TETRA TECH

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Mr. Charlie Doud, P.E.
Environmental Division
Orlando Utilities Commission
5971 Pershing Avenue
Orlando, Florida 32822-3881

Subject: 2012 Fish & Wildlife Annual Monitoring Report
Curtis H. Stanton Energy Center, Orange County, Florida

Dear Mr. Doud,

Tetra Tech, Inc. is pleased to provide you with the 2012 Fish & Wildlife Annual Monitoring Report for Orlando Utilities Commission's (OUC) Stanton Energy Center. This document was prepared on your behalf to satisfy Fish & Wildlife annual reporting requirements outlined in OUC's Conditions of Certification (specifically the RCW Management Plan).

Per your request, this report is being submitted to Jessica Dalton with the Florida Department of Environmental Protection (FDEP), Lisa Prather with the FDEP, Ben Shepherd with the Florida Fish and Wildlife Conservation Commission (FWC), and Will McDearman with the United States Fish and Wildlife Service (USFWS).

Please let me know if you have any questions or comments regarding the attached document.

Tetra Tech, Inc.

Respectfully submitted,

Peter M. Johnson
Environmental Project Manager

for Jennifer Deal
Senior Environmental Engineer

c: Jessica Dalton, FDEP
Lisa Prather, FDEP
Ben Shepherd, FWC
Will McDearman, USFWS
David Giddens, Tetra Tech

Tetra Tech, Inc.
201 East Pine Street | Suite 1000 | Orlando, FL 32801
Tel 407.480.3910 Fax 407.839.3790 www.tetratech.com

2012 FISH & WILDLIFE
ANNUAL MONITORING REPORT
CURTIS H. STANTON ENERGY CENTER
ORLANDO, FLORIDA

Conducted for:
ORLANDO UTILITIES COMMISSION
5971 PERSHING AVENUE
ORLANDO, FLORIDA 32822-3881

OUC
The *Reliable* One

Prepared by:
TETRA TECH, INC.
201 EAST PINE STREET, SUITE 1000
ORLANDO, FLORIDA 32801

Report Date: September 16, 2013

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ATTACHMENTS

1 FDEP Letter, OCD-ERP-04-0588, Orlando Utilities Commission, Mitigation Areas to Release from Monitoring, September 21, 2004

2 Saw Palmetto and Exotic Vegetation Species Survey Report, July 27, 2012

3 Annual Status Report for the Red-cockaded Woodpecker Monitoring, August 15, 2012

4 Joint Agency Mitigation & Management Plan, Appendices A, B, C, and G, 1993

5 The Curtis H. Stanton Energy Center, Red-cockaded Woodpeckers Habitat Management Plan, July 8, 2005, Revised March 2006

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ACRONYMS AND ABBREVIATIONS

95%UCLm	95 percent upper confidence limit on the mean
BA	Basal Area
COC	Condition of Certification
DBH	Diameter at Breast Height
FDEP	Florida Department of Environmental Protection
ft^2/acre	square feet per acre
GIS	Geographic Information System
GPS	global positioning system
JAMMP	Joint Agency Mitigation and Management Plan
LLP	Longleaf Pine
NA	not available
OUC	Orlando Utilities Commission
PC	Pond Cypress
Project Area	Curtis H. Stanton Energy Center, 5100 South Alafaya Trail, Orlando, Orange County, Florida
RCW	Red-cockaded Woodpecker
RHPZ	Riparian Habitat Protection Zone
RSE	Relative Standard Error
SEC	Stanton Energy Center
USFWS	United States Fish & Wildlife Service

1.0 INTRODUCTION

Tetra Tech, Inc. is pleased to provide the Orlando Utilities Commission (OUC) this Fish & Wildlife Annual Monitoring Summary Report 2012 for the Curtis H. Stanton Energy Center (SEC), 5100 South Alafaya Trail, Orlando, Orange County, Florida (hereinafter, the Project Area). Land management and monitoring activities have been prescribed and performed since 1987 for enhancement of habitat for the Red-cockaded Woodpeckers (RCW) *(Picoides borealis)* inhabiting the Project Area. The RCW is a federally-listed endangered species and state-listed species of special concern. This report summarizes field data collected during March 2013 in accordance with the "Fish & Wildlife Annual Monitoring Report" requirement set forth in Table 5, page 38 of the RCW Habitat Management Plan and Monitoring Program (DeLotelle & Guthrie, Inc., 2006), as well as remaining applicable portions of the SEC Joint Agency Mitigation and Management Plan (JAMMP) mitigation success and monitoring requirements.

1.1 PURPOSE

The purpose of this report is to meet the requirements of the following: 1) SEC Conditions of Certification for Fish & Wildlife Annual Monitoring Report (Attachment 5, p. 38, Table 5); and 2) the remaining portions of the JAMMP mitigation monitoring requirement.

Data were evaluated to determine which Mitigation Areas are meeting the Florida Department of Environmental Protection (FDEP) success criteria and should be released from further monitoring. Prior to this reporting period, OUC's ongoing land management activities resulted in the FDEP releasing other previously monitored Mitigation Areas from further monitoring (see Attachment 1). In this report, shrub and herbaceous data are reported along with Longleaf Pine tree (seedling/sapling) density and height data to summarize vegetative layer data for evaluation of OUC's land management practices compared with the USFWS Recovery Plan for the Red-cockaded Woodpecker (*Picoides borealis*): Second Revision (USFWS, 2003) definition of "good quality" RCW foraging habitat.

1.2 PROJECT AREA LOCATION AND DESCRIPTION

The Project Area encompasses approximately 3,250 acres situated between the Big and Little Econlockhatchee Rivers, and is located 8.5 miles southeast of Orlando, Florida. The power plant at the SEC is located in the approximate center of the Project Area, and the surrounding undeveloped land is naturally vegetated and serves as habitat for a variety of wildlife species. Most undeveloped land is contiguous within the SEC, although some areas are separated by paved roads, facilities, and artificial lakes. Outside of the Project Area boundaries, surrounding land use consists of a correctional facility, chopped and burned pasture, and State Road 528 to the south; Innovation Way, developed residential

subdivisions, Orange County Water Treatment Facility, and commercial centers to the north; Innovation Way and the Orange County Landfill to the west; and the Hal Scott Preserve to the east.

The power plant and associated facilities occupy approximately 845 acres of the Project Area. OUC manages and maintains an approximately 2,400-acre buffer area around the facility in a relatively natural state of longleaf pine *(Pinus palustris)* dominated forest, interspersed with cypress domes, bayheads, and numerous connecting wet prairies. Area soils have a high sand content, are strongly acidic, are low in nutrients, and are often underlain by an organic hardpan from 14 to 60 inches below the land surface. The predominant upland vegetation cover type is pine flatwoods, an upland fire sub-climax community with flat to slightly sloping topography and well to moderately well drained soils. OUC conducts prescribed burns (backing fires) on pine flatwoods in the Project Area on a 2-year interval to maintain their natural state. Saw palmetto *(Serenoa repens)* is the most abundant shrub-layer plant in the flatwoods. Gallberry holly *(Ilex glabara)*, fetterbush *(Lyonia lucida)*, staggerbush *(Lyonia fruticosa)*, wax myrtle *(Myrica cerifera)*, running oak *(Quercus pumila)*, and shiny blueberry *(Vaccinium myrsinites)* are other common native Florida shrub species found within these pine flatwoods. Wiregrass *(Aristida stricta* var. *beyrichiana)* is the dominant groundcover plant followed by broomsedges *(Andropogon* spp.), plume grass *(Saccharum gigantium)*, toothache grass *(Ctenium aromaticum)*, panicgrasses *(Panicum* spp.), and witchgrasses *(Dichanthelium* spp.). Interspersed within this groundcover matrix is a diverse mix of other graminoid, forb, and low shrub species adapted to grow in pine flatwoods subject to frequent fire intervals.

The Tree Regeneration Mitigation Areas required for monitoring total 81.5 acres and are part of both upland and wetland planting restoration efforts. Management activities within these mitigation tracts include several longleaf pine (*Pinus palustris)* and pond cypress (*Taxodium distichium* var. *nutans)* planting cycles along with ditch plugging for wetland enhancement, roller-chopping, and rotating prescribed fires.

The 12 Timber Stand Areas, which include suitable RCW habitat addressed in this vegetative cover analysis and land management evaluation, total 1,500 acres within the Project Area.

The buffer area is comprised of the Saw Palmetto and Nuisance Study and RCW Monitoring Study areas (see Attachments 2, Figures 4 and 5, and Attachment 3, Figure 3.1-1).

1.3 MITIGATION AREAS LOCATIONS AND DESCRIPTIONS

In 1993, a JAMMP prepared by Black and Veatch described mitigation and monitoring plans associated with facility expansion (Unit II) activities. Appendices A, B, C, and G of the JAMMP, providing the mitigation plan details and mitigation success criteria, are attached to this report (Attachment 4). The JAMMP designated seven Mitigation Areas to satisfy regulatory agency requirements. The JAMMP

outlined success criteria to evaluate expected mitigation results within seven areas identified as Areas 3.1 through 3.7 (Black and Veatch, 1993). Area 3.7 completely met success criteria approximately ten years ago and is, therefore, no longer monitored.

OUC removed the longleaf pine that was planted in Mitigation Area 3.4 because of interference with the overhead transmission lines. OUC and FDEP agreed to allow Mitigation Area 3.4 (Attachment 5: SEC RCW Habitat Management Plan, section 1.4) to remain as an open natural wetland prairie with a tree buffer outside the transmission line borders. A small longleaf pine tree Planting (0.28 acres) portion of Mitigation Area 3.1 was also removed from the mitigation units due to construction of a permitted gas pipeline along the southern access corridor (Attachment 5: SEC RCW Habitat Management Plan, section 1.4). Section 1.4 of the 2006 updated SEC RCW Habitat Management Plan discusses these impacts and that implementation of the updated RCW Habitat Management Plan will offset them (see Attachment 5).

Additionally, with FDEP concurrence, OUC installed three artificial cavity clusters in 2008 to ensure natural RCW dispersal or translocation. OUC is obligated to monitor RCW dispersal and translocate RCW if cavities are not in use by existing RCW within one year (see Attachment 5, Section 4.3).

Figure 1 shows the locations of these Mitigation Areas relative to the power plant and the property boundaries. Detailed drawings of these Mitigation Areas are provided in Attachment 4 (Appendix A).

The majority of mitigation activities within the five remaining Mitigation Areas have met success criteria and the FDEP released OUC from further monitoring of several parameters in 2004 (see Attachment 1). The following tree planting areas remain for field monitoring and analysis during this reporting event:

- Area 3.1 – Railroad North (see Figure 2)
- Area 3.2 – Railroad South (see Figure 3)
- Area 3.3 – RCW West (see Figure 4)
- Area 3.5 – East Prairies (see Figure 5)
- Area 3.6 – RCD (see Figure 3)

1.3.1 Area 3.1 – Railroad North

This 11.5-acre mitigation and monitoring area is located within a triangular-shaped parcel between the alternate access road and the southern transmission line. The area surrounds a naturally-occurring cypress dome buffered by a 1.5-acre Riparian Habitat Protection Zone (RHPZ). The area is upland and was planted several times with longleaf pine seedlings. The area is also managed to control invasive cogon grass. The cogon grass is responding to ongoing herbicide applications and is mostly under control. A 0.4-acre area previously planted with pond cypress seedlings and saplings exists at the

northwestern corner of Area 3.1. This 0.4-acre area was reconstructed at lower elevations to improve the wetland hydroperiod and replanted with pond cypress saplings in the fall of 2011 to replace those that had previously died due to lack of water.

1.3.2 Area 3.2 – Railroad South

Railroad South is a narrow strip of land adjacent to the western side of the railroad, extending from the southern property boundary northward to the lower third of the western side of the railroad loop. Several cycles of longleaf pine seedlings were planted in the 11.7-acre RHPZ, which runs along the entire southwestern side of Area 3.2. The remaining 9-acre wetland strand spans the length of the Mitigation Area along the northeastern edge of Area 3.2 and was planted with pond cypress saplings. The RHPZ and pond cypress mitigation areas run through a pre-existing, natural wetland system in the northwestern end of Area 3.2.

1.3.3 Area 3.3 – RCW West

This 15.6-acre disturbed upland area is located in the northwestern portion of the SEC property, within an area previously cleared to stockpile building materials during Unit 1 construction. Prior to Unit 1 construction, this area consisted of longleaf pine flatwoods with sparse tree cover. Longleaf pine seedling planting is the only activity prescribed in this area. Longleaf pine plantings occurred in 1993 and have been repeated several times.

1.3.4 Area 3.5 – East Prairies

Area 3.5 is a northerly-flowing series of interconnected wet prairies and cypress domes located on the northeastern corner of the RCW management area, and encompasses 30.7 acres. OUC filled the man-made inner connecting ditch that connected the wetland areas. The adjacent RHPZ buffer surrounding these wetlands is longleaf pine flatwoods. Several cycles of longleaf pine seedling plantings were part of the mitigation activities in the RHPZ.

1.3.5 Area 3.6 – RCD

Area 3.6 is a series of interconnected wet prairies, similar to Area 3.5. OUC filled the man-made inner connecting ditch that connected the wetland areas. Most of this area has already met success criteria and has been released from further monitoring by the FDEP. The only section of Area 3.6 that remains to be monitored for success is a 3.4-acre upland tract that has been planted several times with longleaf pine seedlings.

1.4 NATURAL COMMUNITIES AND HABITAT

Of the 2,400-acre buffer area, 1,700 acres are LLP flatwoods. Saw palmetto *(Serenoa repens)*, wiregrass species *(Aristida stricta* var. *beyrichiana* and *A. spiciformis)*, gallberry *(Ilex glabra)*, and broomsedge *(Andropogon virginicus)* dominate the understory of the longleaf pine flatwoods. A very diverse mix of low shrubs, forbs and graminoids are prevalent mixed within the wiregrass groundcover. Interspersed among longleaf pine flatwoods are pond cypress *(Taxodium distichum* var. *nutans)* domes and strands, maidencane *(Panicum hemitomon)*, graminoid, St. Johns wort *(Hypericum spp.)* marshes, hydric pond pine flatwoods, and willow/maple shrub swamps. Scrubby flatwoods, dominated by longleaf pine and myrtle oak *(Quercus myrtifolia)*, occupy a few small areas of the Project Area.

This mosaic of natural communities provides suitable habitat for many native wildlife species including RCWs and several other listed species such as state-listed threatened Bald Eagles (nesting), state-listed threatened gopher tortoises, and state-listed threatened Florida Sandhill Cranes. Although low in percentage cover, exotic plants were noted mainly near roads, construction areas, railroad tracks, and other disturbed areas. An exotic plant control program is in place at the SEC that consists of identification and treatment on a yearly basis.

2.0 METHODOLOGY

2.1 FIELD METHODOLOGY

2.1.1 Long Leaf Pine and Cypress Mitigation Area Monitoring

The five Mitigation Areas were monitored for success criteria according to the JAMMP success requirement.

All five Mitigation Areas were monitored for longleaf pine survival densities and size classes. Two of the five Mitigation Areas have sub-areas comprised of pond cypress plantings requiring monitoring. The two pond cypress planting areas were monitored for pond cypress survival densities and size classes.

Field maps were plotted depicting recent true color aerials. OUC provided Geographic Information System (GIS) Mitigation Area boundary data from the JAMMP and timber stand boundary data from the Fish & Wildlife Annual Monitoring Report 2007 (PSI, 2008). The field team performed data collection activities from March 11 through March 22, 2013.

A series of paved and unpaved roads provided access to the planted areas within the Mitigation Units for the Project Area. Pedestrian field surveys were conducted by a team of two field biologists in each of the five remaining Mitigation Areas requiring monitoring.

Field plots were identified and mapped using field measurements and a hand-held global positioning system (GPS) unit. Individual longleaf pine and pond cypress seedlings, saplings, and mature trees were counted and measured for height (nearest 0.5-foot seedlings and 1.0-foot for saplings and mature trees).

2.1.2 Tree Regeneration Sampling Methodology

Stratified random sampling methods were employed to lay out a predetermined number of circular plots in each Mitigation Area. Randomly identified plots that would overlap the previous plot were skipped so that no plots overlapped one another. The sample plot radii were based on the tree species being monitored and the sub-sampling percentage target per mitigation.

Since longleaf pine has a sparse distribution in the first Mitigation Area (Area 3.1), a complete inventory of all trees within the area was performed. A complete tree inventory was also performed in the 0.4-acre cypress planting area within Mitigation Area 3.1.

Within the remaining Mitigation Areas, a sample size (number of plots sampled) determination was made using site-specific plot count data to determine the Relative Standard Error (RSE) for each Mitigation Area.

The relative standard error (RSE) is the standard error of the mean divided by the mean and expressed as a percentage.

The **standard error of the mean** (SEM) is the standard deviation of the sample-mean's estimate of a population mean. (It can also be viewed as the standard deviation of the error in the sample mean relative to the true mean, since the sample mean is an unbiased estimator.) SEM is usually estimated by the sample estimate of the population standard deviation (sample standard deviation) divided by the square root of the sample size (assuming statistical independence of the values in the sample):

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

where

s is the sample standard deviation (i.e., the sample-based estimate of the standard deviation of the population), and
n is the size (number of observations) of the sample.

Tree count sampling within each Mitigation Area was continued (plots added) until the field-calculated RSE was reduced to 15 percent or less. RSE is a data quality objective tool used in the forestry industry and by the Center for Disease Control (Nowak et. al, 2008; Klein et al, 2002). An RSE that falls within the 15 to 10 percent range is considered acceptable in the forest industry (Nowak, personal communication, 2013).

The following are the number of plots, plot sizes, and associated radii sampled within each Mitigation Area as necessary to reach target RSE of 15 percent or less:

- Area 3.1: LLP – complete area survey (no sub-sampling)
  PC – complete area survey (no sub-sampling)
- Area 3.2: LLP – 34 plots, each 1/25 acre (23.5-foot radius)
  PC – 15 plots, each 1/25 acre (23.5-foot radius)
- Area 3.3: LLP – 61 plots each 1/20 acre (26.3-foot radius)
- Area 3.5: LLP – 59 plots, each 1/40 acre (18.6-foot radius)

- Area 3.6: LLP – 25 plots each 1/50 acre (16.7-foot radius)

For each plot, a center point was recorded with a hand-held GPS unit and marked with flagged stakes. The perimeter of the circular plot was measured and temporarily marked with flagged stakes. All living seedlings, saplings, and trees within each plot were located, counted, and measured for height. The total numbers of dead seedlings, saplings, mature trees, and other pine tree species within each plot were recorded. Observations of soil disturbances or nuisance plant conditions were also noted.

2.1.3 Timber Stand Area Monitoring

Twelve Timber Stand Areas were monitored for vegetative layer coverage and longleaf pine tree survival (see Figure 6). Timber Stand Areas were monitored for percent cover within both the herbaceous and shrub layers, as well as longleaf pine seedling and sapling survival.

Field maps were plotted depicting recent true color aerials. OUC provided maps depicting the Timber Stand boundaries from the Fish & Wildlife Annual Monitoring Report 2007 (PSI, 2008). Tetra Tech recreated the Timber Stand Areas using GIS data to create maps for plot layout and field use. The field team performed data collection activities from March 11 through March 22, 2012.

A series of paved and unpaved roads provided access to the vicinity of Timber Stand Areas within the Project Area. Pedestrian field surveys were conducted by a team of two field biologists in each of the 12 Timber Stand selected for monitoring. Field plots were identified and mapped using field measurements and a hand held GPS unit. Photographs were also taken of most plots for visual representation. Panoramic photographs were also taken from locations 3.1 North and South, 3.2 North, South and Cypress, and 3.3 North and South (Attachment 7)

2.1.4 Timber Stand Herbaceous and Shrub Cover Sampling Methodology

Stratified random sampling methods were employed to lay out a predetermined number of circular 1/10-acre plots in each Timber Stand Area. The sample plot radii (37.2 feet) were based on a 1/10-acre circle vegetative sampling methodology (James, 1970), and circular sub-plots (1/500-acre, 5.3-foot radius) were selected for estimating longleaf pine seedling and sapling survival.

Sample size (number of plots sampled) determination was made using site-specific plot count data to determine the RSE for each Timber Stand Area. Herbaceous/shrub count sampling within each Timber Stand Area was continued (plots added) until the field-calculated RSE fell below 15 percent. The minimum number of plots sampled from any Timber Stand Area was 10, regardless if fewer plots were

necessary to reach RSE less than 15 percent. The following are the number of plots sampled within each Timber Stand Area as necessary per RSE target or 10 plot minimum:

- Stand 1: 10 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 2: 13 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 3: 24 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 4: 10 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 5: 10 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 6: 20 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 7: 10 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 8: 16 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 9: 10 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 10: 10 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 11: 11 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)
- Stand 12: 10 plots, each 1/10-acre (37.2-foot radius) and 1/500-acre (5.3-foot radius)

For each plot, a center point was recorded with a hand-held GPS unit and marked with flagged stakes. Two perpendicular 74.4-foot transects were measured and temporarily marked with flagged stakes across the circle. Herbaceous and shrub coverage was then sampled (per methodology modified from James, 1970, Attachment 9) using an ocular tube held pointed down with outstretched arm's length and waist level at a consistent angle to take sightings of vegetative type (herb or shrub). Ten vegetative cover sightings, one every other step, were taken along each transect. Sightings were recorded as a "+" for herbaceous cover and a "-" for shrub cover. Sub-plots were sampled for longleaf pine seedling and sapling survival by counting and measuring all live and dead trees within each sub plot. Qualitative observations of vegetative height, dominant species, soil disturbances, or nuisance plant conditions were also noted per plot. Photographs were also taken of most plots for visual representation.

2.2 DATA ANALYSIS

This section presents an analysis of the data collected from the Mitigation Areas (3.1 Longleaf Pine, 3.1 Pond Cypress, 3.2 Longleaf Pine, 3.2 Pond Cypress, 3.3 Longleaf Pine, 3.5 Longleaf Pine, and 3.6 Longleaf Pine) and timber stands (ST01 through ST012). The results of the data analysis, including RSE, are briefly presented by Mitigation Area and timber stand. For the Mitigation Areas, the tree count by plot was used to calculate the RSE. The total herbaceous count by plot was used to calculate the RSE for the Timber Stands.

Standard deviation and a 95 percent upper confidence limit on the mean (95% UCLm) were calculated when at least eight distinct observations were reported. There were some cases with both the Mitigation Area and the Timber Stand data where less than eight seedlings and/or saplings were recorded. The standard deviation and the 95% UCLm were not calculated when this condition arose.

2.3 TREE REGENERATION MITIGATION AREAS

For the Mitigation Areas, the data were evaluated in three different data groups. The first group was total trees (i.e., seedlings, saplings, and mature trees). The second group included only seedlings, and the third group included only saplings. The data were used to develop estimates of the average tree density (trees per acre), seedling density (seedlings per acre) and sapling density (saplings per acre). The average tree density was calculated as the mean of the tree densities calculated from each sample plot within a particular Mitigation Area. The tree density of each sample plot was simply the number of live trees counted within the plot per the acreage of the plot. For example, if a total of 25 trees were counted in a sample plot of 0.04 acres in size, then the tree density was 625 trees per acre, where 625 = 25 / 0.04.

Seedling and sapling density calculations were simply the total seedlings and saplings counted in the sample plots divided by the total acreage of the sample plots. For example, if a total of 75 seedlings were counted in 10 sample plots, and each sample plot was 0.04 acre, then the density (seedlings per acre) was 188 seedlings per acre where 187.5 = 75/(10*0.04). The seedling and sapling data were also analyzed for population height and percent survival. Summary statistics on live tree density, and seedling and sapling height are minimum, maximum, mean, and standard deviation. A 95% UCLm was developed on seedling and sapling height and live tree density using the computer program ProUCL Version 4.1.00[1]. Information on population sapling height was presented as a histogram of sapling heights. The histograms for each Mitigation Area are presented in Attachment 6.

Different methods were used to calculate the percent survival of seedlings and the percent of seedlings and saplings.

- Percent currently existing seedling survival was calculated as the number of live seedlings counted divided by the total number of live seedlings plus the total number of dead seedlings counted.

- Percent originally planted seedling survival was calculated as the combined seedling and sapling densities divided by the Mitigation Area planting density. Each Mitigation Area was planted in 1993 at a given rate: 500 seedlings per acre for longleaf pine and 400 to 700 seedlings per acre

[1] http://www.epa.gov/osp/hstl/tsc/software.htm

for pond cypress. Over the last 20 years, many of the surviving seedlings have grown into the sapling size class. These classes are seedlings (less than four feet), saplings (four feet to less than 30 feet). If a Mitigation Area was originally planted at 500 seedlings per acre and there are currently 100 seedlings per acre and 150 saplings per acre, then the percent originally planted seedling survival is 50 percent (0.5 = 250/500).

2.4 TIMBER SANDS

For the Timber Stands, the data were evaluated in two different data groups. The first group was seedlings, and the second group was saplings. The seedling and sapling data were analyzed for density, height, and percent survival. Summary statistics on seedling and sapling height are minimum, maximum, mean, and standard deviation. A 95% UCLm seedlings and sapling height was developed using the computer program ProUCL Version 4.1.00.

Similar methods were used to calculate the percent survival of existing seedlings and the percent survival of existing saplings:

- The percent seedling survival was calculated as the number of live seedling counted divided by the total number of live seedling plus the total number of dead seedling counted.

- The percent sapling survival was calculated as the number of live sapling counted divided by the total number of live sapling plus the total number of dead sapling counted.

3.0 RESULTS

3.1 MITIGATION AREAS

3.1.1 Mitigation Area 3.1 Longleaf Pine

Tree Mitigation Area 3.1 longleaf pine was not sampled using randomly placed plots. The entire 11.1 acres of Tree Mitigation Area 3.1 longleaf pine was surveyed, and 72 trees were counted.

3.1.1.1 Tree Density

The estimated total tree density, which includes mature trees, seedlings, and saplings, is six trees per acre (72 trees counted divided by 11.1 acres surveyed). The estimated seedling density is 0.5 seedlings per acre. The estimated sapling density is 1.8 saplings per acre. The estimated mature tree density is 3.7 trees per acre.

3.1.1.2 Seedlings

The summary statistics on seedling are presented in Table 3.1.1a.

Table 3.1.1a Mitigation Area 3.1 Longleaf Pine Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	6
Minimum	1
Maximum	2.5
Mean	1.75
Median	1.75
SD	0.689

A 95% UCLm seedling height was not calculated as six observations may not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of currently existing seedlings was estimated to be 100 percent as per the methodology discussed in Section 2.3 on page 2-5.

3.1.1.3 Saplings

The summary statistics on sapling height are presented in Table 3.1.1b

Table 3.1.1b Mitigation Area 3.1 Longleaf Pine Summary Statistics on Sapling Height (feet)	
Number of Sapling Observed	20
Minimum	4.5
Maximum	28
Mean	17.68
Median	19.5
SD	7.487

Data appear normal, and the 95% Student's-t UCLm sapling height was estimated to be 20.57 feet. The histogram of sapling heights is provided in Attachment 6.

The percent originally planted seedling survival is less than one percent (0.5 seedling per acre plus 1.8 saplings per acre divided by 500 seedlings per acre original planting density).

3.1.2 Mitigation Area 3.1 Pond Cypress

Tree Mitigation Area 3.1 pond cypress was not sampled using randomly placed plots. The entire 0.4 acre of Tree Mitigation Area 3.1 pond cypress was surveyed, and 116 total trees were counted.

3.1.2.1 Tree Density

The estimated total tree density, which includes mature trees, seedlings, and saplings, is 290 trees per acre (116 trees counted divided by 0.4 acre surveyed). The estimated seedling density is 62.5 seedlings per acre. The estimated sapling density is 222.5 saplings per acre. The estimated mature tree density is 5 trees per acre.

3.1.2.2 Seedlings

The summary statistics on seedlings are presented in Table 3.1.2a.

Table 3.1.2a Mitigation Area 3.1 Pond Cypress Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	25
Minimum	1
Maximum	3.5
Mean	2.04
Median	1.5
SD	1.06

The 95% Chebyshev UCL on the mean seedling height was estimated to be 2.96 feet as the data distribution was not normal.

The percent survival of currently existing seedlings was estimated to be 71 percent as per the methodology discussed in Section 2.3 on page 2-5.

3.1.2.3 Saplings

The summary statistics on sapling height are presented in Table 3.1.2b

Table 3.1.2b Mitigation Area 3.1 Pond Cypress Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	89
Minimum	4
Maximum	26
Mean	7.051
Median	4.5
SD	5.617

The 95% Chebyshev UCLm seedling height was estimated to be 9.65 feet as the data distribution was not normal. The histogram of sapling heights is provided in Attachment 6.

The percent originally planted seedling survival is 71 percent (62.5 seedlings per acre plus 222.5 saplings per acre divided by 400 seedlings per acre original planting density).

3.1.3 Mitigation Area 3.2 Longleaf Pine

Thirty-four plots were surveyed from Tree Mitigation Area 3.2 LLP, which has a total Mitigation Area of 11.7 acres. Each plot was 0.04 acre; thus, a total of 1.36 acres were surveyed, 353 total longleaf pine trees were counted, and the estimated RSE was 14 percent.

3.1.3.1 Tree Density

The estimated total tree density is 260 trees per acre (353 trees counted divided by 1.36 acres sampled). The estimated seedling density is 75.74 seedlings per acre, and the estimated sapling density is 133.8 saplings per acre. The estimated mature tree density is 50.46 trees per acre.

The plot level summary statistics on tree density are presented in Table 3.1.3.

Table 3.1.3 Mitigation Area 3.2 Longleaf Pine Plot Summary Statistics on Live Trees per Acre (LTPA)	
Number of Plots	34
Minimum LTPA	25
Maximum LTPA	775
Mean LTPA	260
Median LTPA	225
SD LTPA	201
95% Approximate Gamma UCLm LTPA	331

The 95% Gamma UCLm live tree density was estimated to be 331 trees per acre as the data distribution was not normal.

3.1.3.2 Seedlings

The summary statistics on seedling are presented in Table 3.1.3a.

Table 3.1.3a Mitigation Area 3.2 Longleaf Pine Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	102
Minimum	0.5
Maximum	3.5
Mean	1.35
Median	1
SD	0.931

The 95% Chebyshev UCLm seedling height was estimated to be 1.75 feet as the data distribution was not normal.

The percent survival of existing seedlings was estimated to be 94 percent as per the methodology discussed in Section 2.3 on page 2-5.

3.1.3.3 Saplings

The summary statistics on sapling height are presented in Table 3.1.3b.

Table 3.1.3b Mitigation Area 3.2 Longleaf Pine Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	182
Minimum	4
Maximum	29
Mean	14.67
Median	15
SD	7.442

The 95% Chebyshev UCLm sapling height was estimated to be 17.08 feet as the data distribution was not normal. The histogram of sapling heights is provided in Attachment 6.

The percent originally planted seedling survival is 42 percent (75.74 seedlings per acre plus 133.8 saplings per acre divided by 500 seedlings per acre original planting density).

3.1.4 Mitigation Area 3.2 Pond Cypress

Fifteen plots were surveyed from Tree Mitigation Area 3.2 pond cypress, which has a total Mitigation Area of 9 acres. Each plot was 0.04 acre; thus, a total of 0.6 acre was surveyed, 255 total trees were counted, and the estimated RSE was 13 percent.

3.1.4.1 Tree Density

The estimated total tree density is 425 trees per acre (255 trees counted divided 0.6 acres sampled). The estimated seedling density is 50 seedlings per acre. The estimated sapling density is 366.7 saplings per acre. The estimated mature tree density is 8.3 trees per acre.

The plot level summary statistics on tree density are presented in Table 3.1.4.

Table 3.1.4 Mitigation Area 3.2 Pond Cypress Plot Summary Statistics on Live Trees per Acre (LTPA)	
Number of Plots	15
Minimum LTPA	0
Maximum LTPA	725
Mean LTPA	425
Median LTPA	500
SD LTPA	232
95% Student's-t UCLm LTPA	531

The 95% Student's-t UCLm live tree density was estimated to be 531 trees per acre as the data distribution was normal.

3.1.4.2 Seedlings

The summary statistics on seedling are presented in Table 3.1.4a.

Table 3.1.4a Mitigation Area 3.2 Pond Cypress Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	30
Minimum	0.5
Maximum	3.5
Mean	2.183
Median	2.5
SD	1.185

The 95% Chebyshev UCLm seedling height was estimated to be 3.13 feet as the data distribution was not normal.

The percent survival of existing seedlings was estimated to be 644 percent as per the methodology discussed in Section 2.3 on page 2-5.

3.1.4.3 Saplings

The summary statistics on sapling height are presented in Table 3.1.4b.

Table 3.1.4b Mitigation Area 3.2 Pond Cypress Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	220
Minimum	4
Maximum	29
Mean	12.77
Median	11
SD	7.334

The 95% Chebyshev UCLm sapling height was estimated to be 14.92 feet as the data distribution was not normal. The histogram of sapling heights is provided in Attachment 6.

The percent originally planted seedling survival is 1044 percent (50 seedlings per acre plus 366.7 saplings per acre divided by 400 seedlings per acre original planting density). Natural recruitment can allow the planted seedling survival rate to exceed 100 percent.

3.1.5 Mitigation Area 3.3 Longleaf Pine

Sixty-one plots were surveyed from Tree Mitigation Area 3.3 LLP, which has a total Mitigation Area of 15.6 acres. Each plot was 0.05 acre; thus, a total of 3.05 acres were surveyed, 204 total trees were counted, and the estimated RSE was 15 percent.

3.1.5.1 Tree Density

The estimated total tree density is 67 trees per acre (204 trees counted divided by 3.05 acres sampled). The estimated seedling density is 2.3 seedlings per acre, and the estimated sapling density is 32.8 saplings per acre. The estimated mature tree density is 31.9 trees per acre.

The plot level summary statistics on tree density are presented in Table 3.1.5.

Table 3.1.5 Mitigation Area 3.3 Longleaf Pine Plot Summary Statistics on Live Trees per Acre (LTPA)

Number of Plots	62
Minimum LTPA	0
Maximum LTPA	440
Mean LTPA	70
Median LTPA	40
SD LTPA	93
95% Chebyshev UCLm LTPA	122

The 95% Chebyshev UCLm live tree density was estimated to be 122 trees per acre as the data distribution was not normal.

3.1.5.2 Seedlings

The summary statistics on seedling are presented in Table 3.1.5a.

Table 3.1.5a Mitigation Area 3.3 Longleaf Pine Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	7
Minimum	0.5
Maximum	3.5
Mean	2.14
Median	2
SD	1.107

A 95% UCLm seedling height was not calculated as seven observations may not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of existing seedlings was estimated to be 70 percent as per the methodology discussed in Section 2.3 on page 2-5.

3.1.5.3 Saplings

The summary statistics on sapling height are presented in Table 3.1.5b.

Table 3.1.5b Mitigation Area 3.3 Longleaf Pine Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	100
Minimum	4.5
Maximum	29
Mean	16.91
Median	15
SD	6.882

The 95% Chebyshev UCLm sapling height was estimated to be 19.91 feet as the data distribution was not normal. The histogram of sapling heights is provided in Attachment 6.

The percent originally planted seedling survival is 12 percent (2.3 seedlings per acre plus 32.8 saplings per acre divided by 300 seedlings per acre original planting density).

3.1.6 Mitigation Area 3.5 Longleaf Pine

Fifty-nine plots were surveyed from Tree Mitigation Area 3.5 longleaf pine, which has a total Mitigation Area of 30.7 acres. Each plot was 0.025 acre; thus, a total of 1.48 acres were surveyed, 293 total trees were counted, and the estimated RSE was 24 percent. The target RSE of less than 15 percent was not achieved due to one outlier sample plot that contained a very high number of trees (67, mostly seedlings).

This outlier sample plot was removed from the RSE calculation and the RSE for the remaining 58 plots (maximum of 17 trees counted in any given plot) became 13 percent. This outlier plot was not used in calculating the mean plot tree density or 95 percent confidence limits.

3.1.6.1 Tree Density

The estimated total tree density is 198 trees per acre (293 trees counted divided by 1.48 acres sampled). The estimated seedling density is 130.41 seedlings per acre, and the estimated sapling density is 43.9 saplings per acre. The estimated mature tree density is 23.69 trees per acre.

The plot level summary statistics on tree density are presented in Table 3.1.6.

Table 3.1.6 Mitigation Area 3.5 Longleaf Pine Plot Summary Statistics on Live Trees per Acre (LTPA)

Number of Plots	58
Minimum LTPA	0
Maximum LTPA	680
Mean LTPA	154
Median LTPA	120
SD LTPA	150
95% Chebyshev UCLm LTPA	240

The 95% Chebyshev UCLm live tree density was estimated to be 240 trees per acre as the data distribution was not normal.

3.1.6.2 Seedlings

The summary statistics on seedling are presented in Table 3.1.6a.

Table 3.1.6a Mitigation Area 3.5 Longleaf Pine Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	193
Minimum	0.5
Maximum	5
Mean	0.961
Median	0.5
SD	0.789

The 95% Chebyshev UCLm seedling height was estimated to be 1.21 feet as the data distribution was not normal.

The percent survival of existing seedlings was estimated to be 97 percent as per the methodology discussed in Section 2.3 on page 2-5.

3.1.6.3 Saplings

The summary statistics on sapling height are presented in Table 3.1.6b.

Table 3.1.6b Mitigation Area 3.5 Longleaf Pine Summary Statistics on Sapling Height (feet)

Number of Saplings Observed	65
Minimum	3.5
Maximum	29
Mean	13.82
Median	12
SD	7.761

The 95% Chebyshev UCLm sapling height was estimated to be 15.64 feet as the data distribution was not normal. The histogram of sapling heights is provided in Attachment 6.

The percent originally planted seedling survival is 35 percent (130.41 seedlings per acre plus 43.9 saplings per acre divided by 500 seedlings per acre original planting density).

3.1.7 Mitigation Area 3.6 Longleaf Pine

Twenty-five plots were surveyed from Tree Mitigation Area 3.6 Longleaf Pine, which has a total Mitigation Area of 3.4 acres. Each plot was 0.02 acre; thus, a total of 0.5 acre was surveyed, 65 total trees were counted, and the estimated RSE was 27 percent. The target RSE of less than 15 percent was not achieved. While no single outlier sample with a very high tree count could be identified as the cause, a majority of the sample plots had relatively low numbers of trees counted, or none at all. Additional sampling to reach the target RSE was determined not practicable due to the small size of Mitigation Area 3.6 and difficulty in preventing overlap between sample plots.

3.1.7.1 Tree Density

The estimated total tree density is 130 trees per acre (65 trees counted divided by 0.5 acre sampled). The estimated seedling density is 12 seedlings per acre, and the estimated sapling density is 54 saplings per acre. The estimated mature tree density is 64 trees per acre.

The plot level summary statistics on tree density are presented in Table 3.1.7.

Table 3.1.7 Mitigation Area 3.6 Longleaf Pine Plot Summary Statistics on Live Trees per Acre (LTPA)

Number of Plots	25
Minimum LTPA	0
Maximum LTPA	950
Mean LTPA	130
Median LTPA	50
SD LTPA	200
95% Chebyshev UCLm LTPA	304

The 95% Chebyshev UCLm live tree density was estimated to be 304 trees per acre as the data distribution was not normal.

3.1.7.2 Seedlings

The summary statistics on seedling are presented in Table 3.1.7a.

Table 3.1.7a Mitigation Area 3.6 Longleaf Pine Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	6
Minimum	0.5
Maximum	3.5
Mean	2.25
Median	2.5
SD	1.255

A 95% UCLm seedling height was not calculated as six observations may not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of existing seedlings was estimated to be 100 percent as per the methodology discussed in Section 2.3 on page 2-5.

3.1.7.3 Saplings

The summary statistics on sapling height are presented in Table 3.1.7b.

Table 3.1.7b Mitigation Area 3.6 Longleaf Pine Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	27
Minimum	5
Maximum	26
Mean	13.91
Median	13
SD	7.283

The 95% Chebyshev UCLm sapling height was estimated to be 16.8 feet as the data distribution was not normal. The histogram of sapling heights is in Attachment 6.

The percent originally planted seedling survival is 13 percent (12 seedlings per acre plus 54 saplings per acre divided by 500 seedlings per acre original planting density).

3.2 TIMBER STANDS

3.2.1 Timber Sand ST01

Ten plots were surveyed from Timber Sand ST01, which has a total area of 102 acres. The surveyed area was 0.02 acre. The RSE of 3 percent was based on the herbaceous cover sighting count.

3.2.1.1 Tree Density

The estimated total tree density is 500 trees per acre (10 trees counted divided by 0.02 acre sampled). The estimated seedling density is 150 seedlings per acre, and the estimated sapling density is 200 saplings per acre. The estimated mature tree density is 150 trees per acre.

3.2.1.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.1a.

Table 3.2.1a Timber Stand ST01 Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	3
Minimum	0.5
Maximum	0.5
Mean	0.5
Median	0.5
SD	NA

NA = Not applicable as the number of observations does not support a meaningful statistic.

A 95% UCLm seedling height could not be calculated as the number of observations does not support a meaningful statistic.

The percent survival of seedlings was estimated to be 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.1.3 Sapling

The summary statistics on sapling height is presented in 3.2.1b.

Table 3.2.1b Timber Stand ST01 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	4
Minimum	4
Maximum	25
Mean	15
Median	15.5
SD	NA

NA = not applicable

A 95% lower and UCLm saplings height could not be calculated as the number of observations does not support a meaningful statistic.

The percent survival of saplings was estimated to be 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.2 Timber Sand ST02

Thirteen plots were surveyed from Timber Sand ST02, which has a total area of 136.85 acres. The surveyed area was 0.026 acre. The RSE of 3 percent was based on the herbaceous cover sighting count.

3.2.2.1 Tree Density

The estimated total tree density is 269 trees per acre (seven trees counted divided by 0.026 acre sampled). The estimated seedling density is 38 seedlings per acre. The estimated sapling density is 154 saplings per acre. The estimated mature tree density is 77 trees per acre.

3.2.2.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.2a.

Table 3.2.2a Timber Stand ST02
Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	1
Minimum	0.5
Maximum	0.5
Mean	0.5
Median	0.5
SD	NA

A 95% UCLm seedling height could not be calculated as the number of observations does not support a meaningful statistic.

The percent survival of seedlings was estimated to be 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.2.3 Sapling

The summary statistics sapling height is presented in 3.2.1b.

Table 3.2.2b Timber Stand ST02 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	3
Minimum	5.5
Maximum	10.5
Mean	7.667
Median	7
SD	2.566

A 95% UCLm saplings height could not be calculated as the number of observations does not support a meaningful statistic.

The percent survival of saplings was estimated to be 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.3 Timber Sand ST03

Twenty plots were surveyed from Timber Sand ST03, which has a total area of 324.83 acres. The surveyed area was 0.048 acre. The RSE of 7 percent was based on the herbaceous cover sighting count.

3.2.3.1 Tree Density

The estimated total tree density is 479 trees per acre (23 trees counted divided by 0.048 acre sampled). The estimated seedling density is 333 seedlings per acre. The estimated sapling density is 125 saplings per acre. The estimated mature tree density is 21 trees per acre.

3.2.3.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.3a.

Table 3.2.3a Timber Stand ST03 Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	16
Minimum	0.5
Maximum	3
Mean	0.969
Median	0.5
SD	0.785

The 95% Chebyshev UCLm seedling height was estimated to be 1.82 feet as the data distribution was not normal.

The percent survival of seedlings was estimated to be 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.3.3 Sapling

The summary statistics sapling height is presented in 3.2.3b.

Table 3.2.3b Timber Stand ST03 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	6
Minimum	4
Maximum	25
Mean	8.5
Median	5.5
SD	8.167

A 95% UCLm sapling height was not calculated as six observations may not be adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of saplings was estimated to be 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.4 Timber Sand ST04

Nine plots were surveyed from Timber Sand ST04, which has a total area of 65.08 acres. The surveyed area was 0.018 acre. The RSE of 15 percent was based on the herbaceous cover sighting count.

3.2.4.1 Tree Density

The estimated total tree density for all size classes could not be calculated due to lack of data. The sub-plots sampled did not contain trees within any size class.

