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Clayton GROUP SERVICES

Work Plan for Groundwater Investigation Tanapag Village PCB Contamination Tanapag, Saipan, Commonwealth of the Northern Mariana Islands

Contract No. DACA83-00-D-0012
Delivery Order No. 0016

Clayton Project No. 85-01154.00
October 5, 2001

Prepared for:

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LIST OF ACRONYMS

AO	Administrative Order
CFR	Code of Federal Regulations
Clayton	Clayton Group Services
CNMI	Commonwealth of Northern Mariana Islands
DERP-FUDS	Defense Environmental Restoration Project-Formerly Used Defense Sites
DEI	Donaldson Enterprises Inc.
DEQ	Saipan Department of Environmental Quality
DQO	Data Quality Objective
ECD	Electron Capture Detector
EPA	Environmental Protection Agency
FUDS	Formerly Used Defense Site
GC	Gas Chromatograph
HTRW	Hazardous, Toxic and Radioactive Waste Center of Expertise
ID	Identification
Kg	Kilogram
L	Liter
LCS	Laboratory Control Sample
mg/Kg	Milligram per Kilogram
mg/L	Milligram per Liter
ml	Milliliter
MSD	Mass Spectrometer Detector
MS/MSD	Matrix spiked/ matrix spiked duplicate sample
msl	Mean sea level
NHRP	National Register of Historic Places
NIST	National Institute for Standards and Technology
PCB	Polychlorinated biphenyl
PID	Photoionization Detector
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
%R	Percent Recovery
RPD	Relative Percent Difference
SOPs	Standard Operating Procedures
SOW	Scope of Work
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
µg/Kg	Microgram per Kilogram
µg/L	Microgram per Liter
UXO	Unexploded Ordnance
VOC	Volatile Organic Compounds
WCP	Wil Chee Planning, Inc.

1.0 INTRODUCTION

This work plan describes the groundwater investigation to be conducted at the village of Tanapag located in Saipan, Commonwealth of the Northern Mariana Islands (CNMI). A map showing the project location is presented as Figure 1, located behind the Figures Tab.

This work plan incorporates a sampling plan and a quality assurance/quality control (QA/QC) plan. The sampling plan elements include sampling procedure guidelines. The QA/QC plan elements include QA/QC protocols related to the acquisition of chemical data for this investigation, as well as policy, organization and functional activity descriptions.

A separate health and safety plan has been prepared for the field activities related to this project. All work described in this work plan will be conducted in compliance with the project health and safety plan.

The project will be performed under the Defense Environmental Restoration Program - Formerly Used Defense Sites (DERP-FUDS). The project work will be conducted by Wil Chee-Planning, Inc. under Contract Number DACA83-96-D-0012, "Groundwater Investigation, Tanapag Village PCB Contamination, Tanapag, Saipan, Commonwealth of the Northern Mariana Islands," Delivery Order No. 0016. Clayton Group Services, Inc. (Clayton) has been contracted by Wil Chee-Planning, Inc. to conduct the project work and to prepare the associated reports.

2.0 PURPOSE AND PLANNED ACTIVITIES

2.1 PREVIOUS INVESTIGATIONS

The project is a formerly used defense site (FUDS) in which 55 capacitors containing polychlorinated biphenyls (PCBs) were left in the village of Tanapag. The following site history is from the Final Work Plan, Soil Removal, Phase III, Tanapag Cemetery, Tanapag, Island of Saipan, CNMI (ECC, 2000).

Soil in and around Tanapag has been contaminated with PCBs that leaked from electrical capacitors stored in the area. The affected soils include sand, crushed-coral fill, and clay. The PCB solution originally contained in the capacitors has been chemically characterized as Aroclor 1254 (Monsanto Corporation, St. Louis, MO).

Because the capacitors had been originally purchased by the U.S. Department of Defense (DOD) in the early 1960s, the USACE – Pacific Ocean Division (CEPOD), now the USACE-Honolulu District) determined in February 1991 that the funding of remediation of the Tanapag Village site and environs qualified under DOD's DERP-FUDS.

The known capacitors were removed from Tanapag Village in 1988/1989 by Saipan's Department of Environmental Quality (DEQ). The extent of soil contamination was partially defined by a Site Investigation project in 1990 conducted by Woodward Clyde and Associates.

In 1992 and 1993, additional site characterization was performed, and contaminated soil and capacitor debris were packaged and removed from selected sites in Tanapag Village, Cemetery 2, and the Department of Public Works-Lower Base Yard. Approximately 180 tons of PCB-contaminated soil was transported to an U.S. Mainland Transportation, Storage and Disposal Facility (TSDF) for incineration in February 1993. Although several sites were successfully remediated, a combination of poor weather and continued difficulty in defining the extent of contamination (due to the diffuse nature of the contamination) caused the CEPOD to suspend further soil investigation and remediation efforts.

CEPOD estimated that further remediation would produce over 500 additional cubic yards of PCB-contaminated soil. Off-site disposal costs were deemed prohibitive; and therefore, alternative solutions were investigated, including on-site and in-situ treatment options. In early 1995, CEPOD authorized its contractor, Industrial technology, to initiate a pilot study of a biotreatment approach. The pilot study results suggested that none of the five biological treatment approaches produced significant reductions or transformations in the tested soil batches.

An alternative remediation technology was sought, resulting in the selection of thermal desorption using a "Thermal Blanket" technology for the Phase II cleanup. During Phase II, 20 sites were characterized and/or remediated during the project's two-year activity period. PCB soil contamination was found in close proximity to residents, churches and schools, and surrounding burial sites at two local cemeteries. Many sites required multiple rounds of soil sampling and excavation to delineate and remove the diffuse PCB contamination to below the 10 parts per million (ppm) project action level.

Excavated soil was transferred to a prepared soil storage cell adjacent to the treatment area in Lower Base, where it was held prior to thermal treatment. Remediated sites were either backfilled with quarry-supplied crushed, coral fill; or with thermally treated soil.

Of the 20 sites investigated and/or remediated, 16 were excavated with all contamination greater than 10 ppm removed, three were confirmed free of contamination, and one, Cemetery 2, is still contaminated with PCB levels greater than 10 ppm.

Numerous PCB capacitors or capacitor parts were discovered during excavation activities. The majority of these capacitors and capacitors parts were found in soil piles bordering Cemetery 2. All capacitors and capacitor parts were either thermally treated or were packaged and shipped to an U.S. Mainland TSDF for incineration.

Three sites in Tanapag Village were confirmed dioxin contaminated. In aggregate, these sites produced 74 tons of dioxin-contaminated soil. The dioxin-contaminated soil was excavated and temporary stored in one of the four treatment cells at the treatment site in Lower Base. In July and August of 1999, this material was packaged and shipped to an U.S. Mainland TSDF for incineration.

In August of 1997, a thermal desorption system operated by TerraTherm Environmental Services was constructed at Lower Base in an area adjacent to and north of Cemetery 2. Over the next year the system successfully treated 1,181 tons of PCB-contaminated soil to less than 1ppm. In March 1999, the USACE modified the scope of work to have ECC perform a preliminary assessment of existing PCB contamination at Cemetery 2. The assessment of the area showed PCB concentrations ranging from less than 10 ppm to greater than 20,000 ppm. At project demobilization, areas exhibiting levels of PCB contamination greater than 10 ppm were cordoned off with orange construction fence and posted with signs warning the general public to keep out.

In April 1999, the soil remediation approach was changed from on-site thermal desorption to off-site transport and disposal to a TSDF on the U.S. Mainland. A total of 547 tons of PCB-contaminated soil was shipped and disposed. Contaminated soil removal, site restoration and demobilization of all site equipment was completed by August 1999.

In May 2000, the United States Environmental Protection Agency (USEPA) collected soil screening samples in Tanapag, which have augmented the information obtained during Phase II; and established new areas of PCB contamination previously not identified.

On December 20, 2000, the USEPA issued an Administrative Order (AO) in which a groundwater investigation was required for the village of Tanapag.

2.2 PROPERTIES OF POLYCHLORINATED BIPHENYLS

PCBs are a group of manufactured organic chemicals that contain 209 individual chlorinated chemicals (known as congeners). PCBs are either oily liquids or solids and are colorless to light yellow in color. They have no known smell or taste. There are no known natural sources of PCBs. Some commercial PCB mixtures are known in the United States by their industrial trade name, Aroclor. PCBs don't burn easily and are good insulating material. They have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The contaminant of concern for this project is Aroclor 1254. The chemical properties for Aroclor 1254 are presented below:

Table 2-1
Aroclor 1254 Chemical Properties

Chemical Abstract Number (CAS #)	11097691
Temperature for Properties	25 Celsius
Molecular Weight	328.4
Specific Gravity	1.5
Solubility	0.031 mg/liter
Octanol-Water Partition Coefficent	1.10E+06
Henrys Law Constant	2.60E-03
Vapor Pressure	0.71E-05 ml/20C

Source of Table: USACE, Riverine Emergency Management Model, Chemical Properties Table, August 1997

2.3 PURPOSE OF THE PROJECT

The purpose of this project is to assess the presence of PCB contamination in the groundwater at the site.

2.4 PROJECT SITE ACTIVITIES

Fieldwork activities are anticipated to take place in the following sequence. However, the final sequence of fieldwork activities will be based on observations and decisions made during the field investigation.

