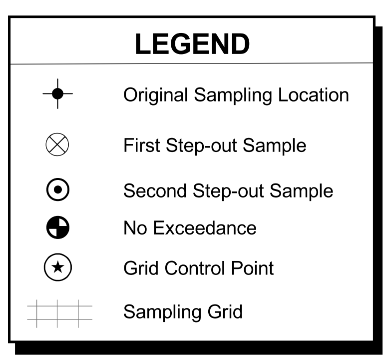
**Figure A-16**
**Proposed Pre-excavation Sample Location Map**
**Transformer TF-09**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF17-02-SS-A | Total PCBs | 4.001 | J |




Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-17**
**Proposed Pre-excavation Sample Location Map**
**Transformer TF-17**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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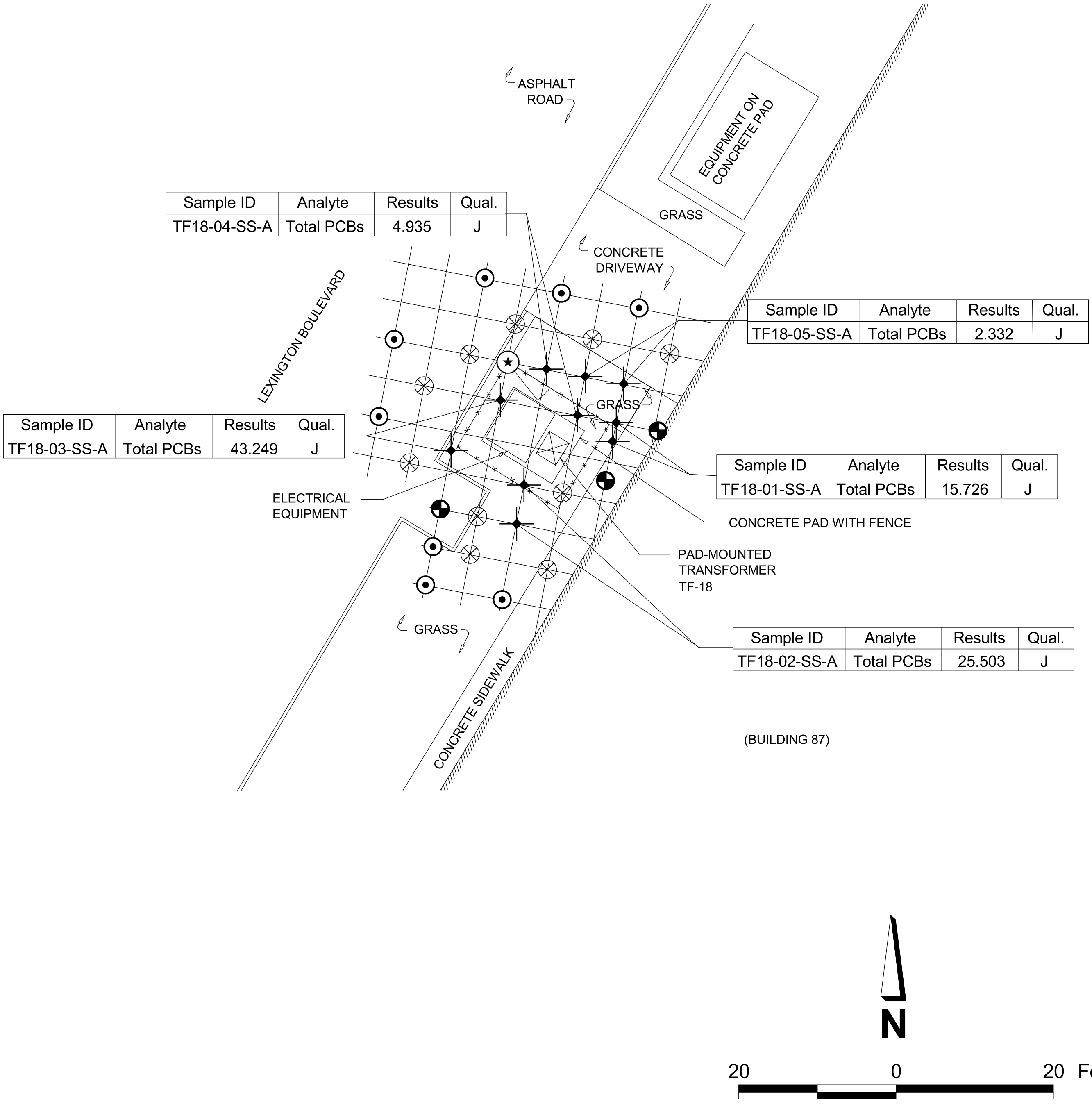


| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF18-04-SS-A | Total PCBs | 4.935 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF18-05-SS-A | Total PCBs | 2.332 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF18-03-SS-A | Total PCBs | 43.249 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF18-01-SS-A | Total PCBs | 15.726 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TF18-02-SS-A | Total PCBs | 25.503 | J |

**LEGEND**

- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-18**
**Proposed Pre-excavation Sample Location Map**
**Transformer TF-18**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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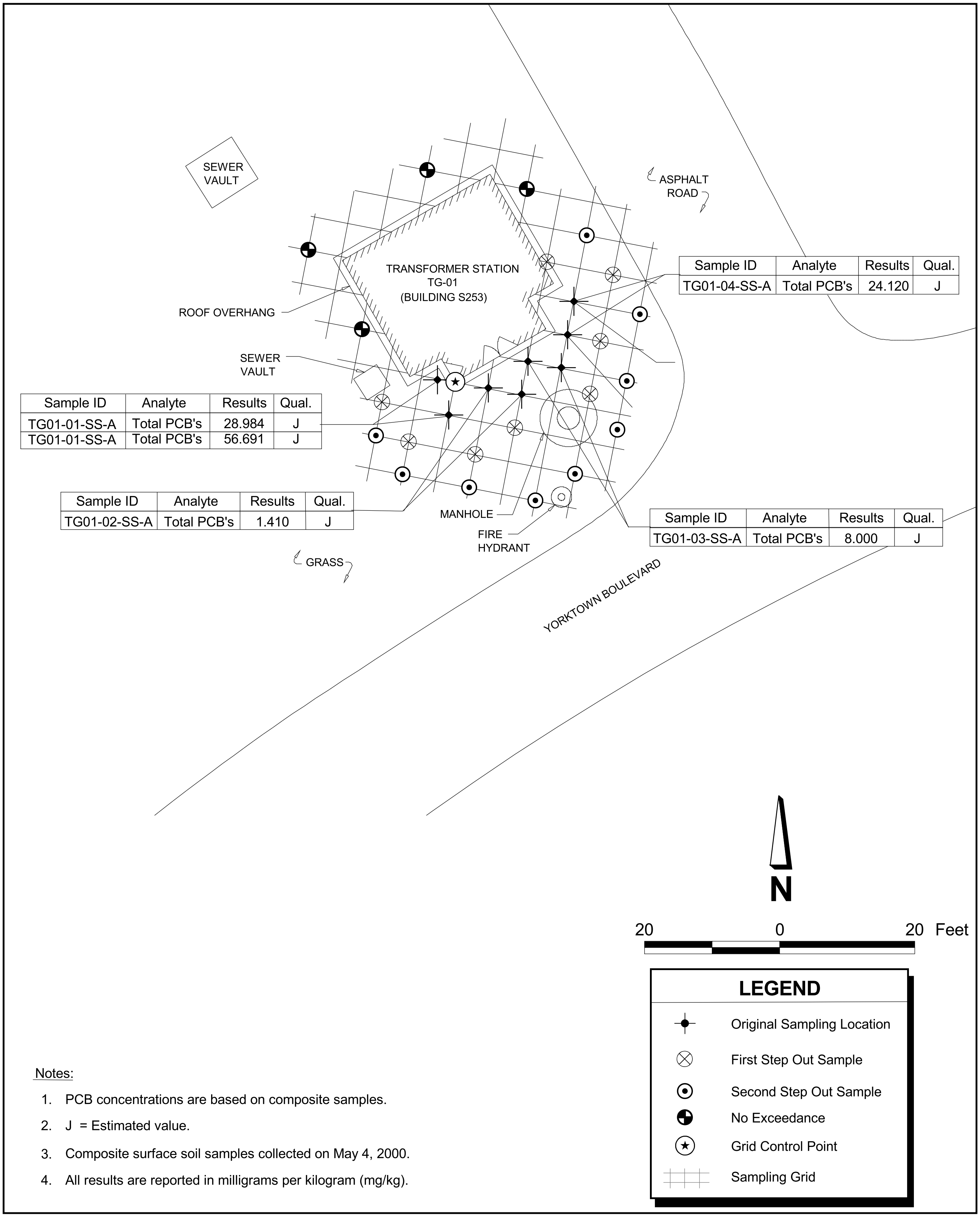


| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TG01-04-SS-A | Total PCB's | 24.120 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TG01-01-SS-A | Total PCB's | 28.984 | J |
| TG01-01-SS-A | Total PCB's | 56.691 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TG01-02-SS-A | Total PCB's | 1.410 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TG01-03-SS-A | Total PCB's | 8.000 | J |

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-19**
**Proposed Pre-excavation Sample Location Map**
**Transformer TG-01**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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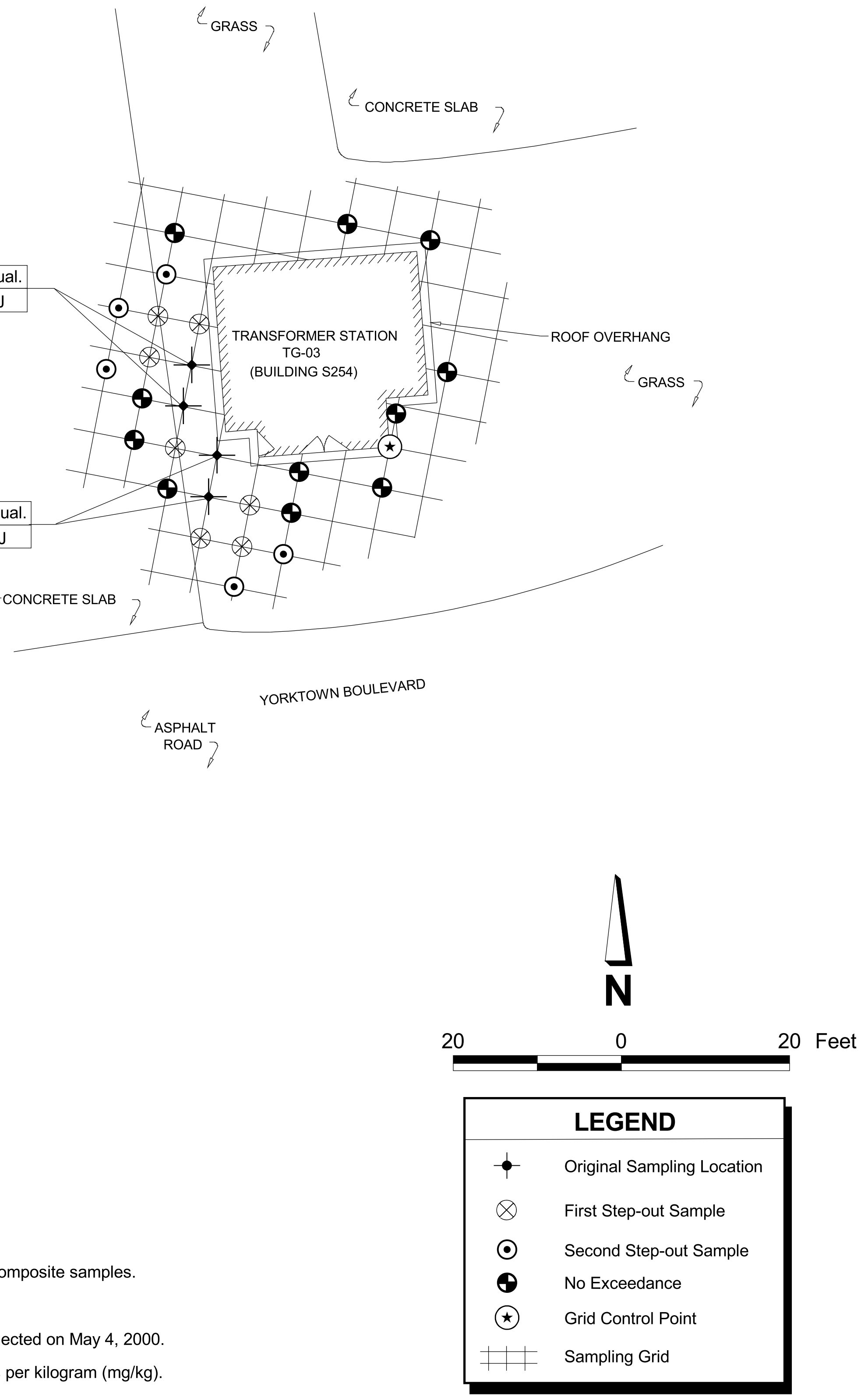


| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TG03-04-SS-A | Total PCBs | 32.334 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TG03-05-SS-A | Total PCBs | 7.053 | J |

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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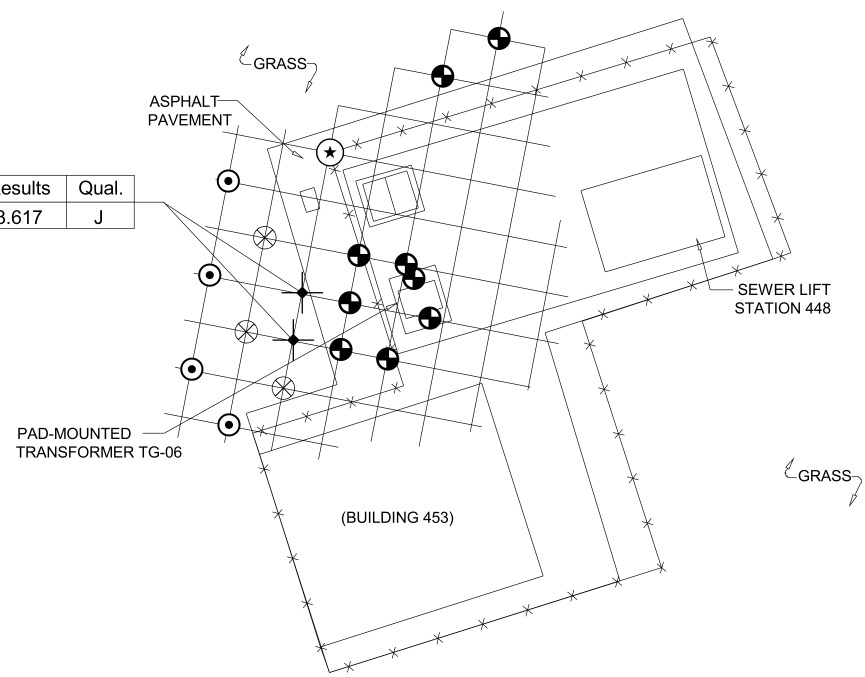
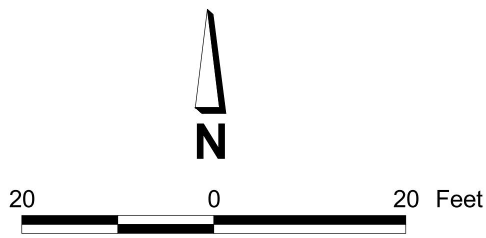
**Figure A-20**
**Proposed Pre-excavation Sample Location Map**
**Transformer TG-03**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TG06-03-SS-A | Total PCBs | 3.617 | J |




**LEGEND**

- Original Sampling Location
- First Step-out Sample
- Second Step-out Sample
- No Exceedance
- Grid Control Point
- Sampling Grid

Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

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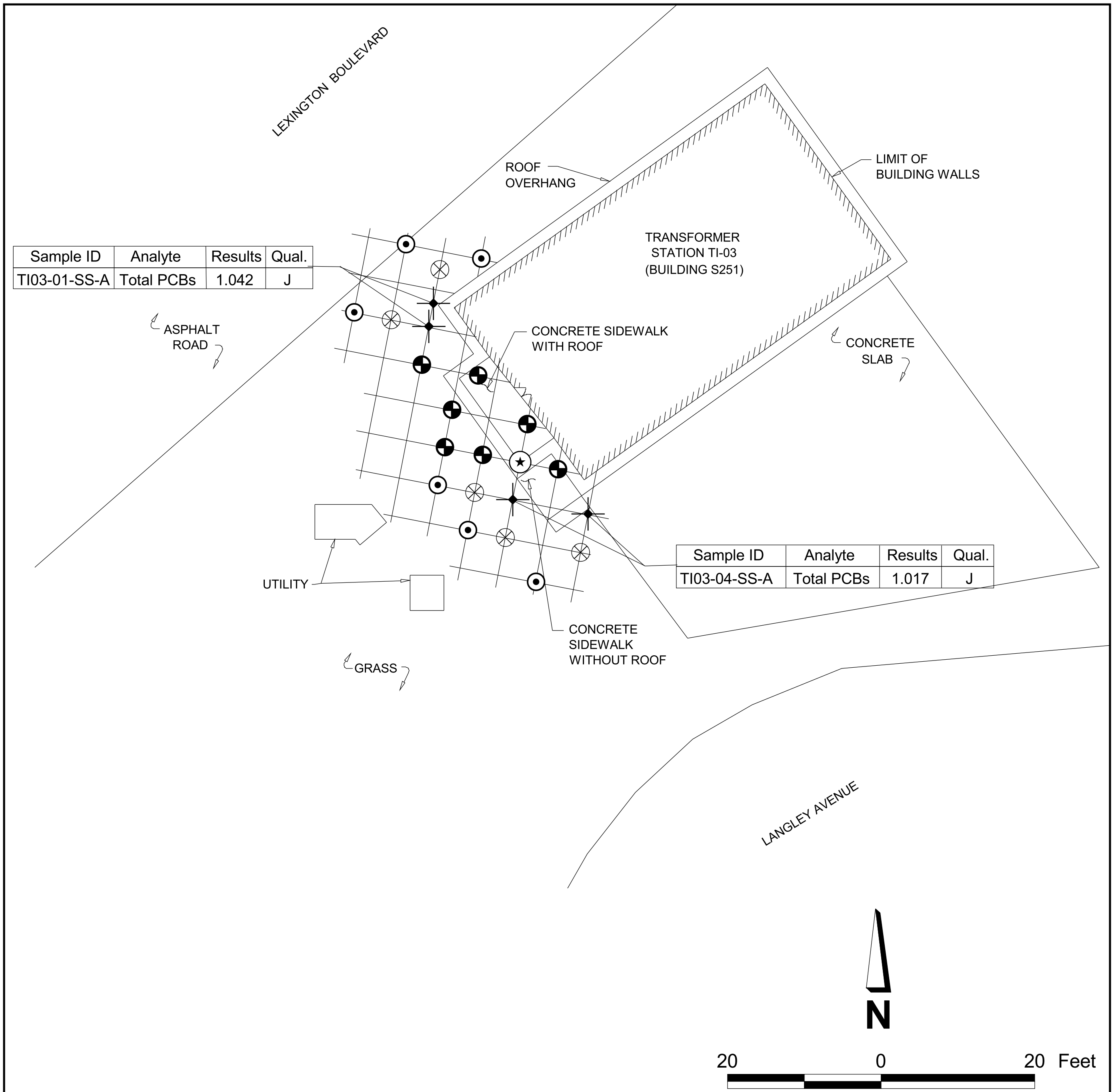
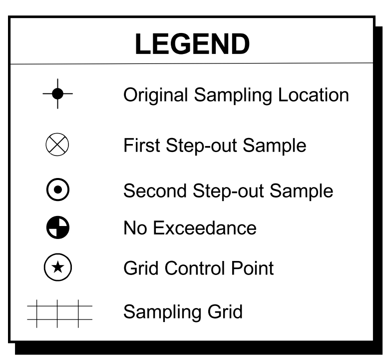
**Figure A-21**
**Proposed Pre-excavation Sample Location Map**
**Transformer TG-06**
**Ford Islandl, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TI03-01-SS-A | Total PCBs | 1.042 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TI03-04-SS-A | Total PCBs | 1.017 | J |

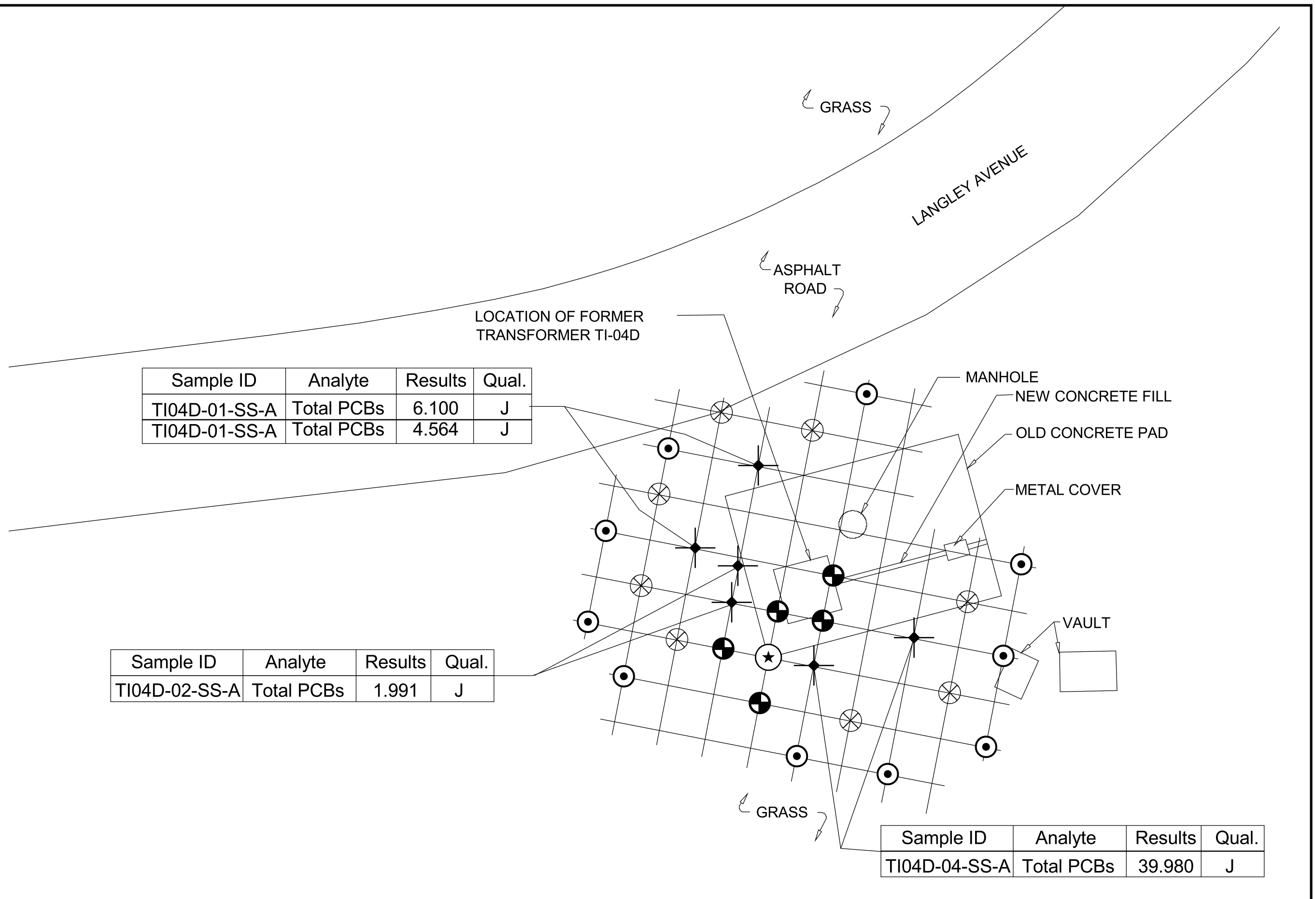



Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

C:\Ford_Island\Navy\ri-transformer-new.apr DN VEC 12-13-01

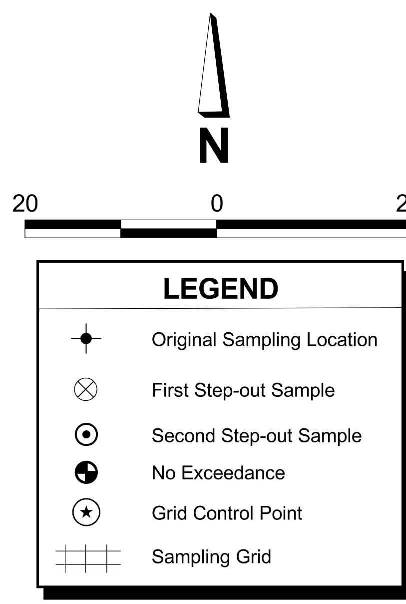
**Figure A-22**
**Proposed Pre-excavation Sample Location Map**
**Transformer TI-03**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**




| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TI04D-01-SS-A | Total PCBs | 6.100 | J |
| TI04D-01-SS-A | Total PCBs | 4.564 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TI04D-02-SS-A | Total PCBs | 1.991 | J |

| Sample ID | Analyte | Results | Qual. |
|---|---|---|---|
| TI04D-04-SS-A | Total PCBs | 39.980 | J |




Notes:

1. PCB concentrations are based on composite samples.
2. J = Estimated value.
3. Composite surface soil samples collected on May 4, 2000.
4. All results are reported in milligrams per kilogram (mg/kg).

**Figure A-23**
**Proposed Pre-excavation Sample Location Map**
**Transformer TI-04D**
**Ford Island, Pearl Harbor Naval Complex**
**Oahu, Hawaii**

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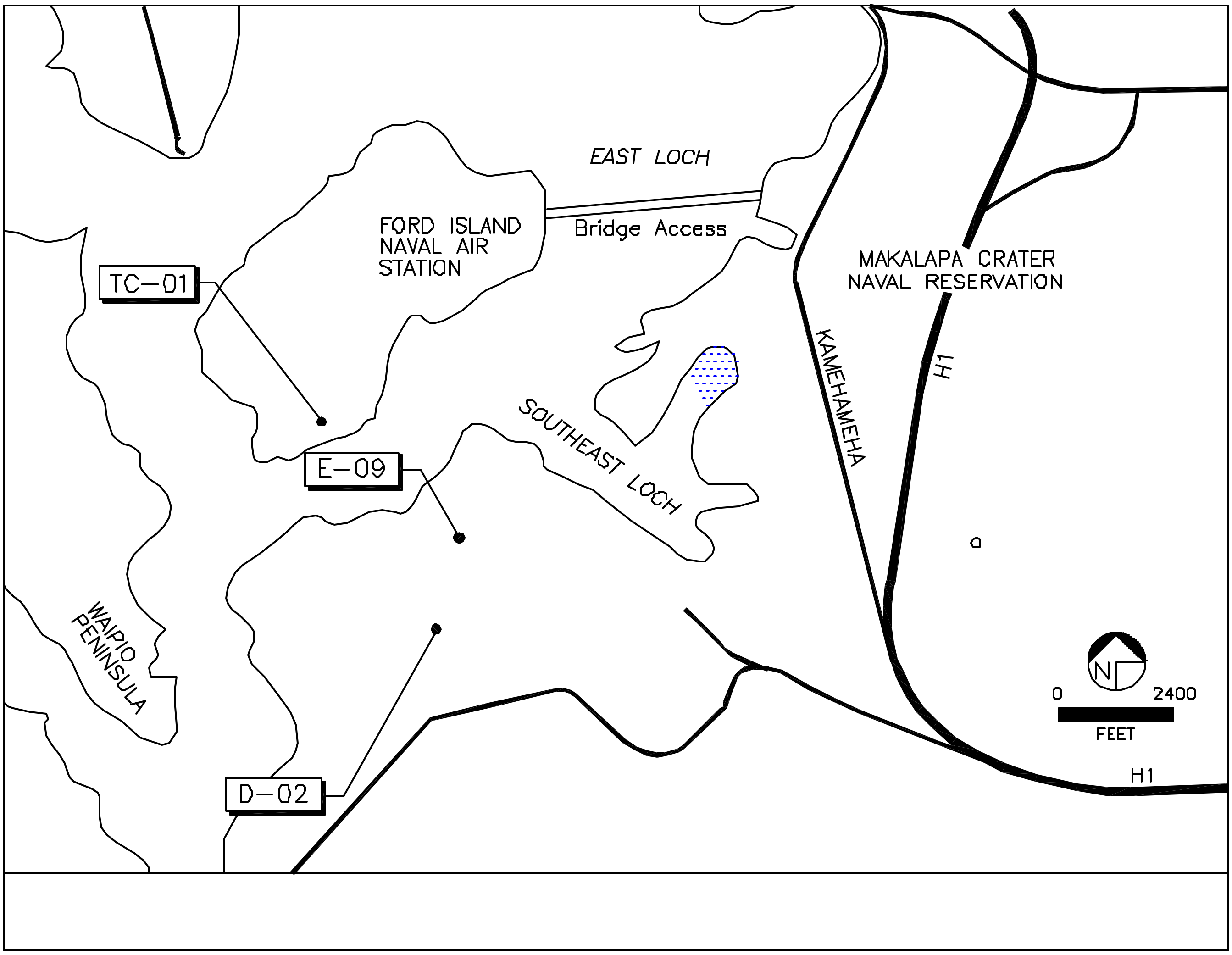
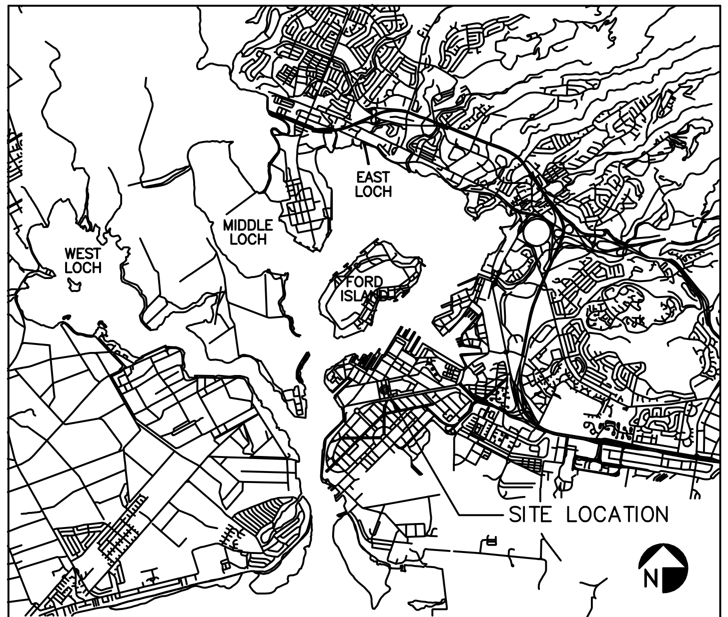



FIGURE A-24

FACILITY LOCATION MAP

Pearl Harbor Naval Complex
Oahu, Hawaii

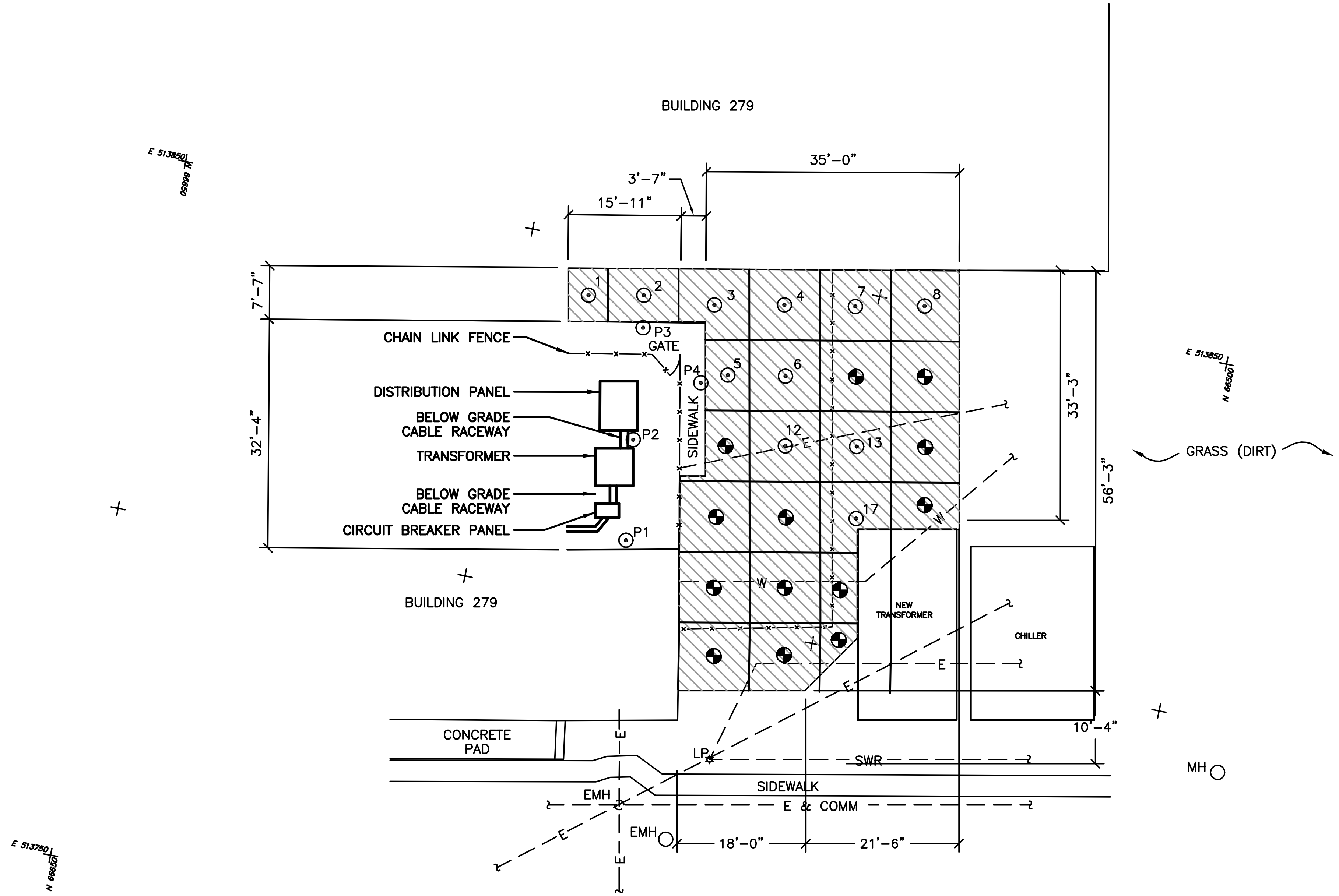
ACAD FILE: FIG2-1_LOCMAP.DWG




SITE VICINITY MAP
NOT TO SCALE

| LOCATION | ORIGINAL DEPTH | PCB (mg/kg) | Proposed boring depth and sample intervals |
|---|---|---|---|
| 1 | 5 | 2.5 | 5/7/9 |
| 2 | 7 | 16.0 | 7/9/11 |
| 3 | 7 | 6.1 | 7/9/11 |
| 4 | 8 | 1.6 | 8/10 |
| 5 | 3 | 7.6 | 3/5/7 |
| 6 | 3 | 5.8 | 3/5/7 |
| 7 | 2 | 2.7 | 2/4/6 |
| 8 | 2 | 1.3 | 2/4/6 |
| 12 | 3 | 9.2 | 3/5/7 |
| 13 | 2 | 17.0 | 2/4/6 |
| 17 | 2 | 3.7 | 2/4/6 |
| P1 | NA | NA | 2/4/6/8/10 |
| P2 | NA | NA | 2/4/6/8/10 |
| P3 | NA | NA | 2/4/6/8/10 |
| P4 | NA | NA | 2/4/6/8/10 |

NA – No samples were collected from soils beneath the transformer concrete pad during the removal action.




