January 31, 2019

United States Fish and Wildlife Service (USFWS)
Pacific Islands Fish and Wildlife Office (PIFWO):
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Attn: Recovery Permit Coordinators
Subject: 2018 Annual Report for Recovery Subpermit FWSPIFWO-26

On October 21, 2017, Recovery Subpermit FWSPIFWO-26, Amendment 26 (SPITS TE 039990-26) (Subpermit) was issued under the Regional Blanket Permit (TE-702631) (Permit). As required under number 27(a) of the terms and conditions of the Permit, the following subpermittee is submitting this annual summary report for activities conducted under the Subpermit in 2018.

- Robert Wescom

This individual is authorized to independently conduct all activities under the attached Preliminary Final Salvage and Transplantation Work Plan: Salvage and Transplantation of Federally Listed Plant Species at Utilities and Site Improvements Phase 1 (NAVFAC Work Plan), and agreed on revisions, for *Cycas micronesica* on Guam.

Introduction

Authorized activities in 2018 took place with the J-001B Utilities and Site Improvements Phase I footprint construction project, which is located on Naval Base Guam Telecommunication Site (NBGTS) in northern Guam (**Figure 1**). The primary objective of this project is to provide salvage and transplanting services for federally listed plants found within the Utilities and Site Improvements Phase I (J-001B) at NBGTS.

For this project, the subpermittee is contracted under Naval Facilities Engineering Command (NAVFAC) Pacific contract N62742-15-D-1822 (Contract Task Order [CTO] N6274217F0101 dated June 29, 2017) to provide the following services:

- Perform a field assessment of the location and condition of plant species to determine salvage and transplant methods.
- Salvage a minimum of five (5) *C. micronesica* within the J-001B project footprint.
- Transplant salvaged plants to a Government-approved location.
- Provide one year of maintenance and monitoring after transplantation.

A modification to CTO N6274217F0101 in April 2018 included the option for whole-stem excavation and transplanting of eight (8) *C. micronesica* trees within the Utilities and Site Improvements Phase I (J-001B) at NBGTS.

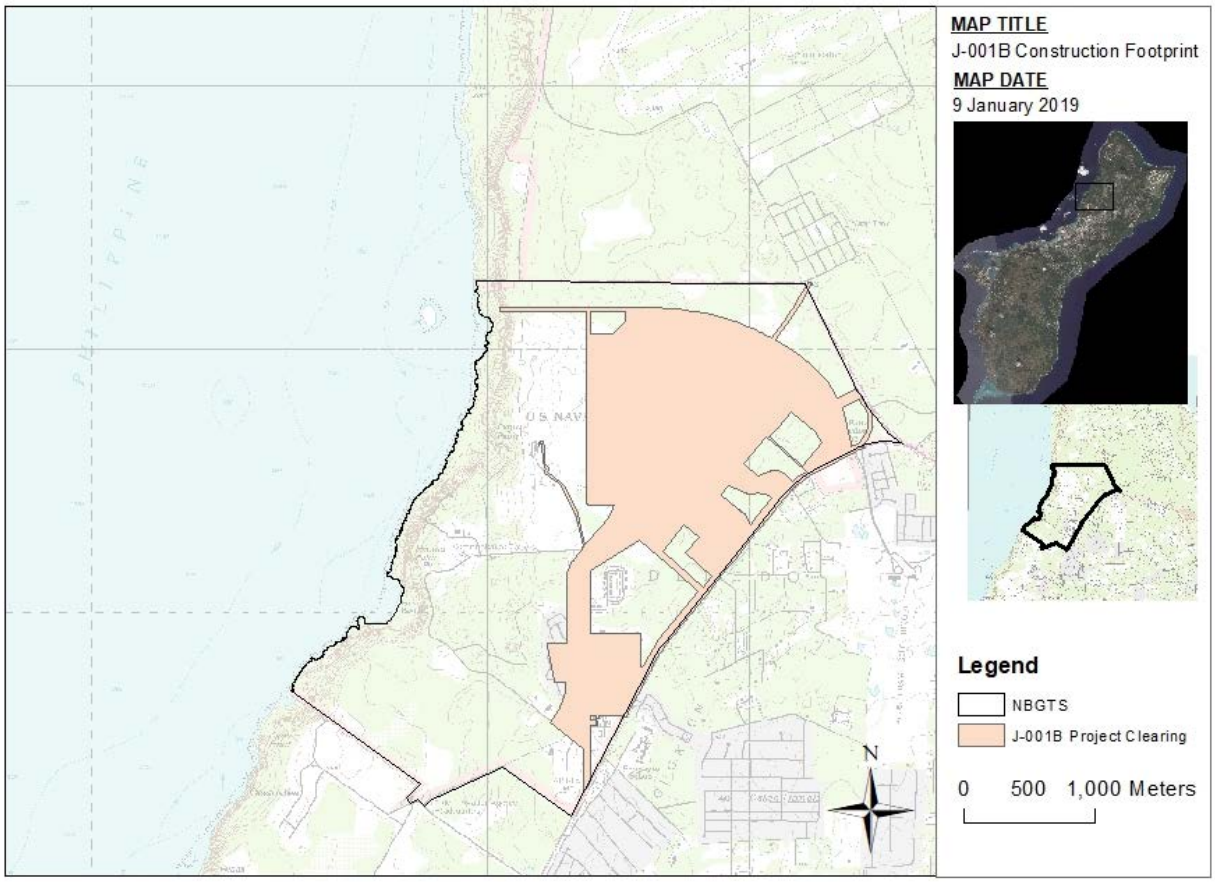

Figure 1. J-001B Construction Footprint

Methods

The methods used for the field assessment, plant salvage, and transplanting are described in detail in the attached Final Work Plan, dated March 2018 (**Attachment 1**). USFWS staff reviewed the Work Plan and the Navy submitted responses to comments in 2018. The Final Work Plan stated that if an approved nursery is not authorized for use in advance of the planned construction vegetation clearing schedule, an alternate method for *C. micronesica* salvage might be used. This would involve direct transplant of adult *C. micronesica* from their existing locations to a pre-determined outplant location in the Forest Enhancement Area.

Results

Field Assessment and Population Analysis

A second field assessment was conducted on May 23, 2018. The purpose of the site visit was to reassess the condition and health of eight (8) *C. micronesica* plants.

In approaching the site identified as Not In Contract Area C, vegetation clearing and construction activity was observed in the vicinity of where two *C. micronesica* plants were assessed in August 2017. Vegetation had been felled and piled, pushed into a windrow, a pile of gravel, and a concrete structure that appeared to be a manhole.

Using GPS coordinates of the previously assessed *C. micronesica* plants, two *C micronesica* plants were located that had recently been felled. One tree stump was located in the open cleared area, and the second stump was located within the windrow of felled vegetation. Based on a prior numbering system, these two *C. micronesica* plans were identified as Tree 6 and 7 in the Salvage and Transplantation Work Plan.

After locating the two felled *C. micronesica* trees, the remaining six (6) *C. micronesica* trees were reassessed (**Figure 2**). Initially, the recommendation was to salvage apical stems and any viable pups; however, since an approved plant nursery was not available, the option for whole-stem excavation and direct transplant to a pre-determined outplant location in the Forest Enhancement Area was identified as the only viable alternative.

Salvage of the six *C. micronesica* stems occurred between September 28, 2018 and October 4, 2018.

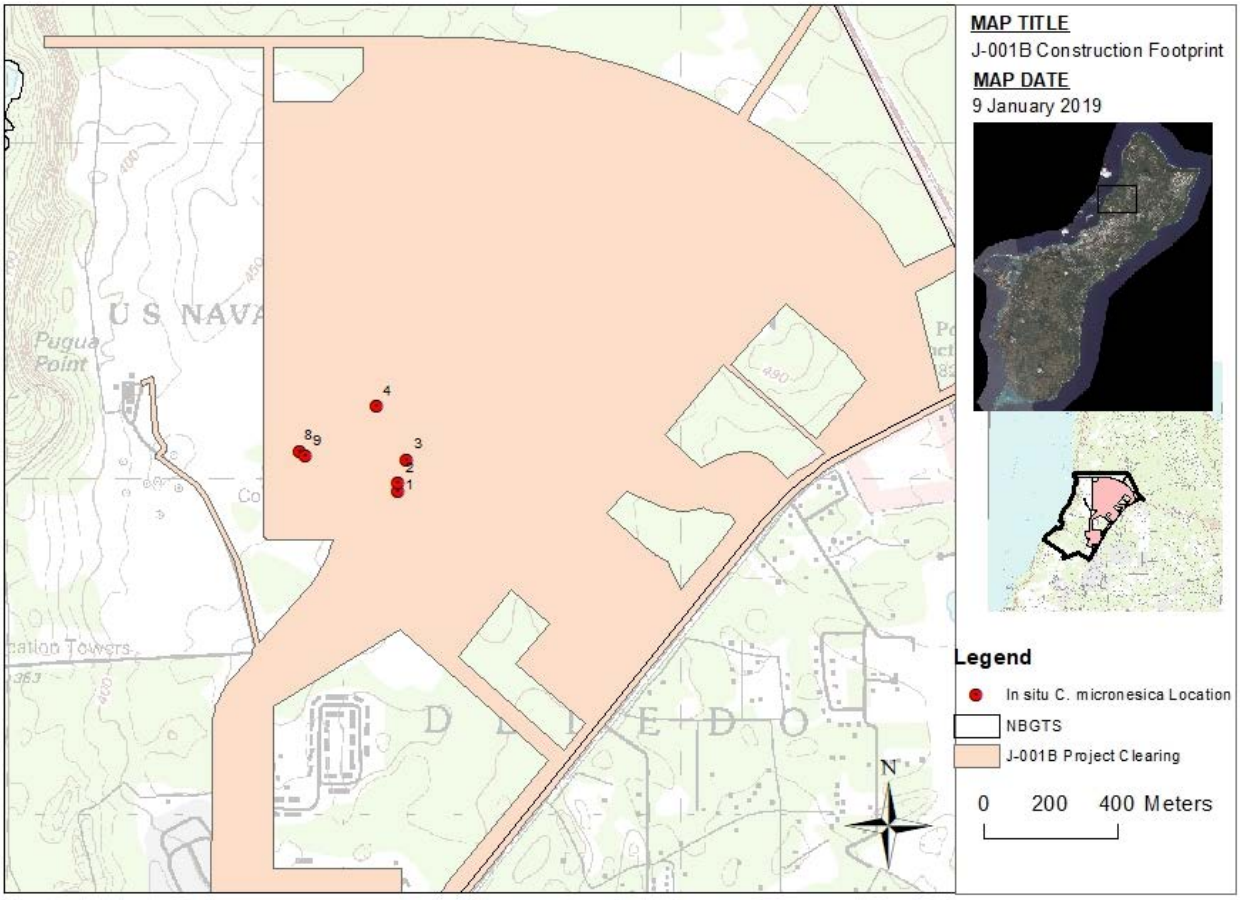

Figure 2. Original location of *C. micronesica* at NBGTS.

The location and salvage recommendation of each tree is described in **Table 1**.

Table 1. *C. micronesica* Assessment and Final Salvage Recommendations

ID	Coordinates		Salvage Recommendation
	Northing	Easting	
Cycad 1	1502963	267160	Whole-stem excavation of two stems
Cycad 2	1502988	267160	Whole-stem excavation of one stem
Cycad 3	1503059	267187	Whole-stem excavation of one stem
Cycad 4	1503217	267094	Whole-stem excavation of one stem
Cycad 8	1503083	266869	Whole-stem excavation of one stem.
Cycad 9	1503070	266886	Whole-stem excavation of one stem

Salvage, Transplant, and Monitoring

Six (6) individual plants were salvaged and transplanted in 2018 as summarized in **Table 2**.

Table 2. Summary of Authorized Plant Species Salvaged in 2018

Plant Species	Salvaged	Transplanted
Cycas micronesica	6	6

On June 13, 2018 *Safari* insecticide was applied to the soil around the six *C. micronesica*. A total of 234 g (46.8 g a.i.) were applied by the subpermittee, a Certified Pesticide Applicator.

On September 19, 2018 the subpermittee conducted a site visit to the six *C. micronesica* plants and observed that construction clearing had commenced and four (4) of the six (6) *C. micronesica* were now surrounded by felled trees making access more difficult.

On September 26, 2018 the team visited each of the six *C. micronesica* plants determine the most appropriate access and approach to whole-tree salvage. Surrounding felled trees had been piled allowing for easier access.

The team encountered *C. micronesica* tree number 5, which had previously determined to be dead; however, it had three small leaves indicating that it was alive. After consultation with Dr. Marler it was concluded to have an extremely low probability of survivorship; therefore, not salvageable.

On September 27, 2018 the UXO technicians conducted a sweep of the outplant area prior to the backhoe beginning excavation of the six transplanting holes.

On September 28, 2018 the team began salvage of *C. micronesica* plant number 8. Excavation was deeper than anticipated with lateral roots not encountered until the excavation was greater than 60-cm deep. Lateral roots were cut using a battery powered Saws-All. Once all of the lateral roots and taproot were cut all of the leaves and other growth (e.g. seeds, ferns) were removed. Five gallon buckets were filled with excavated soil to be added to the transplanting hole.

The excavated *C. micronesica* was moved via the backhoe to the ATV and trailer. The *C. micronesica* was transported to a water source where the roots were washed clean before moving the *C. micronesica* to the previously excavated transplanting site.

The cleaned roots were further cut with a knife and fine-toothed Saws-All blade. The cut surfaces were treated with 10% bleach solution, and sprayed with a solution of *Daconil* fungicide (29.6% a.i.). The cut surfaces were air dried and sealed with a tar-like tree pruning mix before being placed in the excavated transplant hole and supported by the backhoe while five-gallon buckets of soil from the excavation site were poured around the root system. The stem was supported with 3/8-inch rope running through rubber hose and secured to surrounding trees. The remaining hole was filled with soil excavated from the transplant hole.

Five-gallon buckets of water were poured into the surrounding soil to remove any potential large air pockets. Following successful transplanting the entire stem was sprayed with *Distance* insecticide to control cycad aulacaspis scale (*Aulacaspis yasumatsui*) by the subpermittee, who is a Guam Certified Pesticide Applicator.

Operations were suspended over the weekend (September 29-30, 2018). Tropical disturbance 30-W passed north of Guam over the weekend bringing strong winds and heavy rainfall.

Salvage operations continued on October 1, 2018 with the salvage and transplanting of *C. micronesica* tree number 9. The same procedures as tree number 8 were followed.

C. micronesica trees 1 and 2 were salvaged and transplanted on October 2, 2018. *C. micronesica* tree 1 had two stems, which had grown up through two large rocks, which the backhoe carefully pulled apart before salvage continued. The two stems are connected; therefore, treated as a single stem. Attachment 2 shows photographs of the progression *C. micronesica* tree 1 following transplanting.

C. micronesica tree 3 was salvaged and transplanted on October 3, 2018 using the same procedure as trees 1 and 2.

C. micronesica tree 4 was the last to be salvaged and transplanted on October 4, 2018. This tree was growing in very deep loamy soil and had very large lateral roots and taproot.

Table 3 describes the location of the six outplanted *C. micronesica* trees.

Table 3. Description and GPS location of six outplanted *C. micronesica* trees at NBGTS.

Cycad ID	DBH (cm)	Height (m)	Pups	HorizEstAcc (m)	Northing	Easting
1	17.50	1.50	0	0.27	1501419.87	266217.00
2	12.50	1.75	0	0.11	1501426.75	266208.12
3	20.50	2.25	0	0.49	1501424.76	266209.96
4	22.00	2.50	2	0.42	1501422.66	266213.46
8	21.00	3.50	20	0.17	1501432.50	266194.77
9	15.40	2.20	1	0.12	1501429.90	266199.48

Coordinates of the *C. micronesica* transplanting locations were recorded using a Trimble R2 GPS and Trimble Ranger 3 tablet computer running ESRI ArcPad software. GPS positions were recorded in WGS-84 Zone 55N (m) coordinates. Post processing of the GPS positions was completed using Trimble Positions software in order to obtain the required one meter horizontal estimated accuracy (HorizEstAcc).

The one-year monitoring period for these individuals was initiated on October 4, 2018. Monitoring of the six transplanted C. micronesica stems occurred on October 5, October 17, November 1, November 13, November 29, December 6, and December 20, 2018. **Table 4** shows dates when new leaf growth was observed on the six (6) *C. micronesica* outplanted trees.

Table 4. Dates of transplanting and observed new leaf growth of six (6) *C. micronesica*.

Cycad ID	Date Outplanted	Date when new leaf growth observed
1	October 2, 2018	October 17, 2018
2	October 2, 2018	October 17, 2018
3	October 3, 2018	November 29, 2018
4	October 4, 2018	November, 13, 2018
8	September 28, 2018	November 17, 2018* (New leaves on multiple pups, new apical leaves observed; however, the new leaves died)
9	October 1, 2018	October 17, 2018

On November 26, 2018 an application of *Distance* insecticide was applied to control cycad aulacaspis scale (*Aulacaspis yasumatsui*); by the subpermittee, who is a Guam Certified Pesticide Applicator, to the leaves and stems of all six (6) outplanted *C. micronesica*.

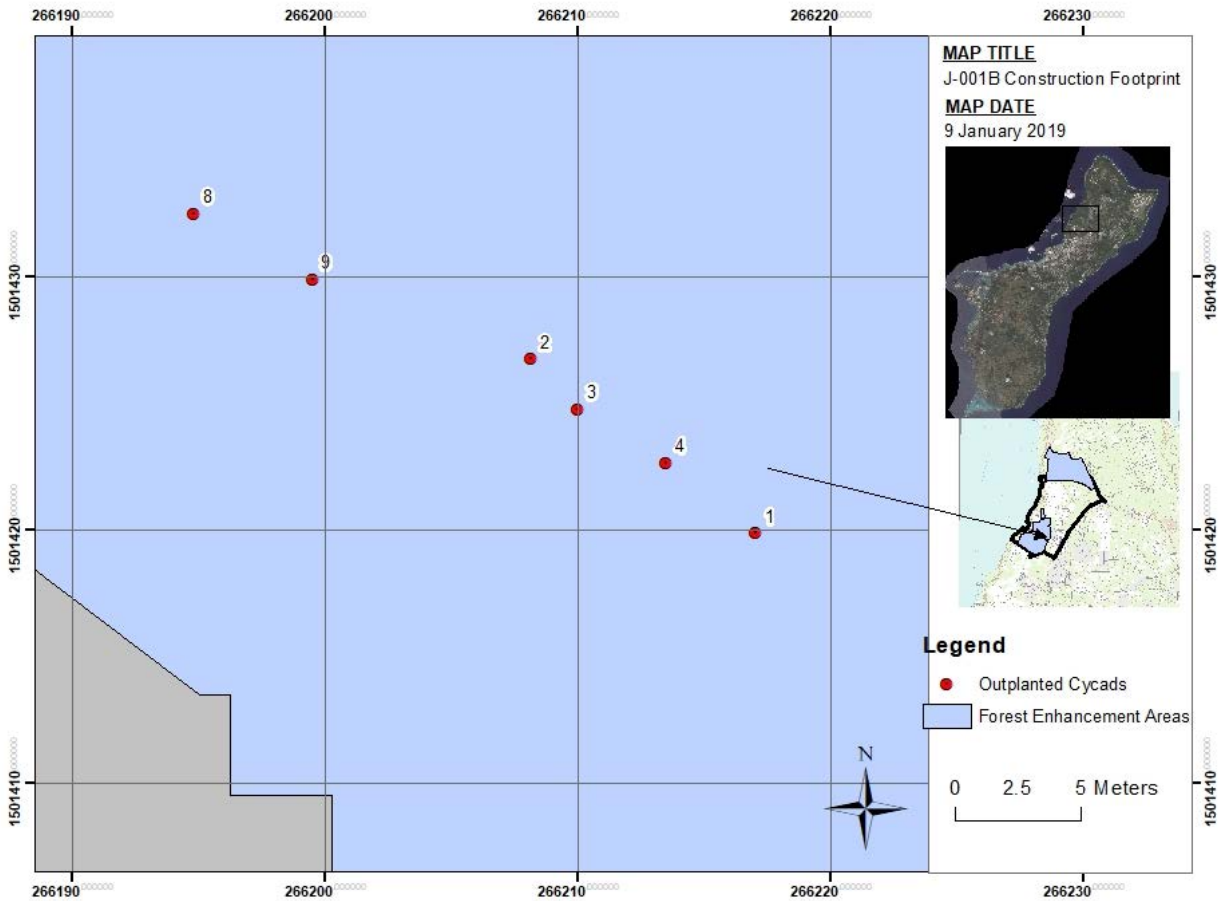

Figure 2. Location of transplanting site of six *C. micronesica* trees at NBGTS (*Note: gray area in lower left represents road).*

Other Authorized Activities

Other than the salvage and transplantation of six (6) *C. micronesica*, no propagation of *C. micronesica* from the J-001B project site took place in 2018. No additional propagules, vegetative samples, vouchers, or tissues samples were collected as summarized in **Table 5**. Additionally, no individual plants were damaged or destroyed.

Table 5. Summary of Other Activity with Authorized Plant Species in 2018

Plant Species	Number of Propagules Collected	Number of Vegetative Samples Collected	Number of Herbarium Vouchers Collected	Number of Tissue Samples Collected	Number of Plants Damaged or Destroyed
Cycas micronesica	0	0	0	0	0

Further, no genetic testing was performed on any individuals salvaged or transplanted in 2018.

Unintentional Takes

No other federally listed plant or wildlife species were subject to unintentional takes in 2018.

Table 6. Summary of Unintentional Takes in 2018

Plant Species	Number of Individuals Salvaged	Number of Individuals Injured or Killed	Date Taken	Location (Coordinates)	Outcome
Other Plants and Wildlife	0	0	N/A	N/A	N/A

Conclusions

Other pertinent observations made regarding the status or ecology of the species in 2018 include:

- Excavation of the six living *C. micronesica* within the J-001B Utilities and Site Improvements Phase I footprint construction project required a backhoe. The depths to lateral roots of the six *C. micronesica* were deeper and larger than expected. Manual excavation, extraction, and transplanting of the six *C. micronesica* would have been extremely difficult using only manual labor (e.g. shovels and pickaxe) due to root depth and, rocky soil.
- Due to their large size and weight the excavated *C. micronesica* had to be transported and loaded on to the trailer and placed in the excavated transplanting hole with the assistance of the backhoe. Manual handling of the six *C. micronesica* was not practical.
- New leaf growth on the outplanted *C. micronesica* occurred rapidly.
- Pups also exhibited rapid new leaf growth.
- Cycad aulacaspis scale (*Aulacaspis yasumatsui*) continues to infect the outplanted *C. micronesica* trees, especially Cycad #1. Continued application of *Distance* insecticide is recommended.
- No cycad blue butterfly (*Chilades pandava*) insects or damage was observed on any of the living *C. micronesica*.
- Multiple *C. micronesica* pups are present on Cycad #8, which could be harvested and grown in the NBGTS native tree nursery after the 12-month maintenance period.
- Because of continued rainfall, supplemental watering on the outplanted *C. micronesica* was not necessary in 2018.

Under the Subpermit the authorized individual is planning to conduct the following activities in 2019:

- Monitoring of outplanted *C. micronesica* individuals and maintenance of transplant site as needed till October 4, 2019.

Please contact Robert Wescom by email at wesmurph@outlook.com or by telephone at 671-486-6119 should you have any questions or concerns regarding this report.

Attachment 1 – Final Work Plan

March

2018

Final

Salvage and Transplantation Work Plan

Salvage and Transplantation of Federally Listed Plant Species at Utilities and Site Improvements Phase I

Naval Base Guam Telecommunications Site, NAVFAC Pacific

Prepared for:

Naval Facilities Engineering Command Pacific

Prepared by:

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Honolulu, HI 96813

Attachment (5)

ACRONYMS AND ABBREVIATIONS

AAFB	Andersen Air Force Base
CD	compact disc
COR	Contracting Officer Representative
CPC	Center for Plant Conservation
GIS	Geographic Information System
GPEPP	Guam Plant Extinction Prevention Program
HACCP	Hazard Analysis and Critical Control Point
LMS Inc.	Landscape Management Systems Inc.
MCAG	Marine Corps Activity Guam
MEC	munitions and explosives of concern
NAVFAC	Naval Facilities Engineering Command
NBGTS	Naval Base Guam Telecommunication Site
NTR	Navy Technical Representative
NWF	Northwest Field
PM	Project Manager
POAM	Plan of Action and Milestones
PWS	Performance Work Statement
SDSFIE	Spatial Data Standards for Facilities, Infrastructure and Environment

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1. Salvage and Transplantation Work Plan Overview

1.1 Introduction

This Work Plan presents background information, project management details, proposed methodology, required deliverables, and an anticipated schedule for the salvage and transplantation of federally listed plant species identified within the footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

Specifically, this Work Plan describes the efforts that will be performed by the HDR Team to salvage and transplant 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I at NBGTS as described in the contract's task order Performance Work Statement (PWS), signed June 29, 2017 and modified on December 12, 2017. This work will be conducted under contract to Naval Facilities Engineering Command (NAVFAC) Pacific, contract N62742-15-D-1822. Rebecca Ralston (HDR) will serve as the Project Manager, WESMURPH Consulting and Landscape Management Systems (LMS Inc.) will perform field activities.

1.2 Project Description

The purpose of this project is the salvage and transplantation of federally listed plant species identified within the construction footprint for the J-001B at NBGTS.

All work will be performed following applicable and appropriate Department of Defense guidance and policy and consider all site documentation and reports available to the date of this Work Plan. The period of performance of this Contract Task Order is from June 29, 2017, through July 31, 2019. The following services will be provided:

1. Perform a field assessment of the location and condition of plant species to determine salvage and transplant methods.
2. Salvage five *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint.
3. Transplant salvaged plants to a Navy-approved location.
4. Provide one year of maintenance and monitoring after transplantation.

1.2.1 Project Location

The J001B Utilities and Site Improvements Phase I footprint construction project is on NBGTS in northern Guam (**Figure 1**). Orchid and cycad salvage will be done within the construction footprint which has been divided into four priority areas ranked in order of anticipated work by the construction contractor (as of September 6, 2017; subject to change). Two Forest Enhancement Areas have been designated—one in the southern portion of NBGTS and the

other in the northern portion of NBGTS/southern portion of AAFB NWF. Transplantation activities will be done in one or both of those designated areas.

1.3 Objective

Project team members will assess the best method to salvage 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense*, treat and maintain them in an approved nursery (if appropriate), transplant them (when appropriate), and provide 12 months of maintenance and monitoring of the transplanted plants with a minimum of a 50 percent plant survivorship after one year from the date of transplant of the individual plant. Survivorship is defined for *Cycas micronesica* pups as a new canopy of healthy fronds and leaf formation one year after transplanting from trunk cuttings and for Orchidaceae species as the documented observation of new root growth after transplantation into a protected area.

Based on the results of the field assessment, this task order will salvage 4 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, up to 20 *Dendrobium guamense*, and up to 70 *Bulbophyllum guamense*, with a minimum survivorship of 2 *C. micronesica*, 2,500 *T. guamense* individuals, 10 *D. guamense* individuals, and 35 *B. guamense* individuals. The minimum survivorship will be based on the final number of individuals salvaged in the event that fewer than the required number of individuals are located or salvageable.

1.4 Project Management

Under this task order, assigned management staff will have the appropriate experience and skills necessary to meet the needs of the PWS objectives. The field assessment, salvage and transplantation operations, plant care, monitoring and maintenance and associated documents prepared under this task order will provide sufficient documented information to assist the Department of the Navy in managing lands on NBGTS Guam.

The management effort required for this task order includes continuous oversight for the length of the project, including management of resources and schedules; budget tracking and review; periodic liaison with Marine Corps Activity Guam (MCAG) and NAVFAC Pacific points of contact as required. **Section 6** includes a contact list of project personnel.

HDR Project Manager Rebecca Ralston will be responsible for the planning and execution of task activities, budgeting, and technical coordination for this effort. She will also supervise the development of all deliverables specified in the PWS. WESMURPH Consulting and LMS Inc. will perform all field activities. Dustin Janeke, Project Quality Assurance for HDR, will conduct a quality assurance/quality control review of deliverables before submission.

Ms. Nicole Olmsted, Natural Resources Specialist at NAVFAC Pacific, is the Contracting Officer Representative (COR)/Navy Technical Representative (NTR) for work performed under this contract. The COR/NTR is responsible for monitoring the project team member's performance and for ensuring that work is performed per the requirements and specifications outlined in the PWS. Ms. Coralie Cobb is the alternate COR. Ms. Christiana Quinata and Ms. Lauren Gutierrez will be NBGTS MCAG contacts.

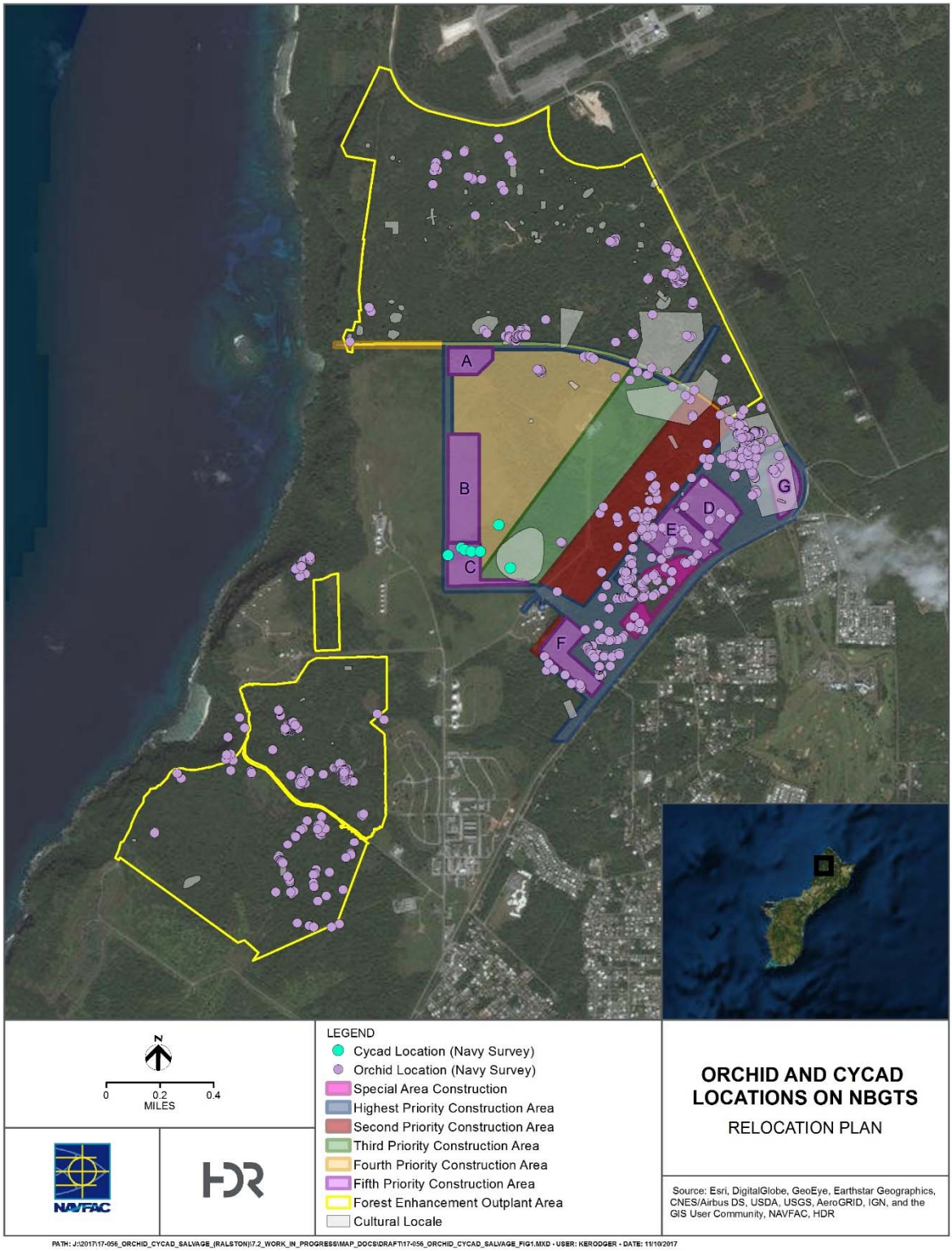

Figure 1. Project Location on NBGTS

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2. Methodology

To complete this project, multiple levels of personnel will be used. The Lead Biologist for either orchids or cycads has oversight and accountability for the health of the respective species. The Lead Biologist and Field Biologists are required to obtain a recovery permit issued under Section 10(a)(1)(A) of the Endangered Species Act (ESA), 16 U.S.C. 1531 et seq. and abide by the Special Terms and Conditions of the recovery permit. Field Biologists for either cycads or orchids are able to work with the respective species without supervision. Field Staff are personnel working under the direct guidance and supervision of the Lead and Field Biologists.