The major fieldwork activities that comprise sampling and analysis include:

Site Preparation

- Site pre-work meeting
- Site clearing for drilling equipment access

Drilling and Monitoring Well Installation

- Drill three boreholes to a maximum depth of 20 feet below ground surface using a truck-mounted drill rig.
- Install monitoring wells in each borehole. A total of three monitoring wells will be installed. The monitoring wells will consist of 2-inch stainless steel casing with 10 feet of continuous slot wire wound screens at the bottom portion. A minimum of 2.0 feet of hydrated bentonite clay or equivalent materials shall be placed above the screen for sealing purposes. The stainless steel casing will then be grout-sealed up to the ground surface.
- Install a locking well cover to prevent tampering or unauthorized access to the well

Groundwater Sampling

- Develop each monitoring well by a combination of bailing, surging and overpumping. Development shall occur no sooner than 48 hours after grouting of the well has been completed.
- Purge at least three well volumes of groundwater from each monitoring well utilizing low-flow pumping techniques prior to sampling. Purging of the wells shall occur no sooner than 24-hours following development of the wells.
- Collect one groundwater sample from each purged well using low-flow sampling techniques (a total of 3 groundwater samples will be collected). The groundwater samples will be analyzed for PCB Aroclor 1254 only using Environmental Protection Agency (EPA) Method 8082.

Groundwater Flow Direction and Hydraulic Gradient

- Survey the coordinates and tops of the well casing by a licensed surveyor.
- Obtain groundwater level measurements using a commercially available water-level meter equipped with a noise and light indicator.
- Estimate the groundwater flow direction and hydraulic gradient using the survey data and groundwater level measurements.

3.0 SITE DESCRIPTION

3.1 SITE PHYSICAL SETTING

The Commonwealth of the Northern Mariana Islands (CNMI), a commonwealth of the U.S., is an island group located in the Pacific Ocean, east of the Philippines and south of Japan. Saipan is located at 15 degrees, 15 minutes north latitude and 145 degrees, 45 minutes east longitude. The total land area of the CNMI archipelago, approximately 16 coral and volcanic islands, has been calculated at 176.5 square miles at high tide and 184 square miles at low tide. The Northern Marianas Archipelago extends about 400 nautical miles (460 statute miles) from Rota in the south to the most northern island of Farallon De Pajaros. The principal islands are Saipan, Tinian, and Rota. The island of Saipan is the capital of the CNMI and has a population of 52,670. The economy is based on agriculture, light manufacturing, and tourism. Major exports include clothing and other manufactured goods. The island of Saipan contains the seat of government, a busy seaport, and an international airport. Of the 8 communities on Saipan, Garapan and Chalan Kanoa may be considered the principal urbanized areas.

Saipan is the second largest of the CNMI with an area of about 47 square miles. The island is about 12.5 miles long and 5.5 miles wide and has a total land area of 46.5 square miles. Mount Tapotchau on Saipan is 1,554 feet above sea level and is the highest point. Saipan's 54-mile coastline is irregular except on the western side where there is a fringing reef. Saipan Lagoon encompasses about 20 square miles of mostly shallow water and is separated from the Philippine Sea by a long barrier reef about 2 miles off shore at the entrance to Tanapag Harbor. The width of the lagoon created by the reef varies from less than 300 feet to over 1.5 miles. The depth of the lagoon varies and in many areas it is possible to wade across to the reef. The Tanapag Harbor area ranges from 20 to 50 feet in depth.

The village of Tanapag is located in the northwestern portion of the island (Figure 1, Figure Tab) and is located approximately 8.5 miles north of the Saipan International Airport.

3.2 GENERAL SETTING

Saipan has a tropical climate with an annual mean temperature of 83 degrees Fahrenheit. It is characterized with relatively high humidity that averages between 79 and 86 percent. Average annual rainfall is 81 inches, ranging from 70 inches in the southwestern lowlands to 91 inches in the central ridge. The dry season is usually from December through June and the wet season spans the months of July through October. Limestone and sediment comprise more than two-thirds of the island, and the remainder consists of volcanic rocks, various unconsolidated surficial deposits, marshes, and lakes.

Three wind patterns are prevalent throughout the Northern Mariana Islands. They are trade winds, doldrums and typhoons. Easterly winds prevail about 45 percent of the time on Saipan with an average annual wind velocity of 10.5 miles per hour.

3.3 GROUNDWATER CONDITIONS

The two most prominent aquifers in Saipan are the Mariana and the Tagpochau Limestones. Groundwater occurs as unconfined basal water in the Mariana Limestone and as basal, parabasal, and perched water in the Tagpochau Limestone. The largest concentration of wells is located in the central southern part of Saipan. The wells in the central area tap the highly permeable Tagpochau Limestone. Water quality springs at higher elevations (in the Tagpochau Limestone) are suitable for most uses, although concentrations of bicarbonates are fairly high, and dissolved iron can affect taste, color, and turbidity. Heavy pumping of the basal freshwater in Saipan has induced inland movement of saltwater and salinity concentrations of more than 1,000 milligrams per liter (mg/L) chloride are found in water from many wells.

Based on a previous site investigation, the groundwater directly beneath the village of Tanapag project site occurs as an unconfined brackish water lens, that overlies saltwater. Groundwater is typically encountered in a limestone unit (Tanapag Formation) which is overlain by sand and clay at elevations between –2 to +2 feet. The regional direction of groundwater flow is estimate to be toward the northwest.

3.4 SITE LOCATION AND DESCRIPTION

The project site is located in the region and village of Tanapag (Figure 1, Figures Tab). The area lies the on a coastal plain with elevations ranging from approximately 12 feet above mean seal level (msl) on the southwestern portion to sea level on the north west. A large barrier reef and lagoon is located on the southwestern boundary of the site. Residential houses, livestock areas, heavily vegetated areas, and a garment factory characterize the general area of site. The project site may be tidally influenced due to the proximity to the coastline.

The proposed monitoring wells will be located at three selected areas within the village of Tanapag area that are designated as Cemetery 1, Cemetery 2 and the Beach Site. Cemetery 1 is located in the southeast portion of Tanapag village. Cemetery 2 is located in the southwest of Tanapag between the village of Tanapag and Garapan. Extensive remediation activities have been conducted at the Cemetery 2 site. The Beach Site is located in the northwest portion of Tanapag village near Puntan Dogas. Specific locations for each of the wells are discussed in Section 5.2. The U.S. Geological Survey (USGS) and local agencies will be contacted to provide information such as background on geology and hydrogeology, which may assist in the selection of specific well locations.

4.0 PROJECT ORGANIZATION AND DATA QUALITY OBJECTIVES

4.1 PROJECT ORGANIZATION

The monitoring well installation and groundwater sampling activities will be performed by Clayton Group Services and their subcontractors, as a subconsultant to Wil Chee-Planning, Inc., in accordance with the USAEDH scope of work (SOW) dated January 22, 2001.

The project team consists of a number of key personnel and firms that will be instrumental in the successful completion of the project work. An organization chart for the project team is shown behind the Chart Tab. Key personnel and allocated responsibilities for the tasks of this project are listed below.

Prime Contractor (Wil Chee-Planning, Inc.): Mr. Derek Yasaka

Mr. Yasaka will be responsible for the completion of the project in accordance with the USAEDH SOW. As the prime contractor, Mr. Yasaka will provide strategic direction during the project, oversee work, and maintain communication with the USAEDH. He will also be responsible for the preparation and implementation of the health and safety plan, gaining access agreements to the work sites, and providing heavy equipment to clear vegetation and impediments that limit access to the work sites. As on other USACE-Honolulu District projects conducted in the CNMI, Mr. Yasaka will submit well permit applications for information purposes.

Clayton Project Manager: Mr. Dan Ford

Mr. Ford has the primary responsibility for the overall management of the operational requirements of the project. Mr. Ford will be responsible for the development and quality of the technical reports and other pertinent project documents. He will be responsible for implementing the work plan, implementing corrective measures, scheduling the project sampling program, and maintaining communication with Wil Chee-Planning, Inc.

Clayton Senior Geologist: Mr. John Rau

Mr. Rau will oversee sampling strategy activities, maintaining the project logbook of activities, and will be responsible for the implementation of the work plan in the field, and will supervise project site activities. Mr. Rau will report to the Clayton Project Manager.

Primary Analytical Laboratory: USACE Environmental Research and Development Center, Environmental Chemistry Branch

The U.S. Army Corps of Engineers (USACE) Environmental Research and Development Center, Environmental Chemistry Branch (ERDC-ECB) located in Omaha, Nebraska will serve as the primary analytical laboratory for this project. The ERDC-ECB will analyze the samples collected during the fieldwork activities.

<u>Quality Assurance Laboratory: Sequoia Analytical</u>

Sequoia Analytical will serve as the quality assurance (QA) laboratory for this project. Sequoia Analytical will provide sample analysis for documentation of data quality. The USACE, Hazardous, Toxic and Radioactive Waste Center of Expertise (HTRW), located in Omaha, Nebraska has validated the laboratory for chemical analysis. A copy of the most recent USACE laboratory validation letter is included in Appendix B.

<u>Unexploded Ordnance (UXO) Subcontractor: Donaldson Enterprises, Inc.</u>

Donaldson Enterprises, Inc. will be responsible for UXO surveys of work areas to be cleared and where intrusive activities will be conducted.

Project staff team members will be responsible to the Clayton Project Manager for completion of assigned project activities. They are responsible for understanding and implementing their assigned project tasks, and QA/QC procedures associated with those tasks.

4.2 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) provide guidelines for making decisions regarding the data requirements of a project. DQOs are determined based on the end uses of the obtained data, for example site screening, risk assessment, removal or remedial actions.

Each projected end point of data collection activity should be specified in the DQO. According to the USEPA guidance, the development of DQOs consists of seven steps (USEPA 1993) and are briefly described below:

Step 1: **State the Problem** - A concise description of the problem to be studied. Any prior investigations should be reviewed to gain an understanding of the problem.