3.2.4.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.4a.

Table 3.2.4a Timber Stand ST04 Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	0
Minimum	NA
Maximum	NA
Mean	NA
Median	NA
SD	NA

NA = not applicable

There were no seedlings were observed; thus, the 95% UCLm seedling height was not calculated.

The percent survival of seedlings could not be estimated, as no seedlings were observed.

3.2.4.3 Sapling

The summary statistics on seedling height are presented in Table 3.2.4b.

Table 3.2.4b Timber Stand ST04 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	0
Minimum	NA
Maximum	NA
Mean	NA
Median	NA
SD	NA

NA = not applicable

There were no saplings were observed; thus, the 95% UCLm saplings height was not calculated.

The percent survival of saplings could not be estimated, as no saplings were observed.

3.2.5 Timber Sand ST05

Ten plots were surveyed from Timber Sand ST05 which has a total area of 59.31 acres. The surveyed area was 0.02 acre. The RSE of 6 percent was based on the herbaceous cover sighting count.

3.2.5.1 Tree Density

The estimated total tree density is 200 trees per acre (four trees counted divided by 0.02 acre sampled). The estimated seedling density is 150 seedlings per acre. The estimated sapling density is 50 saplings per acre. The estimated mature tree density is 0 trees per acre, although mature trees were present outside the sample plots.

3.2.5.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.5a.

Table 3.2.5a Timber Stand ST05
Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	3
Minimum	0.5
Maximum	1
Mean	0.67
Median	0.5
SD	0.29

A 95% UCLm seedling height was not calculated as three observations is not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of seedlings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.5.3 Sapling

The summary statistics on seedling height are presented in Table 3.2.5b.

Table 3.2.5b Timber Stand ST05
Summary Statistics on Sapling Height (feet)

Number of Saplings Observed	1
Minimum	21
Maximum	21
Mean	21
Median	21
SD	NA

NA = not applicable

Only one sapling was observed; thus, the 95% UCLm saplings height was not calculated.

The percent survival of saplings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.6 Timber Sand ST06

Twenty plots were surveyed from Timber Sand ST06, which has a total area of 220.64 acres. The surveyed area was 0.04 acre. The RSE of 9 percent was based on the herbaceous cover sighting count.

3.2.6.1 Tree Density

The estimated total tree density is 450 trees per acre (18 trees counted divided by 0.04 acre sampled). The estimated seedling density is 150 seedlings per acre, and the estimated sapling density is 125 saplings per acre. The estimated mature tree density is 175 trees per acre.

3.2.6.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.6a.

Table 3.2.6a Timber Stand ST06 Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	6
Minimum	0.5
Maximum	0.5
Mean	0.50
Median	0.5
SD	0.00

A 95% UCLm seedling height was not calculated as all the observations of seedling height where the same.

The percent survival of seedlings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.6.3 Sapling

The summary statistics on sapling height are presented in Table 3.2.6b.

Table 3.2.6b Timber Stand ST06 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	5
Minimum	5.5
Maximum	25
Mean	20.5
Median	25
SD	8.49

A 95% UCLm sapling height was not calculated as five observations may not be adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of saplings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.7 Timber Sand ST07

Ten plots were surveyed from Timber Sand ST07, which has a total area of 89.89 acres. The surveyed area was 0.02 acre. The RSE of 8 percent was based on the herbaceous cover sighting count.

3.2.7.1 Tree Density

The estimated total tree density is 350 trees per acre (seven trees counted divided by 0.02 acre sampled). The estimated seedling density is 150 seedlings per acre, and the estimated sapling density is 150 saplings per acre. The estimated mature tree density is 50 trees per acre.

3.2.7.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.7a.

Table 3.2.7a Timber Stand ST07 Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	3
Minimum	0.5
Maximum	3
Mean	2.17
Median	3
SD	1.44

A 95% UCLm seedling height was not calculated as three observations are not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of seedlings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.7.3 Sapling

The summary statistics on sapling height are presented in Table 3.2.7b.

Table 3.2.7b Timber Stand ST07
Summary Statistics on Sapling Height (feet)

Number of Saplings Observed	3
Minimum	5
Maximum	12
Mean	9.333
Median	11
SD	3.79

A 95% UCLm seedling height was not calculated as three observations are not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of saplings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.8 Timber Sand ST08

Sixteen plots were surveyed from Timber Sand ST08, which has a total area of 248.48 acres. The surveyed area was 0.032 acre. The RSE of 13 percent was based on the herbaceous cover sighting count.

3.2.8.1 Tree Density

The estimated total tree density is 219 trees per acre (seven trees counted divided by 0.032 acre sampled). The estimated seedling density is 94 seedlings per acre, and the estimated sapling density is 94 saplings per acre. The estimated mature tree density is 31 trees per acre.

3.2.8.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.8a.

Table 3.2.8a Timber Stand ST08 Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	3
Minimum	0.5
Maximum	2.5
Mean	1.33
Median	1
SD	1.04

A 95% UCLm seedling height was not calculated as three observations are not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of seedlings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.8.3 Sapling

The summary statistics on sapling height are presented in Table 3.2.8b.

Table 3.2.8b Timber Stand ST08 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	3
Minimum	19
Maximum	28
Mean	24
Median	25
SD	4.58

A 95% UCLm seedling height was not calculated as three observations are not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of saplings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.9 Timber Sand ST09

Ten plots were surveyed from Timber Sand ST09, which has a total area of 56.15 acres. The surveyed area was 0.02 acre. The RSE of 14 percent was based on the herbaceous cover sighting count.

3.2.9.1 Tree Density

The estimated total tree density is 450 trees per acre (nine trees counted divided by 0.02 acre sampled). The estimated seedling density is 0 seedlings per acre, and the estimated sapling density is 100 saplings per acre. The estimated mature tree density is 350 trees per acre.

3.2.9.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.9a.

Table 3.2.9a Timber Stand ST09
Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	0
Minimum	0
Maximum	0
Mean	0.00
Median	0
SD	NA

NA = not applicable

There were no seedlings observed; thus, the 95% UCLm seedling height was not calculated.

The percent survival of seedlings could not be estimated, as no seedlings were observed.

3.2.9.3 Sapling

The summary statistics on sapling height are presented in Table 3.2.9b.

Table 3.2.9b Timber Stand ST09 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	2
Minimum	11
Maximum	19
Mean	15
Median	15
SD	NA

A 95% UCLm seedling height was not calculated as two observations are not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of saplings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.10 Timber Sand ST10

Ten plots were surveyed from Timber Sand ST10, which has a total area of 83.92 acres. The surveyed area was 0.02 acre. The RSE of 11 percent was based on the herbaceous cover sighting count.

3.2.10.1 Tree Density

The estimated total tree density is 750 trees per acre (15 trees counted divided by 0.02 acre sampled). The estimated seedling density is 300 seedlings per acre, and the estimated sapling density is 200 saplings per acre. The estimated mature tree density is 250 trees per acre.

3.2.10.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.10a.

Table 3.2.10a Timber Stand ST10 Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	6
Minimum	0.5
Maximum	3
Mean	2
Median	2.25
SD	1.14

A 95% UCLm seedling height was not calculated as six may not be adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of seedlings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.10.3 Sapling

The summary statistics on sapling height are presented in Table 3.2.10b.

Table 3.2.10b Timber Stand ST10 Summary Statistics on Sapling Height (feet)

Number of Saplings Observed	4
Minimum	6
Maximum	15
Mean	10.5
Median	10.5
SD	4.66

A 95% UCLm seedling height was not calculated as four observations are not adequate enough to compute a meaningful and reliable 95% UCLm.

The percent survival of saplings was estimated as 100 percent as per the methodology discussed in Section 2.4 on page 2-5.

3.2.11 Timber Sand ST11

Eleven plots were surveyed from Timber Sand ST11, which has a total area of 38.3 acres. The surveyed area was 0.022 acre. The RSE of 13 percent was based on the herbaceous cover sighting count.

3.2.11.1 Tree Density

The estimated total tree density is 136 trees per acre (three trees counted divided by 0.022 acre sampled) and is comprised completely of mature trees only. The estimated seedling and sapling densities could not be calculated due to the lack of data. The sub-plots sampled did not contain trees within the seedling and sapling size classes.

3.2.11.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.11a.

Table 3.2.11a Timber Stand ST11 Summary Statistics on Seedling Height (feet)	
Number of Seedlings Observed	0
Minimum	NA
Maximum	NA
Mean	NA
Median	NA
SD	NA

NA = not applicable

There were no seedlings were observed; thus, the 95% UCLm seedling height was not calculated.

The percent survival of seedlings could not be estimated, as no seedlings were observed.

3.2.11.3 Sapling

The summary statistics on seedling height are presented in Table 3.2.11b.

Table 3.2.11b Timber Stand ST11 Summary Statistics on Sapling Height (feet)	
Number of Saplings Observed	0
Minimum	NA
Maximum	NA
Mean	NA
Median	NA
SD	NA

NA = not applicable

There were no saplings were observed; thus, the 95% UCLm saplings height was not calculated.

The percent survival of saplings could not be estimated, as no saplings were observed.

3.2.12 Timber Sand ST12

Ten plots were surveyed from Timber Sand ST12, which has a total area of 34.08 acres. The surveyed area was 0.02 acre. The RSE of 10 percent was based on the herbaceous cover sighting count.

3.2.12.1 Tree Density

The estimated total tree density is 50 trees per acre (one tree counted divided by 0.02 acre sampled) and is comprised completely of mature trees only. The estimated seedling and sapling densities could not be calculated due to the lack of data. The sub-plots sampled did not contain trees within the seedling and sapling size classes.

3.2.12.2 Seedlings

The summary statistics on seedling height are presented in Table 3.2.12a.

Table 3.2.12a Timber Stand ST12
Summary Statistics on Seedling Height (feet)

Number of Seedlings Observed	0
Minimum	NA
Maximum	NA
Mean	NA
Median	NA
SD	NA

NA = not applicable

There were no seedlings were observed; thus, the 95% UCLm seedling height was not calculated.

The percent survival of seedlings could not be estimated, as no seedlings were observed.

3.2.12.3 Sapling

The summary statistics on seedling height are presented in Table 3.2.12b.

Table 3.2.12b Timber Stand ST12
Summary Statistics on Sapling Height (feet)

Number of Saplings Observed	0
Minimum	NA
Maximum	NA
Mean	NA
Median	NA
SD	NA

NA = not applicable

There were no saplings were observed; thus, the 95% UCLm saplings height was not calculated.

The percent survival of saplings could not be estimated, as no saplings were observed.

4.0 DISCUSSION

4.1 DISCUSSION -- TREE REGENERATION MITIGATION AREAS

According to data evaluated during the 2012 monitoring period, none of the five Longleaf Pine Tree Regeneration Mitigation Areas currently meet success criteria, and one of the two Pond Cypress Tree Regeneration Mitigation Areas currently meets success criteria (see Table 4-1). Longleaf pine and pond cypress tree densities within each Mitigation Area are discussed in further detail below.

4.1.1 Area 3.1 – Railroad North

Currently at an overall pond cypress total tree density of 290 trees per acre, the northern 0.4-acre wetland portion of Area 3.1 (see Figure 2) is not meeting the JAMMP success criteria of 400 wetland trees per acre. The estimated seedling density is 62.5 seedlings per acre, the estimated sapling density is 222.5 saplings per acre, and the estimated mature tree density is 5 trees per acre. Recent activities to increase mitigation success were taken by OUC in 2011, including grading to increase wetland hydrology and cypress sapling planting to increase tree density. While these measures have improved PC tree density, evidence of tree stress and grazing damage by white-tailed deer may be an indicator that the tree density will decline in the future.

Currently, the 3.1 longleaf pine seedling planting area (11.1 acres) is not meeting success criteria. The estimated total tree density (six trees per acre) was used for comparison with JAMMP 5-Year success criteria (300 seedlings per acre). For comparison with success criteria, the estimated density of live trees was used to account for approximately 20 years of growth in original seedlings planted in 1994. The estimated seedling density is 0.5 seedlings per acre with an average height of 1.8 feet, and the estimated sapling density is 1.8 saplings per acre with an average height of 17.7 feet. The estimated mature tree density is 3.7 trees per acre of trees greater than or equal to 30-feet in height.

A majority of the surviving longleaf pine trees are semi-mature and mature individuals in the northeastern corner and along the perimeter of Area 3.1. Lack of longleaf pine survival appears to be primarily due to disturbance from previous land management activities such as fire, roller-chopping, exotic plant control activities, and prior competition by weedy native and exotic plants. Ongoing management activities, including prescribed fire (2013) and the control of cogon grass through low disturbance applications of herbicide by applicators on foot with backpack sprayers, appear to be promoting groundcover conditions conducive to longleaf pine seedling survival.

Photographs taken from Area 3.1 during the March 2013 monitoring event are provided in Attachment 7.

4.1.2 Area 3.2 – Railroad South

Currently, the 3.2 longleaf pine seedling planting area (11.7 acres) is not meeting success criteria. The average total tree density (260 trees per acre) was used for comparison with JAMMP 5-Year success criteria (300 seedling plantings per acre). For comparison with success criteria, the average density of live trees was used to account for approximately 20 years of growth in original seedlings planted in 1994. The estimated seedling density is 75.7 seedlings per acre with an average height of 1.4 feet, and the estimated sapling density is 133.8 saplings per acre with an average height of 14.7 feet. The estimated mature tree density is 50.46 trees per acre of trees greater than or equal to 30-feet in height.

The 3.2 pond cypress seedling planting area (11.7 acres) is currently meeting success criteria. The average total tree density (425 trees per acre) was used for comparison with JAMMP 5-Year success criteria (400 seedling plantings per acre). For comparison with success criteria, the average density of live trees was used to account for approximately 20 years of growth in original seedlings planted in 1994.

The estimated seedling density is 50 seedlings per acre with an average height of 2.2 feet, and the estimated sapling density is 336.7 saplings per acre with an average height of 12.8 feet. The estimated mature tree density is 8.3 trees per acre of trees greater than or equal to 30-feet in height.

Photographs taken from Area 3.2 during the March 2013 monitoring event are provided in Attachment 7.

4.1.3 Area 3.3 – RCW West

Currently, the 3.3 longleaf pine seedling planting area (15.6 acres) is not meeting success criteria. The average total tree density (72 trees per acre) was used for comparison with JAMMP 5-Year success criteria (300 seedling plantings per acre). For comparison with success criteria, the average density of live trees was used to account for approximately 20 years of growth in original seedlings planted in 1994.

The estimated seedling density is 2.3 seedlings per acre with an average height of 2.1 feet, and the estimated sapling density is 32.8 saplings per acre with an average height of 16.9 feet. The estimated mature tree density is 31.9 trees per acre greater than or equal to 30-feet in height.

Photographs taken from Area 3.3 during the March 2013 monitoring event are provided in Attachment 7.

4.1.4 Area 3.5 – East Prairies

Currently, the 3.5 longleaf pine seedling planting area (30.7 acres) is not meeting success criteria. The average total tree density (154 trees per acre) was used for comparison with JAMMP 5-Year success criteria (300 seedling plantings per acre). For comparison with success criteria, the average density of live trees was used to account for approximately 20 years of growth in original seedlings planted in 1994.

The estimated seedling density is 86.5 seedlings per acre with an average height of 0.9 feet, and the estimated sapling density is 42.6 saplings per acre with an average height of 13.8 feet. The estimated mature tree density is 23.69 trees per acre greater than or equal to 30-feet in height.

Photographs taken from Area 3.5 during the March 2013 monitoring event are provided in Attachment 7.

4.1.5 Area 3.6 – RCD

Currently, the 3.6 longleaf pine seedling planting area (3.4 acres) is not meeting success criteria. The average total tree density (130 trees per acre) was used for comparison with JAMMP 5-Year success criteria (300 seedling plantings per acre). For comparison with success criteria, the average density of live trees was used to account for approximately 20 years of growth in original seedlings planted in 1994.

The estimated seedling density is six seedlings per acre with an average height of 2.3 feet, and the estimated sapling density is 27 saplings per acre with an average height of 14.9 feet. The estimated mature tree density is 64 trees per acre greater than or equal to 30-feet in height.

Photographs taken from Area 3.6 during the March 2013 monitoring event are provided in Attachment 7.

Table 4-1

Summary of Longleaf Pine Regeneration and Comparison to JAMMP Success Criteria
Stanton Energy Center

Mitigation Area Name	Subsection Name	Total Mitigation Area (acres)	Size per Plot (acres)	Number of Plots Surveyed 2012	Total Quantity of Trees Surveyed 2012	JAMMP 5-Year Mitigation Success Criteria[1]	2008 Survey Results (trees per acre)	2009 Survey Results (trees per acre)	2010 Survey Results (trees per acre)	2011 Survey Results (trees per acre)	2012 Survey Results[2] (trees per acre)	2012 Success Criteria Results
3.1	LLP	11.1	Entire Area	NA	72	300	17	11	9	5	6	NO
3.1	Cypress	0.4	Entire Area	NA	116	400	75	38	48	268	290	NO
3.2	LLP	11.7	0.04	34	353	300	389	256	157	134	260	NO
3.2	Cypress	9	0.04	15	255	400	517	457	407	215	425	YES
3.3	LLP	15.6	0.05	61	204	150	119	60	47	51	70	NO
3.5	LLP	30.7	0.03	59	293	300	437	264	238	270	154	NO
3.6	LLP	3.4	0.02	25	65	300	393	150	218	127	130	NO

Notes:

1 Success Criteria from JAMMP (Black and Veatch, 1993), specified as seedlings per acre (longleaf pine) or wetland trees per acre (pond cypress)

2 Results expressed as combined LLP seedling, sapling and mature tree densities to account for up to 20 years of growth from original seedlings planting in 1994; pond cypress density expressed as wetland trees per acre

4.2 DISCUSSION -- TIMBER STAND HERBACEOUS AND SHRUB COVERAGE

Estimates of percent ground cover by native species of herbaceous plants within the 12 Timber Stands range between 31 (ST07) to 75 (ST01) percent, with 49 percent overall average (see Table 4-2). Conversely, estimates of percent ground cover by saw palmetto and woody shrubs range between 25 to 69 percent, with 51 percent overall average. General observations indicate that wiregrass *(Aristida stricta var. beyrichiana)* is the dominant groundcover plant and saw palmetto *(Serenoa repens)* is the dominant shrub-layer plant (see sample plot photographs provided in Attachment 7). The sample plots contained variable percentages of dense herbaceous and dense shrub vegetation, with areas of non-vegetated open-ground virtually nonexistent, except for ST01 through ST06 where recent fire had occurred.

It should also be noted that for approximately one to three years following fire, a diverse assemblage of low herbaceous, grass and forb species have been observed on-site to flourish below the regenerating saw palmettos. This "sub-palmetto" herbaceous layer is often obscured from the survey by the prevalence of wide, flat palm fronds, which are more easily detected. While this herbaceous layer is difficult to incorporate within the survey, it should not be discounted as it underscores the importance of frequent fire return interval in maintaining high plant diversity within the pine flatwoods ecosystem.

These results indicate that overall Timber Stand herbaceous coverage is meeting USFWS RCW Recovery Plan recommendations for percent coverage (greater than 40 percent) by "native bunchgrasses and forbs" present within "good quality" RCW foraging habitat (USFWS, 2003). Individually, Timber Stand herbaceous coverage appears to increase immediately following fire for one to two years, and then starts to decrease within two to three years following fire (see Table 4-2 and Figure 7). The specific heights and densities of saw palmetto and locations of invasive plant species throughout the Project Area are indicated in the Saw Palmetto and Nuisance Plant Report for 2012 (see Attachment 2).

Attachment 7 provides representative photographs of a few sample plots from each of the Timber Stands.

Table 4-2

Summary of Timber Stands Percent Herbaceous and Shrub Coverage for 2009, 2010, 2011 and 2012 And Percent Herbaceous Coverage and LLP Basal Area from 2007 Stanton Energy Center

Timber Stand Number	2012 Percent Herbaceous Cover	2012 Percent Shrub Cover	2011 Percent Herbaceous Cover	2011 Percent Shrub Cover	2010 Percent Herbaceous Cover	2010 Percent Shrub Cover	2009 Percent Herbaceous Cover	2009 Percent Shrub Cover	*2007 Mean Percent Herbaceous Cover	*2007 Mean Longleaf Pine BA (ft^2/ac)
ST01	75	25	61	39	55	45	74	26	50	25
ST02	52	48	67	33	56	44	52	48	63	9
ST03	51	49	53	47	52	48	43	57	56	8
ST04	45	55	66	34	58	42	40	60	57	13
ST05	62	38	39	61	38	62	43	57	42	16
ST06	52	48	49	51	56	44	53	47	55	28
ST07	31	69	50	50	51	49	47	53	44	4
ST08	36	64	46	54	50	50	45	55	49	7
ST09	49	51	40	60	60	40	42	58	47	24
ST10	52	48	65	35	38	62	54	46	44	18
ST11	38	62	57	43	48	52	39	61	50	25
ST12	49	51	55	45	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
Average	49	51	54	46	51	49	48	52	51	16

Notes :
*Source PSI, 2008
ft^2/ac = square feet per acre
BA = Basal Area

4.3 LAND MANAGEMENT ACTIVITIES SUMMARY

The OUC has an ongoing land management program within uplands to maintain and improve existing longleaf pine flatwoods ecosystem for the RCW population expansion. The RCW Habitat Management Plan, dated July 8, 2005, and revised March 2006 (DeLotelle & Guthrie, Inc., 2006), is currently guiding these land management activities (see Attachment 5). The primary land management activities currently being conducted are prescribed fire (on a two year rotation), roller-chopping (to control saw palmetto) and the control of invasive exotic plants. Areas are chopped once the palmetto reaches a height of 4-feet. Figure 7 depicts documented prescribed fire and roller-chopping activities to date within the Project Area.

4.4 RCW MONITORING AND HABITAT ENHANCEMENT ACTIVITIES

The objectives of the Annual RCW Monitoring are as follows:

A) Search entire SEC site to locate all RCW cavity trees on the property.

B) Determine the status (occupied, abandoned, or start-hole) of each cavity tree and identify in the annual report.

C) Determine the location of all cavity trees, including the three new artificial clusters using GPS equipment and list in the report.

D) Conduct a census of the clans (a family group consisting of the breeders, helpers, and offspring) nesting on the SEC property following the methods listed below:
   1) Capture and band RCWs with color-coded plastic and numbered identification leg bands (if possible, nestlings will be banded at about six to nine days of age).
   2) Observe daily foraging and diurnal roosting activities of banded RCWs to determine group size and composition. All RCW banding data is to be included in the annual report.
   3) Monitoring of group populations to determine breeder replacement, breeder status, and social structure.

E) Calculate survival and turnover rates by comparing the censuses of banded birds in successive years.

F) Determine group size and breeding status by observation of clans (i.e., determination of the individuals in a clan and their involvement in nesting activities).

G) Determine success primarily by examining nest cavities with a device for visual observation ("nest peeper" or similar apparatus) during the nesting season (April to June) or secondarily from examining group size and individual members after the nesting season.

H) Prepare and submit a summary report presenting and analyzing the above information by September 1 of each year.

Section 4.0 of the Status Report, Red-Cockaded Woodpecker Mitigation Activities (see Attachment 3) states that "there were 22 active (RCW) cavities in 2012, which is down slightly from 25 in 2011". Five family groups initiated nesting activity in 2012, ultimately resulting in seven successful fledglings (BDA, 2012). The total SEC RCW population immediately following the 2012 nesting season was reported to be 26 birds, 19 adults and seven fledglings (BDA, 2012).

Attachment 3 provides specific details of previous mitigation activities, artificial cavity locations and utilization, as well as 2011 to 2012 cavity monitoring, cavity locations, and banding data.

The one Bald Eagle nest (Nest Identification OR043) within the Project Area is located on the eastern side of the RCW management area near Cluster E. Bald Eagles have nested in the area (two successive nest trees) successfully from 2000 through 2012, producing at least 10 young during these years.

4.5 SAW PALMETTO AND NUISANCE PLANT SURVEY AND REPORT

Tetra Tech conducted a saw palmetto cover (density and height classes) and exotic plant survey throughout the entire Project Area during June 2012. OUC land management activities are increasing open, native bunchgrass cover for RCW foraging and reducing exotic plant and saw palmetto coverage. The exotic nuisance plants currently have approximately six percent cover across the Project Area. Maps included in the July 27, 2012, Tetra Tech report (see Attachment 2) are used to guide annual management activities to restore target areas (nuisance plant outbreaks and dense/high saw palmetto) toward optimal RCW habitat.

5.0 CONCLUSION AND RECOMMENDATIONS

The JAMMP includes success criteria for each of the upland and wetland mitigation areas at the SEC. Annual monitoring of the mitigation areas is required to collect data and evaluate each mitigation area for success. Monitoring is required until each mitigation area/sub-area has achieved the success criteria. Once determined to be successful, no further monitoring will occur and the mitigation area will then continue to be managed under the RCW Habitat Management Plan (DeLotelle & Guthrie, Inc., 2006) as part of the surrounding 2,400-acre buffer preserve. The success criteria are provided in Attachment 4 (JAMMP, 1993 - Appendix A: Conditions of Approval and Final Success Criteria).

Tree data from the mitigation areas and herbaceous/shrub data from the Timber Stands was collected in March 2013. This data is analyzed in Section 3.1 and discussed in Section 4.1 of this report. Table 4-1 lists the results of the 2012 monitoring with respect to the success criteria.

5.1 TREE REGENERATION MITIGATION AREAS MEETING SUCCESS CRITERIA

Mitigation Area 3.2 Pond Cypress is currently meeting success criteria, as discussed in Section 4.1, and should be released from further monitoring.

5.2 TREE REGENERATION MITIGATION AREAS NOT MEETING SUCCESS CRITERIA

Mitigation Areas 3.1 Longleaf Pine, 3.1 Pond Cypress, 3.2 Longleaf Pine, 3.3 Longleaf Pine, 3.5 Longleaf Pine and 3.6 Longleaf Pine are not currently meeting success criteria, as discussed in Section 4.1.

5.2.1 Mitigation Area 3.1 Railroad North

Although Mitigation Area 3.1 Pond Cypress has benefitted from re-grading and additional planting in 2011, it continues to not meet success criteria. Due to factors discussed in Section 4.1.1, conditions may not be favorable to meet success criteria without additional tree planting, augmentation of hydrology (especially during tree planting establishment and extended drought periods) and fencing to exclude wild animals from the area. Monitoring should be continued until such additional measures can be carried out by OUC and success criteria are achieved.

Mitigation Area 3.1 Longleaf Pine has low tree density, due to disturbance discussed in Section 4.1.1. Monitoring should be continued until the area can be replanted and success criteria met.

5.2.2 Mitigation Area 3.2 Railroad South LLP

Although this area is not meeting success criteria (300 trees per acre), it is close at 260 trees per acre. General observations of the shrub and groundcover strata indicate that appropriate native bunchgrass and shrub species dominate throughout the area. Natural recruitment of longleaf pine seedlings is also estimated to be occurring at a significant rate (76 seedlings per acre). Previous recent (four years) results have all been below success criteria, except in 2008 when the estimated tree density exceeded success criteria. Monitoring should be continued until the area meets success criteria, or it can be reasonably determined successful at its current tree density.

5.2.3 Mitigation Areas 3.3 RCW West and 3.6 RCD East

Mitigation Areas 3.3 and 3.6 are currently at approximately one half of the longleaf pine tree densities necessary to meet their respective success criteria (see Figure 4-1). These areas are exhibiting limited natural recruitment, as evidenced by low seedling densities. These mitigation areas may need to be reassessed to determine if they are suitable to support their respective success criteria tree density benchmarks. Monitoring should be continued until the area meets success criteria, either naturally or by adjustments to the mitigation site and methods.

5.2.4 Mitigation Area 3.5 East Prairies

This area is not meeting success criteria (300 trees per acre), at 154 trees per acre. General observations of the shrub and groundcover strata indicate that appropriate native bunchgrass and shrub species dominate throughout the area. Natural recruitment of longleaf pine seedlings is also estimated to be occurring at a significant rate (87 seedlings per acre), which was higher than all other mitigation areas. Previous recent (four years) results have all been below success criteria, except in 2008 when the estimated tree density exceeded success criteria. Monitoring should be continued until the area meets success criteria, or it can be reasonably determined successful at its current tree density.

5.3 TIMBER STANDS VEGETATION CONDITIONS

The overall longleaf pine flatwoods vegetative conditions within Timber Stands 1 through 12 (including all longleaf pine Tree Regeneration Mitigation Areas) appear to be responding well to current land management activities. All timber stands currently meet or approximate the USFWS definition of "good quality" RCW foraging habitat in the groundcover and mid-story (USFWS, 2003). Land management activities should continue to be implemented per the RCW Habitat Management Plan (DeLotelle and Guthrie, 2006) with a focus on reducing areas of dense, tall saw palmetto and control of invasive, exotic plant species.

The estimated tree densities within Timber Stands 1 through 12 ranged between 50 trees per acre (Stand 12) and 750 trees per acre (Stand 10). It is recommended that larger sample size and plot sizes are necessary to increase the accuracy and reliability of future tree density counts within the Timber Stands.

Longleaf pine Mean Basal Area estimates reported for the Project Area within RCW territories in 2004 and Timber Stands 1 through 11 in 2007 ranged between 5.4-15.8 square feet per acre (ft^2/acre) and 7.1-28.0 ft^2/acre respectively (DeLotelle and Guthrie, 2006), (PSI, 2008). Longleaf pine Mean Basal Area estimates reported for Timber Stands 1 through 12 in 2011 ranged between 21.0-43.3 ft^2/acre (Tetra Tech, 2011a). While they appear to be increasing within Timber Stands 1 through 12 from 2004 to 2011, mean basal area densities within these ranges are considered "low" overall. When separated by DBH size classes for comparison with the USFWS definition of "good quality" RCW foraging habitat (USFWS, 2003), several of the USFWS defined habitat criteria are not being met (Tetra Tech, 2011a). Given time to mature, Timber Stands 1 through 12 are likely to meet most USFWS defined habitat criteria for "good quality" foraging habitat. The next in depth 5-Year Habitat Survey will be conducted in 2016.

6.0 REFERENCES

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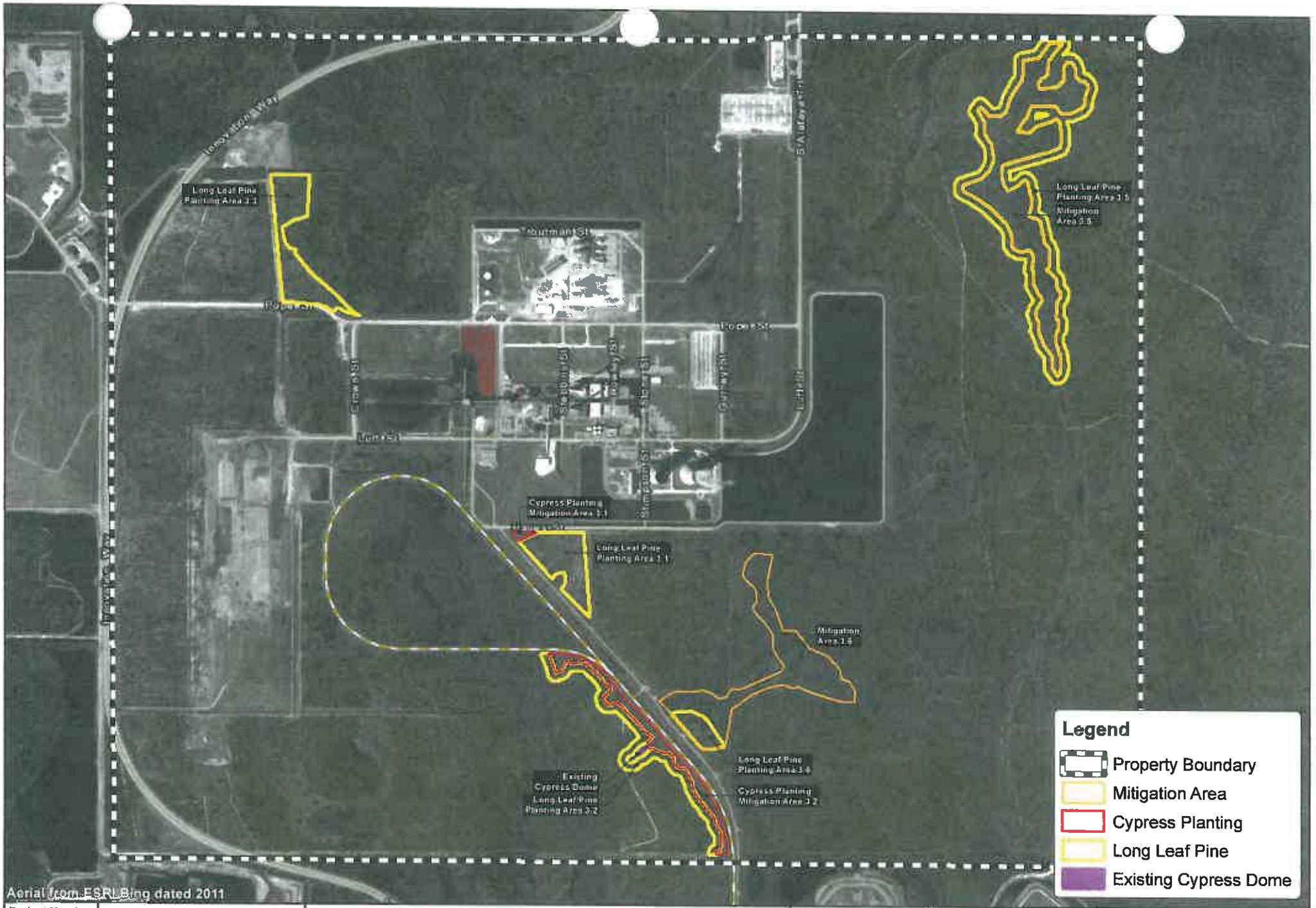
FIGURES



Project Number 112C05141 Date Created 04/11/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 1,600 800 0 1,600 Feet	**FIGURE 1** **JAMMP TREE REGENERATION MITIGATION MONITORING AREAS**

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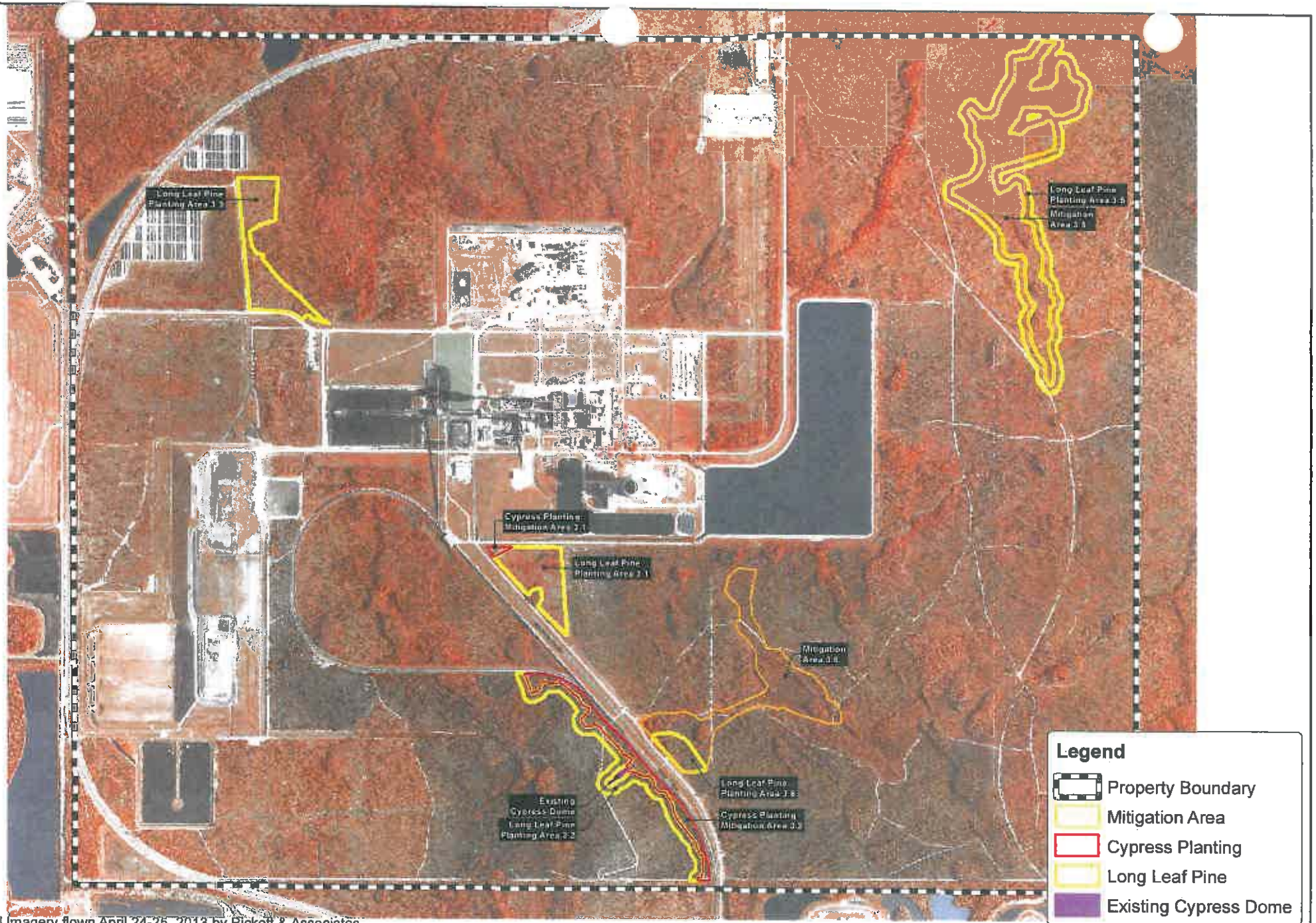

Aerial imagery flown April 24-25, 2013 by Pickett & Associates

Project Number 112C05141 Date Created 04/11/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 1,600 800 0 1,600 Feet	**FIGURE 1A** **JAMMP TREE REGENERATION MITIGATION MONITORING AREAS**

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Aerial Imagery flown April 24-25, 2013 by Pickett & Associates

Project Number 112C05141 Date Created 05/22/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 1,600 800 0 1,600 Feet	**FIGURE 1B** **JAMMP TREE REGENERATION MITIGATION MONITORING AREAS**

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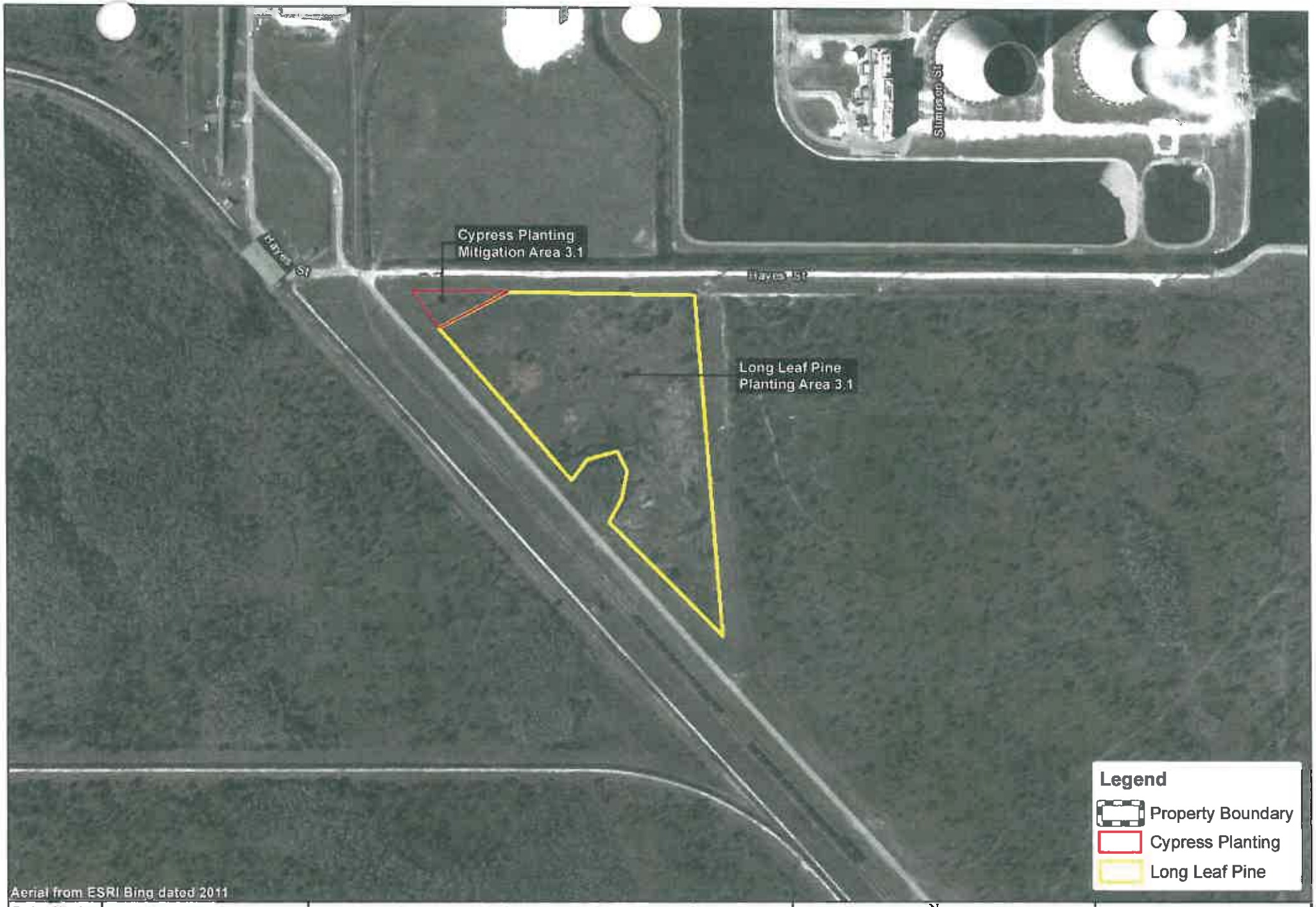

Project Number 112C05141 Date Created 04/11/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 400 200 0 400 Feet	**FIGURE 2** **AREA 3.1**