On August 23, 2017 the USFWS approved the following personnel to support this project:

- Cycad Lead Biologist: Robert Wescom
- Cycad Field Staff: Dr. Thomas Marler
- Orchid Lead Biologist: Dr. Jim McConnell
- Orchid Field Biologist: Jonathan Davis
- Orchid Field Biologist: Mario Martinez
- Orchid Field Biologist: Gregorio Borja
- Orchid Field Staff: John Horeg

2.1 Field Assessment

A field assessment was initiated on August 14, 2017, to determine the most viable salvage options for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

2.1.1 Cycad Field Assessment

Robert Wescom, the Lead Biologist for cycads, conducted a field assessment on August 14, 2017, using Navy-provided GIS data (data points, polygons) to locate the five individuals previously recorded. The field assessment included the following steps: (i) conduct a site visit to identify specimens for salvage and transplant, including assessing the condition of cycads, (ii) record all cycads with GPS, and (iii) assess salvage and transplant methods.

The field assessment determined which individual cycads should be salvaged by inspecting the exterior stems of each cycad for termite damage, visible rot, presence of cycad scale, or other pests. The following data were recorded for each cycad during the field assessment:

- GPS location (UTM WGS84 Zone55N meters)
- signs of termite, cycad scale, and cycad butterfly damage
- signs of exterior rot
- number of pups present
- digital photographs of each cycad (**Attachment B**).

The five cycads were located and assessed (**Table 3**). One cycad was dead, one cycad had two apical stems with no pups and three cycads had single apical stems with one of those cycads having four pups; therefore, the salvage operation will include the felling of four mature cycads.

In addition, five cycads outside of the immediate construction area were identified and assessed (**Table 3**). These cycads are not currently proposed for salvage but may be added to the PWS at a later date.

2.1.2 Orchid Field Assessment

The Lead and Field Biologists for orchids began a field assessment on August 14, 2017 and completed the field assessment on September 6, 2017 utilizing Navy-provided GIS (data points, polygons) to locate federally listed plants. The Lead Biologist provided appropriate training and resources for field personnel to identify specimens for transplanting. The field assessment included the following steps: (i) conduct a site visit to identify specimens for salvage and transplant using Navy-provided coordinates, (ii) record species and the number of orchids on each host tree, and (iii) record any new host trees with orchid species.

Field assessment staff included, Dr. McConnell, M. Martinez, J. Horeg, J. Davis, G. Borja, J. Andrew, J. Tuquero, C. Valera, M. Hara, H. Simram, and H. Lizama. The field teams surveyed along 15-meter transects based on Navy-provided transects from the 2015 survey. The 15-meter transects focused on areas where orchids were recorded during Navy surveys. Surveyors systematically located previously identified host trees and recorded the number of orchids on each tree as well as any new host trees with orchids. **Table 1** contains orchid data broken down by Priority Areas. **Table 2** contains host tree species broken down by Priority Areas.

Table 1. Orchid Assessment for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS). *

	Host Trees	*T. guamense*	*D. guamense*	*B. guamense*
Priority Area 1	1,802	9,264	6	68
Priority Area 2	178	870	6	0
Priority Area 3	15	32	0	0
Priority Area 4	60	212	0	0
Priority Area 5**	35	291	0	0
Total	**1,944**	**10,669**	**12**	**68**

**The revised boundaries of construction priorities areas were provided by the Navy on November 8, 2017.*
***Priority Area 5 boundaries were delineated subsequent to the initial field assessment.*

Table 2. Host Tree by species for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

Species	Number
Vitex parviflora	1,795
Morinda citrifolia	37
Guamia mariannae	1
Premna obtusifolia	3
Ochrosia oppositfolia	16
Leucaena leucocephala	6

Species	Number
Hibiscus tiliaceus	19
Pandanus tectorius	38
Glochidion marianum	1
Maytenis thomsenii	1
Ixora triantha	3
Dead Branch	24
Grand Total	**1,944**

The second part of the field assessment was to assess the most appropriate locations for orchid transplanting. Habitats that matched or were similar to the recorded data for the orchid were prioritized for out-planting. Surveyed areas began with the areas with the densest populations of orchids in the transplanting area. Approximately 500 host trees were located within the two Forest Enhancement Areas.

The field assessment identified a sufficient number of host trees (500) to host 5,090 orchids. This allows flexibility in determining which host trees are best suited to host the orchids and will allow salvage and transplant over the required 5,090 individuals, should the need arise. A group of the host trees are located within a sink hole that is expected to add protection from wind and other elements.

The following data were recorded for each host tree during the field assessment:

- GPS location (UTM WGS84 Zone55N meters)
- host tree species
- orchid species
- number of orchids on host tree
- documentation photographs.

2.1.3 Field Assessment Equipment

Field equipment for cycad assessment included the following:

- GPS with geo-tagging camera to mark the locations of cycads and take photographs
- a note pad with waterproof paper to record the condition of cycads.

Field equipment for orchid assessment included the following:

- GPS to mark the locations of the orchids for salvage
- data forms to record the orchids for salvage
- flagging tape to mark the orchids for salvage
- camera to take photographs of the orchids.

2.2 Salvage

Project team members will implement salvage assessment methodologies for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint at NBGTS.

Salvage operations will use the most effective methodology for the site, plant species and health of the plant. Salvage operations will focus on Navy-determined priority areas in numerical order to stay ahead of potential construction. Salvaged cycads will be taken to an approved nursery for care prior to out-planting, while orchids may be directly transplanted to host trees or cared for in a nursery until the most appropriate time to transplant. That determination for orchids will be made by a Biologist based on the health and viability of the plant at the time of salvage. In addition to salvaging orchids, orchid propagation may be utilized to ensure a 50 percent survivability threshold is met. The determination to salvage orchids or collect seeds would be

dependent on the health of the plant, whether or not it would survive transplantation, and whether the plant produces seed. A Biologist will make the determination of health.

Additionally, the orchid salvage areas will be identified to ensure proper sampling is obtained in various locations throughout the construction area including various heights throughout the trees. Plants out of reach will be collected by using the salvage equipment discussed in **Section 2.2.4**.

The ability to salvage the plants would be dependent on the health of the plant and whether or not it would survive transplantation. The Biologist will take into account that the orchids will undergo stress when being relocated, and in order to focus the plant's energy towards root and vegetative growth, flowering or fruiting parts will be removed from the plants to avoid expending energy trying to make pods before it has established. The Biologist will only select orchids for transplanting that have a reasonable chance of survival.

If the minimum percent survival ratio cannot be met with whole plants or viable seeds from within the project footprint, then the project team will pursue seed collection, tissue germination, and plant division and/or stem cuttings, as suitable to the species, from other individual construction project footprints, where construction has yet to begin, or directly outside a construction project footprint in order to protect genetic diversity to provide seedlings to meet out-planting success targets.

2.2.1 Cycad Salvage

The field assessment conducted on August 14, 2017, determined the status of each of the five *Cycas micronesica* trees originally identified by the Navy. One of the original five cycad trees was dead, but the remaining four are healthy enough to obtain stem cuttings or pups for propagation. The status of each tree is described in **Table 3**.

2.2.1.1 CYCAD SALVAGE USING NURSERY FACILITIES

The Navy previously conducted a munitions and explosives of concern (MEC) assessment around the five cycads. There are anomalies surrounding all five cycads, therefore, when deemed necessary, the Lead Biologist would need to cut the cycad at the base and treat them in an approved nursery prior to transplantation. The cycad salvage team will use pups from the trees that have multiple large pups and will use apical stem sections for the trees that do not have pups.

Attachment B contains photographs from each cycad located during the assessment, and **Figure 2** provides the GIS map depicting cycad tree location. The percent survival ratio of salvaged material for *C. micronesica* will be based on the number of salvaged whole plants or basal suckers, known as cycad pups.

Table 3. Cycad Assessment and Salvage Recommendations for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

ID	Coordinates		Condition	Salvage Recommendation
	Easting	Northing		
Cycad 1	1502963	267160	Two healthy stems, 1.5 meters in length.	Salvage two apical stem cuttings
Cycad 2	1502988	267160	1.7-meter-tall relatively healthy tree.	Salvage one apical stem cutting
Cycad 3	1503059	267187	2.5-meter-tall relatively healthy female plant. No pups.	Salvage one apical stem cutting
Cycad 4	1503217	267094	2.5-meter-tall female tree. Four pups. Heavy scale infestation.	Salvage one apical stem cutting and four pups
Cycad 5	1503063	266981	Dead	No action
Cycad 6	1503032	266787	3.5-meter-tall unhealthy tree. Four pups. Heavy scale infestation.	Not currently included in PWS. Salavge four pups
Cycad 7	1503034	266786	3.5-meter-tall tree. One good pup. Heavy scale infestation.	Not currently included in PWS. Salvage one apical stem cutting and one pup
Cycad 8	1503083	266869	3.5-meter-tall unhealthy tree. Numerous pups. Heavy scale infestation.	Not currently included in PWS. Salvage numerous pups
Cycad 9	1503070	266886	2.5-meter-tall unhealthy tree. No pups.	Not currently included in PWS. One apical stem cutting
Cycad 10	N/A	N/A	Dead	Not currently included in PWS. No action

Salvage operation will involve the following steps:

1. One month prior to salvage, a Safari insecticide solution will be poured around the base of each of four living cycad plants. The application of Safari insecticide will conform to label instructions and be supervised by a Guam Certified Pesticide Applicator. Note: Safari is not classified as a Restricted-Use Pesticide.
2. Epiphytes, debris, termite nests, invasive vines and other non-cycad materials will be removed from the apical portion of each tree, and all cycad leaves will be removed with hand shears.
3. Four pups will be removed from the main stem using a sharp blade, not a saw, to slice through the base of each pup.
4. Each cycad tree will be tagged prior to being cut near ground level with a chainsaw and lowered manually to the ground. Unique alpha-numeric aluminum tags will be used and later mounted on a pole next to the outplanted cycad.
5. The cut surfaces will be sealed with tree sealant, and each specimen will be covered with shade cloth to avoid direct sun exposure.

6. Each cycad stem and pup will be placed on a gurney and manually carried to the nearest road, loaded onto a truck, and transported to an approved nursery. Once off-loaded at the nursery, the stems will be kept under 50 percent shade cover. Plants will remain isolated from other plants scheduled for outplanting to reduce the spread of pests and diseases.
7. Each stem will be cleaned with pressurized water to reduce the likelihood of persistent pathogens.
8. The entire specimen will be sprayed with an insect growth regulator solution sprayed over the entire stem at a close distance (<30 centimeters). The specific brand and solution will be selected prior to salvage.
9. If required, sequential cuts will be made with a handsaw toward the stem apex to remove any rot.
10. Stems will be allowed to air-dry.
11. The cut surfaces will be sealed with petroleum-based pruning sealant to retain moisture and serve as a prophylactic for pathogens. The sealant will be applied to the cut surfaces to prevent drying and act as a prophylactic against possible pathogens in the rooting medium. The specific sealant will be selected prior to salvage. Cut surfaces will then be disinfected by spraying with a 10 percent bleach solution. The basal portion of each stem will be immerged in a 10% bleach solution for a minimum of one minute. The commercial root-promoting hormone (0.3% indole-3-butyic acid) will be applied to the stem, but not the sealed base.
12. The base of each pup will be placed in perlite and maintained under 50 percent shade and watered daily.
13. Each stem will be placed in a large container as shown in **Figure 3**.
14. Each container will be placed on a structure at least 18 inches above ground level and supported with guide wire. The wires will be coated in plastic to protect the tree and have three anchor points.
15. Each cycad plant will be monitored for the presence of cycad scale and any other pests, watered as needed until sufficient new roots have formed, which is anticipated to take approximately 6 months.

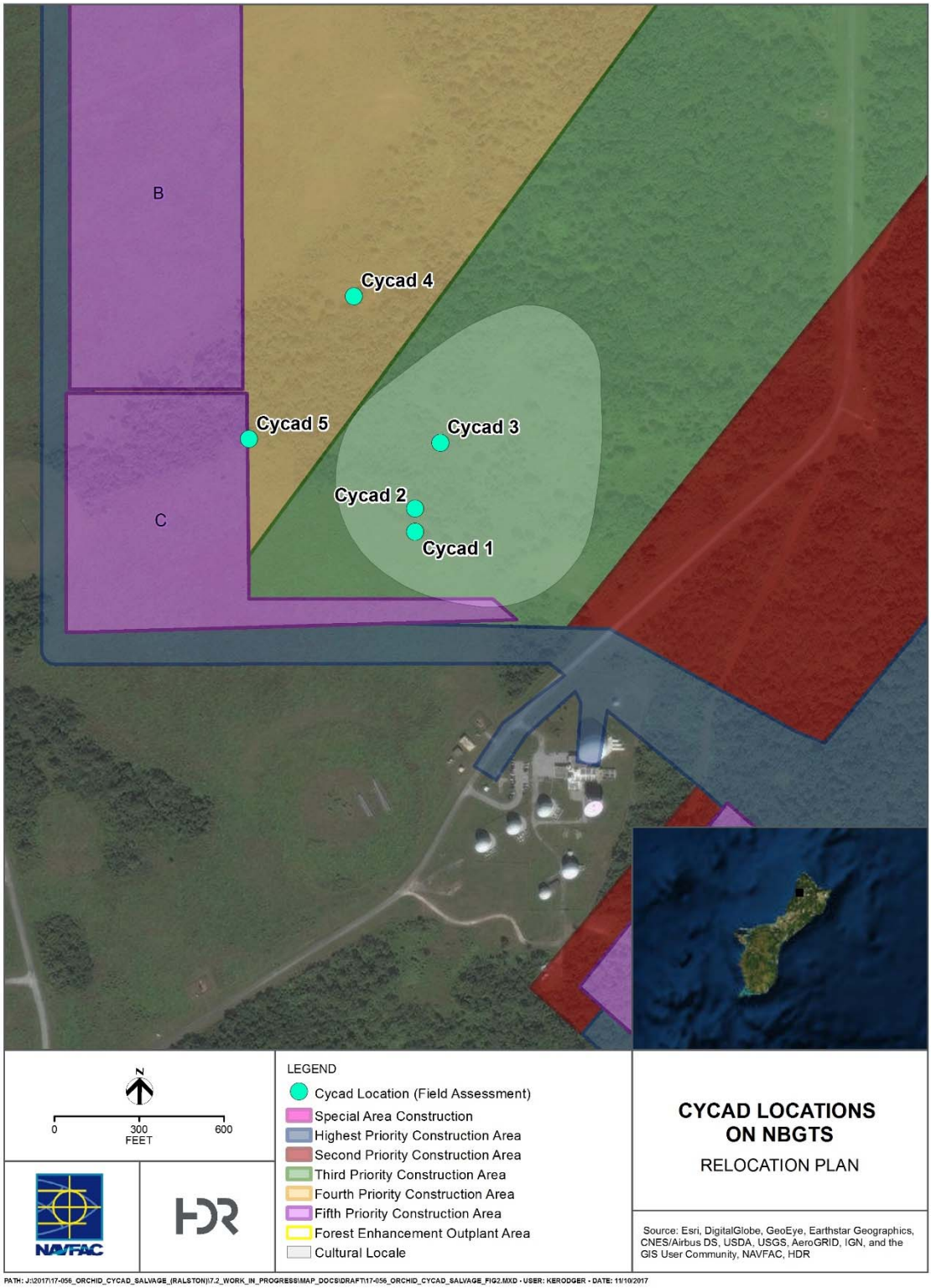

Figure 2. Map of Cycad Locations

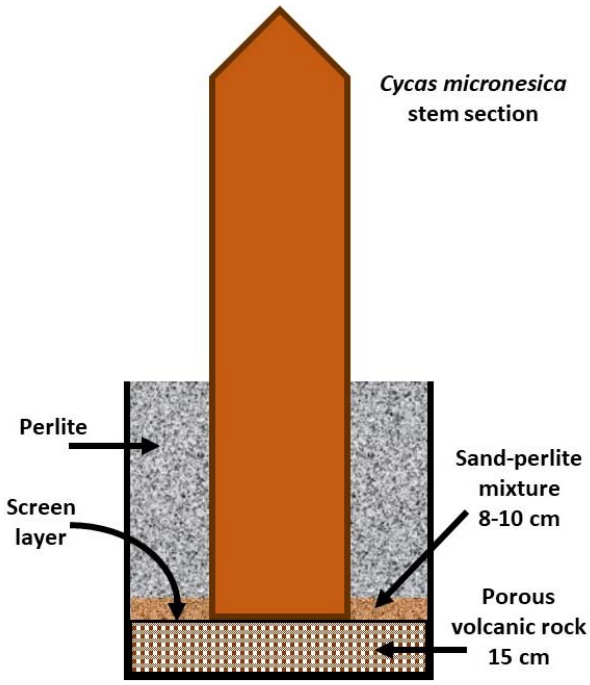

Figure 3. Diagram of container where cycad stems will be placed (Marler and Cruz 2017)

2.2.1.2 CYCAD SALVAGE USING DIRECT TRANSPLANT

If an approved nursery is not authorized for use in advance of the planned construction vegetation clearing schedule, an alternate method for cycad salvage may be used. This would involve direct transplant of adult cycads from their existing locations to a pre-determined outplant location in the Forest Enhancement Area.

Salvage operation using the direct transplant method will involve the following steps:

1. Reassessment of the living cycads to assess their survivorship potential and accessibility.
2. One month prior to salvage, a Safari insecticide solution will be poured around the base of each living cycad plant. The application of Safari insecticide will conform to label instructions and be supervised by a Guam Certified Pesticide Applicator. Note: Safari is not classified as a Restricted-Use Pesticide.
3. Selection of new outplanting location within the NBGTS Forest Enhancement Area.
4. MEC analysis and anomaly clearance of existing and outplant locations, including staking locations.
5. Where feasible clear a path to each cycad plant to allow a backhoe to access each cycad plant and its outplanting site.
6. Remove all of the cycad leaves, all epiphytes, vines, debris, etc. from each cycad plant.

7. Carefully excavate the cycad plants from the current locations, either with a backhoe or manually, making every effort to protect as many roots as possible. Approximately 12 inches of each root will be retained at the base of each tree.
8. Carefully lift the cycad plant out of its existing location.
9. Carefully transport each salvaged cycad plant to the nearest road for transport to its intended outplanting site within the Forest Enhancement Area.
10. Clean cuts will be made with loppers or shears on every severed root and treated with fungicide. Exposed surfaces will be covered with a commercial pruning sealant.
11. Excavate the planting hole that is approximately twice as wide as the root ball and only deep enough so that the resulting planting hole will have the same filled soil level as the original hole.
12. Carefully refill the new hole with the excavated soil, and firm the soil around the root ball.
13. Water the soil around each cycad plant to remove any large air pockets in the soil.
14. Carefully secure the transplanted cycad plant with rubber coated wire to three or four stakes.

2.2.2 Orchid Salvage

To complete orchid salvage on anticipated construction time lines and stay with PWS for this project, HDR recommends beginning with the 3,100 *T. guamense* located in Priority Area 1; 6 *D. guamense* located in Priority Area 1; and 7 *D. guamense* located in Priority Area 2. Following a contract modification, an additional 1,900 *T. guamense*, up to 14 *D. guamense*, and up to 70 *Bulbophyllum guamense* will be salvaged from Priority Areas 1 through 5.

The Lead Biologist, Dr. James McConnell, will first conduct training for all Biologists and assistant field personnel to ensure appropriate methods are utilized. Each Biologist will oversee a team of 4-5 people; each team can salvage and transplant 10-50 orchids per day. On-site personnel will take pictures daily to provide visual evidence of work progress via a WhatsApp group. Any issues encountered will be brought directly to the Lead Biologist for resolution, and the Lead Biologist will conduct periodic inspections to ensure transplanting procedures are followed.

The HDR Team, through subcontractor LMS Inc. will utilize a mulcher to create access at the point of salvage to minimize mobilization time. Mulching process with comply with green management procedures. In creating these access points, LMS Inc. will work with a Field Biologist, refer to **Section 2** for approved USFWS names, to survey the clearing path to ensure no orchids or high value trees are harmed. Further, the HDR Team will avoid areas where Hazard Analysis and Critical Control Point (HACCP) projects are on-going or cultural sites are present.

Orchids will be salvaged from as many subpopulations as possible to maintain genetic diversity. To the fullest extent possible, the project team shall salvage a sufficient amount from each subpopulation to reach an appropriate level of survivability for that particular subpopulation. If all

orchids were salvaged from one area the genetics would not be as diverse as collecting from a higher number of subpopulations.

The Biologists will determine the most efficient and safe way to salvage the orchids based on site-specific context. For branches 6 inches in diameter or less, field personnel will remove the entire branch. The application of water should not be necessary for plant removal. If the orchid is on smaller diameter trees, the entire section of orchid and roots will be moved intact. Roots will not be separated from the bark. This is expected to result in faster orchid attachment to new trees.

For branches greater than 6 inches in diameter, field personnel will chisel out the bark underneath the roots into the xylem to ensure as little damage as possible, essentially removing the orchid with the current media intact. The bark will be large enough to support the orchid and will be cut in a manner that allows the orchid roots to stay intact.

Salvage operations will occur tree by tree. Once an area has had the plants collected, the area will be turned over to the construction contractor for development. Plants out of arms reach will be collected by using climbing gear and salvage equipment mentioned in **Section 2.4.4**. Work will be supervised by competent safety officers on site to ensure that orchids above ground level can be safely obtained for transplanting. The ability to salvage the plants would be dependent on the health of the plant and whether or not it would survive transplantation. A Biologist will make the determination of health.

All orchid roots will be avoided when cutting branches and extra space (not occupied by roots) on the branch ends will be used as the area for securing the branch during transport and relocation. Attachment will be done in one of the following ways: (1) tying the chiseled bark to the tree with twine or breathable synthetic material (i.e. panty hose) or (2) thin branches, approximately 2 inches or less in diameter, may be attached with nylon or nails. Cut branches shall deteriorate naturally and nylon, wire, or plastic ties will be removed once orchids are holding onto the host tree. Orchids shall be attached to the host tree with nylon and or twine. Host trees will be monitored to prevent girdling. The orchids and branches shall be observed during the maintenance and monitoring period and supporting nylon will be provided to ensure orchids remain affixed to the tree if root growth is not sufficient to anchor the orchid to the tree prior to decomposition of the branch. Note that the method of attaching thin branches to trees was employed early in this project, but was discontinued for later phases of orchid transplant.

The field personnel will haul orchids via a transport vehicle with metal racks in the back to hold the orchids. Throughout the transportation process, the orchids will remain covered to avoid direct sun exposure. Orchids will be transported directly to the transplant site or approved nursery. Orchids will be transported in carts with shade cloth to minimize orchid exposure to sunlight during the transportation and transplant process. The distance from the donor to recipient site is approximately one mile, and much of the terrain is not accessible by vehicle. Trails have been cleared to expedite the transportation process where feasible. Covered UTV/ATVs are used to help expedite the transport process and ensure that the orchids have as little exposure to the elements as possible.

2.2.3 Orchid Propagation

For this project, salvaged material from orchids will be in the form of whole plants. If the minimum percent survival ratio cannot be met with whole plants or viable seeds from within the project footprint, then the project team will pursue seed collection, tissue germination, and plant division and/or stem cuttings, as suitable to the species, from other individual construction project footprints, where construction has yet to begin, or directly outside a construction project footprint in order to protect genetic diversity to provide seedlings to meet out-planting success targets. The Lead Biologist will be following the Hawaii Rare Plant Restoration Guidelines.

To meet the PWS requirement of a minimum 50 percent survivability for transplanted orchids, orchids may be propagated as agreed upon in the July 11, 2017, kick-off meeting. Fruits will be collected from orchids at different locations if they are at a mature stage. The fruits can most successfully be propagated at the unopened mature stage. Any excess propagated orchids will be turned over to the Navy or the USFWS, as directed, upon the completion of this project. Propagated orchids will be linked to the original plant's number for reference. The Center for Plant Conservation (CPC) guidelines recommend a minimum of 50 plants be collected from a population. If fruits are collected will be dependent on whether or not there are mature fruits to collect. As applicable, the team will follow the recommended guidelines.

For propagation, Biologists will deliver harvested fruits to the GPEPP tissue culture lab. The methodology for seed germination depends on the maturity of the fruit. If the fruits are mature and not cracked, the seed will be germinated using green pod culture methods. If the fruits are cracked, the seed will be germinated using surface sterilization of the seeds. The seeds will be germinated on Modified Vacin & Went media for orchid seed germination. Once the seedlings are growing, the seedlings will be transflasked onto Modified Vacin & Went orchid transflasking media. The seedlings, in flask, will be transplanted to community pots when they are removed from flask. Water may be used to rinse the media from the seedlings. Seed germination would be done aseptically and plants will be inspected and monitored for any pests, which will be controlled if found. Seeds will be propagated from fruits of different locations throughout the area. If seedlings are used, they will be a balanced representation of the population being destroyed. CPC guidelines recommend collecting from a minimum of 50 plants per population, and those plants should be equally represented at the new site they are introduced into.

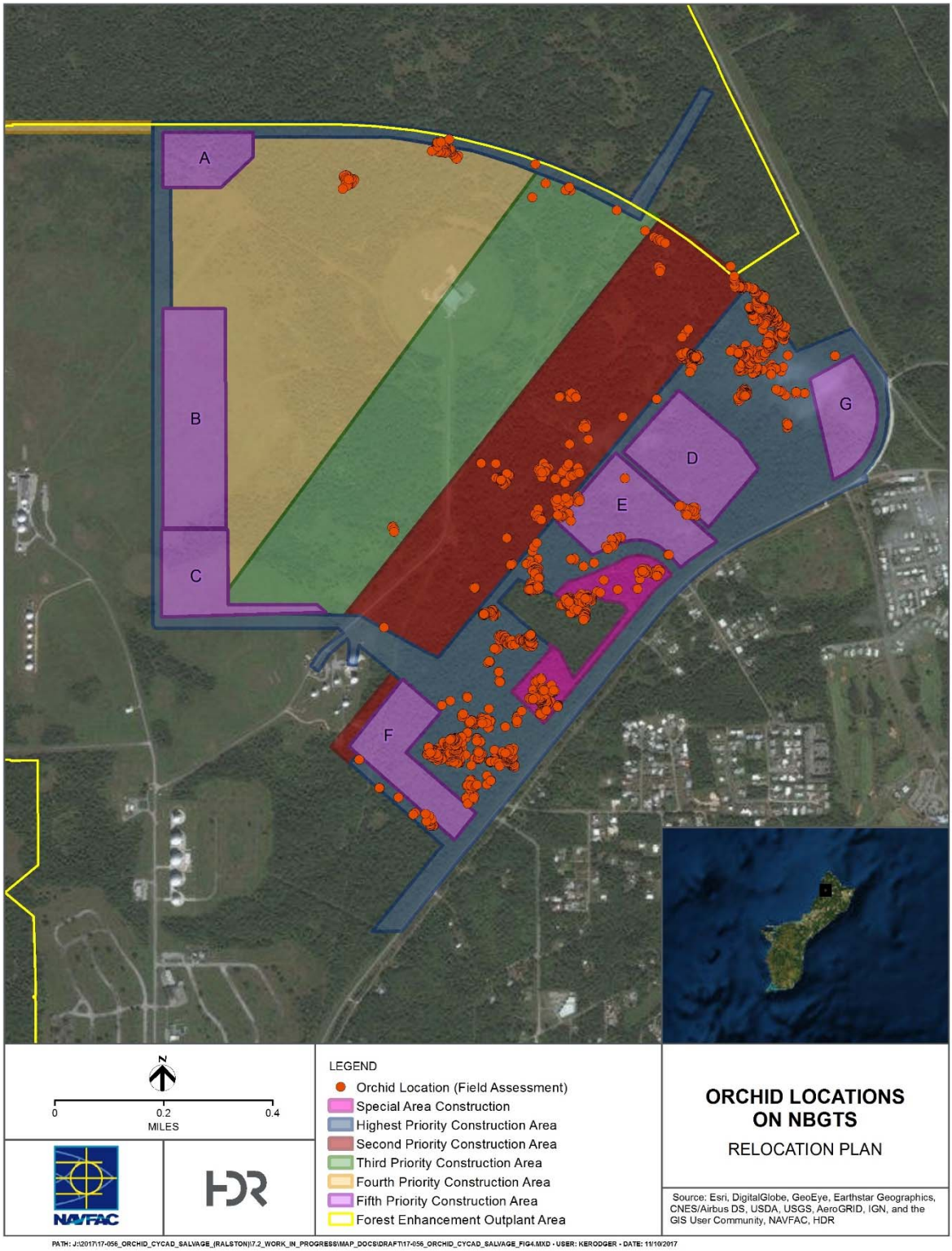

Figure 4. Map of Orchid Salvage Locations

A sample of the propagules would remain in ex situ storage in case the translocation fails, therefore it can be repeated with the propagules that were kept via ex situ techniques (tissue culture, seed storage, and nursery propagation).

2.2.4 Salvage Equipment

Cycad salvage equipment includes the following:

- ladder
- pruning shears
- sharp blade
- Safari insecticide
- bleach
- tree sealant
- note pad with waterproof paper
- digital camera
- gas-powered chainsaw or battery operated Sawzall (™)
- shade cloth to protect the cycad stem from direct sun
- gurney to transport the cycad stem to nearby road
- vehicle to transport the cycad stem to approved nursery.

Orchid salvage equipment includes the following:

- chainsaw or Sawzall (™)
- hand saw
- loppers
- pruners
- twine
- zip ties
- wire
- pliers
- wire cutters
- panty hose
- nails
- metal tags (alphanumeric)
- nail gun
- hammer
- climber gear (harness, ropes, carabiners)
- chisels
- compass
- GPS
- ladders
- metal racks to transport orchids out of the salvage site to the enhancement site
- vehicle to transport orchids out of the salvage site to the enhancement site
- water.

2.3 Transplant

Transplantation will occur as soon as feasible for all plants, accounting for situational indicators and health of the plant. For orchids, multiple areas will be utilized for transplantation, and whenever feasible native trees will be used as host trees based on the Lead Biologist's analysis of microclimate and long-term orchid viability. Cut branches or bark with orchids will be tied to the tree using polypropylene twine. Note that the method of attaching thin branches to trees was employed early in this project, but was discontinued for later phases of orchid transplant.

After transplantation, a watering system will be established, and plants will be monitored monthly (or more frequently as conditions warrant) for 12 months. The water pressure source will be a pump supplied by a water tank. It will be removed after the Biologists determine the plants will survive on their own or as otherwise instructed by the Navy. During the monitoring period, the Biologists will allow the orchids to adjust and will determine the watering needs of the plants.

When transplanting, approximately 15 individual orchids will be placed onto a single host tree to distribute on as many trees as possible while keeping the orchids in close proximity to each other for pollination purposes. Pollinators for these orchid species are not known, therefore, transplanting the orchids relatively close together allows for smaller pollinators to have a chance to cross pollinate, if necessary.

Project team members will transplant 4 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I (J-001B) at NBGTS within designated Forest Enhancement Areas.

2.3.1 Cycad Transplant

Viable transplanting sites within the two identified Forest Enhancement Areas will be determined in advance of out-planting. There are three potential methods for out-planting. The first is to have each selected spot evaluated by a qualified Munitions and Explosives of Concern/Unexploded Ordnance technician to ensure that there are no underground abnormalities (e.g., metal detections). Once sufficient sites have been identified, approved, GPS location recorded and flagged, the cycad plants will be covered with shade cloth prior to transporting in a pickup truck to the out-planting site. From the nearest access point the cycads will be carried to the out-planting site on a gurney.

A planting hole that is large enough to hold the root system will be either manually or mechanically excavated with a backhoe. Since excavating large holes will require the presence of an MEC technician, the size of the hole will be determined at the time of outplanting. The cycad will be removed from the container and placed in the excavated planting hole and the hole filed with native soil which has been examined for presence of pests prior to use. If the cycad has come from an approved nursery, any residual perlite or other material will be removed prior to outplanting. Since MEC requirements limit that only 1/4 inch of soil may be removed without an MEC Tech inspection, availability of sufficient amounts of native soil may be an issue, so additional MEC clearance in surrounding habitat may be conducted to obtain

additional soil or, if feasible, native soil that has been stockpiled by construction crews in the J-001B construction areas most closely located to the salvage and outplant areas may be used. The planted cycad will be supported with plastic-coated guide wire, monitored regularly for health and removal of invasive plants or vines, and watered as needed for one year. Plastic coated wire will be loosely tied around each cycad and tied to an adjacent tree or rebar stake (following MEC Tech inspection) to support the cycad.

The second method, intended to avoid the requirement for Munitions and Explosives of Concern /Unexploded Ordnance inspection entails locating planting locations that are natural indentations or pits in limestone large enough to accommodate the root ball of individual cycads. The cycad will be placed in the natural indentation and native soil mixture, previously examined and determined pest free prior to use, will be placed around the root ball. The natural depression will help prevent soil erosion from around the root ball. The cycad plants will be supported with plastic-coated guide wires, monitored regularly for health and removal of invasive plants or vines, and watered as necessary.

This method assumes an approved nursery is available, and since only viable apical tissue will be grown, the size of the outplanting material is expected to be less than a meter in height and not the full size of the salvaged plant. Outplanted cycads will be manually watered via a bucket, as necessary, dependent on recent rainfall. The initial outplanting stock is not expected to transpire a large quantity of water and manual watering will be sufficient until rainy season.