Step 2: **Identify the Decision** – Identify unresolved issues that the study will attempt to solve and associated actions that may result.

Step 3: **Identify the Inputs to the Decision** – Identify information and measures required to resolve the decision statement.

Step 4: **Identify the Study Boundary** – Define the domain associated with the problem statement

Step 5: **Develop Decision Rules** – Integrate previous DQO outputs to determine the logical basis for choosing among alternative actions

Step 6: Specify Limits on Decision Error Tolerances – Acceptable limits of error of the decision-maker at the site.

Step 7: Optimize the Data Collection Program Design – Site-specific sampling and analysis that enables a site specific problem to be solved within acceptable uncertainty limits.

The development process for this investigation is presented in the following sections.

4.2.1 Problem Statement

Step 1. In general the "problem" at the site is that PCB Aroclor 1254 may have impacted the groundwater due to releases from PCB containing capacitors. On December 20, 2000, the USEPA issued an Administrative Order (AO) in which groundwater investigation was required for Tanapag.

The project activities will focus on drilling of boreholes, installation of groundwater monitoring wells, sampling, and analysis to assess the presence or absence of PCB Aroclor 1254 in groundwater.

4.2.2 Decision

Step 2. A field study has been designed to address the "problem" identified in section 4.2.1. The decisions to be made during the groundwater investigation are to identify the presence or absence of PCB Aroclor 1254 in the groundwater at the site.

If PCB Aroclor 1254 is detected in the groundwater above regulatory action levels, additional investigation may be required to assess the extent of contamination.

4.2.3 Objectives

Steps 3, 4, and 5. Based on the defined problem and the decision statement, the objectives of the groundwater investigation data collection program are to:

- To assess the presence or absence of groundwater contamination due to releases of PCB Aroclor 1254 at the site.
- Obtain groundwater aquifer information including the groundwater flow direction and hydraulic gradient
- Ensure that investigative activities are protective of resources that are eligible for nomination or inclusion or nomination on the National Register of Historic Places (NHRP)

These DQOs were used to develop procedures for field activities, sampling, laboratory analysis, reporting, and data review to provide technically and legally defensible data.

Quality assurance and quality control data objectives are detailed in Section 8.0. These include calibration procedures and frequency, internal quality control checks, performance and system audits, preventive maintenance, data measurement assessment procedures. The sample sets, analytical chemical data, and interpretations will be based on data that meet or exceed QA/QC objectives for acceptance as specified in this plan.

4.2.4 Decision Error Tolerances

Step 6. The uncertainty limits are assessed by the goals of precision, accuracy, representativeness, completeness and comparability parameters. These parameters are presented below:

Table 4-1
Decision Error Tolerances

Method	Analyte	Matrix	Method Reporting Limit	Precision	Accuracy (% Rec)
8082	PCB Aroclor 1254	Water	0.50 µg/L SEQ. R.L. 0.1 µg/L SEQ. MDL	40% LCS/LCSD 40% MS/MSD	60-141% LCS/LCSD 60-141% MS/MSD

The results of analytical testing will be compared to the National Primary Drinking Water Regulations (NPDWRs or primary standards) Maximum Contaminant Level (MCL) for PCB of 0.5 micrograms per liter (µg/L).

Groundwater levels in each well will be measured using a water level meter capable of reading to 0.01 of a foot. The uncertainty limits for the groundwater measurements are expected to be accurate to within ± 0.01 foot.

4.2.5 Data Optimization

Step 7. Based on information from previous investigations, the most resource effective sampling designs for the site were incorporated into this plan. Groundwater samples will be collected. Subsurface soil samples will be collected from the three boreholes to document the lithology present. Soil samples will be collected at 5-foot intervals throughout each borehole, at suspected changes in lithology and at the approximate soil/groundwater interface. Groundwater monitoring wells will be developed, purged and sampled. Selection of chemical constituents for analysis is based on historical knowledge and previous investigation results.

Table 4-2, located on the following page, summarizes the field investigation objectives and proposed field investigation actions for each activity. The personnel involved in the field investigation shall identify any problems or issues identified during the conduct of the field investigation to the USACE construction representative.

Table 4-2
Field Investigation Objectives and Actions

Activities	Objectives	Action
Geophysical and Ordnance Survey	Avoid underground utilities, ordnance, and anomalies during the subsurface investigation.	Clayton personnel will conduct reconnaissance to observe existing structures and evidence of suspected underground utilities. Donaldson Enterprises Inc. (DEI) under contract with Wil Chee Planning, Inc. (WCP) will conduct geophysical toning and an ordnance survey of the field sampling locations. In the event that unexploded ordnance is suspected, DEI will cordon off the identified area and contact WCP and the Clayton field Manager.
Groundwater Sampling and Analyses	To assess the presence or absence of groundwater contamination due to releases of PCB Aroclor 1254 at the site.	Clayton will install groundwater monitoring wells and collect groundwater samples. An analytical laboratory will analyze the groundwater samples to obtain quantitative information regarding the contaminants in the groundwater.
Land Survey	Identify the locations and elevations of the groundwater monitoring wells. This information will facilitate estimating the groundwater elevations and gradient.	A registered land surveyor under contract to WCP will survey the horizontal coordinates and elevations of the monitoring wells with reference to the National Geodetic Datum and Mean Sea Level.
Sample Management	Maintain sample integrity and document field activities and sampling locations.	Field Manager or designee will maintain a bound field logbook. Samples will be labeled. Sample custody procedures will be observed from collection through transfer analyses, and disposal.

4.3 PROJECT SCHEDULE

Upon notice to proceed with the fieldwork described in this Work Plan, the following time line is anticipated for the project.

Table 4-3
Time Line

Project Milestone	Maximum Calendar Days After Notice to Proceed	Estimated Work Complete
Conduct groundwater Investigation	20	40
Prepare Draft Report	40	70
USACE Internal Review Draft Report	70	90
Prepare Final Report	90	120

5.0 FIELD SAMPLING ACTIVITIES

Much of the ground surface in the Tanapag area is covered with heavy vegetation. Therefore, it is anticipated that the some of borehole locations may need to be cleared and grubbed. Depending on the severity of the overgrowth, heavy equipment such as bulldozers may be required. Wil Chee-Planning, Inc. is tasked with clearing and grubbing all areas where intrusive activities will be conducted. Prior to any clearing, the area will be surveyed by the UXO contractor. Clearing will only begin when the UXO subcontractor survey indicates that no hazard exists.

Data gathered from this field investigation will be used to assess if the PCB Aroclor 1254 is present or absent in the groundwater.

5.1 DRILLING AND WELL INSTALLATION EQUIPMENT

A truck-mounted drill rig will be utilized to drill boreholes and install the monitoring wells. The drill rig is equipped with eight-inch diameter continuous flight hollow-stem augers. During soil sampling of the boreholes, the drill rig will be outfitted with a 2.5-inch diameter split spoon sampler attached to solid rods and a 140-pound slide hammer. Soil samples will be collected for soil classification and for lithologic interpretation only. If hollow stem auger drilling techniques are not adequate to create the boreholes due to conditions such as encountering the coral substrate, air rotary drilling may be used to complete the boreholes. Drill cuttings shall be placed into 55-gallon drums pending disposal.

The wells will be constructed of 2-inch diameter stainless well screen (the bottom portion) and with stainless steel well casing (the upper portion). Stainless continuous slot wire wound screens will be utilized. The screened interval will span the air/water interface. All well casing joints shall be threaded and flush-jointed with a threaded bottom cap at the bottom of each well.

The screened interval will be surrounded in #3 silica sand. A bentonite seal will be placed above the sand pack and hydrated with water. Precautions will be taken to ensure that the bentonite seal is properly placed and packed down. The hydrated bentonite seal will be covered by a cement grout mixture seal to grade. A mix of one bag (94 pound) of Portland cement and approximately seven gallons of water with 3-5% powdered bentonite added. A larger diameter outer steel casing rising 24 to 36-inches above the surrounding grade and set into a concrete pad shall surround the well riser. The outer steel casing shall be provided with a lock and cap to prevent tampering or unauthorized access to the well. A drainage hole will be drilled in the base of the outer steel casing to prevent the accumulation of rainwater in the casing. Prior to the complete setting of the concrete, the well identification number shall be marked in the concrete pad.

During soil sampling (for lithology only) of the boreholes, the following equipment will be used.

- Drill rig outfitted with a split spoon sampler attached to solid rods and a slide hammer
- 2.5-inch diameter by 6-inch length brass tubes
- Soil sample cutting/separating tools

During groundwater sampling of the existing monitoring wells, the following equipment will be used.

- Low-volume pump
- Silicone tubing
- Polyethylene tubing (1/4-inch O.D. x .17-inch I.D.)
- 1 liter amber glass bottles
- Sample container labels
- Chain-of-Custody forms
- Chain-of-Custody seals

Decontamination supplies to be used during and after sampling activities will include the following:

- Alconox™ detergent (biodegradable, 7.3% phosphorus by weight)
- 5-gallon plastic buckets
- Distilled water
- Tap water
- Various nylon bristled, plastic handled scrub brushes

5.2 SAMPLING LOCATIONS

The proposed monitoring wells will be located at three selected areas within the village of Tanapag area that are designated as Cemetery 1, Cemetery 2 and the Beach Site. Cemetery 1 is located in the southeast portion of Tanapag village. Cemetery 2 is located in the southwest of Tanapag between the village of Tanapag and Garapan. Extensive remediation activities have been conducted at the Cemetery 2 site. The Beach Site is located in the northwest portion of Tanapag village near Puntan Dogas.