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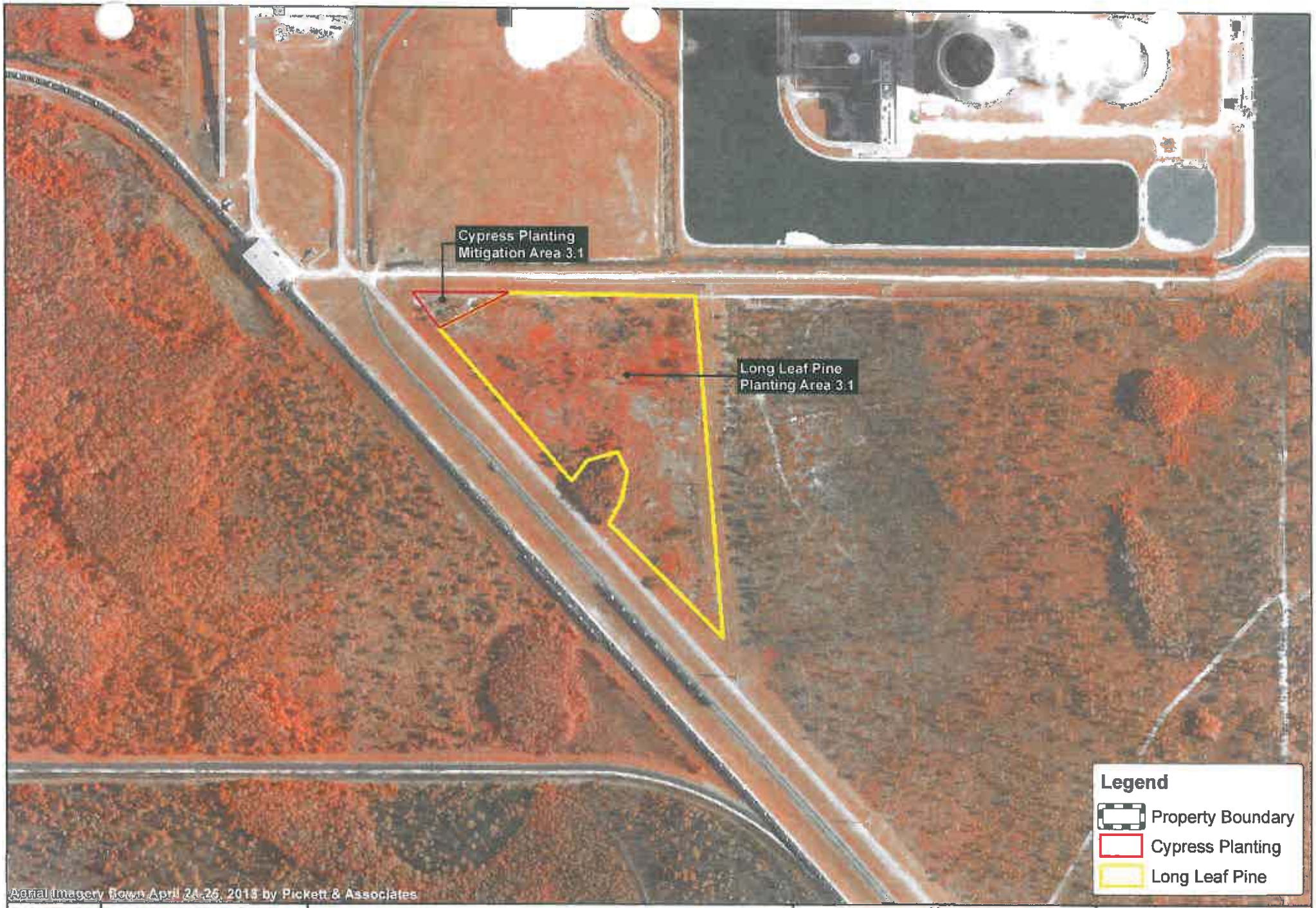
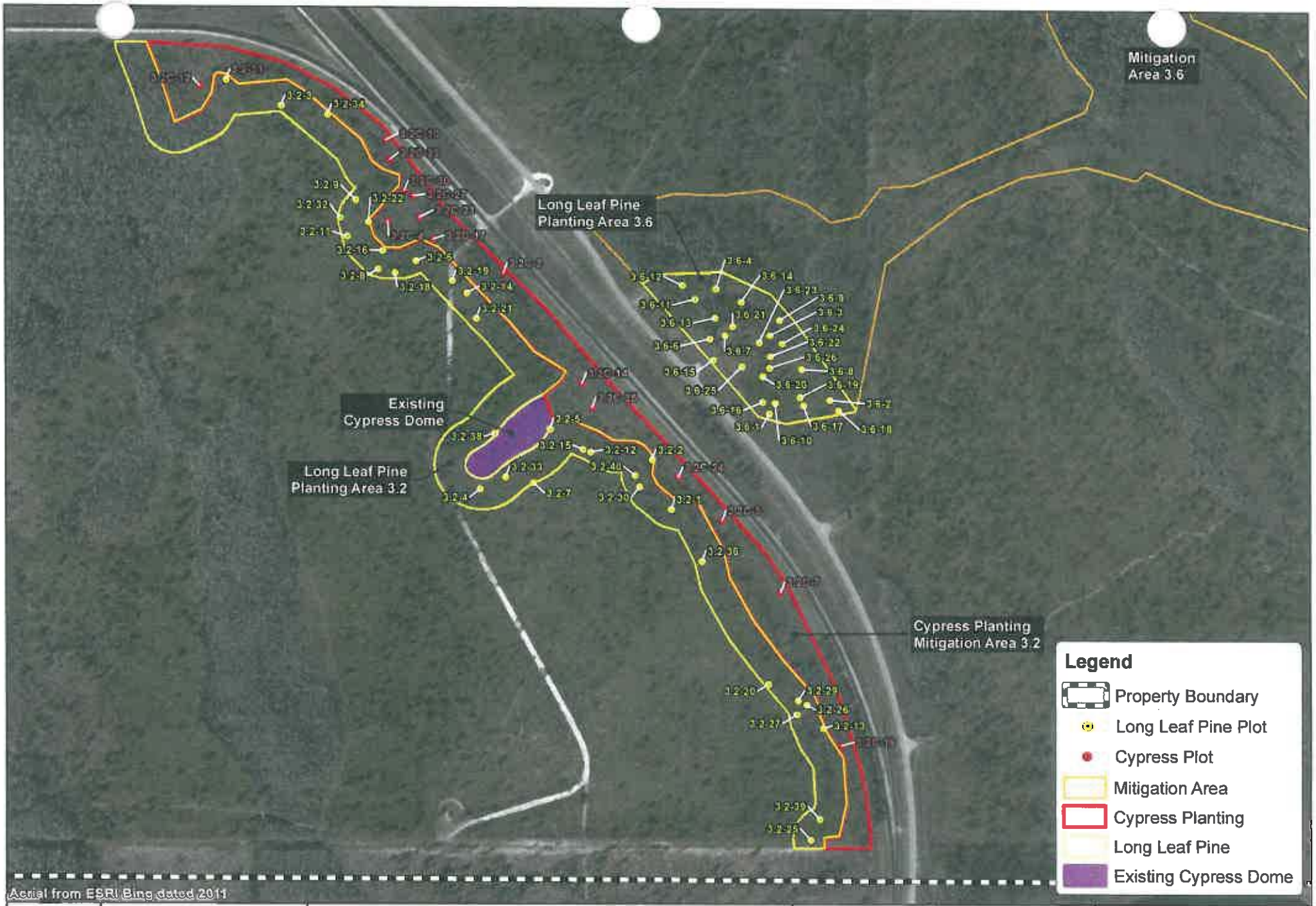


Project Number		The Curtis H. Stanton Energy Center		
112C05141	TETRA TECH	5100 S. Alafaya Trail Orlando, Orange County, Florida	N 400 200 0 400 Feet	FIGURE 2A AREA 3.1
Date Created		ORLANDO UTILITIES COMMISSION		
05/22/2013				

Project Number	TETRA TECH	The Curtis H. Stanton Energy Center	N	FIGURE 2B
112C05141		5100 S. Alafaya Trail	400 200 0 400	AREA 3.1
Date Created		Orlando, Orange County, Florida	Feet	
05/22/2013		ORLANDO UTILITIES COMMISSION		



Project Number		The Curtis H. Stanton Energy Center	N	FIGURE 3
112C05141	TETRA TECH	5100 S. Alafaya Trail		AREAS 3.2 & 3.6
Date Created		Orlando, Orange County, Florida	400 200 0 400 Feet	NEW SAMPLE
04/11/2013		ORLANDO UTILITIES COMMISSION		LOCATIONS

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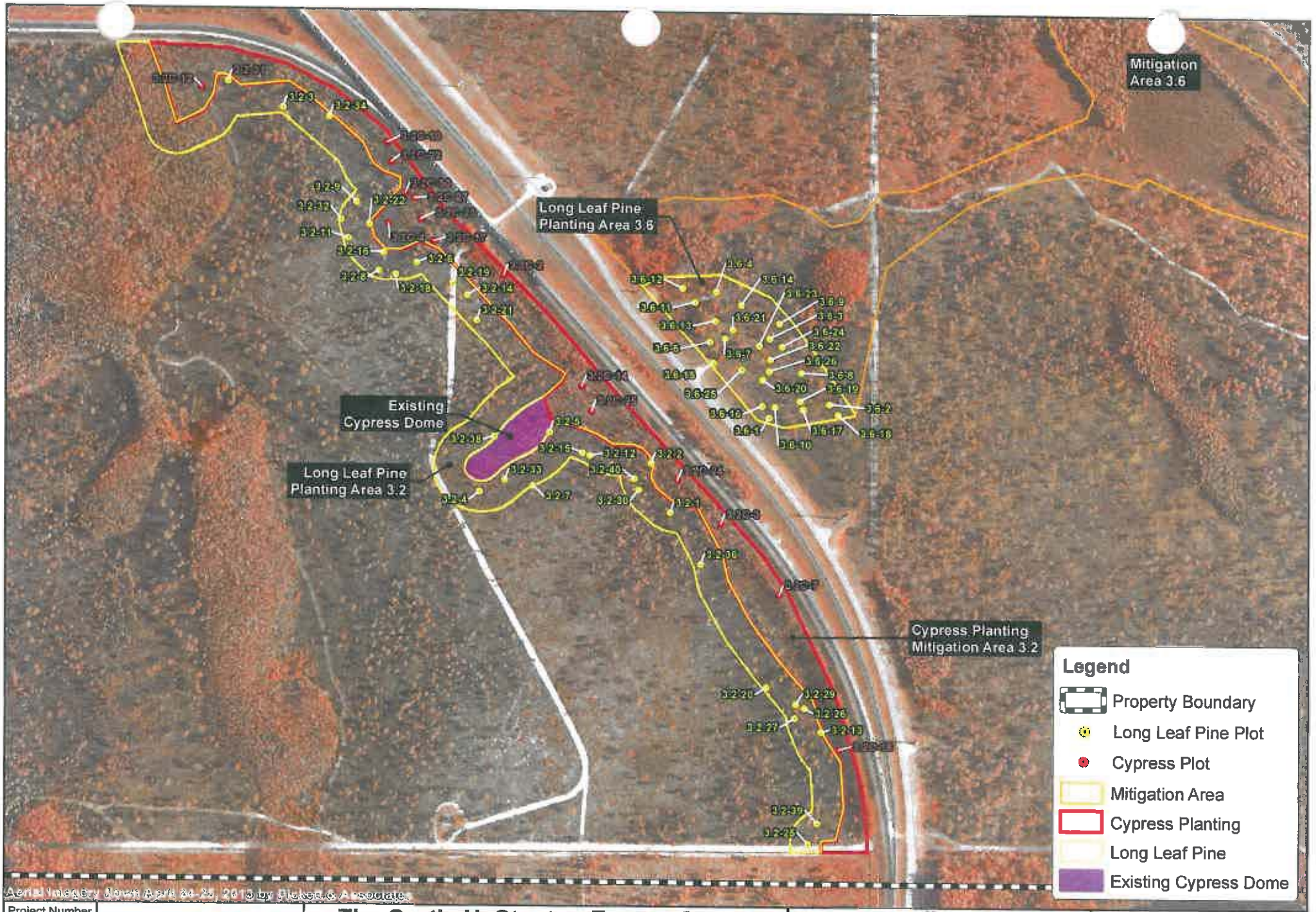

Project Number	TETRA TECH	The Curtis H. Stanton Energy Center	FIGURE 3A
112C05141		5100 S. Alafaya Trail	AREAS 3.2 & 3.6
Date Created		Orlando, Orange County, Florida	NEW SAMPLE LOCATIONS
05/22/2013		ORLANDO UTILITIES COMMISSION	

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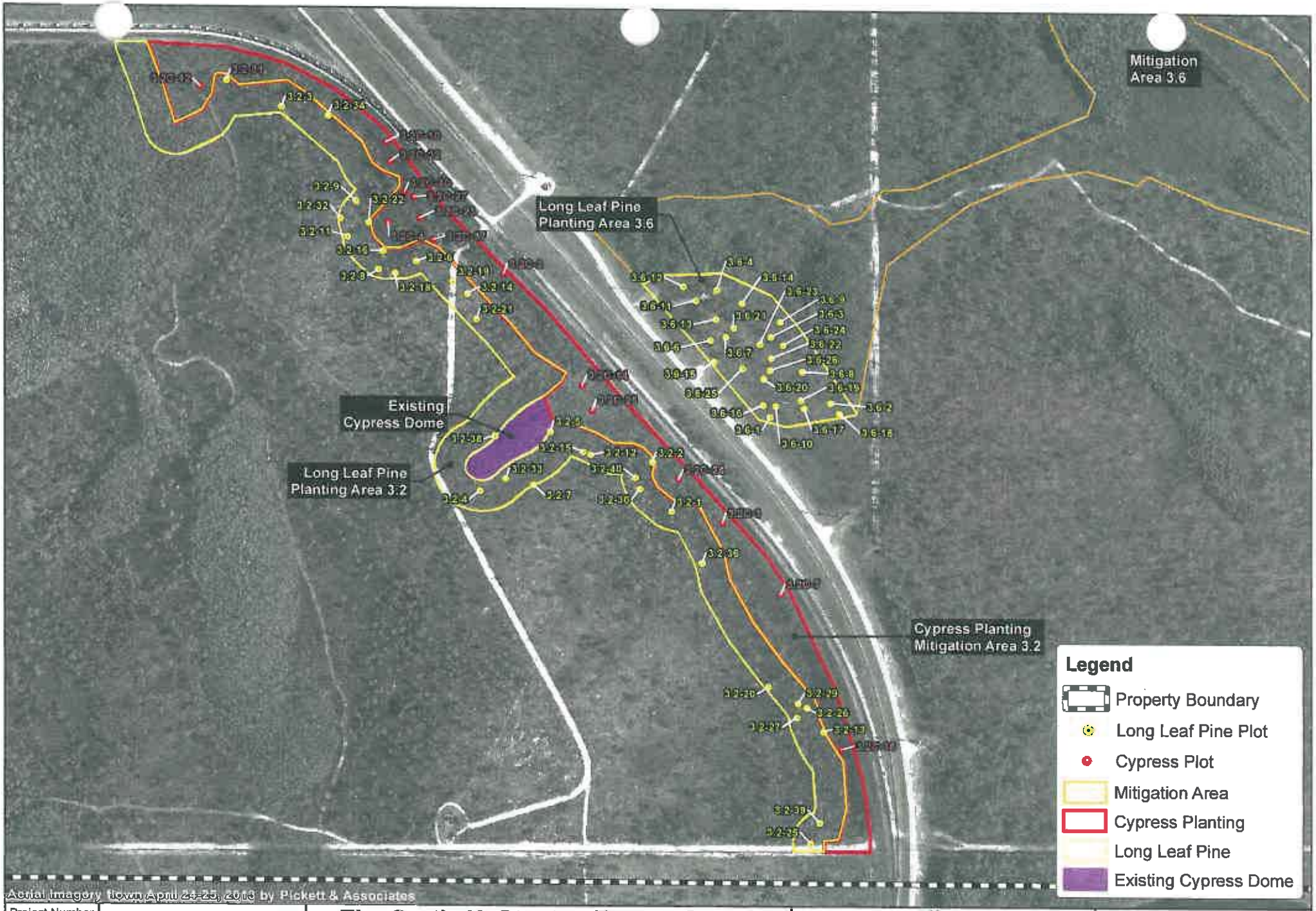

Project Number 112C05141 Date Created 05/22/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 400 200 0 400 Feet	**FIGURE 3B** **AREAS 3.2 & 3.6** **NEW SAMPLE LOCATIONS**

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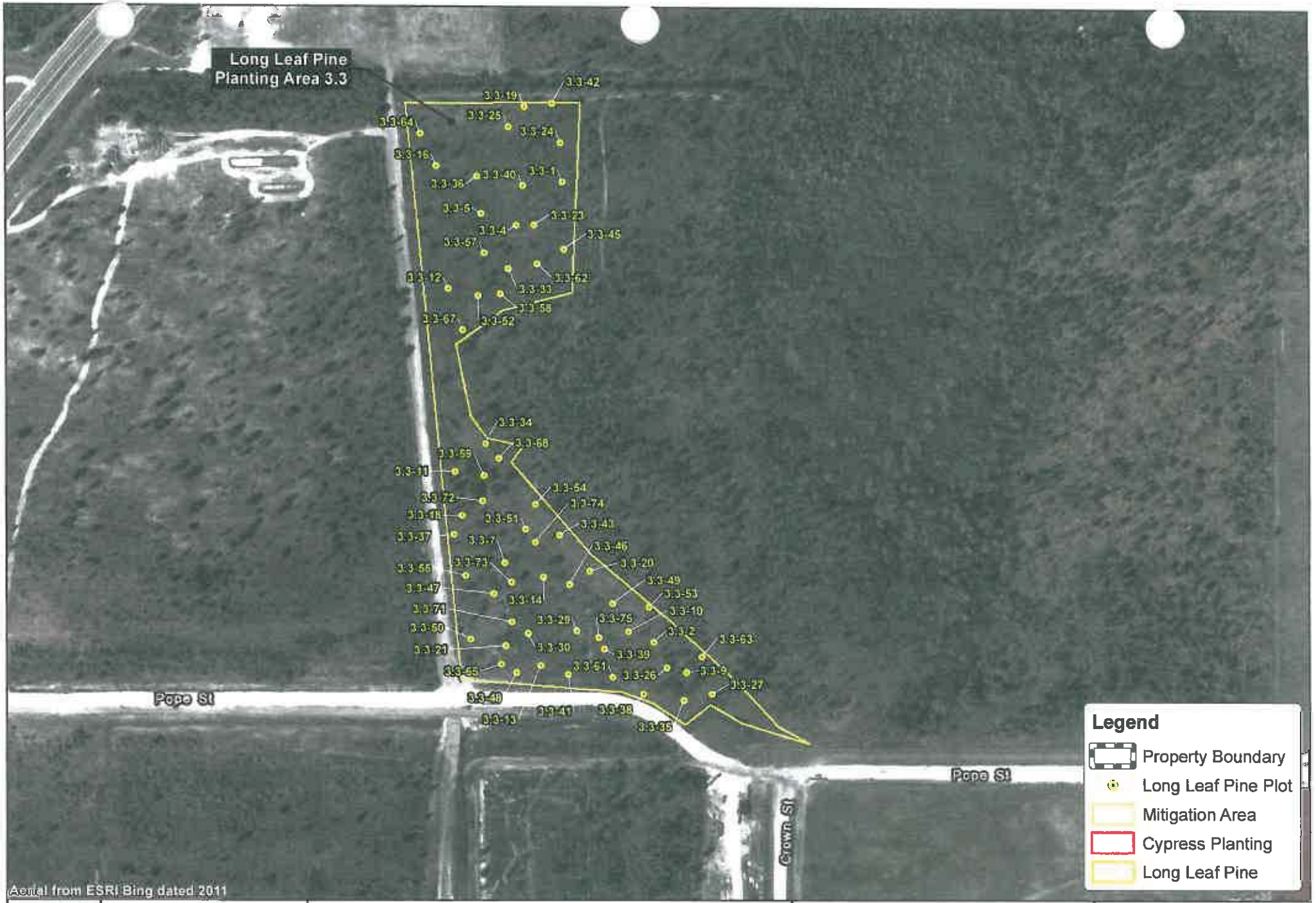

Project Number		The Curtis H. Stanton Energy Center		
112C05141	TETRA TECH	5100 S. Alafaya Trail Orlando, Orange County, Florida ORLANDO UTILITIES COMMISSION	N 350 175 0 350 Feet	FIGURE 4 AREAS 3.3 NEW SAMPLE LOCATIONS
Date Created 04/11/2013				

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Project Number 112C05141 Date Created 05/22/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 350 175 0 350 Feet	**FIGURE 4A** **AREAS 3.3** **NEW SAMPLE LOCATIONS**

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Project Number	TETRA TECH	The Curtis H. Stanton Energy Center	N	FIGURE 4B
112C05141		5100 S. Alafaya Trail		AREAS 3.3
Date Created		Orlando, Orange County, Florida	350 175 0 350 Feet	NEW SAMPLE
05/22/2013		ORLANDO UTILITIES COMMISSION		LOCATIONS

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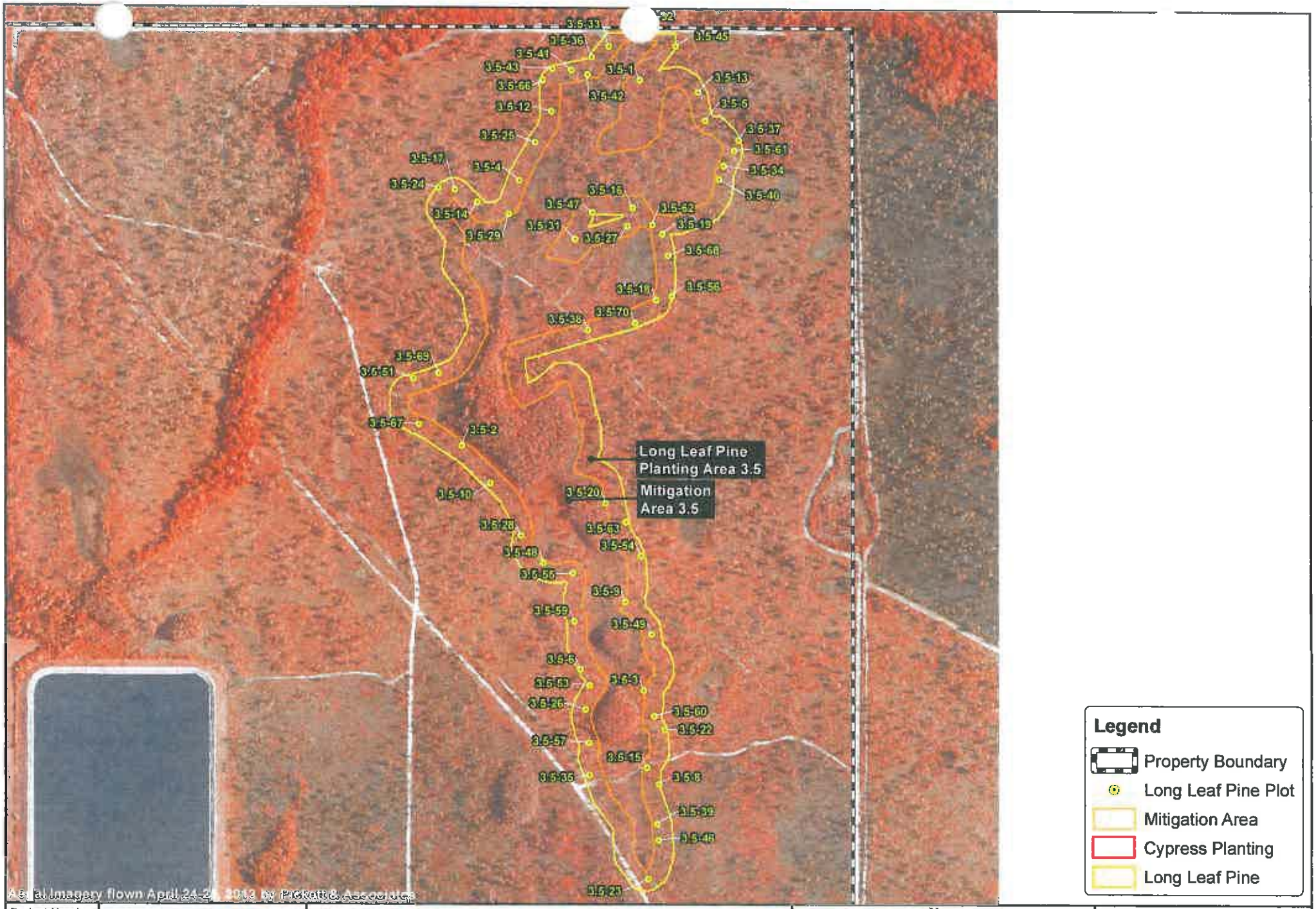
Project Number 112C05141 Date Created 04/11/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 640 320 0 640 Feet	**FIGURE 5** **AREAS 3.5** **NEW SAMPLE LOCATIONS**



A 6" aerial imagery flown April 24-2[illegible] 2013 by Pickett & Associates

Project Number 112C05141 Date Created 05/22/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**		**FIGURE 5A** **AREAS 3.5** **NEW SAMPLE LOCATIONS**

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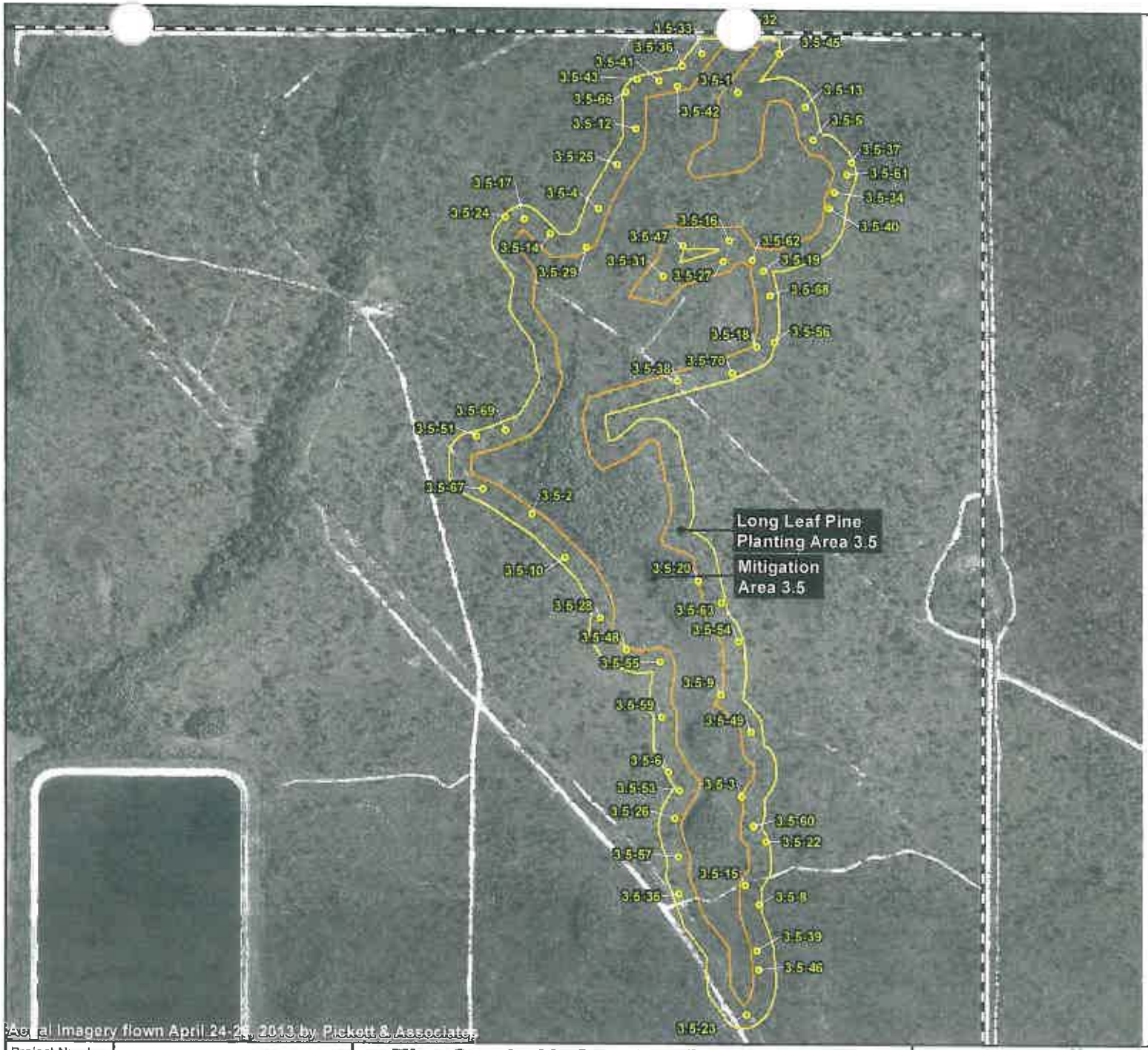

Legend

- Property Boundary
- Long Leaf Pine Plot
- Mitigation Area
- Cypress Planting
- Long Leaf Pine

Project Number 112C05141 Date Created 05/22/2013	TETRA TECH	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 640 320 0 640 Feet	**FIGURE 5B** **AREAS 3.5** **NEW SAMPLE LOCATIONS**

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Project Number	TETRA TECH	The Curtis H. Stanton Energy Center	FIGURE 6 TIMBER STAND SAMPLE LOCATIONS
112C05141		5100 S. Alafaya Trail	
Date Created		Orlando, Orange County, Florida	
04/11/2013		ORLANDO UTILITIES COMMISSION	

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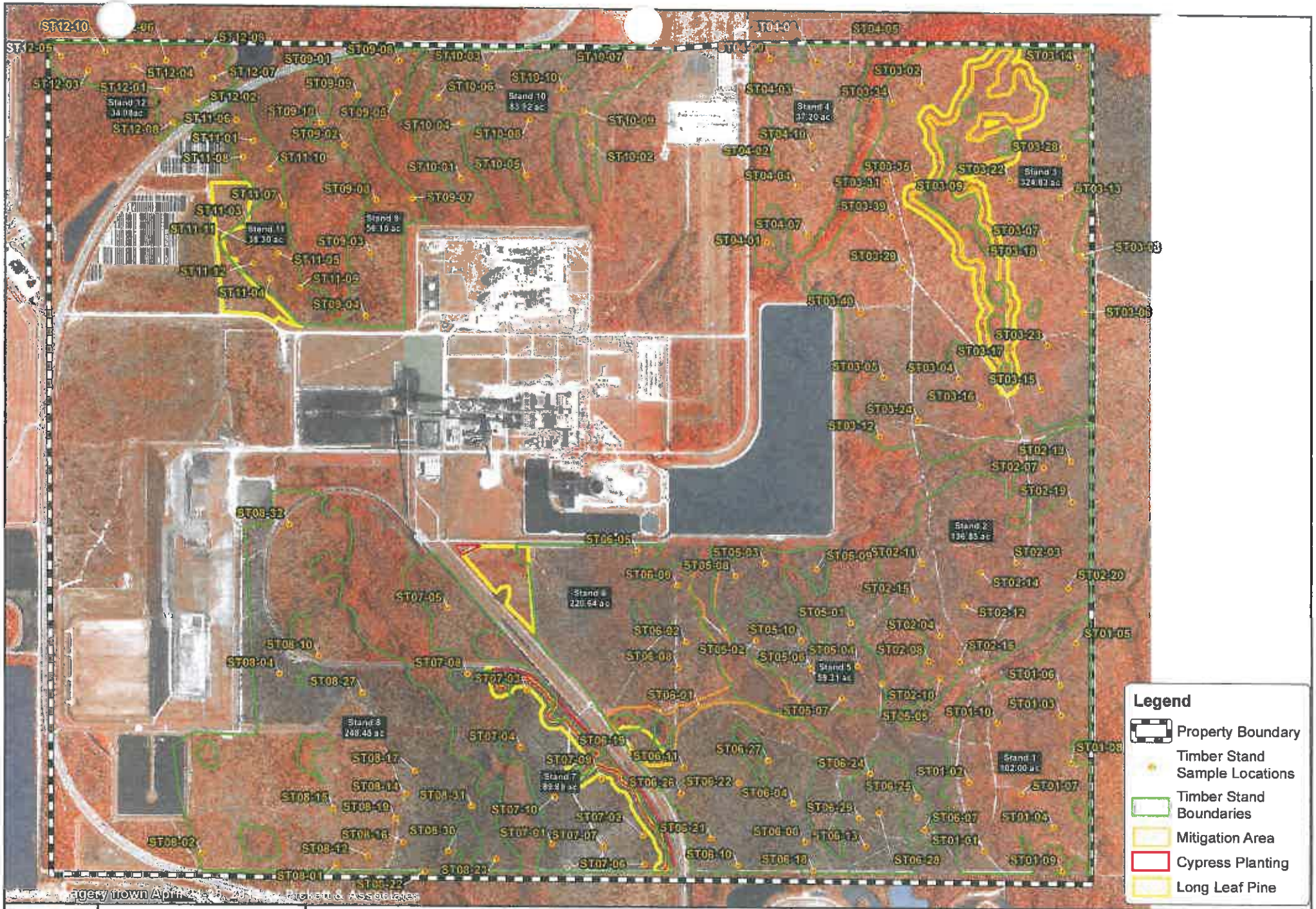
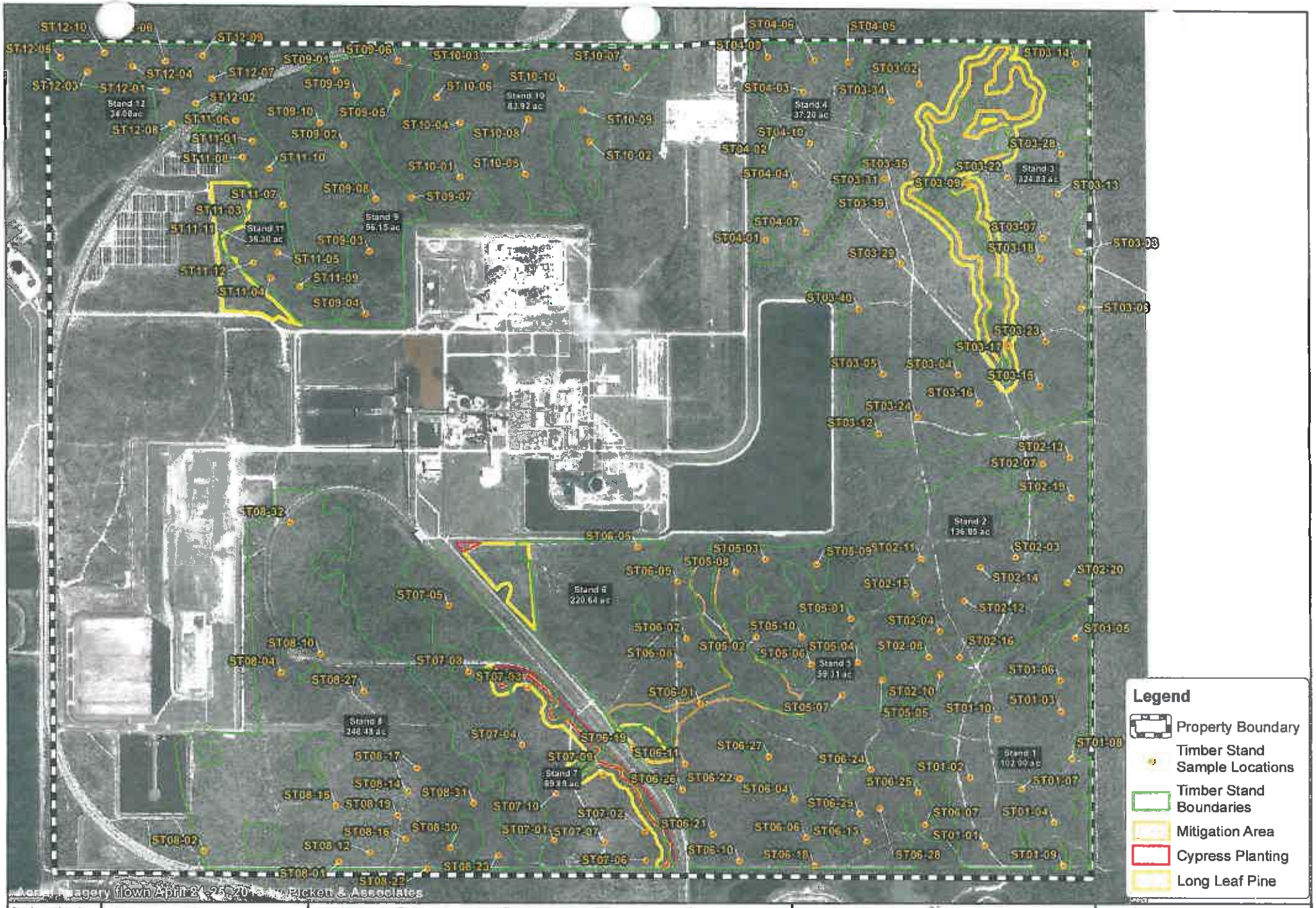


Project Number		The Curtis H. Stanton Energy Center		FIGURE 6A TIMBER STAND SAMPLE LOCATIONS
112C05141	TETRA TECH	5100 S. Alafaya Trail Orlando, Orange County, Florida ORLANDO UTILITIES COMMISSION		
Date Created 05/22/2013				



Project Number		The Curtis H. Stanton Energy Center		FIGURE 6B TIMBER STAND SAMPLE LOCATIONS
112C05141	TETRA TECH	5100 S. Alafaya Trail Orlando, Orange County, Florida ORLANDO UTILITIES COMMISSION	N 1,500 750 0 1,500 Feet	
Date Created 05/22/2013				

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LEGEND

- Property Boundary
- East/West Divide

Site features

- Firelines and pathways
- Railroad
- Waterline
- Wetlands
- Treatment ponds (non-sewage)

Mechanical Treatment

- June - July 2009
- May 2010
- March 2011
- February 2013

Prescribed Burn

- June 2012
- March 2013-June 2013

Documented Burn Events prior to 2011	
Jan. - Mar. 1997	Entire Site
Jan. - Mar. 2004	Entire Site
Aug. 2006	West Side
Jul. 2007	East Side
May. 2008	West Side
June. 2009	Southwest Corner
May. 2010	Entire Site except Southeast Corner

Project Number 112C05141 Date Created 09/16/2013	TETRA TECH	Aerial from ESRI Bing dated 2011	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N	1,200 600 0 1,200 Feet	**FIGURE 7** **MARCH 2013 MECHANICAL TREATMENT AND PRESCRIBED BURN MAP**

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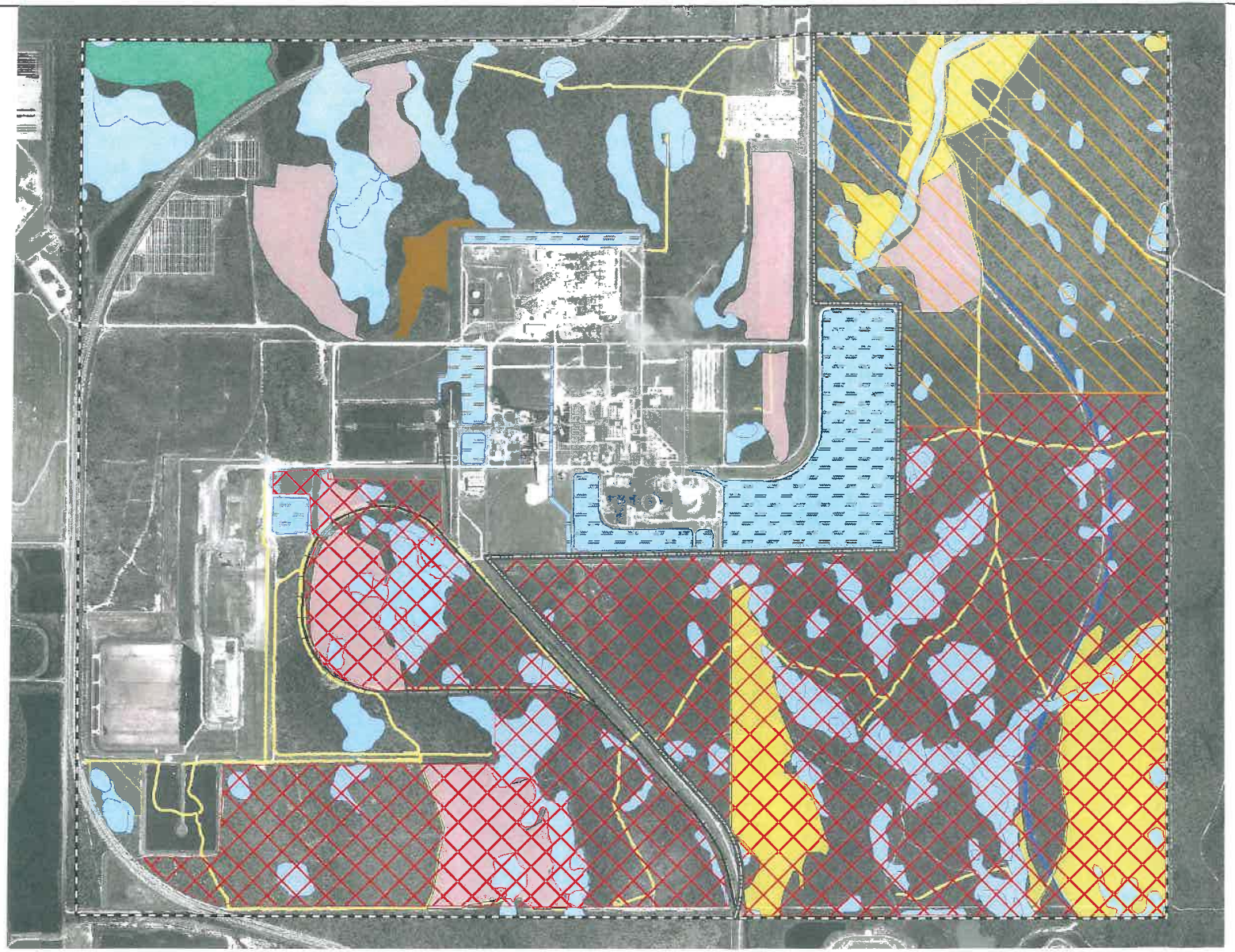

LEGEND

- Property Boundary
- East/West Divide

Site features

- Firelines and pathways
- Railroad
- Waterline
- Wetlands
- Treatment ponds (non-sewage)

Mechanical Treatment

- June - July 2009
- May 2010
- March 2011
- February 2013

Prescribed Burn

- June 2012
- March 2013-June2013

Documented Burn Events prior to 2011	
Jan. - Mar. 1997	Entire Site
Jan. - Mar. 2004	Entire Site
Aug. 2006	West Side
Jul. 2007	East Side
May. 2008	West Side
June. 2009	Southwest Corner
May. 2010	Entire Site except Southeast Corner

Project Number 112C05141 Date Created 09/16/2013	TETRA TECH	Aerial Imagery flown April 24-25, 2013 by Pickett & Associates	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N	1,200 600 0 1,200 Feet

FIGURE 7A
MARCH 2013 MECHANICAL TREATMENT AND PRESCRIBED BURN MAP

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LEGEND

- Property Boundary
- East/West Divide

Site features

- Firelines and pathways
- Railroad
- Waterline
- Wetlands
- Treatment ponds (non-sewage)

Mechanical Treatment

- June - July 2009
- May 2010
- March 2011
- February 2013

Prescribed Burn

- June 2012
- March 2013-June 2013

Documented Burn Events prior to 2011	
Jan. - Mar. 1997	Entire Site
Jan. - Mar. 2004	Entire Site
Aug. 2006	West Side
Jul. 2007	East Side
May. 2008	West Side
June. 2009	Southwest Corner
May. 2010	Entire Site except Southeast Corner

Project Number 112C05141 Date Created 09/16/2013	TETRA TECH	Aerial Imagery flown April 24-25, 2013 by Pickett & Associates	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N	1,200 600 0 1,200 Feet	**FIGURE 7B** **MARCH 2013 MECHANICAL TREATMENT AND PRESCRIBED BURN MAP**

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ATTACHMENTS

ATTACHMENT 1

FDEP Letter dated September 21, 2004
RE: OCD-ERP-04-0588 Mitigation Areas to Release from Monitoring

Department of Environmental Protection

Jeb Bush
Governor

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Colleen M. Castille
Secretary

Charles Doud
Orlando Utilities Commission
P.O. Box 3193
Orlando, FL 32802

OCD-ERP-04-0588

Orange County - ERP
OUC Curtis H. Stanton Energy Center
Orlando Utilities Commision, Mitigation Areas to Release From Monitoring

Dear Mr. Doud:

The Department has received and reviewed the 2003 Annual Biological Monitoring of the Stanton Energy Center Mitigation Areas Report. Mark Langford of this Department has met on site with Charlie Doud of OUC and is in support of the conclusions in the report declaring success criteria is met on some of the mitigation areas on the property. The specific areas meeting success criteria are listed below: The areas not specifically listed are not released. Only the areas specifically listed may be released from further monitoring.

Mitigation Area 3.1. According to the monitoring report, the southern planting area of pond cypress is meeting success criteria and is released from further monitoring. The remaining portions of 3.1 have not yet met success criteria. These areas include the northern planting area of cypress, and the long leaf pine planted areas.

Mitigation Area 3.2. According to the monitoring report, the north and south slash pine plantings are meeting/exceeding success criteria and are released from further monitoring. The remaining portions of 3.2 have not yet met success criteria. These areas include the cypress seedling planting, the cypress tree planting, and the longleaf pine seedling planting.

Mitigation Area 3.5. According to the monitoring report, the existing cypress domes are meeting success criteria and are released from further monitoring. The herbaceous wetlands within this mitigation area also have adequately met success criteria and are released from further monitoring. The longleaf pine seedling planting area has not met success criteria at this time.