The third method, assuming an approved nursery is available, is to outplant pups in the same manner as rooted stems. Whichever method is used, the GPS position of the planted cycad will be recorded, and photographs will be taken of the cycad taken after out-planting and throughout the 12-month maintenance period. Per the current PWS, the goal is to have a minimum of two living cycad plants one year after out planting to meet the 50 percent survivability ratio. Four mature plants will be salvaged; therefore, the 50% survival is a minimum of two plants. *C. micronesica* survival is defined as the documented observation that the plant is alive and new leaves have formed.

2.3.2 Nursery Orchids

Orchids determined not to be ready for direct transplant will be cared for in the approved nursery until the Lead Biologist considers orchid individuals ready for out-planting.

2.3.3 Orchid Transplant

Orchids determined to be ready for direct transplant will be transplanted by a Biologist and mounted to appropriate trees or other suitable hosts. Appropriate trees are in habitats that matched or were similar to the recorded data for the orchids and are prioritized for out-planting. Surveyed areas began with the areas with the densest populations of orchids in the transplanting area. Specific transplanting methods will be determined based upon the individual needs of the plant to maximize survivability of the specimen and orchids will be placed at least six feet above the ground to avoid ungulate damage. There are currently ungulates in both the salvage and outplanting areas.

Based upon the Lead Biologist's experience and study on the survivability of orchids in this specific habitat, orchids have the highest rate of survival within the tree canopy zone (**Figure 5**). As such, Biologists will transplant orchids in tree canopy zone locations that have been determined to have the highest rate of survivability based upon independent research and visual evidence. Specifically, if feasible Biologist will target the tree canopy zone C and D range per the attached illustration. Protective fences will be installed where necessary to facilitate survival of orchids.

The outplanting area (**Figure 6**) was identified as having *T. guamense* during previous surveys. The project team conducted a field assessment to identify suitable sites within the Forest Enhancement Area for transplanting the orchids based on environmental factors such as humidity, host tree, and height placement.

Areas with similar humidity and light levels to the donor/origin site will be prioritized for orchid transplant. When possible, orchids will be placed in areas where other orchids currently exist and on tree species historically successful in hosting orchids in this environment, thus demonstrating a higher likelihood of growth success. Orchids currently on native trees will be transplanted onto the same type of native tree. However, in order to achieve the 50% survival ratio of salvaged material, the Biologists may elect to transplant on to non-native hosts in order to increase survival. Orchids will only be transplanted to areas within the Forest Enhancement Area that already have existing orchids of the same species, which demonstrates that the environment is suitable for orchid growth. Tree species that were not observed with orchids on them in the salvage area will not be used for transplanting. Where orchids will be transplanted depends on the individual orchid needs at the time of salvage.

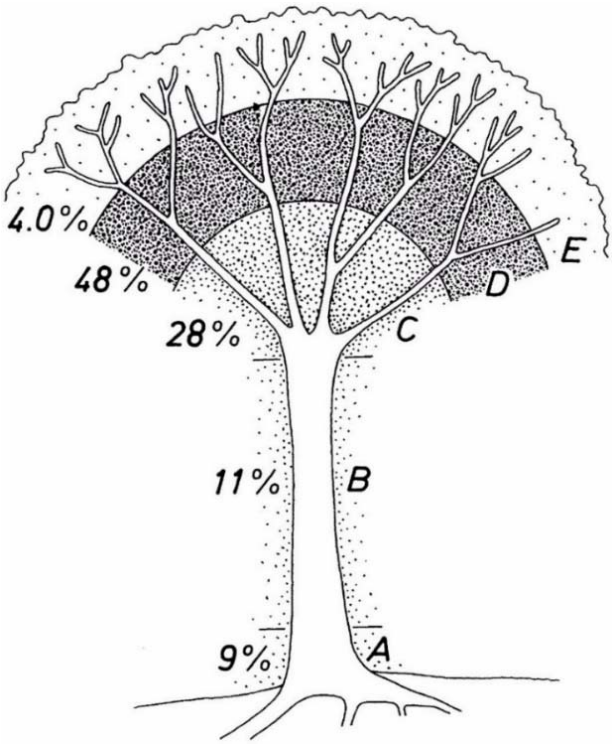

Figure 5. Diagram of Tree Canopy Zone

2.3.4 Transplant Equipment

Cycad transplant equipment includes the following:

- note pad with waterproof paper
- GPS
- digital camera
- soil
- water
- plastic coated guide wire
- rebar as staking material (only for direct transplant)
- backhoe (only for direct transplant)
- shovel, as needed
- shade cloth to protect cycad stem from direct sun
- gurney to transport cycad stem to nearly road
- vehicle to transport cycad stem to approved nursery.

Orchid transplant equipment includes the following:

- note pad with waterproof paper
- GPS
- digital camera
- water
- drill or hammer
- nails or screws
- chainsaw, as needed
- Sawzall (™), as needed
- compass
- ladders
- climber gear (harness, ropes, carabiners)
- eyehooks to provide an attachment point for the cut branch during transport
- metal transport racks
- transport vehicle.

2.4 Maintenance and Monitoring

Project team members will provide maintenance and monitoring for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I (J-001B) for a period of 12 months.

2.4.1 Maintenance

Transplanted cycads will be maintained for one year by the Lead Biologist. Maintenance will include watering, as needed, and the removal of vines and/or encroaching competing plants. If ungulate damage is observed, a temporary fence structure will be placed around each cycad. Temporary fence will be installed in the event that the area is not fenced and ungulates are not suppressed at the time of outplanting.

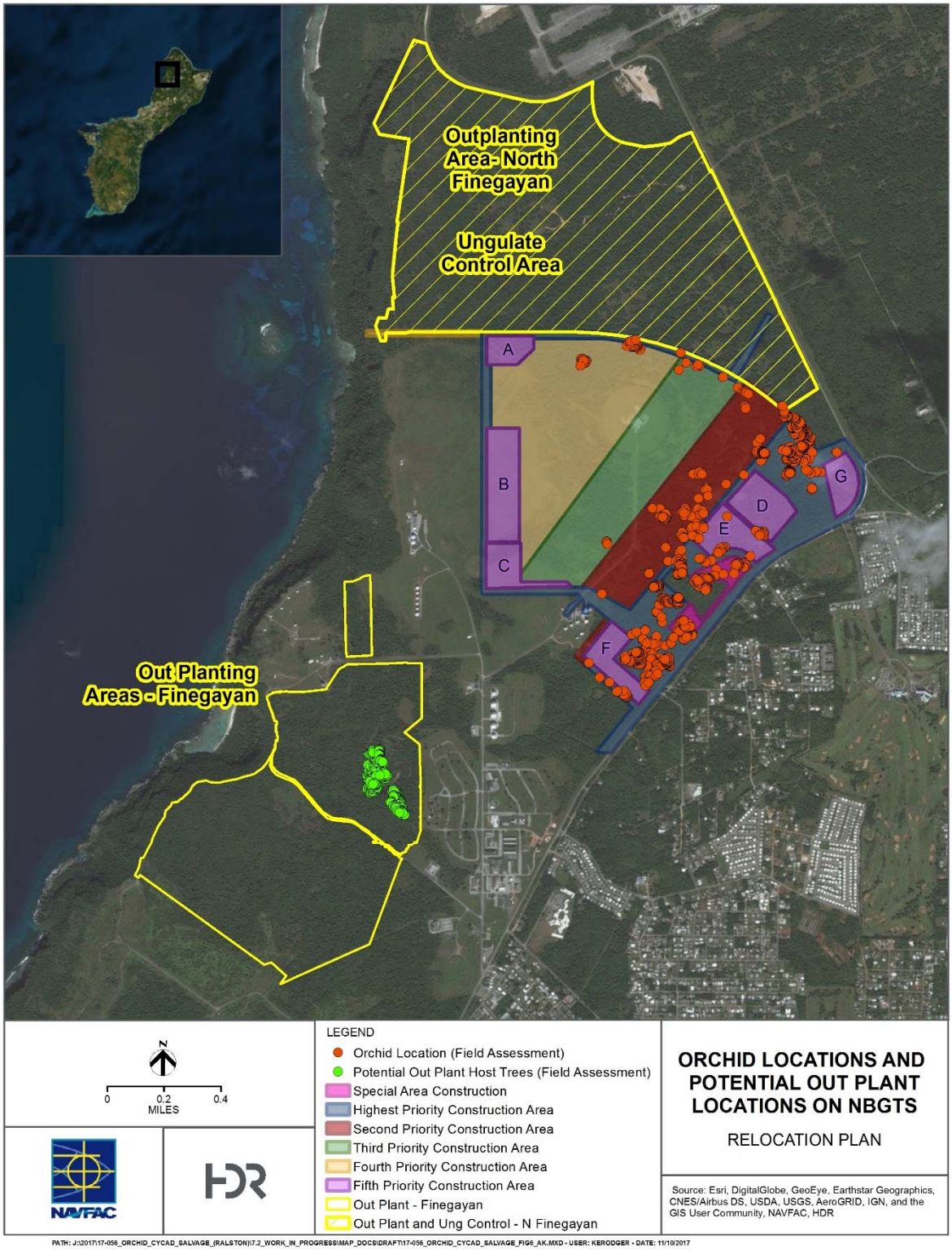

Figure 6. Map of Potential Orchid Transplant Locations

2.4.2 Monthly Monitoring

Transplanted cycads will be monitored monthly, or more frequently if deemed necessary, by the Lead Biologist. Cycads will be inspected for the presence of stress agents, such as cycad scale, ungulate damage, and general plant health. If stress agents are observed, the Lead Biologist will draft a recommended action plan for NAVFAC Pacific to remove or reduce the stress agent(s) affecting the cycads. If approved, the recommended action plan will be implemented. Monitoring records will be maintained for the duration of the project and included in the Draft and Final Reports.

The Biologists will provide regular and routine monitoring of orchids to ensure the minimum 50 percent survivorship PWS requirement is met and address any orchid health issues early on. Specifically, Biologists will inspect the orchid transplant site weekly for the first two months, bi-weekly for months three and four, and monthly thereafter (unless conditions warrant more frequent monitoring).

During monitoring walkthroughs, Biologists will inspect orchids within the transplant site to ensure individuals are not drying out and are growing or flowering. The transplant site will be monitored for pests and treated with approved pesticides, if necessary. Individual orchid records will be initiated if orchids appear stressed. Each individual orchid will be monitored and if it appears stressed it will be recorded. Monitoring records will be maintained for the duration of the project and included in the Draft and Final Reports.

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3. Data and Mapping

3.1 Salvage and Transplantation Success Results

Project team members will provide data and mapping for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint at NBGTS with a minimum 50% survivability rate after twelve months of maintenance and monitoring.

3.1.1 Data

Federally listed plant data will include record, map and photo of all specimens removed; including identification codes associated with GPS coordinates for each plant, both for salvage and transplant. This information will include the data dictionary field information which will note the following:

Cycad data:

- species
- GPS location
- plant height at time of out-planting
- number of leaves
- photographs
- unique alphanumeric tag identifier

Orchid data:

- species
- GPS location
- height on tree
- directional orientation
- health of plant
- host tree
- unique alphanumeric tag identifier
- stage of life
- vigor
- reproductive status of the plant (whether it is vegetative, or has buds, flowers, or fruit)
- photographs

3.1.2 Mapping

Project team members will provide detailed maps and GIS layers which will include specific locations, including the data dictionary information for individual orchids, for all transplanted plant species.

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4. Schedule and Deliverables

4.1 Plan of Action and Milestones

The Plan of Action and Milestones (POAM) prepared for this Salvage and Transplantation Work Plan outlines the schedule of actions and deliverables for the project (**Table 4**). Successful execution of milestones and deadlines for deliverables is contingent upon adequate coordination, completing tasks on schedule, and timely review cycles. Project team members will adhere to the POAM schedule. Any revisions to the POAM that might arise during the project will be submitted for approval. “To be determined” dates are contingent upon Work Plan approval, approval of nursery facilities, and the construction schedule.

4.2 Meetings and Deliverables

4.2.1 Kick-off Meeting

A kick-off meeting between staff with NAVFAC Pacific, MCAG, HDR, LMS Inc. and WESMURPH Consulting was conducted on July 10, 2017. The purpose of the meeting was to discuss the direction and development of the project. A draft of the meeting minutes was submitted via email to the COR/NTR on July 14, 2017. Final meetings minutes were provided on July 25, 2017.

4.2.2 Final Salvage and Transplantation Work Plan

HDR will submit a Final Salvage and Transplantation Work Plan incorporating the comments received from the COR/NTR and other representatives. The Final Salvage and Transplantation Work Plan will be submitted within 10 days of receipt of comments. HDR will provide two hard copies and two digital copies on a compact disc (CD) of the Final Salvage and Transplantation Work Plan to the COR and Contract Specialist.

4.2.3 Monthly Progress Reports

Project team members will provide monthly progress reports that will detail incremental accomplishments throughout the project. These reports will contain: the project title, contractor name, contract and task order number, date of the report, work completed to-date (including a table showing dates of site visits or surveys, personnel attending each visit, findings, difficulties/problems encountered and resolutions, etc.), work proposed for the next reporting period, an approximate percentage of work completed and an updated POAM. The report period will cover the first through the last day of each month. Reports will be submitted on the fifth day of each month when work has been conducted.

4.2.4 Safety Plans (Accident Prevention Plan and Activity Hazard Analysis)

HDR prepared and submitted a draft Accident Prevention Plan and Hazard Analysis and Critical Control Point for Navy review and comments on July 21, 2017. The final Accident Prevention Plan and Activity Hazard Analysis was accepted on August 10, 2017.

Table 4. Plan of Action and Milestones for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

No.	Name	Duration	Start*	Finish
1	Kickoff Meeting	~2 hours	07/11/17	07/11/17
2	Submit Draft POAM	1 day	07/11/17	07/11/17
3	Prepare and Submit Kick-off Meeting Minutes and Final POAM	4 days	07/11/17	07/15/17
4	Contractor Personnel Training (UXO Safety, Cultural and Natural Resources, etc.)	1 day	08/02/17	08/02/17
5	Prepare and Submit Draft APP/AHA and Draft HACCP	10 days	07/11/17	07/21/17
6	Submit Updated Resumes for USFWS approval	30 days	07/12/17	08/11/17
7	Government Review of Draft APP/AHA and Draft HACCP	10 days	07/21/17	07/31/17
8	Prepare and Submit Final APP/AHA and Final HACCP	7 days	08/05/17	08/12/17
9	Field Assessment	~25 days	08/12/17	09/06/17
10	Prepare and Submit Draft Work Plan	~55 days	07/14/17	09/08/17
11	Government Review of Draft Work Plan	5 days	09/08/17	09/13/17
12	Prepare and Submit Final Work Plan	7 days	09/13/17	09/20/17
12.1	USFWS Review of Work Plan	8 days	09/26/17	10/03/17
12.2	Response to USFWS Work Plan Comments	5 days	10/03/17	10/08/17
12.3	Additional USFWS Work Plan Comments and Responses	5 days	10/08/17	10/13/17
12.4	Prepare and Submit Revised Work Plan	10 days	12/12/17	12/22/17
12.5	Government and USFWS Review of Work Plan	20 days	12/22/17	01/11/18
12.6	Prepare and Submit Final Work Plan	5 days	01/11/18	01/16/18
13	Fieldwork - Cycads***	~10 days	TBD	TBD
14	Pup Nursery Care	180 days	TBD	TBD
15	Cycad Out-planting	10 days	TBD	TBD
16	Maintenance and Monitoring - Cycads **	~1 year	TBD	TBD
17	Fieldwork - Orchids (All Priority Areas) ***	160 days	10/16/17	03/25/18
18	Maintenance and Monitoring - Orchids **	>1 year	10/16/17	03/25/19
19	Prepare and Submit Draft Report for Salvage and Transplanting of ESA-Listed Plants***	45 days	03/25/19	05/09/19
20	Government Review of Draft Report	30 days	05/09/19	06/08/19
21	Prepare and Submit Final Report for Salvage and Transplanting of ESA-Listed Plants	20 days	06/08/19	06/28/19
22	Prepare Monthly Progress Reports, Updated POAM & Monthly Invoices by the 5th of each	1 day	Monthly	Monthly

Note: current as of December 20, 2017; pending confirmation with the Navy
** all dates shown are for Guam*
***subject to change based on field assessment, need for in-field treatment prior to salvage and first transplantation.*
****subject to change based on actual number of orchids in each priority area*

4.2.5 Draft Report for Salvage and Transplantation of Cycads and Orchids

HDR will submit two electronic copies of the Draft Report on a CD and electronically via email. HDR will submit the report within 45 days of completing the final plant transplantation.

The report will include the following information:

- title page showing title, date, contact information
- sub-title page showing title, prepared by listing, prepared for listing, date and recommended citation
- table of contents
- introduction (including background information)
- record, map and photo of all specimens removed, including identification codes associated with GPS coordinates from construction site, in addition to GPS coordinates and maps of each new cycad and orchid relocation site
- synopsis of insect treatments and efficacy results for each cycad
- synopsis of cycad and orchid selection and prioritization for transplantation
- synopsis of cycad and orchid survival and condition for each specimen
- synopsis of out planting, husbandry, and monitoring methods
- a master schedule of all project events
- summary and recommendations.

4.2.6 Final Report for Salvage and Transplantation of Cycads and Orchids

HDR will submit five hard copy and two electronic versions of the Final Report on a CD. HDR will submit the report within 20 days of receipt of comments from the COR. The Final Report will be submitted in Microsoft Word and Portable Document Format (PDF). The PDF file will be 10 megabytes or less in order to be sent via electronic mail to requesting entities. In addition, HDR will provide all figures, graphics, and geographic information system (GIS) data layers used in the report as separately labeled files. The electronic files will be delivered on a CD.

4.2.7 Comment Matrix

HDR will provide a blank Comment Response Matrix to the Navy on all reports to facilitate tracking comments. HDR will incorporate all comments into a single matrix. The comment matrix will identify how each comment was addressed by HDR and where in the document the corrections are to be found. The comment response matrix will be provided with each report submission.

4.2.8 GIS Data Products

Project team members will provide GIS data and maps for all salvage and transplant areas. All points will be taken with hand-held global positioning system units using World Geodetic System

1984 55N and projection provided in Universal Transverse Mercator projection, the above zone, and in meters. Digital GIS data will be submitted using ArcGIS 10 or later software. If later software is used it will be backwards compatible with ArcGIS 10. GPS equipment used to record transplant locations will be able to achieve 1 centimeter accuracy at 1 sigma, but the actual error allowed will be no more than 1 meter at any recorded position. Every effort shall be made to capture feature locations without using offsets unless obstructions are present. Data sets derived from GPS data collection efforts shall include metadata to record descriptions of the receiver and other equipment used during collection and processing, base stations used for differential corrections, software used for performing differential corrections, estimated horizontal and vertical accuracies obtained, and conversion routines used to translate the data into final geographic data delivery format.

Geographic data will be provided in a form that does not require translation, preprocessing, or post processing. Final digital geographic maps and the related data sets will be delivered in a Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) compliant file geodatabase format, and be in a structure consistent with the most current version of the SDSFIE. The SDSFIE format shall follow geospatial database table structure, nomenclature, and attributes.

PDF copies of all maps associated with the GIS data for this project will be provided to the Navy. All constructed maps will have the associated ArcMap Document File (MXD) delivered to allow for future printing and modification. MXDs shall use the relative paths option or layer packages. The Table of Contents within the MXD shall be orderly and contain a logical naming structure. Metadata will be included in the final GIS deliverable and will be populated to meet basic data population standards as identified in the ESRI standard template. Additional data shall be provided as appropriate, including, at a minimum:

- the name and description of the data set or layer,
- the source of the data and any related data quality information such as accuracy and time period of content,
- description of the data collection method or survey protocols used; a report citation can suffice,
- description of the equipment or instruments used in the data collection,
- scientific names of the federally listed species to populate in the attribute tables,
- definitions of codes used in the data fields in the appropriate attribute definitions,
- description of ranges of numeric fields and the meaning of numeric ranges,
- definition of fields and attributes not in SDSFIE in the attribute definitions,
- removal of spatial duplicates from GIS data, and
- a point of contact to answer to technical questions.

4.2.9 Maps

All map layouts and data display properties will be created using standard mapping procedures unless specific direction is provided by the Navy. Map layouts will include the following elements:

- north arrow
- scale bar and scale text
- legend
- title
- overview map
- map data
- projection and coordinate system information
- Navy-supplied logos
- HDR
- disclaimer information.

Changes to the map layouts will be made after the first round of comments are provided in the Draft Report.

4.2.10 Annual Reporting to USFWS

USFWS recovery permits require annual reporting that must be submitted to the Recovery Permit Coordinator by January 31 of each year the permit is active. The Annual Report will follow the requirements provided in Subpermit FWSPIFWO-26.

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5. Access and Pass Requests

5.1 Access and Pass Requests

HDR staff and subcontractors will have a valid DBIDS pass with current access to NBGTS and AAFB for access to the project site. A camera pass was requested by subcontractors on September 1, 2017, from Joe Cruz at the NBG Security Department Visitor Control Center.

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6. Points of Contact

Name	Position/Company	Email	Telephone Number
Nicole Olmsted	Natural Resource Specialist NAVFAC Pacific	Nicole.M.Olmsted1@navy.mil	808-472-1475
Coralie Cobb	NAVFAC SW, Alternate Contracting Officer's Representative	Coralie.Cobb@navy.mil	720-542-3085
Cris Caraang	Contract Specialist NAVFAC Pacific	Cris.Caraang@navy.mil	808-471-0130
Christiana Quinata	MCAG, Installation Contact	ChristianaJo.Quinat@fe.navy.mil	671-355-3420
Lauren Gutierrez	MCAG, Installation Contact	Lauren.Gutierrez@fe.navy.mil	671-355-8050
Rebecca Ralston	Project Manager/Biologist HDR	Rebecca.Ralston@hdrinc.com	303-754-4265
Dustin Janeke	HDR QA Lead	Dustin.Janeke@hdrinc.com	858-712-8268

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7. References

De et al. 2013	De, K.K., S. Majumdar, R. Sharma and B. Sharma. 2013. Green Pod Culture and Rapid Micropropagation of Dendrobium chrysanthum Wall. Folia Hort. 25/2 (2013): 169
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Attachment 2 – Photographs

Photo 1. Excavating *C. micronesica* tree 1 on October 2, 2018.

Photo 2. Transporting and cleaning *C. micronesica* following excavation.

Photo 3. *C. micronesica* sealed roots prior to transplanting.

Photo 4. Outplanted *C. micronesica* #1 on October 4, 2018.

Photo 5. *C. micronesica* #1 new leaf growth on November 1, 2018.

Photo 6. *C. micronesica* #1 on December 20, 2018.

January 31, 2019

United States Fish and Wildlife Service (USFWS)
Pacific Islands Fish and Wildlife Office (PIFWO):
FW1PIE_RecPermitAnnRpt@fws.gov
Pacific Regional Office (PRO):
permitsR1ES@fws.gov

Attn: Recovery Permit Coordinators

Subject: 2018 Annual Report for Recovery Subpermit FWSPIFWO-26

On September 22, 2017, Recovery Subpermit FWSPIFWO-26, Amendment 26 (SPITS TE-039990-26) (Subpermit) was issued under the Regional Blanket Permit (TE-702631) (Permit). A List of Authorized Individuals under the Subpermit was issued on October 12, 2017 and on April 16, 2018. As required under number 27(a) of the terms and conditions of the Permit, the following subpermittees are submitting this annual summary report for activities conducted under the Subpermit in Commonwealth of the Northern Mariana Islands, and the Territory of Guam (Guam) in 2017:

- Gregorio Borja, Jonathan K. Davis, Jim McConnell, and Mario Martinez.

These individuals are authorized to independently conduct all activities under the attached NAVFAC Work Plan, and agreed on revisions, for *Tuberolabium guamense, Bulbophyllum guamense* and *Dendrobium guamense* on Guam.

Introduction

Authorized activities in 2018 took place within the J-001B Utilities and Site Improvements Phase I footprint construction project, which is located on Naval Base Guam Telecommunication Site (NBGTS) in northern Guam (**Figure 1**). The primary objective of this project is to provide salvage and transplanting services for federally listed plants found within the Utilities and Site Improvements Phase I (J-001B) at NBGTS.

For this project, the subpermittees are contracted under Naval Facilities Engineering Command (NAVFAC) Pacific contract N62742-15-D-1822 to provide the following services:

- Perform a field assessment of the location and condition of plant species to determine salvage and transplant methods.
- Salvage a minimum of 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint.
- Transplant salvaged plants to a Government-approved location.
- Provide one year of maintenance and monitoring after transplantation.

Orchid salvage occurred in the construction footprint priority areas, and orchid transplant occurred in the Forest Enhancement Area in the southern portion of NBGTS (**Figure 1**).

Methods

The methods used for the field assessment, plant salvage, and transplanting are described in detail in the attached Preliminary Final Work Plan, dated September 2017 and the Final Work Plan, dated March 2018 (**Attachment 1**). The Work Plan was reviewed by USFWS staff and responses to comments were submitted by the Navy in late September, early October 2017, and December 21, 2017. The Navy submitted a Final Work Plan that incorporates comment responses and modified services, specifically for orchid salvage and transplant.

Results

Field Assessment and Population Analysis

As described in **Attachment 1**, the field assessment began on August 14, 2017 and was completed on September 6, 2017. Results of the field assessment were provided in the 2017 Annual Report for Recovery Subpermit FWSPIFWO-26.

Salvage, Transplant, and Monitoring

In total, 1,547 individuals were salvaged and transplanted in 2018. Salvage and transplant activities in 2018 took place from February 2018 to March 2018.

Table 1 lists the total number of salvaged and transplanted individuals in both 2017 and 2018 by federally listed plant species. Salvage locations are shown in **Figure 1**. The associated Geographic Information Systems (GIS) data will be included in the Final Report to the Navy.

Table 1. Summary of Plant Species Salvaged in 2017 and 2018

Plant Species	Salvaged and Transplanted	
	2017	2018
Tuberolabium guamense	3,469	1,531
Dendrobium guamense	4	16
Bulbophyllum guamense	71	0

Several challenges had occurred during the salvage and transplant portion of the project. Initially, there were no clear path to access the remaining orchids for salvage. The team created an additional path through Section F and Section B to finalize the salvage efforts within the areas and increase mobility time. A combination of hand clearing and the use of a mulcher was used to create the access points, which allowed the team to efficiently move the orchids to the Forest Enhancement Site and minimized the stress on the orchids during the transfer.

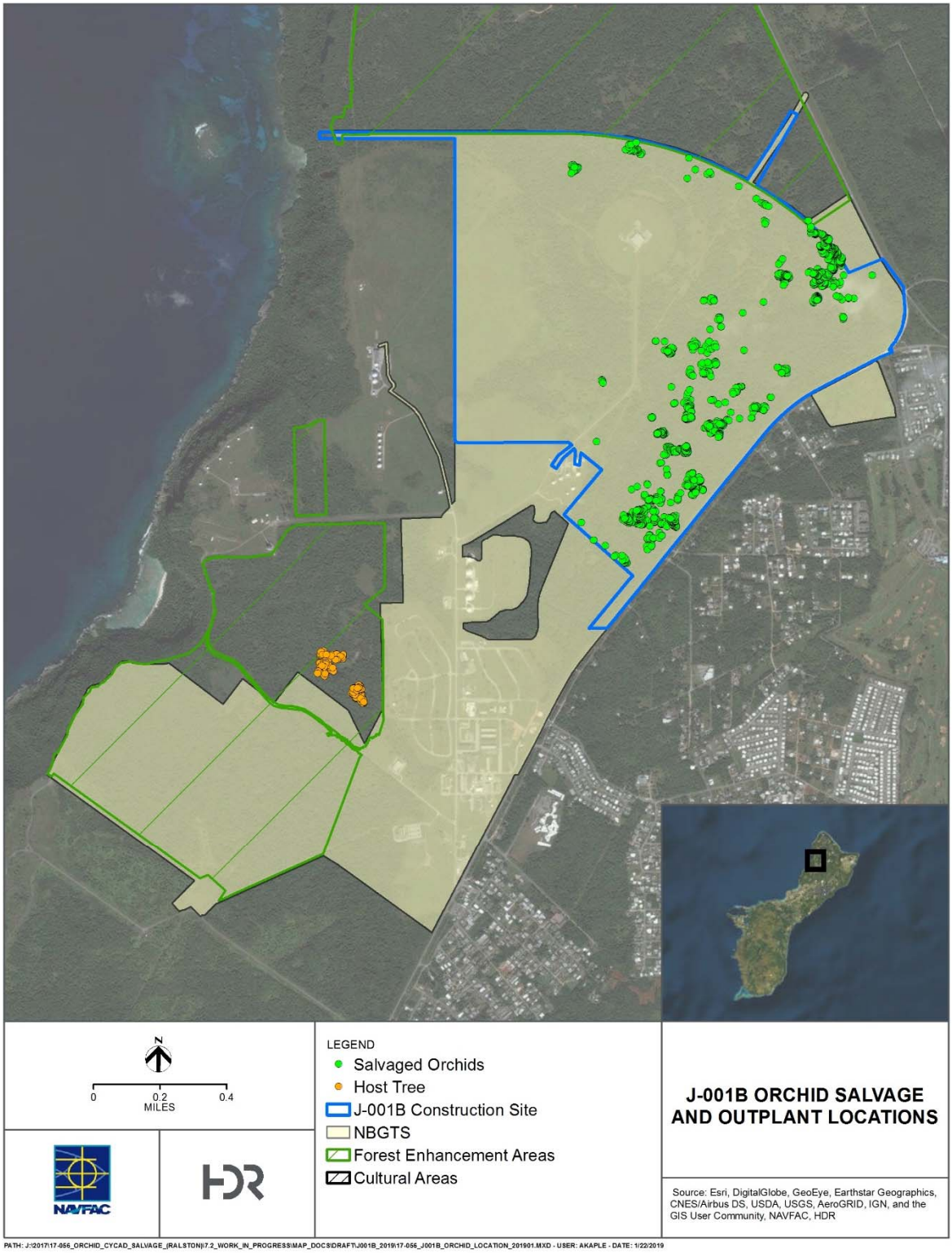

Figure 1: Project Area Showing Location of Salavaged Orchids (green dots) in 2017 and 2018 and Outplant Locations (orange dots).

In addition, the team spread the extraction of the remaining orchids across six salvage areas (points A through F). This potentially resulted in salvage from three to six different subpopulations, and allowed the team to create a degree of diversity in salvaging and transplanting the orchids. Transplant locations are shown in in **Figure 1**. Host tree species for transplanted orchids are included in **Table 2.**

Table 2. Host Tree Species for Transplanted Orchids in 2017 and 2018

Species	Number of Orchids Transplanted 2017	Number of Orchids Transplanted 2018
Aglaia mariannensis	15	0
Drypetes dolichocarpa	9	0
Eugenia reinwardtiana	165	121
Guamia mariannae	28	0
Hibiscus tiliaceus	33	15
Ixora triantha	2	0
Maytenus thompsonii	6	0
Morinda citrifolia	17	15
Ochrosia oppositifolia	441	347
Pandanus tectorius	74	0
Premna obtusifolia	84	300
Vitex parviflora	2,657	730
Artocarpus mariannensis	0	4
Ficus tinctoria	0	15
Intsia bijuga	13	0
Grand Total	**3,544**	**1,547**

The one-year monitoring of transplanted orchids began once the first individual plant was placed in the new location. The first individuals met the one-year requirement for monitoring on October 24, 2018 and were evaluated against survivorship criteria as defined in the Work Plan. **Table 3** below lists the orchid survivability rate for the orchids that completed the one-year requisite of maintenance and monitoring during the months of October 2018 to December 2018.

As described in the Work Plan, orchids were weaned off of the temporary irrigation system after six months. Further, the orchids continue to show and demonstrate signs of rooting and flowering. The subpermittees continue to conduct periodic site visits to inspect the plants, ensure that the plants remain free from pests, and will closely monitor their progress.

Table 3. Orchid Survivability Rate after One Year of Monitoring

One Year Monitoring Complete Date	Status after One-Year Monitoring Period				Total Completed Required One Year Monitoring	Total Remaining to Complete Required One Year Monitoring
Species	Dead		Alive			
October 2018	**410**	-	**790**	-	**1,200**	
D. guamense	1	25.00%	3	75.00%		
T. guamense	409	34.49%	777	65.51%		
B. guamense	0	0.00%	10	100%		
November 2018	**461**	-	**1,451**	-	**1,912**	
D. guamense	0	0.00%	0	0.00%		
T. guamense	461	24.52%	1,451	75.89%		
B. guamense	0	0.00%	0	0.00%		
December 2018	**58**	-	**374**	-	**432**	
D. guamense	0	0.00%	0	0.00%		
T. guamense	58	15.63%	313	84.37%		
B. guamense	0	0.00%	61	100.00%		
Total to Date	**929**	-	**2,615**	-	**3,544**	**1,547**
D. guamense	1	25.00%	3	75.00%	4	16
T. guamense	928	26.75%	2,541	73.25%	3,469	1,531
B. guamense	0	0.00%	71	100.00%	71	0
			Total Transplanted		**5,091**	

Other Authorized Activities

Although authorized in Section 2.2.3 of the Work Plan, no propagation of orchids from the J-001B project site took place in 2018. Individual orchids were salvaged and directly transplanted and no additional seeds, propagules, vegetative samples, vouchers, or tissues samples were collected as summarized in **Table 4**. Additionally, no individual plants were damaged or destroyed during the salvage or transplant activities.