The specific locations for each well were selected based on previous soil sampling results collected during the Phase III Removal Action conducted by Environmental Chemical Corporation (ECC). Based on the ECC Surface Characterization maps provided by Wil Chee-Planning, Inc., Clayton identified the previous soil samples having the highest concentration of PCB within each of the three selected areas (Cemetery 1, Cemetery 2 and the Beach Site).

The well at the Cemetery 1 location will be located not more than 20 feet in the assumed down-gradient direction from former ECC sample location 113, which formerly had a concentration of 84.4 parts per million (ppm) (Figure 2, Figure Tab). The well at the

Cemetery 2 location will be located not more than 20 feet in the assumed down-gradient direction from former ECC sample location 19A, which formerly had a concentration of 146 ppm (Figure 3, Figure Tab). The well at the Beach Site location will be located not more than 20 feet in the assumed down-gradient direction from former ECC sample location 33, 34(QC), 35(QA), which formerly had concentrations of 98.3, 114, and 121 ppm, respectively (Figure 4, Figure Tab).

One groundwater sample will be collected from each of the three monitoring wells at the project site. The quality assurance samples will consist of one replicate sample, one split sample, and two rinsate samples.

5.3 SAMPLE IDENTIFICATION

Sample numbers will be assigned which are unique to each location as described below. Sampling locations will be numbered sequentially and a sketch will be generated showing the sample numbers and the corresponding sample locations. The four-digit identifiers will be discrete and will not have been used elsewhere for other sampling locations in the data set.

An example of the sample numbering format follows:

pppp-ssss-xnnn

"pppp" refers to the project site location, for example:
TNPG = Village of Tanapag, Saipan, CNMI

"ssss" is a four character designation of the sampling location, for example:
MW01 = Monitoring well number 01

"x" describes the sample medium, for example:
G = Groundwater

"nnn" represents the sample number, for example:
001 = Sample number 001

The sample labels will include the project name, project number, sample identification number, date and time of sampling, depth of the sample (if applicable), and sampler's name or initials. The samples will be handled and shipped to the laboratory in accordance with standard chain-of-custody procedures.

5.4 DEVELOPMENT AND SAMPLING PROCEDURES

5.4.1 Well Development Procedures

Each monitoring well shall be developed by a combination of bailing, surging and overpumping. Development shall occur no sooner than 48 hours after grouting of the well has been completed. At least ten well casing volumes of groundwater from each monitoring well will be evacuated during well development. A surge device shall be used to surge the well and a disposable bailer shall be used to remove fines from the well. After bailing and surging have removed the majority of the fines from the well, a pump will be lowered into the well and used to evacuate additional water until the development process is complete. Development will continue until the following three conditions are met: 1) ten casing volumes of groundwater have been bailed, 2) water clarity is clear, and 3) water quality parameters (turbidity, temperature, pH, electrical conductivity, oxygen-reduction potential (ORP), salinity, and dissolved oxygen) have reached equilibrium (±10 percent of previous reading). Clayton will attempt to achieve a turbidity of less than 10 nephelometric turbidity units (NTU).

5.4.2 Groundwater Sampling Procedures

Groundwater purging and sampling will be performed using low-flow sampling techniques. Purging of the wells shall occur no sooner than 24-hours following development of the wells. Purging will continue until the following three conditions are met: 1) three casing volumes of groundwater have been removed, 2) water clarity is clear, and 3) water quality parameters (turbidity, temperature, pH, electrical conductivity, ORP, salinity, and dissolved oxygen) have reached equilibrium (±10 percent of previous reading). Clayton will attempt to achieve a turbidity of less than 10 NTU. Field Parameters and the depth to water will be measured and recorded during the purge process. A peristaltic pump with new unused silicone tubing and polyethylene tubing (1/4-inch O.D. x .17-inch I.D.) will be used to purge the well and collect the groundwater sample. Dedicated tubing will be used for each well. Development and purge water shall be placed into 55-gallon drums pending disposal.

The in-take end of the pump tubing will be slowly lowered into the well casing until it is positioned in the middle or slightly above the middle of the screened interval. During purging and sample collection, the flow rate will be in the range of 0.1 to 0.5-liter per minute. The purge rate will be monitored to attempt to minimized drawdown to 0.5 feet or less. During sample collection, the groundwater will be pumped into appropriate sample containers. The sample will then be labeled (including project name, project number, sample identification number, date/time of sampling, and sampler’s name or initials), placed in self-sealing plastic bags, and stored in a portable cooler with frozen gel ice. The samples will then be repacked in a portable cooler with frozen gel ice and delivered by priority express mail to the laboratory following standard chain-of-custody procedures.

The samples will be collected using containers and preservation techniques deemed appropriate by the sampling and preservation guidelines of the USEPA (40 CFR 136). Containers, preservatives, and holding times for the groundwater samples are listed below in Table 5-1.

Table 5-1
Groundwater Sample Handling Table

Parameter	Container	Preservation	Holding Time
Polychlorinated biphenyls	Two 1 liter amber glass jars with Teflon-lined cap	Cool to 4°C	E: 7 days A: 40 days

Notes:
E: Designates the maximum sample holding time from sample collection until preparatory extraction.
A: Designates the maximum holding time for the preparatory extraction until analysis.

Sampling location, matrix, number of field samples, number of field replicate samples, number of split samples, and number of rinsate blanks are listed in the table below.

Table 5-2
Sampling Table

Sampling Location	Matrix	No. of Field Samples	No. of Replicate Samples	No. of Split Samples	No. of Rinsate Blanks
Monitoring Wells (3)	Ground water	3	1	1	2

The groundwater samples will be analyzed for PCB Aroclor 1254 using EPA method 8082. Sample preparation shall follow EPA method 3510C separatory funnel (liquid-liquid) extraction.

5.5 GROUNDWATER FLOW DIRECTION AND HYDRAULIC GRADIENT

In areas affected by the tide, the groundwater gradient and flow direction can change significantly with changes in the tides. A series of water level readings taken from each of the three wells over the course of a tidal cycle shall be collected. Groundwater levels in each well will be measured using a water level meter capable of reading to 0.01 of a foot. A licensed surveyor shall survey the coordinates and tops of the well casing. The groundwater flow direction and hydraulic gradient will be estimated using the survey data and groundwater level measurements.

5.6 DECONTAMINATION PROCEDURES

Clayton will decontaminate sampling equipment such as pumps and trowels. During soil sampling (for lithology only) and groundwater sampling, decontamination of the sampling equipment will be conducted as follows:

- Cleaned with Alconox™ detergent using a brush to remove particulate matter and surface films;
- Rinsed with tap water;
- Rinsed with distilled water; and

- Air dry.

Decontamination fluids shall be placed into 55-gallon drums pending disposal.

5.7 FIELD DOCUMENTATION

Each sample will be recorded on a project-specific sample collection logbook to include, at a minimum, the following information:

- Date and time of sampling
- Sample ID number
- Sample location: This location will be marked on the site sketch. Sites where samples are collected will be identified in the logbook and on the sketch.
- Observations, including descriptions of material sampled
- Weather conditions: Temperature, wind, clouds, precipitation
- Printed name of sampling personnel

These logbooks will be completed by the field sampling team and Project Manager, and will provide the necessary information for tracking and documenting sample collection. In addition to the field logbook, boring logs and well completion diagrams shall be completed for each well. Records of well development shall be kept documenting the development process.

6.0 PACKAGING AND SHIPPING SAMPLES

Each sample collected will be labeled using the described sample identification method (in the previous section). The sample labels will be filled out using indelible ink, and include the project name, project number, sample number, depth of sample (if pertinent), initials of the sampler, and date and time of sampling.

Procedures for packaging and shipping the samples collected:

- Place each labeled sample in a portable cooler with frozen gel ice;
- Place sufficient cushioning material around the samples to fill up additional space in the cooler, if necessary;
- A chain-of-custody form will be used for tracking of the samples from the field to the laboratory until they are analyzed. A copy of the chain-of-custody form is included in Appendix C. The sampler will retain one copy of the chain-of-custody form. The original and other copy of the chain-of-custody form will be placed in the portable cooler with the samples in a self-sealing plastic bag taped to the underside of the cooler lid;
- Seal the cooler lid to the body of the cooler with duct/mailing tape;
- Place chain-of-custody seal(s) over the cooler lid and body; and
- Place a completed shipping label with pouch on the top of the sealed cooler.

The samples shall be shipped using priority express delivery from Saipan, CNMI to Honolulu, Hawaii where they will be repacked with frozen gel-ice. The samples will then be shipped using priority express delivery from Honolulu to the laboratory. When transferring the possession of samples, the sample custodians relinquishing the samples will sign, date and note the time on the chain-of-custody form.

The chain-of-custody form will include:

- Name, address and telephone number of sender;
- Project number and name;
- Sample identification number and number of containers;
- Date sampled and sample matrix;
- Requested analytes by EPA method and name;
- Turn around time information;
- Any special instructions or explanation of preservatives;
- Sign off on chain-of-custody (samplers' name/initials); and
- Authorized signature (samplers' or other signature shipping the samples).

The receiving analytical laboratory will follow procedures to check-in the samples.

- The shipping cooler will be examined, and then opened;
- The chain-of-custody form(s) and shipping label will be removed, and their presence/absence and number will be recorded on the package receipt form;
- The internal cooler temperature will be taken and recorded, and the samples will be examined for condition (i.e., breakage) and recorded. If there are any problems, the Project manager will be contacted immediately. The problem and corrective action will be recorded on a corrective action log sheet;
- The numbers on the samples will be checked to ensure they match the numbers on the chain-of-custody form. If there is a problem, it will be reported immediately to the Project Manager. The corrective action instructions will be followed and recorded;
- The chain-of-custody form will be signed in the "received by laboratory" box. Any problems will be noted in the remark section of the chain-of-custody form;
- The samples will be checked-in on the computer; and
- The laboratory manager will receive a copy of all paperwork and assign the work.