N

10 0 5 10 20
(SCALE IN FEET)
1 inch = 20 ft.

LEGEND

- AREA OF PREVIOUS SOIL EXCAVATION
- MH — MANHOLE
- EMH — ELECTRICAL MANHOLE
- — — E — — ELECTRICAL
- —E&COMM— ELECTRICAL AND COMMUNICATION
- — —SWR— SEWER
- — — W — — WATER
- —x—x— FENCE
- PROPOSED SAMPLING LOCATIONS
- NO EXCEEDANCE
- SAMPLING GRID

NOTES:

1. SAMPLING LOCATIONS BASED ON RESIDUAL CONTAMINATION PRESENT AT SITE.

SOURCES:
BASE MAPS: SAMPLE LOCATIONS, SITE D–02
NAVBASE PEARL HARBOR FACILITY
R.M. TOWILL CORPORATION, JANUARY 4, 1996

UTILITIES: UTILITY LOCATION SURVEY SITE D–02
NAVSTA PEARL HARBOR
ULS SERVICES, CO., NOVEMBER 13, 1995

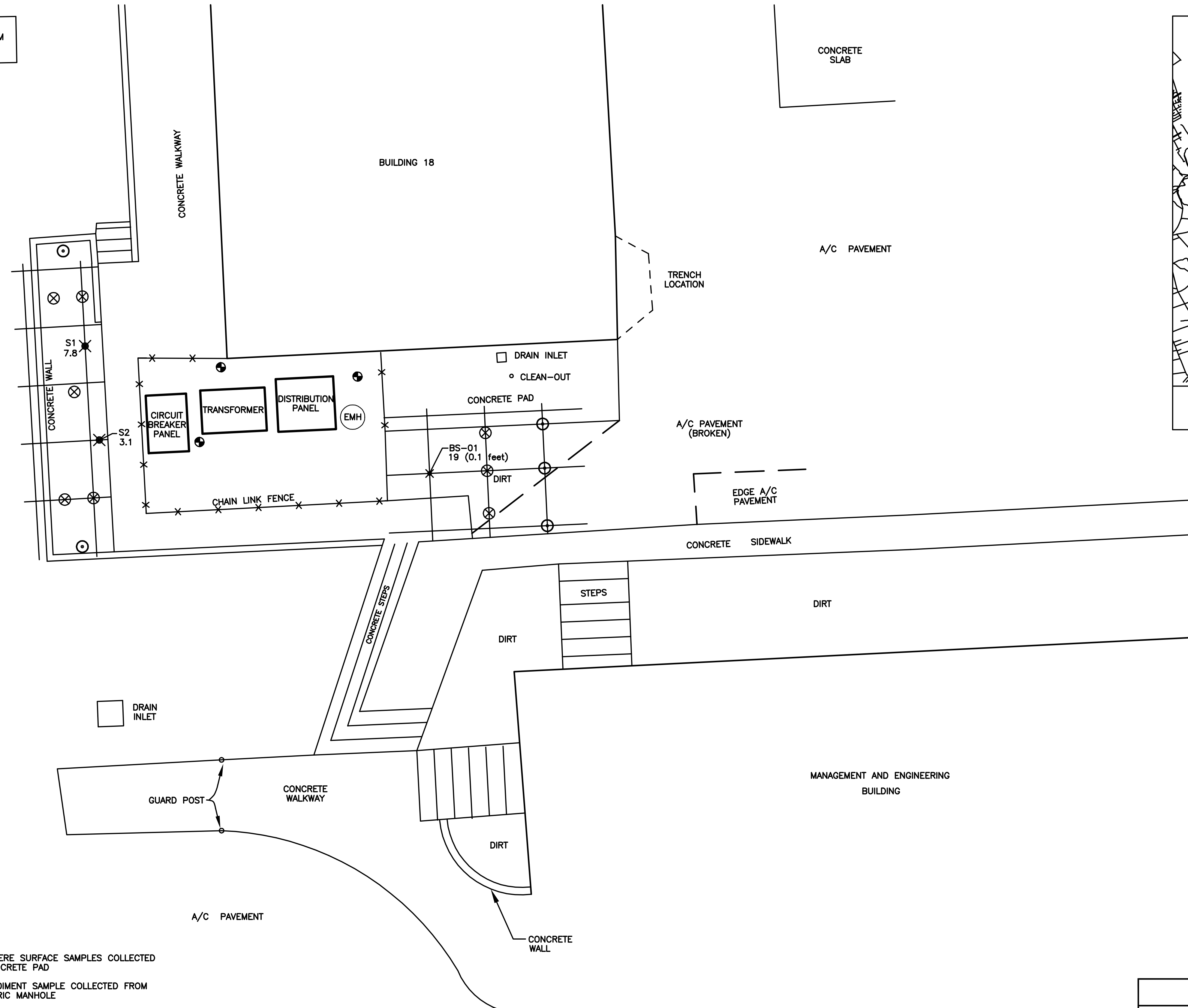
O:\FORD_ISLAND\NAVY\CAD\FIG5-5_TC01.DWG VEC DN 1-8-02

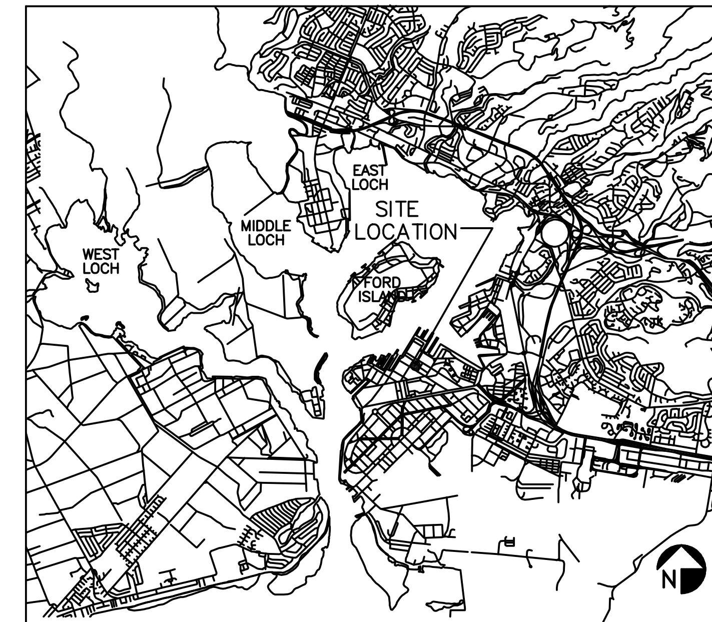
PEARL HARBOR NAVAL COMPLEX, OAHU, HAWAII

FIGURE A–25

TRANSFORMER D–02 EXCAVATION LIMITS AND PRE–EXCAVATION SAMPLING LOCATION MAP

PHNC TRANSFORMER SITE REMOVAL ACTION




SITE VICINITY MAP
NOT TO SCALE

N

0 10
FEET

NOTES:

1. SOIL SAMPLE S3 AND S4 WERE SURFACE SAMPLES COLLECTED FROM SOIL ON TOP OF CONCRETE PAD
2. SOIL SAMPLE S5 WAS A SEDIMENT SAMPLE COLLECTED FROM THE BOTTOM OF THE ELECTRIC MANHOLE
3. SI SAMPLE LOCATIONS ARE APPROXIMATE

EXPLANATION

| | |
|---|---|
| BS-01 | Original sampling location |
| | First Step-out Sample |
| | Second Step-out Sample |
| | No Exceedance |
| (0.5 ft) | Sample depth below ground surface |
| AC | Asphaltic concrete |
| EMH | Electrical Manhole |
| SI | Site inspection |
| RSE | Removal site evaluation |
| | Sampling grid |

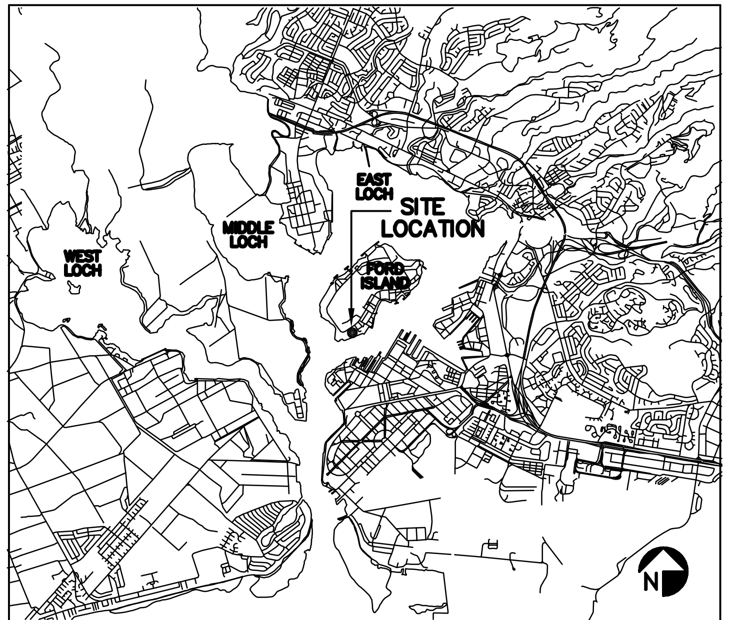
PEARL HARBOR NAVAL COMPLEX, OAHU, HAWAII

# FIGURE A–26

**TRANSFORMER E–09**
**PROPOSED PRE–EXCAVATION SAMPLING LOCATION MAP**

**PHNC TRANSFORMER SITE REMOVAL ACTION**

O:\FORD_ISLAND\NAVY\CAD\FIGUREA-26.DWG VEC DN 3-5-02



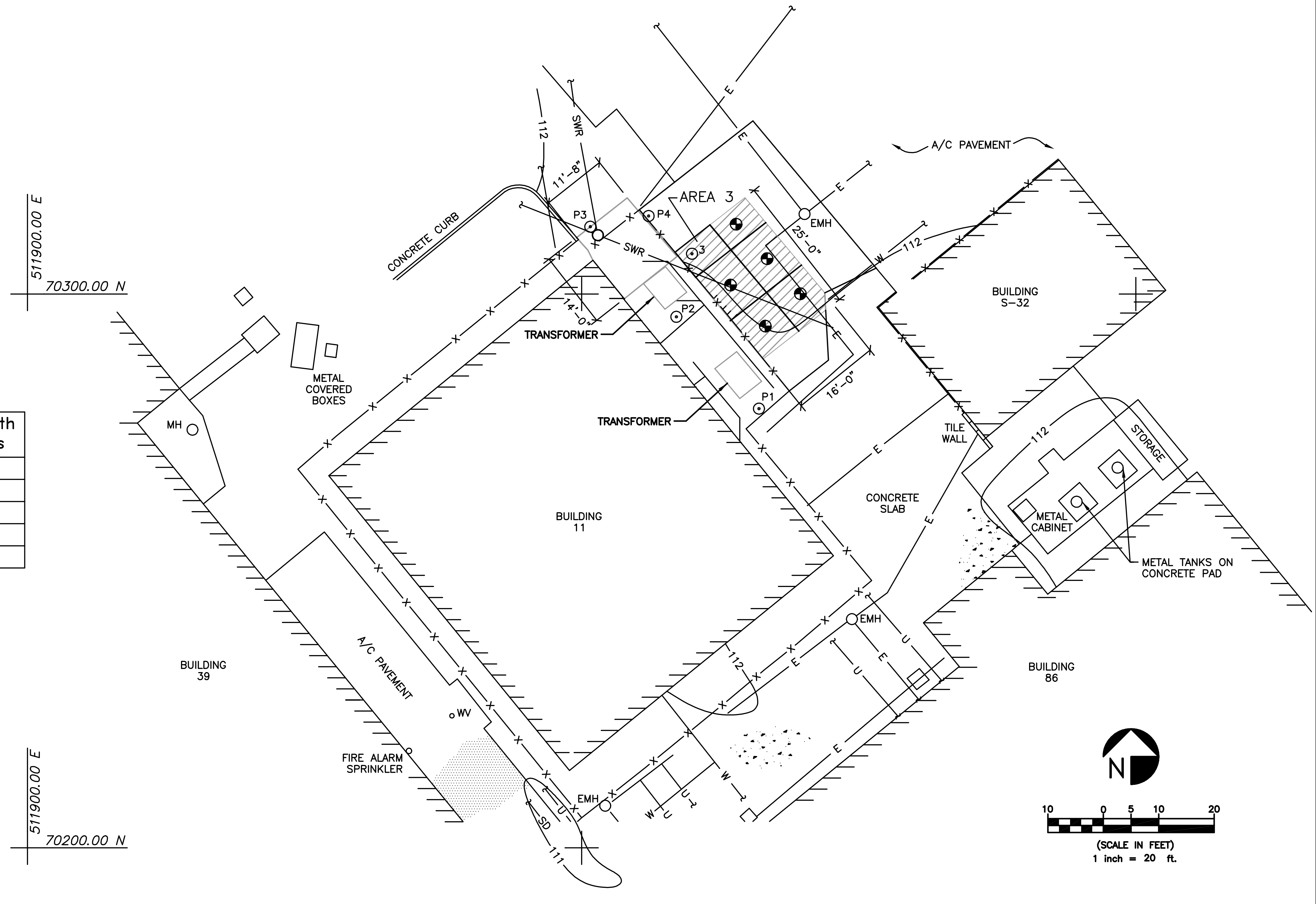

**SITE VICINITY MAP**
NOT TO SCALE

| LOCATION | ORIGINAL DEPTH | PCB (mg/kg) | Proposed boring depth and sample intervals |
|---|---|---|---|
| 3 | 6 | 9,100 | 6/8/10/12/14/16 |
| P1 | NA | NA | 2/4/6/8/10/12/14/16 |
| P2 | NA | NA | 2/4/6/8/10/12/14/16 |
| P3 | NA | NA | 2/4/6/8/10/12/14/16 |
| P4 | NA | NA | 2/4/6/8/10/12/14/16 |

NA — No samples were collected from soils beneath the transformer concrete pad during the removal action.

**LEGEND**

- AREA OF PREVIOUS SOIL EXCAVATION
- A/C — ASPHALT CONCRETE
- DI — DRAIN INLET
- EMH — ELECTRIC MANHOLE
- MH — MANHOLE
- WV — WATER VALVE
- 2"ø CONDUIT
- ——SD—— STORM DRAIN
- ——SWR—— SEWER
- —— E —— ELECTRICAL
- —— W —— WATER
- —— U —— UNKNOWN UTILITY
- X——X CHAIN LINK FENCE
- PROPOSED SAMPLING LOCATIONS
- NO EXCEEDANCE
- SAMPLING GRID




**NOTES:**

1. ELEVATIONS ARE BASED ON STATION "602" WITH AN ELEVATION OF 111.12 FEET AS ESTABLISHED BY PAREN, INC. ON JANUARY 28,1992.
2. SAMPLING LOCATIONS BASED ON RESIDUAL CONTAMINATION PRESENT AT SITE.

SOURCES:
BASE MAP: SAMPLE LOCATIONS, SITE TC-01
NAVBASE PEARL HARBOR FACILITY
R.M. TOWILL CORPORATION, JANUARY 3, 1996

UTILITIES: UTILITY LOCATION SURVEY SITE TC-01
NAVSTA PEARL HARBOR
ULS SERVICES, CO., NOVEMBER 15, 1995

O:\FORD_ISLAND\NAVY\CAD\FIG5-06_TC01.DWG VEC DN 1-8-02

**PEARL HARBOR NAVAL COMPLEX, OAHU, HAWAII**

FIGURE A-27

**TRANSFORMER TC-01**
**PROPOSED PRE-EXCAVATION SAMPLING LOCATION MAP**

**PHNC TRANSFORMER SITE REMOVAL ACTION**

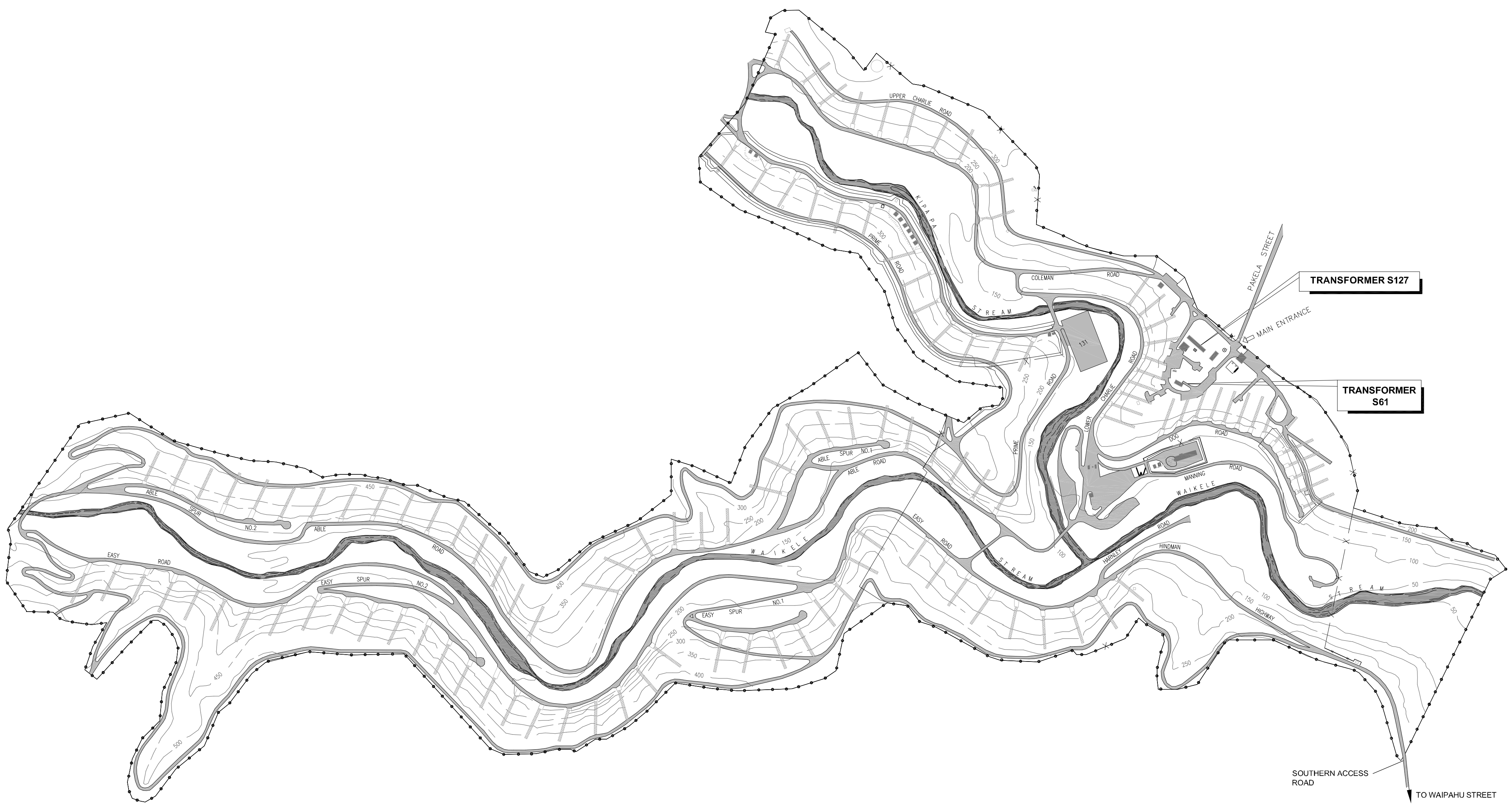
LEGEND

- EXISTING BUILDINGS OR STRUCTURES
- NAVY PROPERTY BOUNDARY LINE
- EXISTING ROADS OR PAVED AREAS
- EXISTING FENCE
- TOPOGRAPHIC CONTOUR (CONTOUR INTERVAL 50 FEET)
- STREAM

**SITE DESCRIPTION**

SOURCE

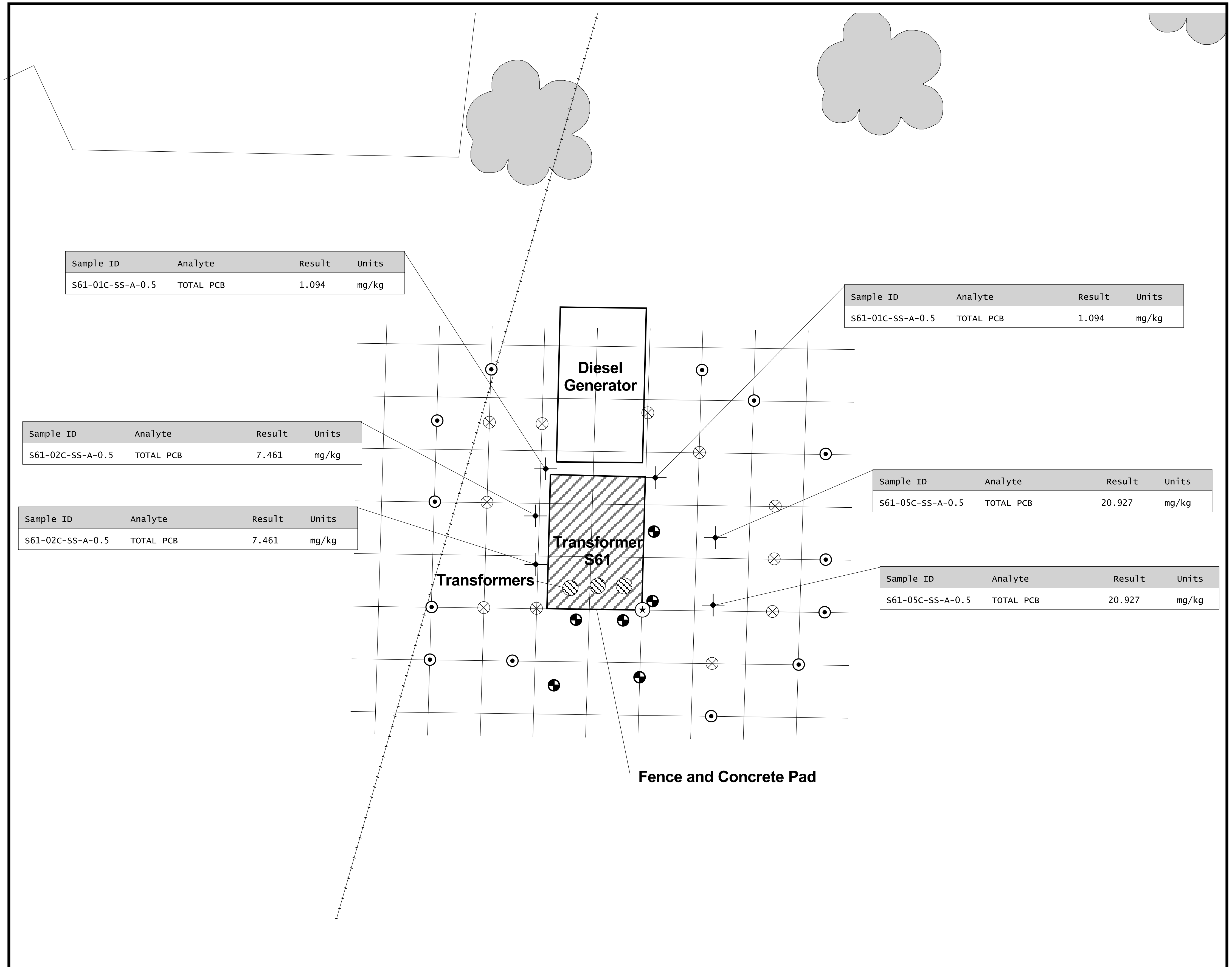
BASE MAP FEATURES EXTRACTED FROM MFA, 1999




500 0 500 1000
SCALE 1"= 1000' (APPROXIMATE)

**Figure A-28**
**Facility Location Map**
**Waikele Branch**
**Oahu, Hawaii**

O:\FORD_ISLAND\NAVY\CAD\FigureA-28.dwg VEC DN 12-7-01




## LEGEND

- Original sample location
- First step out sample
- Second step out sample
- No Exceedance
- Grid Control Point
- Trees
- Buildings
- Concrete slab
- Transformer
- Pavement
- Chainlink fence
- Overhead lines

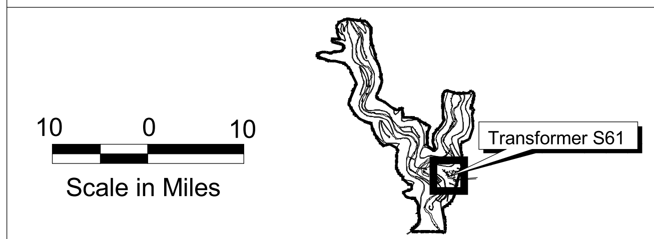
## NOTES

mg/kg = Milligrams per kilogram

## SOURCE

* Control Point Surveying, Inc. June 2000.

## SITE LOCATION



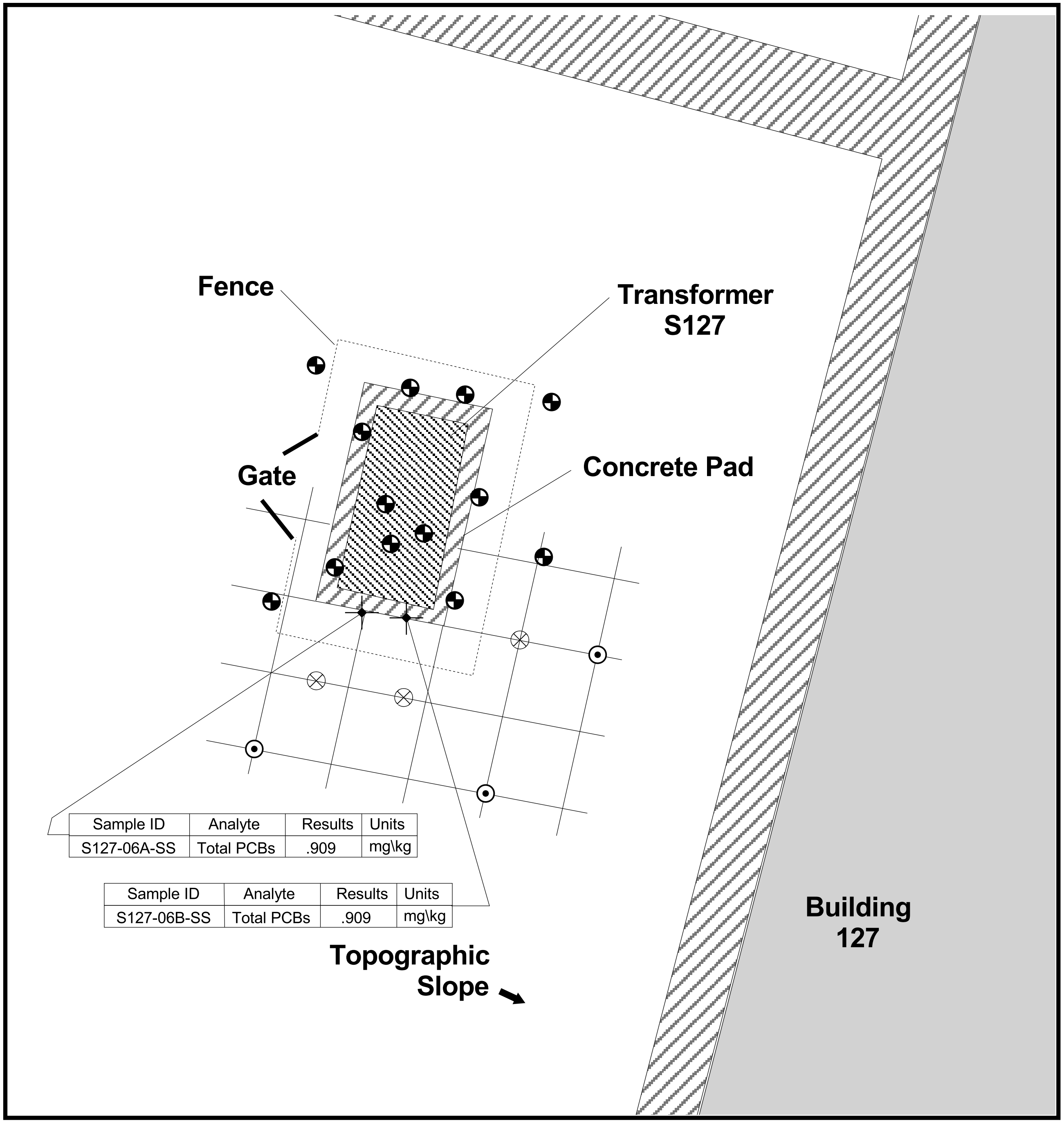

N

5 0 5

Scale in Feet

**Figure A-29**
**Proposed Pre-excavation Sample Location Map**
**Screening Criteria in Soil**
**Transformer S61**
**Waikele Branch, NAVMAG Pearl Harbor**
**Oahu, Hawaii**

O:\FORD_ISLAND\NAVY\GIS_Projects\AV_Projects\Trans_S61_C.APR VEC DN 12-13-01




| Sample ID | Analyte | Results | Units |
|---|---|---|---|
| S127-06A-SS | Total PCBs | .909 | mg\kg |

| Sample ID | Analyte | Results | Units |
|---|---|---|---|
| S127-06B-SS | Total PCBs | .909 | mg\kg |

## LEGEND

- Original sample location
- No Exceedance
- First Step-out Sample
- Second Step Out Sample
- Chainlink fence
- Buildings
- Concrete slab
- Transformer
- Sampling Grid

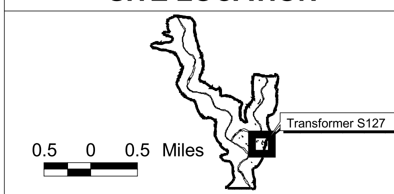
## NOTES

* Posted data exceeds the more stringent of either the Hawaii DOH Tier I Action Levels or the EPA Region IX Residential Soil PRGs
* SS = Surface Soil Sample

## SOURCE

* Control Point Surveying, Inc. June 2000.