Table 4. Summary of Other Activity with Listed Plant Species in 2018

Plant Species	Number of Seeds Collected	Number of Propagules Collected	Number of Vegetative Samples Collected	Number of Herbarium Vouchers Collected	Number of Tissue Samples Collected	Number of Plants Damaged or Destroyed
Tuberolabium guamense	0	0	0	0	0	0
Dendrobium guamense	0	0	0	0	0	0
Bulbophyllum guamense	0	0	0	0	0	0

Further, no genetic testing was performed on any individuals salvaged or transplanted in 2018.

Unintentional Takes

No federally listed plant or wildlife species were subject to unintentional takes in 2018. **Table 5** summarizes the individuals incidentally taken during salvage and transplant activities, including the dates, location of salvage, and outcome (location of transplant) for those individuals.

Table 5. Summary of Unintentional Takes in 2018

Species	Number of Individuals Salvaged	Number of Individuals Injured or Killed	Date Taken	Location (Coordinates)	Outcome
Other Plants and Wildlife	0	0	NA	NA	NA

Conclusions

Under the Subpermit the authorized individuals are planning to conduct the following activities in 2019:

- Monitoring of transplant orchid individuals and maintenance of transplant site as needed.
- Submit a Final Report of salvage and transplant results to the Navy.

Please contact Dr. James McConnell at mcconnell@triton.uog.edu should you have any questions or concerns regarding this report.

Attachment 1 – Work Plan

March

2018

Final

Salvage and Transplantation Work Plan

Salvage and Transplantation of Federally Listed Plant Species at Utilities and Site Improvements Phase I

Naval Base Guam Telecommunications Site, NAVFAC Pacific

Prepared for:

Naval Facilities Engineering Command Pacific

Prepared by:

1132 Bishop Street
Suite 1200
Honolulu, HI 96813

Attachment (5)

ACRONYMS AND ABBREVIATIONS

AAFB	Andersen Air Force Base
CD	compact disc
COR	Contracting Officer Representative
CPC	Center for Plant Conservation
GIS	Geographic Information System
GPEPP	Guam Plant Extinction Prevention Program
HACCP	Hazard Analysis and Critical Control Point
LMS Inc.	Landscape Management Systems Inc.
MCAG	Marine Corps Activity Guam
MEC	munitions and explosives of concern
NAVFAC	Naval Facilities Engineering Command
NBGTS	Naval Base Guam Telecommunication Site
NTR	Navy Technical Representative
NWF	Northwest Field
PM	Project Manager
POAM	Plan of Action and Milestones
PWS	Performance Work Statement
SDSFIE	Spatial Data Standards for Facilities, Infrastructure and Environment

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1. Salvage and Transplantation Work Plan Overview

1.1 Introduction

This Work Plan presents background information, project management details, proposed methodology, required deliverables, and an anticipated schedule for the salvage and transplantation of federally listed plant species identified within the footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

Specifically, this Work Plan describes the efforts that will be performed by the HDR Team to salvage and transplant 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I at NBGTS as described in the contract's task order Performance Work Statement (PWS), signed June 29, 2017 and modified on December 12, 2017. This work will be conducted under contract to Naval Facilities Engineering Command (NAVFAC) Pacific, contract N62742-15-D-1822. Rebecca Ralston (HDR) will serve as the Project Manager, WESMURPH Consulting and Landscape Management Systems (LMS Inc.) will perform field activities.

1.2 Project Description

The purpose of this project is the salvage and transplantation of federally listed plant species identified within the construction footprint for the J-001B at NBGTS.

All work will be performed following applicable and appropriate Department of Defense guidance and policy and consider all site documentation and reports available to the date of this Work Plan. The period of performance of this Contract Task Order is from June 29, 2017, through July 31, 2019. The following services will be provided:

1. Perform a field assessment of the location and condition of plant species to determine salvage and transplant methods.
2. Salvage five *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint.
3. Transplant salvaged plants to a Navy-approved location.
4. Provide one year of maintenance and monitoring after transplantation.

1.2.1 Project Location

The J001B Utilities and Site Improvements Phase I footprint construction project is on NBGTS in northern Guam (**Figure 1**). Orchid and cycad salvage will be done within the construction footprint which has been divided into four priority areas ranked in order of anticipated work by the construction contractor (as of September 6, 2017; subject to change). Two Forest Enhancement Areas have been designated—one in the southern portion of NBGTS and the

other in the northern portion of NBGTS/southern portion of AAFB NWF. Transplantation activities will be done in one or both of those designated areas.

1.3 Objective

Project team members will assess the best method to salvage 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense*, treat and maintain them in an approved nursery (if appropriate), transplant them (when appropriate), and provide 12 months of maintenance and monitoring of the transplanted plants with a minimum of a 50 percent plant survivorship after one year from the date of transplant of the individual plant. Survivorship is defined for *Cycas micronesica* pups as a new canopy of healthy fronds and leaf formation one year after transplanting from trunk cuttings and for Orchidaceae species as the documented observation of new root growth after transplantation into a protected area.

Based on the results of the field assessment, this task order will salvage 4 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, up to 20 *Dendrobium guamense*, and up to 70 *Bulbophyllum guamense*, with a minimum survivorship of 2 *C. micronesica*, 2,500 *T. guamense* individuals, 10 *D. guamense* individuals, and 35 *B. guamense* individuals. The minimum survivorship will be based on the final number of individuals salvaged in the event that fewer than the required number of individuals are located or salvageable.

1.4 Project Management

Under this task order, assigned management staff will have the appropriate experience and skills necessary to meet the needs of the PWS objectives. The field assessment, salvage and transplantation operations, plant care, monitoring and maintenance and associated documents prepared under this task order will provide sufficient documented information to assist the Department of the Navy in managing lands on NBGTS Guam.

The management effort required for this task order includes continuous oversight for the length of the project, including management of resources and schedules; budget tracking and review; periodic liaison with Marine Corps Activity Guam (MCAG) and NAVFAC Pacific points of contact as required. **Section 6** includes a contact list of project personnel.

HDR Project Manager Rebecca Ralston will be responsible for the planning and execution of task activities, budgeting, and technical coordination for this effort. She will also supervise the development of all deliverables specified in the PWS. WESMURPH Consulting and LMS Inc. will perform all field activities. Dustin Janeke, Project Quality Assurance for HDR, will conduct a quality assurance/quality control review of deliverables before submission.

Ms. Nicole Olmsted, Natural Resources Specialist at NAVFAC Pacific, is the Contracting Officer Representative (COR)/Navy Technical Representative (NTR) for work performed under this contract. The COR/NTR is responsible for monitoring the project team member's performance and for ensuring that work is performed per the requirements and specifications outlined in the PWS. Ms. Coralie Cobb is the alternate COR. Ms. Christiana Quinata and Ms. Lauren Gutierrez will be NBGTS MCAG contacts.

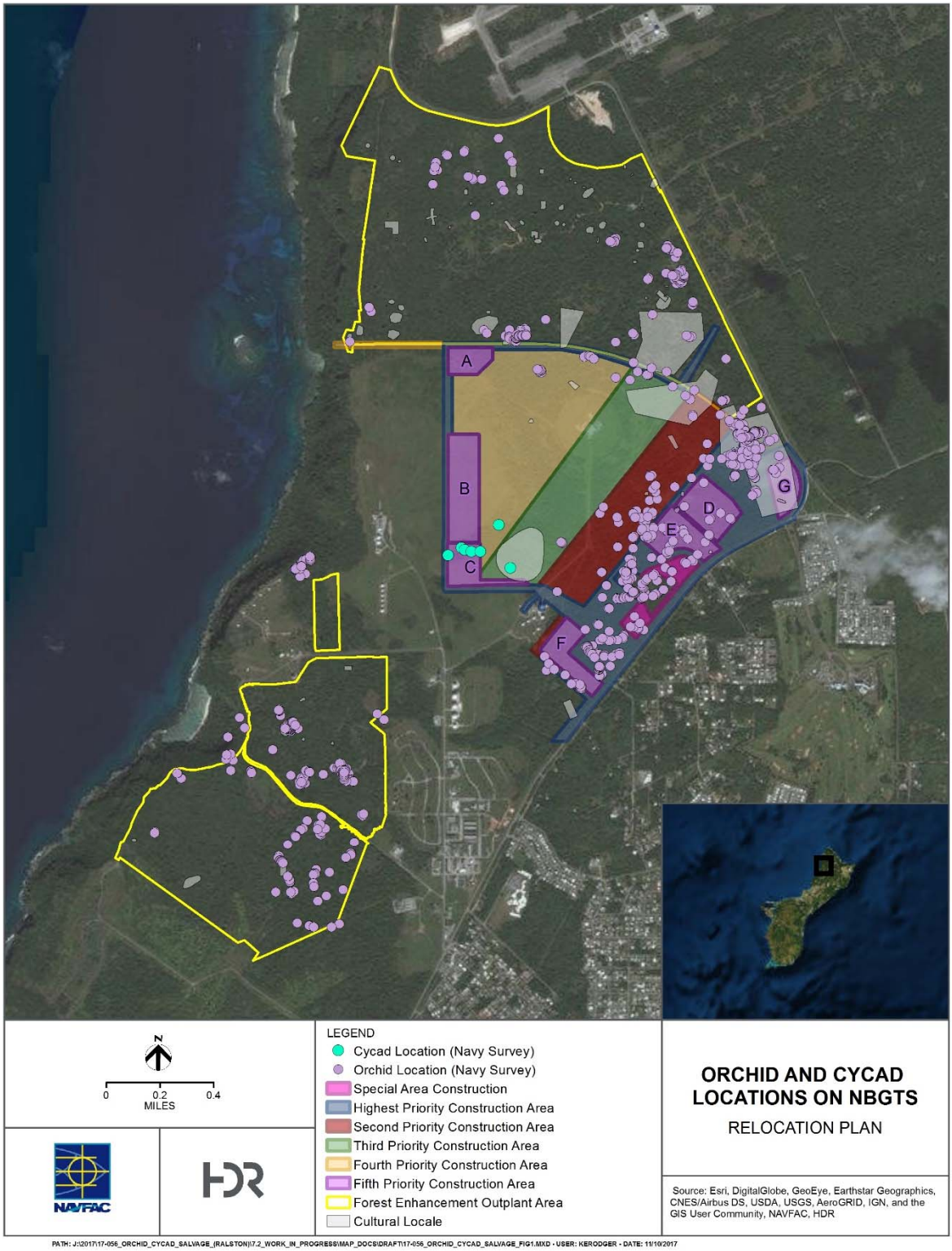

Figure 1. Project Location on NBGTS

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2. Methodology

To complete this project, multiple levels of personnel will be used. The Lead Biologist for either orchids or cycads has oversight and accountability for the health of the respective species. The Lead Biologist and Field Biologists are required to obtain a recovery permit issued under Section 10(a)(1)(A) of the Endangered Species Act (ESA), 16 U.S.C. 1531 et seq. and abide by the Special Terms and Conditions of the recovery permit. Field Biologists for either cycads or orchids are able to work with the respective species without supervision. Field Staff are personnel working under the direct guidance and supervision of the Lead and Field Biologists.

On August 23, 2017 the USFWS approved the following personnel to support this project:

- Cycad Lead Biologist: Robert Wescom
- Cycad Field Staff: Dr. Thomas Marler
- Orchid Lead Biologist: Dr. Jim McConnell
- Orchid Field Biologist: Jonathan Davis
- Orchid Field Biologist: Mario Martinez
- Orchid Field Biologist: Gregorio Borja
- Orchid Field Staff: John Horeg

2.1 Field Assessment

A field assessment was initiated on August 14, 2017, to determine the most viable salvage options for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

2.1.1 Cycad Field Assessment

Robert Wescom, the Lead Biologist for cycads, conducted a field assessment on August 14, 2017, using Navy-provided GIS data (data points, polygons) to locate the five individuals previously recorded. The field assessment included the following steps: (i) conduct a site visit to identify specimens for salvage and transplant, including assessing the condition of cycads, (ii) record all cycads with GPS, and (iii) assess salvage and transplant methods.

The field assessment determined which individual cycads should be salvaged by inspecting the exterior stems of each cycad for termite damage, visible rot, presence of cycad scale, or other pests. The following data were recorded for each cycad during the field assessment:

- GPS location (UTM WGS84 Zone55N meters)
- signs of termite, cycad scale, and cycad butterfly damage
- signs of exterior rot
- number of pups present
- digital photographs of each cycad (**Attachment B**).

The five cycads were located and assessed (**Table 3**). One cycad was dead, one cycad had two apical stems with no pups and three cycads had single apical stems with one of those cycads having four pups; therefore, the salvage operation will include the felling of four mature cycads.

In addition, five cycads outside of the immediate construction area were identified and assessed (**Table 3**). These cycads are not currently proposed for salvage but may be added to the PWS at a later date.

2.1.2 Orchid Field Assessment

The Lead and Field Biologists for orchids began a field assessment on August 14, 2017 and completed the field assessment on September 6, 2017 utilizing Navy-provided GIS (data points, polygons) to locate federally listed plants. The Lead Biologist provided appropriate training and resources for field personnel to identify specimens for transplanting. The field assessment included the following steps: (i) conduct a site visit to identify specimens for salvage and transplant using Navy-provided coordinates, (ii) record species and the number of orchids on each host tree, and (iii) record any new host trees with orchid species.

Field assessment staff included, Dr. McConnell, M. Martinez, J. Horeg, J. Davis, G. Borja, J. Andrew, J. Tuquero, C. Valera, M. Hara, H. Simram, and H. Lizama. The field teams surveyed along 15-meter transects based on Navy-provided transects from the 2015 survey. The 15-meter transects focused on areas where orchids were recorded during Navy surveys. Surveyors systematically located previously identified host trees and recorded the number of orchids on each tree as well as any new host trees with orchids. **Table 1** contains orchid data broken down by Priority Areas. **Table 2** contains host tree species broken down by Priority Areas.

Table 1. Orchid Assessment for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS). *

	Host Trees	*T. guamense*	*D. guamense*	*B. guamense*
Priority Area 1	1,802	9,264	6	68
Priority Area 2	178	870	6	0
Priority Area 3	15	32	0	0
Priority Area 4	60	212	0	0
Priority Area 5**	35	291	0	0
Total	**1,944**	**10,669**	**12**	**68**

**The revised boundaries of construction priorities areas were provided by the Navy on November 8, 2017.*
***Priority Area 5 boundaries were delineated subsequent to the initial field assessment.*

Table 2. Host Tree by species for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

Species	Number
Vitex parviflora	1,795
Morinda citrifolia	37
Guamia mariannae	1
Premna obtusifolia	3
Ochrosia oppositfolia	16
Leucaena leucocephala	6

Species	Number
Hibiscus tiliaceus	19
Pandanus tectorius	38
Glochidion marianum	1
Maytenis thomsenii	1
Ixora triantha	3
Dead Branch	24
Grand Total	**1,944**

The second part of the field assessment was to assess the most appropriate locations for orchid transplanting. Habitats that matched or were similar to the recorded data for the orchid were prioritized for out-planting. Surveyed areas began with the areas with the densest populations of orchids in the transplanting area. Approximately 500 host trees were located within the two Forest Enhancement Areas.

The field assessment identified a sufficient number of host trees (500) to host 5,090 orchids. This allows flexibility in determining which host trees are best suited to host the orchids and will allow salvage and transplant over the required 5,090 individuals, should the need arise. A group of the host trees are located within a sink hole that is expected to add protection from wind and other elements.

The following data were recorded for each host tree during the field assessment:

- GPS location (UTM WGS84 Zone55N meters)
- host tree species
- orchid species
- number of orchids on host tree
- documentation photographs.

2.1.3 Field Assessment Equipment

Field equipment for cycad assessment included the following:

- GPS with geo-tagging camera to mark the locations of cycads and take photographs
- a note pad with waterproof paper to record the condition of cycads.

Field equipment for orchid assessment included the following:

- GPS to mark the locations of the orchids for salvage
- data forms to record the orchids for salvage
- flagging tape to mark the orchids for salvage
- camera to take photographs of the orchids.

2.2 Salvage

Project team members will implement salvage assessment methodologies for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint at NBGTS.

Salvage operations will use the most effective methodology for the site, plant species and health of the plant. Salvage operations will focus on Navy-determined priority areas in numerical order to stay ahead of potential construction. Salvaged cycads will be taken to an approved nursery for care prior to out-planting, while orchids may be directly transplanted to host trees or cared for in a nursery until the most appropriate time to transplant. That determination for orchids will be made by a Biologist based on the health and viability of the plant at the time of salvage. In addition to salvaging orchids, orchid propagation may be utilized to ensure a 50 percent survivability threshold is met. The determination to salvage orchids or collect seeds would be

dependent on the health of the plant, whether or not it would survive transplantation, and whether the plant produces seed. A Biologist will make the determination of health.

Additionally, the orchid salvage areas will be identified to ensure proper sampling is obtained in various locations throughout the construction area including various heights throughout the trees. Plants out of reach will be collected by using the salvage equipment discussed in **Section 2.2.4**.

The ability to salvage the plants would be dependent on the health of the plant and whether or not it would survive transplantation. The Biologist will take into account that the orchids will undergo stress when being relocated, and in order to focus the plant's energy towards root and vegetative growth, flowering or fruiting parts will be removed from the plants to avoid expending energy trying to make pods before it has established. The Biologist will only select orchids for transplanting that have a reasonable chance of survival.

If the minimum percent survival ratio cannot be met with whole plants or viable seeds from within the project footprint, then the project team will pursue seed collection, tissue germination, and plant division and/or stem cuttings, as suitable to the species, from other individual construction project footprints, where construction has yet to begin, or directly outside a construction project footprint in order to protect genetic diversity to provide seedlings to meet out-planting success targets.

2.2.1 Cycad Salvage

The field assessment conducted on August 14, 2017, determined the status of each of the five *Cycas micronesica* trees originally identified by the Navy. One of the original five cycad trees was dead, but the remaining four are healthy enough to obtain stem cuttings or pups for propagation. The status of each tree is described in **Table 3**.

2.2.1.1 CYCAD SALVAGE USING NURSERY FACILITIES

The Navy previously conducted a munitions and explosives of concern (MEC) assessment around the five cycads. There are anomalies surrounding all five cycads, therefore, when deemed necessary, the Lead Biologist would need to cut the cycad at the base and treat them in an approved nursery prior to transplantation. The cycad salvage team will use pups from the trees that have multiple large pups and will use apical stem sections for the trees that do not have pups.

Attachment B contains photographs from each cycad located during the assessment, and **Figure 2** provides the GIS map depicting cycad tree location. The percent survival ratio of salvaged material for *C. micronesica* will be based on the number of salvaged whole plants or basal suckers, known as cycad pups.

Table 3. Cycad Assessment and Salvage Recommendations for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

ID	Coordinates		Condition	Salvage Recommendation
	Easting	Northing		
Cycad 1	1502963	267160	Two healthy stems, 1.5 meters in length.	Salvage two apical stem cuttings
Cycad 2	1502988	267160	1.7-meter-tall relatively healthy tree.	Salvage one apical stem cutting
Cycad 3	1503059	267187	2.5-meter-tall relatively healthy female plant. No pups.	Salvage one apical stem cutting
Cycad 4	1503217	267094	2.5-meter-tall female tree. Four pups. Heavy scale infestation.	Salvage one apical stem cutting and four pups
Cycad 5	1503063	266981	Dead	No action
Cycad 6	1503032	266787	3.5-meter-tall unhealthy tree. Four pups. Heavy scale infestation.	Not currently included in PWS. Salavge four pups
Cycad 7	1503034	266786	3.5-meter-tall tree. One good pup. Heavy scale infestation.	Not currently included in PWS. Salvage one apical stem cutting and one pup
Cycad 8	1503083	266869	3.5-meter-tall unhealthy tree. Numerous pups. Heavy scale infestation.	Not currently included in PWS. Salvage numerous pups
Cycad 9	1503070	266886	2.5-meter-tall unhealthy tree. No pups.	Not currently included in PWS. One apical stem cutting
Cycad 10	N/A	N/A	Dead	Not currently included in PWS. No action

Salvage operation will involve the following steps:

1. One month prior to salvage, a Safari insecticide solution will be poured around the base of each of four living cycad plants. The application of Safari insecticide will conform to label instructions and be supervised by a Guam Certified Pesticide Applicator. Note: Safari is not classified as a Restricted-Use Pesticide.
2. Epiphytes, debris, termite nests, invasive vines and other non-cycad materials will be removed from the apical portion of each tree, and all cycad leaves will be removed with hand shears.
3. Four pups will be removed from the main stem using a sharp blade, not a saw, to slice through the base of each pup.
4. Each cycad tree will be tagged prior to being cut near ground level with a chainsaw and lowered manually to the ground. Unique alpha-numeric aluminum tags will be used and later mounted on a pole next to the outplanted cycad.
5. The cut surfaces will be sealed with tree sealant, and each specimen will be covered with shade cloth to avoid direct sun exposure.

6. Each cycad stem and pup will be placed on a gurney and manually carried to the nearest road, loaded onto a truck, and transported to an approved nursery. Once off-loaded at the nursery, the stems will be kept under 50 percent shade cover. Plants will remain isolated from other plants scheduled for outplanting to reduce the spread of pests and diseases.
7. Each stem will be cleaned with pressurized water to reduce the likelihood of persistent pathogens.
8. The entire specimen will be sprayed with an insect growth regulator solution sprayed over the entire stem at a close distance (<30 centimeters). The specific brand and solution will be selected prior to salvage.
9. If required, sequential cuts will be made with a handsaw toward the stem apex to remove any rot.
10. Stems will be allowed to air-dry.
11. The cut surfaces will be sealed with petroleum-based pruning sealant to retain moisture and serve as a prophylactic for pathogens. The sealant will be applied to the cut surfaces to prevent drying and act as a prophylactic against possible pathogens in the rooting medium. The specific sealant will be selected prior to salvage. Cut surfaces will then be disinfected by spraying with a 10 percent bleach solution. The basal portion of each stem will be immerged in a 10% bleach solution for a minimum of one minute. The commercial root-promoting hormone (0.3% indole-3-butyic acid) will be applied to the stem, but not the sealed base.
12. The base of each pup will be placed in perlite and maintained under 50 percent shade and watered daily.
13. Each stem will be placed in a large container as shown in **Figure 3**.
14. Each container will be placed on a structure at least 18 inches above ground level and supported with guide wire. The wires will be coated in plastic to protect the tree and have three anchor points.
15. Each cycad plant will be monitored for the presence of cycad scale and any other pests, watered as needed until sufficient new roots have formed, which is anticipated to take approximately 6 months.

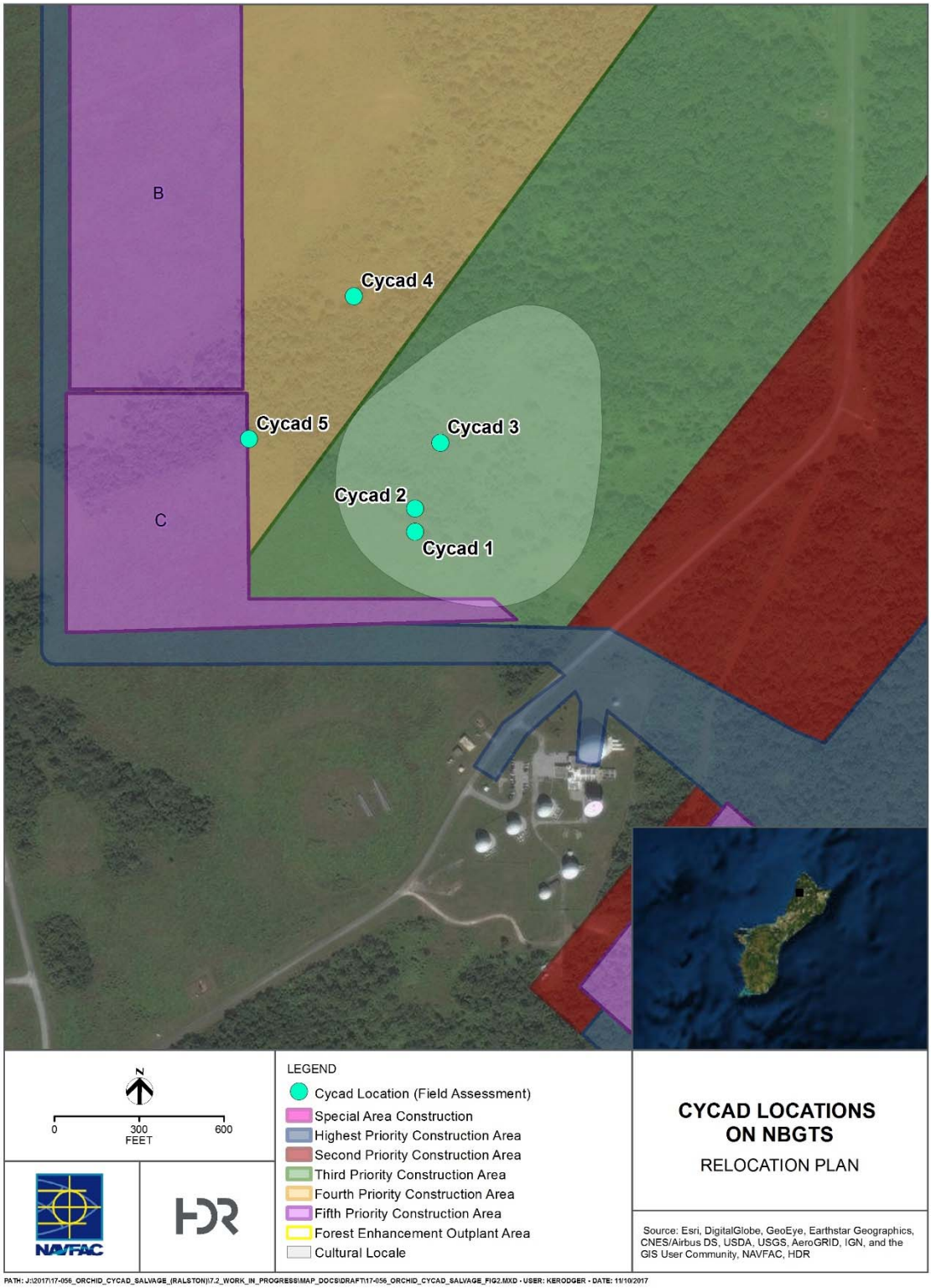

Figure 2. Map of Cycad Locations

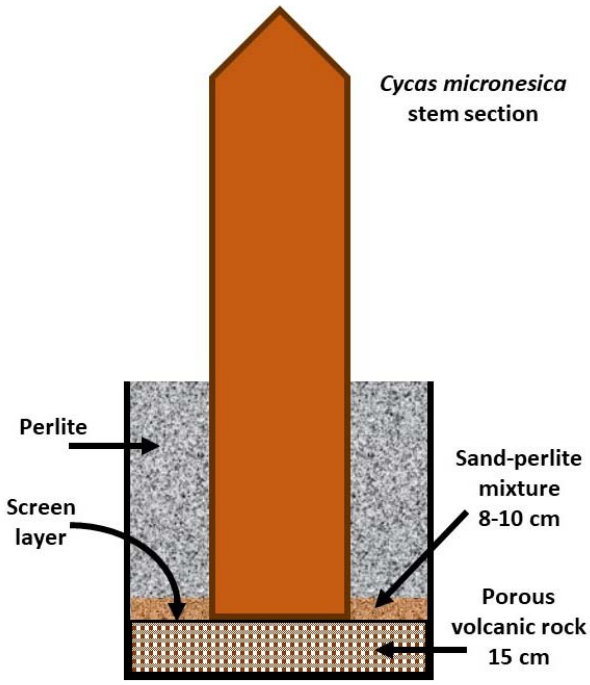

Figure 3. Diagram of container where cycad stems will be placed (Marler and Cruz 2017)

2.2.1.2 CYCAD SALVAGE USING DIRECT TRANSPLANT

If an approved nursery is not authorized for use in advance of the planned construction vegetation clearing schedule, an alternate method for cycad salvage may be used. This would involve direct transplant of adult cycads from their existing locations to a pre-determined outplant location in the Forest Enhancement Area.

Salvage operation using the direct transplant method will involve the following steps:

1. Reassessment of the living cycads to assess their survivorship potential and accessibility.
2. One month prior to salvage, a Safari insecticide solution will be poured around the base of each living cycad plant. The application of Safari insecticide will conform to label instructions and be supervised by a Guam Certified Pesticide Applicator. Note: Safari is not classified as a Restricted-Use Pesticide.
3. Selection of new outplanting location within the NBGTS Forest Enhancement Area.
4. MEC analysis and anomaly clearance of existing and outplant locations, including staking locations.
5. Where feasible clear a path to each cycad plant to allow a backhoe to access each cycad plant and its outplanting site.
6. Remove all of the cycad leaves, all epiphytes, vines, debris, etc. from each cycad plant.

7. Carefully excavate the cycad plants from the current locations, either with a backhoe or manually, making every effort to protect as many roots as possible. Approximately 12 inches of each root will be retained at the base of each tree.
8. Carefully lift the cycad plant out of its existing location.
9. Carefully transport each salvaged cycad plant to the nearest road for transport to its intended outplanting site within the Forest Enhancement Area.
10. Clean cuts will be made with loppers or shears on every severed root and treated with fungicide. Exposed surfaces will be covered with a commercial pruning sealant.
11. Excavate the planting hole that is approximately twice as wide as the root ball and only deep enough so that the resulting planting hole will have the same filled soil level as the original hole.
12. Carefully refill the new hole with the excavated soil, and firm the soil around the root ball.
13. Water the soil around each cycad plant to remove any large air pockets in the soil.
14. Carefully secure the transplanted cycad plant with rubber coated wire to three or four stakes.

2.2.2 Orchid Salvage

To complete orchid salvage on anticipated construction time lines and stay with PWS for this project, HDR recommends beginning with the 3,100 *T. guamense* located in Priority Area 1; 6 *D. guamense* located in Priority Area 1; and 7 *D. guamense* located in Priority Area 2. Following a contract modification, an additional 1,900 *T. guamense*, up to 14 *D. guamense*, and up to 70 *Bulbophyllum guamense* will be salvaged from Priority Areas 1 through 5.

The Lead Biologist, Dr. James McConnell, will first conduct training for all Biologists and assistant field personnel to ensure appropriate methods are utilized. Each Biologist will oversee a team of 4-5 people; each team can salvage and transplant 10-50 orchids per day. On-site personnel will take pictures daily to provide visual evidence of work progress via a WhatsApp group. Any issues encountered will be brought directly to the Lead Biologist for resolution, and the Lead Biologist will conduct periodic inspections to ensure transplanting procedures are followed.

The HDR Team, through subcontractor LMS Inc. will utilize a mulcher to create access at the point of salvage to minimize mobilization time. Mulching process with comply with green management procedures. In creating these access points, LMS Inc. will work with a Field Biologist, refer to **Section 2** for approved USFWS names, to survey the clearing path to ensure no orchids or high value trees are harmed. Further, the HDR Team will avoid areas where Hazard Analysis and Critical Control Point (HACCP) projects are on-going or cultural sites are present.

Orchids will be salvaged from as many subpopulations as possible to maintain genetic diversity. To the fullest extent possible, the project team shall salvage a sufficient amount from each subpopulation to reach an appropriate level of survivability for that particular subpopulation. If all

orchids were salvaged from one area the genetics would not be as diverse as collecting from a higher number of subpopulations.

The Biologists will determine the most efficient and safe way to salvage the orchids based on site-specific context. For branches 6 inches in diameter or less, field personnel will remove the entire branch. The application of water should not be necessary for plant removal. If the orchid is on smaller diameter trees, the entire section of orchid and roots will be moved intact. Roots will not be separated from the bark. This is expected to result in faster orchid attachment to new trees.

For branches greater than 6 inches in diameter, field personnel will chisel out the bark underneath the roots into the xylem to ensure as little damage as possible, essentially removing the orchid with the current media intact. The bark will be large enough to support the orchid and will be cut in a manner that allows the orchid roots to stay intact.

Salvage operations will occur tree by tree. Once an area has had the plants collected, the area will be turned over to the construction contractor for development. Plants out of arms reach will be collected by using climbing gear and salvage equipment mentioned in **Section 2.4.4**. Work will be supervised by competent safety officers on site to ensure that orchids above ground level can be safely obtained for transplanting. The ability to salvage the plants would be dependent on the health of the plant and whether or not it would survive transplantation. A Biologist will make the determination of health.