7.0 LABORATORY ANALYTICAL PROCEDURES

The U.S. Army Corps of Engineers (USACE) Environmental Research and Development Center, Environmental Chemistry Branch (ERDC-ECB) located in Omaha, Nebraska will analyze samples. The analytical procedures to be used are discussed below. The QA/QC requirements will follow EPA SW-846 protocols. Sequoia Analytical, located in Petaluma, California will serve as the quality assurance (QA) laboratory. The Sequoia Analytical laboratory is a USACE validated laboratory, and a copy of the USACE validation letter is included in Appendix B.

The laboratory, based on the method or instrument detection limits, historical data, and EPA limits established for the analytical methods, sets reporting limits to be used. The reporting limits for samples may require adjustment due to matrix interference or if high levels of the chemical of concern require dilution prior to analysis. Matrix interference and sample dilutions have the affect of increasing the reporting limits. Any analytical results exceeding specified reporting limits will be described and summarized in the laboratory reports.

7.1 GAS CHROMATOGRAPHY (METHOD 8082)

The groundwater samples will be analyzed for PCB Aroclor 1254 using EPA Method 8082. Sample preparation shall follow separatory funnel (liquid-liquid) extraction (EPA method 3510C. The analytical technique that will be used to analyze PCBs is gas chromatography (GC)/Electron Capture Detector (ECD).

8.0 QUALITY ASSURANCE/QUALITY CONTROL

8.1 QUALITY ASSURANCE/QUALITY CONTROL DATA OBJECTIVES

The fieldwork objective of this project is to collect and analyze groundwater samples for PCB at the site. Field and laboratory QA/QC procedures will be implemented to ensure that the data gathered during the field investigation will meet the needs of the project objective. Field activities will be performed as previously described.

Analytical data generated will follow EPA methods (SW-846 protocols), and laboratory standard operating procedures (SOPs) and QA/QC guidelines for sample analysis. The chemical of concern for this project is PCB Aroclor 1254.

Adequate reporting levels of the chemicals of concern is dependent on the sample matrix, and laboratory instrumentation.

8.2 CALIBRATION PROCEDURES AND FREQUENCY

Calibration will be performed on field equipment and laboratory instruments. Each piece of equipment will be calibrated according to manufacturer's procedures.

8.2.1 Field Equipment Calibration

Calibration and documentation of field equipment that will be performed includes:

- Field equipment requiring calibration (i.e., photoionization detector) will be calibrated prior to use.
- Field equipment will be checked to verify that it is operating properly and that it has been calibrated according to the manufacturer's procedures.
- Calibration of the field equipment will be documented in a logbook. The logbook will contain information such as (1) date and time of calibration, (2) type and identification number of equipment being calibrated, (3) the reference standard used for calibration, and (4) name or initials of person performing the calibration.

8.2.2 Laboratory Instrument Calibration

The ERDC-ECB will follow calibration procedures established as part of their SOP.

Sequoia Analytical's laboratory instruments are calibrated before use with a 5 point curve (or 3 point where method allows). To verify the calibration, continuing calibration verification standards are used to insure that the calibration curve has not drifted.

8.3 DATA REDUCTION AND VALIDATION

Most analysis data are documented in computer records or on printouts generated by the instrument data-handling computer. Standard logs are maintained to document preparation of standards. The identity and number of the parent material is recorded and each prepared standard is assigned a number that is traceable to the parent material.

The analyst verifies instrumental data, calculations, transfers, and documentation, corrects errors, if detected. Technical department managers, quality control specialists, and project managers perform review of reports and supporting documentation.

The laboratory will be responsible for providing complete documentation of all analytical teat results and QA/QC sample results in a comprehensive certificate of analysis. The laboratory will also maintain records documenting all phases of sample handling from receipt to final report of analysis. Accountable documents used by the laboratory include logbooks, chain-of-custody records, sample work sheets, bench sheets, and other documents relating to the sample and sample analysis. All observations should also be documented on laboratory forms.

8.4 FIELD QUALITY CONTROL SAMPLES

QC samples that will be collected in the field and submitted to the laboratory are the following: 1 field replicate sample, 1 split sample, and 2 equipment rinsate blank samples.

One primary groundwater sample will be collected from each of the groundwater monitoring wells. From one of the groundwater monitoring wells installed, sufficient volume of water will be collected to fill three sets of sample containers. One sample will be submitted to the primary laboratory as the project sample, a second will be submitted to the primary laboratory as a blind replicate, and one sample will be submitted to the QA laboratory as the split sample.

8.4.1 Field Replicate

A replicate sample will be collected in the field. The replicate sample will be submitted blind to the laboratory. The replicate sample is used to check for the natural sample variance, consistency of field collection techniques, and laboratory analyses. The replicate sample will be collected and analyzed for the same constituents as the primary sample.

8.4.2 Split Sample

A split sample will be collected in the field. The split sample is used to check for the natural sample variance, consistency of field collection techniques, and comparison between the primary and QA laboratories. The split sample will be collected and analyzed for the same constituents as the primary sample

8.4.3 Equipment Rinsate Blanks

Two equipment rinsate blank samples will be collected during the project. The rinsate blank samples will be collected by pouring laboratory-provided “analyte-free” water over the sampling equipment that comes in direct contact with the environmental sample. Equipment rinsate blank samples will be used to assess the efficiency of the decontamination process and possible cross-contamination between environmental samples. Rinsate blank samples will be collected and analyzed for the same constituents as the original sample.

8.5 LABORATORY QUALITY CONTROL CHECKS

Internal QC samples will be analyzed at the frequency specified by the method and in these specifications. These QC samples will include method blanks, matrix spikes, matrix spike duplicates (method spikes and method duplicates, if matrix spikes cannot be performed), surrogate analysis for organics, and second source reference standard analysis for metals. One method blank sample will be analyzed for every 20 samples (minimum of one per day, one per matrix).

8.5.1 Method Blank

Method blanks will be analyzed for each analytical batch submitted to the laboratory. An aliquot (extraction blank) equal in weight to the sample is used for the method blank analysis. The method blank is taken through the whole analytical process. The analytical results of the method blank are then reported to show that the blank is free of analytical interference.

8.5.2 Matrix Spike/Matrix Spike Duplicate

Matrix spike and matrix spike duplicates are samples to which known concentrations of analytes are added prior to sample preparation. The matrix spike and matrix spike duplicates are taken through the whole analytical process. Following the analytical process, the recoveries of the spike analytes are calculated and reported for assessment of accuracy. When a matrix spike duplicate is analyzed, the relative percent differences between the matrix spike and the matrix spike duplicate results will also be calculated and reported. The percent recoveries and the relative percent differences are used to evaluate the effect of the sample matrix on the accuracy and precision of the analysis.

8.5.3 Surrogate Spike

Surrogate spike is a known concentration of a non-target analyte added prior to sample preparation. The surrogate spike recovery must meet the established acceptance criteria, and measures the efficiency of the steps of the analytical method in recovering the non-target analytes.

8.6 PERFORMANCE AND SYSTEM AUDITS

Performance audits are an independent means of establishing the quality of measurement data by analyzing samples provided for evaluation.

Sequoia Analytical (the QA laboratory) participates in a number of required and voluntary external quality assurance programs. Those administered by outside organizations include:

- U.S. Army Corps of Engineers
- AFCEE Air Force Center for Environmental Excellence QAPP Version 3.0
- NELAC National Environmental Laboratory Accreditation Conference (Morgan Hill)
- ERA Proficiency Evaluation Program
- Naval Engineering Facilities Service Center
- State of Alaska
- State of Arizona
- State of California
- State of Washington

The laboratory has a strong program of internal performance and system audits. These include:

Routine laboratory surveillance conducted by the Quality Assurance Director. Includes sample maintenance, calibration, preventative maintenance, receipt and storage of standards, chemicals and gases, data validation, and record management.
Annual internal system audit conducted by the Quality Assurance Director, with reporting directly to company officers. Includes review of laboratory operation and resulting documentation, and preparation of an audit summary report.

Training of the laboratory staff in QA procedures is a continuing process. This training can cover analytical methods, data processing procedures, health & safety, quality assurance, marketing, priority management, organizational skills, computer software, and additional areas and can be provided internal or external to the organization.

8.7 PREVENTATIVE MAINTENANCE

To ensure that instruments are properly maintained and continue to operate properly, preventative maintenance activities are undertaken on a routine basis. An experienced analyst or a manufacturer's service representative performs maintenance. The types of preventative maintenance actions are dependent on the instrument. Any unusual conditions are investigated and resolved prior to beginning analysis of samples.

Instrument maintenance records are maintained, and all non-routine maintenance activities are documented and stored in the department. A separate file is maintained for each instrument.

8.8 DATA MEASUREMENT ASSESSMENT PROCEDURES

The laboratory procedures are designed to maintain the quality of its principal product – reliable and defensible analytical results. Staff members are trained in appropriate Quality Assurance procedures to reinforce the laboratory's commitment to consistent high quality.

The laboratory applies acceptance criteria to all quality control data. When a sample analysis is complete, the quality control data are reviewed and evaluated by using acceptance criteria based on standard operating procedures or client specific data quality objectives. This evaluation is used to validate the corresponding data set. Evaluation is based on:

- Continuing Calibration Verification Standard
- Method Blank Evaluation
- Laboratory Control Evaluation
- Matrix Spike and Matrix Spike Duplicate Evaluation
- Surrogate Standard Evaluation

8.8.1 Accuracy

Accuracy will be evaluated through the preparation and analysis of matrix spikes, method spikes (where required by matrix interference), second source reference standards (for metals), and by spiking samples with surrogate compounds (for organic analyses). It is expressed as percent recovery (%R).