Mitigation Area 3.6. According to the monitoring report, the cypress seedling planting area is meeting success criteria and is released from further monitoring. Success criteria are also being met/exceeded for the hydrologically enhanced existing cypress domes. These also are released from further monitoring. The herbaceous wetlands within this mitigation area also are

are considered to be meeting success criteria and are released from further monitoring. It is understood that the above-mentioned areas within this mitigation area have had some difficulty in reaching or maintaining the proper density of wetland herbaceous cover due to the documented drier conditions. The Department does agree with the report that these areas are jurisdictional and have increased in frequency of occurrence of wetland species according to the mitigation goal. The longleaf pine seedling planting area has not yet met success criteria.

Mitigation Area 3.7. According to the monitoring report, this area has met the success criteria for hydrologic enhancement as shown by rainfall and staff guage/piezometer well readings. This entire area is released from further monitoring.

The 2003 Annual Biological Monitoring Report shows there are some mitigation areas at the Stanton Energy Center that have not met success criteria. Seedling survival and tree density appear to be the main problem associated with these areas not reaching success. DEP and other regulatory agencies will discuss these issues with OUC and determine what further course of action needs to be taken to either reach the original success criteria, or to modify it in the interest of the red-cockaded woodpecker.

The Department thanks you for successfully completing the above-mentioned mitigation at your facility. Please contact Mark Langford at the above letterhead address, by e-mail at mark.langford@dep.state.fl.us, or by phone at 407-893-7867 with any questions or concerns.

Sincerely,

Debra Jarvis

for Angela K. Booker
Environmental Manager
Compliance and Enforcement
Submerged Lands and Environmental
Resources Permitting

Sept 21, 2004
Date

DCC
AKB/ml/co

ATTACHMENT 2

Saw Palmetto and Nuisance Plant Survey, July 27, 2012

SAW PALMETTO AND EXOTIC VEGETATION SPECIES SURVEY REPORT

CURTIS H. STANTON ENERGY CENTER

ORLANDO, FLORIDA

Prepared for:
ORLANDO UTILITIES COMMISSION
5971 PERSHING AVENUE
ORLANDO, FLORIDA 32822-3881

OUC
The Reliable One

Prepared by:
TETRA TECH, INC.
201 East Pine Street
Suite 1000
Orlando, Florida 32801

Report Date: July 27, 2012

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2.1.2	Exotic Vegetation Species Survey	2-1
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5.0	**REFERENCES**	**5-1**

TABLES AND GRAPHS

TABLE NUMBER

1 2012 Saw Palmetto Height and Coverage Mapping and Classification in SEC Pine Flatwoods Communities

2 2012 Saw Palmetto Height and Coverage Mapping and Classification in the Xeric Oak/Saw Palmetto Community

GRAPH NUMBER

1-4 Percentage of Pine Flatwoods Occupied by Saw Palmetto Coverage Classes 2008-2012

5-7 Percentage of Pine Flatwoods Occupied by Xeric Oak/Saw Palmetto Coverage Classes 2008-2012

FIGURES

NUMBER

1 General Location Map

2 USGS Topographic Map

3 July 2011 Aerial Map

4 July 2012 Saw Palmetto Survey
5 July 2012 Mechanical Treatment and Prescribed Burn Map
6 July 2012 Exotic Vegetation Species Survey

ATTACHMENTS

1 Noxious Weed List, Chapter 5B-57.007, F.A.C.
2 Photographs
3 Exotic Vegetation Species GPS Data
4 GIS Shapefiles and Metadata

ACRONYMS AND ABBREVIATIONS

COCs	Conditions of Certification
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FLEPPC	Florida Exotic Pest Plant Council
GIS	Geographic Information System
GPS	Global Positioning System
IFAS	Institute of Food and Agricultural Services
OUC	Orlando Utilities Commission
Project Area	Curtis H. Stanton Energy Center, 5100 South Alafaya Trail, Orlando, Orange County, Florida
RCW	Red-cockaded Woodpecker
SEC	Stanton Energy Center
SEC RCW Habitat Management Plan	Red-cockaded Woodpeckers Habitat Management Plan, Curtis H. Stanton Energy Center, Orlando, Orange County, Florida
UF	University of Florida

1.0 INTRODUCTION

Tetra Tech, Inc. is pleased to provide the Orlando Utilities Commission (OUC) with this Saw Palmetto and Exotic Vegetation Species Survey Report for the Curtis H. Stanton Energy Center (SEC), 5100 South Alafaya Trail, Orlando, Orange County, Florida (hereinafter, the Project Area). Ongoing land management and biological monitoring activities have been routinely performed by OUC on portions of the Project Area since 1987 in order to maintain and enhance longleaf pine flatwoods habitat for resident Red-cockaded Woodpeckers (RCW) *(Picoides borealis)*. The RCW is a federally listed endangered species and State of Florida listed species of special concern. This report is intended to address RCW habitat monitoring requirements established by the SEC's Conditions of Certification (COCs); specifically, the Red-cockaded Woodpeckers Habitat Management Plan, Curtis H. Stanton Energy Center, Orlando, Orange County, Florida (SEC RCW Habitat Management Plan) (DeLotelle & Guthrie, Inc., 2006) for saw palmetto reduction and exotic vegetation species control surveys to be conducted annually.

1.1 PURPOSE

The purposes of this report are as follows: 1) to document and map current saw palmetto height/coverage areas and land management activities; 2) to locate and map exotic vegetation species within the Project Area; 3) to discuss the effectiveness of ongoing land management activities on reducing average saw palmetto height/coverage and controlling exotic vegetation; 4) to make recommendations for measures to enhance ongoing land management activities; and 5) to address any areas that are not currently meeting habitat goals outlined in the SEC RCW Habitat Management Plan.

Vegetation sampling data are presented that estimate acreage and percent of total flatwoods area occupied by various saw palmetto height/coverage classes, as well as species occurrences and locations of certain species of exotic vegetation listed as noxious weeds by the Florida Department of Agriculture and Consumer Services (FDACS). Percent coverage of the total natural areas within the Project Area by exotic vegetation species is also estimated.

Attachment 1 provides the noxious weed list per Chapter 5B-57.007, Florida Administrative Code (F.A.C.). Attachment 2 contains photographs of saw palmetto and exotic vegetation. Attachment 3 includes exotic vegetation species global positioning system (GPS) data. Attachment 4 includes geographic information system (GIS) shapefiles and metadata.

1.2 PROJECT AREA LOCATION AND DESCRIPTION

The Project Area encompasses approximately 3,200 acres situated between the Big and Little Econlockhatchee Rivers and is located 8.5 miles southeast of Orlando, Florida (see Figure 1). The power plant at the SEC is located near the center of the Project Area, and the surrounding undeveloped land is naturally vegetated and serves as habitat for a variety of wildlife species. Most of this undeveloped land is contiguous within the SEC, although some areas are separated by paved roads, facilities, and retention ponds. Outside of the Project Area boundaries, surrounding land use consists of a correctional facility, chopped and burned pasture, and State Road 528 to the south; Innovation Way, developed residential subdivisions and commercial centers to the north; Innovation Way and the Orange County Landfill to the west; and the Hal Scott Preserve to the east (see Figure 1).

The power plant and associated facilities occupy approximately 845 acres of the Project Area. OUC manages and maintains an approximate 2,400-acre buffer area around the facility in a natural state of longleaf pine *(Pinus palustris)* dominated forest interspersed with cypress domes, bayheads, and numerous connecting wet prairies. Area soils have a high sand content, are strongly acidic, are low in nutrients, and are often underlain by an organic hardpan 14 to 60 inches below land surface. The predominant upland vegetative cover type is pine flatwoods, an upland sub-climax sere with flat to slightly sloping topography (see Figure 2) and well to moderately well drained soils. OUC conducts prescribed burns on pine flatwoods in the Project Area on a 2-year interval to maintain their natural, sub-climax sere. Saw palmetto *(Serenoa repens)* is the most abundant shrub-layer plant in the flatwoods. Gallberry holly *(Ilex glabara)*, fetterbush *(Lyonia lucida)*, staggerbush *(Lyonia fruticosa)*, wax myrtle *(Myrica cerifera)*, running oak/dwarf live oak *(Quercus pumila, Q. minima)*, and shiny blueberry *(Vaccinium myrsinites)* are other common native Florida shrub species found within these pine flatwoods. Wiregrass *(Aristida stricta* var. *beyrichiana)* is the dominant groundcover plant followed by broomsedges *(Andropogon* spp.), plume grass *(Saccharum gigantium)*, toothache grass *(Ctenium aromaticum)*, panicgrasses *(Panicum* spp.), and witchgrasses *(Dichanthelium* spp.). Interspersed within this groundcover matrix is a diverse mix of other graminoid, forb, and low shrub species, which are adapted to grow in pine flatwoods subject to frequent fire intervals.

Of the approximate 2,400-acre buffer area around the power plant facility (see Figure 3), there are approximately 1,688 acres occupied by longleaf pine flatwoods with saw palmetto and wiregrass dominated groundcover (see Figure 4). Recent construction of a new wet detention pond for the solid waste landfill expansion has reduced the previously reported flatwoods component of the buffer area from 1,700 acres in 2011 to 1,688 acres in 2012 (see Figure 4). The remaining approximately 700 acres of buffer area is dominated by wetlands and other areas without saw palmetto coverage (see Figure 4).

1.3 NATURAL COMMUNITIES AND HABITAT

Approximately 1,688 acres of the natural areas within the Project Area are longleaf pine flatwoods. Saw palmetto *(Serenoa repens)*, wiregrass species *(Aristida stricta* var. *beyrichiana* and *A. spiciformis)*, gallberry *(Ilex glabra)*, and broomsedge *(Andropogon virginicus)* dominate the understory of the longleaf pine flatwoods. A very diverse mix of low shrubs, forbs, and graminoids are prevalent mixed within the wiregrass groundcover. Interspersed among longleaf pine flatwoods are several wetland communities including: 1) pond cypress *(Taxodium distichum* var. *nutans)* domes and strand; 2) maidencane *(Panicum hemitomon)*, graminoid, and St. Johns wort *(Hypericum spp.)* marshes; 3) hydric pond pine flatwoods; and 4) willow/maple shrub swamps (see Figure 4). Scrubby flatwoods/Xeric oak dominated by longleaf pine and myrtle oak *(Quercus myrtifolia)* occupy a few small portions of the Project Area. This mosaic of natural communities provides suitable habitat for many native wildlife species including RCWs, state listed threatened Bald Eagles (nesting), state listed threatened gopher tortoises, and state listed threatened Florida Sandhill Cranes.

Although moderately low in percentage cover of the buffer area (7.3 percent in 2011 and an additional 2.4 percent in 2012), exotic plants were noted mainly near roads, pipelines, railroad tracks, disturbed upland areas, occasionally in undisturbed upland areas, and in several cypress wetlands. This report is the identification component of the OUC's exotic plant control program at the SEC, which consists of identification and treatment on a yearly basis.

2.0 METHODOLOGY

2.1 FIELD METHODOLOGY

2.1.1 Saw Palmetto Survey

The 2011 Saw Palmetto and Nuisance/Exotic Species Survey map was utilized to locate and ground-truth each previously mapped saw palmetto stand. A visual estimate of the average percent ground coverage and average height of saw palmetto within each stand was recorded by height-coverage classes 0 to 2 feet, 2 to 4 feet, 4 to 6 feet, and over 6 feet; and 0 to 25 percent, 25 to 50 percent, 50 to 75 percent, and 75 to 100 percent (see Tables 1 and 2 and Figure 4). Any apparent differences in the 2012 saw palmetto height or percent coverage from the 2011 saw palmetto survey were recorded and noted for update on the July 2012 Saw Palmetto Coverage Map (see Figure 4).

2.1.2 Exotic Vegetation Species Survey

The main species of concern for this survey were cogongrass *(Imperata cylindrica),* Chinese tallow *(Triadica sebiferum)*, and Brazilian pepper *(Schinus terebinthifolius)* as specifically outlined in the SEC RCW Habitat Management Plan (DeLotelle & Guthrie, Inc., 2006). This survey, however, was conducted for any plant species listed on the State of Florida's statutory "Noxious Weed List" (see Attachment 1) per Chapter 5B-57.007, F.A.C., which is administered by the FDACS.

Random (during saw palmetto survey) and targeted (along infrastructure, disturbance areas, and previously mapped/other known locations) pedestrian and vehicular surveys were conducted by experienced Tetra Tech field biologists from June 29 through July 3, 2012. An exotic vegetation control crew, Smith Ranch and Constructors, LLC, was working on-site during the survey and provided additional species and location information. The approximate size of any exotic plant infestation larger than approximately 0.1-acre and the locations of all exotic plant infestations were recorded using standard Garmin handheld GPS units.

2.2 REPORT METHODOLOGY

2.2.1 Saw Palmetto Survey

A GIS layer was developed based on the July 2011 Saw Palmetto Coverage Map and incorporated observed changes in stand configuration and/or cover class per the results of the 2012 saw palmetto survey. The July 2012 Saw Palmetto Coverage Map (see Figure 4) was developed and used to estimate the total acreage of each saw palmetto cover class and the percentage of total longleaf pine flatwoods area occupied by each saw palmetto cover class. The acreage results are reported in the legend on Figure 4 and in Tables 1 and 2 of this report. The percentage of overall flatwoods area results are reported in Tables 1 and 2 of this report. Trends in the percentage of overall flatwoods area occupied by the various saw palmetto height/percent cover classes are charted by year (2008 to 2012) in Graphs 1 through 7 of this report. Saw palmetto survey results are discussed in Section 3.0, and conclusions and recommendations on saw palmetto management are made in Section 4.0 of this report.

The current land management activities map (see Figure 5), depicting mechanical and prescribed burn treatments over the Project Area, was developed based on the 2010-2011 Mechanical Treatment and Prescribed Burn Location Map (Tetra Tech, 2011). Changes incorporated in the July 2012 map include several recent roller chopped portions of the Project Area, where roller chopping was conducted from April to June 2012 in preparation for the application of prescribed fire. Prescribed fire applications had not been conducted on the Project Area at the time of the saw palmetto survey.

2.2.2 Exotic Vegetation Species Survey

Exotic vegetation species survey GPS data were compiled into a GIS layer and plotted over a 2010 true-color aerial photograph (see Figure 6). Major trail roads and pipeline corridors were plotted on the map to highlight access/disturbance corridors. Exotic vegetation species identified within the Project Area are discussed in Section 3.0, and management recommendations are made in Section 4.0 of this report.

3.0 RESULTS AND DISCUSSION

3.1 SAW PALMETTO SURVEY

Results of the saw palmetto survey are spatially represented on the July 2012 Saw Palmetto Survey Map (see Figure 4). Polygons of various hatching patterns are used to represent the saw palmetto cover classes present within specific saw palmetto stands throughout the Project Area. The total acreage of each coverage class is also provided. Saw palmetto cover class acreages and the percent of pine flatwoods occupied by each cover class are summarized in Tables 1 and 2.

The total acreage and percent of total pine flatwoods area occupied by all cover classes within the 0- to 2-foot average height category was 75.4 acres and 4.5 percent. The dominant average cover classes within the 0- to 2-foot height category were 0 to 25 percent (47.3 acres) and 25 to 50 percent (6.47 acres). This represents an overall decrease in acreage of saw palmetto in the 0- to 2-foot height class from 467 acres in 2010, to 321.49 acres in 2011, to 75.4 acres in 2012. Most of the areas of saw palmetto grew out of the average 0- to 2-foot height category over the course of the previous two years. Rapid regeneration of saw palmetto petioles (rachis) and fronds is normal after being removed by fire, because saw palmetto rachi and fronds are highly flammable and adapted to facilitate frequent fire return intervals. Prescribed burning scheduled to be conducted in 2012 should bring the acreage in 0- to 2-foot height class closer to the 2010 acreage, which was recorded immediately following prescribed burns throughout the Project Area. This is because while the rachi and fronds regenerate rapidly, the stems and roots of saw palmetto grow much slower staying low to the ground for long periods of time. Areas remaining in the 0- to 2-foot cover class appear to be those that were roller-chopped recently in 2012 (see Figure 5).

Trends in the percentage of the total pine flatwoods area occupied by 0- to 2-foot average height saw palmetto in the various percent cover classes are shown in Graph 1. These trends indicate that the less dense (0 to 25 and 25 to 50 percent cover) saw palmetto appears to fluctuate (increase) with prescribed fire and roller chopping, especially in 2010, but has remained approximately the same from 2008 to 2012, while denser (50 to 75 and 75 to 100 percent cover) saw palmetto has decreased overall from 2008 to 2012.

The total acreage and percent of total pine flatwoods area occupied by all cover classes within the 2- to 4-foot average height category was 1,403.87 acres and 83.2 percent. The dominant cover classes within the 2- to 4-foot height category were 25 to 50 percent (624.45 acres) and 50 to 75 percent (691.52 acres). This represents an overall increase in acreage of saw palmetto in the 2- to 4-foot height class from 1,020 acres in 2010, to 1,144.55 acres in 2011, to 1,403.87 acres in 2012. This increase in the amount of saw palmetto in the middle height class can be attributed to normal regeneration after fire disturbance.

Trends in the percentage of the total pine flatwoods area occupied by 2- to 4-foot average height saw palmetto in the various percent cover classes are shown in Graph 2. These trends indicate that three cover classes (0 to 25, 25 to 50, and 50 to 75 percent cover) saw palmetto have increased, while the densest (75 to 100 percent cover) saw palmetto has decreased significantly (from 50 percent to 0.3 percent) from 2008 to 2012, due to roller chopping and consistent prescribed fire.

The total acreage and percent of total pine flatwoods area occupied by all cover classes within the 4- to 6-foot average height category was 124.99 acres and 7.4 percent. The dominant cover classes within the 4- to 6-foot height category were 25 to 50 percent (38.41 acres) and 50 to 75 percent (47.03 acres). There appears to be no significant change from 2010 to 2012 in the total acreage (127 acres to 125 acres) of this height category, but the acreage of 75 to 100 percent coverage appears to have decreased significantly from 2008 to 2012. These areas were typically observed along wetland edges, on upland islands within wetland interiors, and difficult to access pockets between wetlands, infrastructure, or other impediments.

Trends in the percentage of the total pine flatwoods area occupied by 4- to 6-foot average height saw palmetto in the various percent cover classes are shown in Graph 3. These trends indicate that three cover classes (0 to 25, 25 to 50, and 50 to 75 percent cover) saw palmetto have increased slightly, while the densest (75 to 100 percent cover) saw palmetto has decreased significantly (from 15 percent to 1.5 percent) from 2008 to 2012, due to roller chopping and prescribed fire.

The total acreage and percent of total pine flatwoods area occupied by all cover classes within the 6-foot or greater average height category was 19.54 acres and 1.2 percent. The dominant cover class within this height class category was 75 to 100 percent (9.57 acres). This represents a significant decrease in acreage of saw palmetto over 6 feet in height from 39 acres in 2010 to 31.79 acres in 2011 to 19.54 acres in 2012, due to roller chopping and prescribed burning of targeted areas. These areas were typically observed along wetland edges, on upland islands within wetland interiors, and difficult to access pockets between wetlands, infrastructure, or other impediments.

Trends in the percentage of the total pine flatwoods area occupied by 6-foot or greater average height saw palmetto in the various percent cover classes are shown in Graph 4. These trends indicate that two cover classes (25 to 50 and 50 to 75 percent cover) saw palmetto have increased slightly, while the least dense (0 to 25 percent cover) has remained approximately constant from 2008 to 2012 and the most dense (75 to 100 percent cover) has decreased by 0.4 percent from 2008 to 2012.

There were three small areas of xeric oak vegetative communities (approximately 17.81 acres total) in the southwestern and northwestern portions of the Project Area. These areas combined contained a small amount of saw palmetto in the 2- to 4-foot height [25 to 50 percent coverage class (2.28 acres), 50 to 75 percent coverage class (14.3 acres)], and 4- to 6-foot height [50 to 75 percent coverage class

(1.23 acres)]. The acreages and height/cover classes within these xeric oak areas have essentially remained the same from 2010 to 2011. A few adjustments, however, were made in 2012 to the xeric oak coverage in the southwestern portion of the SEC site, due to field observations and wet detention pond construction. This resulted in a decrease in overall acreage from 25.9 acres in 2011 to 17.81 acres in 2012.

Trends in the percentage of the total pine flatwoods area occupied by all heights of xeric oak saw palmetto in the various percent cover classes are shown in Graphs 5 through 7. The most significant trends occurred within three cover classes (0 to 25, 25 to 50, and 75 to 100 percent cover) of 2- to 4-foot average height saw palmetto, which have decreased slightly from 2008 to 2012, while one cover class (50 to 75 percent cover) saw palmetto has increased slightly from 2008 to 2012.

3.2 EXOTIC VEGETATION SPECIES SURVEY

As depicted on Figure 6, there are six species of exotic vegetation existing within the Project Area that are listed as noxious weeds by the FDACS. These species are cogongrass *(Imperata cylindrica)*, Chinese tallow *(Triadica sebiferum)*, Brazilian pepper *(Schinus terebinthifolius)*, old world climbing fern *(Lygodium microphyllum)*, tropical soda apple *(Solanum viarum)*, and melaleuca *(Melaleuca quinquenervia)*. Old world climbing fern is the most commonly observed species followed by cogongrass, Chinese tallow, Brazilian pepper, and melaleuca. Five of these species have been previously reported, and treatment activities have been conducted in an effort to eliminate or further prevent throughout the Project Area. Old world climbing fern and melaleuca were first reported to be within the Project Area in 2011, but they appear to have been present for a considerable amount of time based on the observed size of old world climbing fern infestation and maturity of two melaleuca trees (see Attachment 2). One new exotic species, tropical soda apple, was detected during the 2012 survey at two locations within the Project Area. These two small infestations were treated with herbicide, but follow up treatments and monitoring should be conducted as the plants had produced fruit and viable seeds.

The estimated percentage of the 2,400-acre buffer area occupied by the FDACS listed exotic vegetation species in 2011 was 7.3 percent. The estimated percentage of the 2,400-acre buffer area occupied by new occurrences and infestation areas of FDACS listed exotic vegetation species in 2012 is 2.4 percent. While these two percentages are not directly cumulative, since the 2011 locations have all been initially treated and fully or partially reduced in area and number of occurrences. Assuming that 50 percent (3.65 percent) of the 2011 exotic vegetation percent coverage (7.3 percent) has been controlled and adding this to the new 2012 exotic vegetation percent coverage (2.4 percent), the partially cumulative percent coverage by exotic vegetation species in 2012 is 6.05 percent, or 145.2 acres. Of particular note is the exponential increase of old world climbing fern from 10.75 acres in 2011 to 54.65 acres in 2012, an increase of 43.9 acres or approximately 500%. This is important because, if not aggressively controlled,

old world climbing fern will continue to spread at an accelerated pace throughout the buffer area and into adjacent Hal Scott Conservation Area.

The actual acreage/percentage of exotic vegetation is difficult to definitively quantify due to the sporadic distribution of these plants within occurrence areas. A rough estimate of the actual acreage/percentage would be approximately 120 acres or 5 percent of the 2,400-acre buffer area. Many of the individual occurrences consist of one or a few plants mixed with the dominant native vegetation. Larger occurrence areas consist mostly of one or more of the four identified exotic plants at a frequency high enough to limit feasibility of locating each individual plant by GPS, but not dominating the entire area. Several occurrence areas of cogongrass and old world climbing fern formed dense monocultures or completely covered underlying vegetation especially in disturbed or open areas in the western and northwestern portions of the buffer area.

For the purpose of estimating the overall percent coverage of exotic vegetation, individual occurrences were counted as 0.1-acre, and larger occurrence areas were counted as the entire mapped area. While counting the entire occurrence areas may overestimate the actual area occupied by exotic plants, the presence of numerous individual plants within the overall occurrence area indicates the area is significantly infested. Significant infestations usually contain plants that are producing annual seeds that may remain viable in the soil for several years or more. Therefore, it is very likely these areas would become dominated by exotic vegetation if more aggressive control, re-treatment, and, in certain cases, re-infestation prevention measures, are not taken.

Additional potentially problematic exotic or nuisance vegetation species not included on the statutory FDACS Noxious Weed List were observed to occur within the buffer area. The Florida Exotic Pest Plant Council (FLEPPC) maintains an authoritative, but not statutory, list of invasive plant species known to occur in Florida at http://www.fleppc.org/list/list.htm (FLEPPC, 2011). Vegetation species not listed by the FDACS but listed by the FLEPPC as invasive and identified within the buffer area include **lantana *(Lantana camara)*, natal grass (*Rhynchelytrum repens*), camphor tree (*Cinnamomum camphora*),** Chinaberry *(Melia azedarach)*, **primrose willow *(Ludwigia peruviana)*** and Guinea grass *(Panicum maximum)*. Four of these six species (in bold above) are listed by the FLEPPC as Category 1 invasive species, which are considered to be "altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives". GPS locations for some, but not all, of the infestations of these six FLEPPC listed species were recorded. The FLEPPC listed species were not technically part of the exotic species survey and, therefore, were not completely surveyed or reported because the survey was conducted for statutory FDACS listed species as required in the SEC COCs including the RCW Management Plan.

4.0 CONCLUSION AND RECOMMENDATIONS

Tetra Tech has completed the Saw Palmetto and Exotic Vegetation Species Survey in accordance with the RCW Habitat Management Plan required by the SEC COCs. Field measurements and observations have been documented and current saw palmetto and exotic vegetation conditions have been provided herein.

The results of the saw palmetto survey indicate that 1,420.45 acres of the 1,688-acre longleaf pine flatwoods is currently occupied by saw palmetto in the 2- to 4-foot height category. The co-dominant coverage classes in the 2- to 4-foot category are 25 to 50 percent (626.73 acres) and 50 to 75 percent (705.82 acres), followed by 0 to 25 percent (82.22 acres), and 75 to 100 percent (5.68 acres). The saw palmetto areas that were mechanically treated (roller-chopping) in 2012 occupy most of the areas remaining in 0- to 2-foot average height (75.4 acres total).

Ongoing mechanical treatments appear to be effectively reducing the average saw palmetto densities and heights, especially when followed by regular and frequent prescribed burns. Mechanical treatments should be continued and expanded wherever they can be conducted without negatively impacting sensitive ecological areas, such as wiregrass dominated wetland and upland prairies. Mechanical treatments should not be conducted too often within healthy, mixed-age class longleaf pine stands to prevent the potential loss of pine stand density due to root stress prior to prescribed burning or loss of regeneration due to inadvertent chopping of grass and early sapling stage longleaf pines. Prescribed fire should become the principal management tool once saw palmetto is reduced to the target levels. As an enhancement to current mechanical treatment methods, OUC should consider use of multiple-pass single drum, or single-pass tandem drum roller choppers. Range management using roller choppers for saw palmetto reduction to increase grass production, as discussed in the University of Florida (UF) Institute of Food and Agricultural Services (IFAS) electronic data information source publication #SS-AGR-105 (UF, 2010) (http://edis.ifas.ufl.edu/ag173), provides useful recommendations on using roller choppers, and types and sizes of roller choppers available from Marden Industries. This IFAS publication also recommends chopping during saturated conditions because chopping in dry conditions results in higher mortality of bunch grasses such as wiregrass.

OUC's current prescribed burn regime on two year intervals should also be continued as outlined in the SEC RCW Habitat Management Plan. At the time of this report, OUC was preparing to conduct prescribed burns throughout the Project Area, after delaying springtime prescribed burning due to drought conditions. The Project Area was previously burned during the spring of 2010.

Optimally, all invasive species, especially cogongrass and old world climbing fern, identified within areas to be mechanically treated and/or burned should be treated with herbicide several weeks prior to mechanical treatment or prescribed burning activities, whichever occurs first. Post-burn herbicide treatments should

also be conducted on herbaceous species such as cogongrass and old world climbing fern, as they begin to regenerate quickly after disturbance by fire.

The results of the exotic vegetation species survey indicate that occurrences of six species of the FDACS listed noxious weeds are increasing within the Project Area (below one percent of the Project Area from 2008 through 2010 to approximately seven percent of the Project Area in 2011 and to approximately six percent of the Project Area in 2012. Two new FDACS listed species (old world climbing fern and melaleuca) that had not previously been identified were detected within the Project Area last year. This year, one new FDACS listed species (tropical soda apple) that had not previously been identified was detected within the Project Area. Melaleuca and tropical soda apple do not appear to have spread from a few occurrences that were treated recently. These occurrence areas should continue to be monitored for several years to ensure that melaleuca and tropical soda apple remain eradicated from the Project Area.

Alarmingly, old world climbing fern is spreading rapidly and has become very well established within a large cypress swamp and adjacent hydric flatwoods within the northwestern portion of the Project Area (see Figures 5 and 6). Old world climbing fern has now been identified and is becoming moderately established within three additional cypress swamps in the central portion of the Project Area (see Figure 6). Control of these wetland occurrences of old world climbing fern is challenging due to difficult access conditions and the growth habits of this species. As it grows out into hydric flatwoods margins around cypress swamps, it creeps under and around dense saw palmetto and other vegetation making it almost impossible to find and treat, as well as prevent mortality of non-target, native vegetation from overspray. **One potentially feasible approach to dealing with this type of growth is to burn the hydric flatwoods margins as much as possible to eliminate dense vegetative cover, and then follow up with aggressive treatment of old world climbing fern as it re-sprouts from underground rootstock.**

An exotic plant control crew contracted by OUC is currently working within the Project Area to treat all previously identified exotic species locations found during the 2011 survey and any additional locations encountered in the field with herbicide. Herbicides being used and application methods include Element 4 (trichlopyr) mixed with crop oil in basal bark application, Crossbow (trichlopyr/2,4-D mixture) in foliar application, and Touchdown Pro (glyphosate) in foliar and cut stump applications within wetlands, ditches and aquatic areas. Detailed records of herbicide use, species/areas treated, and daily exotic plant control activities are being recorded by the contractor and provided to the OUC Engineer..

The current exotic plant control activities began in June 2012 and are expected to continue through August 2012. Tetra Tech field staff met with the contractor on June 29, 2012, and inspected several recently treated infestation areas of cogongrass, Chinese tallow, and old world climbing fern in the

northwestern portion of the Project Area. The treatments appeared to be effective as evidenced by dead vegetation, wilted vegetation, and chlorotic leaves on plants within inspection areas. As is typical for herbicide treatments in moderately to heavily infested areas, a fair amount of target species remained alive. These plants were either missed, partially sprayed, resistant to herbicide, or applications occurred during drought and early growing season conditions when treatments can be less effective. As of July 20, 2012, the contractor has completed initial treatments in all infestation areas throughout the entire Project Area. Follow up treatments of initial treatment areas are currently being conducted by the contractor and will continue through their contracted period of performance.

Individual occurrences and occurrence areas (significant infestations) of these exotic vegetation species require persistent monitoring, multiple treatments, and preventative measures to bring under full control. The following species-specific recommendations are provided to achieve better control in the Project Area:

1. Cogongrass plants are perennial, flower from February to May, and set seed from May to June or year-round in Florida (Miller, 2003). Herbicide treatments using either imazapyr (per Section 3.3.4 of the approved SEC RCW Habitat Management Plan), glyphosate, or a mixture of the two (as determined appropriate by a qualified FDACS category 21 licensed herbicide applicator) of all identified cogongrass locations should be conducted consistently in the fall and spring to achieve adequate control and prevent wind dispersal of seeds in the spring by plants that grew back over winter or were missed by treatments in the fall. Shilling et al. reported in Ecology, Physiology, and Management of Cogongrass *(Imperata cylindrical)* that autumn applications of imazapyr and glyphosate provided greater control than spring or summer applications. They also reported that two discings and split applications of imazapyr controlled cogongrass regrowth 96 percent, 12 months after treatment (Shilling et al., 1997).

   OUC should also consider coordinating herbicide application after mowing or spot burning specific infestation areas, or in known cogongrass locations following regular prescribed burns. According to The Bugwood Network publication titled Identifying and Controlling Cogongrass in Georgia, "Burning or mowing prior to herbicide application may increase chemical effectiveness by eliminating thatch and causing the production of new growth, which better absorbs pesticide.

   Rehabilitation measures within treatment areas should include establishment of fast growing native or other non-invasive vegetation that can outcompete or outlast any remaining cogongrass plants while stabilizing and protecting the soil. Rehabilitation planting should only occur after several cycles of herbicide treatment and agricultural discing or spot burning (to break rhizome dormancy) after a majority of the cogongrass rhizomes have been eliminated from subsurface soils. Wiregrass seeds or plugs are recommended for rehabilitation areas within the longleaf pine flatwoods areas, while fast

growing cover-crop grasses, shrubs or trees are recommended for rehabilitation areas within wetlands or disturbed right-of-ways, retention pond banks, and infrastructure edges.

A good summary of suggested preventative measures is contained in the University of Georgia's "Invasive Plant Responses to Silvicultural Practices in the South" (Evans et al., 2006). Several practices that are encouraged include "(1) cleaning of radiators, screens, and equipment parts that can collect and harbor seed or that come into contact with the soil and rhizomes when operating on infested sites and moving equipment to other locations; (2) inspecting source locations of off-site material including soil, gravel, and mulch for invasive species; and (3) creating a central location to store equipment and material on-site to allow for easy inspections" (Evans et al., 2007).

According to the article "Cogongrass (Imperata cylindrical) Distribution on Florida Highways and Right-of-Ways", roadside and right-of-way maintenance activities can be a significant facilitator of cogongrass movement/spread (Willard et al., 1990). The recommended preventative measure is training on cogongrass identification and dispersal prevention. Requirements for cogongrass dispersal prevention and equipment decontamination can also be written into right-of-way maintenance contracts to provide contractual incentive for implementation by contractors and enforceable consequences if contractors fail to implement dispersal prevention.

At a minimum, mowing and forestry management contractors should be trained to identify and implement best management practices to prevent the spread of cogongrass and old world climbing fern within the Project Area and to off-site natural areas and right-of-ways. Tetra Tech recommends that OUC accomplish this by developing a concise manual of standard best management practices to be distributed to all contractors and OUC employees working within the Project Area.

2. Old world climbing fern is an evergreen fern that prefers to invade moist freshwater habitats such as cypress stands and bayhead swamps, and to a slightly lesser extent, hardwood swamps, pine flatwoods, wet prairies, sawgrass marshes, and any disturbed wet area. It can smother whole plant communities and alter fire behavior by facilitating fire into tree canopies and wetlands that normally would not burn during a natural or prescribed fire. According to the Old World Climbing Fern Management Plan for Florida (FLEPPC, 2006b), the plant initially goes through a spotty, small infestation phase that eventually transitions into a phase of exponential growth.

   The infestation in the northwestern portion of the Project Area has entered the exponential growth phase in the northwestern infestation area. All infestations of this species should be taken extremely seriously as this species is quickly spreading throughout the Project Area. Concerted effort should also be placed on early detection and treatment of low level infestations before they become more difficult and expensive to control. The exotic plant control treatments currently being conducted on the

Project Area should be continued throughout this summer and fall to reduce the spread of old world climbing fern and limit regrowth throughout the remainder of the growing season. Additionally, OUC should communicate with adjacent land owners and agencies managing adjacent conservation lands to alert them of the potential spread of old world climbing fern to their properties.

Herbicide treatment options for controlling old world climbing fern include foliar applications of 1 to 3 percent glyphosate (labeled aquatic approved formulations only) to plants on the ground, or to cut all climbing plants at 3 to 5 feet above the ground and foliar spray the base of infestations. Care should be taken not to inadvertently spread reproductive spores from the infestation area to non-infested areas during herbicide application and control activities. At a minimum, the spread prevention guidelines outlined in the Old World Climbing Fern Management Plan for Florida should be followed by all exotic species control contractors working old world climbing fern infestation areas (FLEPPC, 2006b).

3. Chinese tallow are fast growing, deciduous hardwood trees that take several years to mature enough to produce seeds, which disperse from August to January (Miller, 2003). Herbicide applications using an oil based trichlopyr/imazapyr mix as a basal bark treatment, per Section 3.3.4 of the approved SEC RCW Habitat Management Plan, or water based trichlopyr, imazapyr, and glyphosate formulations as cut-stump or stem injection treatments, as determined appropriate by a qualified, FDACS category 21, licensed herbicide applicator, of all identified Chinese tallow locations should be conducted prior to August of each year to prevent seed maturity. These herbicide treatments are effective most times of the year except for during spring leaf flush from March to mid-May. Once treated, Chinese tallow locations that contained mature plants of three years or older should be monitored and re-treated annually for re-sprouts of partially controlled trees or newly sprouted seedlings. Tallow seeds are readily eaten and dispersed by birds and mammals and can remain viable in the soil from two to seven years.

   The control and spread prevention guidelines outlined in the Chinese Tallow Management Plan for Florida should be followed by exotic species control contractors working in Chinese tallow infestation areas (FLEPPC, 2005).

4. Brazilian peppertree is a dioecious, evergreen shrub or small tree that flowers and produces fruit mainly in the fall, for a reduced period in the spring, and year-round at some locations in Florida (FLEPPC, 2006a). Plants in central Florida are likely to be more seasonal in fruit maturity (mainly in fall) than plants in southern Florida (year-round) based on general observations. Herbicide applications using an oil based trichlopyr/imazapyr mix as a basal bark treatment, per Section 3.3.4 of the approved SEC RCW Habitat Management Plan, or water based trichlopyr, imazapyr, and glyphosate formulations as cut-stump or stem injection treatments, as determined appropriate by a

qualified, FDACS category 21, licensed herbicide applicator, of all identified Brazilian pepper locations should be conducted prior to August of each year to prevent seed maturity. Once treated, Brazilian peppertree locations that contained mature plants, approximately three years or older, should be monitored and re-treated annually for re-sprouts of partially controlled trees or newly sprouted seedlings.

The control and spread prevention guidelines outlined in Florida's Brazilian Peppertree Management Plan should be followed by exotic species control contractors working in Brazilian peppertree infestation areas (FLEPPC, 2006a).

5. Melaleuca is a small to medium evergreen tree that flowers/fruits and sets seed mainly in the winter, but potentially year-round. The three individual melaleuca trees located during the 2011 and 2012 surveys have been controlled. Monitoring for re-sprouts and seedlings and re-treatments should be conducted for at least one year after treatment, as melaleuca seeds remain viable for up to one year after dispersal.

   The control and spread prevention guidelines outlined in the Melaleuca Management Plan: Ten Years of Successful Management in Florida 1988 to 1998 should be followed by exotic species control contractors working in melaleuca infestation areas (FLEPPC, 1999).

The exotic vegetation species identified within the buffer area that are listed by the FLEPPC, but not listed by FDACS, should be considered for further evaluation of their threat to the natural vegetative communities within the Project Area. If determined to be a significant threat, appropriate control measures should be planned, field tested and applied, as necessary. Lantana continues to be the most commonly observed of these species, followed by natal grass, Guinea grass, Chinaberry and camphor trees. The locations of some occurrences of these species in 2011 and 2012 are provided on Figure 6.

5.0 REFERENCES

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TABLES AND GRAPHS

Table 1: 2012 Saw Palmetto Height and Coverage Mapping and Classification in SEC Pine Flatwoods Communities*									
Average Height (feet)	2012			2011			2010		
	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods[2]	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods
0 to 2	0 - 25	47.3	2.8%	0 - 25*	130.36	7.7%	0 - 25*	216	12.7%
	25 - 50	6.47	0.4%	25 - 50	176.33	10.4%	25 - 50	202	11.9%
	50 - 75	4.5	0.3%	50 - 75	13.49	0.8%	50 - 75	48	2.8%
0 to 2	25 - 50[1]	17.13	1.0%	75 - 100	1.31	0.1%	75 - 100	1	0.1%
Total 0 to 2		**75.4**	4.5%		**321.49**	**18.9%**		**467**	**27.5%**
2 to 4	0 - 25	82.22	4.9%	0 - 25	112.71	6.6%	0 - 25	117	6.9%
	25 - 50	624.45	37.0%	25 - 50	626.79	36.9%	25 - 50	482	28.4%
	50 - 75	691.52	41.0%	50 - 75	400.23	23.5%	50 - 75	286	16.8%
	75 - 100	5.68	0.3%	75 - 100	4.82	0.3%	75 - 100	135	7.9%
Total 2 to 4		**1403.87**	83.2%		**1144.55**	**67.3%**		**1020**	**60.0%**
4 to 6	0 - 25	12.01	0.7%	0 - 25	22.39	1.3%	0 - 25	18	1.1%
	25 - 50	38.41	2.3%	25 - 50	49.65	2.9%	25 - 50	50	2.9%
	50 - 75	47.03	2.8%	50 - 75	29.37	1.7%	50 - 75	18	1.1%
	75 - 100	27.54	1.6%	75 - 100	25.73	1.5%	75 - 100	41	2.4%
Total 4 to 6		**124.99**	7.4%		**127.14**	**7.5%**		**127**	**7.5%**
>6	0 - 25	0	0.0%	0 - 25	0	0.0%	0 - 25	0	0.0%
	25 - 50	6.32	0.4%	25 - 50	5.96	0.4%	25 - 50	13	0.8%
	50 - 75	3.65	0.2%	50 - 75	7.09	0.4%	50 - 75	7	0.4%
	75 - 100	9.57	0.6%	75 - 100	18.74	1.1%	75 - 100	19	1.1%
Total greater that 6		**19.54**	1.2%		**31.79**	**1.9%**		**39**	**2.3%**

Average Height (feet)	2009			2008		
	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods
0 to 2	0 - 25*	51.7	3.0%	0 - 25*	60	3.5%
	25 - 50	31.5	1.9%	25 - 50		0.0%
	50 - 75	108.4	6.4%	50 - 75	58	3.4%
0 to 2	75 - 100	23	1.4%	75 - 100	86	5.1%
Total 0 to 2		**214.6**	**12.6%**		**204**	**12.0%**
2 to 4	0 - 25	84.5	5.0%	0 - 25	12	0.7%
	25 - 50	113.7	6.7%	25 - 50	74	4.4%
	50 - 75	359.6	21.2%	50 - 75	147	8.6%
	75 - 100	349.7	20.6%	75 - 100	853	50.2%
Total 2 to 4		**907.5**	**53.4%**		**1086**	**63.9%**
4 to 6	0 - 25	59.3	3.5%	0 - 25	4	0.2%
	25 - 50	33.2	2.0%	25 - 50	23	1.4%
	50 - 75	146.8	8.6%	50 - 75	11	0.6%
	75 - 100	104.1	6.1%	75 - 100	253	14.9%
Total 4 to 6		**343.4**	**20.2%**		**291**	**17.1%**
>6	0 - 25	5.8	0.3%	0 - 25	0	0.0%
	25 - 50	10.1	0.6%	25 - 50	0	0.0%
	50 - 75	0	0.0%	50 - 75	0	0.0%
	75 - 100	18.5	1.1%	75 - 100	17	1.0%
Total greater that 6		**34.4**	**2.0%**		**17**	**1.0%**

* Wiregrass and Tree Mix coverage not included, accounting for 2.7%.