## SITE LOCATION




N

0 5 10 Feet

**Figure A-30**
**Proposed Pre-excavation Sample Location Map**
**Transformer S127**
**Waikele Branch, NAVMAG Pearl Harbor**
**Oahu, Hawaii**

O:FORD ISLAND\Navy\Gis projects\Av projects\Trans S127 c.apr DN VEC 12-13-01

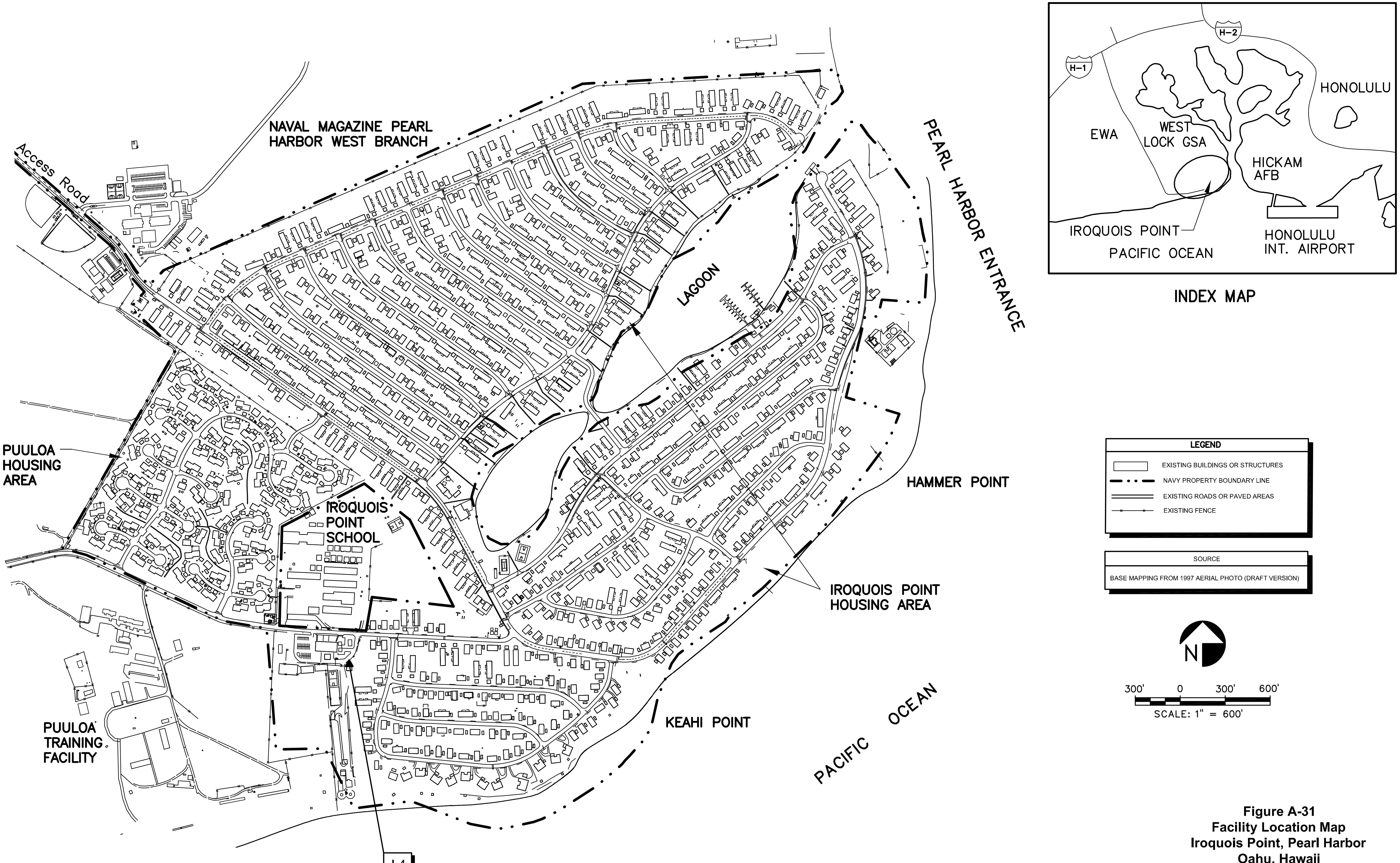
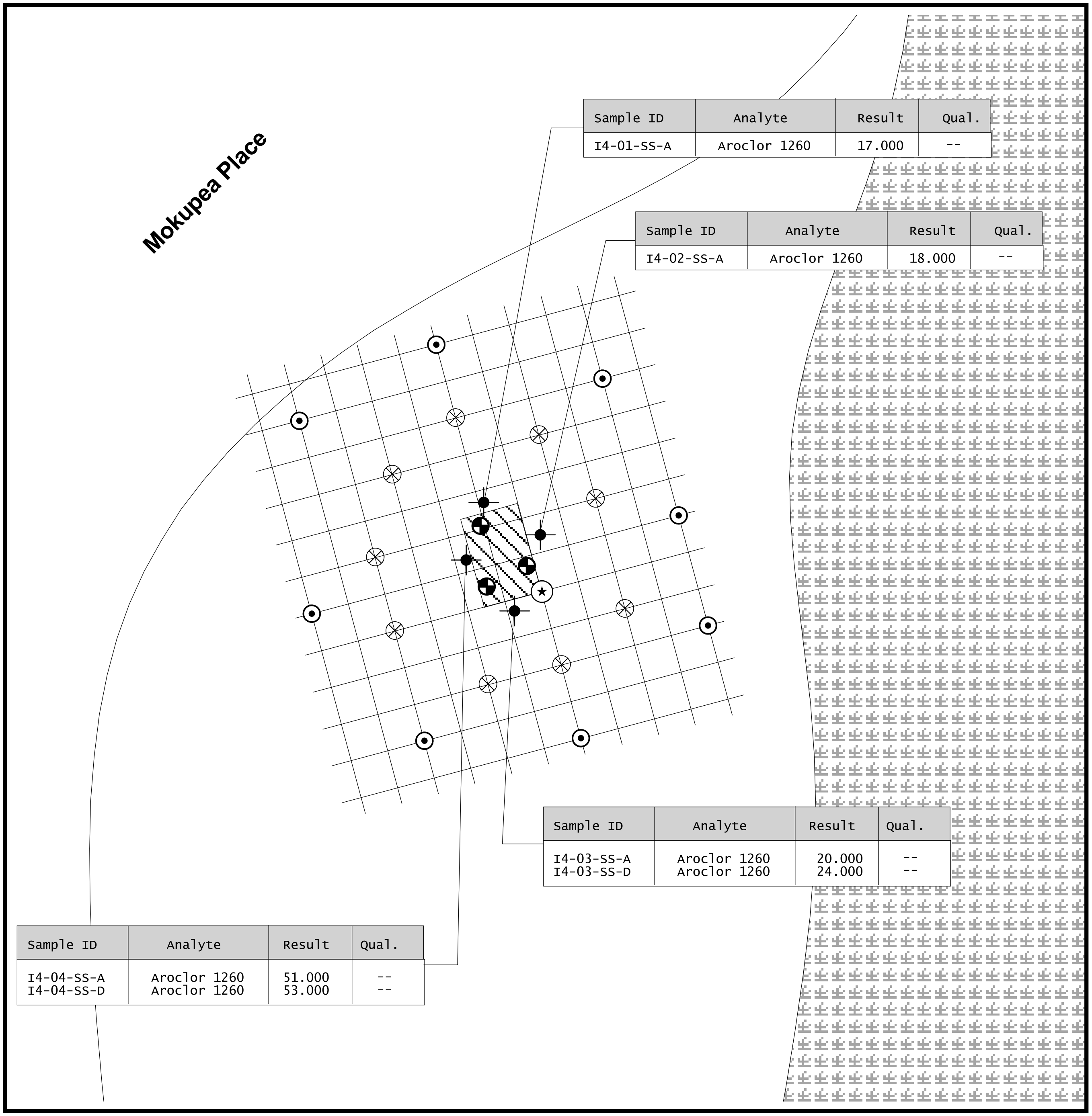



**Figure A-31**
**Facility Location Map**
**Iroquois Point, Pearl Harbor**
**Oahu, Hawaii**

O:\FORD_ISLAND\NAVY\CAD\FigureA-31_IROQUOIS.dwg DMF DN 12-20-01




| Sample ID | Analyte | Result | Qual. |
|---|---|---|---|
| I4-01-SS-A | Aroclor 1260 | 17.000 | -- |

| Sample ID | Analyte | Result | Qual. |
|---|---|---|---|
| I4-02-SS-A | Aroclor 1260 | 18.000 | -- |

| Sample ID | Analyte | Result | Qual. |
|---|---|---|---|
| I4-03-SS-A | Aroclor 1260 | 20.000 | -- |
| I4-03-SS-D | Aroclor 1260 | 24.000 | -- |

| Sample ID | Analyte | Result | Qual. |
|---|---|---|---|
| I4-04-SS-A | Aroclor 1260 | 51.000 | -- |
| I4-04-SS-D | Aroclor 1260 | 53.000 | -- |

## LEGEND

- Original Sampling Location
- First Step-out
- Second Step-out
- Grid Control Point
- No Exceedance
- Transformer
- Vegetation
- Pavement
- Sampling Grid

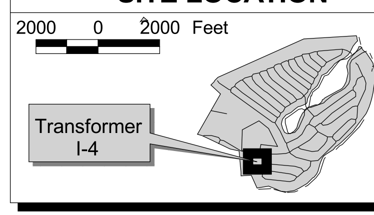
Notes:

1. All results are reported in milligrams per kilogram (mg/kg).

## SOURCE

* Control Point Surveying, Inc. December 2000.

## SITE LOCATION




N

0 10 20 Feet

**Figure A-32**
**Proposed Pre-excavation Sample Location Map**
**Transformer I-4**
**Iroquois Point, PHNC**
**Oahu, Hawaii**

O:\Ford_Island\Navy\Trans-I4_DATA.apr VEC DN 12-21-01 M\GIS\Cto79-Iroquois\av_projects\i4_data.apr

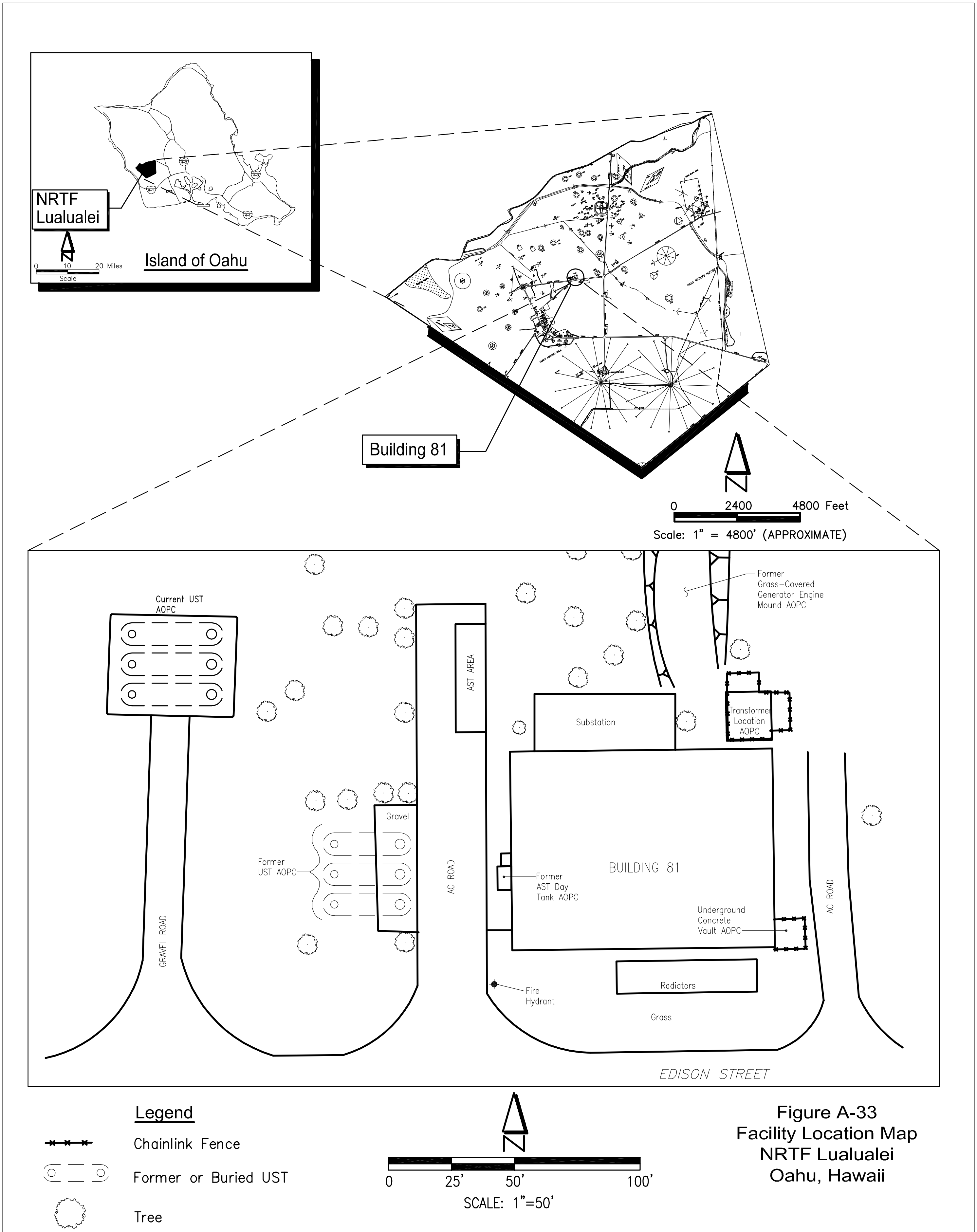
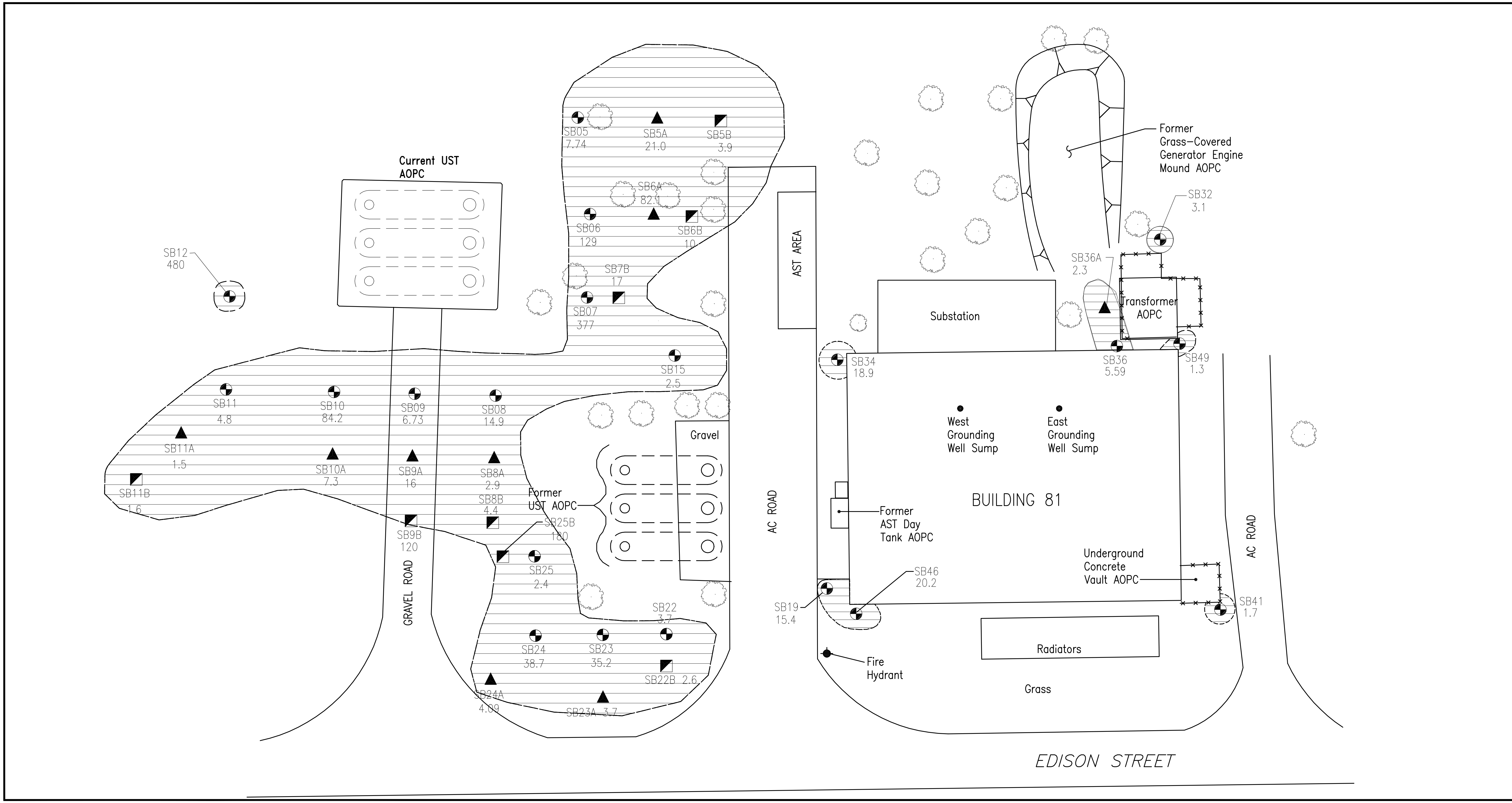



Figure A-33
Facility Location Map
NRTF Lualualei
Oahu, Hawaii

O:\Ford_Island\Navy\CAD\ Bldg81.dwg 12/07/2001 deborah.ford DN




## Legend

- Phase 1 Direct Push Sampling Location
- Phase 2 Direct Push Sampling Location
- Phase 3 Direct Push Sampling Location
- 17 mg/kg of PCBs
- Estimated Extent of Contamination
- Proposed Area of Excavation

Notes:

1. This figure provides sampling locations for PCBs only. All other contaminants of concern are collocated with the PCBs. TPH-d and -o will only be sampled for concentrations present in soil following excavation of PCBs and benzo(a)pyrene remediation.

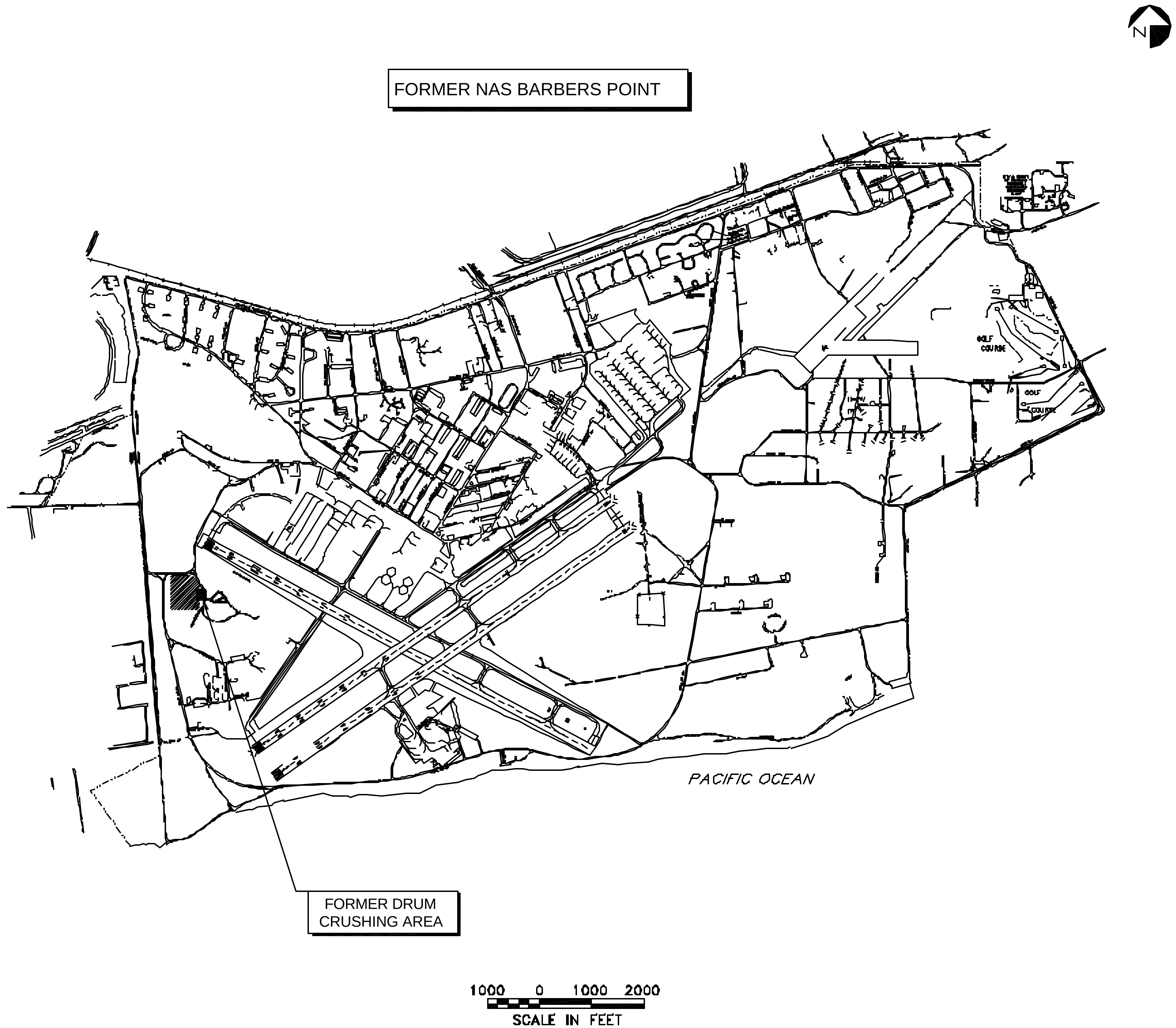
N

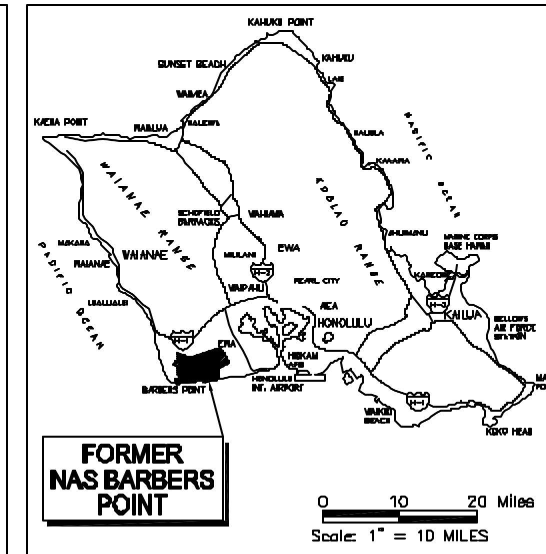
30' 15' 0 30'

SCALE: 1"=30'

Figure A-34
Previous Sampling Locations
Building 81
NRTF Lualualei
Oahu, Hawaii

O:\FORD_ISLAND\NEW_ET-DRAWINGS\BLDG81-4-1A.DWG VEC DN 12/13/01




SOURCES

R.M. Towill Field Survey
U.S. NAVY PUBLIC WORKS CENTER DRAWING:
7462792 DWG

TITLE

FIGURE A–35

FACILITY LOCATION MAP
FORMER NAS BARBERS POINT
OAHU, HAWAII


FIGURE A–36

PROPOSED PRE–EXCAVATION
SAMPLE LOCATION MAP
DRUM CRUSHING AREA
FORMER NAVAL AIR STATION
BARBERS POINT
OAHU, HAWAII

SOURCE: OGDEN. 1999. "FIGURE 2–2, SURFACE SOIL SAMPLING LOCATIONS, DRUM CRUSHING AREA, SANITARY LANDFILL, NAS BARBERS POINT, SURFACE SOIL SAMPLING"

O:\FORD_ISLAND\NAVY\CAD\FIGUREA–36.dwg VEC DN 12–13–01 Aug 07, 2001 – 08:26:44 J:\PROJECTS\812256\81225602.dwg

# Appendix B
# Project-Required Reporting Limits

**Table B-1: Reporting Limits for Metals**

| Analyte Parameter | EPA Analytical Method | Reporting Limit [a] Soils (mg/kg) | Cleanup Criterion [b] Soils (mg/kg) | Reporting Limit [a,c] Waters (μg/L) |
|---|---|---|---|---|
| Arsenic | SW6010B | 1.0 | 22 | 10 |

*Notes:*
[a] EPA Contract Laboratory Program (CLP) reporting limits. Laboratory-specific reporting limits may be substituted for the reporting limits specified in this table, pending laboratory procurement and regulatory approval.
[b] EPA Region IX residential soil preliminary remediation goals (PRGs) (EPA 2000c)
[c] All water samples collected for this method during this project are field or equipment rinsate blanks; therefore, comparisons with regulatory goals such as PRGs are not appropriate.
EPA = U.S. Environmental Protection Agency
μg/L = micrograms per liter
mg/kg = milligrams per kilogram
NA = not available
PRG = preliminary remediation goal

**Table B-2: Reporting Limits for Organochlorine Pesticides**

| Analyte Parameter | EPA Analytical Method | Reporting Limit [a] Soils (mg/kg) | Cleanup Criterion [b] Soils (mg/kg) | Reporting Limit [a,c] Waters (μg/L) |
|---|---|---|---|---|
| 4,4'-DDD | EPA 8081A | 0.0033 | 17 | 0.1 |
| 4,4'-DDE | EPA 8081A | 0.0033 | 12 | 0.1 |
| 4,4'-DDT | EPA 8081A | 0.0033 | 12 | 0.1 |
| Alpha-chlordane | EPA 8081A | 0.0017 | 11 | 0.05 |
| Gamma-chlordane | EPA 8081A | 0.0017 | 11 | 0.05 |
| Heptachlor epoxide | EPA 8081A | 0.0017 | 0.27 | 0.05 |

*Notes:*
[a] EPA Contract Laboratory Program (CLP) reporting limits. Laboratory-specific reporting limits may be substituted for the reporting limits specified in this table, pending laboratory procurement and regulatory approval.
[b] EPA Region IX residential soil preliminary remediation goals (PRGs) (EPA 2000c)
[c] All water samples collected for this method during this project are field or equipment rinsate blanks; therefore, comparisons with regulatory goals such as PRGs are not appropriate.
EPA = U.S. Environmental Protection Agency
μg/L = micrograms per liter
mg/kg = milligrams per kilogram
NA = not available
PRG = preliminary remediation goal

**Table B-3: Reporting Limits for Low-Level Polynuclear Aromatic Hydrocarbons (PAHs)**

| Analyte Parameter | EPA Analytical Method | Reporting Limit [a] Soils (mg/kg) | Cleanup Criterion[b] Soils (mg/kg) | Reporting Limit [a,c] Waters (μg/L) |
|---|---|---|---|---|
| Benzo(a)pyrene | SW8270C-SIM | 0.0067 | 0.029[d] | 0.1 |

*Notes:*
[a] EPA Contract Laboratory Program (CLP) reporting limits. Laboratory-specific reporting limits may be substituted for the reporting limits specified in this table, pending laboratory procurement and regulatory approval.
[b] EPA Region IX residential soil preliminary remediation goal (PRGs) (EPA 2000c)
[c] All water samples collected for this method during this project are field or equipment rinsate blanks; therefore, comparisons with regulatory goals such as PRGs are not appropriate.
[d] Reporting of estimated results for this compound down to the MDL may allow effective qualitative comparisons to the applicable PRG. For specific compliance for all PAH compounds, SW8270-SIM should be requested for the achievement of low-level reporting limits.
EPA = U.S. Environmental Protection Agency
μg/L = micrograms per liter
mg/kg = milligrams per kilogram
NA = not available
PRG = preliminary remediation goal
SIM = Selective Ion Monitoring for the achievement of low-level reporting limits

**Table B-4: Reporting Limits for Polychlorinated Biphenyls (PCBs) as Aroclors**

| Analyte Parameter | EPA Analytical Method | Reporting Limit [a] Soils (mg/kg) | Cleanup Criterion [b] Soils (mg/kg) | Reporting Limit [a,c] Waters (μg/L) |
|---|---|---|---|---|
| Aroclor 1016 | SW8082 | 0.033 | 1.0 | 1.0 |
| Aroclor 1221 | SW8082 | 0.033 | 1.0 | 2.0 |
| Aroclor 1232 | SW8082 | 0.033 | 1.0 | 1.0 |
| Aroclor 1242 | SW8082 | 0.033 | 1.0 | 1.0 |
| Aroclor 1248 | SW8082 | 0.033 | 1.0 | 1.0 |
| Aroclor 1254 | SW8082 | 0.033 | 1.0 | 1.0 |
| Aroclor 1260 | SW8082 | 0.033 | 1.0 | 1.0 |

*Notes:*
[a] EPA Contract Laboratory Program (CLP) reporting limits. Laboratory-specific reporting limits may be substituted for the reporting limits specified in this table, pending laboratory procurement and regulatory approval.
[b] TSCA Screening Level (high occupancy)
[c] All water samples collected for this method during this project are field or equipment rinsate blanks; therefore, comparisons with regulatory goals such as PRGs are not appropriate.
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams per kilogram
μg/L = micrograms per liter
PCBs = polychlorinated biphenyls
PRG = preliminary remediation goal
TSCA = Toxic Substances Control Act

**Table B-5: Reporting Limits for Total Petroleum Hydrocarbons as Fuels**

| Analyte Parameter | EPA Analytical Method | Reporting Limit [a] Soils (mg/kg) | Cleanup Criterion[b] Soils (mg/kg) | Reporting Limit [c] Waters ((μg/L) |
|---|---|---|---|---|
| TPH-extractable as diesel | SW8015B | 25 | 5,000 | 250 |
| TPH-extractable as motor oil | SW8015B | 100 | 5,000 | 1000 |

*Notes:*
[a] Contractually specified maximum quantitation limits. Laboratory-specific reporting limits may be substituted for the reporting limits specified in this table, pending laboratory procurement and regulatory approval.
[b] State of Hawaii Department of Health (DOH) Tier 1 soil action levels (DOH 1995)
[c] All water samples collected for this method during this project are field or equipment rinsate blanks; therefore, comparisons with regulatory goals such as PRGs are not appropriate.
EPA = U.S. Environmental Protection Agency
mg/kg = milligrams per kilogram
μg/L = micrograms per liter
PRG = preliminary remediation goal
TPH = total petroleum hydrocarbons

# Appendix C
# Method Precision and Accuracy Goals

### Table C-1: Quality Control Criteria for Metals [a]

| Analyte Parameter | EPA Analytical Method | Soils and Waters[a] MS/MSD (%R) | Blank Spike/Laboratory Control Sample[b] (%R) | Soils and Waters[c] RPD |
|---|---|---|---|---|
| Arsenic | SW6010B | 75-125 | 80-120 | 20 |

*Notes:*
[a] EPA Contract Laboratory Program (CLP) control limits. Laboratory-specific control limits may be substituted for the control limits specified in this table, pending laboratory procurement and regulatory approval.
[b] Blank Spike is equivalent to laboratory control sample (LCS)
[c] All water samples collected for this method during this project are field, trip, or equipment rinsate blanks; therefore, MS/MSD and matrix duplicate analyses are not applicable.
%R = percent recovery
EPA = U.S. Environmental Protection Agency
MS/MSD = matrix spike/matrix spike duplicate
RPD = relative percent difference

### Table C-2: Quality Control Criteria for Organochlorine Pesticides

| Analyte Parameter | EPA Analytical Method | Soils and Waters[a] MS/MSD/ Surrogate (%R) | Soils and Waters: Laboratory Control Sample (%R) | Soils and Waters: RPD |
|---|---|---|---|---|
| Pesticides | EPA 8081A | 75-125 | 75-125 | <35 |
| Surrogate | | Soils Surrogate (%R) | Waters Surrogate (%R) | |
| Tetrachloro-m-xylene | EPA 8081A | 30-150 | 30-150 | <35 |
| Decachlorobiphenyl | EPA 8081A | 30-150 | 30-150 | <35 |

*Notes:*
[a] All water samples collected for this method during this project are field, trip, or equipment rinsate blanks; therefore, MS/MSD analyses are not applicable.
%R = percent recovery
EPA = U.S. Environmental Protection Agency
MS/MSD = matrix spike/matrix spike duplicate
RPD = relative percent difference
TBD = to be determined
TPH = total petroleum hydrocarbons
Laboratory-specific control limits may be substituted for the control limits specified in this table, pending laboratory procurement and regulatory approval.

**Table C-3: Quality Control Criteria for Low-Level Polynuclear Aromatic Hydrocarbons (PAHs)**

| Analyte Parameter | EPA Analytical Method | Soils: MS/MSD/LCS (%R) | Waters [b]: MS/MSD/LCS (%R) | Soils: RPD | Waters: RPD |
|---|---|---|---|---|---|
| Benzo(a)pyrene | SW8270C-SIM | 30-140 | 30-140 | 30 | 30 |
| Surrogates: | | Soils Surrogate (%R) | Waters Surrogate (%R) | | |
| **Nitrobenzene-$d_5$ [a]** | **SW8270C** | **23-120** | **35-114** | N/A | N/A |
| **2-Fluorobiphenyl [a]** | **SW8270C** | **30-115** | **43-116** | N/A | N/A |
| **p-Terphenyl-$d_{14}$ [a]** | **SW8270C** | **18-137** | **33-141** | N/A | N/A |
| **1,2-Dichlorobenzene-$d_4$ [a]** | **SW8270C** | **20-130** | **16-110** | N/A | N/A |

*Notes:*
[a] EPA Contract Laboratory Program (CLP) **controlling compounds** and control limits will be used for method control and corrective action. Remaining compounds will be used for data validation, not for corrective action.
[b] All water samples collected for this method during this project are field, trip, or equipment rinsate blanks; therefore, MS/MSD analyses are not applicable.
%R = percent recovery
EPA = U.S. Environmental Protection Agency
LCS = laboratory control spike
MS/MSD = matrix spike/matrix spike duplicate
N/A = not applicable
RPD = relative percent difference
SIM = Selective Ion Monitoring for the achievement of low level reporting limits
Laboratory-specific control limits may be substituted for the control limits specified in this table, pending laboratory procurement and regulatory approval.

**Table C-4: Quality Control Criteria for Polychlorinated Biphenyls (PCBs) as Aroclors**

| Analyte Parameter | EPA Analytical Method | Soils and Waters [b]: MS/MSD/ Surrogate (%R) | Soils and Waters: Laboratory Control Sample (%R) | Soils and Waters: RPD |
|---|---|---|---|---|
| **Aroclor 1016 [a]** | **SW8082** | **50-130** | **50-130** | **35** |
| Aroclor 1221 | SW8082 | 50-130 | 50-130 | 35 |
| Aroclor 1232 | SW8082 | 50-130 | 50-130 | 35 |
| Aroclor 1242 | SW8082 | 50-130 | 50-130 | 35 |
| Aroclor 1248 | SW8082 | 50-130 | 50-130 | 35 |
| Aroclor 1254 | SW8082 | 50-130 | 50-130 | 35 |
| **Aroclor 1260 [a]** | **SW8082** | **50-130** | **50-130** | **35** |
| Surrogate: | | | | |
| **Decachlorobiphenyl (DCB) [a]** | **SW8082** | **30-150** | N/A | N/A |

*Notes:*
[a] EPA Contract Laboratory Program (CLP) **controlling compounds** and control limits will be used for method control and corrective action. Remaining compounds will be used for data validation, not for corrective action.
[b] All water samples collected for this method during this project are field, trip, or equipment rinsate blanks; therefore, MS/MSD analyses are not applicable.
%R = percent recovery
EPA = U.S. Environmental Protection Agency
MS/MSD = matrix spike/matrix spike duplicate
N/A = not applicable
RPD = relative percent difference
Laboratory-specific control limits may be substituted for the control limits specified in this table, pending laboratory procurement and regulatory approval.

**Table C-5: Quality Control Criteria for Total Petroleum Hydrocarbons (TPH) as Fuels**

| Analyte Parameter | EPA Analytical Method | Soils and Waters [a]: MS/MSD/ Surrogate (%R) | Soils and Waters: Laboratory Control Sample (%R) | Soils and Waters: RPD |
|---|---|---|---|---|
| TPH-extractables as diesel | SW8015B | 50-150 | 60-140 | < 50 |
| TPH-extractables as oil | SW8015B | 50-150 | 60-140 | < 50 |
| Surrogate (TBD) [b] | SW8015B | 50-150 | 60-140 | < 50 |

*Notes:*

[a] All water samples collected for this method during this project are field, trip, or equipment rinsate blanks; therefore, MS/MSD analyses are not applicable.

[b] The surrogate compound for TPH-extractables will be determined by the laboratory from the following compounds: o-terphenyl, benzo(a)pyrene, octacosane, ortho-terphenyl, fluorobenzene, tricontane

%R = percent recovery
EPA = U.S. Environmental Protection Agency
MS/MSD = matrix spike/matrix spike duplicate
RPD = relative percent difference
TBD = to be determined
TPH = total petroleum hydrocarbons
Laboratory-specific control limits may be substituted for the control limits specified in this table, pending laboratory procurement and regulatory approval.