Accuracy is monitored through mean percent recovery of matrix or method spikes. At least one matrix or method spike is prepared and analyzed with each set of twenty samples.

For metals samples, second source reference standards are included in sample batches. The concentrations of reference samples will be within the working range of the method. Sources of these samples include but are not limited to: quality control samples from EPA, standard reference materials from National Institute of Standards and Technology (NIST), commercially available check samples, samples prepared by other laboratories or samples prepared in-house but from different sources of analyte.

The quality control acceptable range for accuracy is 85 percent to 115 percent recovery of a calibration standard.

8.8.2 Precision

Precision will be evaluated from the sample and sample replicate results. It is expressed as relative percent difference (RPD) or as percent (%D) based on duplicate analyses of a sample. The quality control acceptance level for sample precision is $\pm$ 20 %D or RPD=20 for water matrix, as determined by duplicate analyses. For analytes at concentrations of less than five times the method detection limit, it may be difficult to meet this objective.

8.8.3 Completeness

Completeness will be evaluated by the percentage of valid analytical results compared to the total number of requested sample analytical results. Completeness for this project will be 90 percent.

8.9 CORRECTIVE ACTION

If the accuracy limits for a given chemical are exceeded on a matrix spiked/ matrix spiked duplicate sample (MS/MSD), while the corresponding laboratory control sample (LCS) is within acceptance limits the MS/MSD data is flagged and sample results are accepted. If the LCS fails, the problem is identified and corrected by repeating the analysis. A corrective action report is generated with each occurrence. The laboratory maintains corrective action files.

9.0 REFERENCES

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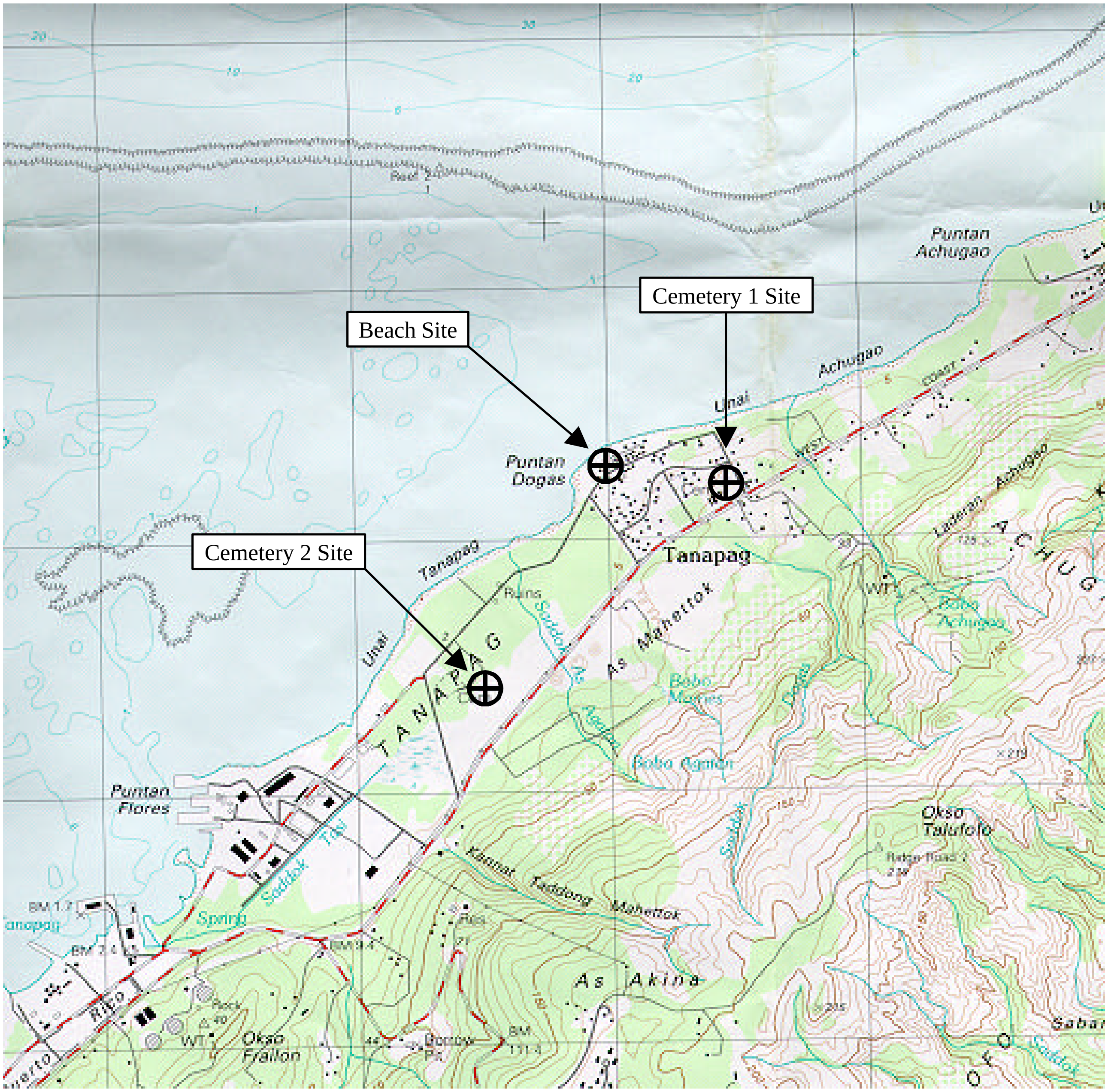
FIGURES



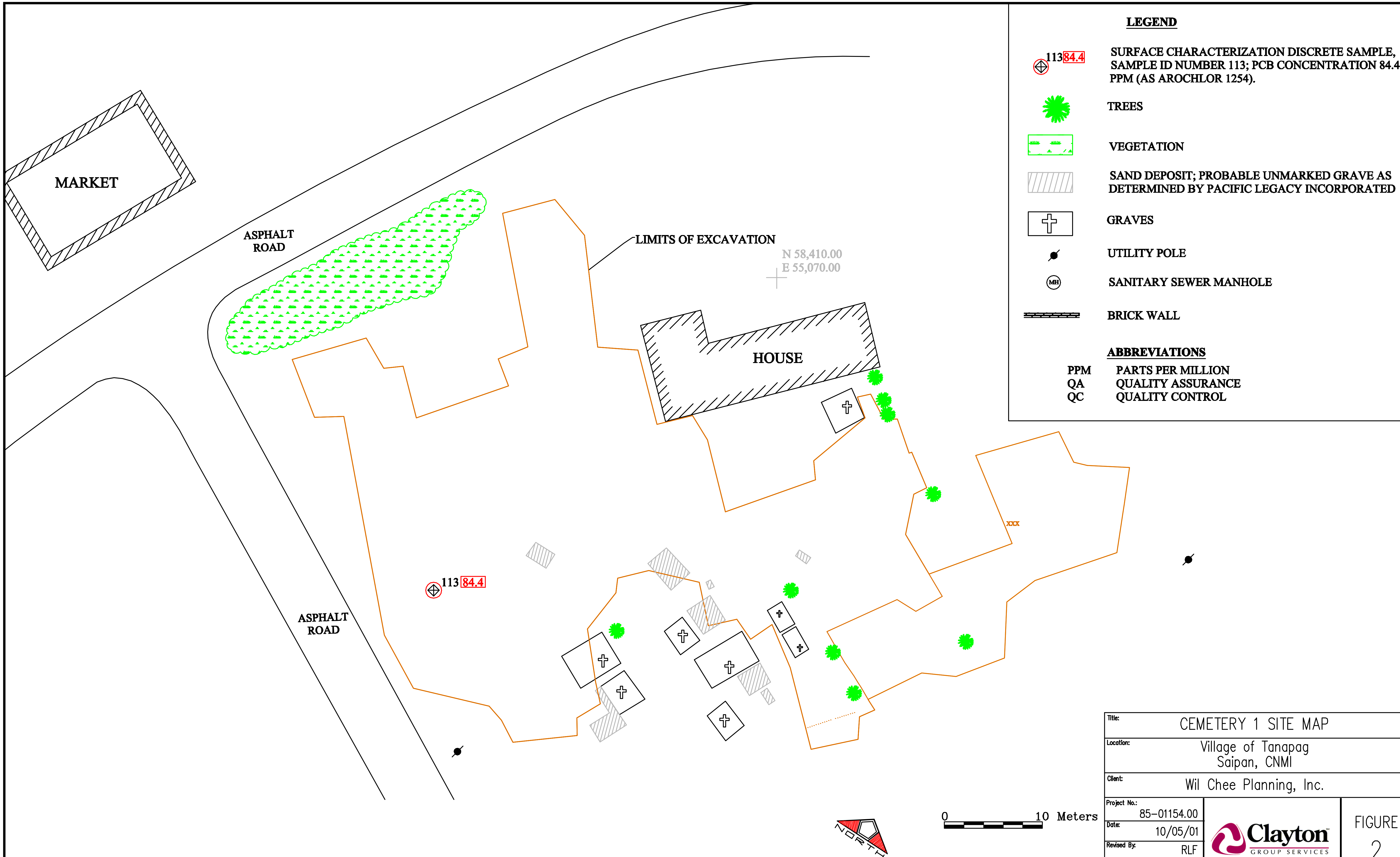
SCALE 1:25,000

1 MILE | 7000 FEET | 1 KILOMETER

NORTH

Topographic Map of the Island of Saipan
Commonwealth of the Northern Mariana Islands
United States Department of the Interior Geological Survey
Contour Interval 10 Meters
1983