[1] 0 to 2' mixed with 4 to 6' after recent roller chopping avoided palmetto around large longleaf pine trees

[2] Acreage of pine flatwoods reduced by approximately 12 acres due to new Wet Detention Pond Construction

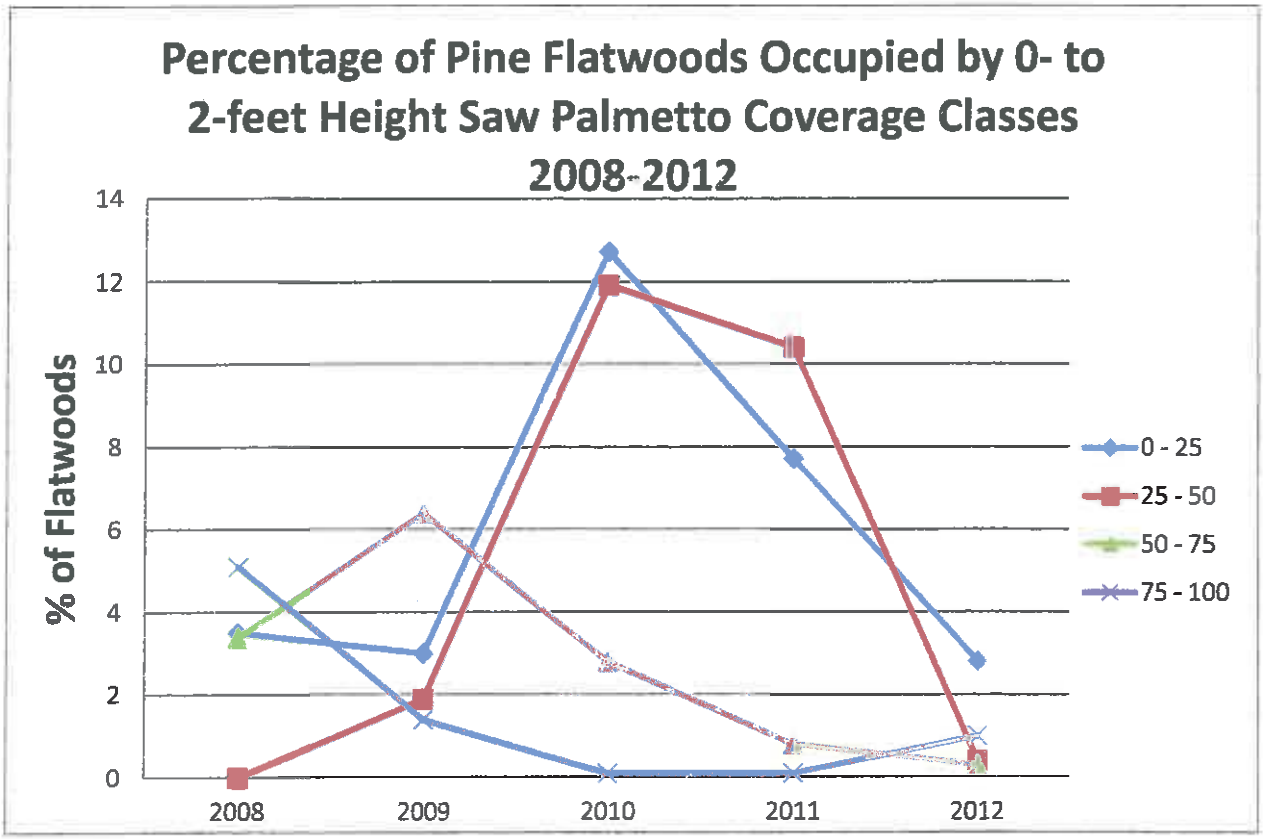
Table 2: 2012 Saw Palmetto Height and Coverage Mapping and Classification in the Xeric Oak / Saw Palmetto Community*									
Average Height (feet)	2012			2011			2010		
	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods[1]	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods
0 to 2	0 - 25*	0	0.0%	0 - 25*	0	0.0%	0 - 25*	0	0.0%
	25 - 50	0	0.0%	25 - 50	0	0.0%	25 - 50	0	0.0%
	50 - 75	0	0.0%	50 - 75	0	0.0%	50 - 75	0	0.0%
	75 - 100	0	0.0%	75 - 100	0	0.0%	75 - 100	0	0.0%
Total 0 to 2		**0**	**0.0%**		**0**	**0.0%**		**0**	**0.0%**
2 to 4	0 - 25	0	0.0%	0 - 25	0	0.0%	0 - 25	0	0.0%
	25 - 50	2.28	0.1%	25 - 50	0	0.0%	25 - 50	0	0.0%
	50 - 75	14.3	0.8%	50 - 75	20.74	1.2%	50 - 75	21	1.2%
	75 - 100	0	0.0%	75 - 100	0	0.0%	75 - 100	0	0.0%
Total 2 to 4		**16.58**	**1.0%**		**20.74**	**1.2%**		**21**	**1.2%**
4 to 6	0 - 25	0	0.0%	0 - 25	0	0.0%	0 - 25	0	0.0%
	25 - 50	0	0.0%	25 - 50	2.24	0.1%	25 - 50	3	0.2%
	50 - 75	1.23	0.1%	50 - 75	2.92	0.2%	50 - 75	2	0.1%
	75 - 100	0	0.0%	75 - 100	0	0.0%	75 - 100	0	0.0%
Total 4 to 6		**1.23**	**0.1%**		**5.16**	**0.3%**		**5**	**0.3%**
>6	0 - 25	0	0.0%	0 - 25	0	0.0%	0 - 25	0	0.0%
	25 - 50	0	0.0%	25 - 50	0	0.0%	25 - 50	0	0.0%
	50 - 75	0	0.0%	50 - 75	0	0.0%	50 - 75	0	0.0%
	75 - 100	0	0.0%	75 - 100	0	0.0%	75 - 100	0	0.0%
Total greater that 6		**0**	**0.0%**		**0**	**0.0%**		**0**	**0.0%**

Average Height (feet)	2009			2008		
	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods	Average Cover (% coverage)	Area (acres)	Percentage of Pine Flatwoods
0 to 2	0 - 25*	0	0.0%	0 - 25*	0	0.0%
	25 - 50	9.7	0.6%	25 - 50	0	0.0%
	50 - 75	0	0.0%	50 - 75	0	0.0%
	75 - 100	0	0.0%	75 - 100	0	0.0%
Total 0 to 2		**9.7**	**0.6%**		**0**	**0.0%**
2 to 4	0 - 25	0	0.0%	0 - 50	14	0.8%
	25 - 50	10.7	0.6%			
	50 - 75	7.4	0.4%	50 - 75	10	0.6%
	75 - 100	0	0.0%	75 - 100	7	0.4%
Total 2 to 4		**18.1**	**1.1%**		**31**	**1.8%**
4 to 6	0 - 25	0	0.0%	0 - 25	0	0.0%
	25 - 50	0	0.0%	25 - 50	0	0.0%
	50 - 75	0	0.0%	50 - 75	0	0.0%
	75 - 100	0	0.0%	75 - 100	0	0.0%
Total 4 to 6		**0**	**0.0%**		**0**	**0.0%**
>6	0 - 25	0	0.0%	0 - 25	0	0.0%
	25 - 50	0	0.0%	25 - 50	0	0.0%
	50 - 75	0	0.0%	50 - 75	0	0.0%
	75 - 100	0	0.0%	75 - 100	0	0.0%
Total greater that 6		**0**	**0.0%**		**0**	**0.0%**

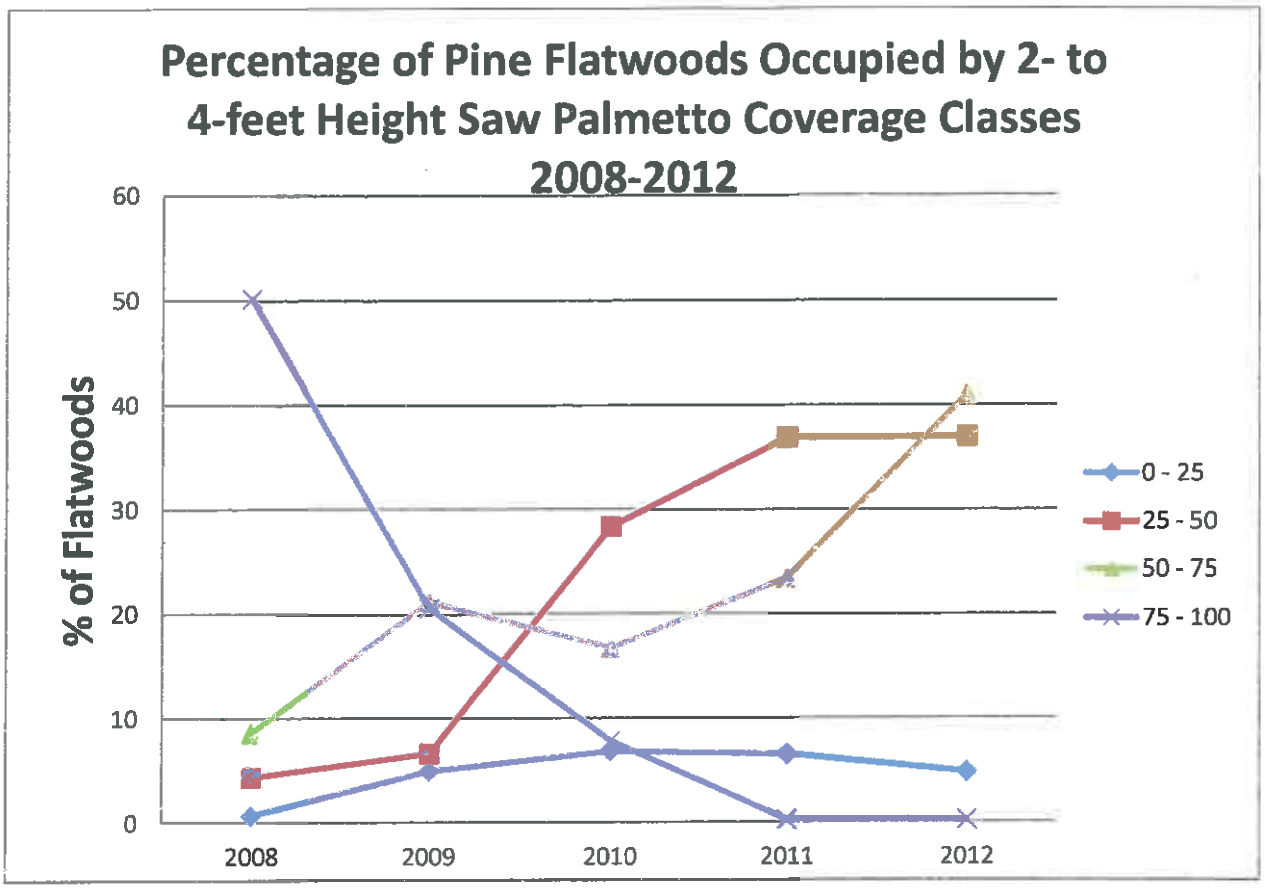
* Wiregrass and Tree Mix coverage not included, accounting for 2.7%.

[1] Acreage of pine flatwoods reduced by approximately 12 acres due to new Wet Detention Pond Construction.

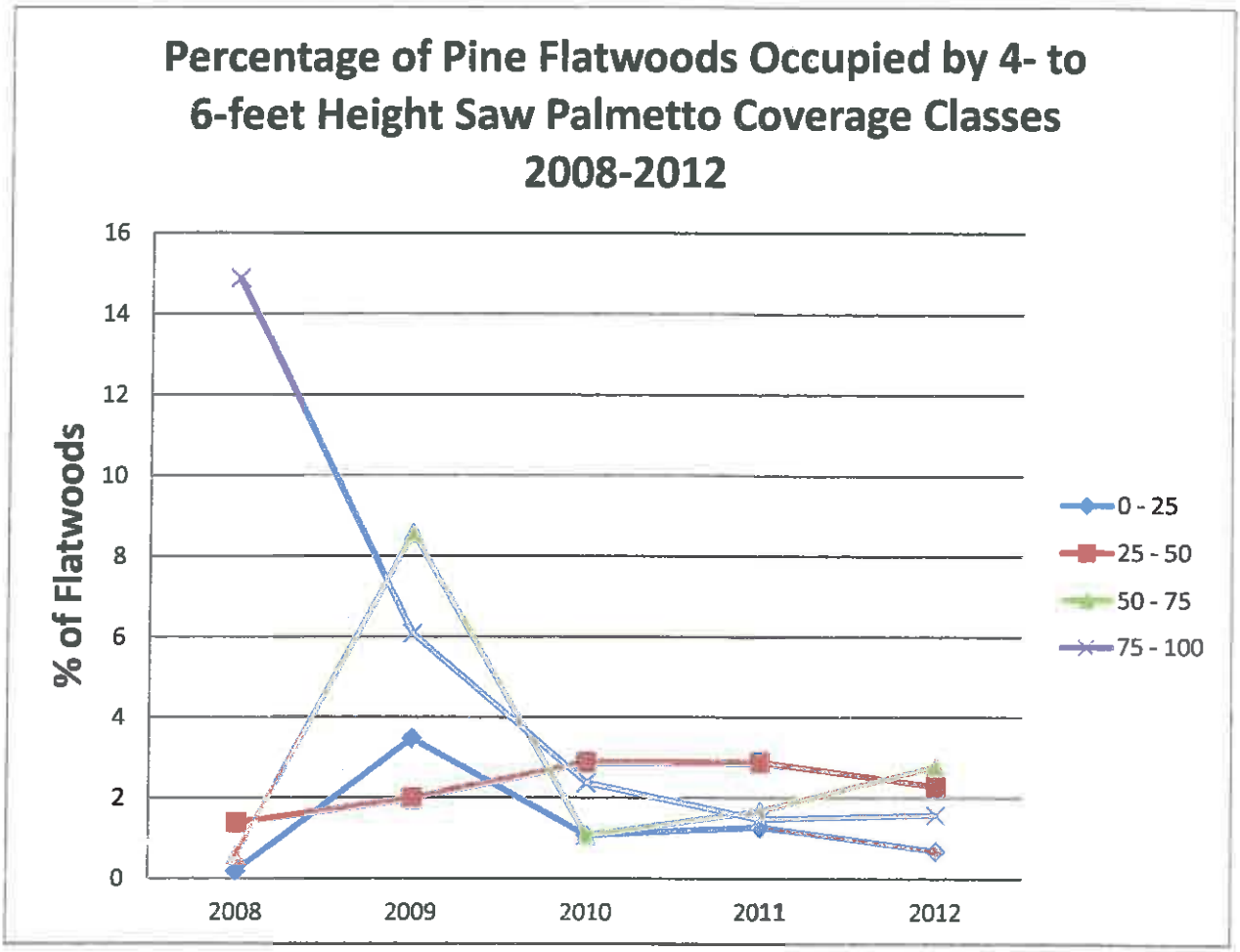
Graphs 1-4: Percentage of Pine Flatwoods Occupied by Saw Palmetto Coverage Classes 2008-2012



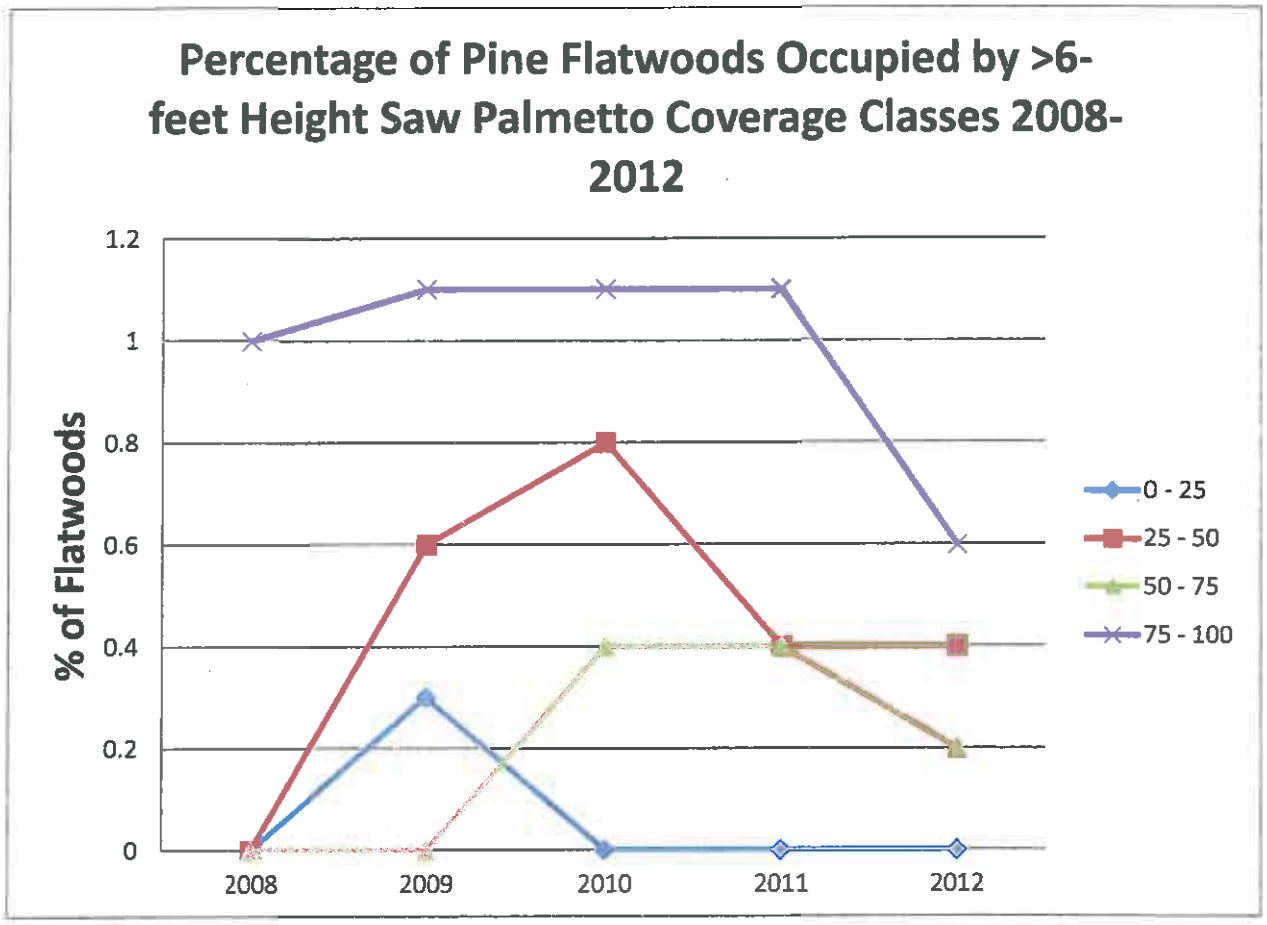
Graph 1: 0- to 2-Feet Height Saw Palmetto



Graph 2: 2- to 4-Feet Height Saw Palmetto

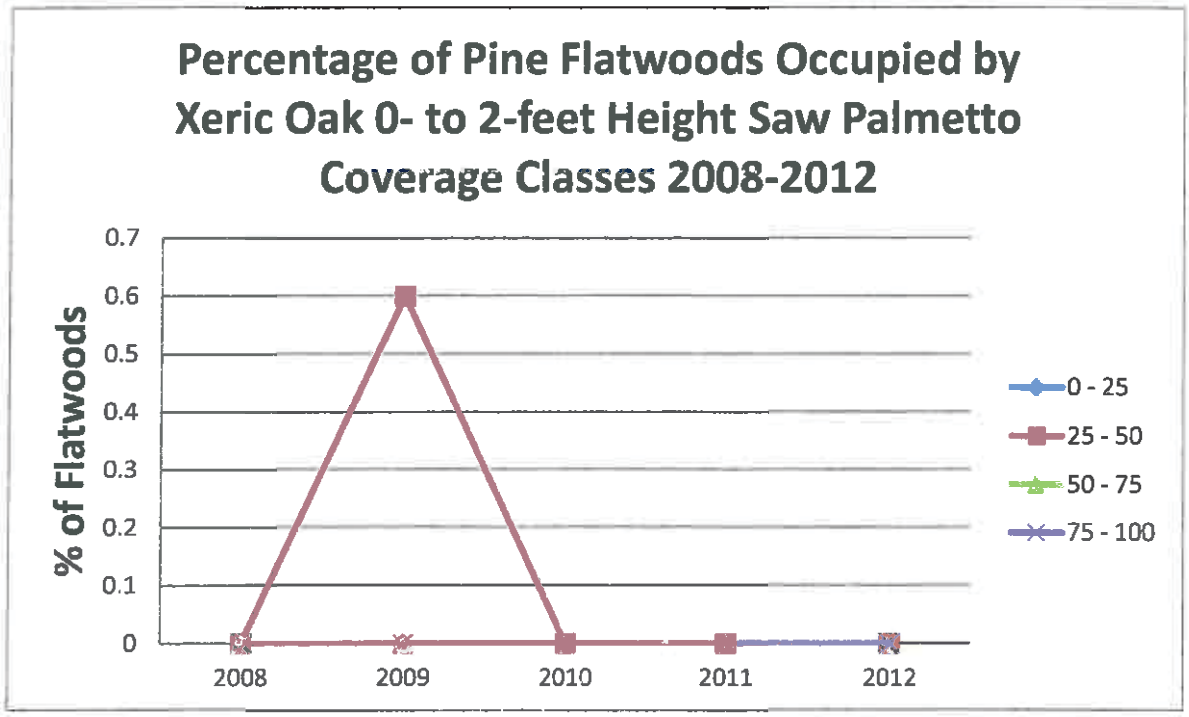


Graph 3: 4- to 6-Feet Height Saw Palmetto

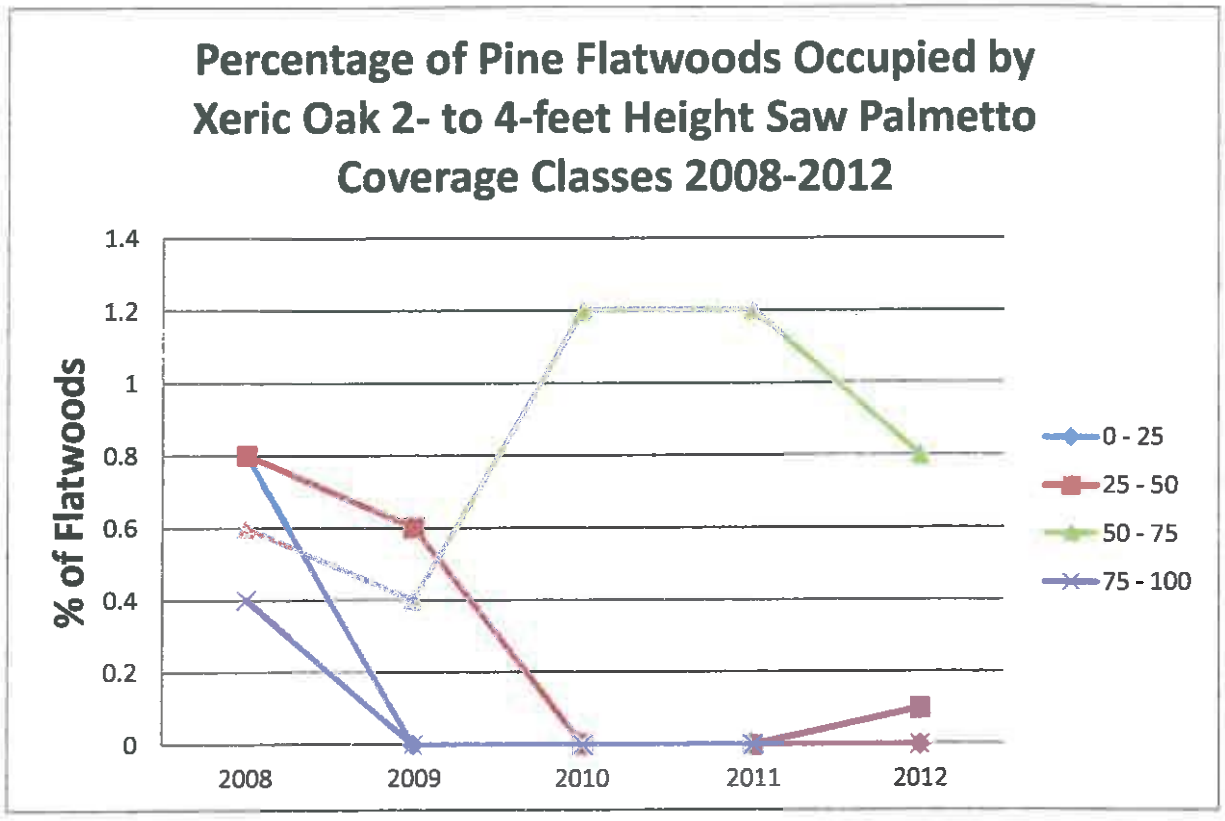


Graph 4: >6-Feet Height Saw Palmetto

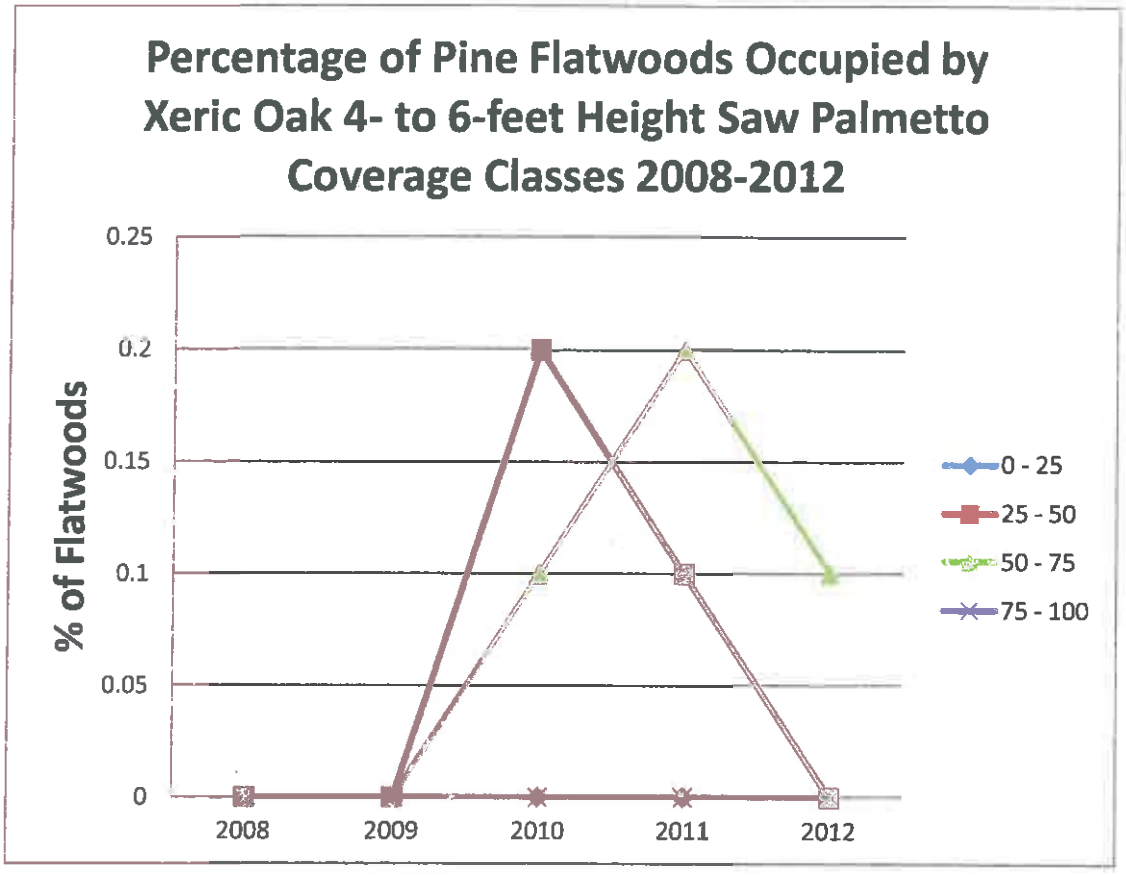
Graphs 5-7: Percentage of Pine Flatwoods Occupied by Xeric Oak/Saw Palmetto Coverage Classes 2008-2012



Graph 5: 0- to 2-Feet Height Xeric Oak/Saw Palmetto

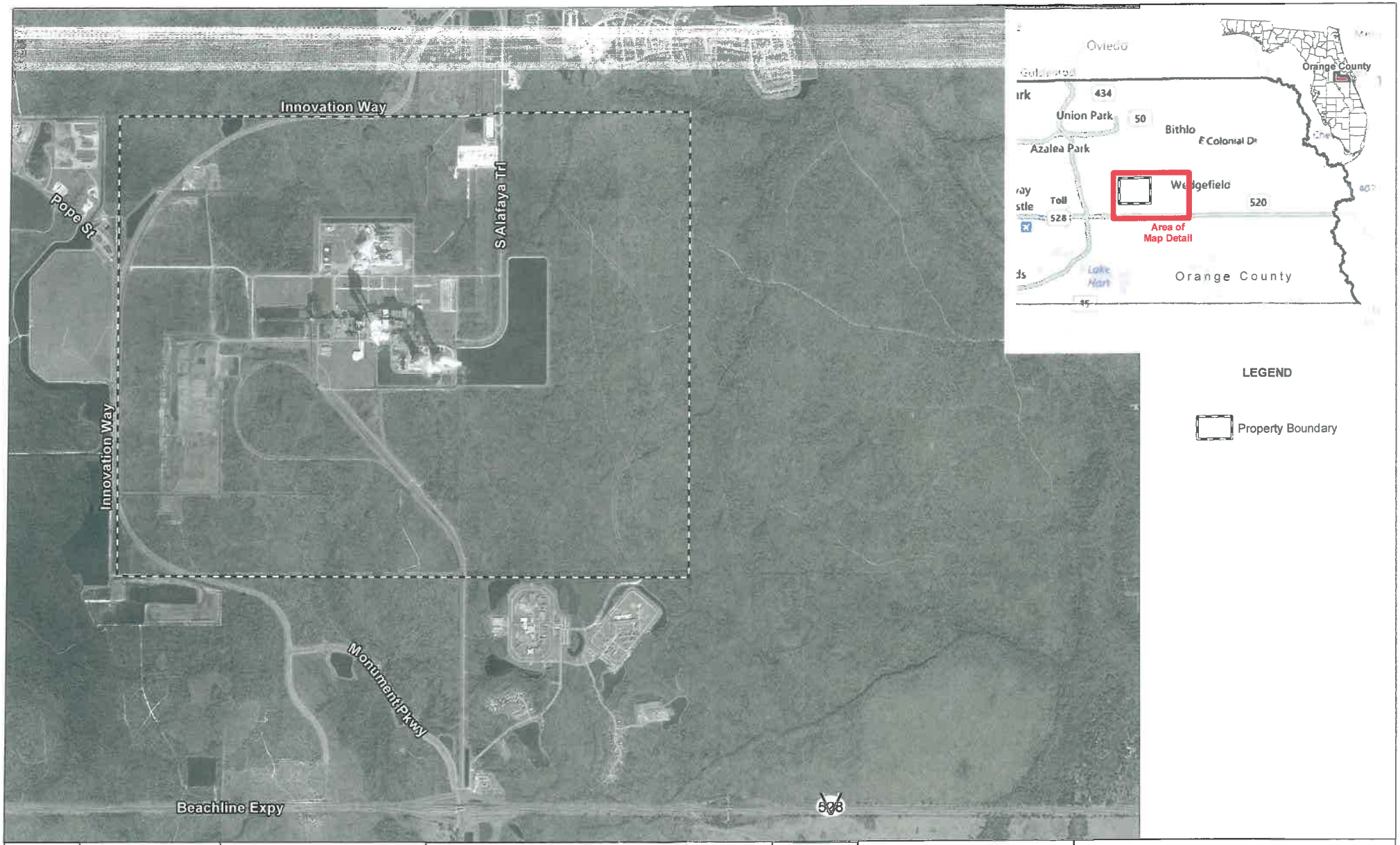


Graph 6: 2- to 4-Feet Height Xeric Oak/Saw Palmetto



Graph 7: 4- to 6-Feet Height Xeric Oak/Saw Palmetto

FIGURES



Project Number 112C04350 Date Created 07/20/2012	TETRA TECH	Source: Orange County 2011 Aerial	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	—	2,000 1,000 0 2,000 Feet

FIGURE 1
GENERAL LOCATION MAP

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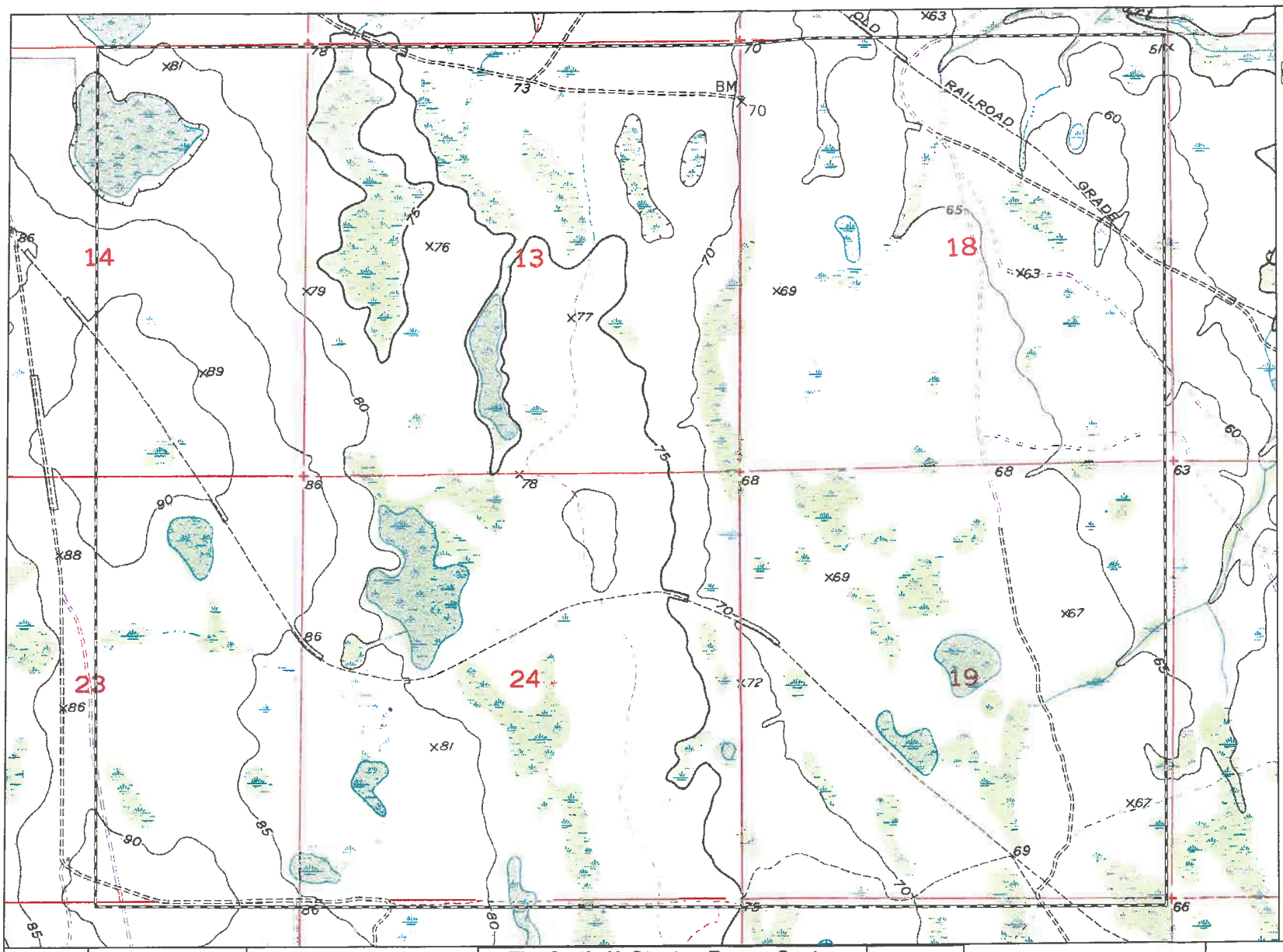

Project Number 112C04350 Date Created 07/20/2012	TETRA TECH	Source: USGS 7.5' Quadrangle Narcoossee NW, FL 1953 Photorevised 1980	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 1,200 600 0 1,200 Feet	**FIGURE 2** **USGS TOPOGRAPHIC MAP**

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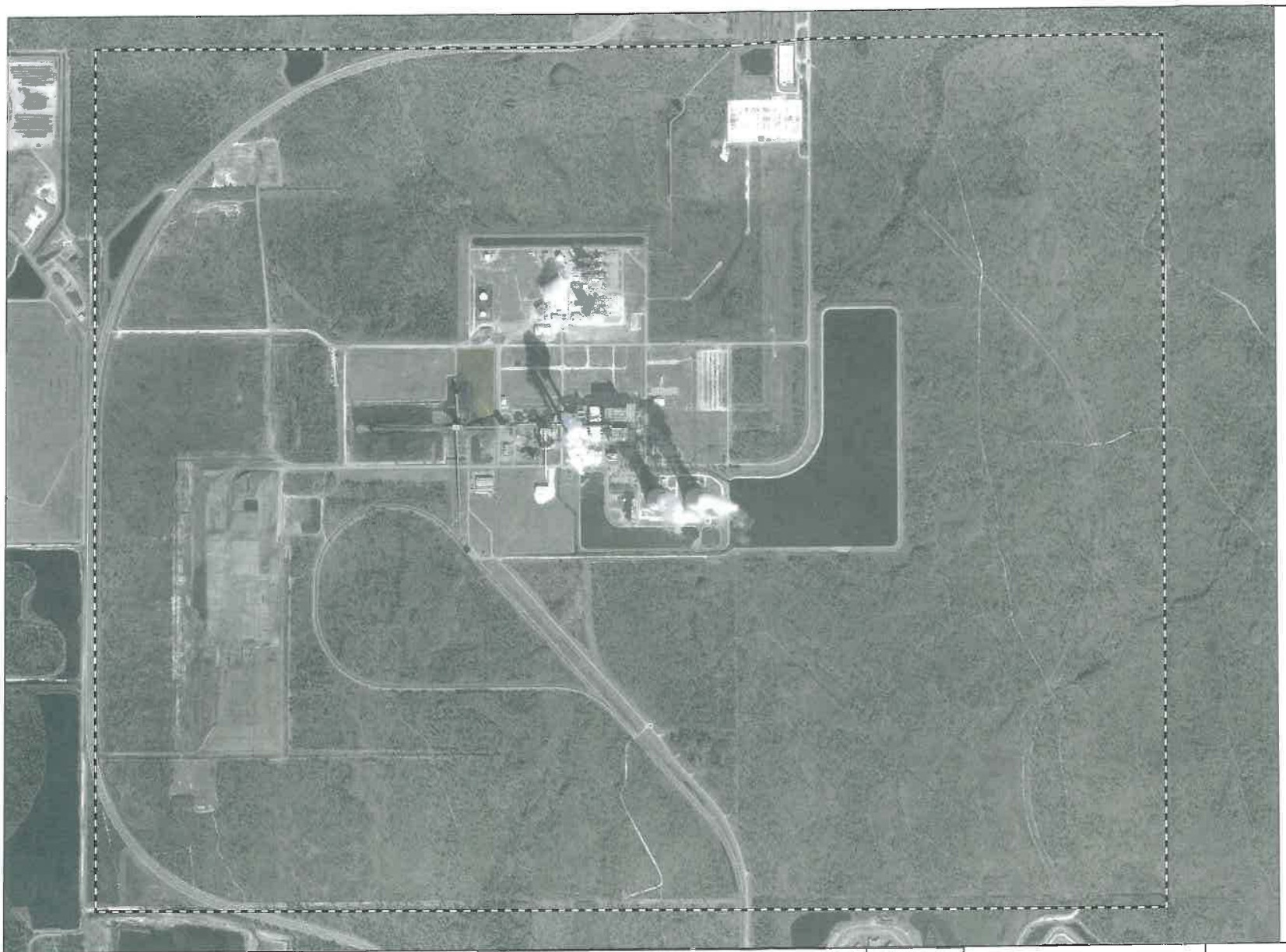

LEGEND

Property Boundary

Project Number 112C04350 Date Created 07/120/2012	TETRA TECH	Source: Orange County 2011 Aerial	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N	1,200 600 0 1,200 Feet	**FIGURE 3** **JANUARY 2011 AERIAL MAP**

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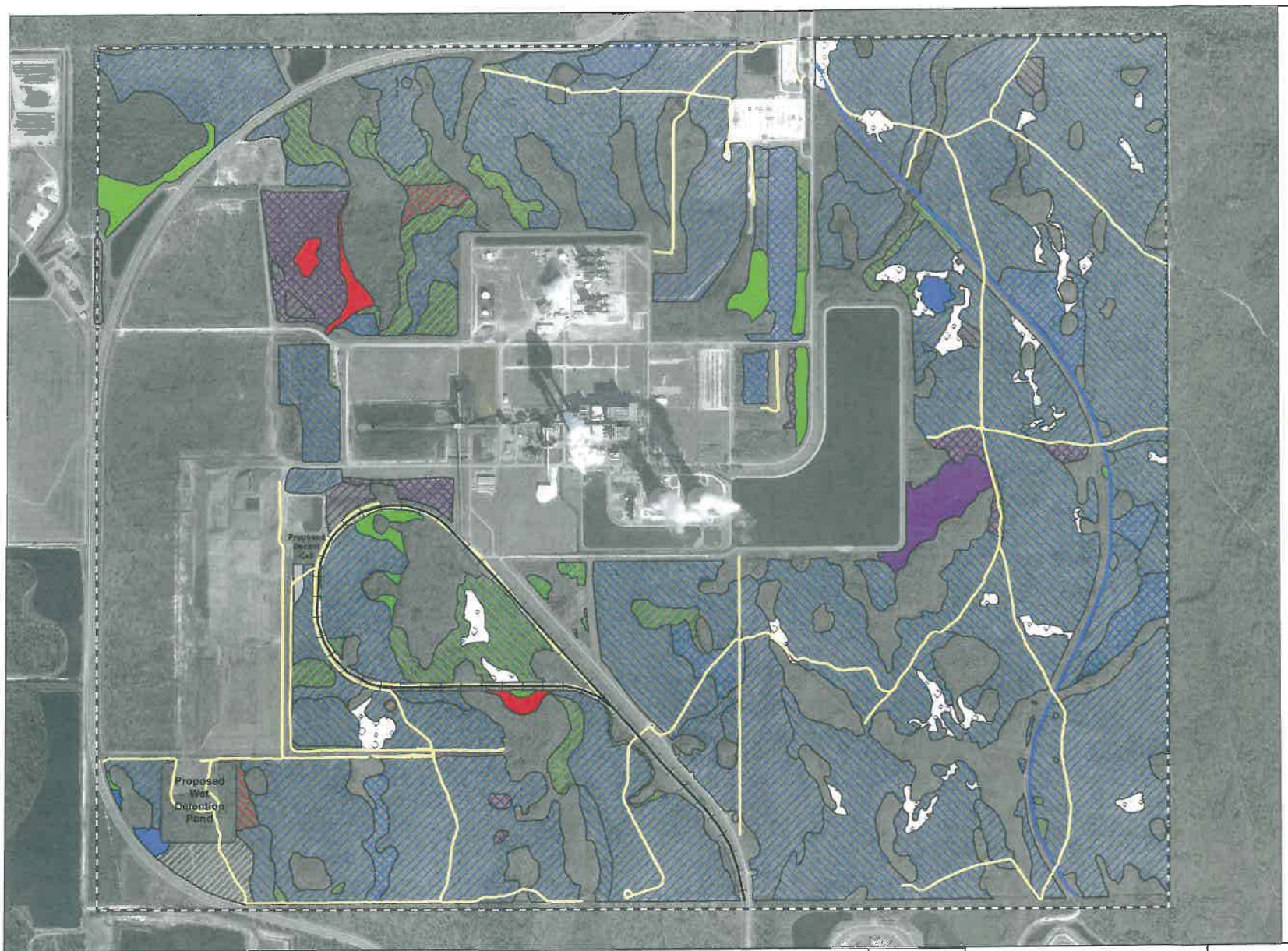

LEGEND

- Property Boundary
- Firelines and pathways
- Railroad
- Waterline

Pine Flatwoods (Hgt/Dnsty/Ac)

- 0-2', 0-25%, 47.3
- 0-2', 25-50%, 6.47
- 0-2', 50-75%, 4.5
- 0-2' & 4-6' mixed, 25-50%, 17.13
- 2-4', 0-25%, 82.22
- 2-4', 25-50%, 624.45
- 2-4', 50-75%, 691.52
- 2-4', 75-100%, 5.68
- 4-6', 0-25%, 12.01
- 4-6', 25-50%, 38.41
- 4-6', 50-75%, 47.03
- 4-6', 75-100%, 27.54
- 6+', 25-50%, 6.32
- 6+', 50-75%, 3.65
- 6+', 75-100%, 9.57

Xeric Oak (Hgt/Dnsty/Ac)

- 2-4', 25-50%, 2.28
- 2-4', 50-75%, 14.30
- 4-6', 50-75%, 1.23

Miscellaneous (Ac)

- Wire Grass, 43.33
- Tree Mix, 2.65

Project Number	Source: Orange County 2011 Aerial	The Curtis H. Stanton Energy Center	N	1,200 600 0 1,200 Feet	FIGURE 4
112C04350		5100 S. Alafaya Trail			JULY 2012 SAW PALMETTO SURVEY
Date Created		Orlando, Orange County, Florida			
07/20/2012		ORLANDO UTILITIES COMMISSION			

TETRA TECH

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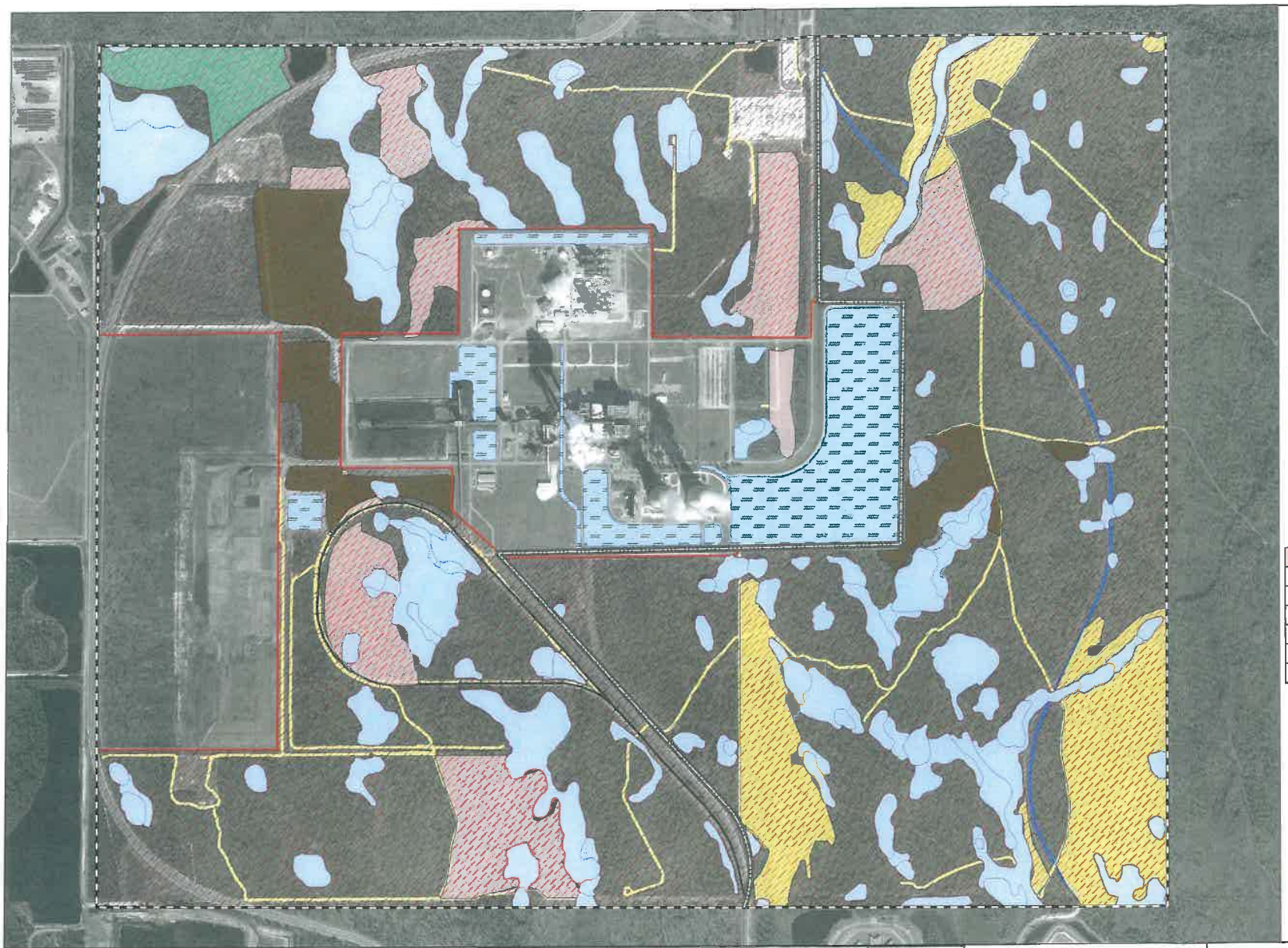

LEGEND

- Property Boundary
- East/West Divide

Site features

- Firelines and pathways
- Railroad
- Waterline
- Wetlands
- Treatment ponds (non-sewage)

Mechanical Treatment

- June - July 2009
- May 2010
- March 2011
- July 2012

Prescribed Burn

- Summer 2012, To be Conducted Over Entire Project Area

Documented Burn Events prior to 2012	
Jan. - Mar. 1997	Entire Site
Jan. - Mar. 2004	Entire Site
Aug. 2006	West Side
Jul. 2007	East Side
May 2008	West Side
Jun. 2009 - May 2012	Entire Site

Project Number	TETRA TECH	Source: Orange County 2011 Aerial	The Curtis H. Stanton Energy Center 5100 S. Alafaya Trail Orlando, Orange County, Florida ORLANDO UTILITIES COMMISSION	N	1,200 600 0 1,200 Feet	FIGURE 5 JULY 2012 MECHANICAL TREATMENT AND PRESCRIBED BURN MAP
112C04350						
Date Created						
07/20/2012						

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LEGEND

- Property Boundary

Site features

- Firelines and pathways
- Railroad
- Waterline
- 2011 Treated Nuisance Species Locations
- 2011 Treated Nuisance Species Dominated Areas

2012 Nuisance Species Locations

- Brazilian pepper
- Camphor tree
- Cattail
- Chinaberry
- Chinese tallow
- Cogon grass
- Guinea grass
- Lantana
- Melaleuca
- Old world climbing fern
- Primrose willow
- Tropical Soda Apple

2012 Nuisance Species Dominated Areas (Ac)

- Chinese tallow, 5.79
- Chinese tallow/Lantana/Cogon grass, 4.27
- Cogon grass, 0.52
- Old world climbing fern, 43.90

Project Number 112C04350 Date Created 07/20/2012	TETRA TECH	Source: Orange County 2011 Aerial	**The Curtis H. Stanton Energy Center** 5100 S. Alafaya Trail Orlando, Orange County, Florida **ORLANDO UTILITIES COMMISSION**	N 1,200 600 0 1,200 Feet	**FIGURE 6** **JULY 2012 EXOTIC VEGETATION SPECIES SURVEY**

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ATTACHMENTS

ATTACHMENT 1

Noxious Weed List
Chapter 5B-57.007, F.A.C.