All orchid roots will be avoided when cutting branches and extra space (not occupied by roots) on the branch ends will be used as the area for securing the branch during transport and relocation. Attachment will be done in one of the following ways: (1) tying the chiseled bark to the tree with twine or breathable synthetic material (i.e. panty hose) or (2) thin branches, approximately 2 inches or less in diameter, may be attached with nylon or nails. Cut branches shall deteriorate naturally and nylon, wire, or plastic ties will be removed once orchids are holding onto the host tree. Orchids shall be attached to the host tree with nylon and or twine. Host trees will be monitored to prevent girdling. The orchids and branches shall be observed during the maintenance and monitoring period and supporting nylon will be provided to ensure orchids remain affixed to the tree if root growth is not sufficient to anchor the orchid to the tree prior to decomposition of the branch. Note that the method of attaching thin branches to trees was employed early in this project, but was discontinued for later phases of orchid transplant.

The field personnel will haul orchids via a transport vehicle with metal racks in the back to hold the orchids. Throughout the transportation process, the orchids will remain covered to avoid direct sun exposure. Orchids will be transported directly to the transplant site or approved nursery. Orchids will be transported in carts with shade cloth to minimize orchid exposure to sunlight during the transportation and transplant process. The distance from the donor to recipient site is approximately one mile, and much of the terrain is not accessible by vehicle. Trails have been cleared to expedite the transportation process where feasible. Covered UTV/ATVs are used to help expedite the transport process and ensure that the orchids have as little exposure to the elements as possible.

2.2.3 Orchid Propagation

For this project, salvaged material from orchids will be in the form of whole plants. If the minimum percent survival ratio cannot be met with whole plants or viable seeds from within the project footprint, then the project team will pursue seed collection, tissue germination, and plant division and/or stem cuttings, as suitable to the species, from other individual construction project footprints, where construction has yet to begin, or directly outside a construction project footprint in order to protect genetic diversity to provide seedlings to meet out-planting success targets. The Lead Biologist will be following the Hawaii Rare Plant Restoration Guidelines.

To meet the PWS requirement of a minimum 50 percent survivability for transplanted orchids, orchids may be propagated as agreed upon in the July 11, 2017, kick-off meeting. Fruits will be collected from orchids at different locations if they are at a mature stage. The fruits can most successfully be propagated at the unopened mature stage. Any excess propagated orchids will be turned over to the Navy or the USFWS, as directed, upon the completion of this project. Propagated orchids will be linked to the original plant's number for reference. The Center for Plant Conservation (CPC) guidelines recommend a minimum of 50 plants be collected from a population. If fruits are collected will be dependent on whether or not there are mature fruits to collect. As applicable, the team will follow the recommended guidelines.

For propagation, Biologists will deliver harvested fruits to the GPEPP tissue culture lab. The methodology for seed germination depends on the maturity of the fruit. If the fruits are mature and not cracked, the seed will be germinated using green pod culture methods. If the fruits are cracked, the seed will be germinated using surface sterilization of the seeds. The seeds will be germinated on Modified Vacin & Went media for orchid seed germination. Once the seedlings are growing, the seedlings will be transflasked onto Modified Vacin & Went orchid transflasking media. The seedlings, in flask, will be transplanted to community pots when they are removed from flask. Water may be used to rinse the media from the seedlings. Seed germination would be done aseptically and plants will be inspected and monitored for any pests, which will be controlled if found. Seeds will be propagated from fruits of different locations throughout the area. If seedlings are used, they will be a balanced representation of the population being destroyed. CPC guidelines recommend collecting from a minimum of 50 plants per population, and those plants should be equally represented at the new site they are introduced into.

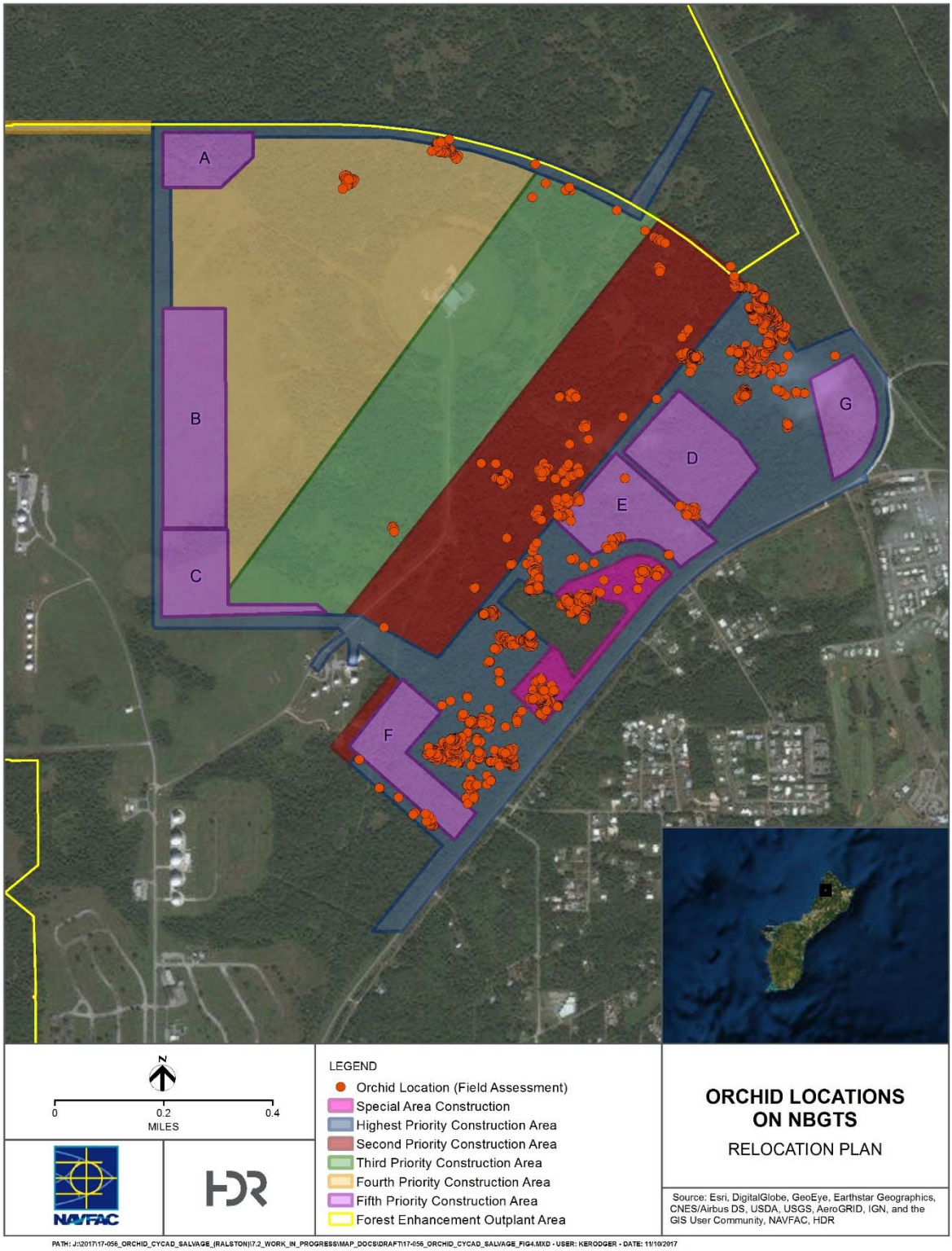

Figure 4. Map of Orchid Salvage Locations

A sample of the propagules would remain in ex situ storage in case the translocation fails, therefore it can be repeated with the propagules that were kept via ex situ techniques (tissue culture, seed storage, and nursery propagation).

2.2.4 Salvage Equipment

Cycad salvage equipment includes the following:

- ladder
- pruning shears
- sharp blade
- Safari insecticide
- bleach
- tree sealant
- note pad with waterproof paper
- digital camera
- gas-powered chainsaw or battery operated Sawzall (™)
- shade cloth to protect the cycad stem from direct sun
- gurney to transport the cycad stem to nearby road
- vehicle to transport the cycad stem to approved nursery.

Orchid salvage equipment includes the following:

- chainsaw or Sawzall (™)
- hand saw
- loppers
- pruners
- twine
- zip ties
- wire
- pliers
- wire cutters
- panty hose
- nails
- metal tags (alphanumeric)
- nail gun
- hammer
- climber gear (harness, ropes, carabiners)
- chisels
- compass
- GPS
- ladders
- metal racks to transport orchids out of the salvage site to the enhancement site
- vehicle to transport orchids out of the salvage site to the enhancement site
- water.

2.3 Transplant

Transplantation will occur as soon as feasible for all plants, accounting for situational indicators and health of the plant. For orchids, multiple areas will be utilized for transplantation, and whenever feasible native trees will be used as host trees based on the Lead Biologist's analysis of microclimate and long-term orchid viability. Cut branches or bark with orchids will be tied to the tree using polypropylene twine. Note that the method of attaching thin branches to trees was employed early in this project, but was discontinued for later phases of orchid transplant.

After transplantation, a watering system will be established, and plants will be monitored monthly (or more frequently as conditions warrant) for 12 months. The water pressure source will be a pump supplied by a water tank. It will be removed after the Biologists determine the plants will survive on their own or as otherwise instructed by the Navy. During the monitoring period, the Biologists will allow the orchids to adjust and will determine the watering needs of the plants.

When transplanting, approximately 15 individual orchids will be placed onto a single host tree to distribute on as many trees as possible while keeping the orchids in close proximity to each other for pollination purposes. Pollinators for these orchid species are not known, therefore, transplanting the orchids relatively close together allows for smaller pollinators to have a chance to cross pollinate, if necessary.

Project team members will transplant 4 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I (J-001B) at NBGTS within designated Forest Enhancement Areas.

2.3.1 Cycad Transplant

Viable transplanting sites within the two identified Forest Enhancement Areas will be determined in advance of out-planting. There are three potential methods for out-planting. The first is to have each selected spot evaluated by a qualified Munitions and Explosives of Concern/Unexploded Ordnance technician to ensure that there are no underground abnormalities (e.g., metal detections). Once sufficient sites have been identified, approved, GPS location recorded and flagged, the cycad plants will be covered with shade cloth prior to transporting in a pickup truck to the out-planting site. From the nearest access point the cycads will be carried to the out-planting site on a gurney.

A planting hole that is large enough to hold the root system will be either manually or mechanically excavated with a backhoe. Since excavating large holes will require the presence of an MEC technician, the size of the hole will be determined at the time of outplanting. The cycad will be removed from the container and placed in the excavated planting hole and the hole filed with native soil which has been examined for presence of pests prior to use. If the cycad has come from an approved nursery, any residual perlite or other material will be removed prior to outplanting. Since MEC requirements limit that only 1/4 inch of soil may be removed without an MEC Tech inspection, availability of sufficient amounts of native soil may be an issue, so additional MEC clearance in surrounding habitat may be conducted to obtain

additional soil or, if feasible, native soil that has been stockpiled by construction crews in the J-001B construction areas most closely located to the salvage and outplant areas may be used. The planted cycad will be supported with plastic-coated guide wire, monitored regularly for health and removal of invasive plants or vines, and watered as needed for one year. Plastic coated wire will be loosely tied around each cycad and tied to an adjacent tree or rebar stake (following MEC Tech inspection) to support the cycad.

The second method, intended to avoid the requirement for Munitions and Explosives of Concern /Unexploded Ordnance inspection entails locating planting locations that are natural indentations or pits in limestone large enough to accommodate the root ball of individual cycads. The cycad will be placed in the natural indentation and native soil mixture, previously examined and determined pest free prior to use, will be placed around the root ball. The natural depression will help prevent soil erosion from around the root ball. The cycad plants will be supported with plastic-coated guide wires, monitored regularly for health and removal of invasive plants or vines, and watered as necessary.

This method assumes an approved nursery is available, and since only viable apical tissue will be grown, the size of the outplanting material is expected to be less than a meter in height and not the full size of the salvaged plant. Outplanted cycads will be manually watered via a bucket, as necessary, dependent on recent rainfall. The initial outplanting stock is not expected to transpire a large quantity of water and manual watering will be sufficient until rainy season.

The third method, assuming an approved nursery is available, is to outplant pups in the same manner as rooted stems. Whichever method is used, the GPS position of the planted cycad will be recorded, and photographs will be taken of the cycad taken after out-planting and throughout the 12-month maintenance period. Per the current PWS, the goal is to have a minimum of two living cycad plants one year after out planting to meet the 50 percent survivability ratio. Four mature plants will be salvaged; therefore, the 50% survival is a minimum of two plants. *C. micronesica* survival is defined as the documented observation that the plant is alive and new leaves have formed.

2.3.2 Nursery Orchids

Orchids determined not to be ready for direct transplant will be cared for in the approved nursery until the Lead Biologist considers orchid individuals ready for out-planting.

2.3.3 Orchid Transplant

Orchids determined to be ready for direct transplant will be transplanted by a Biologist and mounted to appropriate trees or other suitable hosts. Appropriate trees are in habitats that matched or were similar to the recorded data for the orchids and are prioritized for out-planting. Surveyed areas began with the areas with the densest populations of orchids in the transplanting area. Specific transplanting methods will be determined based upon the individual needs of the plant to maximize survivability of the specimen and orchids will be placed at least six feet above the ground to avoid ungulate damage. There are currently ungulates in both the salvage and outplanting areas.

Based upon the Lead Biologist's experience and study on the survivability of orchids in this specific habitat, orchids have the highest rate of survival within the tree canopy zone (**Figure 5**). As such, Biologists will transplant orchids in tree canopy zone locations that have been determined to have the highest rate of survivability based upon independent research and visual evidence. Specifically, if feasible Biologist will target the tree canopy zone C and D range per the attached illustration. Protective fences will be installed where necessary to facilitate survival of orchids.

The outplanting area (**Figure 6**) was identified as having *T. guamense* during previous surveys. The project team conducted a field assessment to identify suitable sites within the Forest Enhancement Area for transplanting the orchids based on environmental factors such as humidity, host tree, and height placement.

Areas with similar humidity and light levels to the donor/origin site will be prioritized for orchid transplant. When possible, orchids will be placed in areas where other orchids currently exist and on tree species historically successful in hosting orchids in this environment, thus demonstrating a higher likelihood of growth success. Orchids currently on native trees will be transplanted onto the same type of native tree. However, in order to achieve the 50% survival ratio of salvaged material, the Biologists may elect to transplant on to non-native hosts in order to increase survival. Orchids will only be transplanted to areas within the Forest Enhancement Area that already have existing orchids of the same species, which demonstrates that the environment is suitable for orchid growth. Tree species that were not observed with orchids on them in the salvage area will not be used for transplanting. Where orchids will be transplanted depends on the individual orchid needs at the time of salvage.

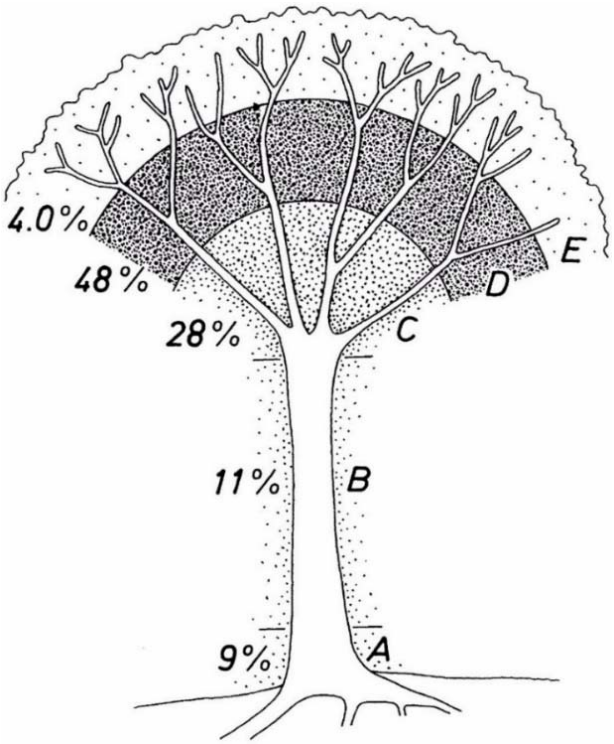

Figure 5. Diagram of Tree Canopy Zone

2.3.4 Transplant Equipment

Cycad transplant equipment includes the following:

- note pad with waterproof paper
- GPS
- digital camera
- soil
- water
- plastic coated guide wire
- rebar as staking material (only for direct transplant)
- backhoe (only for direct transplant)
- shovel, as needed
- shade cloth to protect cycad stem from direct sun
- gurney to transport cycad stem to nearly road
- vehicle to transport cycad stem to approved nursery.

Orchid transplant equipment includes the following:

- note pad with waterproof paper
- GPS
- digital camera
- water
- drill or hammer
- nails or screws
- chainsaw, as needed
- Sawzall (™), as needed
- compass
- ladders
- climber gear (harness, ropes, carabiners)
- eyehooks to provide an attachment point for the cut branch during transport
- metal transport racks
- transport vehicle.

2.4 Maintenance and Monitoring

Project team members will provide maintenance and monitoring for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint for the Utilities and Site Improvements Phase I (J-001B) for a period of 12 months.

2.4.1 Maintenance

Transplanted cycads will be maintained for one year by the Lead Biologist. Maintenance will include watering, as needed, and the removal of vines and/or encroaching competing plants. If ungulate damage is observed, a temporary fence structure will be placed around each cycad. Temporary fence will be installed in the event that the area is not fenced and ungulates are not suppressed at the time of outplanting.

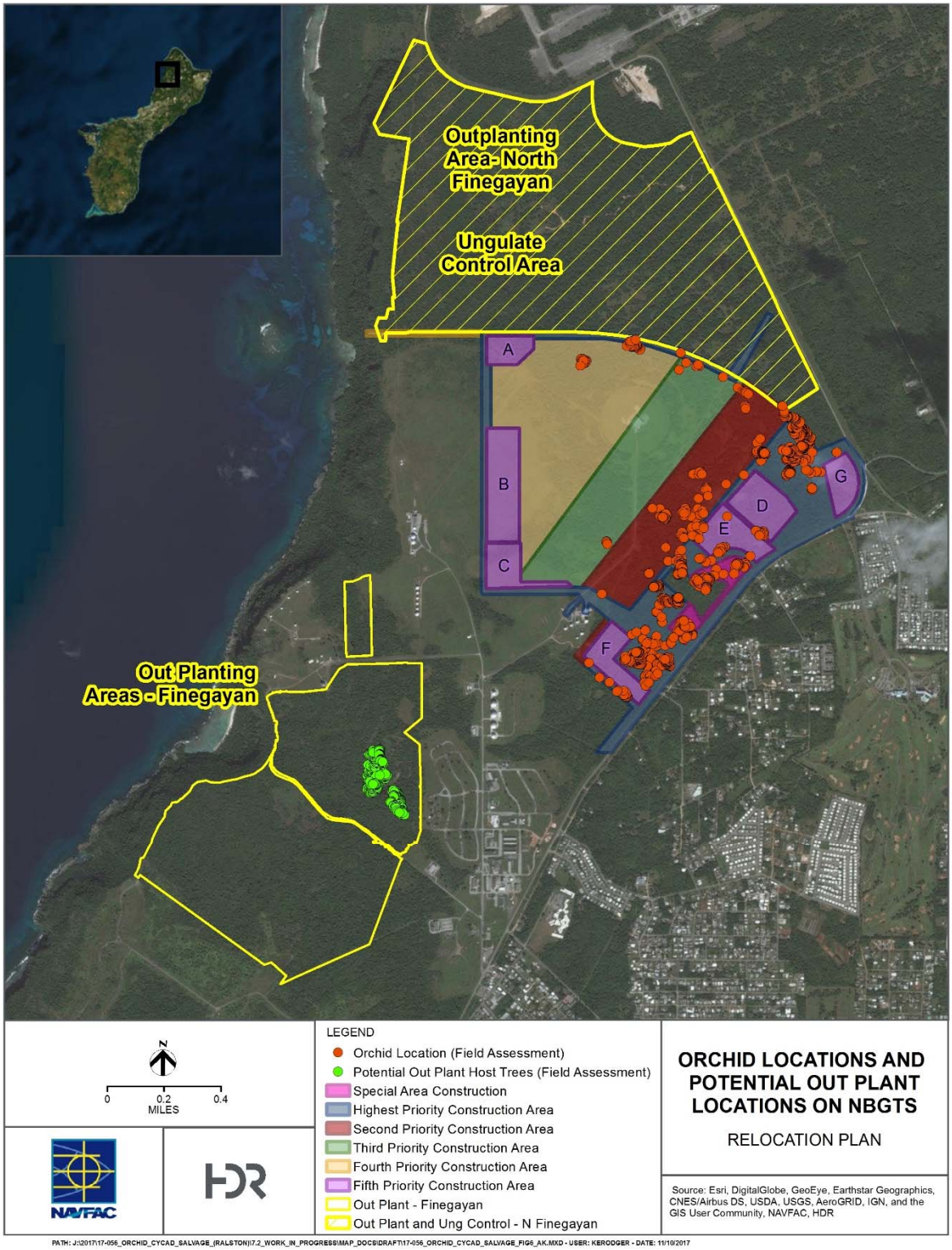

Figure 6. Map of Potential Orchid Transplant Locations

2.4.2 Monthly Monitoring

Transplanted cycads will be monitored monthly, or more frequently if deemed necessary, by the Lead Biologist. Cycads will be inspected for the presence of stress agents, such as cycad scale, ungulate damage, and general plant health. If stress agents are observed, the Lead Biologist will draft a recommended action plan for NAVFAC Pacific to remove or reduce the stress agent(s) affecting the cycads. If approved, the recommended action plan will be implemented. Monitoring records will be maintained for the duration of the project and included in the Draft and Final Reports.

The Biologists will provide regular and routine monitoring of orchids to ensure the minimum 50 percent survivorship PWS requirement is met and address any orchid health issues early on. Specifically, Biologists will inspect the orchid transplant site weekly for the first two months, bi-weekly for months three and four, and monthly thereafter (unless conditions warrant more frequent monitoring).

During monitoring walkthroughs, Biologists will inspect orchids within the transplant site to ensure individuals are not drying out and are growing or flowering. The transplant site will be monitored for pests and treated with approved pesticides, if necessary. Individual orchid records will be initiated if orchids appear stressed. Each individual orchid will be monitored and if it appears stressed it will be recorded. Monitoring records will be maintained for the duration of the project and included in the Draft and Final Reports.

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3. Data and Mapping

3.1 Salvage and Transplantation Success Results

Project team members will provide data and mapping for 5 *Cycas micronesica*, 5,000 *Tuberolabium guamense*, 20 *Dendrobium guamense*, and 70 *Bulbophyllum guamense* from within the J-001B project footprint at NBGTS with a minimum 50% survivability rate after twelve months of maintenance and monitoring.

3.1.1 Data

Federally listed plant data will include record, map and photo of all specimens removed; including identification codes associated with GPS coordinates for each plant, both for salvage and transplant. This information will include the data dictionary field information which will note the following:

Cycad data:

- species
- GPS location
- plant height at time of out-planting
- number of leaves
- photographs
- unique alphanumeric tag identifier

Orchid data:

- species
- GPS location
- height on tree
- directional orientation
- health of plant
- host tree
- unique alphanumeric tag identifier
- stage of life
- vigor
- reproductive status of the plant (whether it is vegetative, or has buds, flowers, or fruit)
- photographs

3.1.2 Mapping

Project team members will provide detailed maps and GIS layers which will include specific locations, including the data dictionary information for individual orchids, for all transplanted plant species.

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4. Schedule and Deliverables

4.1 Plan of Action and Milestones

The Plan of Action and Milestones (POAM) prepared for this Salvage and Transplantation Work Plan outlines the schedule of actions and deliverables for the project (**Table 4**). Successful execution of milestones and deadlines for deliverables is contingent upon adequate coordination, completing tasks on schedule, and timely review cycles. Project team members will adhere to the POAM schedule. Any revisions to the POAM that might arise during the project will be submitted for approval. “To be determined” dates are contingent upon Work Plan approval, approval of nursery facilities, and the construction schedule.

4.2 Meetings and Deliverables

4.2.1 Kick-off Meeting

A kick-off meeting between staff with NAVFAC Pacific, MCAG, HDR, LMS Inc. and WESMURPH Consulting was conducted on July 10, 2017. The purpose of the meeting was to discuss the direction and development of the project. A draft of the meeting minutes was submitted via email to the COR/NTR on July 14, 2017. Final meetings minutes were provided on July 25, 2017.

4.2.2 Final Salvage and Transplantation Work Plan

HDR will submit a Final Salvage and Transplantation Work Plan incorporating the comments received from the COR/NTR and other representatives. The Final Salvage and Transplantation Work Plan will be submitted within 10 days of receipt of comments. HDR will provide two hard copies and two digital copies on a compact disc (CD) of the Final Salvage and Transplantation Work Plan to the COR and Contract Specialist.

4.2.3 Monthly Progress Reports

Project team members will provide monthly progress reports that will detail incremental accomplishments throughout the project. These reports will contain: the project title, contractor name, contract and task order number, date of the report, work completed to-date (including a table showing dates of site visits or surveys, personnel attending each visit, findings, difficulties/problems encountered and resolutions, etc.), work proposed for the next reporting period, an approximate percentage of work completed and an updated POAM. The report period will cover the first through the last day of each month. Reports will be submitted on the fifth day of each month when work has been conducted.

4.2.4 Safety Plans (Accident Prevention Plan and Activity Hazard Analysis)

HDR prepared and submitted a draft Accident Prevention Plan and Hazard Analysis and Critical Control Point for Navy review and comments on July 21, 2017. The final Accident Prevention Plan and Activity Hazard Analysis was accepted on August 10, 2017.

Table 4. Plan of Action and Milestones for Salvage and Transplantation of Federally Listed Plant Species Identified Within the Footprint for the Utilities and Site Improvements Phase I (J-001B) at Naval Base Guam Telecommunication Site (NBGTS).

No.	Name	Duration	Start*	Finish
1	Kickoff Meeting	~2 hours	07/11/17	07/11/17
2	Submit Draft POAM	1 day	07/11/17	07/11/17
3	Prepare and Submit Kick-off Meeting Minutes and Final POAM	4 days	07/11/17	07/15/17
4	Contractor Personnel Training (UXO Safety, Cultural and Natural Resources, etc.)	1 day	08/02/17	08/02/17
5	Prepare and Submit Draft APP/AHA and Draft HACCP	10 days	07/11/17	07/21/17
6	Submit Updated Resumes for USFWS approval	30 days	07/12/17	08/11/17
7	Government Review of Draft APP/AHA and Draft HACCP	10 days	07/21/17	07/31/17
8	Prepare and Submit Final APP/AHA and Final HACCP	7 days	08/05/17	08/12/17
9	Field Assessment	~25 days	08/12/17	09/06/17
10	Prepare and Submit Draft Work Plan	~55 days	07/14/17	09/08/17
11	Government Review of Draft Work Plan	5 days	09/08/17	09/13/17
12	Prepare and Submit Final Work Plan	7 days	09/13/17	09/20/17
12.1	USFWS Review of Work Plan	8 days	09/26/17	10/03/17
12.2	Response to USFWS Work Plan Comments	5 days	10/03/17	10/08/17
12.3	Additional USFWS Work Plan Comments and Responses	5 days	10/08/17	10/13/17
12.4	Prepare and Submit Revised Work Plan	10 days	12/12/17	12/22/17
12.5	Government and USFWS Review of Work Plan	20 days	12/22/17	01/11/18
12.6	Prepare and Submit Final Work Plan	5 days	01/11/18	01/16/18
13	Fieldwork - Cycads***	~10 days	TBD	TBD
14	Pup Nursery Care	180 days	TBD	TBD
15	Cycad Out-planting	10 days	TBD	TBD
16	Maintenance and Monitoring - Cycads **	~1 year	TBD	TBD
17	Fieldwork - Orchids (All Priority Areas) ***	160 days	10/16/17	03/25/18
18	Maintenance and Monitoring - Orchids **	>1 year	10/16/17	03/25/19
19	Prepare and Submit Draft Report for Salvage and Transplanting of ESA-Listed Plants***	45 days	03/25/19	05/09/19
20	Government Review of Draft Report	30 days	05/09/19	06/08/19
21	Prepare and Submit Final Report for Salvage and Transplanting of ESA-Listed Plants	20 days	06/08/19	06/28/19
22	Prepare Monthly Progress Reports, Updated POAM & Monthly Invoices by the 5th of each	1 day	Monthly	Monthly

Note: current as of December 20, 2017; pending confirmation with the Navy
** all dates shown are for Guam*
***subject to change based on field assessment, need for in-field treatment prior to salvage and first transplantation.*
****subject to change based on actual number of orchids in each priority area*

4.2.5 Draft Report for Salvage and Transplantation of Cycads and Orchids

HDR will submit two electronic copies of the Draft Report on a CD and electronically via email. HDR will submit the report within 45 days of completing the final plant transplantation.

The report will include the following information:

- title page showing title, date, contact information
- sub-title page showing title, prepared by listing, prepared for listing, date and recommended citation
- table of contents
- introduction (including background information)
- record, map and photo of all specimens removed, including identification codes associated with GPS coordinates from construction site, in addition to GPS coordinates and maps of each new cycad and orchid relocation site
- synopsis of insect treatments and efficacy results for each cycad
- synopsis of cycad and orchid selection and prioritization for transplantation
- synopsis of cycad and orchid survival and condition for each specimen
- synopsis of out planting, husbandry, and monitoring methods
- a master schedule of all project events
- summary and recommendations.

4.2.6 Final Report for Salvage and Transplantation of Cycads and Orchids

HDR will submit five hard copy and two electronic versions of the Final Report on a CD. HDR will submit the report within 20 days of receipt of comments from the COR. The Final Report will be submitted in Microsoft Word and Portable Document Format (PDF). The PDF file will be 10 megabytes or less in order to be sent via electronic mail to requesting entities. In addition, HDR will provide all figures, graphics, and geographic information system (GIS) data layers used in the report as separately labeled files. The electronic files will be delivered on a CD.

4.2.7 Comment Matrix

HDR will provide a blank Comment Response Matrix to the Navy on all reports to facilitate tracking comments. HDR will incorporate all comments into a single matrix. The comment matrix will identify how each comment was addressed by HDR and where in the document the corrections are to be found. The comment response matrix will be provided with each report submission.

4.2.8 GIS Data Products

Project team members will provide GIS data and maps for all salvage and transplant areas. All points will be taken with hand-held global positioning system units using World Geodetic System

1984 55N and projection provided in Universal Transverse Mercator projection, the above zone, and in meters. Digital GIS data will be submitted using ArcGIS 10 or later software. If later software is used it will be backwards compatible with ArcGIS 10. GPS equipment used to record transplant locations will be able to achieve 1 centimeter accuracy at 1 sigma, but the actual error allowed will be no more than 1 meter at any recorded position. Every effort shall be made to capture feature locations without using offsets unless obstructions are present. Data sets derived from GPS data collection efforts shall include metadata to record descriptions of the receiver and other equipment used during collection and processing, base stations used for differential corrections, software used for performing differential corrections, estimated horizontal and vertical accuracies obtained, and conversion routines used to translate the data into final geographic data delivery format.

Geographic data will be provided in a form that does not require translation, preprocessing, or post processing. Final digital geographic maps and the related data sets will be delivered in a Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) compliant file geodatabase format, and be in a structure consistent with the most current version of the SDSFIE. The SDSFIE format shall follow geospatial database table structure, nomenclature, and attributes.

PDF copies of all maps associated with the GIS data for this project will be provided to the Navy. All constructed maps will have the associated ArcMap Document File (MXD) delivered to allow for future printing and modification. MXDs shall use the relative paths option or layer packages. The Table of Contents within the MXD shall be orderly and contain a logical naming structure. Metadata will be included in the final GIS deliverable and will be populated to meet basic data population standards as identified in the ESRI standard template. Additional data shall be provided as appropriate, including, at a minimum:

- the name and description of the data set or layer,
- the source of the data and any related data quality information such as accuracy and time period of content,
- description of the data collection method or survey protocols used; a report citation can suffice,
- description of the equipment or instruments used in the data collection,
- scientific names of the federally listed species to populate in the attribute tables,
- definitions of codes used in the data fields in the appropriate attribute definitions,
- description of ranges of numeric fields and the meaning of numeric ranges,
- definition of fields and attributes not in SDSFIE in the attribute definitions,
- removal of spatial duplicates from GIS data, and
- a point of contact to answer to technical questions.

4.2.9 Maps

All map layouts and data display properties will be created using standard mapping procedures unless specific direction is provided by the Navy. Map layouts will include the following elements:

- north arrow
- scale bar and scale text
- legend
- title
- overview map
- map data
- projection and coordinate system information
- Navy-supplied logos
- HDR
- disclaimer information.

Changes to the map layouts will be made after the first round of comments are provided in the Draft Report.

4.2.10 Annual Reporting to USFWS

USFWS recovery permits require annual reporting that must be submitted to the Recovery Permit Coordinator by January 31 of each year the permit is active. The Annual Report will follow the requirements provided in Subpermit FWSPIFWO-26.

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5. Access and Pass Requests

5.1 Access and Pass Requests

HDR staff and subcontractors will have a valid DBIDS pass with current access to NBGTS and AAFB for access to the project site. A camera pass was requested by subcontractors on September 1, 2017, from Joe Cruz at the NBG Security Department Visitor Control Center.