# Appendix D
# Field Forms

**Tetra Tech EM Inc.**
2828 Paa Street, Suite 3080
Honolulu, Hawaii 96819
Phone: (808) 831-6600
Fax: (808) 836-1689

# Chain of Custody Record

Page ______ of ______

PO Number: ______________

Lab:

| Project name: | technical contact: | Field samplers: |
|---|---|---|
| **Project number:** | **project manager:** | **Field samplers' signatures:** |

| Sample ID | Sample Description/Notes | Date | Time | Matrix | 40 ml VOA | 1 Liter Amber | 1 Liter Poly | Brass Tube | Glass Jar | | | | CLP VOA | CLP SVOA | CLP Pest/PCBs | CLP Metals | TPH Purgeables | TPH Extractables | BTEX (8020) | TRPH (418.1) | PCB (8082) | PAH (8270C) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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No./Container Types — Preservative Added — Analysis Required

| | Name (print) | Company Name | Date | Time |
|---|---|---|---|---|
| **Relinquished by:** | | | | |
| **Received by:** | | | | |
| **Relinquished by:** | | | | |
| **Received by:** | | | | |
| **Relinquished by:** | | | | |
| **Received by:** | | | | |
| **Relinquished by:** | | | | |
| **Received by:** | | | | |

**Turnaround time/remarks:**

WHITE–Laboratory Copy YELLOW–Project Office Copy

Project Name: Field Investigation, CTO 004
Project Number:
Laboratory:

**Sample Tracking Form**

| SITE | USEPA ID | Field Sampling ID | Matrix | Collection Date | Collection Time | Number of Containers and Size/Type | Sampler Initials & Sample Notes, i.e DUP |
|---|---|---|---|---|---|---|---|
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**Tetra Tech EM Inc.**

# BOREHOLE LOG

SHEET _____ OF _______

| LOCATION OF BOREHOLE | JOB NO.: | BOREHOLE ID: |
|---|---|---|
| | CLIENT: | DEPTH TO WATER: |
| | SITE: | LOGGED BY: |
| | SUBSITE: | DRILLING DATE(S): |
| | DRILLING CO.: | DRILLING METHOD: |
| | PERSONNEL: | SAMPLING METHOD: |

| SAMPLE INTERVAL | | | BLOWS/ 6 IN. SAMPLE | TIME | PID READING | LABORATORY ANALYSIS | DEPTH IN FEET | USCS SOIL TYPE | SOIL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|
| TOP | BOTTOM | RECOVERED | | | | | | | |
| | | | | | | | 1 | | |
| | | | | | | | 2 | | |
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| | | | | | | | 8 | | |
| | | | | | | | 9 | | |
| | | | | | | | 0 | | |

**ORDER OF DESCRIPTIONS:**
1. Texture and Proportion of Constituents 2. Color 3. Grading 4. Plasticity 5. Moisture 6. Density/Consistency 7. Structure 8. Cementation 9. Angularity/Mineralogy 10. Contact 11. Miscellaneous

**EXAMPLE DESCRIPTION:**
Medium sand with 30% silt and trace fine gravel, pale brown (10YR6/3) with dark brown (10YR3/3) mottling, well graded, slightly plastic, moist, loose, laminated (4 mm thick laminations), no cementation, subrounded, arkosic (quartz and feldspar), sharp contact

## UNIFIED SOIL CLASSIFICATION SYSTEM

| | | | | |
|---|---|---|---|---|
| COARSE-GRAINED SOILS <50% passes #200 sieve | GRAVELS <50% coarse fraction passes #4 sieve | GRAVELS with little or no fines | **GW** | Well graded gravels, gravel-sand mixtures, little or no fines |
| | | | **GP** | Poorly graded gravels, gravel-sand mixtures, little or no fines |
| | | GRAVELS with ≥15% fines | **GM** | Silty gravels, poorly graded gravel-sand-silt mixtures |
| | | | **GC** | Clayey gravels, poorly graded gravel-sand-clay mixtures |
| | SANDS ≥50% coarse fraction passes #4 sieve | SANDS with little or no fines | **SW** | Well graded sands, gravelly sands, little or no fines |
| | | | **SP** | Poorly graded sands, gravelly sands, little or no fines |
| | | SANDS with ≥15% fines | **SM** | Silty sands, sand-gravel-silt mixtures |
| | | | **SC** | Clayey sands, sand-gravel-clay mixtures |
| FINE-GRAINED SOILS ≥50% passes #200 sieve | SILTS & CLAYS Liquid Limit <50 | | **ML** | Inorganic silts and very fine sands, silty or clayey fine sands, silts with slight plasticity |
| | | | **CL** | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | | **OL** | Organic silts and silty clays of low plasticity |
| | SILTS & CLAYS Liquid Limit >50 | | **MH** | Inorganic silts, micaceous or diatomaceous fine sand or silt |
| | | | **CH** | Inorganic clays of high plasticity, fat clays |
| | | | **OH** | Organic silts and clays of medium-to-high plasticity |
| | | | **PT** | Peat, humus, swamp soils with high organic content |

NOTE: Well graded (wide range of grain sizes) = poorly sorted; poorly graded (predominantly one grain size) = well sorted

## GRAIN SIZE

| **DESCRIPTION** | **SIEVE SIZE** | **GRAIN SIZE** | | |
|---|---|---|---|---|
| | | **mm** | **in** | |
| Boulders | >12” | >300 | >12 | |
| Cobbles | 12” - 3” | 300 - 75 | 12 - 3 | |
| Gravel - Coarse | 3” - ¾” | 75 - 19 | 3 - 3/4 | |
| Fine | 3/4” - #4 | 19 - 4.75 | 0.75 - 0.19 | |
| Sand - Coarse | #4 - #10 | 4.75 - 2 | 0.19 - 0.079 | |
| Medium | #10 - #40 | 2 - 0.425 | 0.079 - 0.017 | |
| Fine | #40 - #200 | 0.425 - 0.075 | 0.017 - 0.0029 | |
| Fines | Passing #200 | <0.075 | <0.0029 | |

**COLOR**
Assign color using Munsell Soil Color Chart (1992) if possible. Provide name and color code in parenthesis.

▽ Depth to first water (time and date)

▼ Depth to water after drilling (time and date)

## PLASTICITY

| **DESCRIPTION** | **FIELD TEST** |
|---|---|
| Nonplastic | Soil falls apart at any water content |
| Slightly Plastic | Soil easily crushed with fingers; thread is rolled with difficulty |
| Plastic | Soil difficult to crush with fingers; thread is rolled easily up to the plastic limit, failure after reaching the plastic limit |
| Very Plastic | Soil impossible to crush with fingers; thread is rolled easily, does not fail after reaching the plastic limit |

## MOISTURE CONTENT

| DESCRIPTION | FIELD TEST |
|---|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible free water |

## DENSITY (GRANULAR) CONSISTENCY (COHESIVE)

| GRANULAR | COHESIVE | FIELD TEST FOR COHESIVE SOIL |
|---|---|---|
| Very loose | Very soft | Easily penetrated several inches by thumb. Exudes between thumb and fingers when squeezed. |
| Loose | Soft | Easily penetrated one inch by thumb. Molded by light finger pressure. |
| Medium dense | Medium stiff | Penetrated over 1/2 inch by thumb with moderate effort. Molded by strong finger pressure. |
| Dense | Stiff | Indented about 1/2 inch by thumb but penetrated only with great effort. |
| Very dense | Very stiff | Readily indented by thumbnail. |
| | Hard | Indented with difficulty by thumbnail. |

## STRUCTURE

Stratified (layers ≥6 mm thick)
Laminated (layers <6 mm thick)
Platy
Columnar
Prismatic
Blocky (angular, subangular)
Granular (single grain, massive)
Homogeneous

## CEMENTATION

| DESCRIPTION | FIELD TEST |
|---|---|
| Weak | Crumbles or breaks with handling or slight finger pressure |
| Moderate | Crumbles or breaks with considerable finger pressure |
| Strong | Will not crumble or break with finger pressure |

## MISCELLANEOUS

Organics, carbon, vegetation
Coloration (staining, mottling)
Odor
Stratigraphic unit (if known)
Drilling rate
Rig behavior
Heaving sands
Loss of drilling fluid
Caving/sloughing

## ROCK CLASSIFICATION:

Rock Name - Color - Weathering - Fracturing - Competency - Mineralogy - Miscellaneous

### Sch 40 PVC

CASING VOLUMES

| DIAMETER (in) | VOLUME (gal/ft) |
|---|---|
| 2 | 0.17 |
| 4 | 0.66 |
| 6 | 1.50 |

BORING VOLUMES

| HOLE DIAMETER (in) | VOLUME (gal/ft) |
|---|---|
| 7.25 | 2.14 |
| 7.75 | 2.45 |
| 8.25 | 2.78 |
| 10.25 | 4.29 |
| 12.25 | 6.13 |

CONVERSIONS

| MULTIPLY | BY | TO OBTAIN |
|---|---|---|
| in | 2.54 | cm |
| ft | 0.3048 | m |
| mi | 1760 | yd |
| mi | 5280 | ft |
| mi | 1.6093 | km |
| cm | 0.3937 | in |
| cm | 3.2808 E-2 | ft |
| m | 3.2808 | ft |
| km | 0.6214 | mi |
| cu ft | 2.8317 E-2 | cu m |
| gal | 3.7850 E-3 | cu m |
| cu ft | 7.4814 | gal |
| quart | 0.9464 | liter |
| gal | 3.7854 | liter |
| liter | 0.2642 | gal |

### WELL VOLUME CALCULATION EXAMPLE:

Well Volume = Annular Volume + Casing Volume

Annular Volume = (Boring Volume - Casing Volume) x Sand Pack Porosity

EXAMPLE: Assume 10.25" dia. hole, 4" dia. casing,
30% sand pack porosity, 8' water column

Annular Volume = (4.29 gal/ft - 0.66 gal/ft) x 0.30 x 8 ft = 8.71 gal.

Casing Volume = 0.66 gal/ft x 8 ft = 5.28 gal.

One Well Volume = 8.71 gal + 5.28 gal = 13.99 gal.

**CTO 004**
**DRUM INVENTORY LOG FOR FIELD INVESTIGATION**
**SITE NAME:**

| DRUM NO.<br><br>(xxxx_AA_Dzzz) | DRUM STORAGE LOCATION | SOURCE ID NUMBER | IDW TYPE | CAPACITY<br><br>(fill level %) | DATE GENERATED<br><br>(dd-Mon-yy) | EXPECTED DISPOSAL DATE (Mon-yy) | ACTUAL DISPOSAL DATE (dd-Mon-yy) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

# Appendix E
# PACDIV IRP Procedures

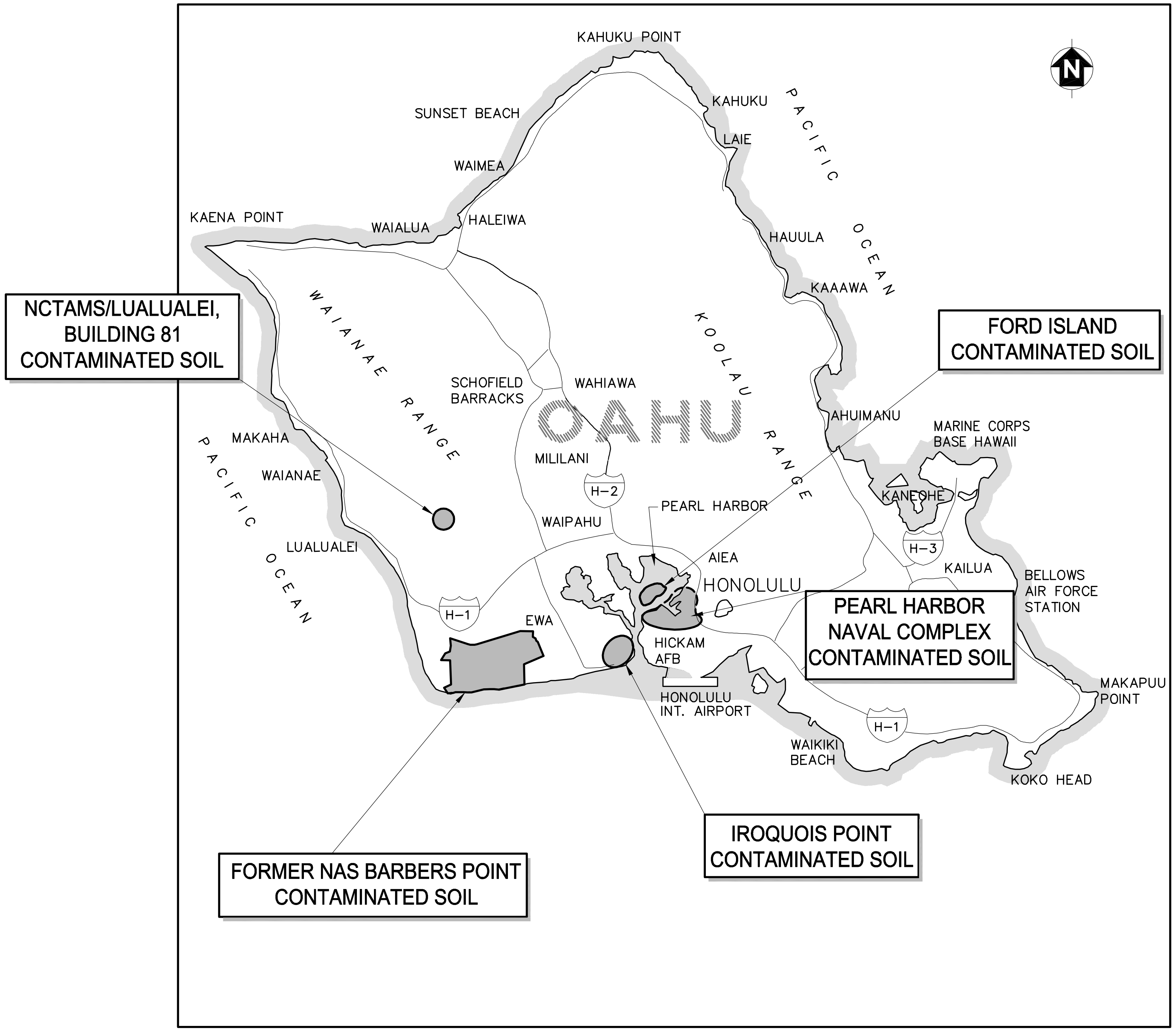
The following IRP Procedures were used to support this sampling and analysis plan:

I-A-6, *Utility Clearance*
I-A-7, *IDW Management*
I-A-9, *Sample Naming*
I-B-1, *Soil Sampling*
I-E, *Soil and Rock Classification*
I-F, *Equipment Decontamination*
I-H, *Direct Push Sampling Techniques*
II-A, *Data Validation Procedure 1, Presentation*
III-B, *Field QC Samples (Water, Soil)*
III-D, *Logbooks*
III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*
III-F, *Sample Handling, Storage, and Shipping Procedures*

Department of Navy. 1998. *Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP). Prepared for Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM).* October.

# Appendix F
# Confirmation Sampling Location Figures

# CONFIRMATION SAMPLING FOR REMOVAL ACTION DESIGN SUPPORT




ISLAND OF OAHU
VICINITY MAP

5 0 5 10
SCALE: 1" = 5 MILES

GENERAL ABBREVIATIONS

| | |
|---|---|
| ' | FEET |
| " | INCHES |
| A/C | ASPHALT CONCRETE |
| APROX. | APPROXIMATELY |
| BGS | BELOW GROUND SURFACE |
| ℄ | CENTER LINE |
| CLF | CHAIN LINK FENCE |
| C.Y. | CUBIC YARDS |
| DECON. | DECONTAMINATION |
| DIA. | DIAMETER |
| ELEV. | ELEVATION |
| EMH | ELECTRIC MANHOLE |
| EQUIP. | EQUIPMENT |
| EXC. | EXCAVATION |
| EXIST. | EXISTING |
| FT. | FEET |
| H | HEIGHT |
| LF | LINEAR FEET |
| MIN | MINIMUM |
| M.S.L. | MEAN SEA LEVEL |
| mg/kg | MILLIGRAMS PER KILOGRAM |
| NAS | NAVAL AIR STATION |
| NCTAMS | NAVAL COMPUTER AND TELECOMMUNICATIONS AREA MASTER STATION |
| NAVFAC | NAVAL FACILITIES ENGINEERING COMMAND |
| ppm | PARTS PER MILLION |
| PHNC | PEARL HARBOR NAVAL COMPLEX |
| PCB | POLYCHLORINATED BIPHENYL |
| PWC | PUBLIC WORKS CENTER |
| R | RADIUS |
| SMH | SEWER MANHOLE |
| SQ. FT. | SQUARE FEET |
| T | TOP |
| TYP. | TYPICAL |
| UST | UNDERGROUND STORAGE TANK |
| WV | WATER VALVE |

## FIGURE INDEX

| FIGURE NUMBER | FIGURE TITLE |
|---|---|
| F1 | VICINITY MAP AND FIGURE INDEX |
| F2 | TRANSFORMER SITES TA-01 AND TC-04, FORD ISLAND, PHNC |
| F3 | TRANSFORMER SITES TC-06D AND TC-07D, FORD ISLAND, PHNC |
| F4 | TRANSFORMER SITES TD-01 AND TD-02, FORD ISLAND, PHNC |
| F5 | TRANSFORMER SITES TD-03 AND TD-05, FORD ISLAND, PHNC |
| F6 | TRANSFORMER SITES TD-07, TF-01, AND TF-01D, FORD ISLAND, PHNC |
| F7 | TRANSFORMER SITES TF-04 AND TF-05, FORD ISLAND, PHNC |
| F8 | TRANSFORMER SITES TF-07 AND TF-08, FORD ISLAND, PHNC |
| F9 | TRANSFORMER SITES TF-09 AND TF-17, FORD ISLAND, PHNC |
| F10 | TRANSFORMER SITES TF-18 AND TG-01, FORD ISLAND, PHNC |
| F11 | TRANSFORMER SITES TG-03 AND TG-06, FORD ISLAND, PHNC |
| F12 | TRANSFORMER SITES TI-03 AND TI-04D, FORD ISLAND, PHNC |
| F13 | TRANSFORMER SITE TC-01, FORD ISLAND, PHNC |
| F14 | TRANSFORMER SITES D-02 AND E-09, PHNC |
| F15 | TRANSFORMER SITE I-4, IROQUOIS POINT, PHNC AND BUILDING 81, NRTF LUALUALEI |
| F16 | FORMER DRUM CRUSHING AREA, FORMER NAS BARBERS POINT |
| F17 | TRANSFORMER SITES S61 AND S127, WAIKELE BRANCH, PHNC |

NOTES:

1. TD-10, TF-06 AND TF-10 DO NOT REQUIRE EXCAVATION, NO CONFIRMATION SAMPLING NECESSARY.

THERMAL DESORPTION TREATMENT OF PCB-CONTAMINATED SOIL AT THE FORMER NAVAL AIR STATION BARBERS POINT, AND PEARL HARBOR NAVAL COMPLEX
OAHU, HAWAII

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
PACIFIC DIVISION
MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT THE FORMER NAVAL AIR STATION BARBERS POINT, AND FORD ISLAND PEARL HARBOR NAVAL COMPLEX
OAHU, HAWAII

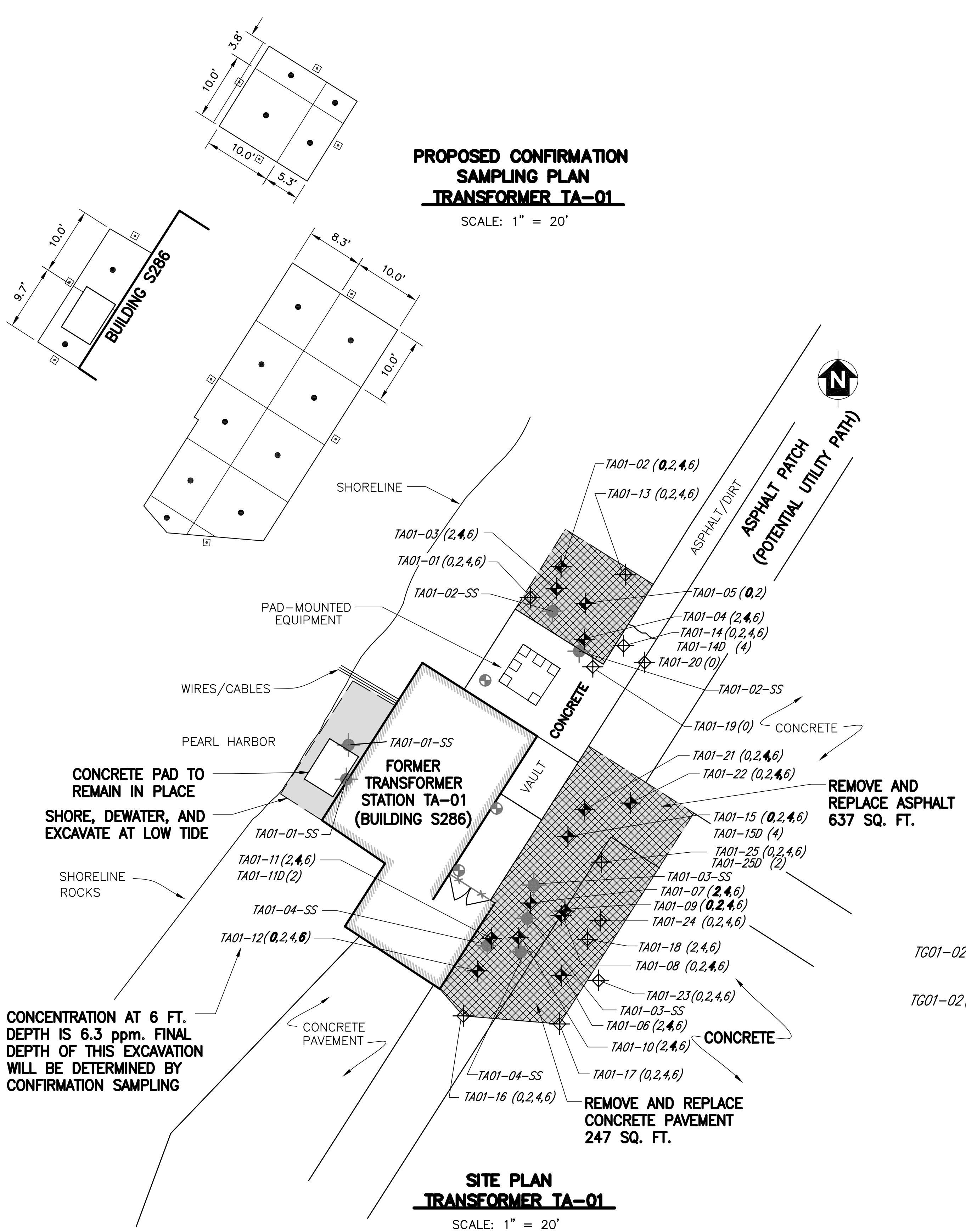
VICINITY MAP AND FIGURE INDEX

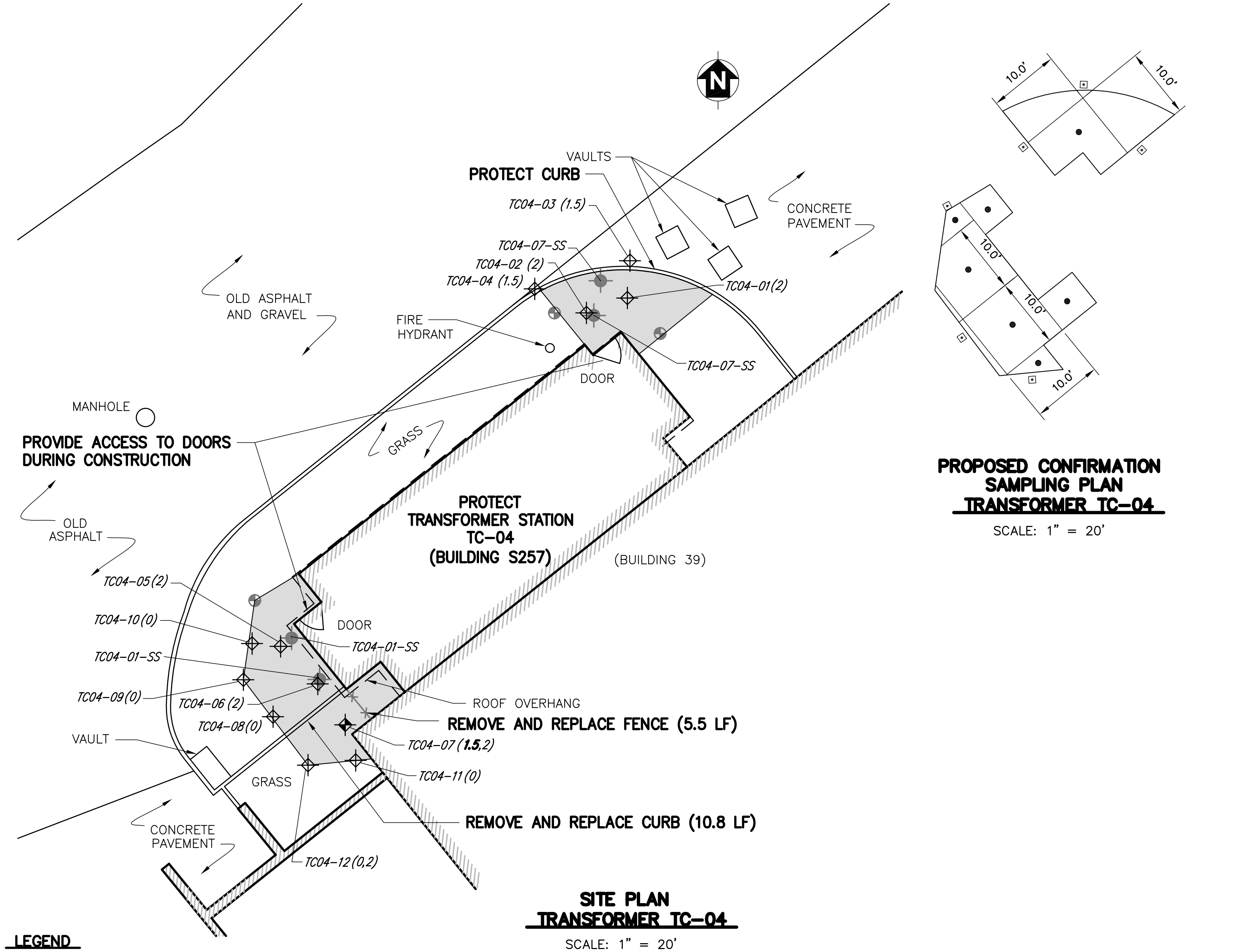
| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |

PLOT DATE 04/11/2003 F1

SCALE AS NOTED SHEET 1 OF 17

R:\Navy\BarbersPoint\CtoD0A\M19\Confirmation\ F1-TRANS-LOC.dwg 04/11/2003 Vincent.Cavanaugh DN




## LEGEND

| | |
|---|---|
| TG01-02 (2) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| TG01-02 (**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | EXCAVATION AREA – DEPTH 6 FT. |
| | ESTIMATED BOUNDARY: DELINEATION EFFORTS INCONCLUSIVE |
| | BUILDING |
| | CURB |
| | FENCE |

10' 0 10' 20'

SCALE: 1" = 20'

PLOT DATE 04/11/2003

F2

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

**PACIFIC DIVISION**

MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII

**TRANSFORMER SITES TA-01 AND TC-04 PROPOSED CONFIRMATION SAMPLING LOCATIONS**

| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |

SCALE AS NOTED — SHEET 2 OF 17

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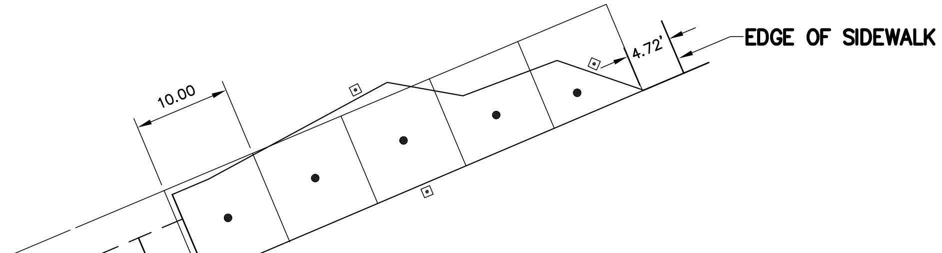
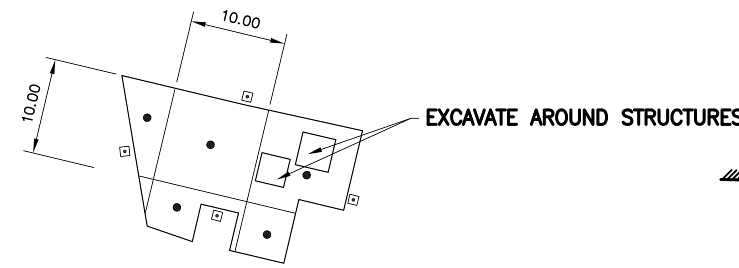


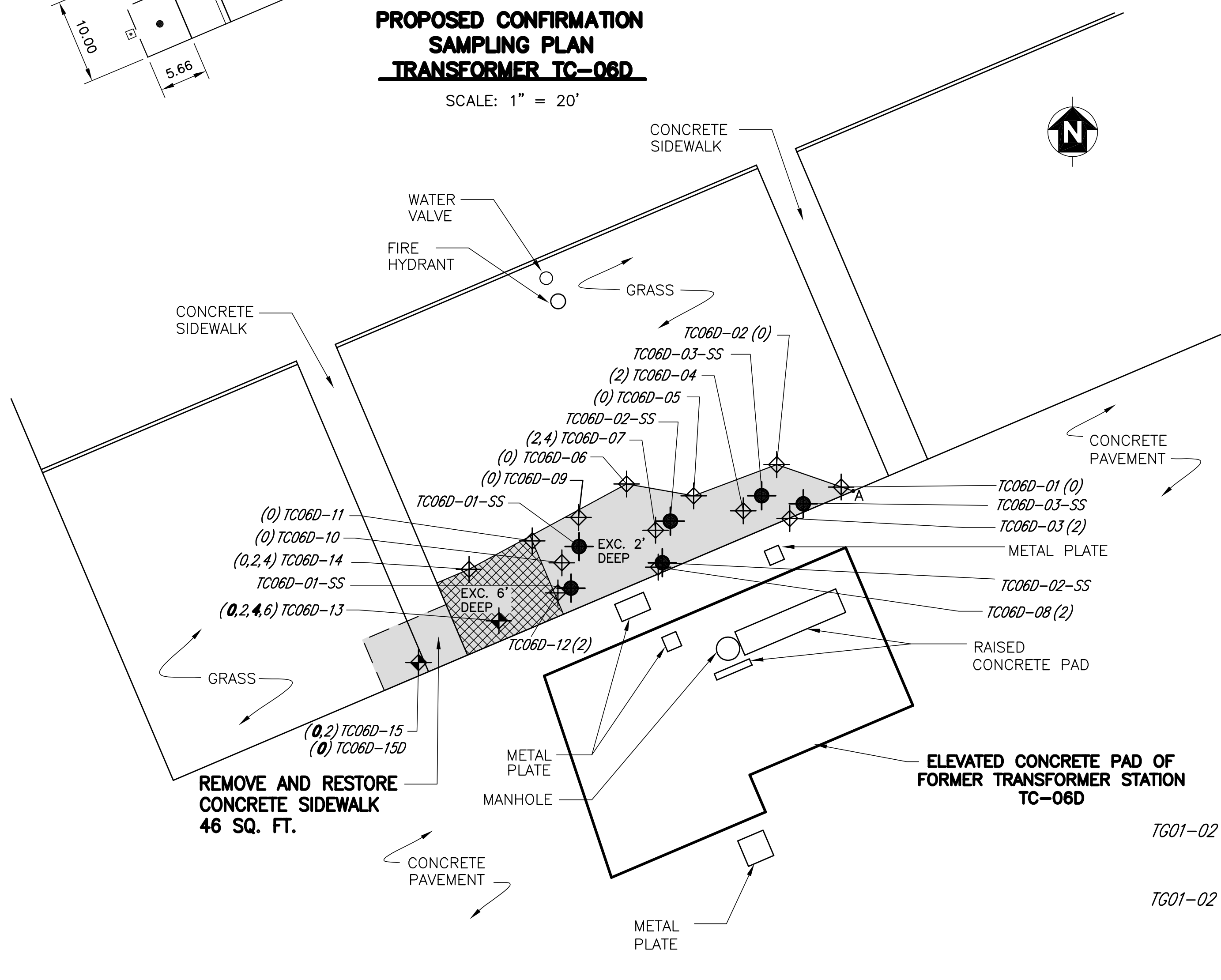

**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TC-06D**

SCALE: 1" = 20'