5B-57.007 Noxious Weed List.

(1) Parasitic Weeds.

(a) Aeginetia spp. (Aeginetia).

(b) Alectra spp. (Alectra).

(c) Cuscuta spp. Only the native Florida species are excluded from this list. These include:

1. C. americana.
2. C. compacta.
3. C. exaltata.
4. C. gronovii.
5. C. indecora.
6. C. obtusiflora.
7. C. pentagona.
8. C. umbellata.

(d)1. Orobanche spp. (broomrapes), with the exception of:

2. O. uniflora. (oneflowered broomrape)

(2) Terrestrial Weeds.

(a) Ageratina adenophora (crofton weed).

(b) Alternanthera sessilis (sessile joyweed).

(c) Abrus precatorius (rosary pea).

(d) Ardisia elliptica (shoebutton ardisia).

(e) Asphodelus fistulosus (onionweed).

(f) Avena sterilis (including Avena budoviciana) (animated oat, wild oat).

(g) Borreria alata (broadleaf buttonweed).

(h) Carthamus oxyacantha (wild safflower).

(i) Casuarina equisetifolia (Australian pine).

(j) Casuarina glauca (suckering Australian pine).

(k) Chrysopogon aciculatus (pilipiliula).

(l) Colubrina asiatica (latherleaf)

(m) Commelina benghalensis (Benghal dayflower).

(n) Crupina vulgaris (common crupina).

(o) Cupaniopsis anacardioides (carrotwood) Propagation prohibited effective 7/1/99; sale or distribution prohibited 1/1/2001.

(p) Digitaria scalarum (African couchgrass, fingergrass).

(q) Digitaria velutina (velvet fingergrass, annual couchgrass).

(r) Dioscorea alata (white yam).

(s) Dioscorea bulbifera (air potato).

(t) Drymaria arenarioides (lightning weed).

(u) Emex australis (three-corner jack).

(v) Emex spinosa (devil's thorn).

(w) Euphorbia prunifolia (painted euphorbia).

(x) Galega officinalis (goat's rue).

(y) Heracleum mantegazzianum (giant hogweed).

(z) Imperata brasiliensis (Brazilian satintail).

(aa) Imperata cylindrica (cogongrass).

(bb) Ipomoea triloba (little bell, aiea morning glory).

(cc) Ischaemum rugosum (murainograss).

(dd) Leptochloa chinensis (Asian sprangletop).

(ee) Leucaena leucocephala (lead tree).

(ff) Lycium ferocissimum (African boxthorn).

(gg) Lygodium japonicum (Japanese climbing fern).

(hh) Lygodium microphyllum (small-leaved climbing fern).
(ii) Melaleuca quinquenervia (melaleuca).[1]
(jj) Melastoma malabathricum (Indian rhododendron).
(kk) Mikania cordata (mile-a-minute).
(ll) Mikania micrantha (climbing hempweed).
(mm) Mimosa invisa (giant sensitive plant).
(nn) Mimosa pigra (catclaw mimosa).[1]
(oo) Nassella trichotoma (serrated tussock).
(pp) Neyraudia reynaudiana (Burma reed).
(qq) Opuntia aurantiaca (jointed prickly pear).
(rr) Oryza longistaminata (red rice).
(ss) Oryza punctata (red rice).
(tt) Oryza rufipogon (wild red rice).
(uu) Paederia cruddasiana (sewer-vine).
(vv) Paederia foetida (skunk-vine).
(ww) Paspalum scrobiculatum (Kodomillet).
(xx) Pennisetum clandestinum (Kikuyu grass).
(yy) Pennisetum macrourum (African feathergrass).
(zz) Pennisetum pedicellatum (Kyasuma grass).
(aaa) Pennisetum polystachyon (missiongrass, thin napiergrass).
(bbb) Prosopis spp.
(ccc) Pueraria montana (kudzu).
(ddd) Rhodomyrtus tomentosa (downy myrtle).
(eee) Rottboellia cochinchinensis (itchgrass).
(fff) Rubus fruticosus (bramble blackberry).
(ggg) Rubus molluccanus (wild raspberry).
(hhh) Saccharum spontaneum (wild sugarcane).
(iii) Salsola vermiculata (wormleaf salsola).
(jjj) Sapium sebiferum (Chinese tallow tree).
(kkk) Scaevola taccada (beach naupaka). Propagation prohibited immediately and distribution prohibited by July 1, 2007.
(lll) Schinus terebinthifolius (Brazilian pepper-tree).[1]
(mmm) Setaria pallidefusca (cattail grass).
(nnn) Solanum tampicense (wetland nightshade).
(ooo) Solanum torvum (turkeyberry).
(ppp) Solanum viarum (tropical soda apple).
(qqq) Tridax procumbens (coat buttons).
(rrr) Urochloa panicoides (liverseed grass).

[1]Department of Environmental Protection permit required for these species.

Specific Authority 570.07(13), (23) FS. Law Implemented 581.031(4), (5), (6), 581.083, 581.091 FS. History–New 7-27-93, Amended 2-28-94, 6-30-96, 7-7-99, 10-1-06.

ATTACHMENT 2

Photographs

SAW PALMETTO PHOTOGRAPHS

1. 0- to 2-foot average height saw palmetto (foreground) that was roller chopped in 2012 with 4- to 6-foot average height saw palmetto (background) that was not chopped to protect longleaf pine trees.

2. 2- to 4-foot average height saw palmetto that was roller chopped in 2012.

3. 2- to 4-foot average height saw palmetto at 50 to 75% coverage.

4. 2- to 4-foot average height saw palmetto at 25 to 50% coverage.

5. 0- to 2-foot average height saw palmetto at 0 to 25% ground coverage.

6. Similar area to Photo 7, but zoomed further out. Note the dominant herbaceous cover.

7. 2- to 4-foot average height saw palmetto recently chopped in 2012.

8. Saw palmetto mixed with wiregrass area recovered from being chopped and burned in 2010.

EXOTIC VEGETATION PHOTOGRAPHS

1. Old world climbing fern fronds and twining stems.

2. Old world climbing fern, treated, on base of cypress tree beginning to climb up trunk and into tree canopy.

3. Cogongrass with two mature seed spikes (white spots).

4. Cogongrass with mature seed spikes, located within recently roller chopped area.

5. Looking **east** at the Old World Climbing Fern encroaching on the wetland edge in the northwestern portion of the Project Area in 2011.

6. Same view as Photo 5 in 2012, after herbicide treatment.

7. Treated old world climbing fern in northwestern wetland infestation area.

8. Old world climbing fern, treated at center, entwined within saw palmetto plant in northwestern flatwoods margin around cypress wetland.

9. Cogongrass patch within disturbed longleaf pine flatwoods, treated approximately one day before picture taken on June 29, 2012.

10. Exotic control crew spraying cogongrass using a backpack sprayer in foliar application.

ATTACHMENT 3

Exotic Vegetation Species GPS Data

Attachment 3 provided electronically.

ATTACHMENT 4

GIS Shapefiles and Metadata

Attachment 4 provided electronically.

ATTACHMENT 3

Annual Status Report for the Red-cockaded Woodpecker Monitoring 2012
August 15, 2012

BDA
ENVIRONMENTAL CONSULTANTS

2012-037

ANNUAL STATUS REPORT OF RED-COCKADED WOODPECKER MONITORING AT THE CURTIS H. STANTON ENERGY CENTER, ORANGE COUNTY, FLORIDA

Submitted on behalf of:

Orlando Utilities Commission

For:

TetraTech, Inc.
Suite 1000
201 E. Pine Street
Orlando, Florida 32801
Phone: 407-480-3917
Fax: 407-839-3790

August 15, 2012

Submitted by:

Christopher J. Harrington, M.S., PWS
Associate Scientist III

Tom H. Logan, M.S., C.W.B.
Vice President

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1.0 INTRODUCTION

The Curtis H. Stanton Energy Center (SEC) project site is located approximately three miles east of Orlando, Florida in Sections 13, 14, 23, and 24, Township 23 South, and Range 31 East, and Sections 18 and 19, Township 23 South, and Range 32 East in Orange County, Florida (Figure 1.0-1). The entire SEC covers approximately 3,280 acres, of which about 2,400 acres have been preserved in accordance with the Florida Department of Environmental Protection (FDEP) conditions of certification per the 1982 Site Certification Agreement (SCA) for project development. The following tracks the history of FDEP certification of SEC:

- Certification for Unit 1 was issued December 15, 1982.
- Certification for Unit 2 was issued December 17, 1991, and modified April 5, 1993; July 24, 1995 (Alafaya Trail Extension); and December 24, 1997 (merge certification for Unit 1 and Unit 2).
- Supplemental certification for Unit A was issued September 21, 2001, and modified February 24, 2003, and July 20, 2006.
- Supplemental certification for Unit B was issued August 17, 2006, and modified January 17, 2007; December 3, 2007; February 6, 2008; February 20, 2008; February 24, 2008; and July 24, 2008.

Surveys for the red-cockaded woodpecker (*Picoides borealis*) (RCW) were performed on SEC as part of this certification process. The RCW is listed by the U.S. Fish and Wildlife Service (USFWS) as an Endangered species under provisions of the Endangered Species Act of 1973 16 United States Code 1531-1544, December 28, 1973, as amended 1976 – 1982, 1984, and 1988 and Florida Rule (68A-27.001 – 27.007, Florida Administrative Code) and is documented to occur on the site. Therefore, monitoring, reporting, and management plans were subsequently developed for the protection and survival of this species on SEC. Orlando Utilities Commission (OUC), Florida Municipal Power Agency, and

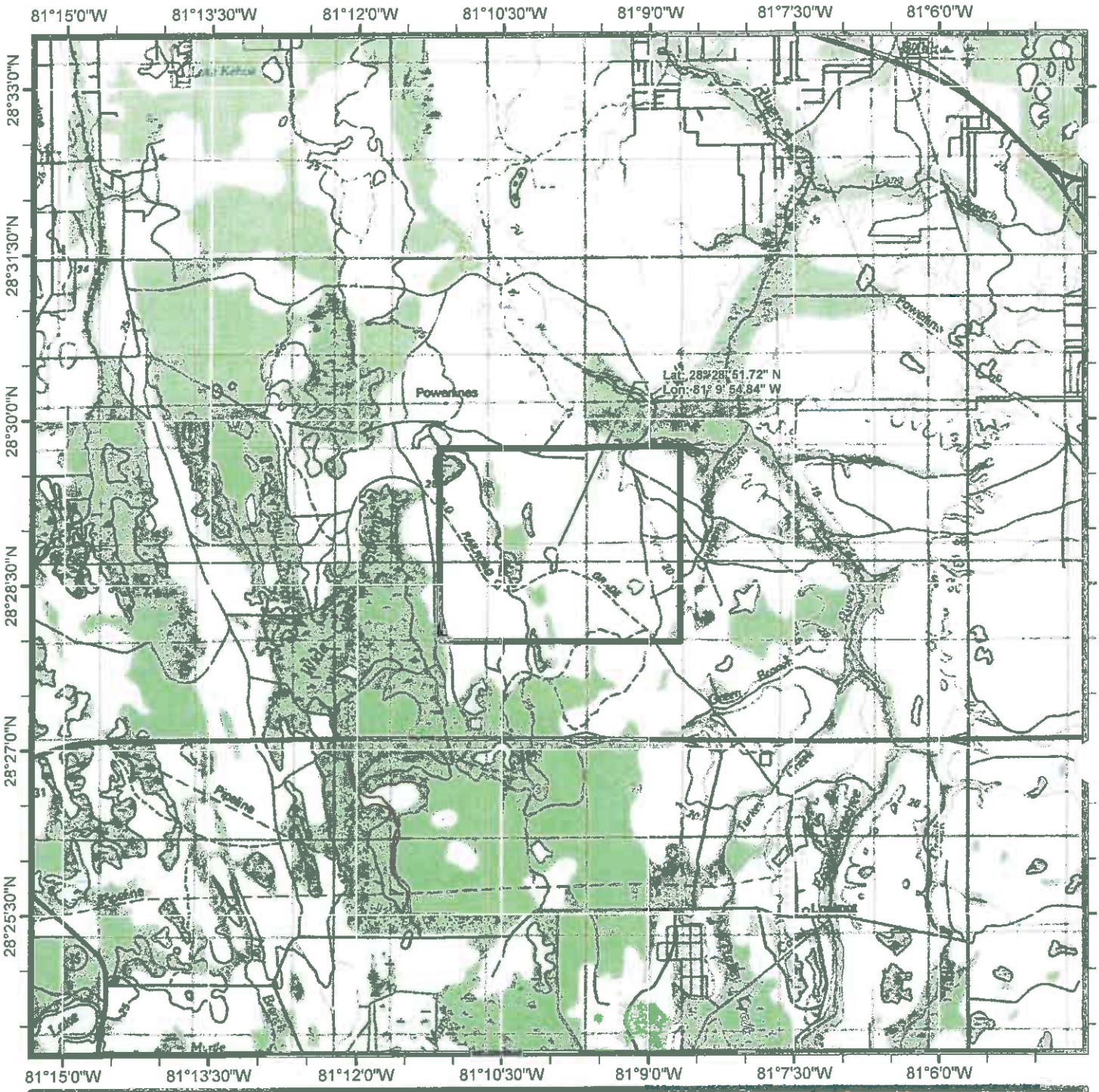

FIGURE 1.0-1. LOCATION OF CURTIS H. STANTON ENERGY CENTER PROJECT SITE (SECTIONS 13, 14, 23, AND 24, TOWNSHIP 23 S, RANGE 31 E AND SECTIONS 18, AND 19, TOWNSHIP 23 S, RANGE 32 E), ORANGE COUNTY, FLORIDA.

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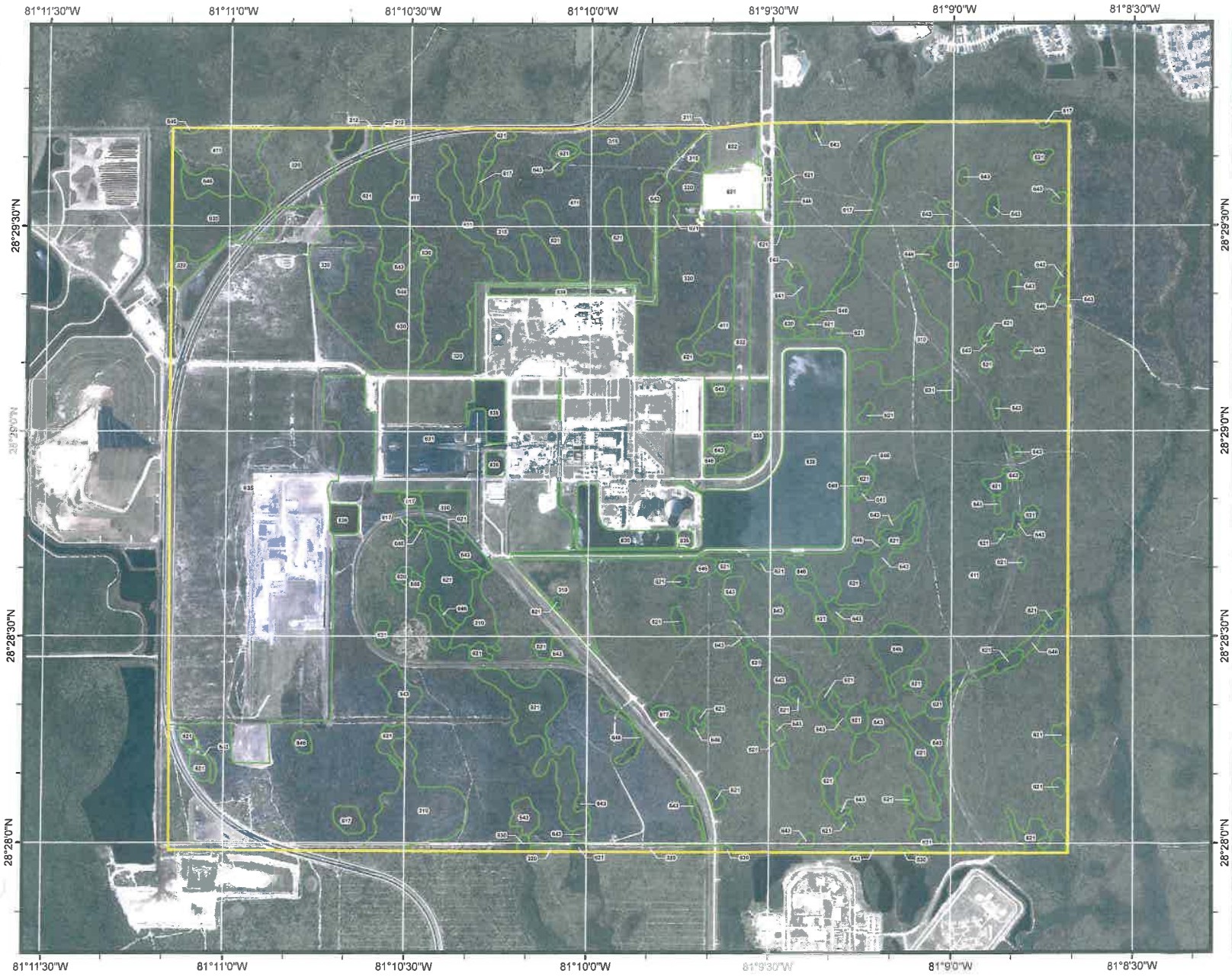
Kissimmee Utility Authority agreed to manage the approximately 2,400 acres of habitat on SEC for the long-term benefit of the RCW as required by the SCA.

The 2,400 acres of preserved land consist of various upland and wetland communities, dominated by mature longleaf pine (*Pinus palustris*) flatwoods. Notable wetland community types embedded within the pine flatwoods include cypress swamps, mixed wetland hardwoods, shrub wetlands, freshwater marshes, and wet prairies (Figure 1.0-2). Several tributaries including Green Branch, Cowpen Branch, Hart Branch, and an unnamed tributary drain the site eastward into the Big Econlockhatchee River (Figure 1.0-3).

Well-managed and extensive land consisting of open, mature pine flatwoods is essential habitat for the persistence of RCWs. RCWs prefer live pines (*Pinus* sp.) for cavity excavation as roost and nest trees that are a minimum of 60 to 80 years of age (USFWS, 2003). Pine flatwoods with good age-class distribution and density, an open understory with very limited shrub and hardwood encroachment, and low-growth saw palmetto (*Serenoa repens*), wiregrass (*Aristida stricta*), and other various bunch grasses and forbes is optimal RCW habitat. The likelihood for cavity or cluster abandonment increases as hardwood density and height increase in the understory (USFWS 2003). Sound management techniques are critical to maintaining extensive tracts of suitable RCW habitat, which OUC has undertaken and continues to date.

OUC has been conducting regular, sustainable management practices at SEC to maintain suitable RCW habitat as described in the Habitat Management Plan (HMP) prepared by DeLotelle and Guthrie, Inc. (DGI) dated July 8, 2005 (revised March 2006). The SEC HMP describes procedures for timber management, pine habitat monitoring, invasive species monitoring and management, RCW cluster and population studies, and general land management practices. Prescribed burning and mechanical treatment



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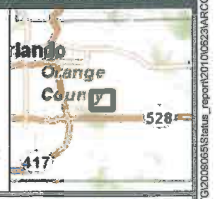
0 700 1,400 Feet
1 inch = 1,400 feet



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Legend

Preliminary Property Boundary

SJRWMD Land Use Data

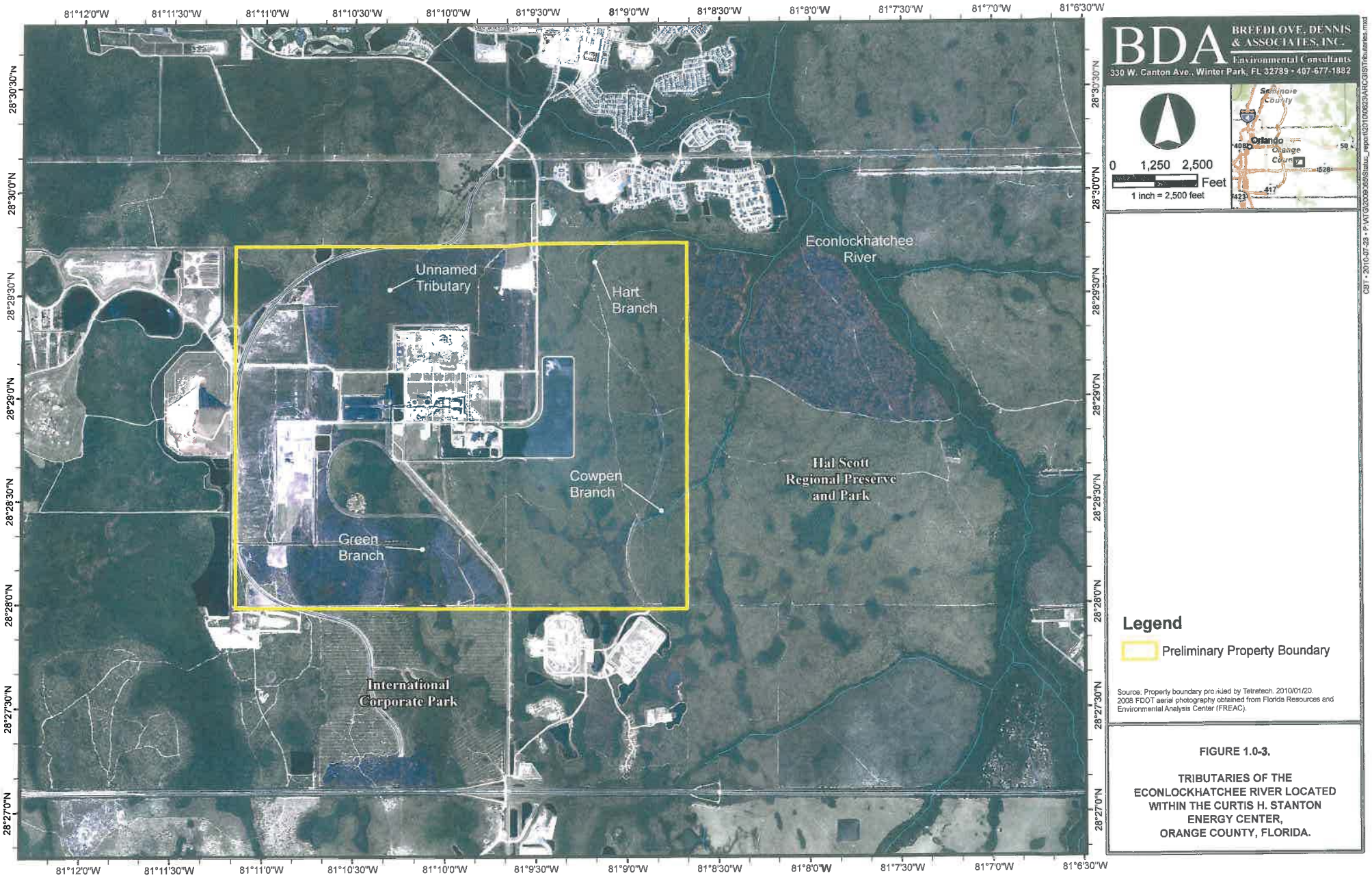
ID - Description

- 211 - Improved Pastures (<0.01 ac)
- 212 - Unimproved Pastures (0.02 ac)
- 310 - Herbaceous Upland Nonforested (111.84 ac)
- 320 - Shrub and Brushland (47.87 ac)
- 330 - Mixed Upland Nonforested (96.16 ac)
- 411 - Pine Flatwoods (1685.32 ac)
- 530 - Reservoirs (0.12 ac)
- 617 - Mixed Wetland Hardwoods (19.66 ac)
- 621 - Cypress (201.45 ac)
- 630 - Wetland Forested Mixed (38.58 ac)
- 641 - Freshwater Marshes (3.10 ac)
- 643 - Wet Prairies (95.79 ac)
- 646 - Mixed Scrub-Shrub Wetland (55.40 ac)
- 831 - Electrical Power Facilities (356.41 ac)
- 832 - Electrical Power Transmission Lines (32.14 ac)
- 835 - Solid Waste Disposal (401.06 ac)
- 836 - Electrical Power Facilities (123.81 ac)
- 836 - Solid Waste Disposal (4.15 ac)

Source: Boundary provided by Tetratech on 20100120.
Aerials: FREAC MrSids, Flight Date: 2008.

FIGURE 1.0-2.

FLORIDA LAND USE, COVER, AND FORMS CLASSIFICATION SYSTEM MAP OF THE CURTIS H. STANTON ENERGY CENTER PROJECT SITE, ORANGE COUNTY, FLORIDA.



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0 1,250 2,500 Feet
1 inch = 2,500 feet

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Legend

Preliminary Property Boundary

Source: Property boundary provided by Tetratech. 2010/01/20.
2008 FDOT aerial photography obtained from Florida Resources and Environmental Analysis Center (FREAC).

FIGURE 1.0-3.

TRIBUTARIES OF THE ECONLOCKHATCHEE RIVER LOCATED WITHIN THE CURTIS H. STANTON ENERGY CENTER, ORANGE COUNTY, FLORIDA.

are common practices employed at the SEC site for controlling understory growth. All prescribed burns are backing fires only and are scheduled on a two-year rotation and conducted by certified burn managers. Management is primarily focused on maintaining the long-term suitability of habitat and survival of RCWs at the SEC site.

RCW family groups at the SEC site are one of the longest studied in the central Florida area. RCW population studies began at SEC during the early 1980s and will continue for the life of the power plant. DGI was closely involved with RCW monitoring at the SEC site for much of the data collection prior to the 2009 nesting season. Breedlove, Dennis & Associates, Inc. (BDA) has been contracted by TetraTech since 2009 on an annual basis to continue the ongoing monitoring studies at SEC.

2.0 METHODS

Please note that the methods discussed below describe typical procedures employed during a normal monitoring seasonal study. The methods of data collection were generally conducted each season to track the SEC RCWs. However, due to the timing and constraints that may affect when monitoring begins each year, methods were modified as necessary during each given season.

2.1 Guidance

RCW monitoring and reporting activities are detailed in the applicable sections below and were conducted in accordance with the SEC SCA, Specifications for the Annual Monitoring Study of RCWs, and consistent with survey recommendations in the *Recovery plan for the Red-Cockaded Woodpecker (Picoides borealis): Second Revision* (USFWS 2003) (Recovery Plan). These documents, including DGI monitoring reports, were provided to BDA by TetraTech prior to the 2010 nesting season. BDA used monitoring methods similar to those employed by DGI, the SEC Land Management Plan (SEC Conditions of Certification), and the Recovery Plan to ensure consistency with previous survey work and use of recommended protocols. Methods of monitoring were also modified, when applicable, to improve the quality of data being collected for the SEC RCWs.

2.2 State and Federal Permitting

BDA subcontracted with Mrs. Maria Zondervan and Mr. Duff Swan of the St. Johns River Water Management District (SJRWMD) for assistance with RCW chick banding activities at the SEC during the 2012 nesting season. Mrs. Zondervan, a Senior Land Management Specialist, and Mr. Swan, a Land Management Specialist, with SJRWMD, possess the necessary state and federal permits to conduct these activities. Both also work at the neighboring Hal Scott Regional Preserve and Park as well as several other SJRWMD properties conducting RCW monitoring and management activities. Mrs. Zondervans' and Mr. Swans' state and federal authorizations (permits) are as follows:

- USFWS Permit No. TE084047-3, expires July 31, 2014 (authorization to capture, band, and translocate RCWs, inspect nests, and install artificial cavity inserts);
- USFWS permit amendment, issued May 6, 2010 (authorization to include SEC site under TE084047-3);
- U.S. Geological Survey (USGS) Federal Bird Banding Permit No. 23416, valid until September 30, 2014 (authorization to trap and band RCWs); and
- Florida Fish and Wildlife Conservation Commission (FWC) Permit No. WB09002, expires July 31, 2012 (authorization to capture, band, and release birds within Florida).

BDA possesses state and federal authorizations to inspect RCW cavities with a video probe or "nest peeper" scope. Mr. Christopher J. Harrington conducted RCW monitoring with a "nest peeper" late in the nesting season under the following authorizations:

- FWC Scientific Collecting Permit No. LSSC-10-00091, valid until December 31, 2013 (authorization to inspect nests with video probe or "nest peeper" and monitor unoccupied cavities); and
- USFWS Permit No. TE14105A-0, valid until June 30, 2014 (authorization to perform cavity inspections with video probe or "peeper", supervise artificial cavity installation, etc.).

2.3 Roost and Nest Trees

2.3.1 Historical Data

Historical data and annual status reports prepared by DGI were provided to BDA by TetraTech. These reports provided data regarding previously identified RCW cluster sites documented through the 2009 nesting season. Historic banding data for Hal Scott RCWs was also provided to BDA from Mrs. Zondervan. Historic and current aerial photography was also reviewed for potential suitable habitat.

2.3.2 Cavity Tree Census

Pedestrian and vehicular (all-terrain vehicle) surveys are conducted in and around existing cluster sites and randomly through areas of previously non-occupied habitat to search for new cavity trees and potential clusters. A cluster is generally defined as "the aggregation of cavity trees previously and currently used and defended by a group of woodpeckers..." (USFWS 2003). Transects are generally run in the north-south direction in accordance with the Recovery Plan; however, potentially suitable trees greater than approximately 50 years of age and 14 inches diameter at breast height are circled to confirm presence or absence of a potential RCW cavity. Careful visual observation is used during all field surveys. All cavity trees at the SEC site are geo-referenced with a hand-held Global Positioning System unit and subsequently mapped on a field aerial. RCW cavity trees are tagged with an identification letter and number corresponding to the cluster grouping and tree number within that cluster. The status of all current and previously recorded cavity trees within clusters are mapped as active, inactive, or start hole based on visual inspection of activity level and condition, or observed occupancy during "morning follows" or evening roost checks. It typically takes a RCW several months or even several years to excavate and complete a usable cavity for roosting or nesting. RCW cavities identified during the surveys are either natural or artificially constructed (drilled or inserts).

2.4 Annual Monitoring Study

2.4.1 Population Surveys

Population estimates were assessed during 2012 at the SEC site. Each RCW is marked with a unique combination sequence of color-coded leg bands and a USGS aluminum band. Leg bands are described in greater detail under the "Banding" section of this report. Visual observation of RCWs, especially the leg band sequence, is the primary method for identification to distinguish one individual bird from another. Population estimates were determined by conducting "morning follows" and evening roost checks, and observing cavity maintenance, group interaction, and social dynamics. "Morning follows" began approximately one half-hour before sunrise and consisted of following all group members until all family

members could be identified. Roost checks began approximately one hour before sunset and consisted of observing a RCW family group as they returned to roost in cavity trees. RCWs were identified utilizing a high-powered spotting scope (i.e., Zeiss Diascope 85 mm Angled Spotting Scope) and binoculars. Audible detection was used to locate the general location of a RCW, but not for identification.

2.4.2 Demographics

Family group composition was evaluated in combination with the field surveys and methods described above. Family groups are defined as "the social group of red-cockaded woodpeckers, consisting of a breeding pair with one or more helpers, a breeding pair without helpers, or a solitary male" (USFWS, Second Revision, 2003). RCW activities and interactions were observed and assessed, and group status was assigned based on these observations, and/or previously recorded data. The sex of a RCW was documented, when possible. Observations also were recorded of opposite sex RCWs foraging together as this often signifies a current or formation of a future breeding pair.

Breeding male status was assigned if the bird was the only male in the group, the oldest male in the group, roosted in a nest cavity, or was the breeding male the previous year. Breeding female status was assigned if the bird was the only female in the group, the oldest female in the group, or was the breeding female the previous year. All other males in a group were assigned helper status if they were on their natal territory or were observed incubating eggs, tending young, or interacting peacefully with other adult members of the group. Non-breeding females were only assigned helper status if they were on their natal territory. Otherwise, the non-breeding female was assigned as an auxiliary female, a female that interacts peacefully with a group but was not on her natal territory. An adult RCW that was not associated with a breeding group is known as a floater. Any male that was not observed with a group is also known as a floater. Intruders are RCWs observed in conflict with a group member not their own, or are present in a neighboring group's territory. Demographic status was assigned to each family group after these determinations were made.

2.4.3 Nesting Status

The nesting status of all family groups was checked every 7 to 11 days. All active roost trees were evaluated for potential or active nesting. Checks for nesting status typically begin the first week of April and end in July. Potential signs of nesting were suspected if a RCW was observed entering or leaving a roost cavity during the middle of the day, if a RCW stayed within a roost cavity for long periods, or if an active group member was missing during a "morning follows" or evening roost check (i.e., group member potentially assisting in incubation). Intensive nest monitoring was initiated if potential signs of nesting were detected. Positive signs of nesting were confirmed by observing a nest exchange, by audible detection of chicks in the nest, or by confirming the presence of eggs or chicks in the nest using a "nest peeper". Artificial clusters were checked at least twice during the nesting season to determine occupancy and any reproductive potential.

All nest trees are typically protected during the nesting season from predators that include climbing tree snakes such as yellow rat snakes (*Elaphe obsolete quadrivittata*) and corn snakes (*Elaphe guttata guttata*) as recommended in the USFWS 2003 Recovery Plan. The bark along the trunk is smoothed with a draw knife, pine cone, or other instrument to make the climbing surface less accessible for snakes and allow for a better purchase of the foil. The trunk of the nest tree is then wrapped in foil from the bottom near the ground upward as high as possible. The tree is wrapped from the bottom up so water would not collect in the foil folds that might rot or damage the bark. The foil is overlapped at least one to two inches to avoid gaps. The top and bottom of the foil wrap, as well as any tears, are secured with duct tape to prevent movement or slippage of the wrap. The foil wrap is removed following the nesting season.

2.4.4 Banding

Eggs hatch asynchronously typically at about 8 to 12 days from the date each egg is laid. Banding of nestlings is typically conducted between 5 and 10 days of age. Celluloid, Darvic, or other approved band

types is used to band SEC chicks. A sectional or Swedish ladder is used to climb the nest tree to cavity height. Nestlings were captured using a soft noose or similar apparatus liberally lubricated with cornstarch to avoid injury to the chicks. Nestlings were kept warm and dry, and away from direct sunlight. Nestlings are weighed and measured (i.e. beak length) during banding procedures and immediately returned to the cavity. Any pertinent observations, such as age, mites present, etc. are recorded along with all other necessary data. Attempts are made to locate roost cavities of any unbanded fledglings that cannot be captured between 5 and 10 days of age. These fledglings are banded if and when roost cavities are determined, or in the winter season. Any unbanded RCW adult that is identified at the SEC site, is typically banded following the nesting season or in the winter season once the roost cavity is determined.

A revised banding scheme was adopted for nestlings banded during the 2010 nesting season and is used for banding all chicks thereafter (Table 2.4.4-1). The right legs of nestlings are marked with the "family group color combination" or originating group for unbanded adults consisting of a USGS aluminum band with a colored band above or below to signify the birds natal territory or originating family group. The left legs are banded with three colored bands, unless the nestling is small and whose leg only supports two bands or a half-sized band as the third band. The top band (closer to the abdomen) on the left leg is the "yearly color" band for all chicks born in a particular year. All 2011 chicks, for example, have a light blue band placed in this position so the approximate age of a bird can be immediately determined in the field. The remaining two bands (or one band if the chick is small) located below the "yearly color" band are random colors to provide a unique banding sequence for each RCW born on the SEC site. Historic, as well as Hal Scott banding data, were reviewed to assure exact or similar color combinations are not repeated. Unbanded adults are also banded with the previously described family group color combination on the right legs (Table 2.4.4-1). The left leg has three bands (a black band in the middle with a random color band above and below the black band).

Table 2.4.4-1 Curtis H. Stanton Banding Sequence Initiated in May 2010

NESTLINGS

All nestlings will be banded in the following manner beginning May 2010:

Left Leg*	Right Leg (Family Group Color Combination)	
	Family Group	**Color Combination (Right Leg)**
Yearly Color ** (top) Random (middle) Random (bottom)	C/D	USGS (top) Light Green [LG] (bottom)
	E	USGS (top) Light Blue [LB] (bottom)
	F	USGS (top) Magenta [MA] (bottom)
	G	USGS (top) Dark Green [DG] (bottom)
	H	USGS (top) Dark Blue [DB] (bottom)
	X	USGS (top) Purple [PR] (bottom)
	A	LG (top) USGS (bottom)
	B	LB (top) USGS (bottom)
	C	DB (top) USGS (bottom)
	D	DG (top) USGS (bottom)

**If chick is too small for 3 full-size bands on left leg, only 2 bands (yearly color and random) may be used or a half-band may be substituted as the third band.*

Table 2.4.4-1 Continued

ADULTS

All adults will be banded in the following manner beginning May 2010:

Left Leg*	Right Leg (Family Group Color Combination)	
	Family Group	**Color Combination (Right Leg)**
Random (top) Random (middle) Random (bottom)	same as nestlings	same as nestlings

****Yearly Colors are as follows:**

Year	Color
2006	Yellow (YE)
2007	Dark Blue (DB)
2008	Orange (OR)
2009	Pink (PI)
2010	Dark Green (DG)
2011	Light Blue (LB)
2012	Purple (PR)
2013	Light Green (LG)
2014	Magenta (MA)
2015	Start Same Sequence Over Again

Notes:

Remember that BLACK is reserved for birds banded as adults!
White should not be used as a top color because it can be confused with body feathers.
When possible, avoid yellow Darvic band for a bottom color because slightly large.
The USGS aluminum band is tracked by the USFWS in accordance with USFWS Recovery Plan 2003.

2.4.5 Fledgling Checks

Surveys of fledgling checks are typically conducted to determine their fledgling success for the current nesting season. Surviving nestlings fledge the nest tree at about 26 days of age. Nestling age is typically confirmed during the banding process so the approximate chick fledging date can be estimated. Field surveys are conducted at 2 to 14 days following estimated fledging dates in an attempt to locate all fledglings, observe their activities in the field, and determine the sex of each fledgling.

A clear view of the crown is required to determine sex. A female fledgling has all black feathers on the crown; a male fledgling has a red cap of feathers that disappears with time.