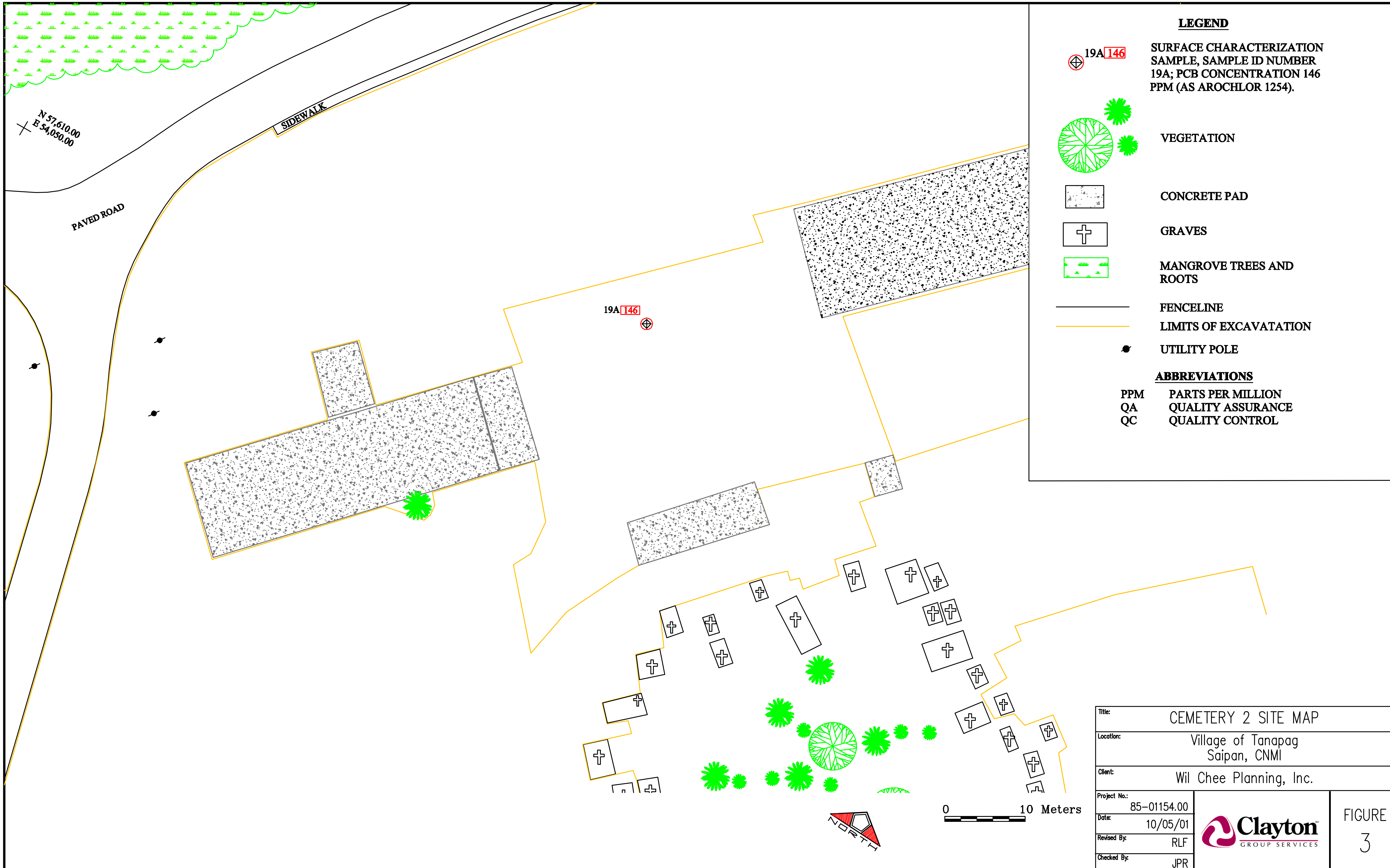
Clayton GROUP SERVICES			
Project No.: 85-01154.00	Title: SITE MAP WITH PROPOSED WELL LOCATIONS		FIGURE 1
Date: 2/22/01	Site and Location: Village of Tanapag Saipan, CNMI		
Revised By: JPR			
Checked By: DPF	Client: Wil Chee Planning, Inc.		

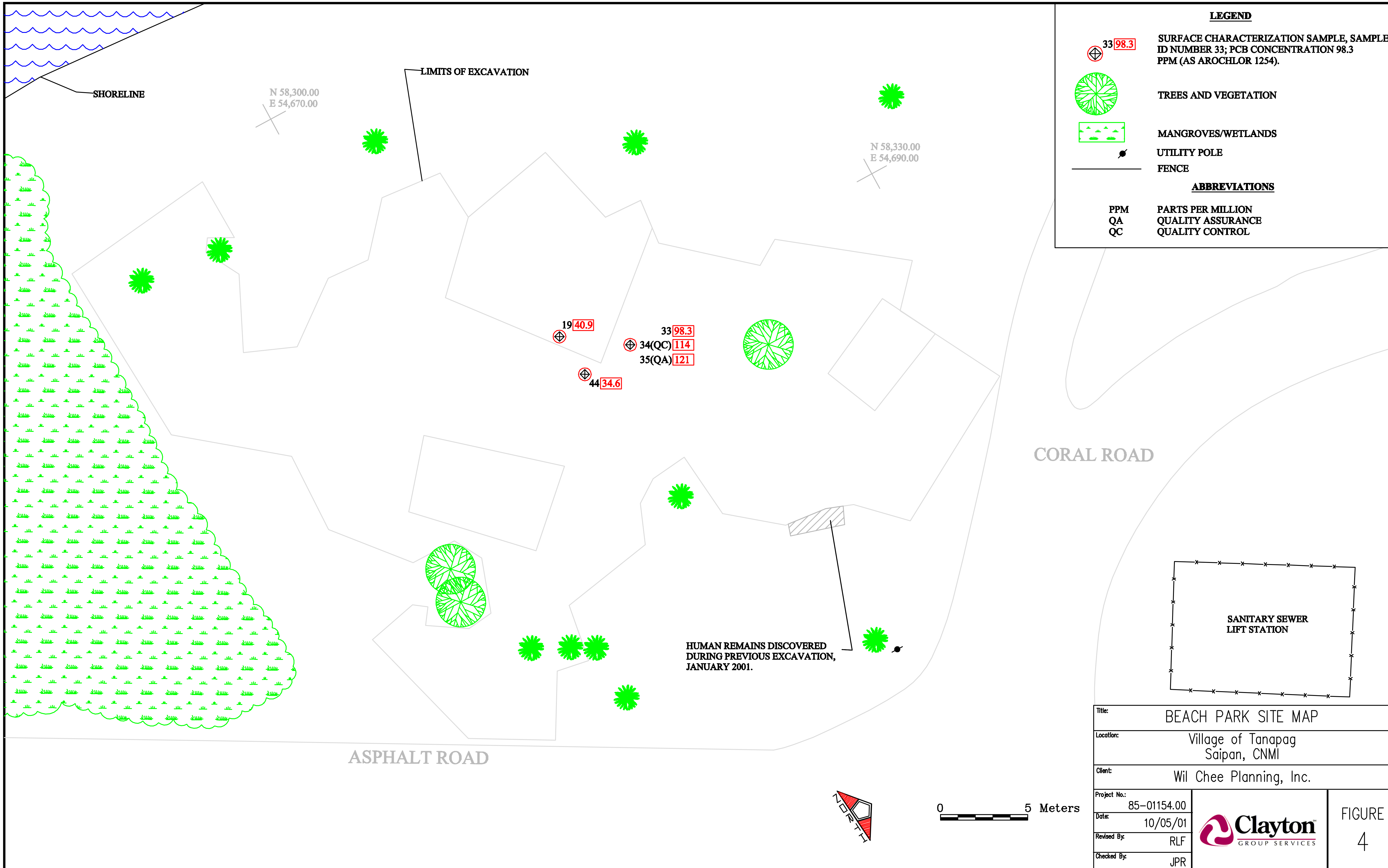


Title:	CEMETERY 1 SITE MAP
Location:	Village of Tanapag Saipan, CNMI
Client:	Wil Chee Planning, Inc.
Project No.:	85-01154.00
Date:	10/05/01
Revised By:	RLF
Checked By:	JPR