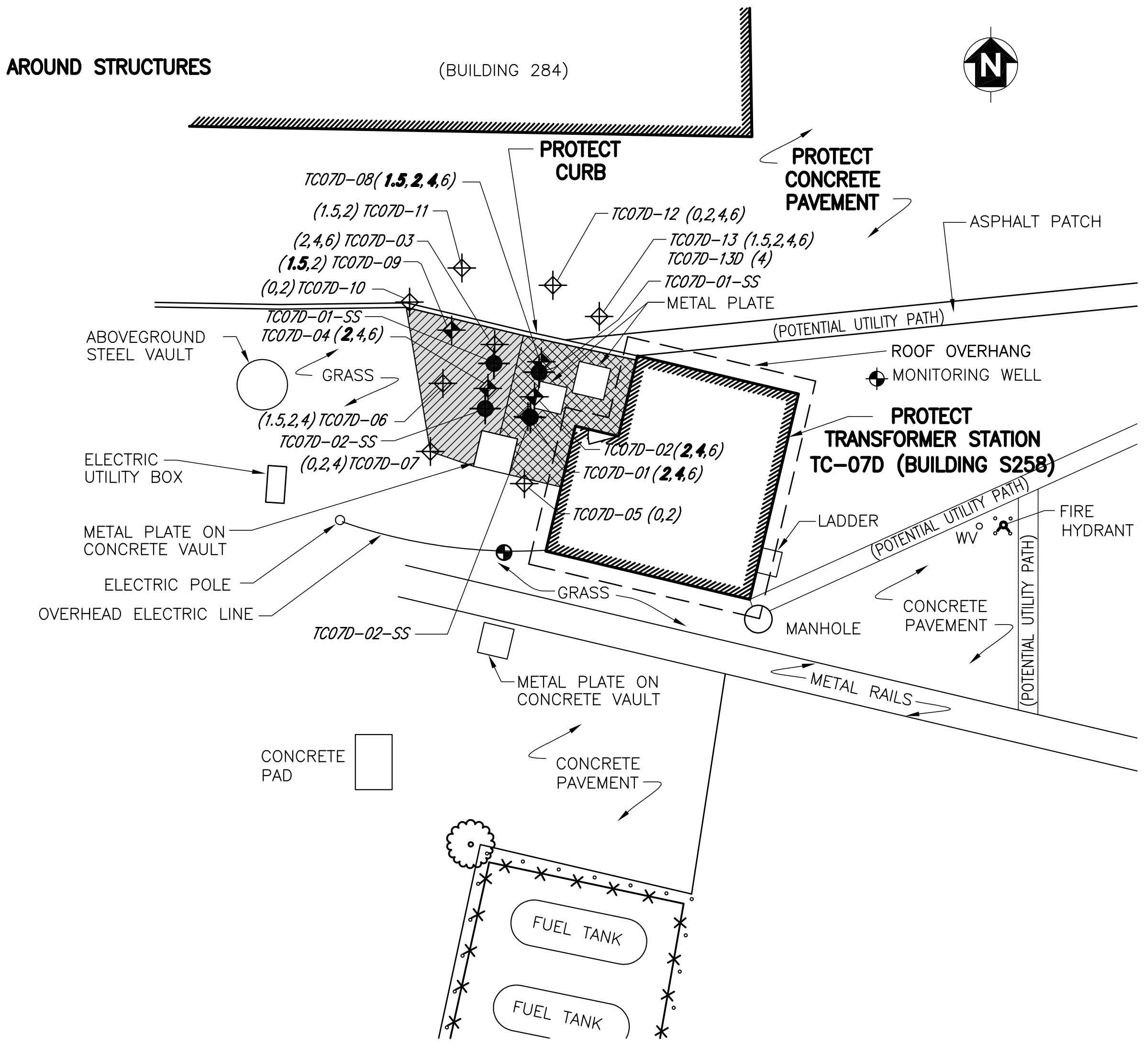

**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TC-07D**

SCALE: 1" = 20'




**SITE PLAN**
**TRANSFORMER TC-06D**

SCALE: 1" = 20'




**SITE PLAN**
**TRANSFORMER TC-07D**

SCALE: 1" = 20'

**LEGEND**

| | |
|---|---|
| TG01-02 (2) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| TG01-02 (**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | EXCAVATION AREA – DEPTH 4 FT. |
| | EXCAVATION AREA – DEPTH 6 FT. |
| — — — | ESTIMATED BOUNDARY: DELINEATION EFFORTS INCONCLUSIVE |
| | BUILDING |
| | CURB |
| ×—×—× | FENCE |

10' 0 10' 20'

SCALE: 1" = 20'

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

**PACIFIC DIVISION**

MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII

**TRANSFORMER SITES TC-06D AND TC-07D PROPOSED CONFIRMATION SAMPLING LOCATIONS**

| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |

PLOT DATE 04/11/2003 | F3 | SCALE AS NOTED | SHEET 3 OF 17

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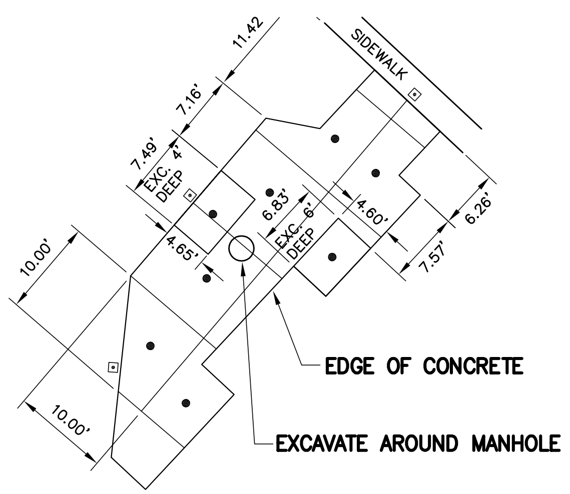
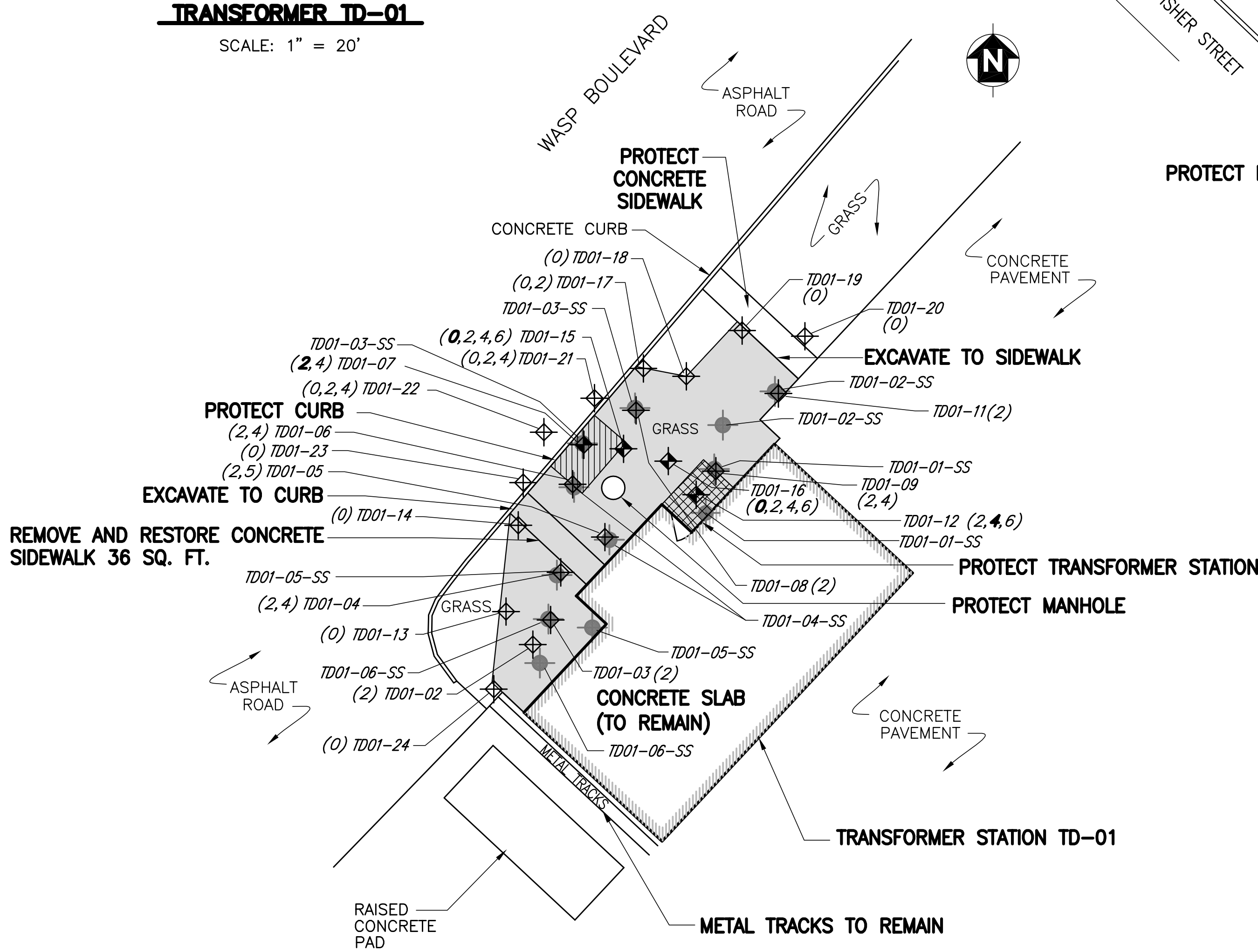


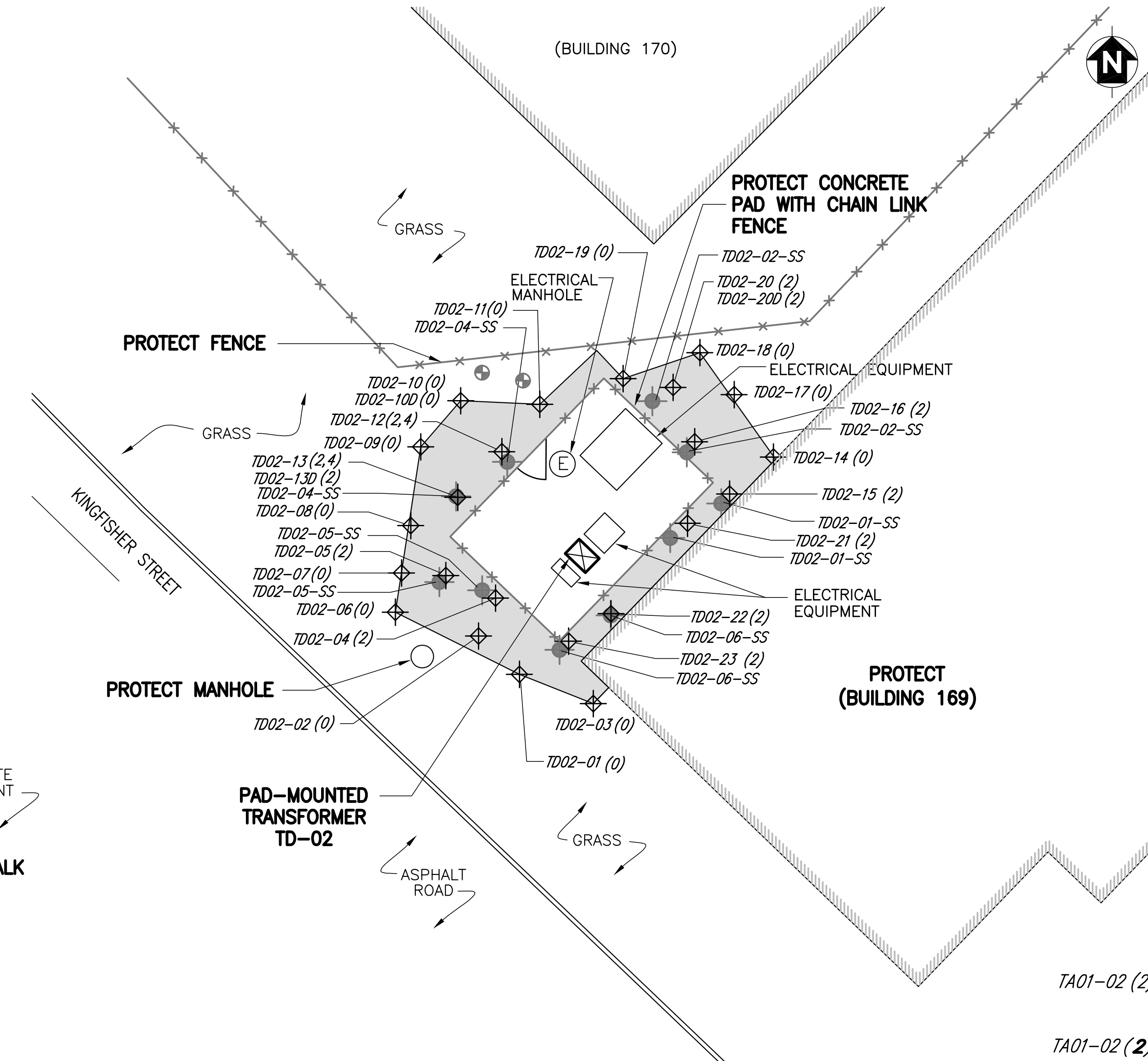

**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TD-01**

SCALE: 1" = 20'



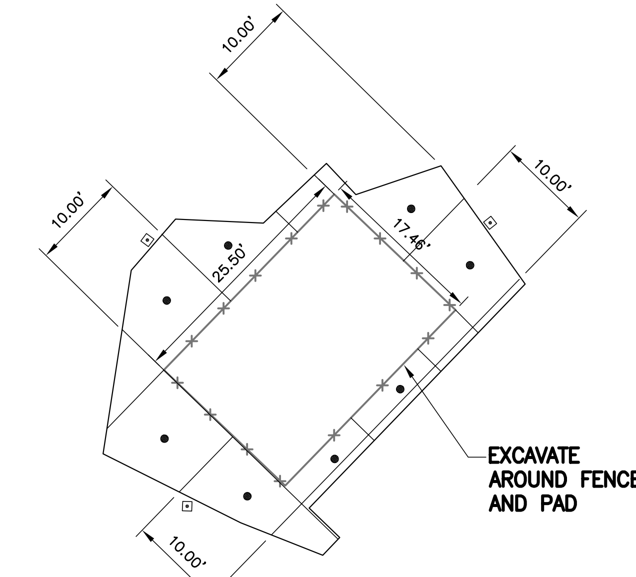

**SITE PLAN**
**TRANSFORMER TD-01**

SCALE: 1" = 20'




**SITE PLAN**
**TRANSFORMER TD-02**

SCALE: 1" = 20'




**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TD-02**

SCALE: 1" = 20'

**LEGEND**

- TA01-02 (2) — SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES
- TA01-02 (**2**) — SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES
- PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg
- PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg
- EXCAVATION CONFIRMATION SAMPLE
- SIDEWALL CONFIRMATION SAMPLE
- EXCAVATION AREA – DEPTH 2 FT.
- EXCAVATION AREA – DEPTH 4 FT.
- EXCAVATION AREA – DEPTH 6 FT.
- BUILDING
- CURB
- FENCE

10' 0 10' 20'

SCALE: 1" = 20'

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

**PACIFIC DIVISION**

MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE
AT FORD ISLAND PEARL HARBOR,
OAHU, HAWAII

**TRANSFORMER SITES TD-01 AND TD-02**
**PROPOSED CONFIRMATION SAMPLING LOCATIONS**

| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |

SCALE AS NOTED — SHEET 4 OF 17

PLOT DATE 04/11/2003

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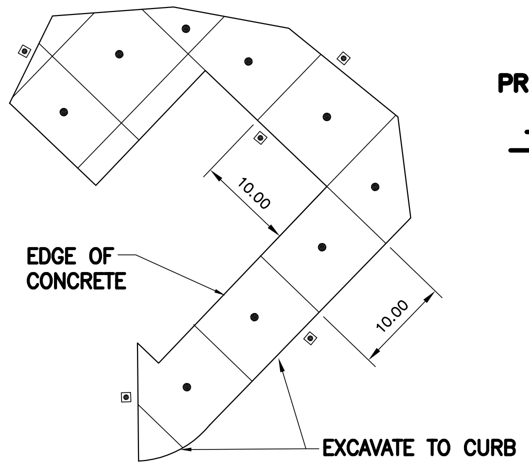
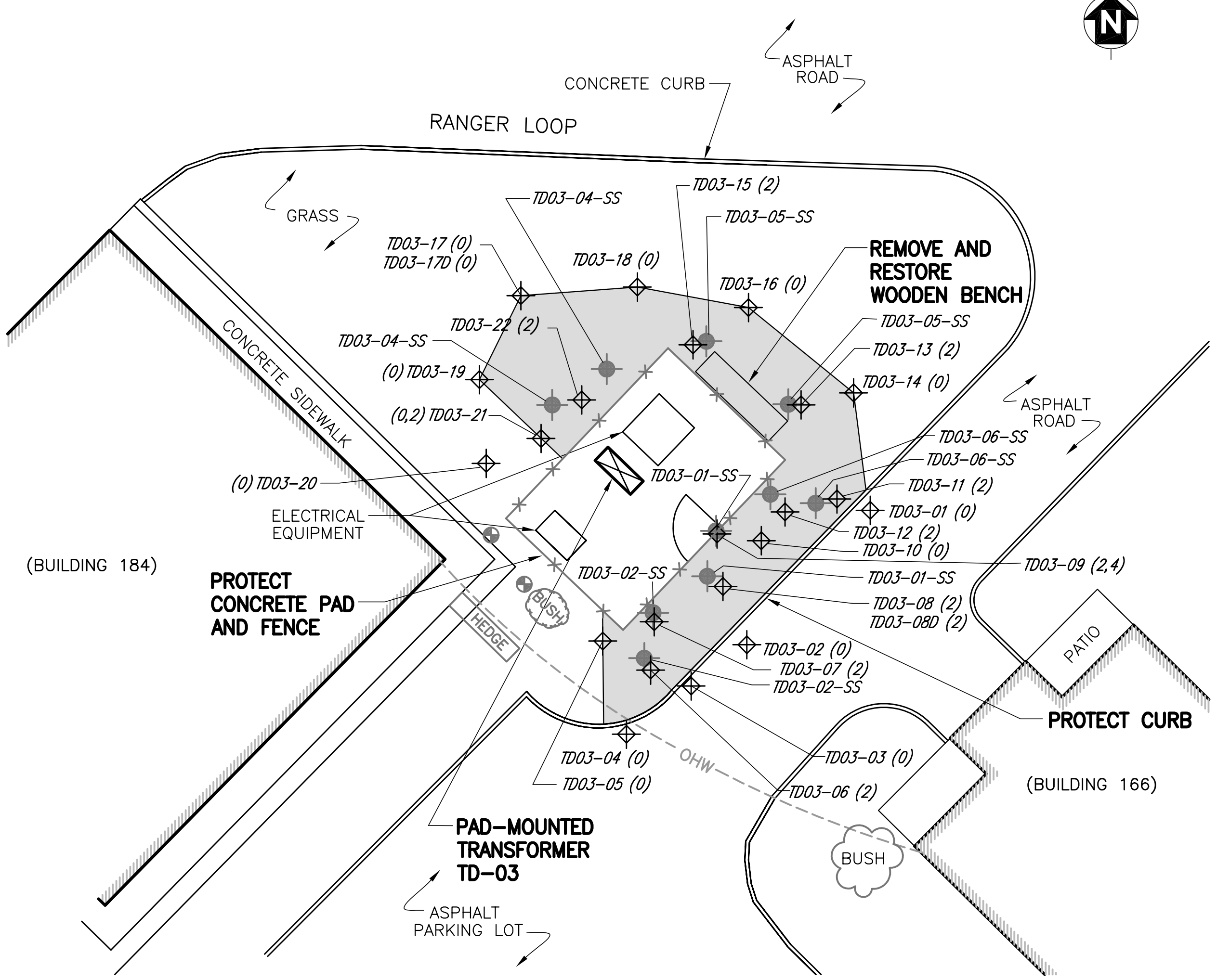


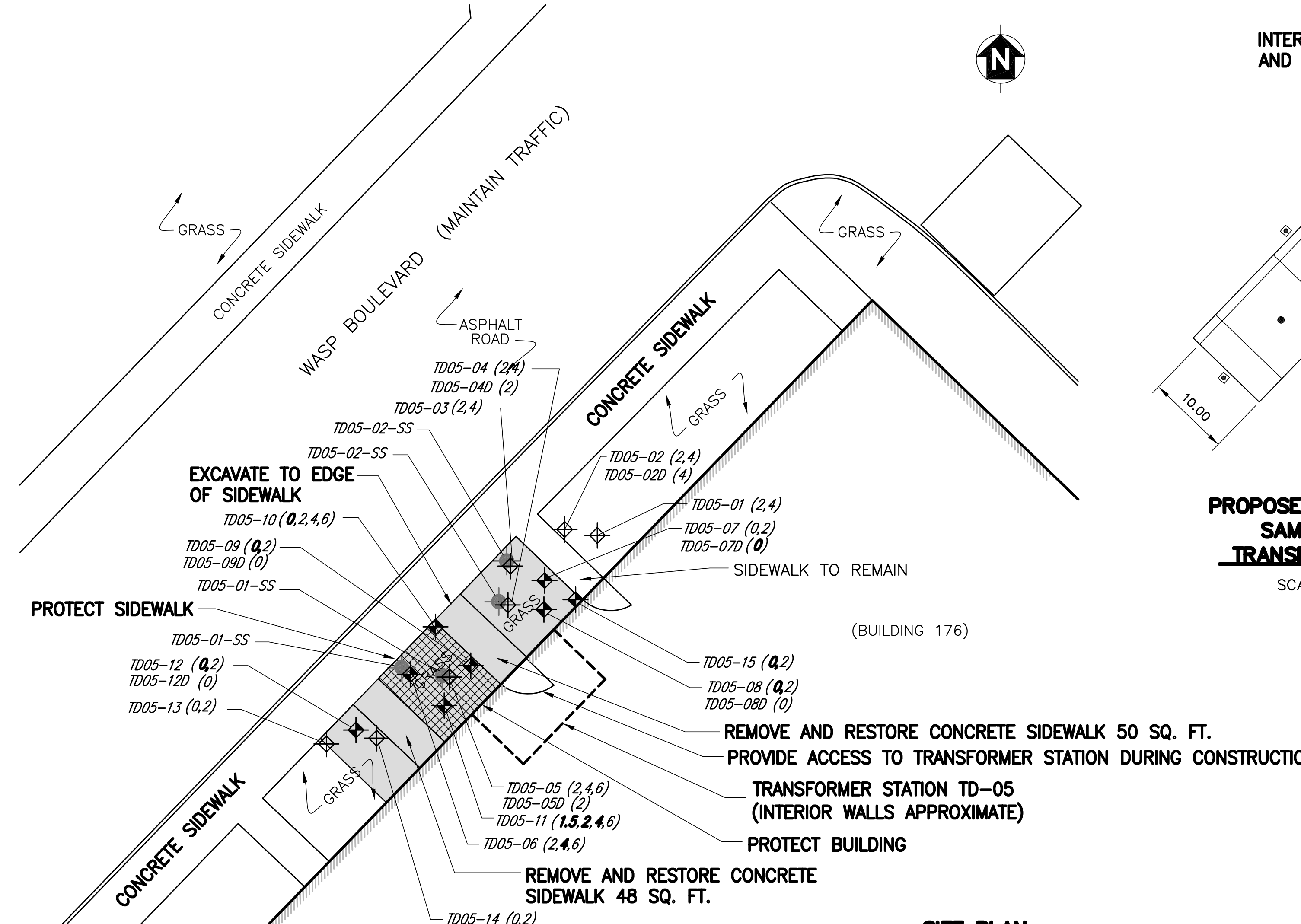

**PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER TD-03**

SCALE: 1" = 20'



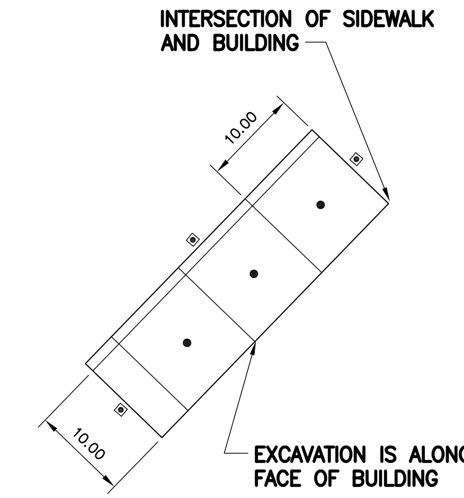

**SITE PLAN TRANSFORMER TD-03**

SCALE: 1" = 20'




**SITE PLAN TRANSFORMER TD-05**

SCALE: 1" = 20'




**PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER TD-05**

SCALE: 1" = 20'

**LEGEND**

- TG01-02 (2) — SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES
- TG01-02 (**2**) — SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES
- PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg
- PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg
- EXCAVATION CONFIRMATION SAMPLE
- SIDEWALL CONFIRMATION SAMPLE
- EXCAVATION AREA – DEPTH 2 FT.
- EXCAVATION AREA – DEPTH 6 FT.
- BUILDING
- CURB
- FENCE
- – –OHW– – OVERHEAD LINE

10' 0 10' 20'

SCALE: 1" = 20'

| | | |
|---|---|---|
| DEPARTMENT OF THE NAVY | PACIFIC DIVISION MAKALAPA, HAWAII | NAVAL FACILITIES ENGINEERING COMMAND |
| EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII | | |
| TRANSFORMER SITES TD-03 AND TD-05 PROPOSED CONFIRMATION SAMPLING LOCATIONS | | |
| SIZE B | CODE IDENT NO 0 | |
| SCALE AS NOTED | | SHEET 5 OF 17 |

PLOT DATE 04/11/2003

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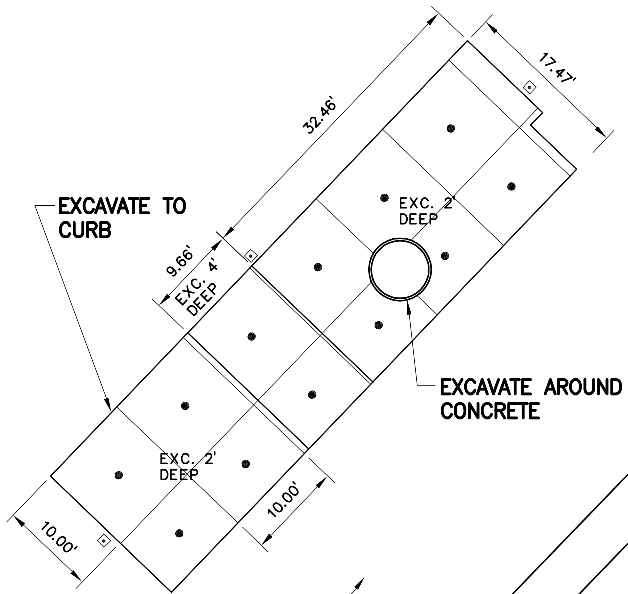
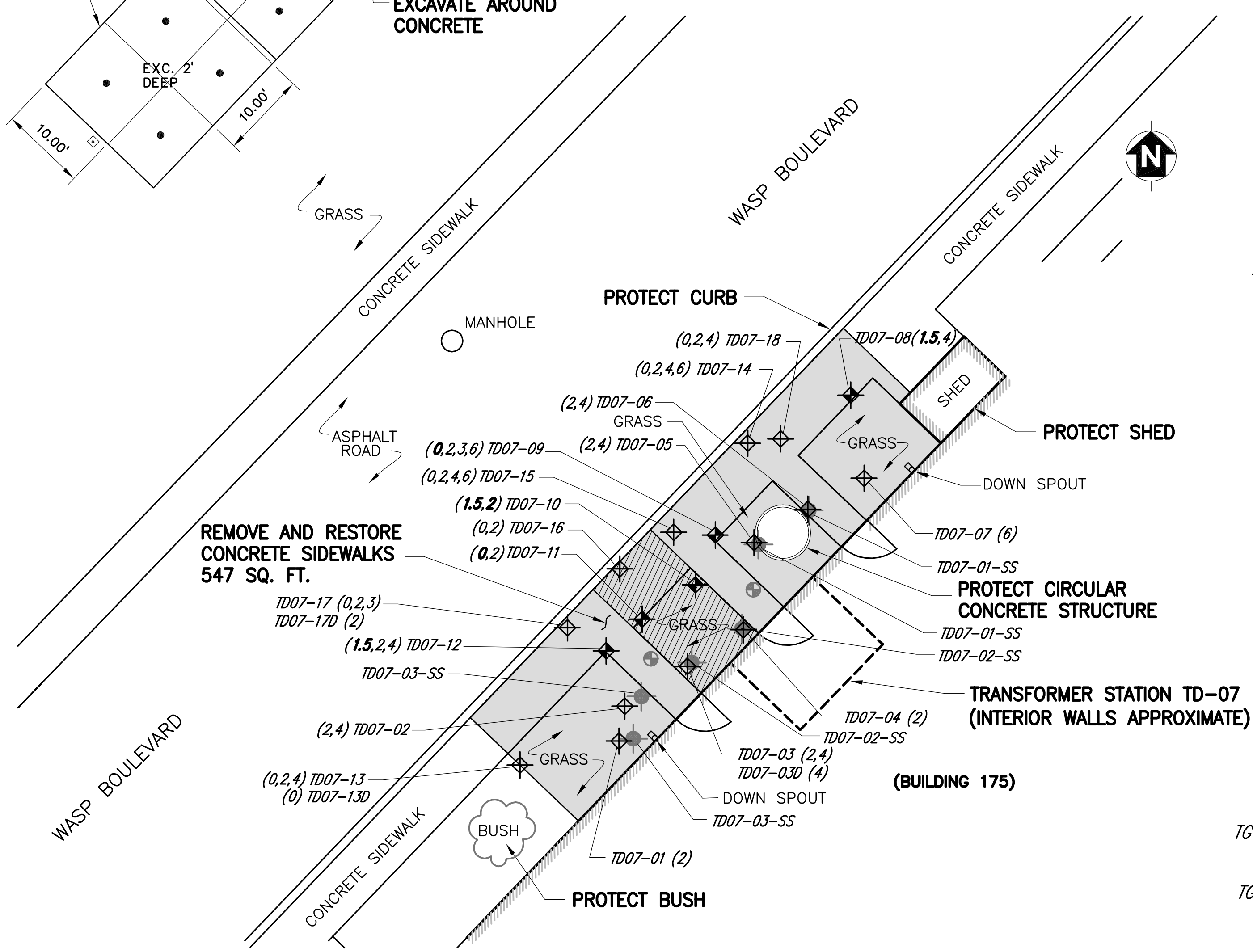


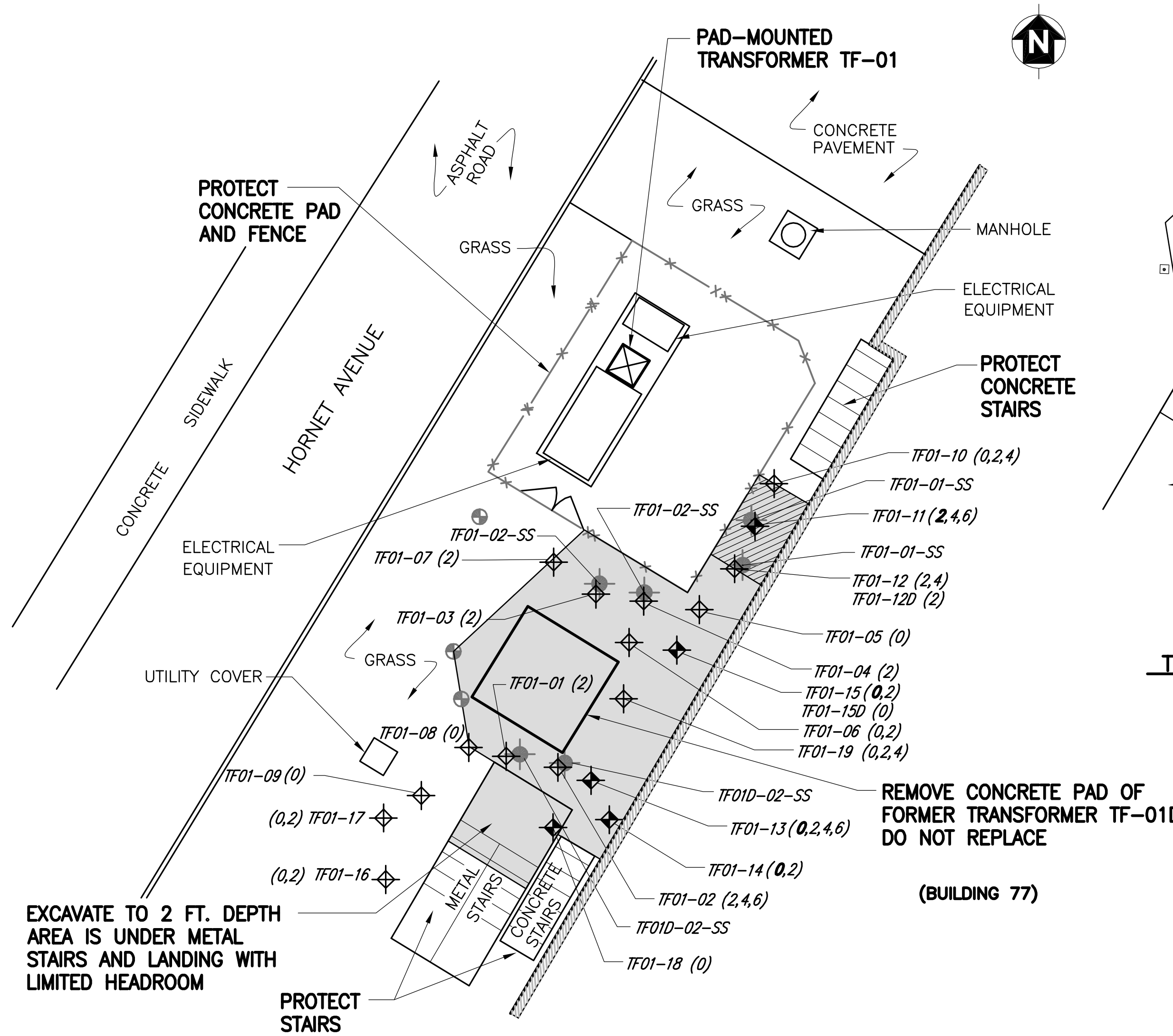

## PROPOSED CONFIRMATION SAMPLING PLAN
## TRANSFORMER TD-07

SCALE: 1" = 20'



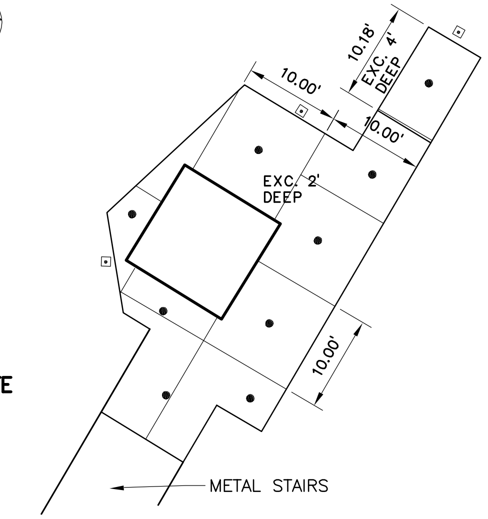

## SITE PLAN
## TRANSFORMER TD-07

SCALE: 1" = 20'




## SITE PLAN
## TRANSFORMER TF-01 & TF-01D

SCALE: 1" = 20'




## PROPOSED CONFIRMATION SAMPLING PLAN
## TRANSFORMER TF-01 AND TF-01D

SCALE: 1" = 20'

### LEGEND

| | |
|---|---|
| TG01-02(2) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| TG01-02(**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | EXCAVATION AREA – DEPTH 4 FT. |
| | ESTIMATED BOUNDARY: DELINEATION EFFORTS INCONCLUSIVE |
| | BUILDING |
| | CURB |
| | FENCE |