Fledglings are usually observed begging for food, flying between pine trees, feeding on arthropods, and/or being fed by group members. Inactive cavities are cleaned if they contain grassy nest material or debris left from another species such as eastern bluebird (*Sialia sialis*), or contain another competitor resident such as southern flying squirrels (*Glaucomys volans*) or climbing tree snakes. This activity restores the quality of a cavity and facilitates a potential capture for roost site for new fledglings.

2.5 Data Analysis

Demographic data for all SEC family groups were analyzed in the annual status report. Historic data from the SEC were used to the greatest extent practicable in an effort to determine past group associations, family group structure, and other applicable data. Group size, breeder status and replacement, number of helpers, family composition, activities observed, etc., were documented and compared to previous monitoring years. Reproductive success was also analyzed, when possible. Cluster data recorded include the number of active and successful nests, re-nesting attempts (i.e., additional clutch), number of eggs laid and dates, number of chicks and dates, etc. Translocation movement of

RCWs in and out of the SEC site was documented. Survival and turnover rates and trends were calculated and compared to previous years when sufficient data were available.

2.6 Reporting

All population monitoring and nesting season data and analysis are summarized in this annual status report for submittal to the OUC engineer for review typically by July 5 of each year. A final report is due to OUC annually by July 30.

3.0 RESULTS

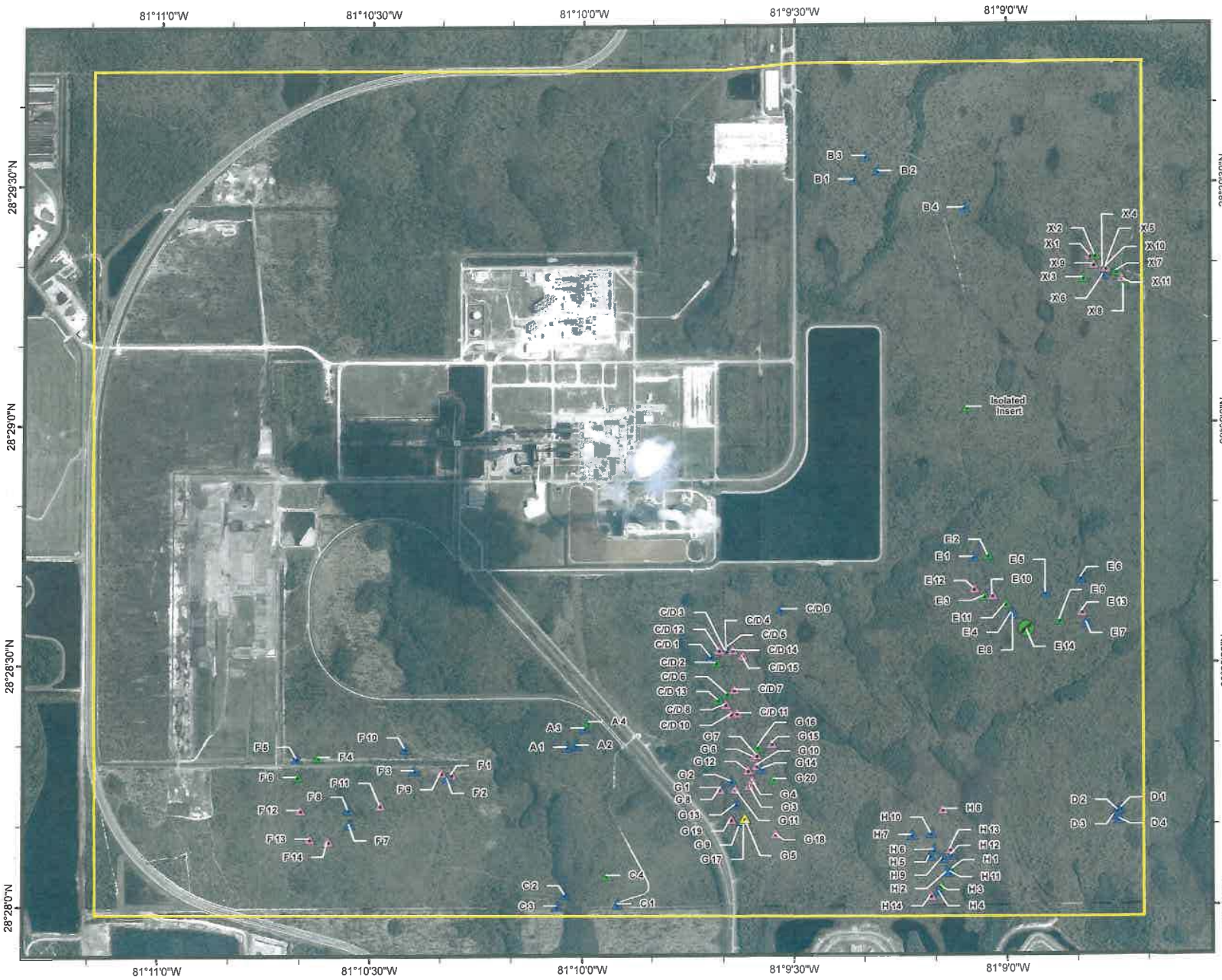
3.1 RCW Cavity Trees

All RCW cavity trees at SEC were surveyed during the 2012 season (Figure 3.1-1). DGI and others had previously installed artificial cavities (drilled cavities or artificial inserts) at the SEC site, some of which were installed within natural cluster sites, while others were installed at new cluster sites with no natural cavities. Table 3.1-1 lists the location of all natural and artificial RCW cavities. A total of 105 RCW cavities (active, inactive, and start hole) in 10 cluster sites, plus one isolated insert, were confirmed during the 2012 field season as follows:

- Cluster A – four cavities (all artificial cavities)
- Cluster B – four cavities (all artificial cavities)
- Cluster C – four cavities (all artificial cavities)
- Cluster D – four cavities (all artificial cavities)
- Cluster E – 14 cavities (natural and artificial cavities)
- Cluster F – 14 cavities (natural and artificial cavities)
- Cluster G – 20 cavities (all natural cavities)
- Cluster H – 14 cavities (all natural cavities)
- Cluster X – 11 cavities (natural and artificial cavities)
- Cluster C/D – 15 cavities (all natural cavities)
- Isolated cavity – there is one cavity insert located north of Cluster E, south of Cluster B, and southwest of Cluster X.

3.1.1 Active Trees

Cavity tree status was determined by the observed level of RCW activity present. Active trees generally have numerous flowing resin wells with clear sap and a fresh, well-chipped reddish plate around the cavity.



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BREEDLOVE, DENNIS & ASSOCIATES, INC.
Environmental Consultants
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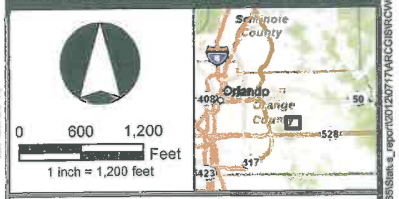


0 600 1,200 Feet
1 inch = 1,200 feet

Legend

Preliminary Property Boundary

Legend

- Eagle Nest [OR-043] and E 14 Start Hole Cavity
- 2012 Red Cockaded Woodpecker (RCW) Cavity Trees and RCW Activity Status
- Active Nest Cavity
- Active Cavity
- Inactive Cavity
- Start Hole

Source: Property boundary provided by Tetratech. 2010/01/20. Red Cockaded Woodpecker cavity tree GPS locations acquired by BDA on 2010/02/26 through 2010/06/17 and 2011/04/12 through 2011/04/16 and 2012/06/19 through 2012/07/17. 2010 Orange County aerial photography obtained from NRCS.

LDP • 7/28/2012 • P:\AT\2\2009\09058\tasks_s_report\2012\07\7\ARCGIS\RCW\CavityTrees_B.mxd

FIGURE 3.1-1

2012 RED-COCKADED WOODPECKER CAVITY TREES AND FAMILY GROUPS AT THE CURTIS H. STANTON ENERGY CENTER PROJECT SITE, ORANGE COUNTY, FLORIDA

Table 3.1-1 **2012 Red-Cockaded Woodpecker Cavity Tree Locations and Status for the Curtis H. Stanton Energy Center, Orlando Utilities Commission, Orange County, Florida**

Cavity Tree ID	Latitude / Longitude		Status
	X	Y	
A 1	81° 10' 2.24" W	28° 28' 19.80" N	Inactive
A 2	81° 10' 0.95" W	28° 28' 20.03" N	Inactive
A 3	81° 9' 59.74" W	28° 28' 22.15" N	Inactive
A 4	81° 9' 59.19" W	28° 28' 22.89" N	Active
B 1	81° 9' 21.63" W	28° 29' 30.60" N	Inactive
B 2	81° 9' 18.21" W	28° 29' 31.70" N	Inactive
B 3	81° 9' 19.98" W	28° 29' 33.52" N	Inactive
B 4	81° 9' 5.99" W	28° 29' 27.04" N	Inactive
C 1	81° 9' 55.04" W	28° 28' 0.31" N	Inactive
C 2	81° 10' 2.54" W	28° 28' 1.51" N	Inactive
C 3	81° 10' 3.64" W	28° 28' 0.08" N	Inactive
C 4	81° 9' 56.62" W	28° 28' 3.85" N	Active
C/D 1	81° 9' 41.96" W	28° 28' 30.97" N	Inactive
C/D 2	81° 9' 41.22" W	28° 28' 30.26" N	Active
C/D 3	81° 9' 39.97" W	28° 28' 31.72" N	Start Hole
C/D 4	81° 9' 39.79" W	28° 28' 31.69" N	Start Hole
C/D 5	81° 9' 39.68" W	28° 28' 32.21" N	Inactive
C/D 6	81° 9' 39.71" W	28° 28' 26.36" N	Active
C/D 7	81° 9' 38.68" W	28° 28' 26.92" N	Start Hole
C/D 8	81° 9' 39.89" W	28° 28' 25.06" N	Start Hole
C/D 9	81° 9' 32.00" W	28° 28' 36.90" N	Inactive
C/D 10	81° 9' 39.08" W	28° 28' 23.86" N	Start Hole
C/D 11	81° 9' 38.30" W	28° 28' 24.02" N	Start Hole
C/D 12	81° 9' 40.85" W	28° 28' 31.82" N	Start Hole
C/D 13	81° 9' 54.94" W	28° 28' 32.29" N	Active
C/D 14	81° 9' 38.98" W	28° 28' 31.82" N	Start Hole
C/D 15	81° 9' 37.58" W	28° 28' 31.11" N	Start Hole
D 1	81° 8' 43.93" W	28° 28' 11.96" N	Inactive
D 2	81° 8' 44.37" W	28° 28' 11.74" N	Inactive
D 3	81° 8' 44.89" W	28° 28' 11.15" N	Inactive
D 4	81° 8' 44.15" W	28° 28' 10.63" N	Inactive
E 1	81° 9' 4.79" W	28° 28' 43.30" N	Inactive
E 2	81° 9' 2.73" W	28° 28' 43.50" N	Active
E 3	81° 9' 3.20" W	28° 28' 38.43" N	Active
E 4	81° 8' 59.34" W	28° 28' 36.32" N	Inactive

Table 3.1-1 Continued.

Cavity Tree ID	Latitude / Longitude		Status
	X	Y	
E 5	81° 8' 54.52" W	28° 28' 38.76" N	Inactive
E 6	81° 8' 49.56" W	28° 28' 40.62" N	Inactive
E 7	81° 8' 48.78" W	28° 28' 35.10" N	Inactive
E 8	81° 8' 59.33" W	28° 28' 36.95" N	Inactive
E 9	81° 8' 54.45" W	28° 28' 30.74" N	Active
E 10	81° 9' 2.10" W	28° 28' 38.49" N	Start Hole
E 11	81° 9' 0.19" W	28° 28' 37.46" N	Active
E 12	-81°9' 4.71" W	28° 28' 39.37" N	Start Hole
E 13	81° 8' 49.45" W	28° 28' 36.43" N	Start Hole
E 14 (and OR-043)	81° 8' 57.20" W	28° 28' 34.24" N	Start Hole
F 1	81° 10' 18.53" W	28° 28' 16.44" N	Start Hole
F 2	81° 10' 19.11" W	28° 28' 16.01" N	Inactive
F 3	81° 10' 23.78" W	28° 28' 16.92" N	Inactive
F 4	81° 10' 37.39" W	28° 28' 18.56" N	Active
F 5	81° 10' 40.45" W	28° 28' 18.42" N	Inactive
F 6	81° 10' 40.33" W	28° 28' 16.18" N	Active
F 7	81° 10' 32.93" W	28° 28' 10.28" N	Inactive
F 8	81° 10' 33.08" W	28° 28' 12.03" N	Inactive
F 9	81° 10' 19.96" W	28° 28' 16.66" N	Start Hole
F 10	81° 10' 25.08" W	28° 28' 19.64" N	Inactive
F 11	81° 10' 28.63" W	28° 28' 12.65" N	Start Hole
F 12	81° 10' 39.92" W	28° 28' 12.02" N	Start Hole
F 13	81° 10' 38.63" W	28° 28' 8.45" N	Start Hole
F 14	81° 10' 35.98" W	28° 28' 8.13" N	Start Hole
G 1	81° 9' 40.50" W	28° 28' 14.70" N	Inactive
G 2	81° 9' 39.10" W	28° 28' 15.51" N	Inactive
G 3	81° 9' 36.56" W	28° 28' 14.96" N	Start Hole
G 4	81° 9' 36.20" W	28° 28' 15.64" N	Start Hole
G 5	81° 9' 37.18" W	28° 28' 10.90" N	Active
G 6	81° 9' 35.94" W	28° 28' 18.50" N	Start Hole
G 7	81° 9' 35.54" W	28° 28' 18.73" N	Start Hole
G 8	81° 9' 40.75" W	28° 28' 14.50" N	Start Hole
G 9	81° 9' 37.70" W	28° 28' 10.47" N	Start Hole
G 10	81° 9' 35.57" W	28° 28' 17.43" N	Start Hole
G 11	81° 9' 38.55" W	28° 28' 14.57" N	Start Hole
G 12	81° 9' 36.79" W	28° 28' 16.88" N	Start Hole

Table 3.1-1 Continued.

Cavity Tree ID	Latitude / Longitude		Status
	X	Y	
G 13	81° 9' 38.47" W	28° 28' 12.68" N	Inactive
G 14	81° 9' 34.837" W	28° 28' 17.009" N	Inactive
G 15	81° 9' 33.41" W	28° 28' 20.20" N	Start Hole
G 16	81° 9' 35.39" W	28° 28' 19.74" N	Active
G 17	81° 9' 37.25" W	28° 28' 10.73" N	Start Hole
G 18	81° 9' 32.80" W	28° 28' 8.99" N	Start Hole
G 19	81° 9' 39.17" W	28° 28' 10.80" N	Start Hole
G 20	81° 9' 33.11" W	28° 28' 15.78" N	Active
H 1	81° 9' 7.83" W	28° 28' 4.56" N	Active
H 2	81° 9' 8.60" W	28° 28' 4.17" N	Inactive
H 3	81° 9' 9.44" W	28° 28' 2.51" N	Active
H 4	81° 9' 9.73" W	28° 28' 1.83" N	Inactive
H 5	81° 9' 10.99" W	28° 28' 6.22" N	Inactive
H 6	81° 9' 10.40" W	28° 28' 6.93" N	Inactive
H 7	81° 9' 13.50" W	28° 28' 8.78" N	Inactive
H 8	81° 9' 9.16" W	28° 28' 11.97" N	Start Hole
H 9	81° 9' 9.23" W	28° 28' 5.93" N	Inactive
H 10	81° 9' 10.81" W	28° 28' 8.98" N	Inactive
H 11	81° 9' 8.120" W	28° 28' 4.204" N	Inactive
H 12	81° 9' 7.75" W	28° 28' 6.70" N	Inactive
H-13	81° 9' 8.10" W	28° 28' 7.02" N	Start Hole
H 14	81° 9' 10.87" W	28° 28' 1.28" N	Inactive
X 1	81° 8' 48.18" W	28° 29' 20.95" N	Start Hole
X 2	81° 8' 47.49" W	28° 29' 20.98" N	Active
X 3	81° 8' 49.17" W	28° 29' 18.19" N	Active
X 4	81° 8' 46.31" W	28° 29' 19.46" N	Start Hole
X 5	81° 8' 45.83" W	28° 29' 19.72" N	Active
X 6	81° 8' 46.23" W	28° 29' 18.55" N	Inactive
X 7	81° 8' 44.39" W	28° 29' 19.00" N	Active
X 8	81° 8' 43.40" W	28° 29' 17.64" N	Active
X 9	81° 8' 47.74" W	28° 29' 19.88" N	Start Hole
X 10	81° 8' 45.94" W	28° 29' 19.42" N	Start Hole
X 11	81° 8' 43.69" W	28° 29' 18.19" N	Start Hole
Isolated Insert	81° 9' 5.702" W	28° 29' 2.050" N	Active

Inactive trees generally have whitish, dried sap in the resin wells and around the plate, or with dead exposed wood around the plate. Start holes will be addressed in Section 3.1.3. Roost trees were assessed and identified during "morning follows" or evening roost checks when a RCW was observed entering a cavity just before sunset or leaving the cavity after sunrise to forage with family group members. Most of the active cavities were also roost cavities at some point during the 2012 season, although not always. Some RCWs switched roost cavities between active trees; while others were maintained as active, perhaps in preparation as future fledgling roost sites. A total of 22 active trees (i.e., nest, roost, and other active trees, not including start holes) were identified during 2012 (Figure 3.1-1) as follows:

- Cluster A – one cavity (A4)
- Cluster C – one cavity (C4)
- Cluster C/D – three cavities (C/D2, C/D6, and C/D13)
- Cluster E – five cavities (E2, E3, E9, E11, and Isolated Insert)
- Cluster F – two cavities (F4 and F6)
- Cluster G – three cavities (G5, G16, and G20)
- Cluster H – two cavities (H1 and H3)
- Cluster X – five cavities (X2, X3, X5, X7, and X8)

Observations of all cavity trees on the SEC site during 2012 indicated there were no active trees in artificial Cluster B and D. D1 appears to have been used previously by an RCW; however, current status was inactive in 2012.

3.1.2. Nest Trees

Nest tree data were unavailable for most groups due to the timing of monitoring initiation. One active nest tree (G5) was identified on June 19, 2012. There were at least 4 other nests in 2012, but specific nest trees were unknown. It is also unknown whether Group H produced eggs in 2012.

3.1.3 Start holes

New and inactive start holes were identified during the cavity tree surveys. Start holes are the initial tunnel that is excavated by RCWs typically one to several inches deep, but lacks a completed suitable cavity due to its current stage of construction. Icicle-shaped sap begins to flow downward from the mouth of the start hole as construction progresses. Some new start holes identified in 2012 appeared on existing inactive cavity trees or there was additional data collected (trees were climbed as well as viewed with a video peeper) to better update tree status. For example, some trees that appeared to have inactive cavities during visual observation or with using a video peeper were climbed for inspection and found to be an advanced start hole. Therefore, status of these trees was updated. At least one start hole was completed prior to the 2012 nesting season (C/D13) and is now being used as an RCW roost cavity. Forty start holes (i.e., old, new, and advanced) were identified during the 2012 season in the following clusters:

- Cluster E – four cavities (E10, E12, E13, and E14)
- Cluster G – thirteen cavities (G3, G4, G6, G7, G8, G9, G10, G11, G12, G15, G17, G18, and G19)
- Cluster X – five cavities (X1, X4, X9, X10, and X11)
- Cluster C/D – nine cavities (C/D3, C/D4, C/D7, C/D8, C/D10, C/D11, C/D12, C/D14, and C/D15)
- Cluster F – six cavity (F1, F9, F11, F12, F13, and F14)
- Cluster H – three cavities (H8, H13, and H14)

3.2 Population Surveys

Proper leg band identification is of particular importance to the monitoring study. Historical banding charts and monitoring reports from DGI (Appendix A) were provided to BDA to support this effort and aid in matching RCWs observed during previous field seasons with those observed during current

seasons. Band discoloration and potential band loss provided a challenge to identification of some birds. Some reasonable assumptions for band discoloration were made in the identification process to match birds observed this season with historical data. A RCW could be identified if records showed the bird was a family group member for one or more years and sufficient band pattern and color information was obtained in the field that could be matched concisely or approximately to pattern and color data recorded for an individual in the banding records. However, some bands were so faded that identification could not be made with certainty. Assumptions concerning the color of faded bands were sometimes made in combination with other supporting data, if it was probable that a band sequence matched historical data, and if it was reasonable to do so. Supporting data included the sex of the bird, the cluster in which the observation was made, band color records from adjacent or nearby clusters, and banding data from adjacent areas to the SEC site.

Bands can become covered with sap and appear black or become brittle over time and break off. Documentation errors may sometimes occur in banding charts providing further potential for uncertainty in RCW identification. It is unclear if all historic banding schemes were recorded in the exact order from top (closest to body) to bottom (closest to foot) of the leg. RCW identification was not made when current band observations and historical band data matched color, but were in the incorrect sequential order. This reversed band situation may represent a different RCW or a documentation error. Banding data for the Hal Scott Regional Preserve and Park site were provided by Mrs. Zondervan to aid in RCW identification at the SEC site. Despite occasional challenges, most RCWs were identified in the data and information discussed below.

3.2.1 Group Size

A family group may consist of a breeding pair with one or more helpers, a breeding pair without helpers, or a solitary male, as previously defined in Section 2.4.2. All RCW family groups identified during the 2012 season surveys, including fledglings, are provided in Table 3.2:1-1. However, discussions below for

individual groups and group size calculations exclude fledglings and non-resident birds as these will be discussed separately. A total of 19 resident RCWs were documented on the SEC site during 2012. Eighteen of the 19 resident birds were all members in one of six family groups. The 19th resident bird was a female floater, a non-group member. There were also six Potential Breeding Groups (PBGs) in 2012. PBGs are defined as "an adult female and adult male that occupy the same cluster, whether or not they are accompanied by a helper, attempt to nest, or successfully fledge young" (USFWS 2003). Specifically, group size in 2012 included two four-bird groups, two three-bird group, and two two-bird groups, averaging 3.0 birds per family group (18 RCWs/six groups) on the SEC[1]. Specific group discussions are detailed below.

3.2.1.1 Group E (and Isolated Insert)

Group E consists of a total of four RCWs (breeding pair and two male helpers) (Table 3.2.1-1) located in the east-central portion of the SEC site. The breeding pair consists of the male (Identification [ID] No. 175182808), that was previously a helper at Group E from 2005-2008 and later captured a breeding position in 2009. The breeding female (ID No. 22374) was previously a breeder at Group H in 2005, but became the breeding female at Group E in 2006. One male helper (ID No. 82860) has been a helper at Group E since 2006. A second male helper (ID No. 2421-41003) was a fledgling from this group in 2011 and is therefore, a new helper. All group members were observed foraging about the territory, and assisted with feeding the female fledgling. The breeding male was observed roosting in cavity tree E9, the breeding female in E2, the first male helper in E3, and the second male helper in the Isolated Insert north of Cluster E.

[1] Please note that the female floater from Group G was excluded from the group size calculation since female floaters will not participate with family groups and by definition do not qualify as a stand-alone group, like single adult male RCWs. Therefore, only 18 RCWs were considered in group size calculations at this time.

Table 3.2.1-1 **2012 Red-Cockaded Woodpecker Family Group Census Data for the Curtis H. Stanton Energy Center, Orlando Utilities Commission, Orange County, Florida.**

Identification (ID) No.	Family Group ID[1]	Left Leg Above / Below	Right Leg Above / Below	Last Seen	Current Status[2]	Sex	Roost Cavity	Comments
GROUP E								
175182808	E	Orange/ White/ Black	USFWS[3]	July 2012	B	Male	E9	Orange band on left leg appears pink from fading; red-cockaded woodpecker (*Picoides borealis*) (RCW) presumed to be #175182808.
22374	G-H-E	USFWS, 6/13/02	White/ Burgundy/ White[4]	July 2012	B	Female	E2	Burgundy band on right leg appears pink from fading; bottom white band near foot missing; RCW presumed to be #22374.
82860	E	Dark Blue/ White/ White	USFWS	July 2012	H	Male	E3	Field-confirmed male in May/June 2010
2421-41003	E	Light Blue/ Magenta/ White	USFWS/ Light Blue	July 2012	H	Male	Isolated Insert	Assigned helper status because RCW located on natal territory; bird was a 2011 male fledgling from Stanton Group E
2211-09307	E	Purple/ Orange/ Dark Green	USFWS/ Light Blue	July 2012	FLE	Female	E11	RCW was captured in E11 on July 25, 2012, and banded.
GROUP F								
Unknown	F	Pink/ USFWS	Dark Blue/ Light Green/ Dark Green	July 2012	B	Male	F6	New breeding male in 2011; confirmed male in June/July 2010
82846	G-F	USFWS 3/28/09	Orange/ Light Blue/ Light Blue	July 2012	B	Female	F4	

Table 3.2.1-1 Continued.

Identification (ID) No.	Family Group ID[1]	Left Leg Above / Below	Right Leg Above / Below	Last Seen	Current Status[2]	Sex	Roost Cavity	Comments
Unbanded	F	—	—	July 2012	FLE	Female	Open roosting	Fledgling observed open roosting at time of report submittal in F2 tree crown and near F4 and F6
GROUP G								
Unknown	C/D-G	USFWS	White/ White	July 2012	B	Male	G5	Newly captured breeding position in 2012; male roosts in nest cavity and is oldest male in group. Field-confirmed male in May/June 2011.
2211-09351[5]	Hal Scott-C and G	USFWS/ Purple	Orange/ Dark Blue/ Light Green	July 2012	B	Female	G16	Fledged from Hal Scott (HS) in summer 2008; last seen at HS on 3/13/09.
2421-41011	X-G-C and G-C/D	Light Blue/ Orange/ White[6]	USFWS/ Light Green	July 2012	H	Male	G20	RCW was a male fledgling from C/D in 2011.
Unbanded	G	—	—	July 2012	FLE	Male	Unknown	Fledgling observed being fed by family group in territory in July 2012. Current status unknown as bird did not return to roost with natal group.
GROUP H								
2211-09306	X-G-C and G-H	Yellow/ Black/ Light Green	Dark Green/ USFWS	July 2012	B	Male	H3	RCW presumed to be 2011 helper male from G, captured breeding position at H in 2012. RCW was evicted from roost site in July 2011 by Camp Blanding female (ID No. 2301-74982). Bird was banded on July 19, 2012.

Table 3.2.1-1 Continued.

Identification (ID) No.	Family Group ID[1]	Left Leg Above / Below	Right Leg Above / Below	Last Seen	Current Status[2]	Sex	Roost Cavity	Comments
2211-09392[4]	A(sj)-H	Purple/ USFWS	Dark Green/ Orange/ Light Blue	July 2012	B	Female	H1	RCW presumed to be #2211-09392 if left leg missing purple band above USFWS band. Note from Hal Scott indicated purple band was slipping over USFWS. RCW is a female born at HS in 2010, and was observed foraging on SEC near Cluster F and on ICP property.
GROUP C/D (A)								
Unknown	C/D	Red/ White[4]/ Light Green	USFWS	July 2012	B	Male	C/D6	RCW could be #82805 if left leg bands entered in reverse order by others. Red appears pink. Field-confirmed male in May 2010.
2211-09353	HS-C/D	Light Green/ USFWS	Orange/ Light Blue/ Magenta	July 2012	B	Female	C/D2	HS fledgling last seen at HS on 7/1/08; magenta band on right leg appears pink.
2211-09394	C/D	Dark Green/ Light Blue/ Purple	USFWS/ Light Green	July 2012	H	Male	A4	2010 fledgling from Stanton Group C/D.
Unbanded	C/D	—	—	July 2012	FLE	Male	C/D13	Fledgling observed being fed by family group in territory in July 2012.
Unbanded	C/D	—	—	July 2012	FLE	Female	Unknown	Fledgling observed being fed by family group in territory in July 2012. Current status unknown as Bird did not return to roost with natal group.

Table 3.2.1-1 Continued.

Identification (ID) No.	Family Group ID[1]	Left Leg Above / Below	Right Leg Above / Below	Last Seen	Current Status[2]	Sex	Roost Cavity	Comments
GROUP X								
82849	ICP-sArt-3-X	White/ Light Green/ White	USFWS 3/17/07-3/27/09	July 2012	B	Male	X7	Field-confirmed male in May/June 2010.
175182870	C/D-H-E-X	USFWS 11/04	White/ White/ Burgundy	July 2012	B	Female	X5	Burgundy band on right leg appears pink.
Unknown	X	USFWS	Dark Green/ Light Green/ Light Green	July 2012	H	Unknown	X3	RCW forages with Group X and assists with feeding 2011 nestlings at same group.
2421-41008	X	Light Blue/ Yellow/ Magenta	USFWS/ Purple	July 2012	H	Male	X8	RCW was 2011 male fledgling from X.
Unbanded	X	—	—	July 2012	FLE	Female	X2	RCW roosted in X2, but was evicted by a red-bellied woodpecker (*Melanerpes carolinus*) prior to banding. New roost cavity unknown.
Unbanded	X	-	-	July 2012	FLE	Female	Open roosting	RCW was currently roosting northwest of Cluster X at the time of this report.
FLOATER								
2301-74982	G	Magenta over Dark Blue[7]/ USFWS	Dark Green/ Dark Blue/ Orange	July 2012	FLO	Female	C4	This 2010 fledgling from Camp Blanding was translocated to Hal Scott in October 2010.

Table 3.2.1-1 Continued.

Identification (ID) No.	Family Group ID[1]	Left Leg Above / Below	Right Leg Above / Below	Last Seen	Current Status[2]	Sex	Roost Cavity	Comments
INTRUDERS								
2421-41006	HS (D)	Orange/ USFWS	Light Blue/ Magenta/ Yellow	July 2012	I	Male	Unknown	RCW was a 2011 male fledgling from HS Cluster D, and was observed foraging in Stanton C/D with other RCW below.
Unknown	—	Orange/ USFWS	Pink (or Orange)/ White (or Orange)	July 2012	I	Unknown	Unknown	RCW was observed foraging in Stanton C/D with other RCW below. Bird was also observed near Stanton E. RCW might be #2211-09365 or #2211-09359 if band was lost and others are faded.

[1] Includes previous family group locations of a particular RCW.
[2] Status includes Nestling (N), Fledgling (FLE), Floater (FLO), Helper (H), Auxiliary Female (A), Breeder (B), and Intruder (I)
[3] U.S. Geological Survey (USGS) band tracked by U.S. Fish and Wildlife Service (USFWS).
[4] Indicates band is missing.
[5] Please note that this is a data correction. The original ID number—2211-09350—was provided by Hal Scott to BDA. However, the band ID was confirmed to be ID number 2211-09351.
[6] Half band
[7] This band is a single band with two colors, Magenta over Dark Blue, which is specific to birds banded at Camp Blanding, Florida.

3.2.1.2 Group X

Group X consists of a total of four RCWs similar to Group E, comprised of the breeding pair, a male helper, and a helper of unknown ID and sex (Table 3.2.1-1). Cluster X is located adjacent to the eastern property boundary near the northeastern corner of the SEC site and the adjacent Hal Scott Regional Preserve and Park. The breeding male (ID No. 82849) has been a breeder at X since 2008, but was previously documented at Hal Scott and International Corporate Park. The breeding female (ID No. 175182870) was a fledgling from Group C/D in 2005, was a breeder at Group H in 2007 and 2008, and captured a breeding position at Group X in 2009. One male helper (ID No. 2421-41008) was a fledgling from this group in 2011 and is therefore, a new helper. A second helper of unknown ID and sex has been a helper with this group since at least 2010. All family group members were observed foraging together without conflict, and assisted with feeding the female fledglings. The breeding male roosts in cavity tree X7, the breeding female in cavity tree X5, the male helper at X8, and the helper of unknown ID and sex at X3.

3.2.1.3 Group C/D (and A)

Group C/D consists of three RCWs comprised of the breeding pair and one male helper (Table 3.2.1-1). Group C/D is located in the central portion of the property south of the power plant. The breeding pair has been paired at Group C/D since at least 2010. The breeding male's history could not be discerned from historical data; the breeding female (ID No. 2211-09353) was a Hal Scott fledgling in 2008 and was last observed there in July 2008. The male helper (ID No. 2211-09394) was a 2010 fledgling from this group and now roosts at A4. The breeding male and female roost at C/D6 and C/D2, respectively. All family group members were observed foraging together without conflict, and assisted with feeding the male and female fledglings.

3.2.1.4 Group F

Group F consists of a total of two RCWs, the breeding pair (Table 3.2.1-1). Group F is located in the southwestern part of the SEC site near the southern boundary. The breeding male is the same male that captured the breeding position following the 2010 nesting season. This male roosts in F6. The breeding female (ID No. 82846) was a fledgling from Group G in 2007, moved to Group F in 2008, and became a breeder in 2009 at Group F. This female roosts in F4. The breeding pair was observed foraging together and feeding the female fledgling in 2012.

3.2.1.5 Group H

Group H consists of a total of two RCWs, the breeding pair (Table 3.2.1-1). This family group is located in a cluster in the southeastern portion of the property near the southern boundary. Two new breeders have captured positions here in 2012. The new breeding male (ID No. 2211-09306) is presumed to be the previously unbanded male helper from Group G immediately to the west. This bird was evicted from its previous roost cavity (C4) in July 2011 by a female floater from Camp Blanding, Clay County, Florida. The breeding male currently roosts in cavity tree H3 and was banded on July 19, 2012 (see Tables 3.2.1-1). This male is also included in the RCW banding data table which includes unbanded adults and fledglings (Table 3.2.1.5-1). The new breeding female is presumed to be ID No. 2211-09392, a female fledgling from Hal Scott that is missing the purple band on the left leg. A note in the Hal Scott dataset indicated that the purple band was slipping over the USFWS band. This bird was last seen at Hal Scott in March 2011 and was later seen on SEC near Cluster F and foraging on International Corporate Park property during the 2011 nesting season. This RCW now roosts in H1.

3.2.1.6 Group G

Group G consists of a total of three RCWs consisting of the breeding pair and one male helper (Table 3.2.1-1). There is a new male that has captured a breeding position in 2012. This new breeder was

Table 3.2.1.5-1 **2012 Red-Cockaded Woodpecker Banding Data for the Curtis H. Stanton Energy Center, Orlando Utilities Commission, Orange County, Florida.**

Identification (ID) No.	Left Leg Above / Below	Right Leg Above / Below	Weight (gr)	Beak (mm)	Status	Sex[1]	Comments
GROUP E							
2211-09307	Purple/ Orange/ Dark Green	FWS/ Light Blue	41.0	20.5	Fledgling	Female	Fledgling observed being fed by family group in territory in July 2012. RCW was captured in E11 on July 25, 2012, and banded.
GROUP X							
Unbanded	—	—	—	—	Fledgling	Female	Fledgling observed being fed by family group in territory in July 2012. RCW did not roost with group in cluster during roost checks (June-July), and may have dispersed. New roost cavity unknown; bird could not be captured for banding at this time.
Unbanded	—	—	—	—	Fledgling	Female	Fledgling observed being fed by family group in territory in July 2012. Bird roosted in X2 (mid-July), but moved to an unknown roost site as observed during morning capture attempt on July 19, 2012. New roost cavity unknown; bird could not be captured for banding at this time.
GROUP C/D							
Unbanded	—	—	—	—	Fledgling	Male	Fledgling observed being fed by family group in territory in July 2012. Bird roosted in C/D13 (mid-July), but was observed open roosting during morning capture attempt on July 25, 2012. New roost cavity unknown; bird could not be captured for banding at this time.

Table 3.2.1.5-1 Continued.

Identification (ID) No.	Left Leg Above / Below	Right Leg Above / Below	Weight (gr)	Beak (mm)	Status	Sex[1]	Comments
Unbanded	—	—	—	—	Fledgling	Female	Fledgling observed being fed by family group in territory in July 2012. RCW did not return to roost with group during roost checks (June-July), may have dispersed. New roost cavity unknown; bird could not be captured for banding at this time.
GROUP F							
Unbanded	—	—	—	—	Fledgling	Female	Fledgling observed being fed by family group in territory in July 2012. RCW roosted in pine crown near F2 and F4 during different roost checks (June-July), had not secured roost cavity at time of roost check and therefore, could not be captured for banding at this time.
GROUP G							
Unbanded	—	—	—	—	Fledgling	Male	Fledgling observed being fed by family group in territory in early July 2012; fledge date approximately July 4-5. RCW did not return to roost with group during roost checks (mid-July), may have migrated or is open roosting. New roost location unknown; bird could not be captured for banding at this time.
GROUP H							
2211-09306	Yellow/ Black/ Light Green	Dark Green/ USFWS	45.0	21.9	Breeding male	Male	RCW is an unbanded adult male presumed to be a previous helper at Stanton Cluster G. RCW was captured in H3 on July 19, 2012, and banded.

[1] Sex determination are visually made in field for nestlings after birds have successfully fledged nest and are located foraging and/or being fed by group members within territory. Sex determinations for unbanded adults are made in field and confirmed during banding.

previously one of the two male helpers from Group C/D. The breeding male roosts in G5, which was identified as an active nest tree this year. The breeding female (ID No. 2211-09351) fledged the summer of 2008 from a Hal Scott Group G and remained a helper at its natal cluster in 2009. This RCW became the breeding female at SEC Cluster G in 2010 and currently roosts in cavity tree G16. There is also a new helper in this group this year. The new helper was a male fledgling from Group C/D in 2011; the new helper roosts in G20. All family group members were observed foraging together without conflict and assisting with feeding the new male fledgling.

3.2.2 Female Floater

There is a female floater (ID No. 2301-74982), a 2010 fledgling from Camp Blanding, that was subsequently translocated to Hal Scott in October 2010 (Table 3.2.1-1). This RCW appears to forage alone and roosts in C4. It is the only RCW to roost in Cluster C in 2012. Two birds from Group G previously roosted in this cluster in 2011. This bird does not qualify as its own group, unlike solitary males.

3.2.3 Intruders

Two intruders were identified in 2012. One RCW (ID No. 2421-41006), a 2011 male fledgling from Hal Scott, was observed foraging with another unidentified intruder (see Table 3.2.1-1). These birds may be a pair, could be from the same cluster, and/or may be related since they have the same left leg band sequence. These birds were both observed foraging in Cluster C/D. The second unidentified intruder was observed in Cluster E and attempted capture of a roost cavity there.

3.3 Nesting Season

3.3.1 Egg Laying

These data were unavailable in 2012 due to the timing of monitoring initiation. One active nest tree (G5) was identified on June 19, 2012.

3.3.2 Nestlings

These data were unavailable in 2012 due to the timing of monitoring initiation.

3.3.3 Fledglings

Seven fledglings were located and identified in relation to their natal group in the field. All seven fledglings were observed in pine canopies or on the trunk of a tree other than their respective nest tree. All fledglings were also observed in sustained flight from tree to tree, but within their natal territory. The fledglings were primarily observed begging for food and being fed by all group members. Rarely, some feeding behavior was displayed by fledglings, although it was mostly limited to the light pecking or ripping of bark. Fledglings that were located and/or banded are included in Tables 3.2.1-1 and 3.2.1.5-1.

3.3.4 Breeder Replacement

The SEC groups retained 9 of 12 breeders from the previous year. Therefore, there were three new breeders. Breeder replacement was 25.0% between the 2011 and 2012 nesting seasons. The breeding pair at Group H was completely replaced this year, as well as the breeding male at Group G.

3.3.5 Survival and Turnover Rates

Adult turnover in groups ranged from none to 100%. No adult turnover was observed in Group F between the 2011 and 2012 nesting seasons. All remaining groups have some degree of adult turnover as follows:

- Group E (25.0% adult turnover) – new helper male in group
- Group G (66.7% adult turnover) – new breeder male and helper male in group
- Group H (100% adult turnover) – new breeding group
- Group C/D (25% adult turnover) – lost helper male to Group G

- Group X (25% adult turnover) – new helper male in group
- Group X (25% adult turnover) – new helper male in group
- Floaters (50% adult turnover) – two resident floaters in 2011, only one resident floater in 2012

Fledgling retention at SEC from 2011 to 2012 was 60%, or 40% turnover. Three of five of the fledglings (60%) from 2011 still reside with one of the SEC groups and roost and/or use territory on SEC. Two of five (40%) fledglings from 2011 have dispersed, migrated, or did not survive between nesting years. Two fledglings from 2011 are now adults on their natal territories (Groups E and X) and one fledgling from 2011 at Group C/D joined Group G on SEC.

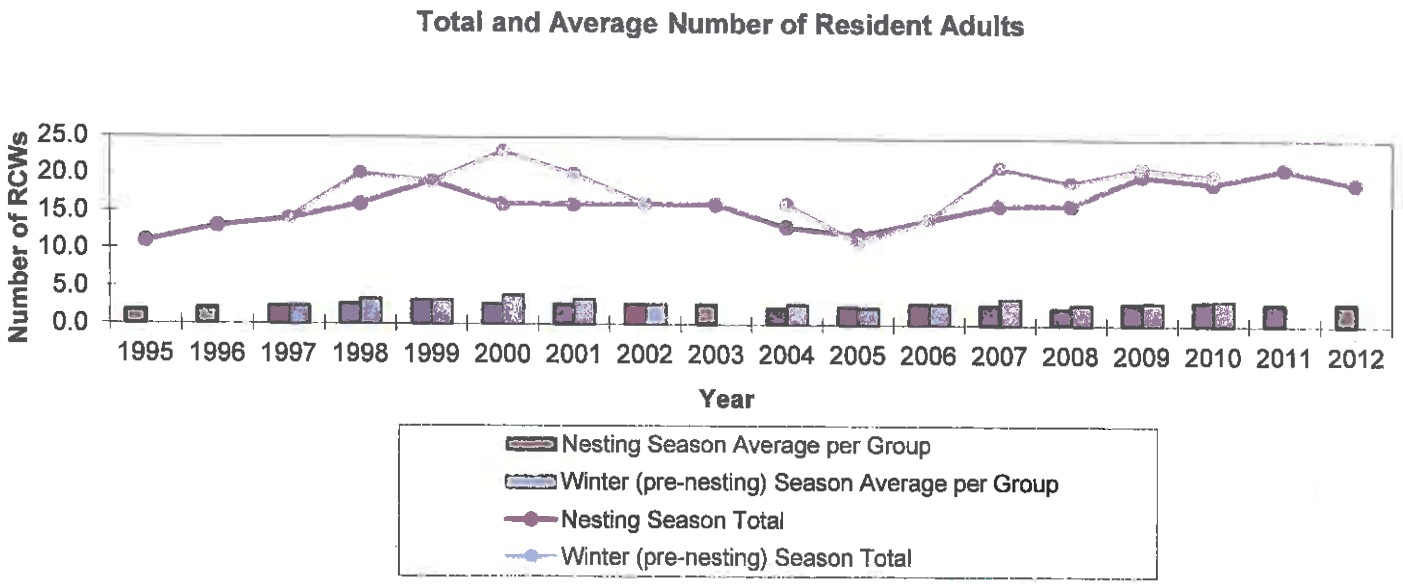
4.0 DISCUSSION

The 2012 nesting season at SEC has concluded and group demographics, number of active clusters and cavity trees, and fledgling production are comparable to the previous nesting season and the long-term average (1995-2012). The number of cavity trees increased from 90 to 105 primarily due to the identification of new start holes. Cavity tree status was also updated as many more trees were climbed for visual observation along with video peeper inspection. This accounted for a substantial increase in start holes and decrease in inactive cavities. Start hole status ranged from newly begun and active holes to advanced tunnels that were inactive and abandoned. Trees with older, inactive holes may remain dormant or may be restarted at some point. Interestingly, new start hole was also located on Eagle nest tree (OR-043) in 2012. There were 22 active cavities in 2012, which is down slightly from 25 in 2011.

Family group size during the nesting season was 3.0 birds/group (18 birds/6 groups) which is slightly above the 2011 nesting season group size of 2.9 birds/group (20 birds/7 groups). This average group size is above the long-term average nesting group size of 2.6 RCWs per group recorded each year since 1995 (Figure 4.0-1). The total number of nesting season resident RCWs decreased from 21 to 19 between 2011 and 2012. However, this number of resident RCWs is substantially above the long-term average of 15.4 total nesting season residents from 1995 to present (Figure 4.0-1). Group size declined slightly from 7 (2011) to 6 (2012). This decrease is due to the fact that a solitary male (single bird group) was no longer a SEC resident in 2012.