Clayton GROUP SERVICES

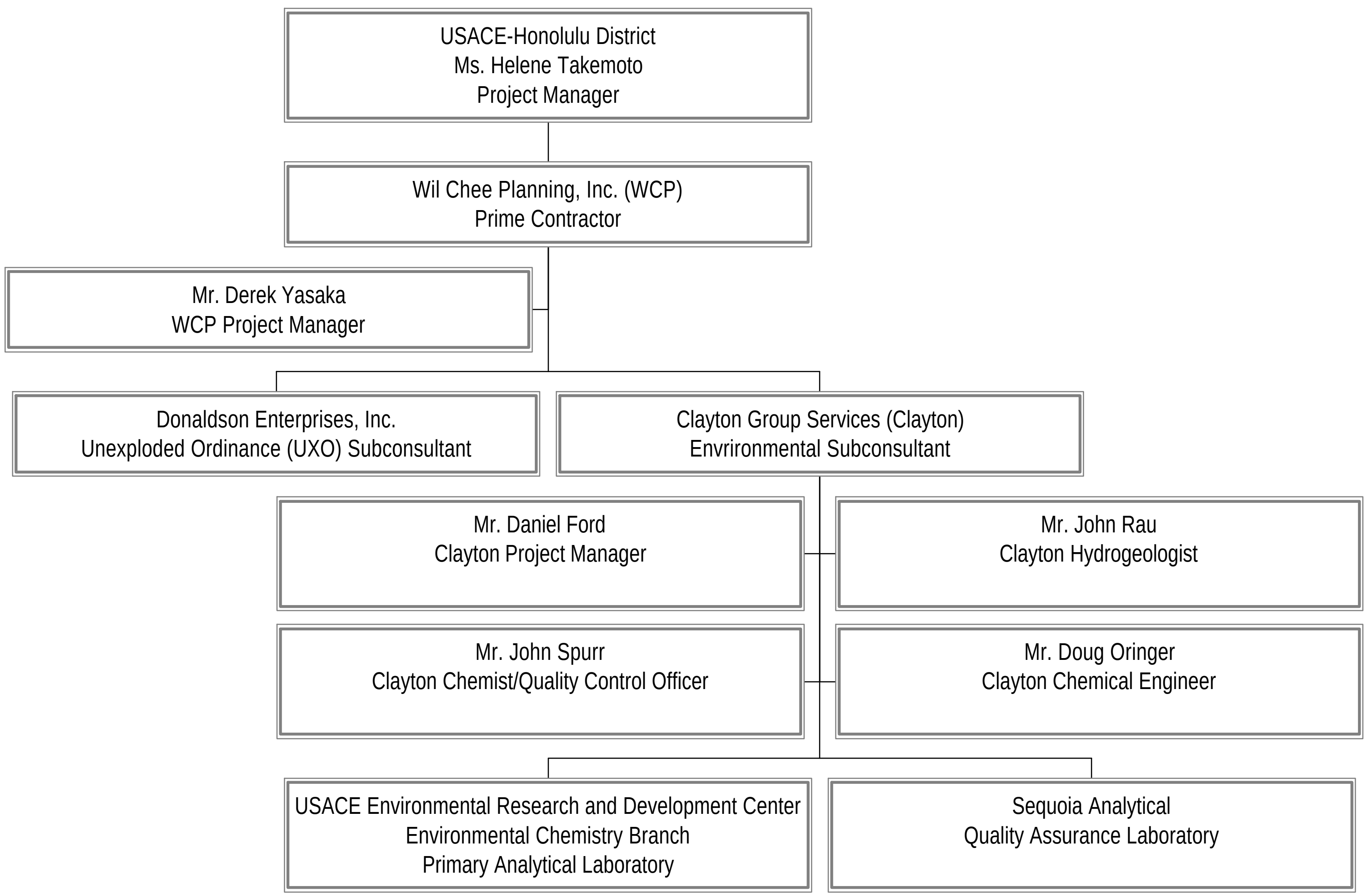
FIGURE 2


N 57,610.00
E 54,050.00
SIDEWALK
PAVED ROAD
19A 146
LEGEND
19A 146
SURFACE CHARACTERIZATION SAMPLE, SAMPLE ID NUMBER 19A; PCB CONCENTRATION 146 PPM (AS AROCHLOR 1254).
VEGETATION
CONCRETE PAD
GRAVES
MANGROVE TREES AND ROOTS
FENCELINE
LIMITS OF EXCAVATION
UTILITY POLE
ABBREVIATIONS
PPM PARTS PER MILLION
QA QUALITY ASSURANCE
QC QUALITY CONTROL
NORTH
0 10 Meters
Title: CEMETERY 2 SITE MAP
Location: Village of Tanapag Saipan, CNMI
Client: Wil Chee Planning, Inc.
Project No.: 85-01154.00
Date: 10/05/01
Revised By: RLF
Checked By: JPR
Clayton GROUP SERVICES
FIGURE 3


LEGEND
33 98.3
SURFACE CHARACTERIZATION SAMPLE, SAMPLE ID NUMBER 33; PCB CONCENTRATION 98.3 PPM (AS AROCHLOR 1254).
TREES AND VEGETATION
MANGROVES/WETLANDS
UTILITY POLE
FENCE
ABBREVIATIONS
PPM PARTS PER MILLION
QA QUALITY ASSURANCE
QC QUALITY CONTROL
SHORELINE
LIMITS OF EXCAVATION
N 58,300.00
E 54,670.00
N 58,330.00
E 54,690.00
19 40.9
33 98.3
34(QC) 114
35(QA) 121
44 34.6
CORAL ROAD
HUMAN REMAINS DISCOVERED DURING PREVIOUS EXCAVATION, JANUARY 2001.
SANITARY SEWER LIFT STATION
ASPHALT ROAD
NORTH
0 5 Meters
Title: BEACH PARK SITE MAP
Location: Village of Tanapag Saipan, CNMI
Client: Wil Chee Planning, Inc.
Project No.: 85-01154.00
Date: 10/05/01
Revised By: RLF
Checked By: JPR
Clayton GROUP SERVICES
FIGURE 4

CHARTS

Chart
Organizational Chart
Groundwater Investigation
Tanapag Village PCB Contamination
Tanapag, Saipan, CNMI



APPENDIX A

LABORATORY USACE VALIDATION LETTER

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
HTRW CENTER OF EXPERTISE
12565 WEST CENTER ROAD
OMAHA, NEBRASKA 68144-3869

REPLY TO
ATTENTION OF:

June 14, 2001

Hazardous, Toxic and Radioactive Waste
Center of Expertise

JUN 25 2001

Sequoia Analytical
ATTN: Gary Costley
1455 McDowell Blvd North, Suite D
Petaluma, CA 94954

Gentlemen:

This correspondence addresses the recent evaluation of Sequoia Analytical of Petaluma, CA by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the USACE Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below:

METHOD	PARAMETERS	MATRIX(1)
300 series	Anions(4)	Water(2)
8330	Explosives	Water(2)
8330	Explosives	Solids(2)
8151A	Herbicides	Water(2)
8151A	Herbicides	Solids
8081A	Organochlorine Pesticides	Water(2)
8081A	Organochlorine Pesticides	Solids
8082	Polychlorinated Biphenyls	Water(2)
8082	Polychlorinated Biphenyls	Solids(2)
8310	Polynuclear Aromatic Hydrocarbons	Water(2)
8310	Polynuclear Aromatic Hydrocarbons	Solids
8270C	Semivolatile Organics	Water(2)
8270C	Semivolatile Organics	Solids(2)
6010B/7000A	TAL Metals(3)	Water(2)
6010B/7000A	TAL Metals(3)	Solids(2)
6020	TAL Metals(3)	Water(2)
6020	TAL Metals(3)	Solids(2)
Mod 8015	TPH - DRO/GRO(5)	Water
Mod 8015	TPH - DRO/GRO(5)	Solids
8021B	Volatile Organics	Water(2)
8021B	Volatile Organics	Solids
8260B	Volatile Organics	Water(2)
8260B	Volatile Organics	Solids

Remarks:

1) 'Solids' includes soils, sediments, and solid waste.

2) The laboratory has successfully analyzed a performance evaluation sample for this method/matrix.

3) TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

4) Anions: Chloride, fluoride, sulfate, nitrate, nitrite, and ortho-phosphate.

5) Approval for this parameter is based on review of SOPs only.

Enclosed for your information is a copy of the Laboratory Inspection and Evaluation Report. Your laboratory has responded to the deficiencies as noted in the report. No further responses are necessary.

Based on the successful analysis of the performance evaluation samples, the results of the laboratory inspection, and your Corrective Action Report, your laboratory will be validated for sample analysis by the methods listed above. The period of validation is 24 months and expires on June 14, 2003.

The USACE reserves the right to conduct additional laboratory inspections or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

Any questions or comments can be directed to Richard Kissinger at (402) 697-2569. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,

Marcia C. Davies, Ph.D.
Director, USACE Hazardous,
Toxic and Radioactive Waste
Center of Expertise

Enclosure

APPENDIX B

SAMPLE CHAIN-OF-CUSTODY FORM

SEQUOIA ANALYTICAL CHAIN OF COUSTODY

❑ 885 Jarvis Drive • Morgan Hill, CA 95037 • (408) 776-9600 • FAX (408) 782-6308
❑ 819 Striker Ave., Suite 8 • Sacramento, CA 95834 • (916) 921-9600 • FAX (916) 921-0100
❑ 404 N. Wiget Lane • Walnut Creek, CA 94598 • (925) 988-9600 • FAX (925) 988-9673
❑ 1455 McDowell Blvd. North, Suite D • Petaluma, CA 94954 • (707) 792-1865 • FAX (707) 792-0342
❑ 1551 Industrial Road • San Carlos, CA 94070 • (650) 232-9600 • FAX (650) 232-9612

Company Name:	Project:
Mailing Address:	Billing Address (if different):
City: State: Zip Code:	
Telephone: Fax #:	P.O. #: Payment Received: ❑ Yes ❑ No
Report To: E-Mail:	QC Data: ❑ Level D (Standard) ❑ Level C ❑ Level B ❑ Level A

Turnaround Time: ❑ 10 - 15 Working Days ❑ 7 Working Days ❑ 5 Working Days ❑ 3 Working Days ❑ 2 Working Days ❑ 1 Working Day ❑ 2 - 8 Hours

Mandatory: ❑ Drinking Water ❑ Waste Water ❑ Other

Sampler:

Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Sequoia's Sample #	Analyses Requested										Comments
1.																
2.																
3.																
4.																
5.																
6.																
7.																
8.																
9.																
10.																

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

Were Samples Received in Good Condition? ❑ Yes ❑ No Samples on Ice? ❑ Yes ❑ No Method of Shipment ________ Page ____ of ____

Pink - Client Yellow - Sequoia White - Sequoia