10' 0 10' 20'

SCALE: 1" = 20'

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

**PACIFIC DIVISION**
MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE
AT FORD ISLAND PEARL HARBOR,
OAHU, HAWAII

## TRANSFORMER SITES TD-07, TF-01, AND TF-01D PROPOSED CONFIRMATION SAMPLING LOCATIONS

| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |
| SCALE AS NOTED | | SHEET 6 OF 16 |

PLOT DATE 04/08/2003

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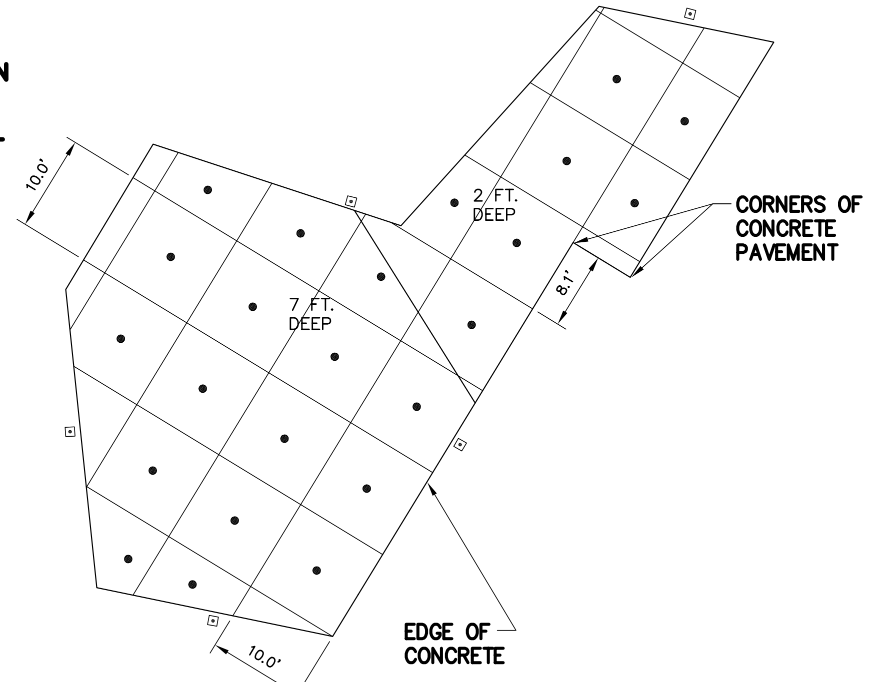
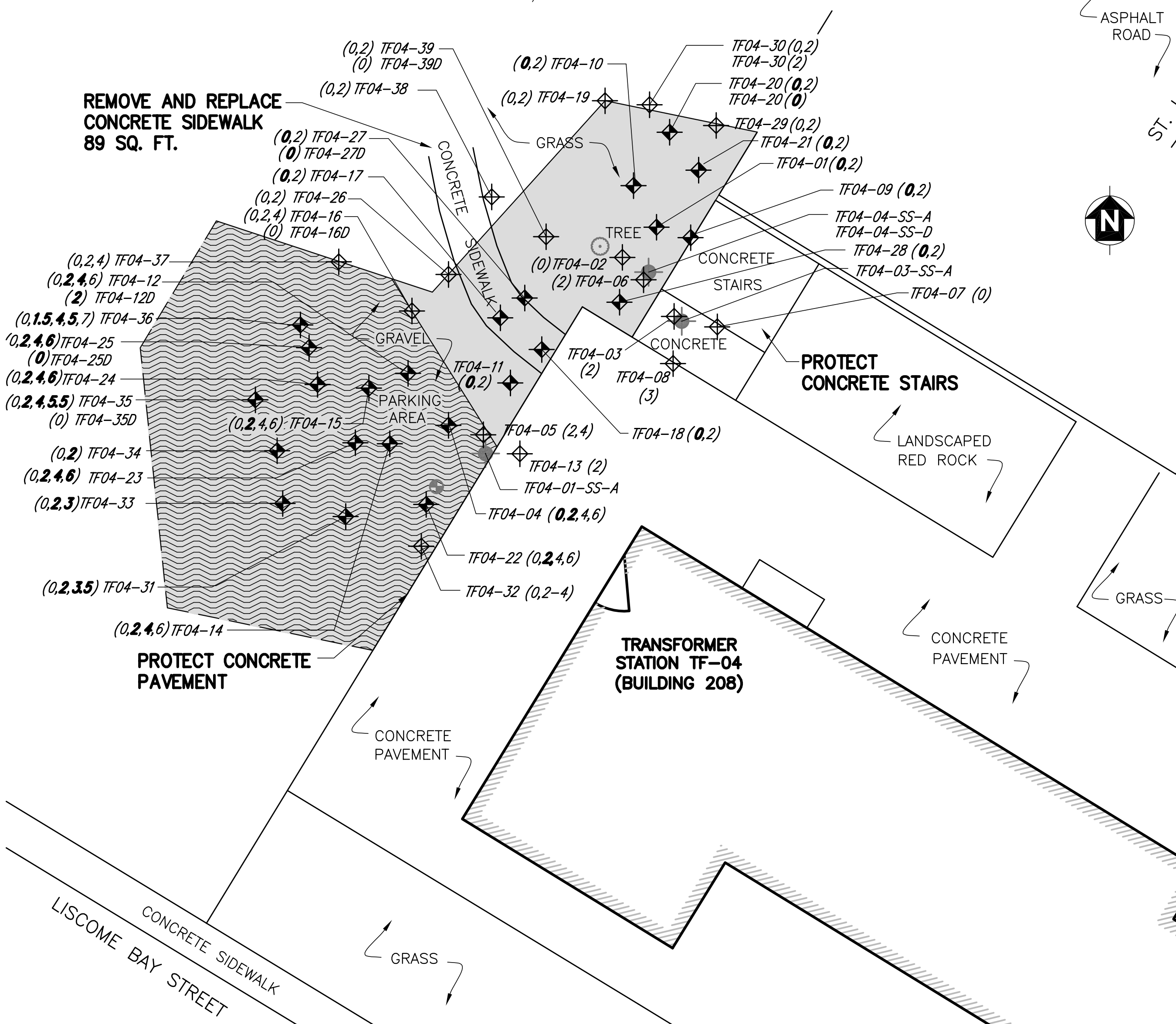
**PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER TF-04**

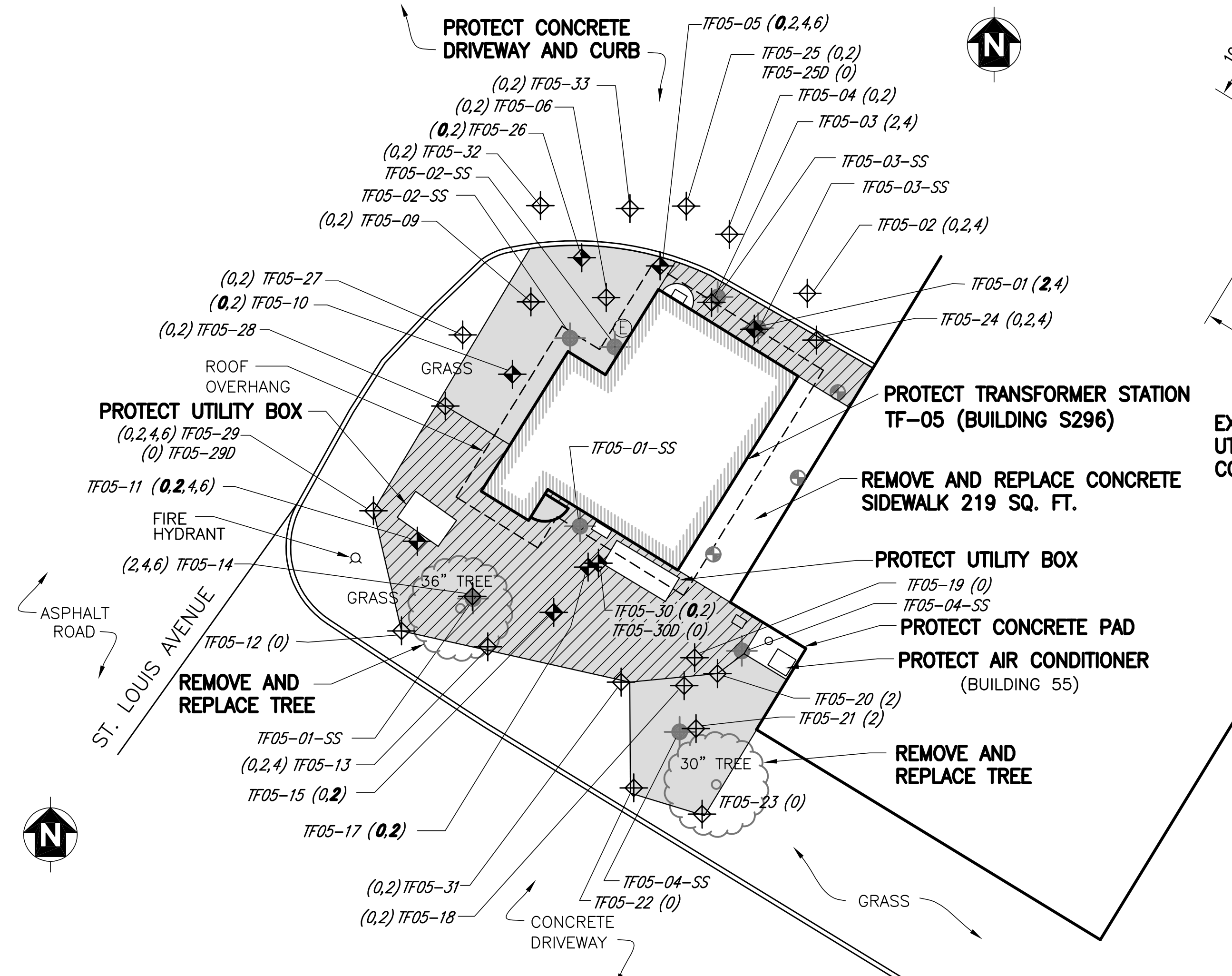
SCALE: 1" = 20'



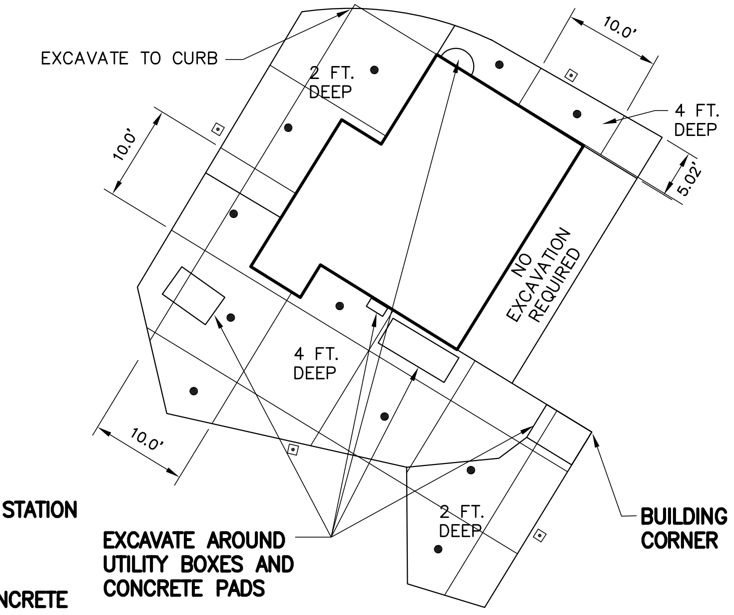

**SITE PLAN TRANSFORMER TF-04**

SCALE: 1" = 20'




**SITE PLAN TRANSFORMER TF-05**

SCALE: 1" = 20'




**PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER TF-05**

SCALE: 1" = 20'

**LEGEND**

| | |
|---|---|
| TG01-02 (2) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| TG01-02 (**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | EXCAVATION AREA – DEPTH 4 FT. |
| | EXCAVATION AREA – DEPTH 7 FT. |
| | ESTIMATED BOUNDARY: DELINEATION EFFORTS INCONCLUSIVE |
| | BUILDING |
| | CURB |

10' 0 10' 20'

SCALE: 1" = 20'

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PLOT DATE 04/11/2003

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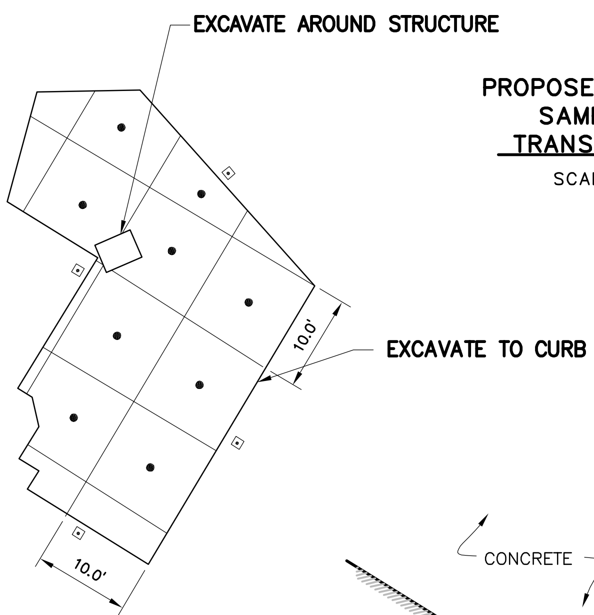
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

**PACIFIC DIVISION**
MAKALAPA, HAWAII

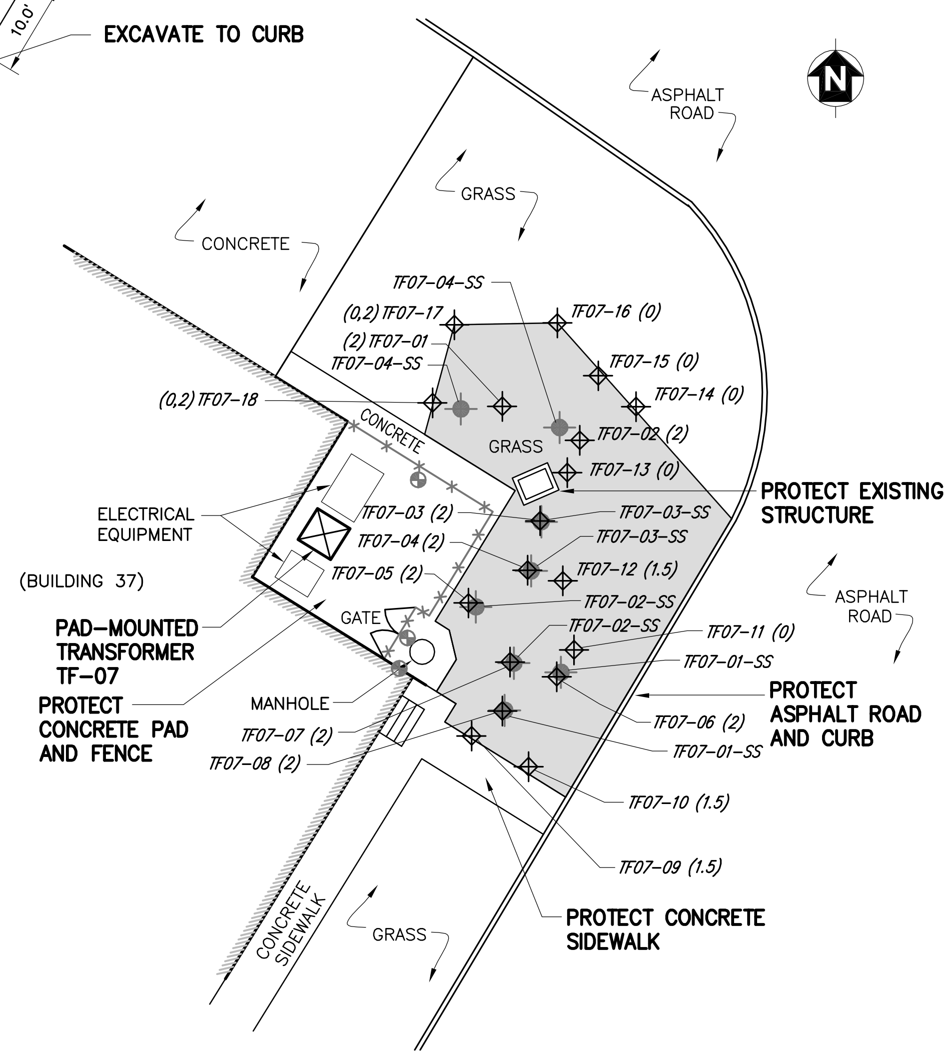
EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII

**TRANSFORMER SITES TF-04 AND TF-05 PROPOSED CONFIRMATION SAMPLING LOCATIONS**

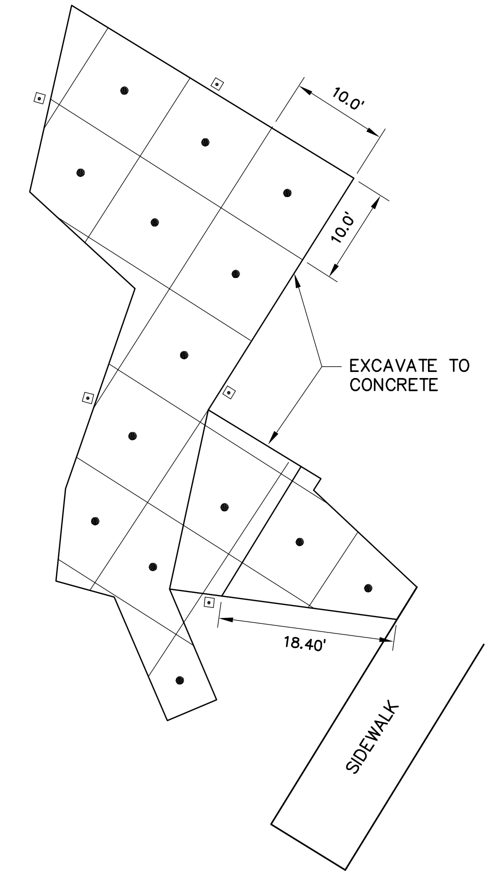
| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |
| SCALE AS NOTED | | SHEET 7 OF 17 |



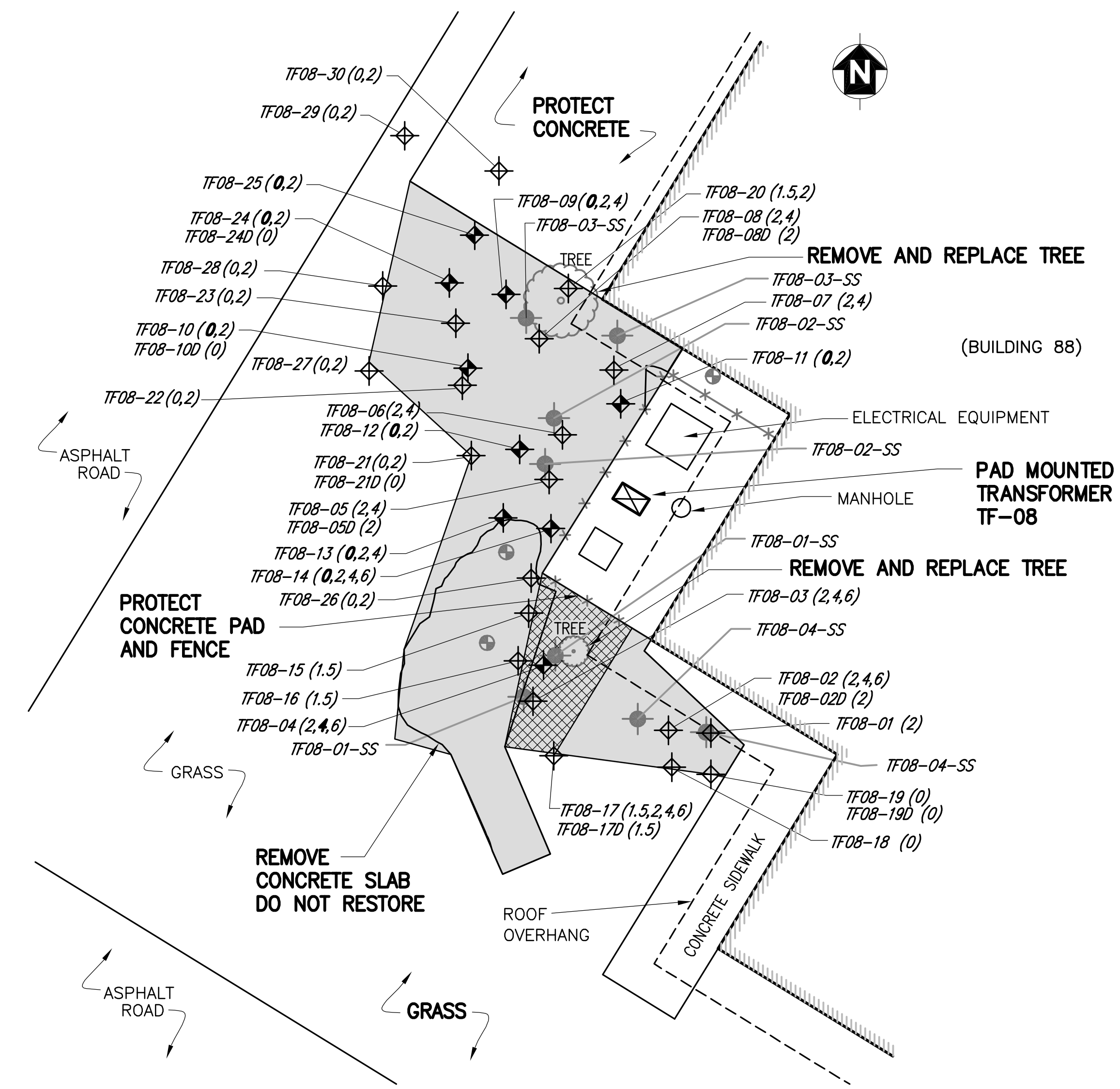

PROPOSED CONFIRMATION SAMPLING PLAN
TRANSFORMER TF-07
SCALE: 1" = 20'




SITE PLAN
TRANSFORMER TF-07
SCALE: 1" = 20'




PROPOSED CONFIRMATION SAMPLING PLAN
TRANSFORMER TF-08
SCALE: 1" = 20'




SITE PLAN
TRANSFORMER TF-08
SCALE: 1" = 20'

**LEGEND**

| | |
|---|---|
| TF08-02 (0) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| TF08-02 (**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | EXCAVATION AREA – DEPTH 6 FT. |
| | BUILDING |
| | CURB |
| | FENCE |

10' 0 10' 20'
SCALE: 1" = 20'

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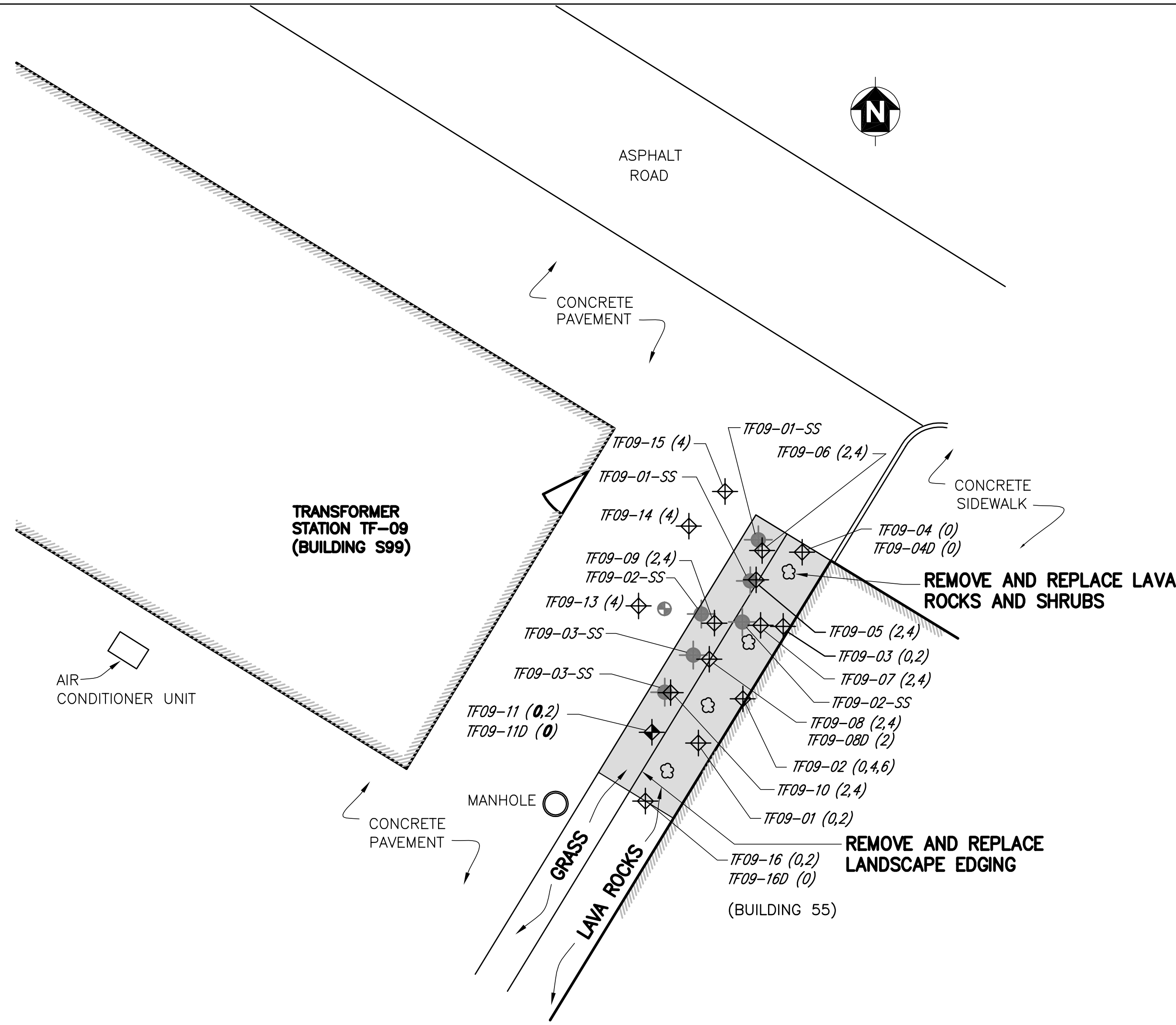
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
**PACIFIC DIVISION**
MAKALAPA, HAWAII

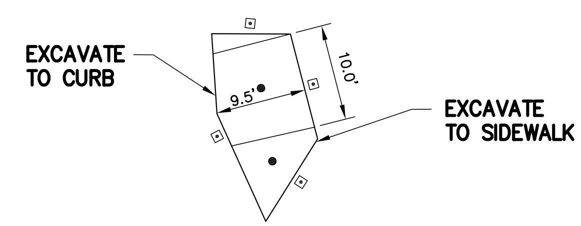
EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE
AT FORD ISLAND PEARL HARBOR,
OAHU, HAWAII

TRANSFORMER SITES TF-07 AND TF-08
PROPOSED CONFIRMATION SAMPLING LOCATIONS

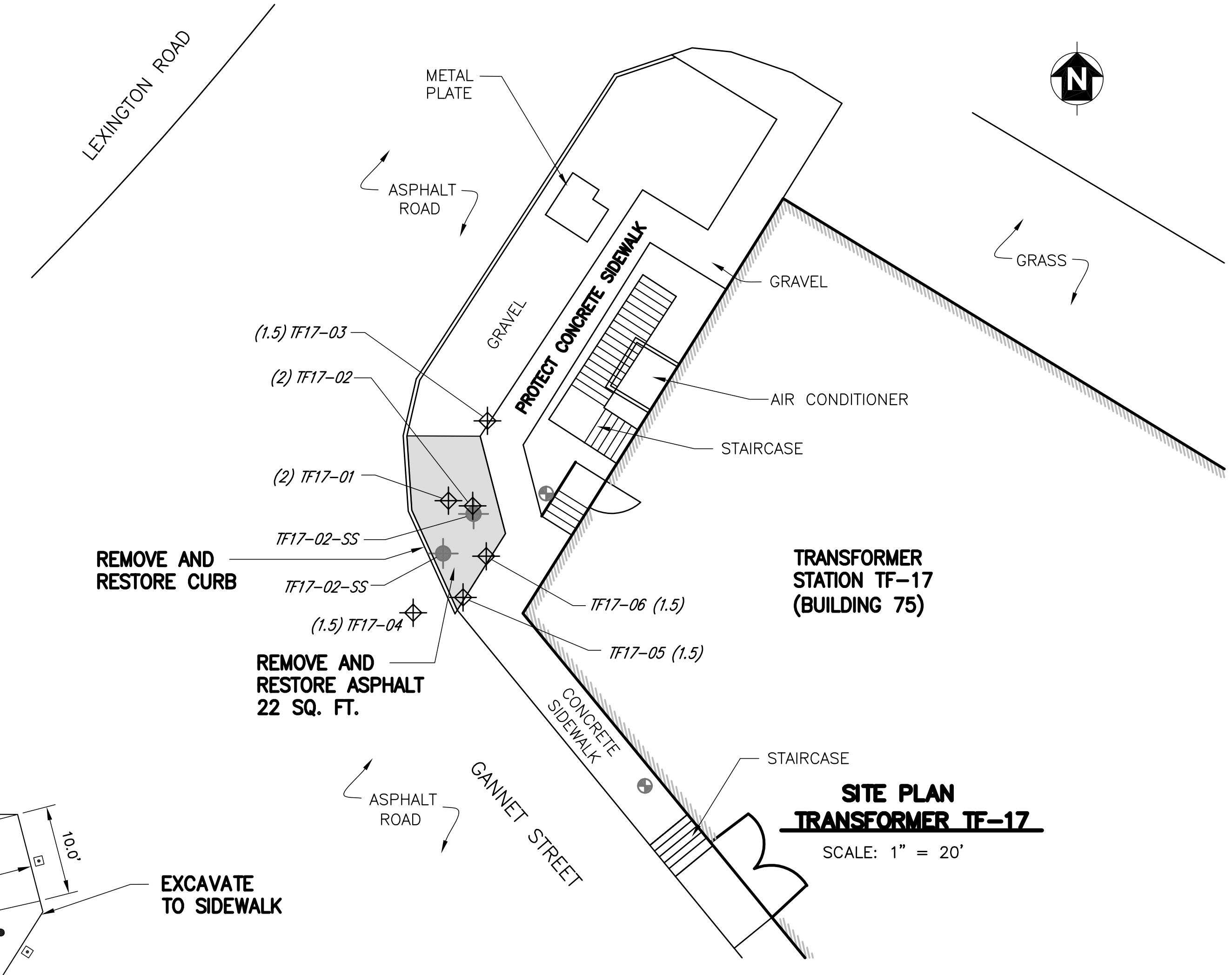
| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |
| SCALE AS NOTED | | SHEET 8 OF 17 |



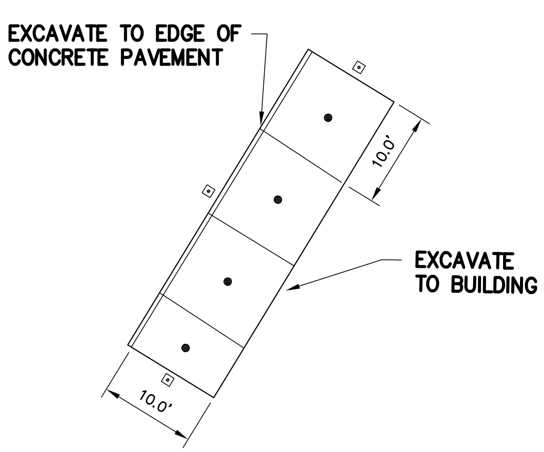

**SITE PLAN**
**TRANSFORMER TF-09**
SCALE: 1" = 20'




**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TF-17**
SCALE: 1" = 20'




**SITE PLAN**
**TRANSFORMER TF-17**
SCALE: 1" = 20'




**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TF-09**
SCALE: 1" = 20'

**LEGEND**

TF17-02(2) — SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES

TF17-02(**0**) — SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES

PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg

PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg

EXCAVATION CONFIRMATION SAMPLE

SIDEWALL CONFIRMATION SAMPLE

EXCAVATION AREA – DEPTH 2 FT.