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6. Points of Contact

Name	Position/Company	Email	Telephone Number
Nicole Olmsted	Natural Resource Specialist NAVFAC Pacific	Nicole.M.Olmsted1@navy.mil	808-472-1475
Coralie Cobb	NAVFAC SW, Alternate Contracting Officer's Representative	Coralie.Cobb@navy.mil	720-542-3085
Cris Caraang	Contract Specialist NAVFAC Pacific	Cris.Caraang@navy.mil	808-471-0130
Christiana Quinata	MCAG, Installation Contact	ChristianaJo.Quinat@fe.navy.mil	671-355-3420
Lauren Gutierrez	MCAG, Installation Contact	Lauren.Gutierrez@fe.navy.mil	671-355-8050
Rebecca Ralston	Project Manager/Biologist HDR	Rebecca.Ralston@hdrinc.com	303-754-4265
Dustin Janeke	HDR QA Lead	Dustin.Janeke@hdrinc.com	858-712-8268

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7. References

De et al. 2013	De, K.K., S. Majumdar, R. Sharma and B. Sharma. 2013. Green Pod Culture and Rapid Micropropagation of Dendrobium chrysanthum Wall. Folia Hort. 25/2 (2013): 169
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Marler and Cruz 2017	Adventitious rooting of mature *Cycas micronesica* K.D. Hill tree stem reveals moderate success for salvage of endangered cycad. Available at: <http://threatenedtaxa.org/index.php/JoTT/article/view/3523/4134>
Martinez-Falero, and Gonzalez-Alonso 1995	Martinez-Falero E and Gonzalez-Alonso, S.E. 1995. Quantitative Techniques in Landscape Planning. Lewis, New York.
Turner, Gardner and O'Neill 2001	Turner MG, RH Gardner, and RV O'Neill. 2001. Landscape Ecology in Theory and Practice: Pattern and Process. Springer, New York.
Van Der Pijil and Dodson 1966	Van Der Pijl L. and Dodson, C.H. 1966. Orchid Flowers Their Pollination and Evolution. University of Miami Press, Coral Gables.
Wells and Williams 1991	Wells, T.C.E. & Willems, J.H. 1991. Population Ecology of Terrestrial Orchids. SPB Academic, The Hague.
Withner 1988	Withner, C.L. 1988. The Orchids: A Scientific Survey. Krieger Pub Co.

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January 31, 2019

United States Fish and Wildlife Service (USFWS)
Pacific Islands Fish and Wildlife Office (PIFWO):
FW1PIE_RecPermitAnnRpt@fws.gov
Pacific Regional Office (PRO):
permitsR1ES@fws.gov

Attn: Recovery Permit Coordinators
Subject: 2018 Annual Report for Recovery Permit TE78730C-0

Recovery Permit Number: TE78730C-0 (Permit) dated August 3, 2018 was issued under the authority of section 10(a)(l)(A) of the ESA and its implementing regulations at 50 Code of Federal Regulations (CFR). As required under number 2(c) of the terms and conditions of the Permit, the following permittee is submitting this annual summary report for activities conducted under the Permit in 2018.

- Robert Wescom

Mr. Wescom is authorized to purposefully remove/reduce to possession the following federally listed plant species from lands under Federal jurisdiction in conjunction with the following authorized activities for scientific purposes or to enhance the recovery, survival, and propagation of the species as specified in the permittee's February 19, 2018, recovery permit application, in accordance with the Permit's Special Terms and Conditions.

Species [Common and (Scientific) Name]	Federal Status	Authorized Activities
Heritiera longipetiolata (ufa halomtano)	Endangered	Conduct ESA compliance contractual activities and salvage
Cycas micronesica (fading), and *Tabernaemontana rotensis* (no common name)	Threatened	Conduct ESA compliance contractual activities and salvage

Introduction

Authorized activities in 2018 took place within Andersen South, AAFB in northeast Guam (**Figure 1**). The primary objective of this project is to provide salvage and transplanting services for federally listed plants found within the Urban Combat Training Area at Andersen South.

For this project, the permittee is contracted under Naval Facilities Engineering Command (NAVFAC) Pacific contract N62742-15-R-1804, task order N6274218F0113 to provide the following service:

- Perform a field assessment of the previously recorded plant locations and condition of

plant species to determine salvage and transplant methods.

- Salvage 27 *C. micronesica*, 23 *T. rotensis* (seeds) from within the J-755 project footprint.
- Transplant salvaged plants to a Navy-approved location.
- Provide one year of plant maintenance and monitoring of adult *C. micronesica* after transplantation, and
- Provide up to 18 months of maintenance and monitoring for *C. micronesica* pups at a Navy-approved nursery, and
- Provide up to 90 days of storage of *T. rotensis* seeds.
- The Navy did not record the location of any *H. longipetiolata* within the J-755 footprint; therefore, no field assessment was conducted for this species.

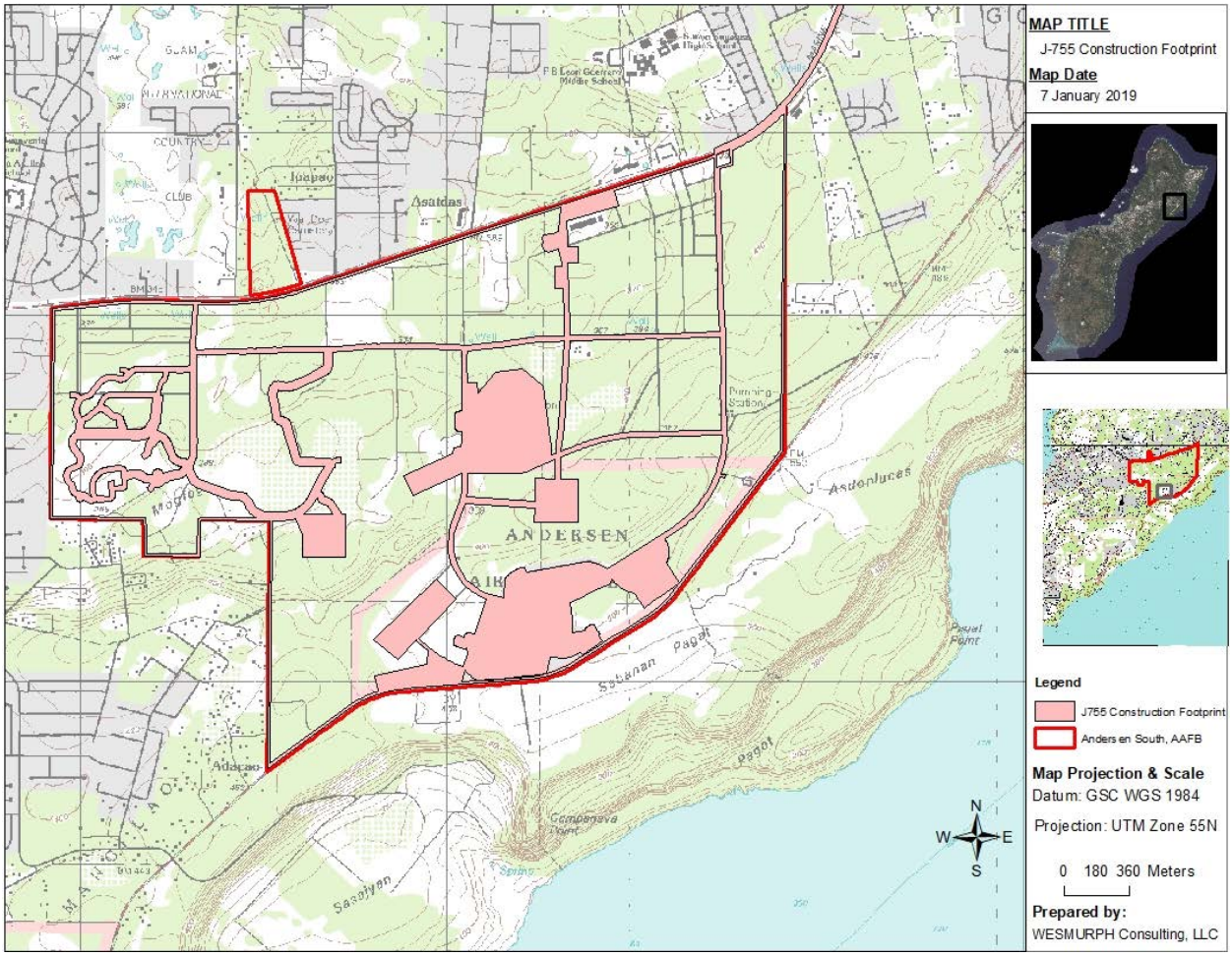

Figure 1. J-755 Construction Footprint.

Methods

The methods used for the field assessment and anticipated for use for plant salvage and transplanting are described in detail in the draft Plant Salvage and Transplantation Work Plan.

Initial Field Assessment Results

Field Assessment and Population Analysis

The permittee conducted a field assessment in July 2018 using Navy-provided GPS data (data points) to locate and determine the health and most viable salvage options for 27 *C. micronesica* and seed collection from 23 *T. rotensis* within the J-755 footprint (**Figure 2a, 2b, 2c, 2d**). The field assessment included the following steps:

- Conduct a site visit to identify specimens for salvage and transplant, including assessing the condition of *C. micronesica* and seed availability of *T. rotensis*
- Record the location of all plants with GPS
- Assess salvage, transplant, and seed collection methods

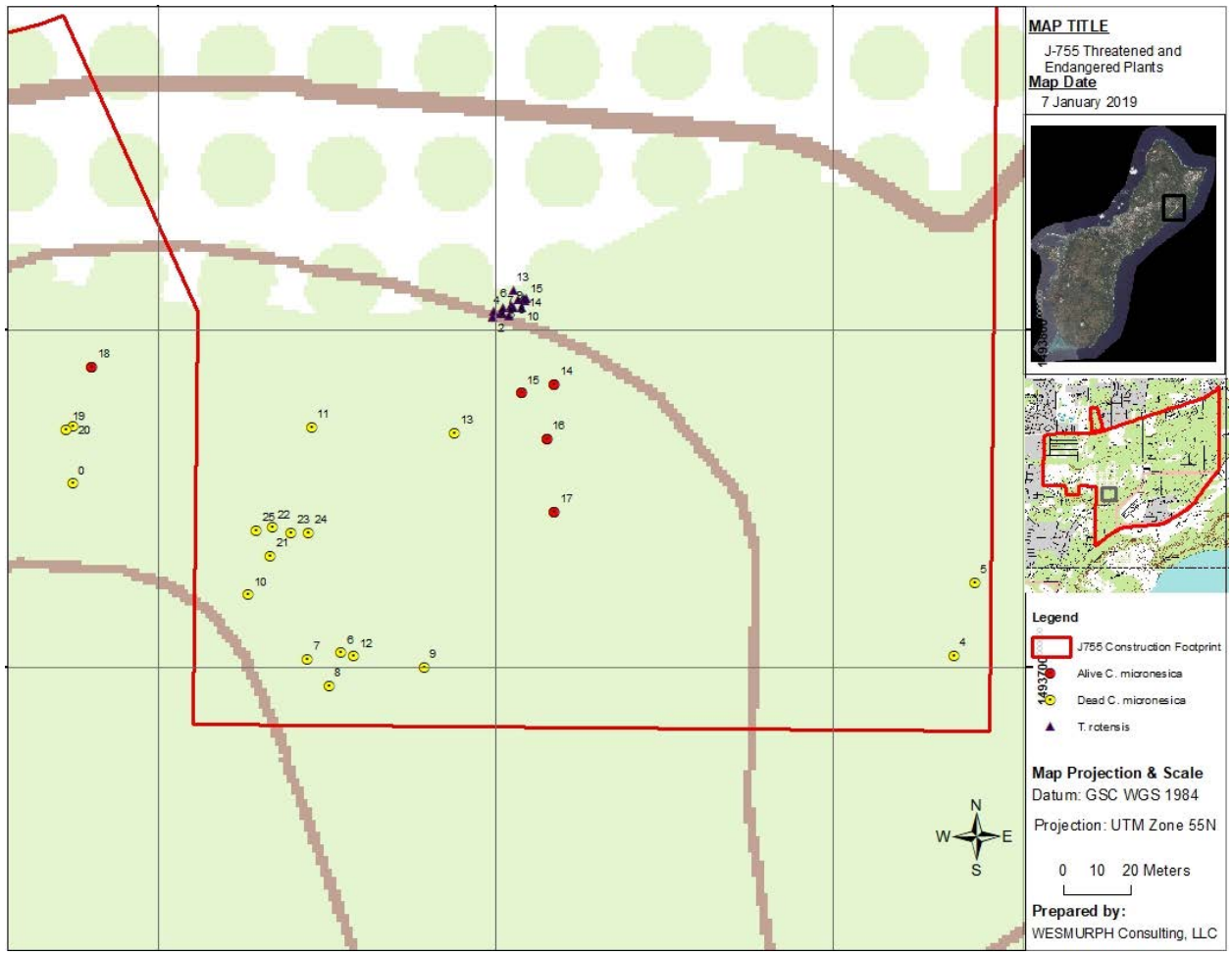

Figure 2a. Location of *C. micronesica* and *T. rotensis* in western footprint of J-755.

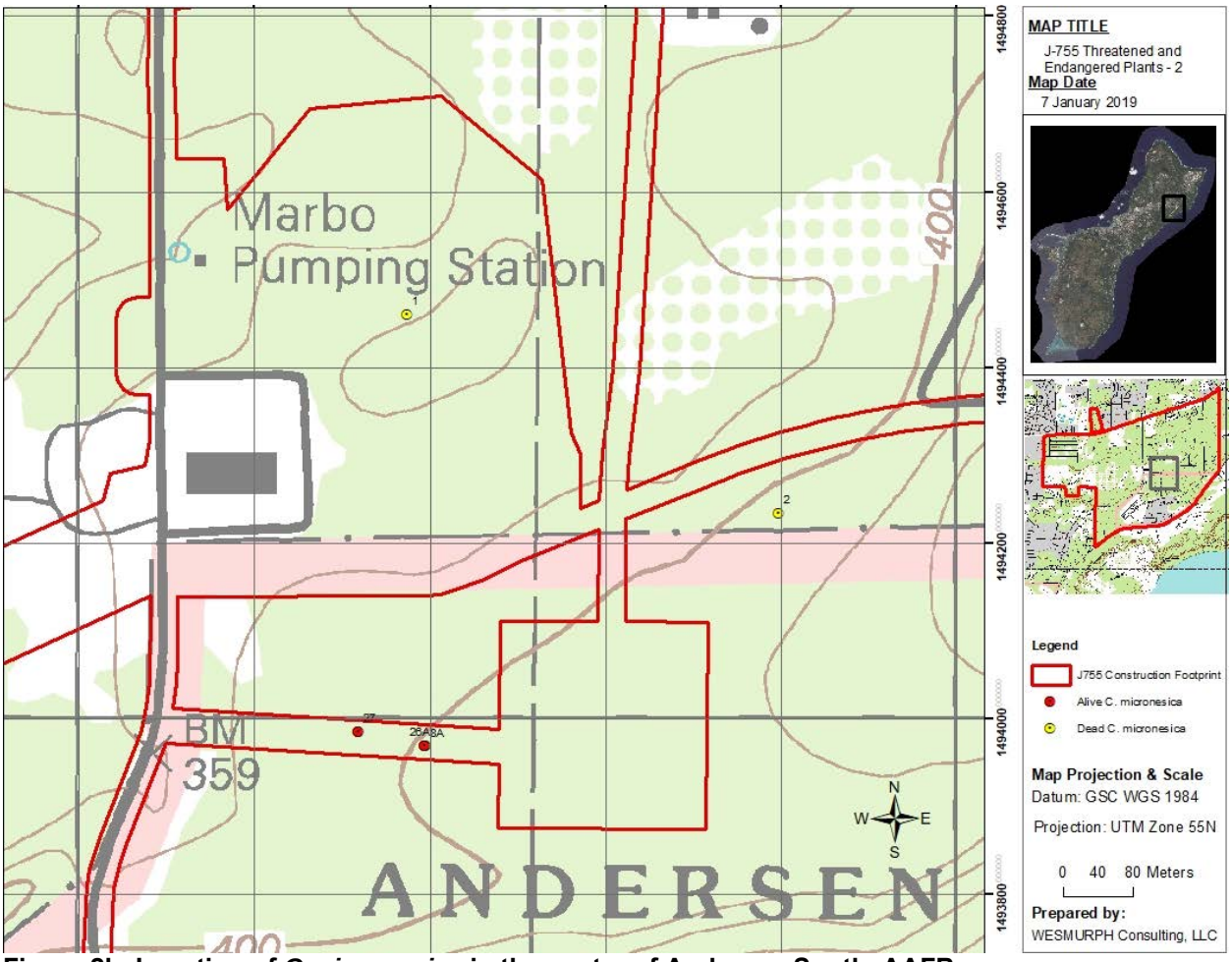

Figure 2b. Location of *C.micronesica* in the center of Andersen South, AAFB.

The field assessment for *C. micronesica* determined which individuals potentially could be salvaged by inspecting the exterior stems of each *C. micronesica* for termite damage, visible rot, presence of cycad scale, or other pests, including little fire ant. The following data were recorded for each *C. micronesica* during the field assessment:

- GPS location (UTM WGS84 Zone 55N)
- Health assessment rating signs of termite, cycad scale, cycad butterfly damage, and little fire ant signs of exterior rot,
- Number of pups present
- Digital photographs of each *C. micronesica*.

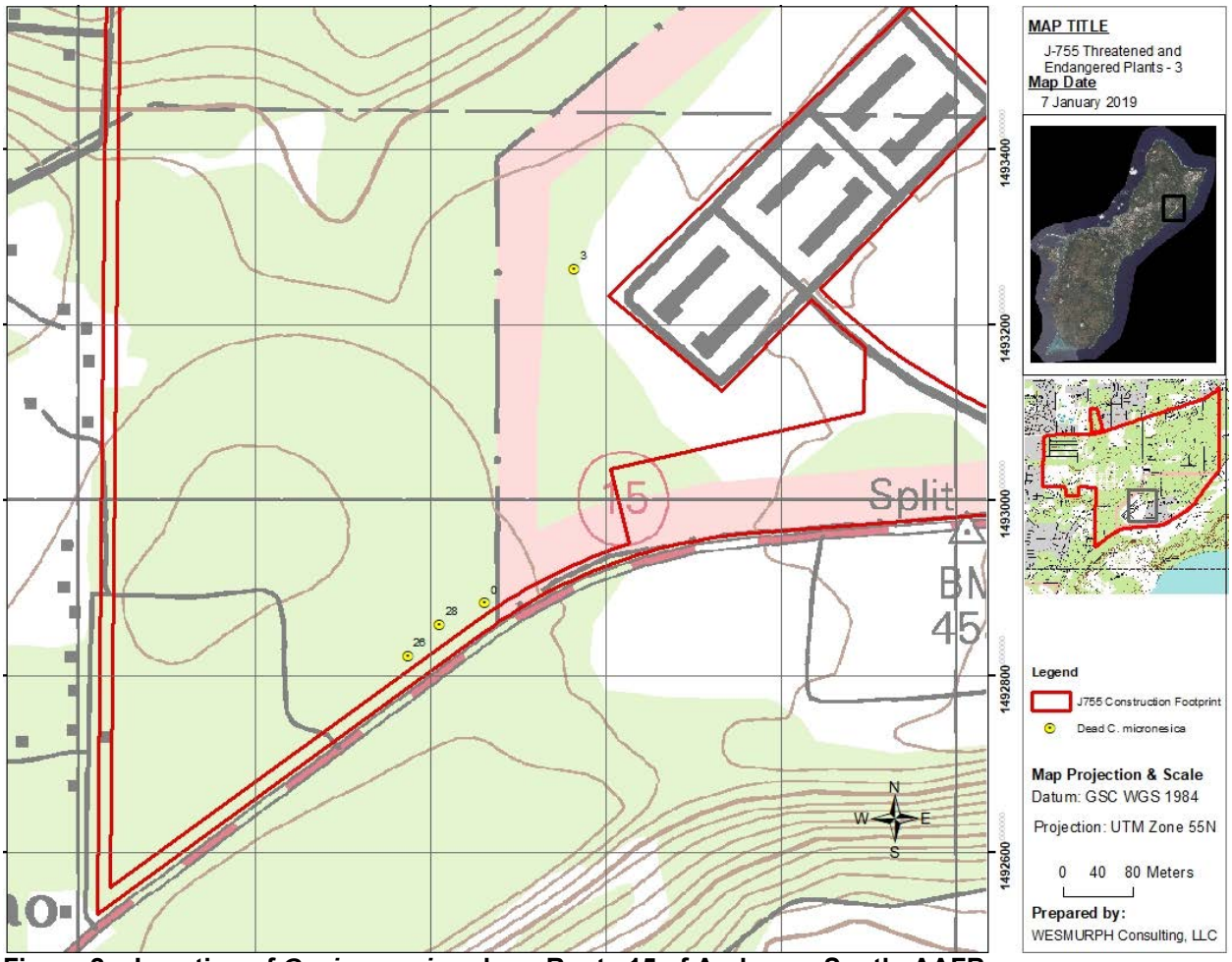

Figure 2c. Location of *C.micronesica* along Route 15 of Andersen South, AAFB.

A total of 27 previously identified *C. micronesica* were located and assessed and an additional five (5) *C. micronesica* were identified and assessed during the course of the fieldwork. Only seven (7) of the 32 assessed *C. micronesica* plants are deemed potentially salvageable with a "Good" or 'Fair" health rating (**Table 1**).

Table 1. *C. micronesica* Health Assessment Summary

Health Rating	Count	Percentage
Good	2	6.3%
Fair	5	15.6%
Poor	1	3.1%
Very Poor	2	6.3%
Dead	22	68.8%
Total	32	100.0%

Recommendations for each tree are included in **Table 2.**

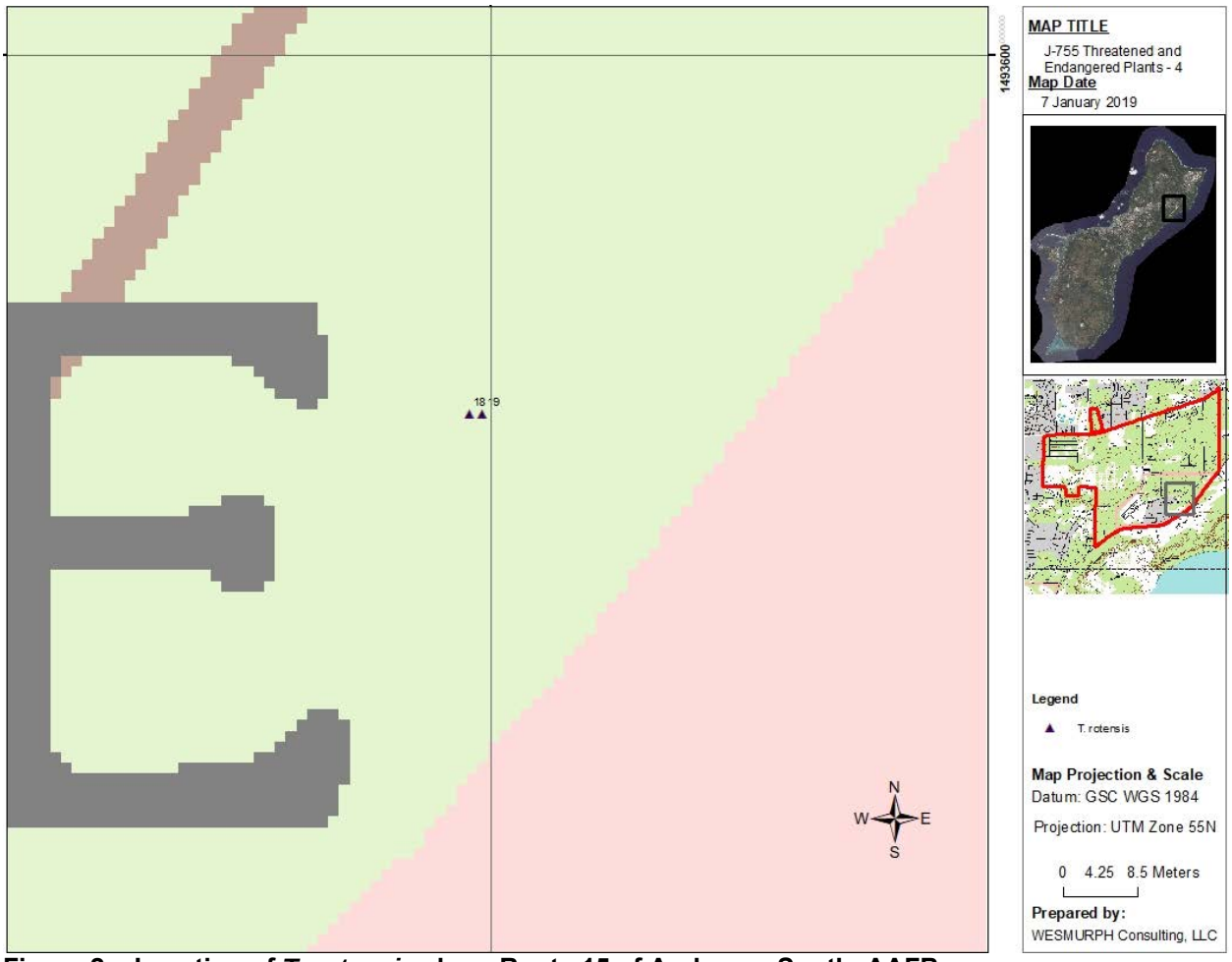

Figure 2c. Location of *T. rotensis* along Route 15 of Andersen South, AAFB.

Table 2. *C. micronesica* Assessment and Salvage Recommendations

ID	Easting	Northing	Health Assessment	Salvage Recommendation
0*	268174.44	1493754.59	Dead	Not salvageable
0*	268462.67	1492883.79	Dead	Not salvageable
1	269374.19	1494460.67	Dead	Not salvageable
2	269797.65	1494234.57	Dead	Decomposed; Not salvageable
3	268564.65	1493264.07	Dead	Recently dead; Not salvageable
4	268435.98	1493703.47	Dead	Not salvageable
5	268442.11	1493725.28	Dead	Leaning over; Not salvageable
6	268254.17	1493704.43	Dead	Fallen over; Not salvageable
7	268244.16	1493702.53	Dead	Not salvageable
8	268250.46	1493694.65	Dead	Rotten; Not salvageable
8A	269395.76	1493969.18	Dead	Not salvageable
9	268278.79	1493700.09	Dead	Decomposed stump only; Not salvageable
10	268226.67	1493721.54	Dead	Not salvageable
11	268245.45	1493771.23	Dead	Not salvageable
12	268257.99	1493703.35	Dead	Not salvageable

13	268287.87	1493769.65	Dead	Not salvageable
14	268317.42	1493783.96	Fair	2 stems; 5 meters in height so stem is too large to move intact; therefore, after felling only the top meter of the stems should be salvaged
15	268307.68	1493781.46	Fair	4 meters in height so stem is too large to move intact; therefore, after felling only the top meter of the stem should to salvaged
16	268315.19	1493767.91	Fair	4.5 meters in height so stem is too large to move intact; therefore, after felling only the top meter of the stem should be salvaged
17	268317.38	1493746.13	Good	Salvageable
18	268180.13	1493789.15	Fair	4 meters in height so stem is too large to move intact; therefore, after felling only the top meter of the stem should to salvaged. **Note: This *C. micronesica* appears to be outside the J-755 construction footprint.**
19	268172.58	1493770.59	Dead	Not salvageable
20	268174.54	1493771.40	Poor	Low probability of survivorship if salvaged; Not recommended for salvage
21	268233.11	1493733.05	Dead	Not salvageable
22	268233.74	1493741.46	Very Poor	Low probability of survivorship if salvaged; Not recommended for salvage
23	268239.40	1493739.95	Dead	Not salvageable
24	268244.47	1493740.01	Dead	Decomposed stump only; Not salvageable
25	268229.04	1493740.73	Very Poor	Low probability of survivorship if salvaged; Not recommended for salvage
26	268374.25	1492823.66	Dead	Not salvageable
26A	269394.53	1493970.03	Good	2 meters in height; therefore, the entire stem can be salvaged. Note: This tree was not on the Navy's original list.
27	269318.50	1493985.47	Fair	3.5 meters in height; therefore, the top meter of the stem can be salvaged. Note: This tree was not on the Navy's original list.
28	268410.67	1492858.87	Dead	Not salvageable

Trees ID'ed as "0" were not previously surveyed by the Navy and are not salvageable.

The field assessment for *T. rotensis* determined which of the trees may be available for seed collection by inspecting the vitality of the tree and its seed production. The following data were recorded for each tree during the field assessment:

- GPS location (UTM WGS84 Zone 55N)
- Diameter at breast height (DBH)

- Maturity assessment (and whether the tree is producing seed)
- Signs of disease or damage
- Digital photographs of each tree

The coordinates of 23 *T. rotensis* were provided by the Navy, and of those, a total of 19 trees were located and assessed. The maturity of those trees was recorded to evaluate whether the tree was expected to produce seed. Results of the maturity assessment are shown in **Table 3**.

Table 3. *T. rotensis* Maturity Assessment

Rating	Count
Seedlings (<2.5 cm)	11
Saplings (>2.5 cm and < 5 cm)	4
Adult (> 5 cm)	4
Total	19

The results of the assessment of each individual tree are displayed in **Table 4**. No flowering or seeds were observed on any of the located *T. rotensis* trees. The majority of the *T. rotensis* trees is within a 10-meter radius and were either seedlings or saplings.

Table 4. *T. rotensis* Assessment and Seed Collection Recommendations

ID	Coordinates		DBH (cm)	Maturity	Seed Collection Recommendation
	Easting	Northing			
1	268303.97	1493804.28	25	Adult	Monitor monthly
2	268299.12	1493803.88	1	Seedling	Monitor monthly
3	268299.40	1493805.67	2.5	Seedling	Monitor monthly
4	268301.45	1493804.96	1.5	Seedling	Monitor monthly
5	268302.11	1493806.67	2	Seedling	Monitor monthly
6	268304.58	1493807.19	5	Sapling	Monitor monthly
7	268301.86	1493804.98	3	Sapling	Monitor monthly
8	268305.30	1493806.72	2	Seedling	Monitor monthly
9	268304.69	1493806.51	20	Adult	Monitor monthly
10	268307.83	1493806.49	10	Adult	Monitor monthly
11	268309.18	1493809.53	3.5	Sapling	Monitor monthly
12	268306.52	1493809.01	1.5	Seedling	Monitor monthly
13	268305.40	1493811.83	4	Sapling	Monitor monthly
14	268308.26	1493809.22	2	Seedling	Monitor monthly
15	268308.76	1493808.57	2	Seedling	Monitor monthly
16	NA	NA	1	Seedling	Monitor monthly
17	NA	NA	1	Seedling	Monitor monthly
18	270197.60	1493559.11	10	Adult	Monitor monthly
19	270199.01	1493559.11	1	Seedling	Monitor monthly

Salvage, Transplant, and Monitoring

No *C. micronesica* individuals were salvaged and transplanted, no *H. longipetiolata* individuals were salvaged and transplanted, and no *T. rotensis* seed were collected in 2018 as summarized in **Table 5**.

Table 5. Summary of Listed Plant Species Salvaged in 2018

Plant Species	Salvaged Plants or Seeds Collected	Transplanted or Seed Germinated
C. micronesica	0	0
H. longipetiolata	0	0
T. rotensis	0	0

Other Authorized Activities

No propagation of *C. micronesica, H. longipetiolata,* or *T. rotensis* from the J-755 project site took place in 2018. No additional propagules, vegetative samples, vouchers, or tissues samples were collected as summarized in **Table 6**. Additionally, no individual plants were damaged or destroyed.

Table 6. Summary of Other Activity with Authorized Plant Species in 2018

Plant Species	Number of Propagules Collected	Number of Vegetative Samples Collected	Number of Herbarium Vouchers Collected	Number of Tissue Samples Collected	Number of Plants Damaged or Destroyed
Cycas micronesica	0	0	0	0	0
H. longipetiolata	0	0	0	0	0
T. rotensis	0	0	0	0	0

Further, no genetic testing was performed on any individuals salvaged or transplanted in 2018.

Unintentional Takes

As summarized in **Table 7** no other federally listed plant or wildlife species were subject to unintentional takes in 2018.

Table 7. Summary of Unintentional Takes of other federally listed species in 2018

Plant Species	Number of Individuals Salvaged	Number of Individuals Injured or Killed	Date Taken	Location (Coordinates)	Outcome
Other Plants and Wildlife	0	0	N/A	N/A	N/A

Further, no genetic testing was performed on any individuals salvaged or transplanted in 2018.

Conclusions

Other pertinent observations made regarding the status or ecology of the species in 2018 include:

- In addition to the 27 Navy identified *C. micronesica* within the Andersen South, AAFB another five (5) *C. micronesica* were located by the permittee; however, of the total 32 *C. micronesica*, only 10 *C. micronesica* were living with seven (7) of the 10 trees having a health rating of fair and above. This suggests a rapid mortality rate (approximately 70%) of the identified *C micronesica* within Andersen South, AAFB. **Note: *C. micronesica* 18 appears on the map to be outside the J-755 construction footprint**. Cycad aulacaspis scale (*Aulacaspis yasumatsui*) is considered the primary cause of the high mortality.
- The few living *C. micronesica* are inaccessible via vehicle due to distance and terrain from roads; therefore, only apical cuttings (of approximately one meter) and salvage of *C. micronesica* pups is deemed feasible.
- The great majority of *T. rotensis* (approximately 90%) are rated as immature (e.g. seedling or saplings), which are unlikely to flower and produce viable seed. Historically, *T. rotensis* flower and seed following a stress event, such as, defoliation caused by high wind events (e.g. typhoons). Artificially induced stress could potentially accelerate flowering and therefore; seed production.
- No cycad blue butterfly (*Chilades pandava*) insects or damage was observed on any of the few living *C. micronesica* plants.