BUILDING

CURB

10' 0 10' 20'
SCALE: 1" = 20'

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| | | |
|---|---|---|
| DEPARTMENT OF THE NAVY | **PACIFIC DIVISION** MAKALAPA, HAWAII | NAVAL FACILITIES ENGINEERING COMMAND |
| EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII | | |
| TRANSFORMER SITES TF-09 AND TF-17 PROPOSED CONFIRMATION SAMPLING LOCATIONS | | |
| SIZE B | CODE IDENT NO 0 | |
| SCALE AS NOTED | | SHEET 9 OF 17 |

PLOT DATE 04/11/2003

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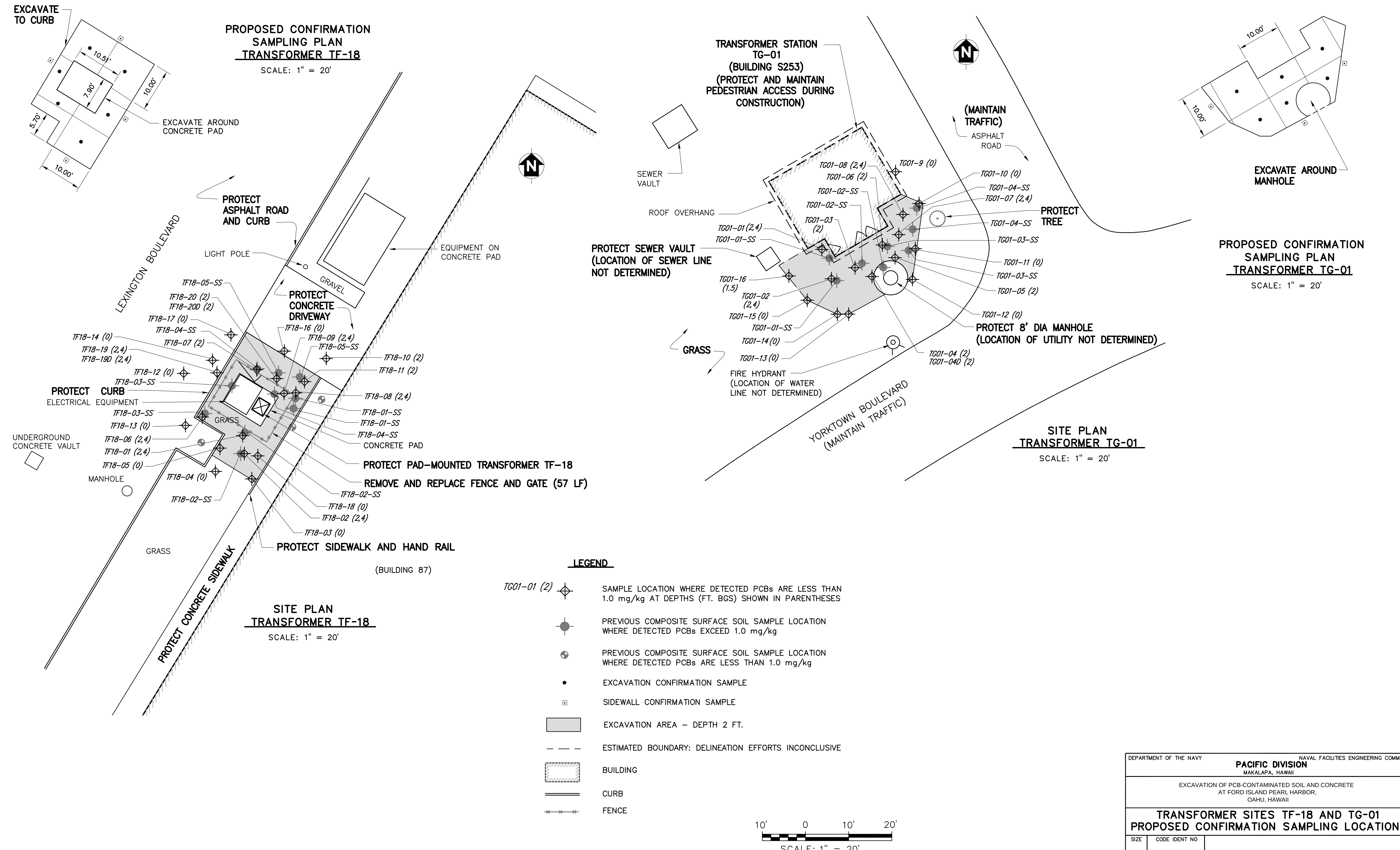


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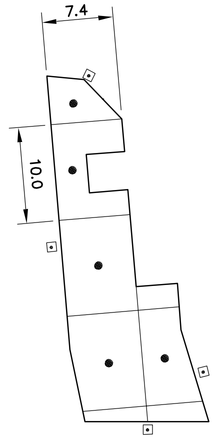
| | | |
|---|---|---|
| DEPARTMENT OF THE NAVY | PACIFIC DIVISION MAKALAPA, HAWAII | NAVAL FACILITIES ENGINEERING COMMAND |
| EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII | | |
| TRANSFORMER SITES TF-18 AND TG-01 PROPOSED CONFIRMATION SAMPLING LOCATIONS | | |
| SIZE B | CODE IDENT NO 0 | |
| SCALE AS NOTED | | SHEET 10 OF 16 |

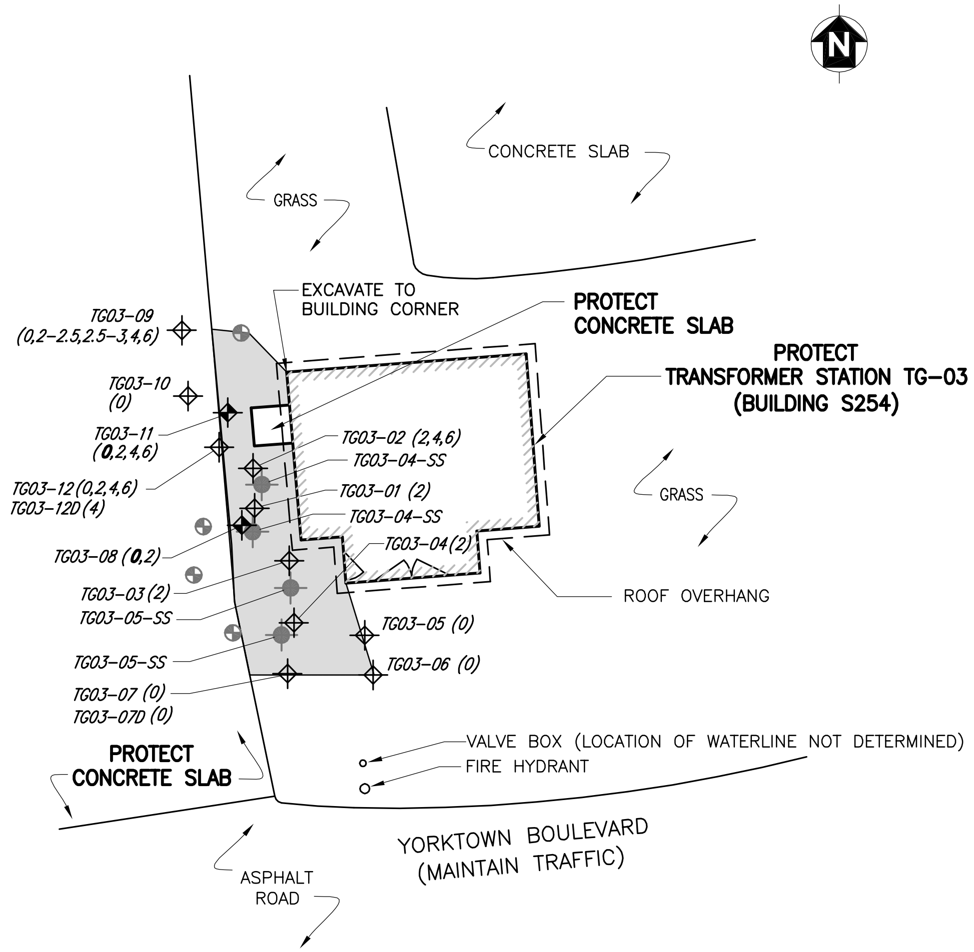
PLOT DATE 04/08/2003

F10



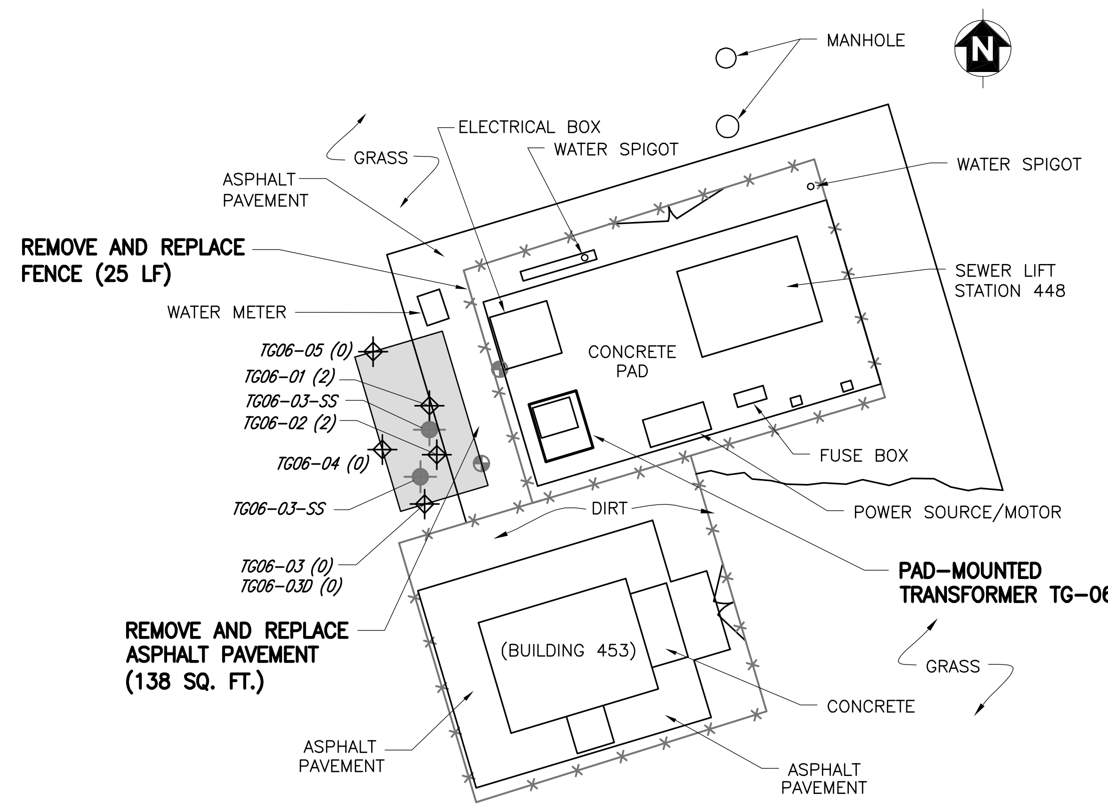

## PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER TG-03

SCALE: 1" = 20'



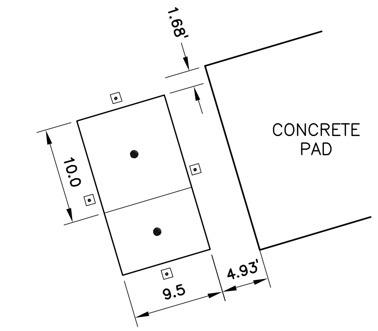

## SITE PLAN TRANSFORMER TG-03

SCALE: 1" = 20'




## SITE PLAN TRANSFORMER TG-06

SCALE: 1" = 20'




## PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER TG-06

SCALE: 1" = 20'

### LEGEND

| | |
|---|---|
| TG03-01 (2) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| TG03-08 (**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | BUILDING |
| | FENCE |

10' 0 10' 20'

SCALE: 1" = 20'

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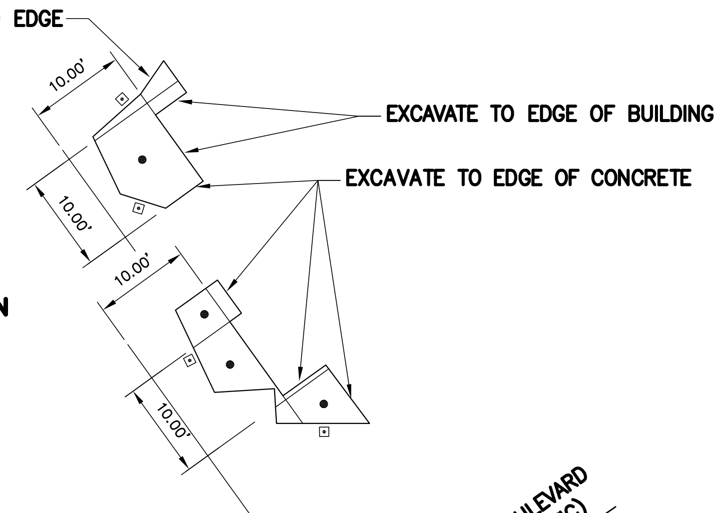
| | |
|---|---|
| DEPARTMENT OF THE NAVY | NAVAL FACILITIES ENGINEERING COMMAND |
| PACIFIC DIVISION MAKALAPA, HAWAII | |
| EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII | |
| TRANSFORMER SITES TG-03 AND TG-06 PROPOSED CONFIRMATION SAMPLING LOCATIONS | |
| SIZE: B | CODE IDENT NO: 0 |
| SCALE: AS NOTED | SHEET 11 OF 16 |

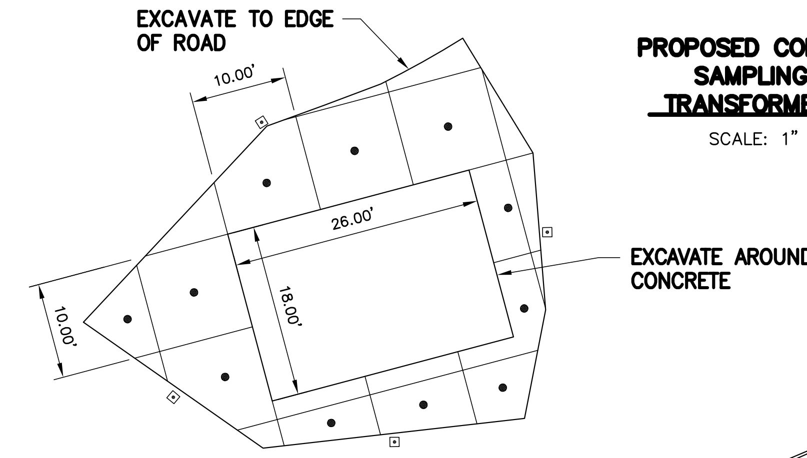
PLOT DATE 04/08/2003

F11



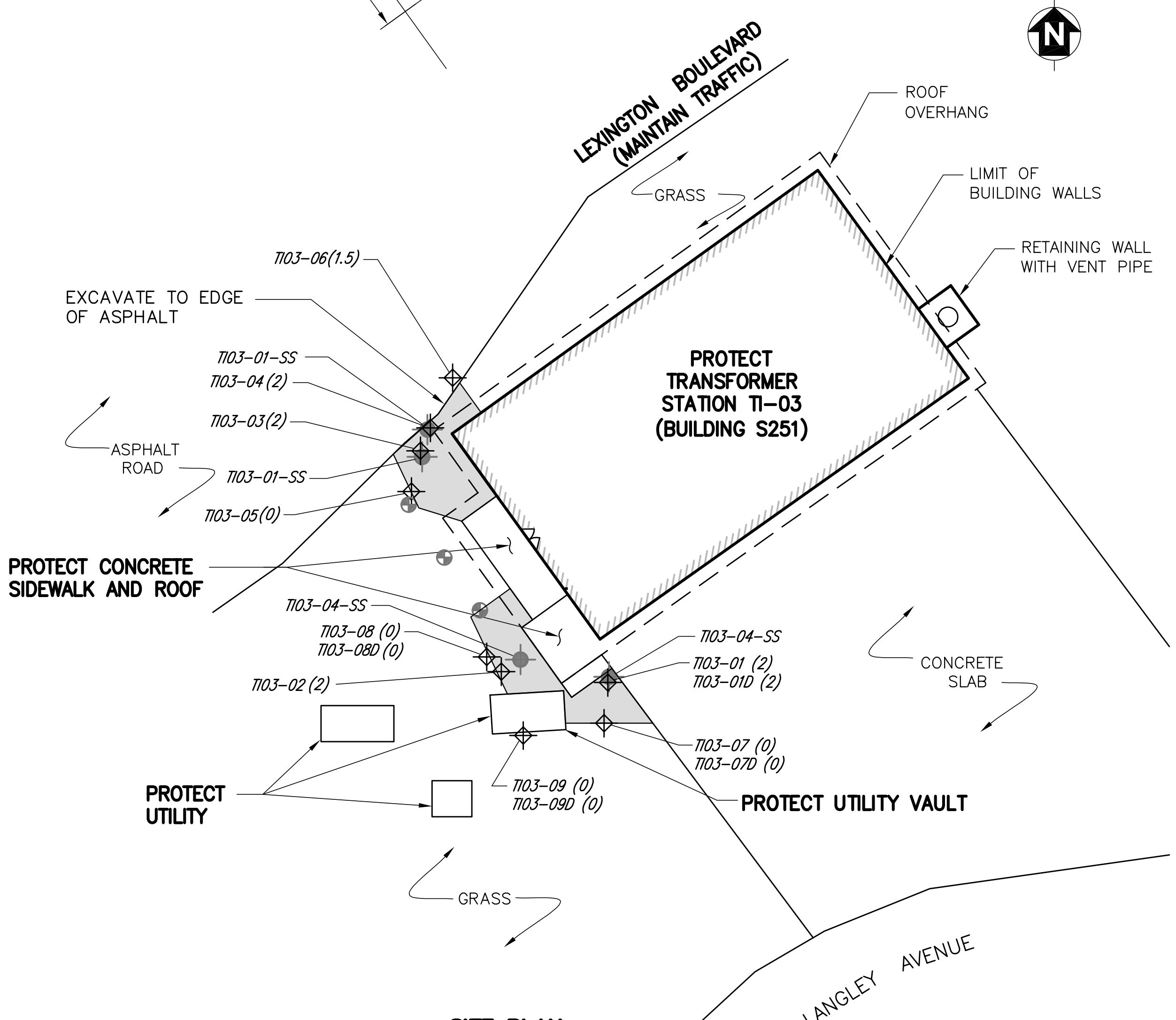

**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TI-03**

SCALE: 1" = 20'



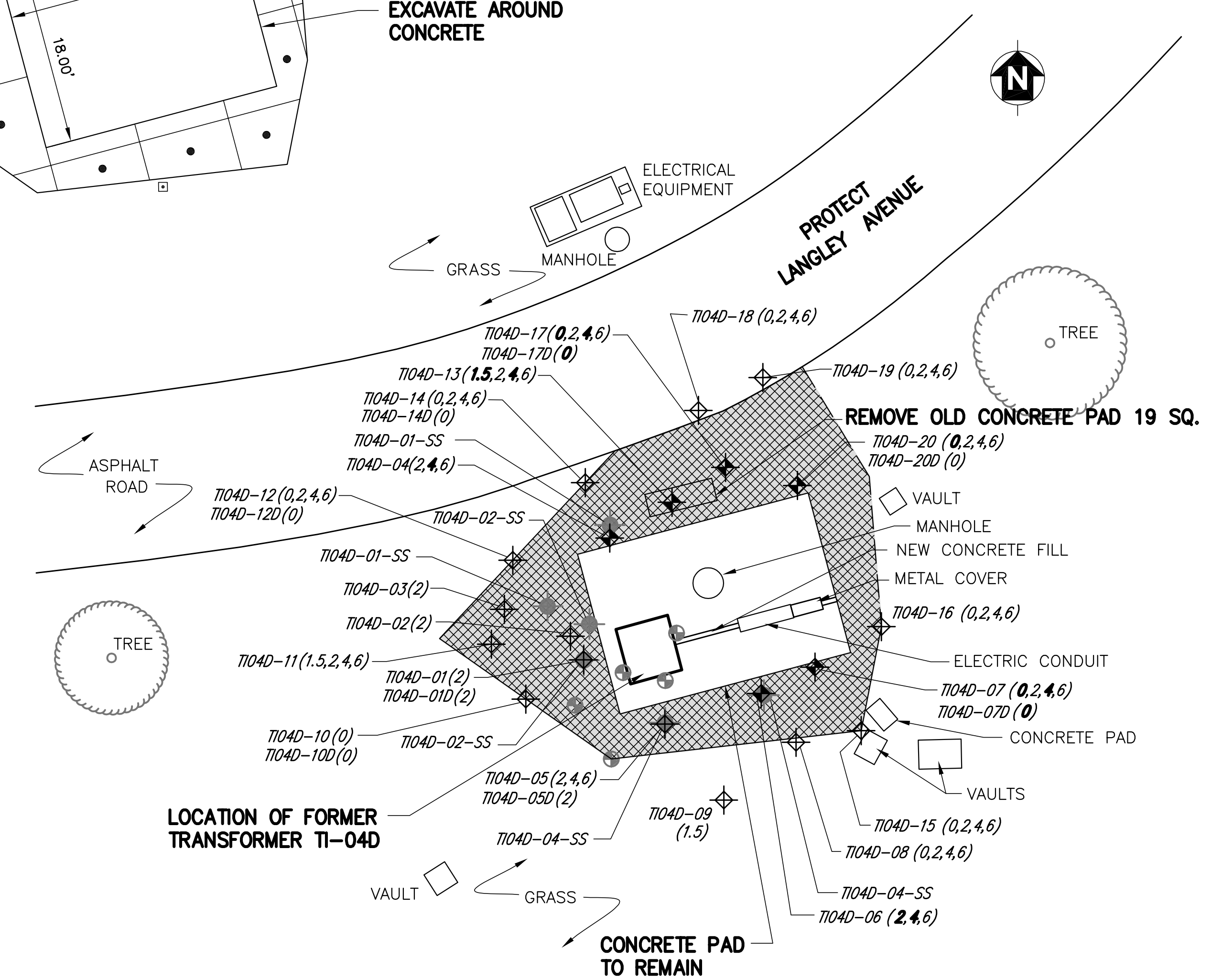

**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TI-04D**

SCALE: 1" = 20'




**SITE PLAN**
**TRANSFORMER TI-03**

SCALE: 1" = 20'




**SITE PLAN**
**TRANSFORMER TI-04D**

SCALE: 1" = 20'

**LEGEND**

| | |
|---|---|
| TI04-02 (2) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| TI04-02 (**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | EXCAVATION AREA – DEPTH 6 FT. |
| | ESTIMATED BOUNDARY: DELINEATION EFFORTS INCONCLUSIVE |
| | BUILDING |
| | FENCE |

10' 0 10' 20'

SCALE: 1" = 20'

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

**PACIFIC DIVISION**

MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT FORD ISLAND PEARL HARBOR, OAHU, HAWAII

TRANSFORMER SITES TI-03 AND TI-04D PROPOSED CONFIRMATION SAMPLING LOCATIONS

| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |
| SCALE AS NOTED | | SHEET 12 OF 17 |

PLOT DATE 04/11/2003

F12

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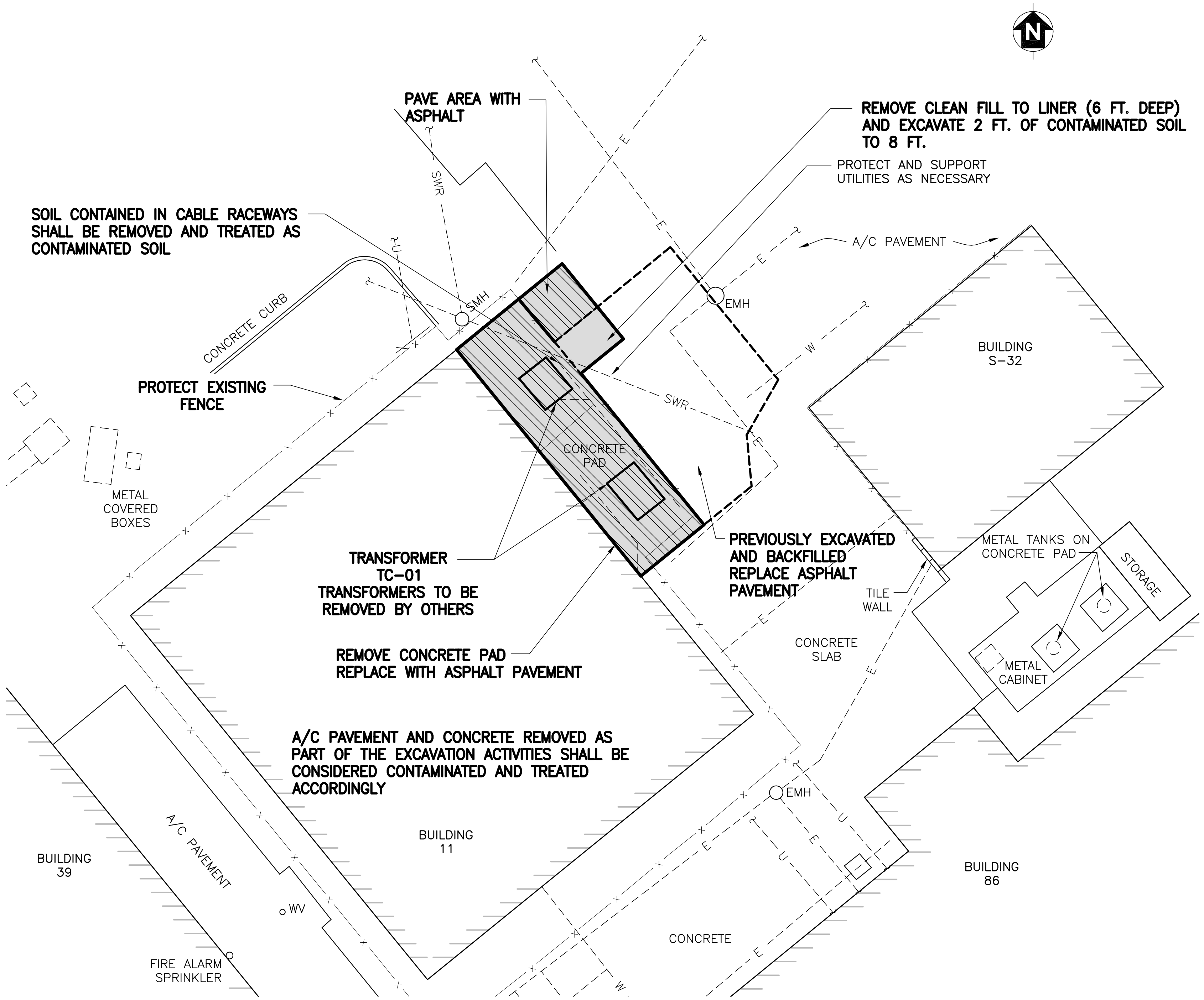
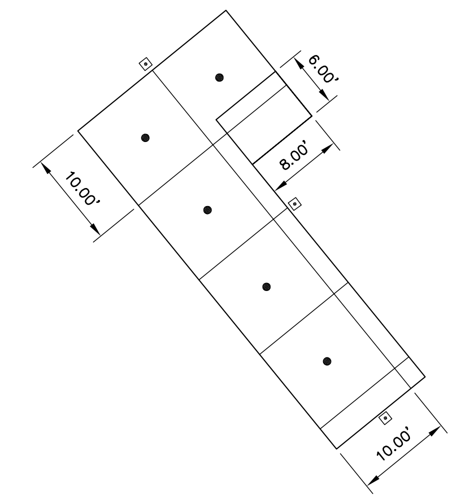



**SITE PLAN**
**TRANSFORMER TC-01**
SCALE: 1" = 20'




**PROPOSED CONFIRMATION SAMPLING PLAN**
**TRANSFORMER TC-01**
SCALE: 1" = 20'

**LEGEND**

- • EXCAVATION CONFIRMATION SAMPLE
- ⊡ SIDEWALL CONFIRMATION SAMPLE
- EXCAVATION AREA – DEPTH 2 FT. ADDITIONAL AFTER REMOVING 6 FT. OF CLEAN FILL
- EXCAVATION AREA – DEPTH 8 FT.
- BUILDING
- A/C ASPHALT CONCRETE
- EMH ELECTRIC MANHOLE
- SMH SEWER MANHOLE
- WV WATER VALVE
- ---SD--- STORM DRAIN
- --- W --- WATER
- --- U --- UNKNOWN UTILITY
- --- E --- ELECTRICAL
- --SWR-- SEWER
- —x—x— FENCE

PREVIOUS WORK HAS BEEN DONE AT THIS SITE.
ONLY REMAINING WORK IS SHOWN.

10' 0 10' 20'
SCALE: 1" = 20'

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
**PACIFIC DIVISION**
MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE
AT FORD ISLAND PEARL HARBOR,
OAHU, HAWAII

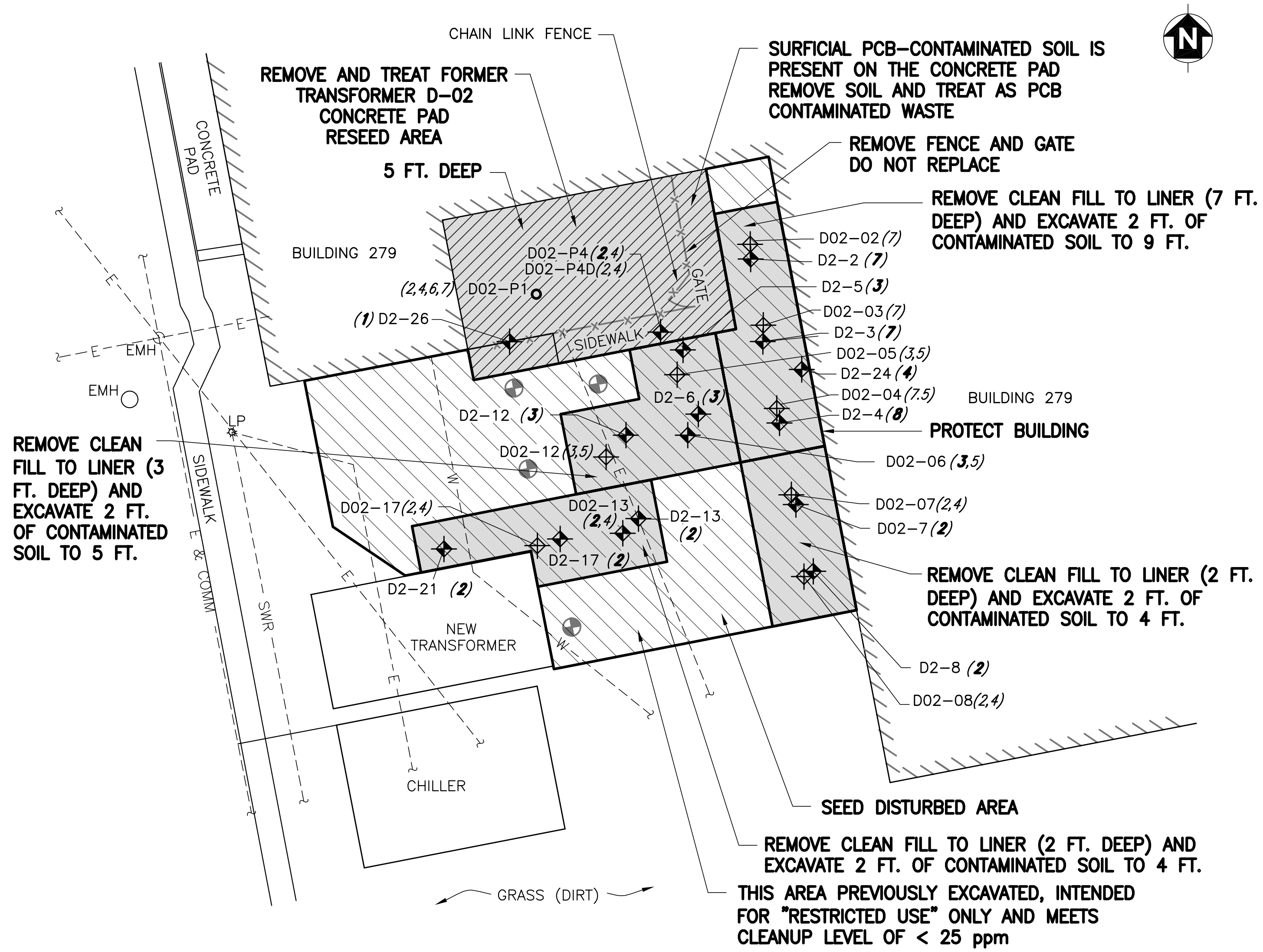
**TRANSFORMER SITE TC-01**
**PROPOSED CONFIRMATION SAMPLING LOCATIONS**

| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |

PLOT DATE 04/11/2003 — F13

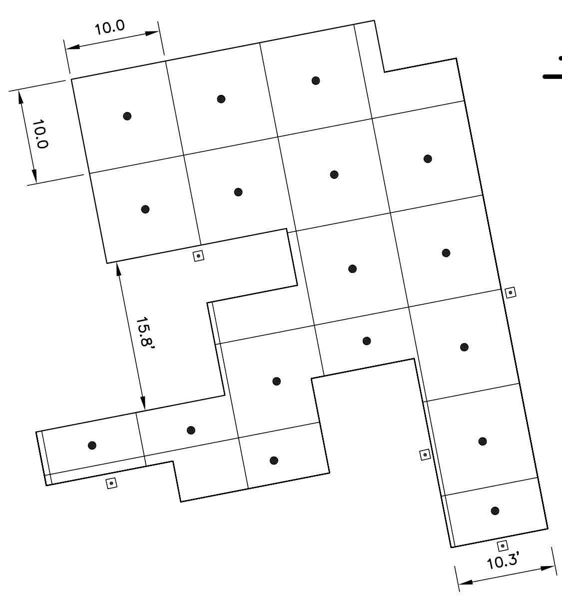
SCALE AS NOTED — SHEET 13 OF 17

J. O. NO. ________



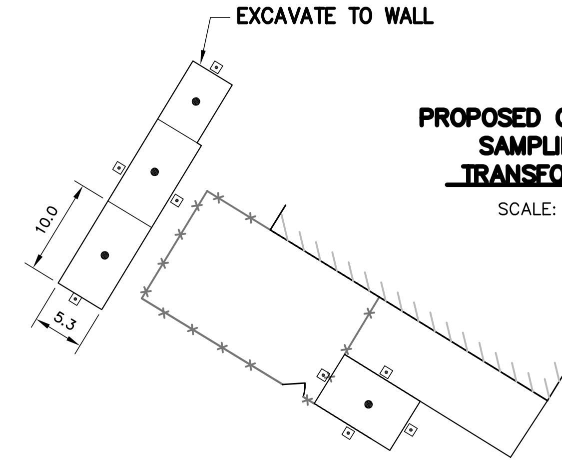

**SITE PLAN TRANSFORMER D-02**

SCALE: 1" = 20'
EXCAVATION REQUIRED



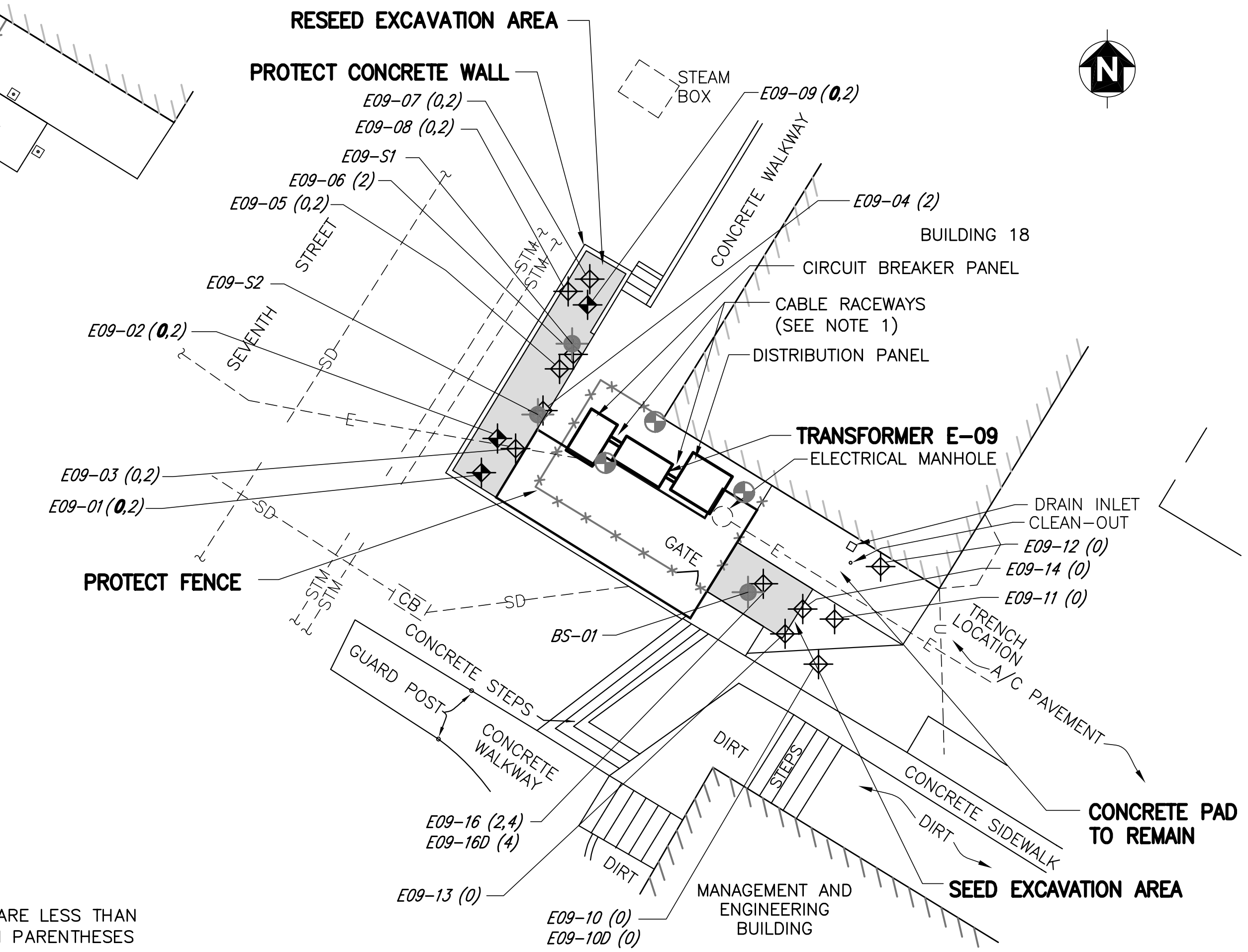

**PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER D-02**

SCALE: 1" = 20'




**PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER E-09**

SCALE: 1" = 20'




**SITE PLAN TRANSFORMER E-09**

SCALE: 1" = 20'

**LEGEND**

- D02-02 (2) — SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES
- D02-02 (**2**) — PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg
- SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES
- PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg
- EXCAVATION CONFIRMATION SAMPLE
- SIDEWALL CONFIRMATION SAMPLE
- EXCAVATION AREA – DEPTH 2 FT.
- EXCAVATION AREA – DEPTH 5 FT.
- DISTURBED AREA
- CB — CATCH BASIN
- A/C — ASPHALT CONCRETE
- EMH — ELECTRIC MANHOLE
- SMH — SEWER MANHOLE
- ----SD---- — STORM DRAIN
- ----W---- — WATER
- ----STM---- — STEAM
- ----SWR---- — SEWER
- ----E---- — ELECTRICAL
- --E & COM-- — ELECTRICAL AND COMMUNICATIONS
- ----U---- — UNKNOWN UTILITY
- x—x—x—x— — FENCE

PREVIOUS WORK HAS BEEN DONE AT THIS SITE.
ONLY REMAINING WORK IS SHOWN.