Under the Permit the authorized individual is planning to conduct the following activities in 2019:

- Salvage and nursery propagation of living *C. micronesica* within the J-755 footprint for eventual outplanting of newly rooted *C. micronesica*.
- Monthly monitoring of *T. rotensis* for the presence of flowers and seed.
- No *H. longipetiolata* have been identified within the J-755 footprint; therefore, no salvage of *H. longipetiolata* is anticipated in 2019.

Please contact Robert Wescom by email at wesmurph@outlook.com or by telephone at 671-486-6119 should you have any questions or concerns regarding this report.

January 31, 2019

United States Fish and Wildlife Service (USFWS)
Pacific Islands Fish and Wildlife Office (PIFWO):
FW1PIE_RecPermitAnnRpt@fws.gov
Pacific Regional Office (PRO):
permitsR1ES@fws.gov

Attn: Recovery Permit Coordinators

Subject: 2018 Annual Report for Recovery Permit TE78405C-0

On July 19, 2018, the Guam Plant Extinction Prevention Program ("GPEPP") of the University of Guam ("UOG") was issued the Endangered Species Act (ESA) recovery permit TE78405C-0 under the authority of section 10(a)(1)(A) of the ESA and its implementing regulations. As required under number four (4) of the terms and conditions of the Permit, the following individuals are submitting this annual summary report for the activities conducted under the Territory of Guam (Guam) in 2018:

- Dr. James McConnell, Mario Martinez, Gregorio Borja, Jonathan Davis, Cyann Valera, John Horeg, Jason Andrew, and Rowena Mendi

These individuals are authorized to independently conduct all activities under the attached NAVFAC Work Plan, and agreed on revisions, for the salvage and transplantation of *Tuberolabium guamense* on Guam.

Introduction

Authorized activities in 2018 took place within the P-102 Power Upgrade, from Harmon to Andersen Airforce Base (AAFB), on Guam (**Figure 1**). The primary objective of this project is to provide salvage and transplanting services for federally listed plants found along the P-102 Power Upgrade.

For this project, GPEPP was contracted under the Naval facilities Engineering Command (NAVFAC) Pacific under Contract No. N62742-15-D-1825, under the Contract Task Order (CTO) N62742-18-F-0114 to provide the following services:

- Perform field assessment of the location and condition of the federally listed plant species to determine the salvage and transplant methods.
- Salvage 98 *Tuberolabium guamense* from within the P-102 project footprint.
- Transplant salvaged plants to a government-approved location.
- Provide one-year of maintenance and monitoring after transplantation.

Orchid salvage occurred within the P-102 project footprint areas, and orchid transplant occurred in the Forest Enhancement Area within the Naval Base Guam Telecommunications Site (NBGTS) (**Figure 2**).

Methods

The methods used for the field assessment, plant salvage, and transplanting are described in detail in the attached Preliminary Final NAVFAC Work Plan, dated August 2018 (**Attachment 1**). The Work Plan was reviewed by USFWS staff on October 03, 2018 and responses to comments were submitted by the Navy mid-October. The Work Plan was conditionally approved on October 26, 2018 with a change in methodology by choosing only native tree species as the host tree recipients for the orchids, as opposed to the *Vitex parviflora* described in the attached Work Plan.

Results

Field Assessment and Population Analysis

As described in **Attachment 1**, the field assessment began on May 14, 2018 and was completed on May 30, 2018. The field assessment included the following steps: 1) Conduct a site visit to identify the healthy orchid species for salvage and transplant using government-provided GIS coordinates, 2) Tag or label all host trees in the project footprint and assign them with a unique alphanumeric identifier, 3) Record species and the number of orchids on each host tree, and 4) Record any new host trees with other orchid species.

The field assessment surveyed along 15-meter transects based on Navy-provided transects from a previous survey. Surveyors systematically located previously identified host trees and recorded the number of orchids on each tree as well as any new host trees with orchids.

A total of 178 orchids were found at the P-102 project footprint. A total of 100 orchids will be salvaged. The *Tuberolabium guamense* were found mostly on *Vitex parviflora* host trees (98%). **Table 1** and **Table 2** contains a summary of plant data from the field assessment broken down by host tree species and maturity.

Table 1. Orchid Assessment during initial site visit

Species	Mature	Seedlings	Total
Tuberolabium guamense	98	80	**178**

Table 2. Salvage Host Trees by Species

Species	Number
Vitex parviflora	40
Morinda citrifolia	1
Leucaena leucocephala	1
Total	**42**

Salvage, Transplant, and Monitoring

In total 100 authorized plant individuals were salvaged and transplanted in 2018, which consisted of 82 mature *Tuberolabium guamense* and 19 seedlings. The salvage and transplant activities took place during October 29, 2018 to October 30, 2018.

Table 3. *Tuberolabium guamense* Recipient Tree and Maturity Level

Recipient Host Tree Species		Mature	Seedling	Total
EURE	*Eugenia reinwardtiana*	24	6	30
PATE	*Pandanus tectorius*	0	5	5
PROB	*Premna obtusifolia*	10	0	10
NEOP	*Ochrosia oppositifolia*	28	7	35
GUMA	*Meiogyne cylindrocarpa*	20	0	20
Total		82	18	***100***

A change in the PWS ordered the use of only native host tree species to Guam as the recipient host tree for the salvaged orchids. A total of 19 new recipient trees from five (5) different species of native host trees were identified on November 08, 2018 in lieu of the *Vitex parviflora.* **Table 3** lists the number of salvaged and transplanted individuals by their native recipient host tree species.

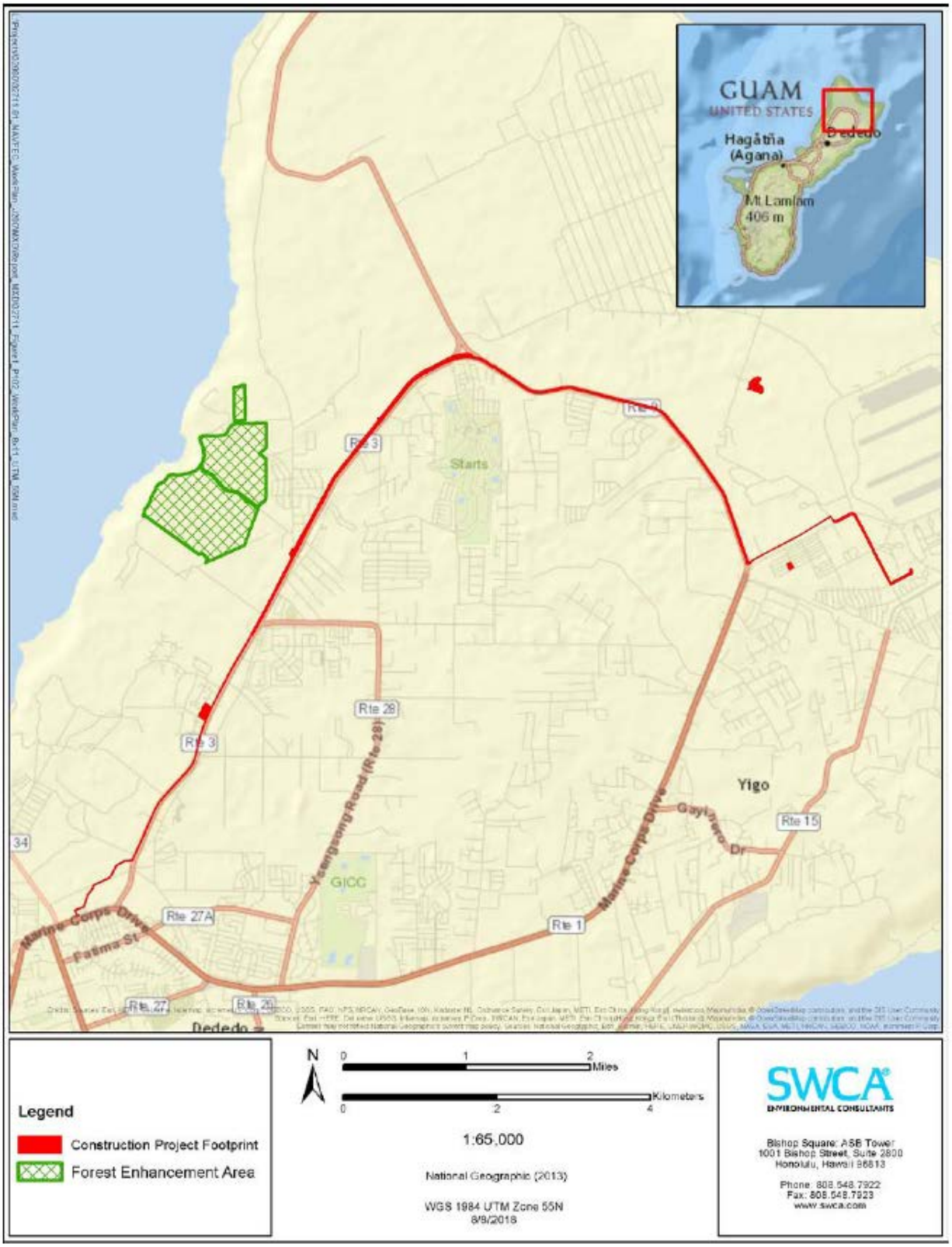

Figure 1. Project Location of P-102 Power Upgrade Harmon and Out-planting Location

Figure 2. Map of Orchids at the Salvage Location

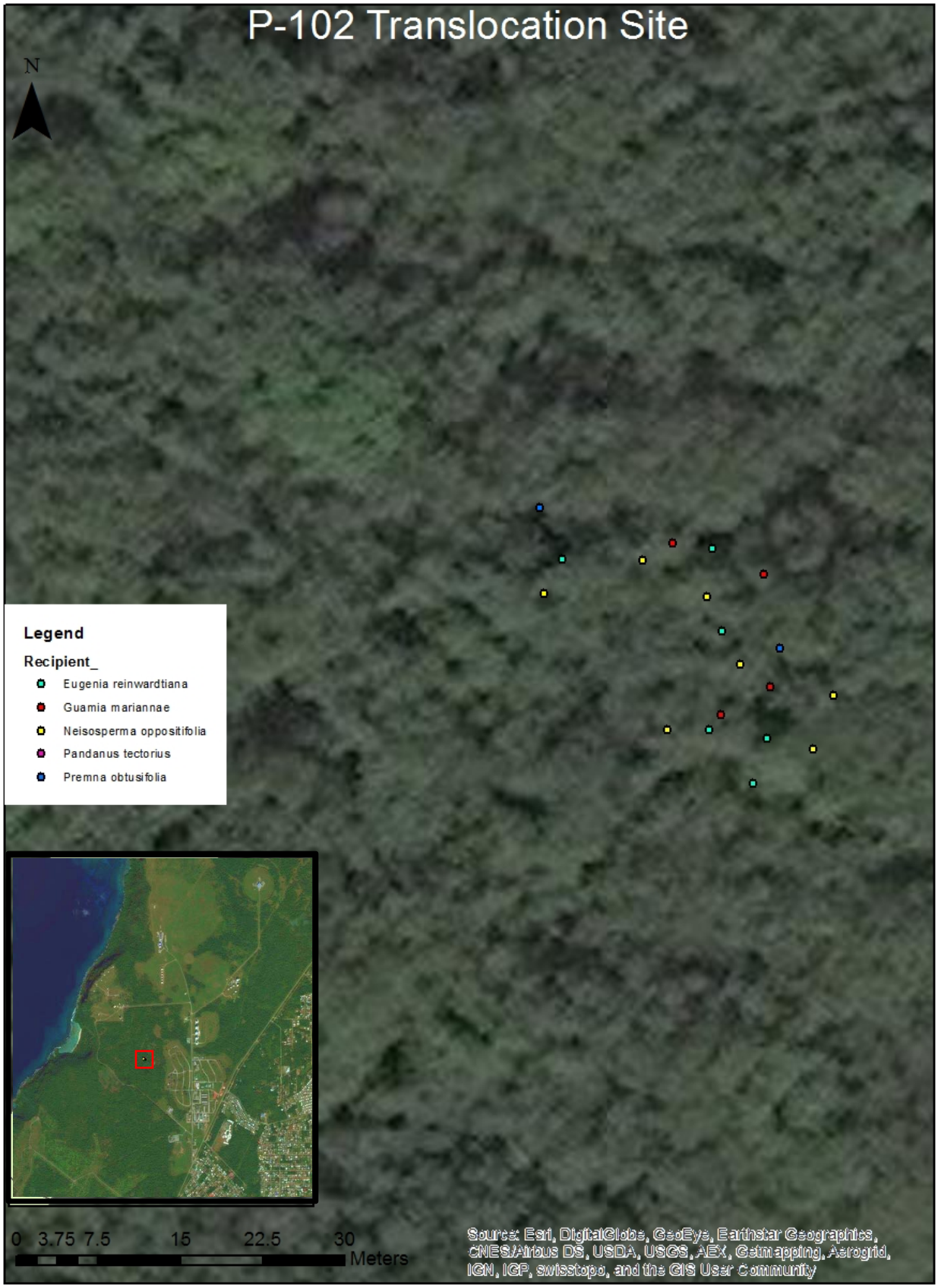

Figure 3. Orchid Out-planting Site by Host Trees

Other Authorized Activities

No propagation of orchids from the P-102 Power Upgrade, Harmon project site took place in 2018. Individual orchids were salvaged and directly transplanted on the date specified above. No additional seeds, propagules, or other vegetative/tissue samples were collected. No individual plants were damaged or destroyed during the operations and no genetic testing was performed. **Table 3** below shows a summary of other authorized collections.

Table 3. Summary of Other Activity with Authorized Plant Species in 2018

Plant Species	Number of Seeds Collected	Number of Propagules Collected	Number of Vegetative Samples Collected	Number of Herbarium Vouchers Collected	Number of Tissue Samples Collected	Number of Plants Damaged or Destroyed
Tuberolabium guamense	0	0	0	0	0	0

Unintentional Takes

No federally listed plant or wildlife species were subject to unintentional takes in 2018. **Table 4** summarizes the individuals incidentally taken during the salvage and transplant activities.

Table 4. Summary of Unintentional Takes in 2018

Species	Number of Individuals Salvaged	Number of Individuals Injured or Killed	Date Taken	Location (Coordinates)	Outcome
Other Plants and Wildlife	0	0	NA	NA	NA

Conclusions

As of December 2018, the transplanted orchids are currently at a 97% success rate. The orchid roots have already their native host tree and are vigorous and healthy. Despite the minimal loss, the vast majority of orchids remain stable and continue establish and grow.

Under the recovery permit TE78405C-0, no further activities will be conducted in 2019. All project deliverables under Contract No. N62742-15-D-1825, Delivery Order N62742-18-F-0114 has been satisfied and the project has been marked completed.

Please contact Dr. James McConnell at mcconnell@triton.uog.edu should you have any questions or concerns regarding this report.

Attachment A. Work Plan

SWCA

WORK PLAN FOR THE SALVAGE AND TRANSPLANTATION OF FEDERALLY LISTED PLANT SPECIES FROM THE P-102 POWER UPGRADE (HARMON TO ANDERSEN AIR FORCE BASE) ON GUAM

AUGUST 2018

PREPARED FOR

Naval Facilities Engineering Command, Pacific

PREPARED BY

SWCA Environmental Consultants

WORK PLAN FOR THE SALVAGE AND TRANSPLANTATION OF FEDERALLY LISTED PLANT SPECIES FROM THE P-102 POWER UPGRADE (HARMON TO ANDERSEN AIR FORCE BASE) ON GUAM

Prepared for

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August 2018

SIGNATURE SHEET

Draft Rev. 3 Work Plan

Salvage and Transplantation of Federally Listed Plant Species from the P-102 Power Upgrade (Harmon to Andersen Air Force Base) on Guam

Signature will be placed on Final Report. _____ _____

(Name) Date

Health and Safety Manager

Signature will be placed on Final Report. _____ _____

Jaap Eijzenga Date

Project Manager

Signature will be placed on Final Report. _____ _____

(Name) Date

Principal

Signature will be placed on Final Report. _____ _____

(Name) Date

Managing Manager

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LIST OF ACRONYMS AND ABBREVIATIONS

AAFB	Andersen Air Force Base
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
COR	Contracting Officer's Representative
DON	Department of the Navy
FEA	Forest Enhancement Area
GIS	Geographic Information System
GPS	Global Positioning System
HACCP	Hazard Analysis and Critical Control Point
LMS	Landscape Management Systems, Inc.
MCAG	Marine Corps Activity Guam
MPR	Monthly Progress Report
MS	Microsoft
NAVFAC	Naval Facilities Engineering Command
NGBTS	Naval Base Guam Telecommunication Site
PDF	Portable Document Format
PM	Project Manager
POC	Point-of-Contact
PWS	Performance Work Statement
TPOC	Technical Point-of-Contact
UOG	University of Guam
USFWS	U.S. Fish and Wildlife Service
WP	Work Plan

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1 SALVAGE AND TRANSPLANTATION WORK PLAN OVERVIEW

1.1 Introduction

This work plan presents background information, project management details, proposed methodology, required deliverables, and an anticipated schedule for the salvage and transplantation of federally listed plant species identified within the P-102 Power Upgrade construction footprint from Harmon to Andersen Air Force Base (AAFB), Guam.

Specifically, this work plan describes the efforts that will be performed by the SWCA Environmental Consultants (SWCA) team to assess, salvage, and transplant, as appropriate, 98 *Tuberolabium guamense*. This epiphytic plant species is federally protected by the Endangered Species Act (ESA) and was previously identified during the preconstruction surveys within the P-102 project footprint.

The salvage and transplant actions will take place from within the P-102 construction footprint and will be transferred to a Forest Enhancement Area within AAFB, as described in the contract's task order Performance Work Statement (PWS) given on November 8, 2017. This work will be conducted under contract to Naval Facilities Engineering Command (NAVFAC) Pacific, Contract No. **N62742-15-D-1825, Contract Task Order (CTO) N6274218F0114**. Jaap Eijzenga (SWCA) will serve as the project manager, and Landscape Management Systems (LMS Inc.) along with the Guam Plant Extinction Prevention Program (GPEPP) will perform field activities related to federally listed plants.

1.2 Project Description

The purpose of this project is the salvage and transplantation of federally listed plant species identified within the construction footprint of P-102 that stretches from Harmon to Andersen Air Force Base (AAFB).

All work must be performed following applicable and appropriate Department of Defense (DoD) guidance and policy and consider all site documentation and reports to the date of this Work Plan. The period of performance under this CTO shall not exceed 18 months from the award date.

The following services will be required:

- Perform a field assessment of the location and condition of plant species to determine salvage and transplant methods.
- Salvage 98 *Tuberolabium guamense* from within the P-102 project footprint. The locations of these plants have been flagged and recorded by the government.
- Transplant salvaged plants to a government-approved location.
- Provide 1 year of maintenance and monitoring after transplantation.

1.2.1 Project Location

The P-102 Power Upgrade Project (project) stretches from Harmon to AAFB, in the northern part of Guam **(Figure 1)**. Plant salvage will be undertaken within the construction footprint of the project area. The transplantation site for the orchids will be within the Forest Enhancement Area in the southern portion of the Naval Base Guam Telecommunication Site (NGBTS) (Figures 2 and 3).

1.3 Project Objectives

Project team members will provide salvage, transplanting, and translocating services for federally listed plants found within the P-102 project footprint.

A field assessment was performed to verify the findings of previously conducted surveys by the Department of the Navy and documented any additional specimens and species. LMS identified 98 *T. guamense*. This number was higher by 8 individuals, compared to the 90 individuals that were identified during the survey conducted on XX. The field crew assessed the orchids identified by the Government to determine if the individuals had sufficient health and vigor to survive transplantation.

The number of individuals to meet the survivorship requirements will be based on the final number of individuals salvaged, in the event that fewer than the identified number of individuals are located or salvageable. With respect to survivability of the orchids, survived is defined as the documented observation of new root growth during a growth cycle, after transplantation into a protected area.

1.4 Project Management

Under this CTO, assigned management staff will have the appropriate experience and skills necessary to meet the needs of the PWS objectives. The field assessment, salvage and transplantation/translocation operations, monitoring and maintenance, and associated documents prepared under this task order will provide sufficient documented information to assist the Navy in managing lands on Guam.

The management effort required for this task order includes continuous oversight for the length of the project, including management of resources and schedules, budget tracking and review, and periodic liaison with NAVFAC Pacific points of contact as required. Section 10 of this work plan includes a contact list of project personnel.

Mr. Eijzenga will be responsible for the planning and execution of task activities, budgeting, and technical coordination for this effort. He will also supervise the development of all deliverables specified in the PWS. LMS Inc. with GPEPP as their subcontractor will perform field activities for the plants.

Nicole Olmsted, Natural Resources Specialist at NAVFAC Pacific, is the technical point of contact (TPOC) for work performed under this CTO. The TPOC is responsible for monitoring the project team members' performance and ensuring that work is performed per the requirements and specifications outlined in the PWS. Coralie Cobb, Senior Natural Resources Specialist, is the alternate TPOC. Lauren Gutierrez will be the Marine Corps Activity Guam (MCAG) contact (local TPOC). Lastly, the contract specialist (CS) for this project is Cris Caraang.

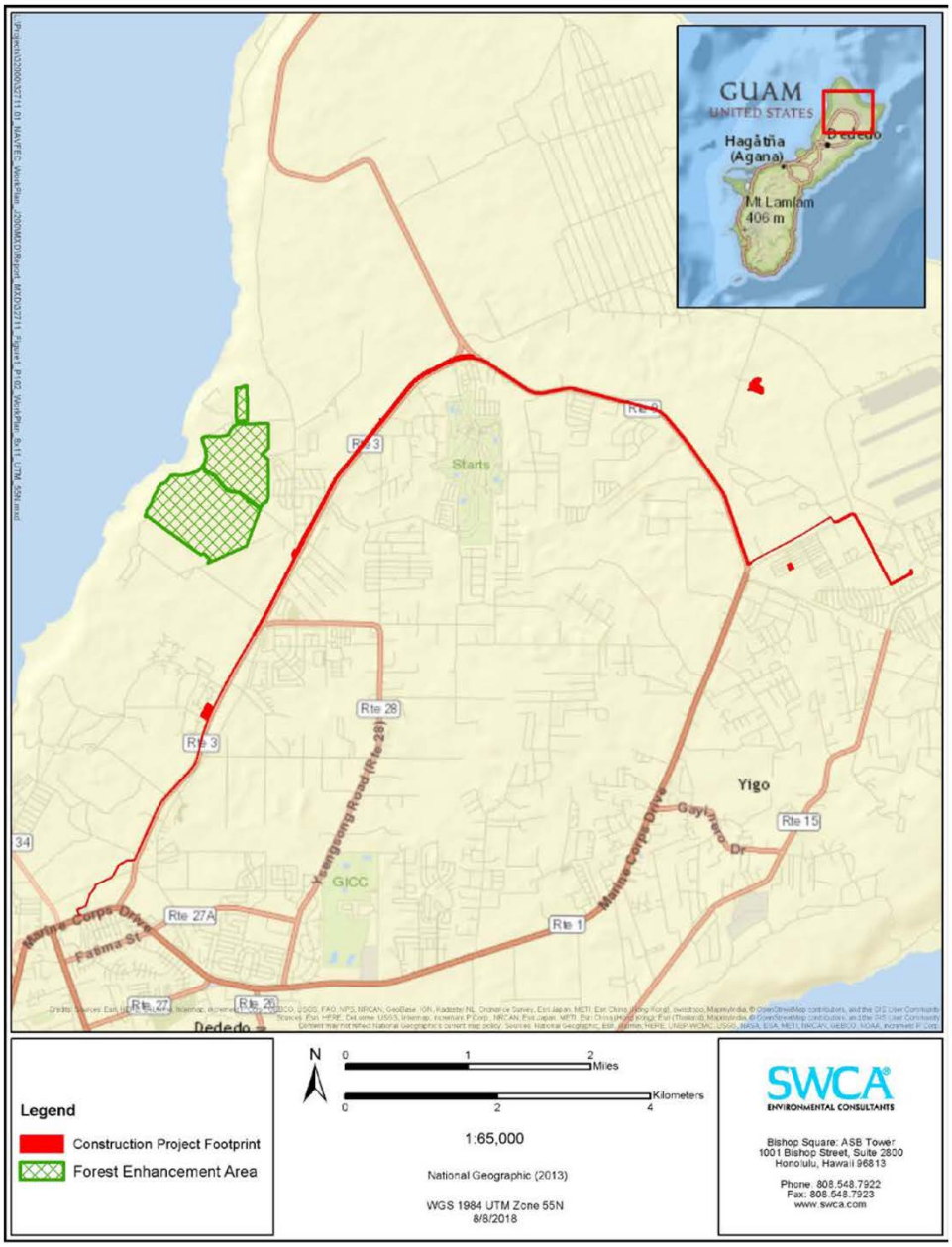

Figure 1. Salvage and Transplant Location for the P-102 Power Upgrade.

2 SURVEY TEAM

Multiple levels of personnel will be used to complete this project. The Lead Biologist has an extensive background in orchid propagation and out-planting. The Lead Biologist for this team is Dr. James McConnell. He has oversight and accountability for the health of the aforementioned orchid species. He will work with and train other Biologists who have sufficient hours working with the desired plant species and leads field staff to correctly follow and abide by practices stated by the Lead Biologist. The field staff conducts all field work as directed by the Lead Biologist and Biologist(s).

Our Lead Biologist and the team members listed in Table 1 are listed on the U.S. Fish and Wildlife Service (USFWS) Section 10(a)(1)(A) recovery permit #TE78405C-0, where authorized to purposefully remove/reduce federally listed plants species such as the *T. guamense* from lands under Federal jurisdiction. Only the individuals below will be allowed to do work unsupervised by the LLead Biologist. The USFWS will be requested to review the applicability of this permit for this particular CTO. Should the permit be found inadequate, the permit may be amended, or an alternative permit solution may be sought.

Table 1. Team Members

Name	Role
Dr. James McConnell	Lead Biologist
Mario Martinez	Biologist
Gregorio Borja	Biologist
Jonathan Davis	Biologist
John Horeg	Field Staff
Cyann Valera	Biologist
Rowena Mendi	Biologist (under supervision of permitted biologist)

3 FIELD ASSESSMENT

A field assessment was initiated on May 14, 2018, to determine the most viable salvage options for the *T. guamense* that were previously identified and any other orchid species that may be found within the area. This was conducted from within the P-102 project footprint for the Harmon Power Upgrade. The filed assessment was independent of this work plan and it did not affect any of the listed plants (only observations took place).

Dr. James McConnell, the Lead Biologist, along with biologists Mario Martinez, Gregorio Borja, Jonathan Davis, Cyann Valera, and Rowena Mendi and field staff John Horeg, conducted the field assessment on May 14 through 18, 2018, using government-provided geographic information system (GIS) data to locate the previously documented *T. guamense*. Their assessment concluded with identifying a total of 178 orchids (98 mature and 80 seedlings) (Table 2). LMS conducted a field assessment to ensure that there would still be at least 98 *T. guamense* available for salvage as identified in the previous assessment. Based on this survey, it was determined that 98 mature *T. guamense* are available to be salvaged.

Dr. McConnell provided the appropriate training and resources for field personnel to identify the federally listed orchid species for transplanting. The field assessment included the following steps: 1) Conduct a site visit to identify the healthy orchid species for salvage and transplant using government-provided GIS

coordinates, 2) Tag or label all host trees in the project footprint and assign them with a unique alphanumeric identifier, 3) Record species and the number of orchids on each host tree, and 4) Record any new host trees with other orchid species.

Fifteen-meter transects focused on areas where plants were recorded during previous Navy surveys. The surveyors systematically located the previously identified trees or host trees and recorded the number of orchid species to salvage.

The following data were recorded for each plant during the field assessment:

- global positioning system location
- orchid species
- host tree species
- number of orchids on host tree
- maturity of orchids
- documentation photographs (Appendix B)

Tables 2 and 3 contain a summary of plant data from the field assessment broken down by host tree species and maturity.

Table 2. Orchid Assessment for Salvage

Species	Mature	Seedlings	Total
Tuberolabium guamense	98	80	**178**

Table 3. Host Trees by Species for Salvage

Species	Number
Vitex parviflora	40
Morinda citrifolia	1
Leucaena leucocephala	1
Total	**42**

The second part of the field assessment took place on May 30, 2018, and its purpose was to assess the most appropriate locations for orchid transplanting. Orchids will be transplanted to suitable host trees within the NGBTS Forest Enhancement Area (Figure 3) (the orchids will be tagged and tracked and will be separate and distinct from the J001B outplanting site). In this case, majority of the orchids to be translocated are currently growing on *Vitex parviflora*. In order to ensure the 50% orchid survivability, all salvaged orchids will be translocated onto the species of tree that it originated from. Habitats that matched or were similar to the recorded data for the orchids were prioritized for out-planting. Surveys began in areas with the densest populations of orchids in the transplanting area.

The following data were recorded for the host tree during the field assessment:

- GPS location
- host tree species

- number of orchids on host tree, if present
- documentation photographs

3.1 Equipment and Supplies

Field equipment for orchid and tree assessment included the following:

- GPS to mark the locations of the orchids for salvage
- iPad™ with digital data form application
- orange field flagging
- tags with unique numbers to identify plants to salvage (orchids on same tree are under a single tag)
- camera to photograph the orchids

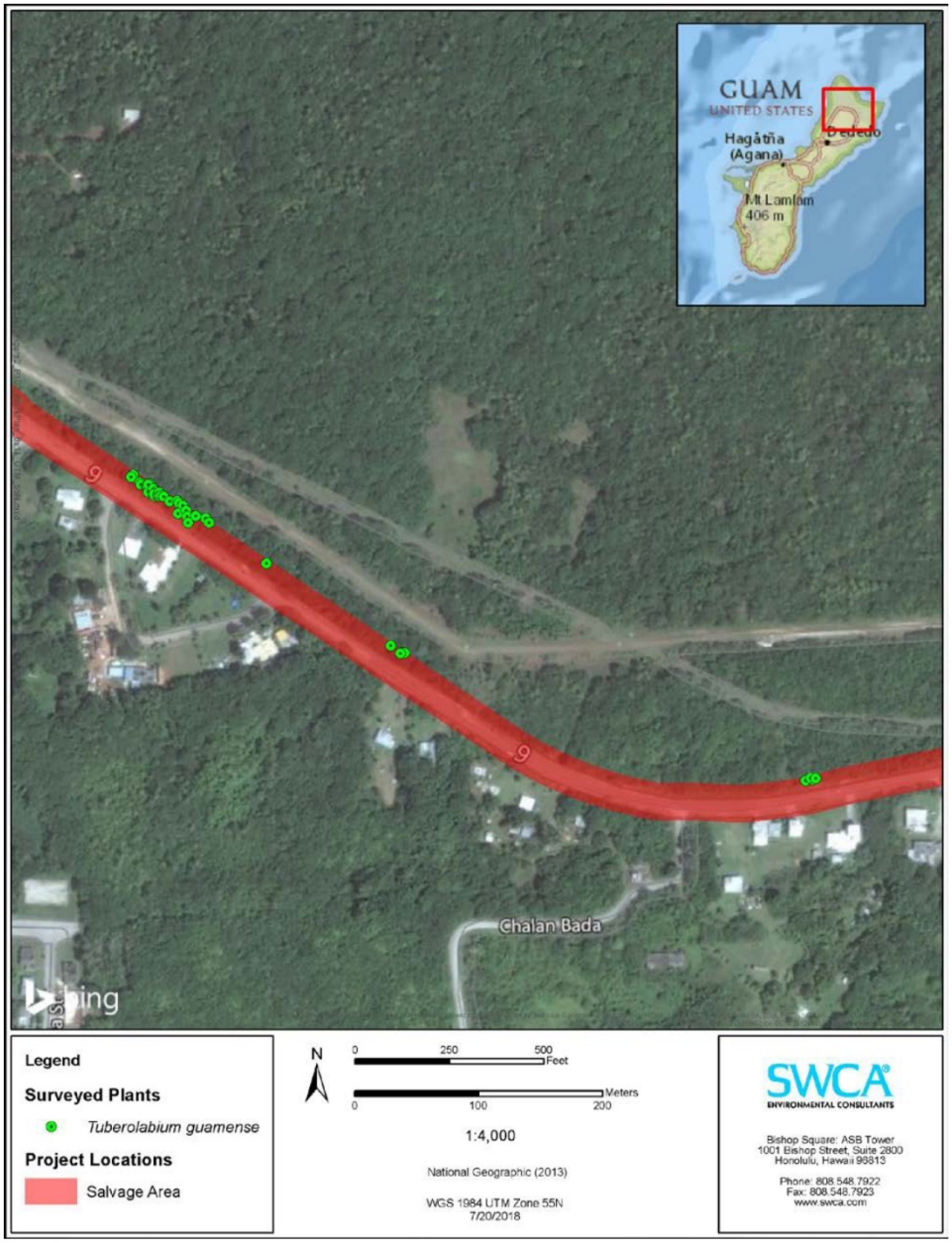

Figure 2. Map of orchids identified in the P-102 field assessment.