10' 0 10' 20'
SCALE: 1" = 20'

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
**PACIFIC DIVISION**
MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT PEARL HARBOR NAVAL COMPLEX, OAHU, HAWAII

**TRANSFORMER SITES D-02 AND E-09 PROPOSED CONFIRMATION SAMPLING LOCATIONS**

| SIZE | CODE IDENT NO | |
|---|---|---|
| B | 0 | |
| SCALE AS NOTED | | SHEET 14 OF 17 |

PLOT DATE 04/11/2003

F14

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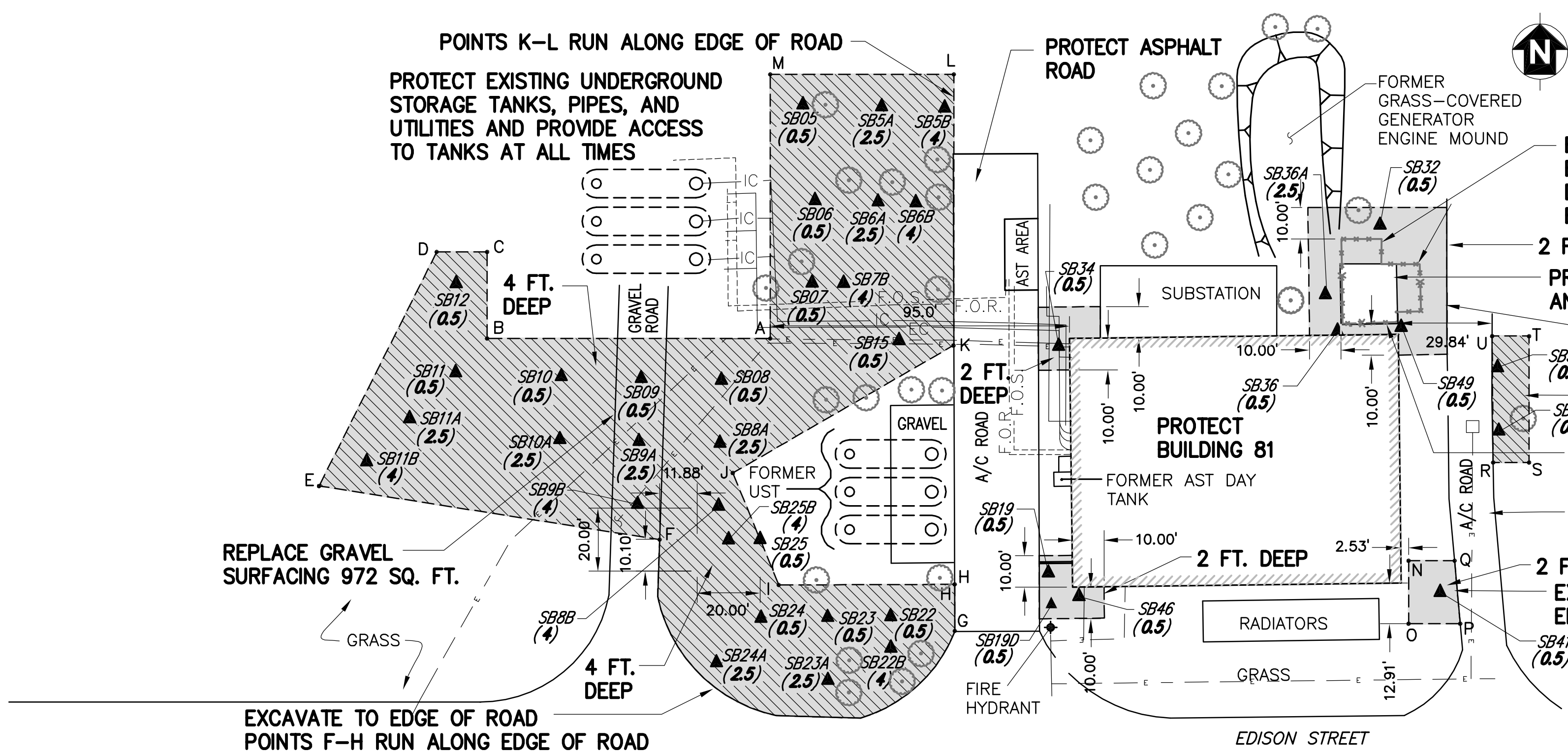
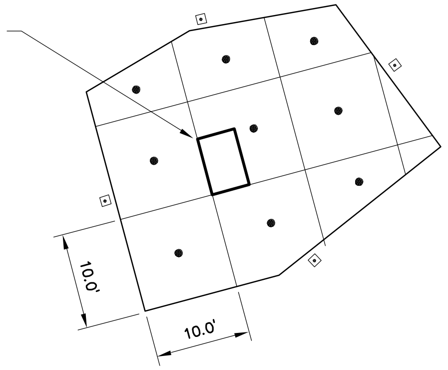


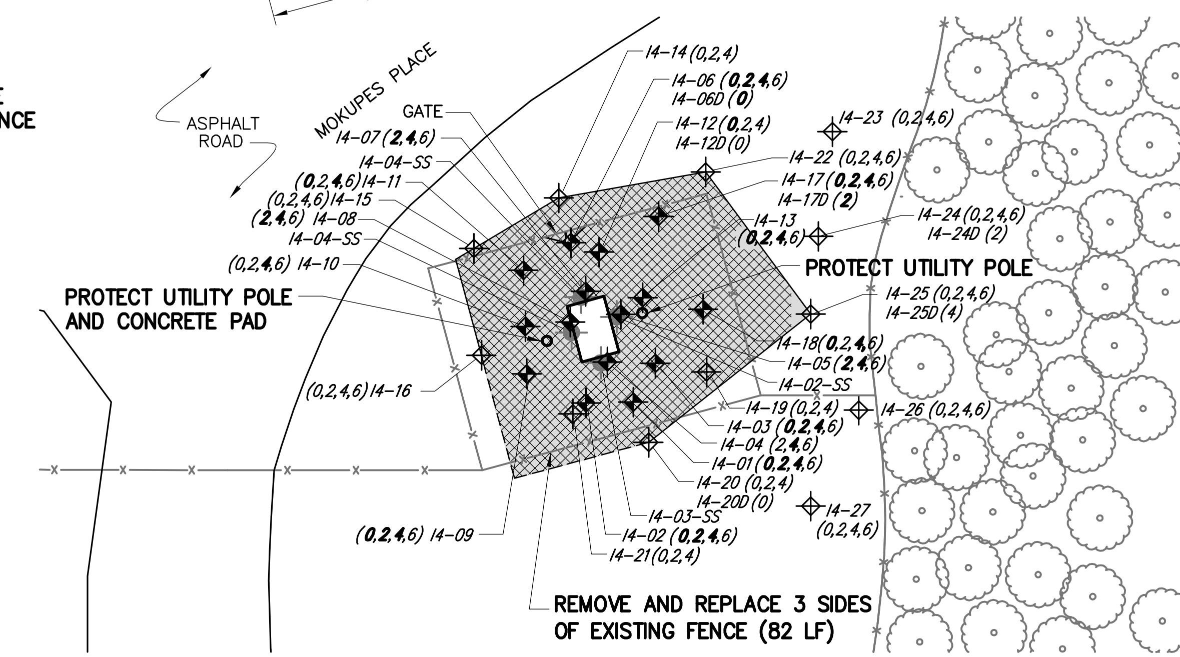

## BUILDING 81

SCALE: 1" = 120'




## PROPOSED CONFIRMATION SAMPLING PLAN TRANSFORMER I-4

SCALE: 1" = 40'

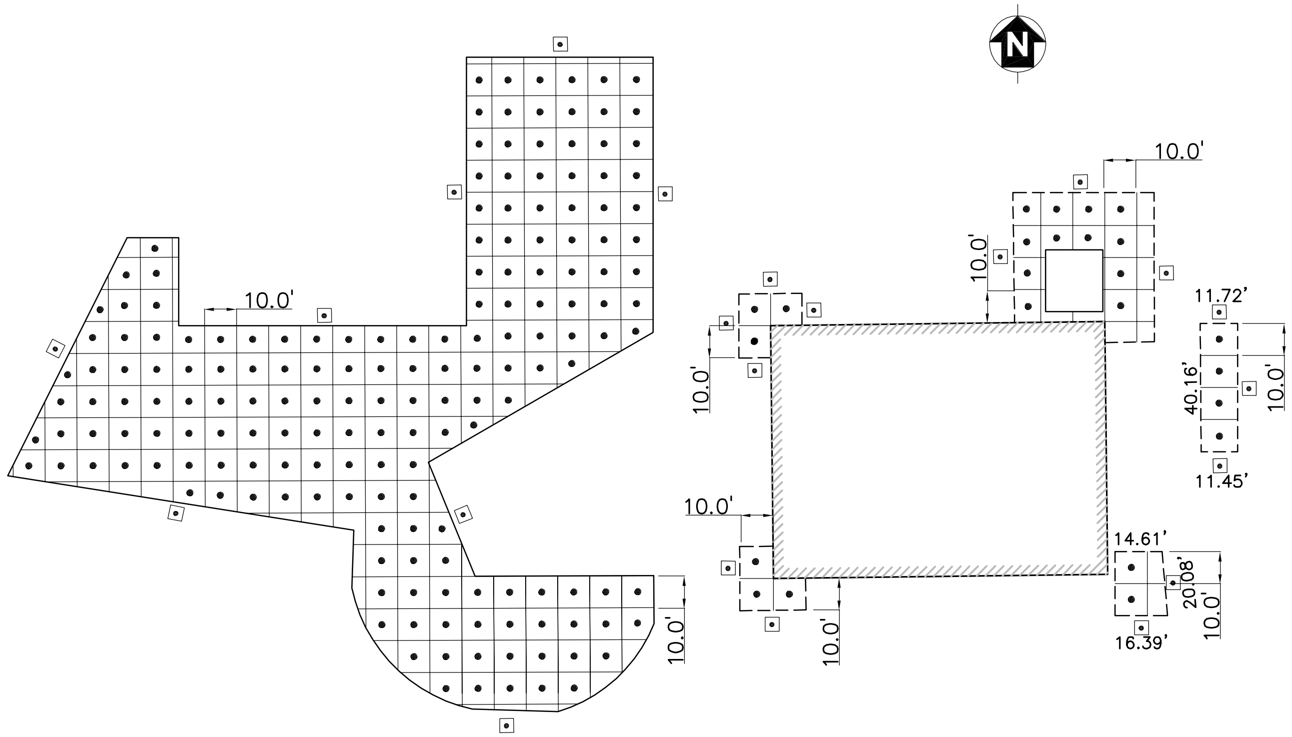



## SITE PLAN TRANSFORMER I-4

SCALE: 1" = 40'

20' 0 20' 40'

SCALE: 1" = 40'




## PROPOSED CONFIRMATION SAMPLING PLAN BUILDING 81

SCALE: 1" = 120'

60' 0 60' 120'

SCALE: 1" = 120'

## LEGEND

- 14-02 (2) — SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES
- I4-02 (**2**) — SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES
- PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg
- SB05 (**0.5**) — DIRECT PUSH SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES
- EXCAVATION CONFIRMATION SAMPLE
- SIDEWALL CONFIRMATION SAMPLE
- EXCAVATION AREA – DEPTH 2 FT.
- EXCAVATION AREA – DEPTH 4 FT.
- EXCAVATION AREA – DEPTH 6 FT.
- ESTIMATED BOUNDARY: DELINEATION EFFORTS INCONCLUSIVE
- BUILDING
- FENCE
- TREES
- FORMER OR EXISTING UST
- —E— ELECTRICAL LINE
- —IC— ELECTRICAL LINE
- —EC— ELECTRICAL LINE
- —F.O.S.— FUEL OIL SUPPLY
- —F.O.R.— FUEL OIL RETURN

DEPARTMENT OF THE NAVY | NAVAL FACILITIES ENGINEERING COMMAND

PACIFIC DIVISION
MAKALAPA, HAWAII

EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT IROQUOIS POINT, PEARL HARBOR AND BUILDING 81, NRTF LUALUALEI, OAHU, HAWAII

# TRANSFORMER SITE I-4, IROQUOIS POINT, PHNC AND BUILDING 81, NRTF LUALUALEI

| SIZE | CODE IDENT NO |
| --- | --- |
| B | 0 |

SCALE AS NOTED | SHEET 15 OF 17

PLOT DATE 04/11/2003

F15

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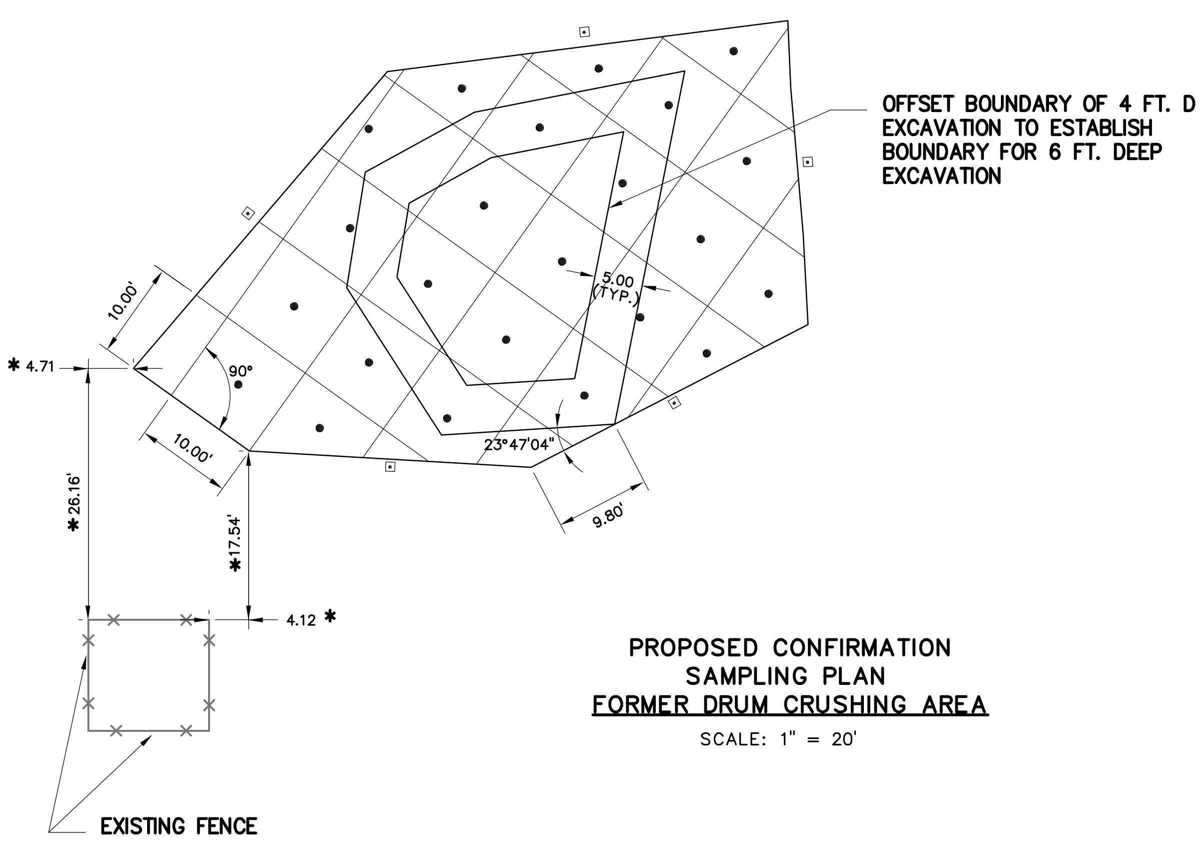
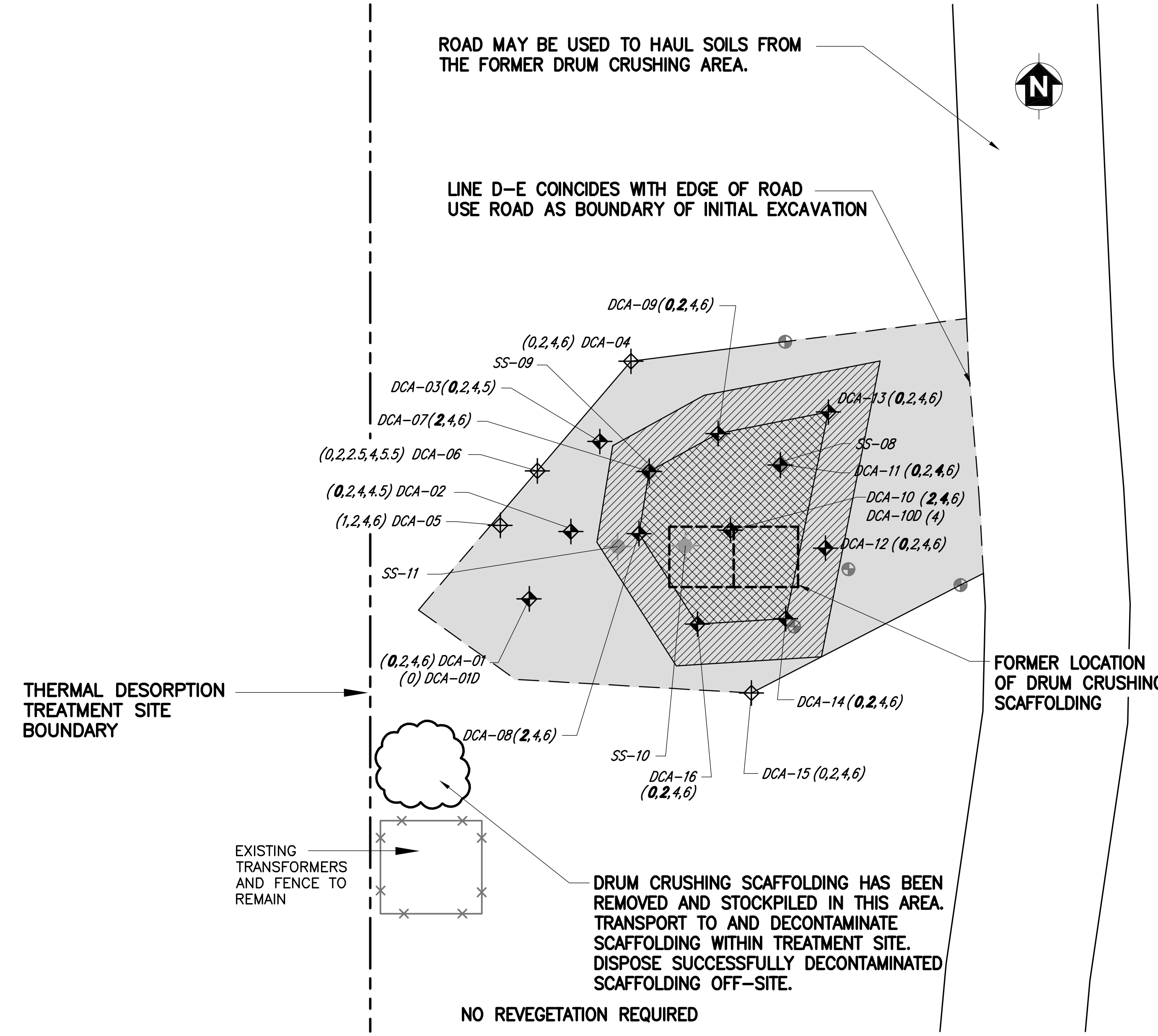



PROPOSED CONFIRMATION
SAMPLING PLAN
FORMER DRUM CRUSHING AREA

SCALE: 1" = 20'

* DIMENSIONS ARE PERPENDICULAR TO OR PARALLEL WITH NORTH FENCE SURROUNDING TRANSFORMERS




SITE PLAN
FORMER DRUM CRUSHING AREA

SCALE: 1" = 20'

10' 0 10' 20'
SCALE: 1" = 20'

LEGEND

| | |
|---|---|
| DCA-06 (2) | SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES |
| DCA-07 (**2**) | SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg |
| | PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg |
| | EXCAVATION CONFIRMATION SAMPLE |
| | SIDEWALL CONFIRMATION SAMPLE |
| | EXCAVATION AREA – DEPTH 2 FT. |
| | EXCAVATION AREA – DEPTH 4 FT. |
| | EXCAVATION AREA – DEPTH 6 FT. |
| | ESTIMATED BOUNDARY: DELINEATION EFFORTS INCONCLUSIVE |
| | TREATMENT SITE BOUNDARY |
| | FENCE |

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
PACIFIC DIVISION
MAKALAPA, HAWAII

FORMER DRUM CRUSHING AREA
AT FORMER NAS BARBERS POINT
OAHU, HAWAII

FORMER DRUM CRUSING AREA
PROPOSED CONFIRMATION SAMPLING LOCATIONS

| SIZE | CODE IDENT NO |
|---|---|
| B | 0 |

PLOT DATE 04/08/2003 — F16

SCALE AS NOTED — SHEET 16 OF 16

J. O. NO.

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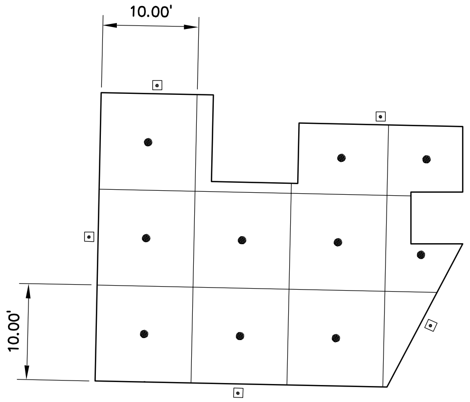
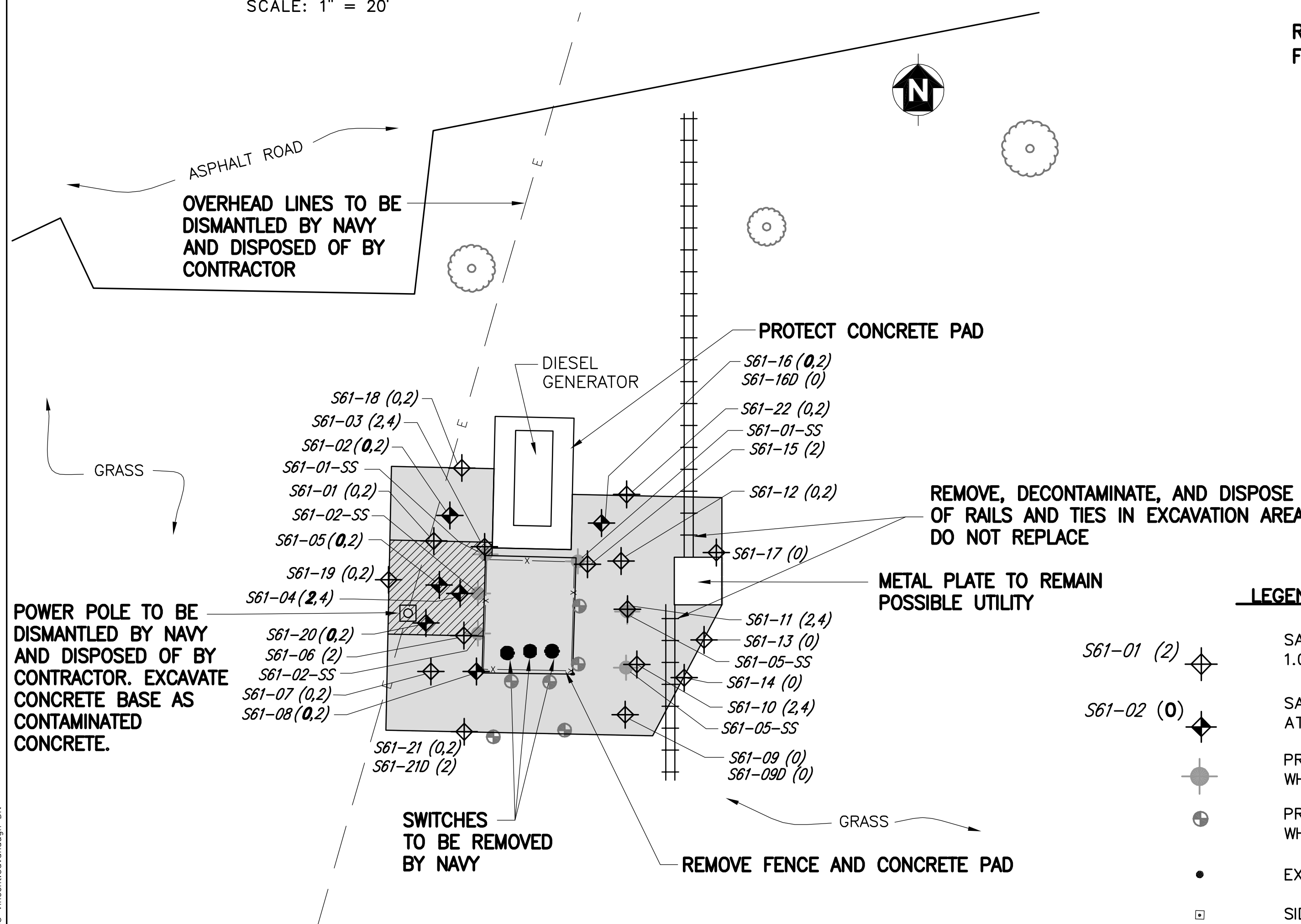
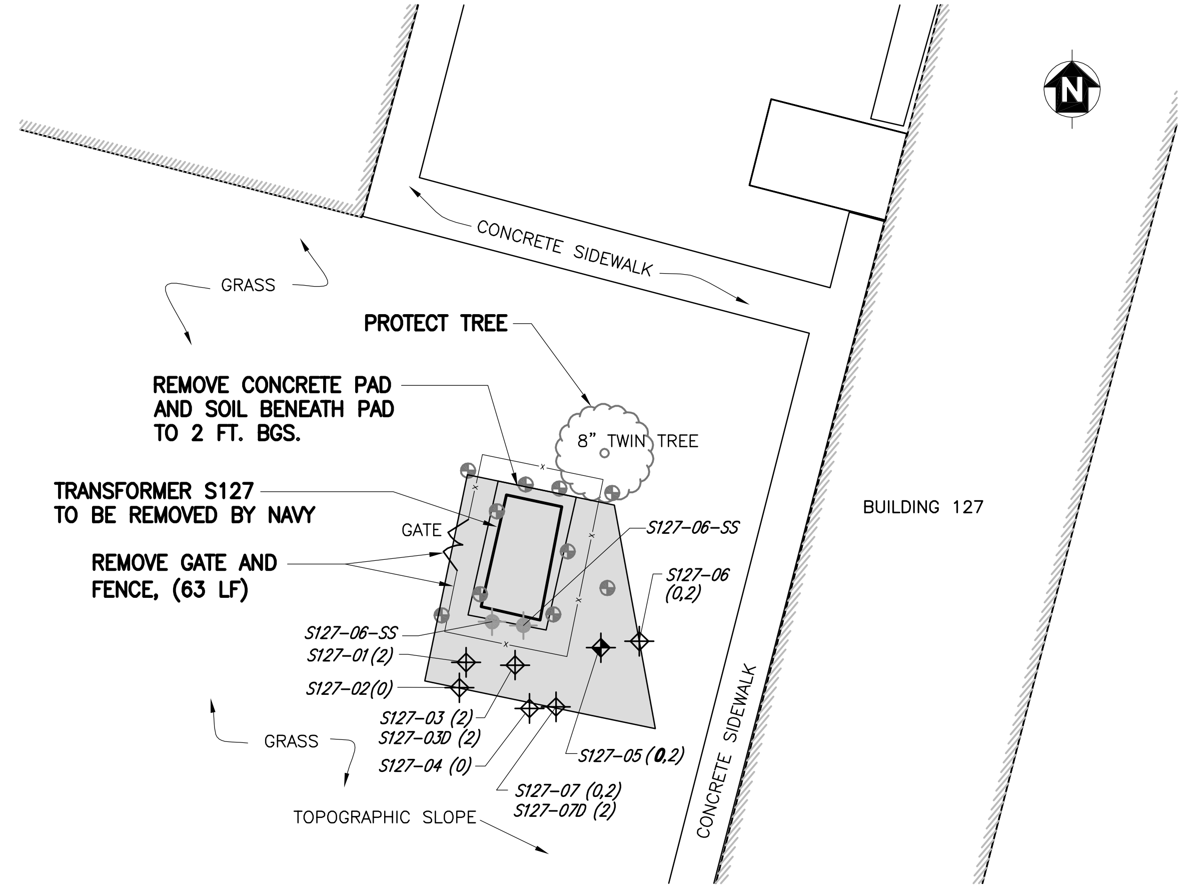


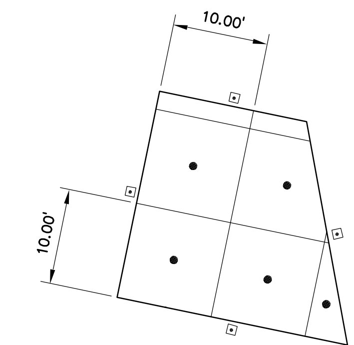

PROPOSED CONFIRMATION SAMPLING PLAN
TRANSFORMER S61
SCALE: 1" = 20'




SITE PLAN
TRANSFORMER S61
SCALE: 1" = 20'




SITE PLAN
TRANSFORMER S127
SCALE: 1" = 20'




PROPOSED CONFIRMATION SAMPLING PLAN
TRANSFORMER S127
SCALE: 1" = 20'

LEGEND

S61-01 (2) SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN IN PARENTHESES

S61-02 (**0**) SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg AT DEPTHS (FT. BGS) SHOWN BOLD IN PARENTHESES

PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs EXCEED 1.0 mg/kg

PREVIOUS COMPOSITE SURFACE SOIL SAMPLE LOCATION WHERE DETECTED PCBs ARE LESS THAN 1.0 mg/kg

EXCAVATION CONFIRMATION SAMPLE

SIDEWALL CONFIRMATION SAMPLE

TREE OR SHRUB

EXCAVATION AREA – DEPTH 2 FT.

EXCAVATION AREA – DEPTH 4 FT.

BUILDING

FENCE

– – – E – – – OVERHEAD ELECTRICAL LINE

TRACK

10' 0 10' 20'
SCALE: 1" = 20'

PLOT DATE 04/11/2003 **F17**

| DEPARTMENT OF THE NAVY | NAVAL FACILITIES ENGINEERING COMMAND |
|---|---|
| **PACIFIC DIVISION** MAKALAPA, HAWAII | |
| EXCAVATION OF PCB-CONTAMINATED SOIL AND CONCRETE AT NAVAL MAGAZINE PEARL HARBOR, WAIKELE BRANCH, OAHU, HAWAII | |
| TRANSFORMER SITES S61 AND S127 PROPOSED CONFIRMATION SAMPLING LOCATIONS | |
| SIZE B | CODE IDENT NO 0 |
| SCALE AS NOTED | SHEET 17 OF 17 |

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