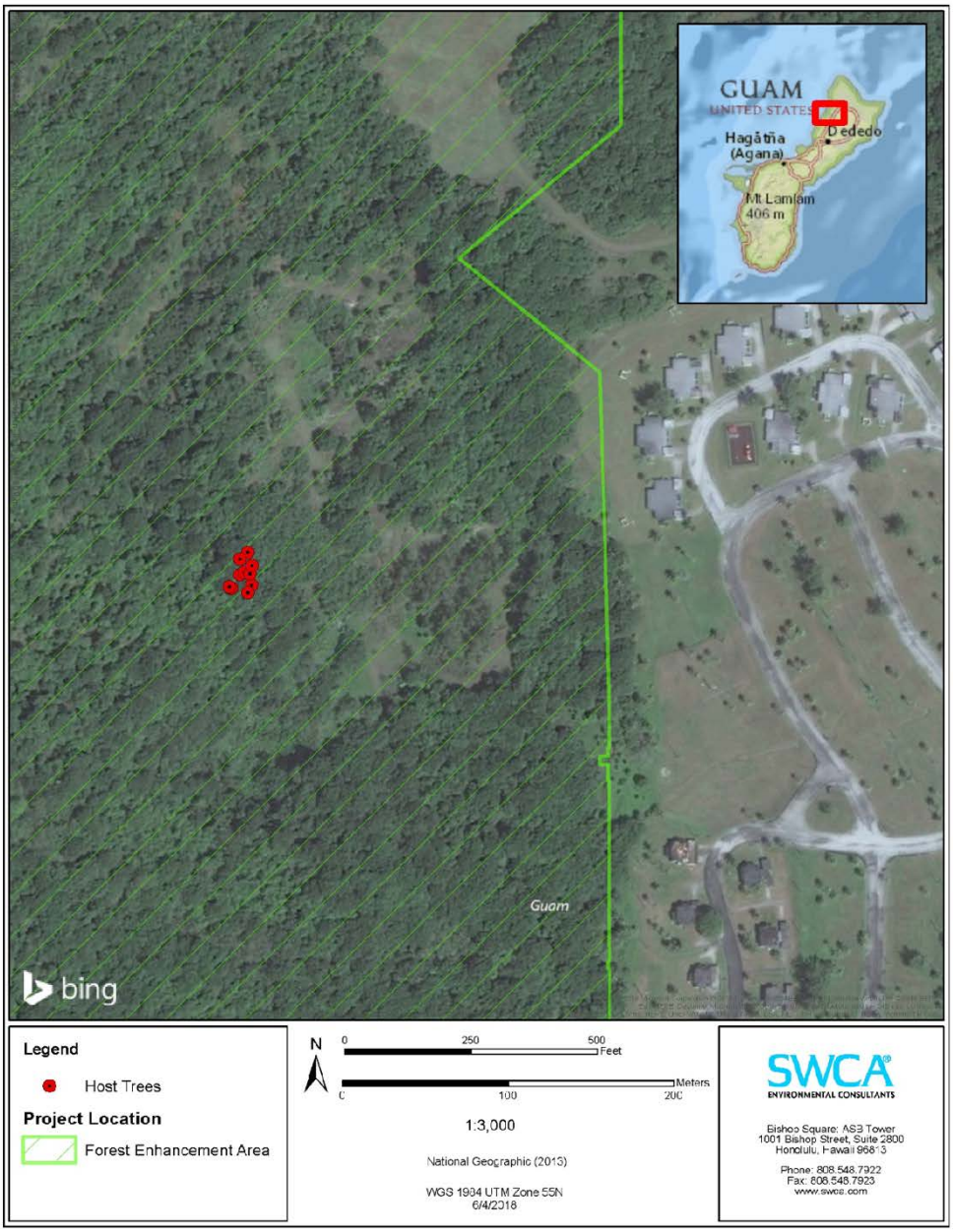

Figure 3. Location of the *Vites parviflora* host trees within the Naval Base Guam Telecommunication Site out-planting site.

4 ORCHID SALVAGE OPERATIONS

Salvage operations will use the most effective methodology for the site, plant species, and health of the plant at the time of the salvage. A 10(a)(1)(A) permitted biologist will make the determination of health. Salvaged orchids will be directly transplanted to host trees.

4.1 Methods and Protocols

Dr. McConnell will first conduct training for all permitted biologists and field staff to ensure that appropriate methods are utilized. On-site, personnel will take pictures daily to provide visual evidence of work progress via a WhatsApp© group. The Lead Biologist and/or other 10(a)(1)(A) permitted biologists will be present for the salvage and translocation of *T. guamense*. Any issues encountered will be brought directly to the Lead Biologist for resolution, and the Lead Biologist will conduct periodic inspections to ensure that transplanting procedures are being followed.

The Lead Biologist will only select orchids for transplanting that have a reasonable chance of survival, as determined by the health and maturity of the orchid and will take into account that the orchids will undergo stress when being relocated. An orchid is deemed "healthy" if it displays turgid leaves, active root growth, and a growing meristem. Maturity is determined on whether the orchids exhibits signs of flowering and fruiting. However, in order to focus the plant's energy toward root and vegetative growth, flowering or fruiting parts will be removed from the plants so they avoid expending energy trying to make pods before being established. Further, when it is not possible to remove the bark, the team will only separate the roots from the bark. An example would be if the orchid is growing in a tree crotch. The general procedure will be to remove the entire orchid attached to the bark. It may be necessary to cut roots that entirely encircle the trunk or are longer than 6 inches.

4.1.1 Orchid Salvage

The LMS team, based upon their knowledge and experience working with local orchids, has determined that healthy, mature orchids best withstand the stress of salvage and transplanting. Seedlings may not have the vigor to withstand transplanting directly into the jungle with a reasonably high rate of survival. Based on the results from the May 14, 2018 field assessment, the team will attempt to salvage 98 mature *T. guamense*. The Lead Biologist will determine the most efficient and safe way to salvage the orchids based on site-specific context.

Humidity and light levels will be measured and cloud cover will be estimated (percent cover) at the salvage and recipient site locations during salvage and transplantation activities using a humidity and light meters to ensure similar environmental conditions, while taking into consideration cloud cover. Field personnel will chisel out the bark underneath the roots, essentially removing the orchid with the current media intact. For orchids that are tightly attached, the bark will be large enough to support the orchid and will be cut in a manner that keeps the roots intact. Salvage operations will occur tree by tree. Once plants have been collected from an area, the area will be turned over to the construction contractor for development. As discussed above, the team has the necessary climbing gear, equipment, and approved methodology to reach orchids above ground level. All work will be supervised by competent safety officers on-site to ensure that orchids above ground level can be safely obtained for transplanting.

Orchids will be transported in plastic baskets. Field personnel will haul the baskets via a van or truck. Throughout the transportation process, the orchids will remain covered to avoid direct sun exposure. Orchids will be transported directly to the transplant site.

4.2 Equipment and Supplies

Orchid salvage equipment includes the following:

- iPad™ (collecting salvage data)
- chainsaw or Sawzall™
- hand saw
- hand blades
- loppers
- pruners
- twine/strings
- zip ties
- baskets
- climbing gear (harness, ropes, carabiners)
- chisels/tile knife
- compass
- GPS unit
- ladders
- eye hooks
- vehicle to transport orchids out of the salvage site to the forest enhancement site

5 TRANSPLANTING

Transplanting will occur as soon as feasible for all plants, accounting for situational indicators (unsafe working conditions due to inclement weather). Multiple areas will be utilized for transplantation, and whenever feasible, native trees will be used as host trees based on the Lead Biologist's analysis of microclimate and long-term orchid viability.

5.1 Orchid Transplant

Orchids determined to be ready for direct transplant will be transplanted by the Lead Biologist and the team members, and mounted to the appropriate a *Vitex parviflora* trees, which were selected as the best recipient to mimic the same conditions each orchid originated from. Specific transplanting methods will be determined based upon the individual needs of the plant to maximize the 50 percent survivability of the specimen. Orchids will be planted facing the same general direction from which they were originally salvaged. LMS intends to best mimic the orchid's original environment in order to minimize the stress of transportation and to allow the orchid to continue to thrive. An existing water system is available on site should there be need for supplemental watering. The orchid species are not reported to be vulnerable to destruction caused by nonnative ungulates; however, to reduce possible ungulate damage, all orchids will be placed at 1.84 meters or higher on the recipient host tree. Orchids salvaged at or above 1.84 meters will be placed at the same height on the host trees. No more than five individuals will be transplanted onto recipient host trees. Additional protective fences will be installed, where necessary, to facilitate orchid survival.

Areas with similar humidity and light levels will be prioritized for orchid transplant. When possible, orchids will be placed in areas where other orchids currently exist and on tree species historically successful in hosting orchids in this environment, thus demonstrating a higher likelihood of growth success. The recipient tree trunk or branch will be carefully selected, taking into account the desired height (not below 1.8 meters), light level, microclimate, and ecology (Reiter et al, 2016). No orchids will be placed on the downward facing section of a leaning tree trunk or the bottom of horizontal branches to avoid poor exposure to irrigation. Optimal light conditions are at 60%; light measurements will be recorded during salvage and transplantation to ensure orchids receive appropriate light levels at the transplantation site. Cloud cover will be taken into account during salvage and transplantation activities and factored in when collecting light measurements. Humidity levels will be measured during salvage and transplantation using a humidity meter. Orchids will be placed on the recipient tree in an area where there are no other epiphytes (i.e., *Asplenium nidus, Polypodium punctatum, Phymatosorus scolopendria,* and *Pyrrosia lanceolata*). Orchids removed from its original host tree will be placed on its identified translocation tree on the same day.

Orchids will only be transplanted to an area within the Forest Enhancement Area that already have existing orchids from a similar salvage and transplantation project. This area demonstrates that the environment is suitable for orchid growth. Tree species that were not observed with orchids on them in the salvage area will not be used for transplanting on this site. The transplantation location of the out-planting host tree is identified in Figure 3. There is approximately 50 feet or more distance between the identified host trees under this work plan and the other existing trees with thriving orchids from another project. The *Vitex parviflora* trees for this out-planting effort will be easily distinguishable and will be marked with a flag of a different color.

Prior to placement onto the recipient host tree, bark on the recipient tree where the orchid will be placed may be sprayed with fertilizer to provide nutrients to transplanted orchids. It is not recommended to have moss underneath the entire orchid, because roots need to attach to the tree, not the moss. The roots will eventually grow in the moss or lichens (Dearnaley et al, 2012). Batke (2012) states that orchids need less humus than other epiphytes. Too much moss can cause rot.

Attachment will be done in one of the following ways: 1) Stapling the bark to the host tree, 2) Tying the chiseled bark to the tree with twine or 3) Stapling twine across bare-rooted orchids.

Epiphytic orchids prefer roots to be exposed to air. Excess water can block this necessity. The string will eventually decompose, and not harm the environment.

Orchids will be monitored for 12 months because they are in a state of shock when removed from their host tree. Since water is essential to maintain the orchids vigor, they will be supplemented with water through the temporary irrigation system for six (6) months. After the initial six (6) months, orchids will be weaned off of the supplemental water. However, if an orchid appears to be stressed or weak, during the last six-month maintenance period due to a poor rainy season, intense dry season, and substantial loss of leaves due to the host trees' response to the dry season, temporary watering will be conducted along with other adaptive management protocols described in Section 6.1 will be followed. Established plants will eventually be maintenance free. Plants will be flagged and labeled with a unique alphanumeric identifier. Flagging tape will be replaced during monitoring and maintenance activities, as needed. GPS coordinates will be recorded and stored in a Microsoft (MS) Excel database along with monitoring data (health, stress, pests).

5.2 Equipment and Supplies

Orchid transplant equipment includes the following:

- Waterproof paper

- GPS unit
- iPad™
- digital camera
- hammer
- nails
- compass
- ladders
- baskets
- aluminum tags
- staple guns and staples
- chainsaw, as needed
- climbing gear (harness, ropes, carabiners)
- twine
- transport vehicle

6 MAINTENANCE AND MONITORING

Project team members will provide maintenance and monitoring monthly for up to 98 *T. guamense* from within the transplanting site for a period of 12 months. The year of maintenance starts as soon as the orchids are transplanted. A record will be kept when the transplanting activities occur (see Appendix A). The orchid species are not reported to be vulnerable to destruction caused by nonnative ungulates; however, if ungulate damage is observed, a temporary fence structure will be placed around each host tree.

6.1 Methods and Protocols

Routine maintenance will be performed to ensure the survival of the orchids. In particular, the crews will establish reverse osmosis purification irrigation systems designed to take out the salt and minerals from the water to replicate rainwater, promoting growth of the orchids. The temporary irrigation system will help the orchids establish on the new trees.

The irrigation system will be comprised of a central unit, a pump, and an electrical and distribution system. The water system will be strung through the tree line off the ground to avoid damage from pests and ungulates. There will be a mister in all locations where the orchids are transplanted to maintain sufficient water per orchids, at least one adjustable mister per orchid. Watering units with ranges varying between 150 and 1,000 gallons per day will be utilized to facilitate the anticipated 24 ounces per week per orchid recommendation and will be adjusted as necessary based on the observed orchids' health. However, orchids will be watered more if they display signs of wilting (reduced turgor pressure) or water deficiency (deflated aerial roots), until the plant recovers. Our team will initiate weaning of the orchids from water by the six-month period. The exact reduction of water will depend upon the weather and season upon which the six-month period arrives. If the orchids do not appear to have vigor then we can postpone the weaning period as needed to maximize the survivability of the orchid. During the weaning period, if a formerly vigorous orchid appears to be stressed or weak, adaptive management protocols described below will be followed and the irrigation could be adjusted to ensure the survivability of the orchid.

Regular and routine monitoring of orchids will ensure the minimum 50 percent survivorship requirement is met and address any orchid health issues early on. Specifically, the orchid transplant site will be inspected weekly for the first 2 months, biweekly for months 3 and 4, and monthly thereafter (unless conditions warrant more frequent monitoring). During monitoring walkthroughs, orchids will be inspected within the transplant site to ensure individuals are healthy and not stressed. The three most common causes of stress are due to pests, insufficient water, and drastic change in light level. Any orchid that appears to be stressed or weak will be assessed for adaptive management protocols.

Adaptive management protocols may include one or more of the followings:

- More frequent watering
- Fertilizer application, as needed
- Recovery from recipient site, translocated to an USFWS approved nursery (in accordance with the 10(a)(1)(A) permit), and closely monitored and cared for, and re-transplanted into the recipient site during rainy season.

The transplant site will be monitored for pests such as a scale of mealy bugs or an outbreak of fungus or bacteria. The orchids will be treated with Government-approved pesticides like, if necessary. Pesticides use for consideration includes Physan 20. All pesticide(s) used will be reported on the NAVFAC Online Pesticide Reporting System. LMS will follow all U.S. Environmental Protection Agency labeling and local requirements/ instructions. All field data in the HRPRG Rare Plant Monitoring Form will be collected at least once at the area of population and translocation, and at least once at one year. In addition, individual orchid records will be initiated if orchids appear stressed. Monitoring records will be maintained for the duration of the project and included in the draft and final reports.

7 DATA ANALYSIS

Project team members will provide data and mapping for up to 98 *T. guamense* from within the P-102 project footprint with a minimum 50 percent survivability rate after 12 months of maintenance and monitoring. Federally listed plant data will include a record, map, and photograph of all specimens removed, including identification codes associated with GPS coordinates for each plant, both for salvage and transplant. This information will include the data field information (see Appendix A), which will note the following:

- Genus, species, subspecies, etc.
- Date of Collection
- Collector
- GPS location/ Collection site
- height on tree
- directional orientation
- health of plant
- host tree
- unique alphanumeric tag identifier
- stage of life

- humidity
- light data
- cloud coverage data
- photographs
- maps

8 DELIVERABLES AND SCHEDULE

The Plan of Action and Milestones (POAM) prepared for this Salvage and Transplantation Work Plan outlines the schedule of actions and deliverables for the project (Table 4). Successful execution of milestones and deadlines for deliverables is contingent upon adequate coordination, completing tasks on schedule, and timely review cycles. Project team members will adhere to the POAM schedule. Any revisions to the POAM that might arise during the project will be submitted for approval. "To be determined" dates are contingent upon the construction schedule and will be solidified once that information is received.

8.1 Kick-Off Meeting

A kick-off meeting was conducted on February 13, 2018, Hawaii Standard Time. The purpose of the meeting was to discuss the direction and development of the project. Meeting minutes were submitted to NAVFAC on February 16, 2018.

8.2 Final Salvage and Transplantation Work Plan

SWCA will submit a final Salvage and Transplantation Work Plan incorporating the comments received from NAVFAC and the USFWS. The final Salvage and Transplantation Work Plan will be submitted within 10 days of the receipt of comments. An electronic draft will be provided to USFWS along with their incorporated comments. A final version will be sent out for approval prior to SWCA providing four hard copies of the approved plan by USFWS and two digital copies on a compact disc of the final Salvage and Transplantation Work Plan to the navy technical representative and contract specialist. The final Salvage and Transportation Work Plan must be approved by the Government prior to work being conducted.

8.3 Monthly Progress Reports

Project team members will provide monthly progress reports that detail incremental accomplishments throughout the project. The report shall cover the first through the last day of each month. These reports will contain: project name, contract and task order number, date of the report, period covered, personnel involved, percent survival, work completed during the time period, data collected, problems encountered and resolutions/action items, photographic documentation of the threatened and endangered species, and work proposed for the next reporting period.

8.4 Safety Plans (Accident Prevention Plan and Activity Hazard Analysis)

SWCA prepared and submitted a draft Accident Prevention Plan and Activity Hazard Analysis and Critical Control Point for government review and comments by email within 30 days of the kick-off meeting. The final Accident Prevention Plan and Activity Hazard Analysis was accepted on April 16, 2018.

Table 4. Deliverables Schedule

Task	Date
Kick-off meeting	02/13/2018
Meeting minutes	02/16/2018
One-hour training UXO Safety/NR	11/13/2017–11/17/2017
Inspect, locate, and flag orchids	05/14/2018–05/18/2018
Field assessment of transplanting locations	05/14/2018 – 05/18/2018
Draft work plan	06/05/2018
Final work plan	08/31/2018
Safety plan	04/11/2018
Hazard Analysis and Critical Control Point plan	04/11/2018
Salvage orchids	09/01/2018-09/12/2018
Transplantation	09/12/2018-09/19/2018
Install temporary irrigation	09/19/2018-09/22/2017
Maintenance/Monitoring	09/23/2018-09/23/2019
Seed storage	09/19/2019-09/23/2019
Draft final report	09/24/2019-10/24/2019
Final report	11/01/2019-11/08/2019
Monthly progress reports	09/23/2018-09/23/2019

9 ACCESS AND PASS REQUESTS

SWCA staff and subcontractors will have a valid Defense Biometric Identification System pass with current access to NGBTS and AAFB for access to the project site.

Valid Navy passes that provide access to NBGTS will provide access for this project. The AAFB Pass and ID Office will only issue separate passes should staff need to access AAFB through security gates, which is not expected for this project.

10 POINTS OF CONTACT

Name	Position/Company	Email	Telephone Number
Nicole Olmsted	Technical Point of Contact/Natural Resource Specialist, NAVFAC, Pacific	Nicole.M.Olmsted1@navy.mil	808-472-1475
Coralie Cobb	Alternate Contracting Officer's Representative, NAVFAC SW	Coralie.Cobb@navy.mil	720-542-3085
Cris Caraang	Contract Specialist/Acquisitions, NAVFAC, Pacific	Cris.Caraang@navy.mil	808-471-0130
Lauren Gutierrez	Local Technical Point of Contact/Installation Contact, MCAG	Lauren.Gutierrez@fe.navy.mil	671-355-8050
Jaap Eijzenga	Project Manager and Biologist, SWCA	jeijzenga@swca.com	808-548-7922
Robert Salas	Subcontract Project Manager, LMS Inc.	rob.salas@lmsfm.com	671-647-2617

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APPENDIX A

Transplant and Monitoring Data Sheet from Geographic Information System Files Application

Canopy Zone
- ○ A
- ○ B
- ○ C
- ○ D
- ○ E

Orchid Direction
- ○ N
- ○ E
- ○ S
- ○ W

Light level % [A number...]

Maturity
- ○ Mature
- ○ Seedling

Transplanted Host ID [A number...]

Transplanted Host Species [Some text...]

Vigor OK
- ○ Yes
- ○ No

Moss
- ○ Yes
- ○ No

Comments [Some text...]

Bark ○ Yes
○ No

Panty Hose ○ Yes
○ No

Active Root Growth ○ Yes
○ No

Number of Roots A number...

Flower ○ Yes
○ No

Fruit ○ Yes
○ No

Alive ○ Yes
○ No

Vigor OK ○ Yes
○ No

Form preview

Date & Time	2018-02-14T01:43:53.11
Tag #	A number...
Host Species	Some text...
DBH (Host if Orchid)	A number...
Height	A number...
Canopy Zone	○ A ○ B ○ C ○ D ○ E
Orchid Direction	○ N ○ E

Endangered and Threatened Plants Recovery permit TE64600C-0

Center for Island Sustainability, Else Demeulenaere

1 INTRODUCTION

This annual report covers two endangered and threatened plant species projects.

(1) Phylogentic study of *Serianthes* (U.S. Fish & Wildlife Service grant number: F16AP00679)
(2) Subcontracts with Sundance Consulting Inc.
    a. Salvage and Transplantation of Federally Listed Plant Species at Northwest Field in the Construction Footprint of the Live Fire Training Range Complex (P-715), AAFB (N62742-15-D-1823, N6274218F0102)
    b. Water Wells Salvage and Transplantation of Federally Listed Species at Andersen Air Force Base, Guam (P-103), AAFB (N62742-15-R-1804).

2 REPORTS

2.1 PHYLOGENETIC STUDY *SERIANTHES*

It was determined that the current herbarium specimens at the University of Guam are in poor condition, and not complete therefore six new herbarium voucher specimens from *Serianthes nelsonii* were obtained from six different populations in Rota on 7/10/2018 and 7/11/20. The species were collected by Else Demeulenaere and James Bamba from the Rota Forestry department. A transfer letter, provided by U.S. Fish & Wildlife, allowed Else Demeulenaere to hand carry the vouchers by plane to the University of Guam.

Sernel Rota 1 (Rota SN) As Igua, outplanting along the road
N 14°10.209’
E 145°12.366’

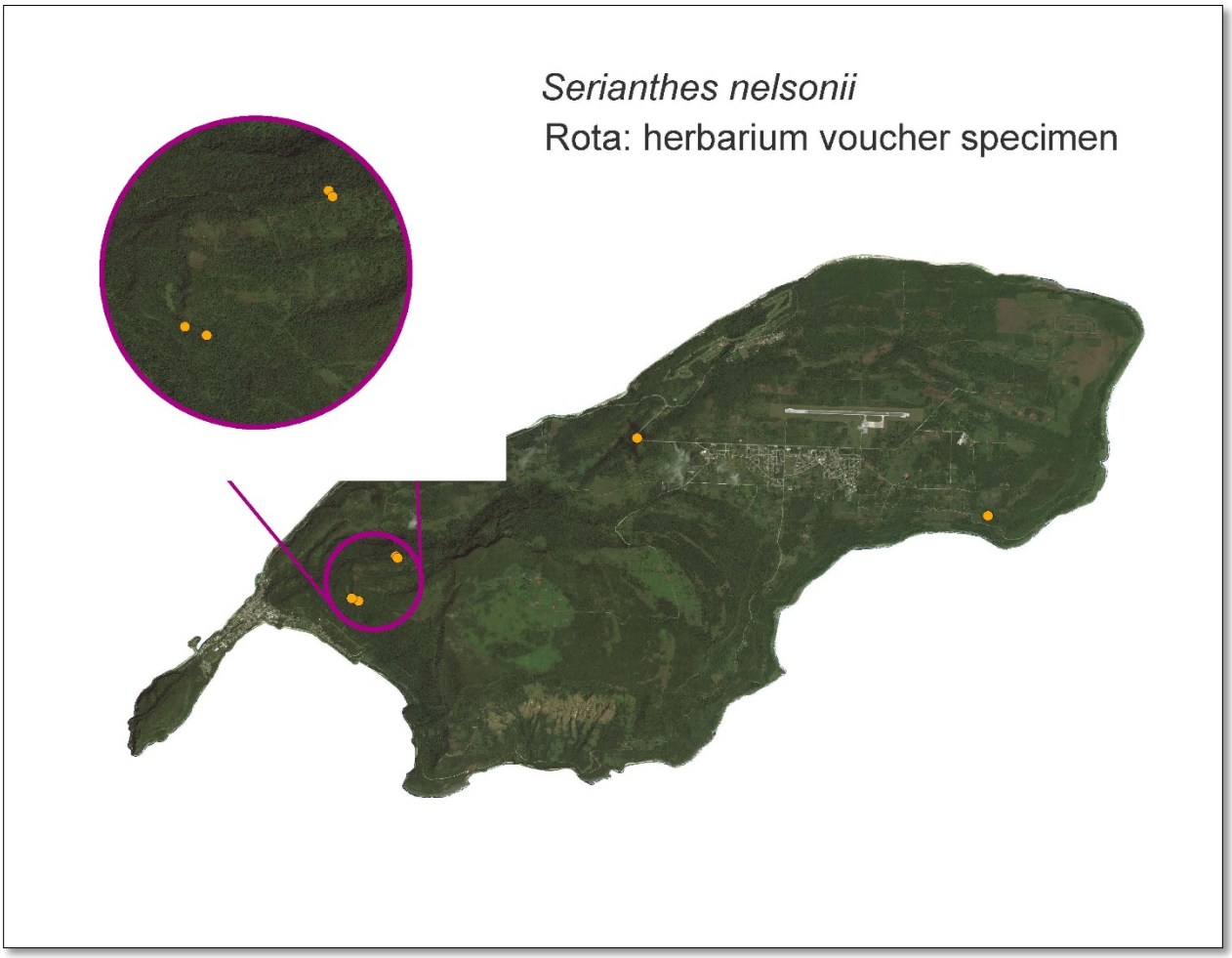
Sernel Rota 2 (Rota SN) bird sanctuary, outplanting
N14°09.433’
E145°15.876’

Sernel Rota 3 (Rota SN) Isang, wild population
N14°09.028’
N145°09.955’

Sernel Rota 4 (Rota SN), Lonow, wild population
N 14°09.010’
E125°09.968’

Sernel Rota 5 (Rota SN44), Guayaungan, (known as Isang), wild population 1
N 14°08.582’
E145°09.578’
Flowers 3, leaves (4), 3 fruits

Sernel Rota 6 (ROTA SN70), Guayaungan, (known as Isang), wild population 2
N14°08.607’
E145°09.511’



Map: collection of herbarium voucher specimen

2.2 SALVAGE OF *TUBEROLABIUM GUAMENSE* UNDER SUBCONTRACTS WITH SUNDANCE CONSULTING INC.

2.2.1 Introduction

This report covers the action performed under the workplans (see attachment 1 and 2) for the "salvage and transplantation of federally listed plant species at Northwest field in the construction footprint of the live fire training range complex (P-715) (attachment 1), Andersen Air Force Base" and "P-103 water wells and transplantation of federally listed species at Anderson Air Force Base" (attachment 2).

It needs to be noted no seed has been collected for *Heritiera longipetiolata* and *Tabernaemontana rotensis* under P-715 until we receive a notice to proceed form NAFVAC.

The *Bulbophyllum guamense* mentioned in the P-715 workplan were misidentified. I confirmed at a field assessment they were *Bulbophyllum longiflorum*, which is not a listed species.

2.2.2 Methods

The methods for P-715 are detailed on page 14-16 of the attached workplan (attachment 1).
The methods for P-103 are detailed on page 12-20 of the attached workplan (attachment 2).

2.2.3 Results

2.2.3.1 P715 Orchid Salvage and Transplantation

I. Personnel:
   a. Sundance-EA: Shannon Cauley, Sheeka Tareyama, Michael Crowley, Viri Glennon, Christopher Rosario, and Timothy Chargualaf
   b. UOG CIS: Else Demeulenaere, Matthew Putnam, Michael Rucinski, Khanh Ly, and Jivan Ramachandran

II. Salvage & Transplantation:
   On 2-3 July 2018, 67 *Tuberolabium guamense* and 1 *Bulbophyllum longiflorum* were salvaged from the P-715 project footprint and transplanted to the Forest Enhancement Site on Naval Base Guam Telecommunications Station. Orchids will be maintained and monitored for 12 months.

III. Data (*Tuberolabium guamense* only)
   a. 59 (88%) alive
   b. 8 (12%) are dead or missing from typhoons
   c. 2 (3%) yellowing
   d. 1 (1%) had black leaf spots

2.2.4 P103 Orchid Salvage and Transplantation

I. Personnel:
   a. Sundance-EA: Daniel Savercool, Shannon Cauley, Sheeka Tareyama, Michael Crowley, Viri Glennon, Christopher Rosario, Jaquay Soriano and Timothy Chargualaf
   b. UOG CIS: Else Demeulenaere, Matthew Putnam, Michael Rucinski, Khanh Ly, Jivan Ramachandran, and Lauren Swaddell

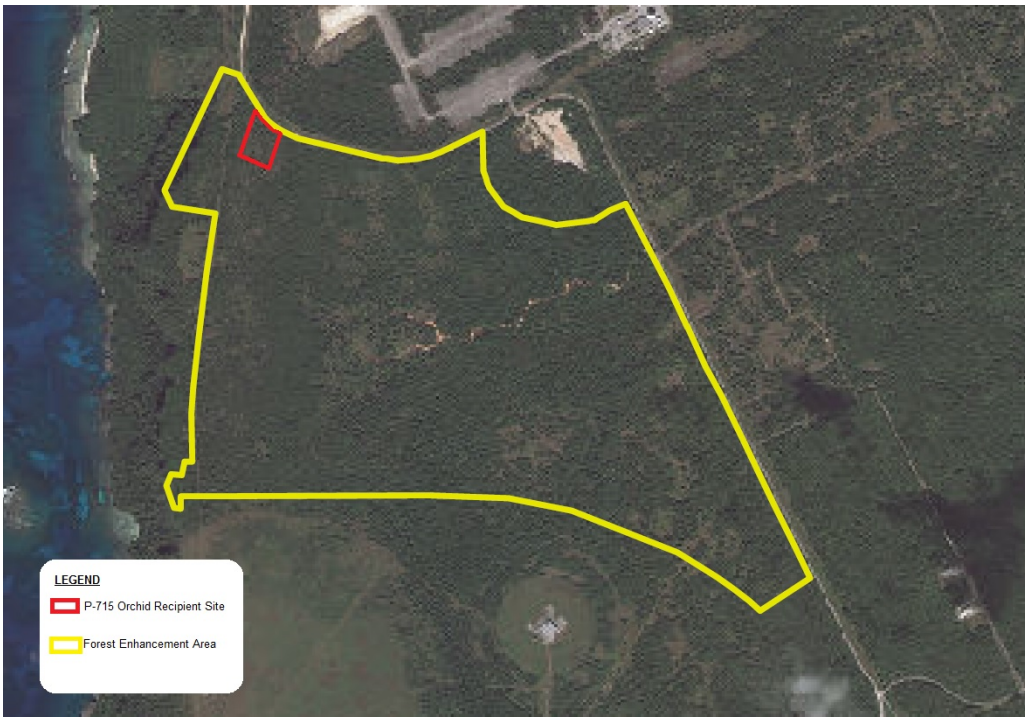
II. Salvage & Transplantation:
   On 16 July 2018 to 31 August 2018, 1,189 *Tuberolabium guamense* were salvaged from the P-103 project footprint and transplanted to the Forest Enhancement Site on Naval Base Guam Telecommunications Station. From the three project areas (Test Well 1, Test Well 2, and Pump Station), 143 from Test Well 2 site and 1,047 from Test Well 1; no orchids were salvaged from the Pump Station. Approximately 123 orchids were not salvaged due to brown/black leaf spots and white growth on the leaf surface. Orchids will be maintained and monitored for 12 months.

III. Data (*Tuberolabium guamense* only)
   a. 1,135 (95%) alive
   b. 54 (5%) are dead or missing from typhoons
   c. 18 (2%) yellowing
   d. 17 (1%) had black leaf spots

2.2.4.1 Maps

The maps with collection points for P-715 are detailed on page 14 of the attached workplan (attachment 1). The maps with collection points for P-103 are detailed on page 14-16 of the attached workplan (attachment 2).

The two maps below show the recipient sites locations. The orchids were transplanted within this footprint. Detailed maps and data points will be provided at the end of the project. The local U.S. Fish & Wildlife office advised to provide a map with a general location where the orchids were transplanted and provide all the other details at the end of the project.



Map P-715 recipient site

Map P-103 recipient site