At least 5 of 6 Potential Breeding Groups attempted nesting activity this year, which is slightly below the 2011 nesting group number (6 groups); due to the timing of monitoring initiation, it is unclear whether or not Group H initiated monitoring or not. This number of PBGs that initiated nesting (at least 5 in 2012) is almost twice as many as in 2009 when only three PBGs attempted nesting.

Figure 4.0-1 Total and Average Number of Red-Cockaded Woodpecker Resident Adults 1995-2012 at the Curtis H. Stanton Energy Center Site, Orange County, Florida



Year[1]	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Nesting Season Resident Total	11	13	14	16	19	16	16	16	16	13	12	14	16	16	20	19	21 [2]	19 [2]	15.4
Number of Nesting Season Groups	6	6	6	6	6	6	6	6	6	6	5	5	6	7	7	6	7	6	6.1
Nesting Season Average per Group	1.8	2.2	2.3	2.7	3.2	2.7	2.7	2.7	2.7	2.2	2.4	2.8	2.7	2.3	2.9	3.2	2.9	3.0	2.6
Winter (pre-nesting) Season Resident Total	—	—	14	20	19	23	20	16	—	16	11	14	21	19	21	20	—	—	18.0
Number of Winter Season Groups	—	—	6	6	6	6	6	6	—	6	5	5	6	7	7	6	—	—	6.0
Winter (pre-nesting) Season Average per Group	—	—	2.3	3.3	3.2	3.8	3.3	2.7	—	2.7	2.2	2.8	3.5	2.7	3.0	3.3	—	—	3.0

[1] Data were uavailable to, or could ot be collected by, Breedlove, Dennis & Associates, Inc. for 1995, 1996, 2003, 2011, 2012 Winter (pre-nesting) Seasons

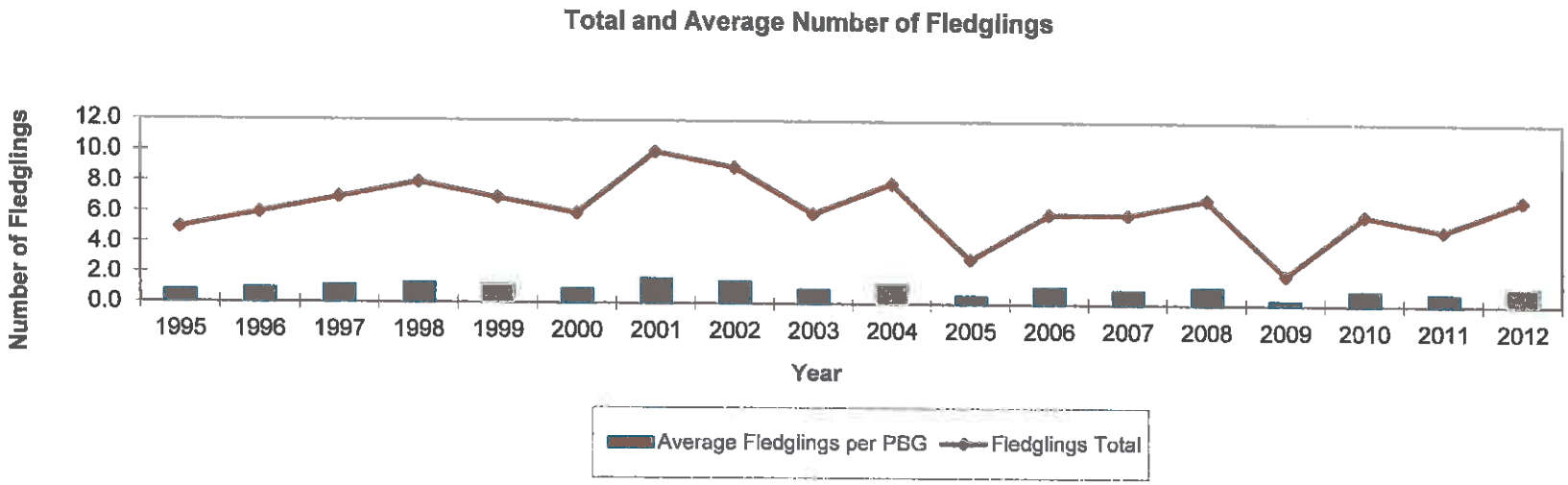
[2] The female RCW living at Group G was assigned floater status and not part of this group or any other group; therefore, this RCW was excuded from average group size calculation.

Clutch data and nestling production were unavailable in 2012 due to the timing and constraints that affected the initiation of monitoring. Group G produced a nest in G5 which was the same active nest tree as in 2011. Although most nest locations were not known in 2012, it is likely that the majority of nests were located in the breeding male's roost cavity, especially first clutch attempts, similar to previous years.

More groups in 2012 produced successful fledglings than in 2011. Five groups (C/D, E, F, G, and X) produced at least one successful fledgling in 2012. This is almost twice as many groups as produced successful fledglings in 2011 (C/D, E, and X). There were seven successful fledglings confirmed during the 2012 nesting season. The number of fledglings per PBG has also increased from 0.8 to 1.2 from 2011 to 2012. The total number of fledglings produced at the SEC site in any given year from 1995 to present has ranged from 2 to 10 per year, averaging 6.3 fledglings per year (Figure 4.0-2). Therefore, the production of seven fledglings at SEC in 2012 represents a slightly better than average year. As such, the SEC RCW population immediately following the 2012 nesting season was confirmed at 26 RCWs (19 adults and 7 fledglings) which is comparable to 26 RCWs (21 adults and 5 fledglings) immediately following the 2011 nesting season. Five of the seven fledglings in 2012 were female; the dominant strategy for females is dispersal (USFWS 2003). Since most of the fledglings at SEC are female, dispersal has likely already happened for some, or may occur at some point in time. The time for most RCW movement is immediately before or after the nesting season (USFWS 2003).

Breeder experience, i.e. being new breeders, and/or age may be factors in the lack of fledgling production in Group H this year. Two new breeders have secured positions in this group. Both birds are new breeders this year at SEC. The breeding male is at least three years old and the breeding female only two years old. The peak reproductive years are ages four to eight (USFWS 2003). Productivity declines, to some degree, at age nine and beyond for both males and females. Any unbanded fledglings or adults that

Figure 4.0-2 Total and Average Number of Red-Cockaded Woodpecker Fledglings 1995-2012 at the Curtis H. Stanton Energy Center Site, Orange County, Florida



Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Fledglings Total	5	6	7	8	7	6	10	9	6	8	3	6	6	7	2	6	5	7	6.3
Number of Potential Breeding Groups (PBGs)	6	6	6	6	6	6	6	6	6	6	5	5	6	6	6	6	6	6	5.9
Average Fledglings per PBG[1]	0.8	1.0	1.2	1.3	1.2	1.0	1.7	1.5	1.0	1.3	0.6	1.2	1.0	1.2	0.3	1.0	0.8	1.2	1.1

[1]Average calculated by dividing total fledlings by the total number of Potential Breeding Groups (PBGs)

survive and have not dispersed to other sites, will continue to be tracked as much as possible to identify roost site for future banding. Unbanded birds will be banded in the winter season or sooner.

Dispersal continues between the SEC and other RCW populations through natural migration and movement. Several SEC birds have also moved to Hal Scott over time. There are now four breeding females previously from Hal Scott that have breeding positions at SEC, including a new female at Group H. A breeding male from an unknown site is also at Group F as well. A resident female floater at SEC from Camp Blanding still roosts at C4.

Existing RCW data will continue to be reviewed for future management and planning purposes. Long-term management strategies will be considered to sustain and expand family groups at SEC, a significant support population, as listed in the 2003 Recovery Plan. Cavity maintenance (i.e., cleaning of inactive cavities of debris, kleptoparasites, and water) is a common practice employed at SEC to improve cavity suitability and sustain appropriate numbers of cluster cavities for roosting and nesting. This practice will be continued to increase opportunities for use by new fledglings or migrating juveniles and adults. The number of new start holes observed in 2011 is encouraging as the birds are continuing to naturally excavate future roost sites. These new trees were marked with the standard white band for ease of identification and protection. The need for artificial inserts or drilled starts will be evaluated, and may be used as a management tool if the number of suitable cavities is determined inadequate by the OUC engineer.

Two artificial clusters at SEC are currently occupied by a neighboring family group or a non-group RCW. A Camp Blanding female floater roosts at one captured cluster (C4) and the male helper from C/D roosts at A4. These clusters will continue to be monitored for addition of other birds and pairing of potential breeders. A pairing event seems more likely in the future than in 2011 since the breeding female at Group G that (previously roosted west of the tracks at C1 in close proximity to the Camp Blanding bird) has

moved away and back to a roost site (G16) east of the tracks. Several suitable cavities at Cluster C could become future roost sites for another RCW. Group C/D will continue to be monitored for budding, the splitting of one territory into two, since one of its members roosts at A4. The two remaining artificial clusters, Clusters B and D, will be maintained and evaluated for future dispersal activity. One tree at Cluster D (D1), although currently inactive, was previously used by an RCW prior to 2012. One tree each at Clusters A and B have been killed by lightening strikes. All artificial cavity trees in these clusters are assessed annually and cleaned of debris. Some cavity inserts in artificial cluster sites are in need of preparing, cleaning, and/or replacement prior to any translocation activities to improve the quality of the cavity and likelihood of the RCW to become a permanent resident. Translocation may be appropriate for SEC if data support this management decision.

5.0 LITERATURE CITED

U.S. Fish and Wildlife Service. 2003. Recovery plan for the Red-Cockaded Woodpecker (Picoides borealis): Second Revision. U.S. Fish and Wildlife Service, Atlanta, GA. 296 pp.

DeLotelle and Guthrie, Inc. July 8, 2005. The Curtis H. Stanton Energy Center Red-Cockaded Woodpeckers Habitat Management Plan. 37 pp.

APPENDIX A

HISTORIC STANTON BANDING DATA PROVIDED BY DELOTELLE AND GUTHRIE, INC.

Appendix A **Historic Red-cockaded Woodpecker Banding Data for the Curtis H. Stanton Energy Center provided by Delotelle and Guthrie, Inc., Orlando Utilities Commission, Orange County, Florida[1]**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
GROUP E								
161	E	Yellow/ Light Blue/ White	Silver 4/2/99	1998-	B	Male	44.6	—
175182808	E	Orange/ White/ Black	Silver	6/24/04-07	B	Male	42.3	—
82860	E	Dark blue/ White/ White	Silver	6/1/05-07	H	Male	—	—
82850	E	White/ White/ Dark blue	Silver	5/14/06	H	Male	42.2	—
53	Aj1-E	Silver	Dark Blue/ White	2/5/2002-5	B	Female	—	—
22359	E	Silver	Light Green/ Orange	6/7/2002	F	Female	21.3	—
22399	E	Black/ Burgundy	Silver	6/3/2003	F	Female	—	—
Unbanded	E	—	—	6/7/2002	F	Male	—	—
Unbanded	E	—	—	6/24/2004	F	Female	—	Too small
22374	G-H-E	Silver, 6/13/02	White/ Burgundy/ White	1998-2004	B	Female	44.4	—

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
82716	E	Dark blue/ Black/ Light blue	Silver 1/13/09	5/8/2008	F	Male	21.0	—
Unbanded	E	—	—	5/8/2008	Dead	—	11.2	—
GROUP F								
193	F	Orange/ Green/ White	Silver 1996	5/97-12/3/97	H	Male	43.4-44.2	—
247	F	Double Bl/ White	Silver	6/2/2000	F	Male	24.9	—
99	F	Orange/ Yellow/ Dark Blue	Light Blue/ Silver 3/21/98	1996-	B	Male	46.0-44.4	—
075	G-F	Yellow/ Green	Silver	1995-02	B	Female	39.7	Duplicate Id No. in Clan ICP with different band combinations
185	A1-F-At1	Yellow/ Yellow/ Dark Green	Silver	12/8/97	F	Male	44.4	—
0239	F	Yellow	Silver	5/27/98	F	Male	—	—
22357	F	Yellow/ Orange	Silver	5/26/2002	F	Female	19.6	—
34	F-SJN	Silver	Blue/ Yellow	1996	F	Female	42.2	—

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
190	F	Silver 9/4/98	Yellow/ Purple/ Green 3/20/98	1997	H	Male	42.7-45.5	—
191	F	Silver	Green & Yellow/ Blue	1997	N/ dead	—	—	Historical data is unclear if right leg has 2or 3 separate bands
0275	G-F	Silver	Red/ Yellow/ Light Green 1/11/98	12/3/97-5/30/97	F	Female	40.3-44.7	Duplicate Id No. in Clan H with different band combinations
0270	F	Silver	Yellow	5/27-98	F	Male	—	—
82846	G-F	Silver 3/28/09	Orange/ Light Blue/ Light Blue	5/5/07-1/3/2009	B	Female	—	—
249	G-ART1-F	Silver/ Light Green	Red/ Light Green/ Red 12/23/97-01/9/98	5/30/97	F	Female	42.9	—
82837	F	Orange/ Dark Blue	Silver	5/27/2007	F	Female	27.9	—
214	F	Burgundy/ Orange	Silver	5/23/2001	F	Male	26.0	—
82853	C/D-F	Orange	Silver	5/14/06-07	B	Female	14.5-36.5	Unclear from old data if orange is still banded to left leg

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
83837	F	Blue/ Black	Silver	6/1/2008	N	Female	28.2	—
246	F	Silver	Blue/ Blue	6/2/200	F	Female	27.9	—
22358	F	—	Green/ Silver	5/26/2002	F	Female	11.1	—
82801	F	Dark Green/ Black	Silver	5/12/2003	F	Male	15.5	—
22387	F	Silver	Black/ Dark Green	5/12/2003	F	Female	21.7	—
175182705	F	Silver	Dark Blue/ Dark Blue	5/29/2005	Dead	Unknown	—	Cavity flooding
212	F	—	Silver	5/23/2001	F	Male	15.1	—
Unbanded	F	—	—	6/12/2004	F	Female	—	—
GROUP G								
82848	G-ICP-OUC	White/ Light Blue/ Black	Silver 3/29/09	5/5/2006-1/22/09	H	Male	—	—
276	G	Silver	Purple/ Orange/ White	10/11/2000	B	Female	43.0	—

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
157	X-G	Yellow/ Blue	Orange/ Silver 1/22/97	8/11/96	B	Male	48.2	—
—	G	—	Yellow/ Blue	1994	F	Female	—	No FWS (silver) band attached?
82872	G	Light Blue/ Pink/ Light blue	Silver 1/12/04	512/2002-3	H	Male	42.1	—
018	G	Silver	Red/ Light Green/ Red 1/17/97	1993-99	B	Female	38.9	—
37	SJS-G	Silver	Burgundy/ Light Green	1/5/2002	B	Female	—	—
022	G	Orange/ Dark Green	Silver	1995	FL	Male	—	—
82886	G	Black/ Black/ Orange	Silver 2/22/04	6/25/2005	I	Male	41.1	—
82720	G	Burgundy/ Orange	Silver	5/29/2008	F	—	42.0	—
111	G	Silver	Orange/ Dark Blue	1996	F	Female	40.6	—
46	G	Silver	Dark Blue/ Orange	8/2/96	H	Male	44.7	—

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
602	M-SJN-X-A	Silver	Orange/ Orange	4/26/2003	B	Female	—	—
203	H-G	Dark Blue/ Red/ Dark Blue	Silver 3/8/01	1997	B	Male	46.2	—
22346	C/D-G	Silver	Dark Blue/ Dark Blue/ Dark Blue	5/7/2004	B	Female	—	—
Unbanded	G	—	—	6/2/1999	F	Female	—	—
Unbanded	G	—	—	6/2/1999	F	Male	—	—
GROUP H								
175182708	H	White/ Orange/ Black	Silver	5/31/01-04	H	Male	—	—
113	H	Silver/ Dark Green	Yellow/ White	1996	N	Female	—	—
221109319	A(sj)-H	Silver,/ Orange 3/27/09	Light Blue/ White/ Orange	5/18/2007	B	Female	—	—
031	H	Orange/ Yellow/ Light Blue	Silver 2/96-9/5/98	1996-03	B	Male	45.4	—

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
275	H	Yellow/ Dark Blue/ Pink	Silver 9/6/98	1998-01	F	Male	41.1	Duplicate Id No. in Clan F with different band combinations
049	H	Silver 10/9/98	Dark Blue (gr)/ Yellow/ Orange 2/9	1990-98	B	Female	39.8	Unclear of designation (gr)?
011	H-E-H	Silver	Green/ Orange 1/22/97	1995-98	H	Female	45.0	—
175182852	H	Orange/ Light Blue/ Light Blue	Silver	5/31/01-04-07	B	Male	—	—
22356	H	Dark Blue/ Light Green	—	6/2/2002	F	Male	16.3	—
175182836	H	Black/ Blue	Silver	5/16/07	B	Male	18.5	—
175182822	H	Burgundy,/ Black,/ Burgundy	Silver 6/9/07	6/5/06-08	H	Male	43.2 (6/9/07)	—
175182835	H	Silver	—	6/3/2007	Dead	Female	10.1	—
—	H	—	Silver	10/18/2007	B	Male	—	No FWS ID # listed in old data chart

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
Unbanded	H	—	—	6/2/2002	Dead	Female	—	Too small?
Unbanded	H	—	—	6/3/2004	F	Female	—	—
Unbanded	H	—	—	6/3/2004	F	Female	—	—
GROUP C/D								
2315	C/D	Purple/ Dark Blue/ White	Silver	5/99	F	Female	—	—
82805	C/D	Light Green/ White/ Red	Silver	5/13/2003	B	Male	—	—
2314	C/D	Silver	Purple/ Dark Blue/ White	9/8/99	B	Female	43.3	—
82820	C/D	Silver	White/ White	5/6/2007	Dead	Female	11.5	—
166	C/D	Yellow	Silver	1997	F	Female	—	—
19910440	Art-1-C/D	Light Green/ Silver	Yellow/ Yellow/ Burgundy	5/11/2005	B	Female	—	Translocated from Ft. Benning

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
010	G-C/D	Yellow-Green (small)	Silver 1/21/97	1996-05	B	Male	43.1	Unclear from old data if this is 1 or 2 bands on left leg
82821	C/D	Light Green/ Light Green	Silver	5/6/2007	F	Female	12.5	—
147	C/D	Silver/ Orange	Orange/ Orange	1996-05	B	Female	38.9	—
22338	C/D	Orange/ Orange	Silver	5/1/2002	F	Female	21.9	—
82714	C/D	Orange/ Orange	Silver	5/2/2008	F	Female	20.2	—
0238	C/D	Silver	Red/ Blue/ Orange 9/4/98	5/98/00	H	Female	41.5	—
22339	C/D	Silver	Dark Blue/ Orange	5/1/2002	F	Male	16.4	—
82715	C/D	Silver	Orange/ Orange	5/2/2008	F	Unknown	21.1	—
028	C/D	Silver	Red/ Green	1993-96	R	Female	—	—

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
2316	C/D	Dark Blue	Silver	5/99	F	Female	—	—
82854	C/D	Black/ Black	Silver	5/14/2006	F	Female	36.5	—
Unbanded	C/D	—	—	5/11/2004	F	Female	—	—
GROUP X								
244	X	Double Bl./White	Silver	5/18/98	F	Male	—	—
243	X	White/ Double Bl.	Silver	5/18/98	F	Male	—	—
55	X	White/ Black	Silver	5/24/2001-04	R	Male	25.2	—
82849	ICP-sArt-3-X	White/ Light Green/ White	Silver 3/17/07-3/27/09	5/18/04-1/9/2008	B	Male	—	—
093	X	Yellow/ Silver	Yellow/ White	1995	F	Female	—	—
232	X	Silver 8/26/99	Dark Blue/ White/ Red	5/11/99-00	H	Male	18.5-46.0	—

Appendix A **Continued.**

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
032	X	Silver	Dark Green/ White/ Bl.	1996	N	Male	—	—
56	X	Silver	White/ Bl.	5/24/2001	F	Male	20.3	—
175182870	C/D-H-E-X	Silver 11/04	White/ White/ Burgundy	5/13/03-5/11/2008	B	Female	39.8	—
176	X	Light Green/ Yellow	Silver/ Orange 1/26/97	1994-99	B	Male	43.0	—
026	X	Light Green/ Yellow	Silver 2/24/97	1994-99	B	Female	46.7	—
82	X	Silver 3/22/01	Yellow/ Orange 6/29/02	5/00-2	B	Female	41.2	Duplicate Id No. in Clan ICP with different band combinations
235	X	Pink/ D. Bl.	Silver	5/11/99	F	Female	—	—
63	X	Silver	Double Bl./ Light Blue	6/6/2000	Dead	Unknown	23.7	—
189170541	X	Light Green/ Silver	Light Green/ Black/ Purple	1/2/2007	U	Female	—	Translocated from Apalachicola area
82721	X	Light Green/ Burgundy	Silver	5/20/2008	F	Male	25.0	—

Appendix A Continued.

Identification (ID) No.	Family Group ID	Left Leg Above/ below	Right Leg Above/ Below	Date	Last Known Status[1]	Sex	Weight (g)	Comments
82722	X	Silver	Light Green	5/20/2008	F	Male	19.9	—
194	X	Silver 1/10/98	Green	5/97-01	B	Male	42.8	—
22400	E-Icp-X	Black/ Black/ Orange	Silver	6/3/03-3/1/2007	B	Male	43.0	Unclear from old data if orange band is still present at bottom of left leg
195	X-E	—	Silver	1997	F	Female	—	—

ICP = International Corporate Park,
Source: Data found in DGI Annual Progress Reports (2007 to 2009).

[1] Status includes Nestling (N), Fledgling (F), Floater (FL), Helper (H), Intruder (I), Resident (R), Breeder (B), and Unknown (U).

ATTACHMENT 4

Joint Agency Mitigation & Management Plan, 1993

Appendix A: Conditions of Approval and Final Success Criteria
Appendix A: Site Specific Maps and Figures
Appendix B: Planting Specifications
Appendix G: Permanent Photographic Plot Locations

Appendix A: Conditions of Approval and Final Success Criteria

OUC received Conditional Approval for the Joint Agency Mitigation and Monitoring Plan (JAMMP) on June 9, 1993. This appendix lists the conditions of approval, provides responses to requests for clarification, and indicates the final mitigation success criteria.

St. John's River Water Management District

A May 27, 1993 letter from Cammie Dewey (SJRWMD) to Hamilton Oven (FDEP) contained several requests for clarification about the alternate access road construction. The questions and responses are listed below.

- Question: *"it appears that the actual area of dredge and fill impacts for construction of the Transmission Line 'keyholes' have almost doubled from what was authorized during certification:"*

  Response: The 'keyholes', although shown on the drawings, have been removed from the permitting of the access road. They will be permitted along with the transmission line at a later date.

- Question: *"depict the bridge structure bottom elevation and wetland bottom elevation:"*

  Response: Drawing S3215, S3216, and S3217 depict the details for construction of the bridge. Elevation at the crown of the bridge is 81 feet 0 inches. An 8 inch concrete slab will rest on the 3 feet 0 inches deep precast beams. The bottom elevation of the beam at the crown of the bridge will be 77 feet 4 inches. The profile drawings for the existing railroad trestle No.1 immediately adjacent to the bridge indicates a bottom of wetland elevation of 71 feet 0 inches. The 100 year flood elevation at the railroad trestle and bridge is elevation 75 feet 0 inches.

- Question: *"the swales served by structures AAR-5 and AAR-7 do not appear to have the required two feet of retention storage:"*

  Response: Due to the slope of the existing railroad and access road, the high point of swale AAR-5 varies from elevation 83 feet 0 inches on the

north to elevation 82 feet 0 inches on the south end. The bottom of swale elevation is constant at elevation 80 feet 6 inches. The average depth in the swale is 2 feet 0 inches and the stand pipe for structure AAR-5 is set at two feet above the bottom of swale elevation. Sufficient depth exists at the high point on the south to allow for an additional 1 feet 0 inches to the subgrade elevation of both the railroad and access road.

A similar situation exists at structure AAR-7. The high point elevations range from 80 feet 3 inches on the north to 78 feet 0 inches on the south, with a constant bottom elevation of 76 feet 6 inches. Again, the stand pipe is located 2 feet 0 inches above the bottom of the swale elevation.

- Question: *"the southernmost three swales do not appear to have the required two feet of retention storage: and,"*

  Response: Sections 4, 5, and 6 on drawing S3220 relate to the southernmost three swales. Section 4 indicates that from the bottom of swale elevation of 73 feet 6 inches to the Plan elevation "A" of 78 feet 6 inches a depth of 5 feet 0 inches exists.

  Section 5 indicates a depth of 3 feet 0 inches from the bottom of swale to the road and railroad subgrade elevation. Section 6 indicates a depth of 2 feet 0 inches from the bottom of swale to the road and railroad subgrade elevation.

- Question: *"indicate the High Point at the southernmost swale."*

  Response: The high point elevation for this swale should be 76 feet 6 inches.

Florida Department of Environmental Protection

In a June 9, 1993, letter from Trudie Bell to Buck Oven, the FDEP approved the mitigation plan with these conditions:

1. *OUC shall submit the detailed surveys of the remaining vegetation transects to the SJRWMD, SFWMD and the Department no later than July 30. The format*

shall be the format used for the submission of the initial surveys which incorporates the locations of the vegetation monitoring plots.

2. *The presence or absence of non-native and nuisance species is an indicator of the success of the hydrologic enhancement. Control of these species by herbicide use or hand removal could bias the vegetation monitoring results. Therefore OUC shall notify the SJRWMD, DER Central District office and the Bureau of Wetland Resource Management of any proposed vegetation control or removal events in mitigation areas 3.5 and 3.6 at least thirty days prior to the proposed event to allow the regulatory agencies the opportunity to perform a site inspection to review the problem and the proposed remedial action. If the regulatory agencies object to the proposed action, the objection shall be stated in writing to OUC within 30 days of being notified. In no objection is received within 30 days of the original notification date, OUC may assume that the regulatory agencies do not object to the proposed action.*

   In addition, OUC shall include a detailed description of each vegetation control or removal event in the annual mitigation report. The description shall be accompanied by photos of the vegetation prior to removal and shall include the species removed, the acreage affected, the probable cause of the problem and a discussion of whether this is expected to be a recurring problem.

3. *The data collection for the vegetative monitoring program shall occur during the months of August or September of each year to allow identification to the species level for a minimum of five years. The reports shall include the water level data collected for that year and shall be submitted pursuant to the conditions of certification.*

4. *The mitigation monitoring shall proceed in accordance with the Joint Agency Mitigation Monitoring Plan, as revised by the reviewing agencies, and the mitigation area drawings received by the Department on May 14, 1993, which show the transect, staff gauge and piezometer locations.*

5. *The success criteria for the on-site mitigation areas shall be those on Table 3.3-1 received by the Department on June 1, 1993, and attached to this document.*

Table 3.3-1 was originally submitted in the JAMMP. Below is the revised table with complete success criteria for each mitigation area.

Table 3.3-1
Success Criteria for Wetland and Upland Mitigation Sites*
Orlando Utilities Commission, Stanton Energy Center Unit 2, Orlando, Florida, May 28, 1993

		Success Criteria*				
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
3.1 Railroad North						
Cypress Seedling Planting (400 seedlings per acre; 10"-12" in 4" cones)	Success	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Ultimate Success Criteria ·400 wetland trees/acre above the herbaceous stratum, and/or tree cover >33%, with no area greater than 1 acre having <20% cover. ·80% of cover in herbaceous & subcanopy strata shall be USFWS listed as Facultative wet or obligate.*** ·Cover by nuisance, non-wetland and exotic species is less than 10%.** ·The area is jurisdictional. ·Mitigation was completed as approved.
	Remedy	Replant with 10" - 12" potted cypress seedlings to reach 33% total cover. Herbicide or hand clear nuisance, exotic plants to <10% cover	Replant with 10" - 12" potted cypress seedlings to reach 33% total cover. Herbicide or hand clear nuisance, exotic plants to <10% cover	Replant with 3' tall seedlings to reach 33% total cover. Herbicide or hand clear nuisance, exotic plants to <10% cover	Replant with 3' tall seedlings to reach 33% total cover. Herbicide or hand clear nuisance, exotic plants to <10% cover	Reassess site and mitigation methods; continue monitoring.
Longleaf Pine Seedling Planting (500 seedlings per acre; 2 year old containerized)	Success	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Ultimate Success Criterion: Average density 300 seedlings/acre
	Remedy	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Reassess site and mitigation methods; continue monitoring.

Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
Longleaf Pine Tree Planting (10' - 15' tall; average 8' centers)	Success	100% survival	100% survival	100% survival	100% survival	Same # of pines as originally planted
	Remedy	Replace each dead tree with 10' - 15' tree	Replace each dead tree with 10' - 15' tree	Replace each dead tree with 10' - 15' tree	Replace each dead tree with 10' - 15' tree	Reassess site; plant a different species of pine. Continue monitoring.
3.2 Railroad South						
Cypress Seedlings (400 seedlings/acre 10" - 12" in 4: cones)	Success	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Ultimate Success Criteria ·400 wetland trees/acre above the herbaceous stratum, and/or tree cover >33%, with no area greater than 1 acre having <20% cover. ·80% of cover in herbaceous & subcanopy strata shall be USFWS listed as Facultative wet or obligate.*** ·Cover by nuisance, non-wetland and exotic species is less than 10%** ·The area is jurisdictional. ·Mitigation was completed as approved.
	Remedy	Replant with 10" - 12" potted cypress seedlings to reach 33% of total cover. Herbicide or hand clear nuisance, exotic plants to <10% cover	Replant with 10" - 12" potted cypress seedlings to reach 33% of total cover. Herbicide or hand clear nuisance, exotic plants to <10% cover	Replant with 10" - 12" potted cypress seedlings to reach 33% of total cover. Herbicide or hand clear nuisance, exotic plants to <10% cover	Replant with 10" - 12" potted cypress seedlings. Herbicide or hand clear nuisance, exotic plants to <10% cover	Reassess site and mitigation methods; continue monitoring.
Longleaf Pine Seedlings (500 seedlings per acre; 2 year old containerized)	Success	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Ultimate Success Criterion: Average density 300 seedlings/acre
	Remedy	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Reassess site and mitigation methods; continue monitoring.

Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
Slash Pine Trees (10' - 15' trees at average 8' centers)	Success	100% survival	100% survival	100% survival	100% survival	Reassess site and mitigation method
	Remedy	Replace each dead tree with a 10' - 15' tall tree.	Replace each dead tree with a 10' - 15' tall tree.	Replace each dead tree with a 10' - 15' tall tree.	Replace each dead tree with a 10' - 15' tall tree.	Reassess site and mitigation methods; continue monitoring.
Cypress Trees (10' - 15' trees at average 8' centers)	Success	95% survival	95% survival	95% survival	95% survival	Ultimate success criterion is 95% survival, 5 years after last planting.
	Remedy	Replace each dead tree with a 10' - 15' tall tree	Replace each dead tree with a 10' - 15' tall tree	Replace each dead tree with a 10' - 15' tall tree	Replace each dead tree with a 10' - 15' tall tree	Reassess site and mitigation method; continue monitoring.
3.3 RCW-West						
Longleaf Pine Seedlings (300 seedlings per acre; 2 year old containerized)	Success	≥80% survival from planting (240/acre)	≥80% survival from planting (240/acre)	≥85% survival from Year 2 (200/acre)	≥85% survival from Year 3 (175/acre)	≥85% survival from Year 4 (Average density 150/acre)
	Remedy	Replant to reach 80% survival, using two year old potted seedlings.	Replant to reach 80% survival, using two year old potted seedlings.	Replant to reach 80% survival, using two year old potted seedlings.	Replant to reach 80% survival, using two year old potted seedlings.	Reassess site and mitigation methods; continuing monitoring.
3.4 Transmission Line North						
Longleaf Pine Trees (10' - 15' tall; average 8' centers)	Success	100% survival	100% survival	100% survival	100% survival	100% survival
	Remedy	Replant each dead tree with a 10' - 15' tall tree.	Replant each dead tree with a 10' - 15' tall tree.	Replant each dead tree with a 10' - 15' tall tree.	Replant each dead tree with a 10' - 15' tall tree.	Reassess site and mitigation methods; continue monitoring.

Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
3.5 East Prairies						
Herbaceous Wetlands	Success	Trending toward Ultimate Success Criteria (Refer to Year 5). ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Trending toward Ultimate Success Criteria (Refer to Year 5). ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Trending toward Ultimate Success Criteria (Refer to Year 5) ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Trending toward Ultimate Success Criteria (Refer to Year 5). ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Ultimate Success Criteria* ·Encroachment by woody vegetation other than cypress is controlled. ·Wetland species in all strata are reproducing naturally either by fruiting or vegetative spread. **** ·Vegetation boundaries have shifted outward and upward along the elevational gradient, based upon visual observation. ·Herbaceous wetlands show an increased % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·After a minimum of 5 years, jurisdictional area has increased in size. ·The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%. ·The relative frequency of occurrence of non-listed or upland species (USFWS FAC-U and obligate upland) after five years is less than the percent frequency occurence value of the baseline data. ·A success determination shall not occur sooner than 5 years after the completion of the dredge and fill in the enhancement areas.
	Remedy	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation.	Reassess site and mitigation methods, continue monitoring.

Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
Cypress Domes (hydrologic enhancement)	Success	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Ultimate Success Criteria: ·Wetland canopy trees are not dying at an accelerated rate due to the altered hydroperiod, as indicated by annual aerial photography and groundtruthing. ·Wetland species in all strata are reproducing naturally either by fruiting or vegetative spread.*** ·Cover of nuisance non-wetland and exotic species is less than 10%.** ·The mitigation was performed as approved, and increased the hydroperiod in the wetland, as evidenced by attainment of the success criteria.
	Remedy	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy.	Reassess site and mitigation methods, continue monitoring.
Longleaf Pine Seedlings (500 seedlings per acre; 2 year old containerized)	Success	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Ultimate Success Criterion: Average density 300 seedlings/acre
	Remedy	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Reassess site and mitigation methods; continue monitoring.

Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
3.6 RCD East and West						
Herbaceous Wetlands (hydrologic enhancement)	Success	Trending toward Ultimate Success Criteria **(Refer to Year 5).** ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Trending toward Ultimate Success Criteria **(Refer to Year 5).** ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Trending toward Ultimate Success Criteria **(Refer to Year 5).** ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Trending toward Ultimate Success Criteria **(Refer to Year 5).** ·Encroachment by woody vegetation other than cypress is controlled. ·Herbaceous wetlands show an increasing trend in the % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·In existing wetlands, the % frequency of occurrence of upland (i.e., not on the USFWS obligate and FAC-W lists), exotic and nuisance species show a decreasing trend. · The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%.	Ultimate Success Criteria* ·Encroachment by woody vegetation other than cypress is controlled. ·Wetland species in all strata are reproducing naturally either by fruiting or vegetative spread. **** ·Vegetation boundaries have shifted outward and upward along the elevational gradient, based upon visual observation. ·Herbaceous wetlands show an increased % frequency of occurrence of wetland species (USFWS obligate, FAC-wet) in ≥ 95% of plots 2, 3, 4. ·After a minimum of 5 years, jurisdictional area has increased in size. ·The relative % frequency of occurrence of exotic and nuisance species (including Myrica cerifera) is less than 10%. ·The relative frequency of occurrence of non-listed or upland species (USFWS FAC-U and obligate upland) after five years is less than the percent frequency occurence value of the baseline data. ·A success determination shall not occur sooner than 5 years after the completion of the dredge and fill in the enhancement areas.
	Remedy	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy; remove encroaching woody vegetation.	Reassess site and mitigation methods : continue monitoring.

Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
Cypress Domes enhancement	Success	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5)	Trending toward Ultimate Success Criteria (Refer to Year 5).	Ultimate Success Criteria: ·Wetland canopy trees are not dying at an accelerated rate due to the altered hydroperiod, as indicated by annual aerial photography and groundtruthing. ·Wetland species in all strata are reproducing naturally either by fruiting or vegetative spread.*** ·Cover of nuisance non-wetland and exotic species is less than 10%.** ·The mitigation was performed as approved, and increased the hydroperiod in the wetland, as evidenced by attainment of the success criteria.
	Remedy	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy.	Apply herbicide or hand-clear nuisance/exotic species to <10% canopy.	Apply herbicide or hand-clear nuisance/ exotic species to <10% canopy.	Reassess enhancement techniques; apply herbicide on hand-clear nuisance/exotic species to <10% canopy; continue monitoring.
Longleaf Pine Seedlings (500 seedlings per acre; 2 year old containerized) (RCD-West)	Success	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Trending toward ultimate goal; seedling succeeding based upon the growth parameter of height.	Ultimate Success Criterion: Average density 300 seedlings/acre
	Remedy	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Replant as necessary, using two year old potted seedlings.	Reassess site and mitigation methods; continue monitoring.

Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
Cypress Seedlings (400 seedlings per acre; 10" - 12" in 4' cones) (RCD-East)	Success	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Trending toward Ultimate Success Criteria (Refer to Year 5).	Ultimate Success Criteria ·400 wetland trees/acre above the herbaceous stratum, and/or tree cover >33%, with no area greater than 1 acre having <20% cover. ·80% of cover in herbaceous & subcanopy strata shall be USFWS listed as Facultative wet or obligate.*** ·Cover by nuisance, non-wetland and exotic species is less than 10%** ·The area is jurisdictional. ·Mitigation was completed as approved.
	Remedy	Replant with 10" - 12" potted cypress seedlings to reach 33% total cover. Herbicide or hand clear nuisance/exotic species to <10% cover.	Replant with 10" - 12" potted cypress seedlings to reach 33% total cover. Herbicide or hand clear nuisance/exotic species to <10% cover.	Replant with 3' tall seedlings to reach 33% total cover. Herbicide or hand clear nuisance/exotic species to <10% cover.	Replant with 3' tall seedlings to reach 33% total cover. Herbicide or hand clear nuisance/exotic species to <10% cover.	Reassess site and mitigation methods; continue monitoring.
3.7 Railroad Loop						
Staff Gauge #8	Success	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).
	Remedy	Adjust weir	Adjust weir	Adjust weir	Adjust weir	Reassess enhancement and success; continue monitoring.

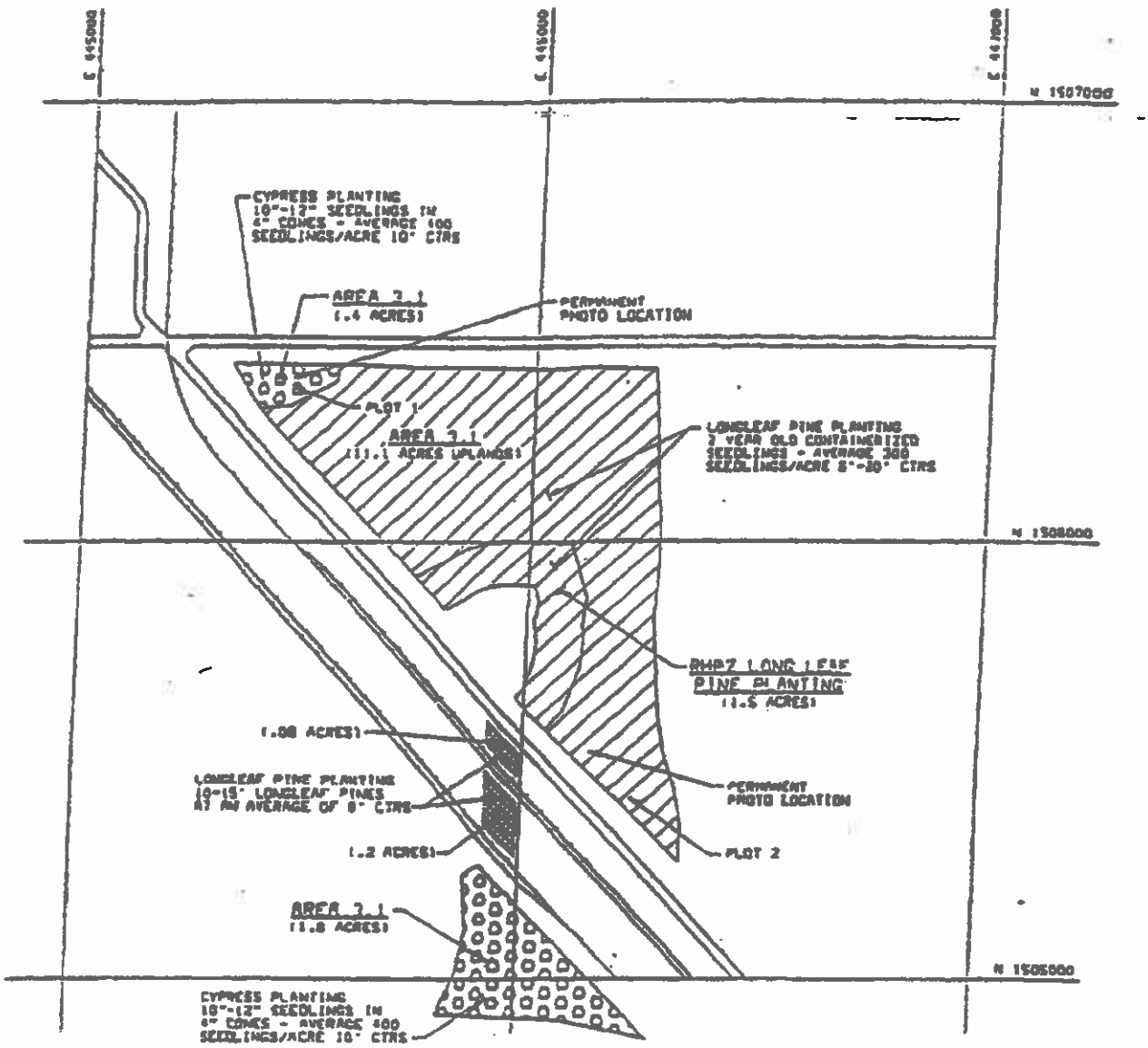
Success Criteria*						
Mitigation Site		Year 1	Year 2	Year 3	Year 4	Year 5
Staff Gauge #9	Success	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly reading).
	Remedy	Adjust weir	Adjust weir	Adjust weir	Adjust weir	Reassess enhancement and success; continue monitoring.
Piezometer #6	Success	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).
	Remedy	Adjust weir	Adjust weir	Adjust weir	Adjust weir	Reassess enhancement and success; continue monitoring.
Piezometer #7	Success	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).	Return of a more natural seasonally fluctuating hydroperiod, as indicated by seasonal water level fluctuation at staff gauges and piezometers (monthly readings).
	Remedy	Adjust weir	Adjust weir	Adjust weir	Adjust weir	Reassess enhancement and success, adjust weir; continue monitoring.

*Each mitigation site will be monitored until it has achieved success. If success is not attained in Year 5, monitoring will continue and site will be reassessed. When success is attained, no further mitigation monitoring will occur, and the mitigation site will then be managed as part of the overall Stanton Energy Center management plan.

**To ensure that undesirable species do not overrun a mitigation area. "Nuisance/wetland species" are defined as Typha latifolia and Ludwigia peruviana.

***Source of wetland categories for plant species is Reed, P.B., Jr., 1988. Wetland Plants of the State of Florida 1988. (A subset of Southeast (Region 2). U.S. Fish Wildl. Serv. Biol. Rep. 88 (26.2).)

****Vegetation reproduction by fruiting will be assumed based upon the presence of fruit on the plants.



RAILROAD NORTH (3.1)
UPLAND RMPZ LONGLEAF PINE PLANTING,
CYPRESS PLANTING; WILDLIFE CORRIDOR CREATION

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NO	DATE	REVISIONS AND RECORD OF ISSUE	BY	CHK	APP	FL
1	03-31-93	REVISED PER FDER COMMENTS				
0	02-22-93	INITIAL ISSUE				

ENGINEER | DRAWN
CHECKED | DATE

ORLANDO UTILITIES COMMISSION
STANTON ENERGY CENTER - UNIT 2

PROJECT | DRAWING NUMBER | REV
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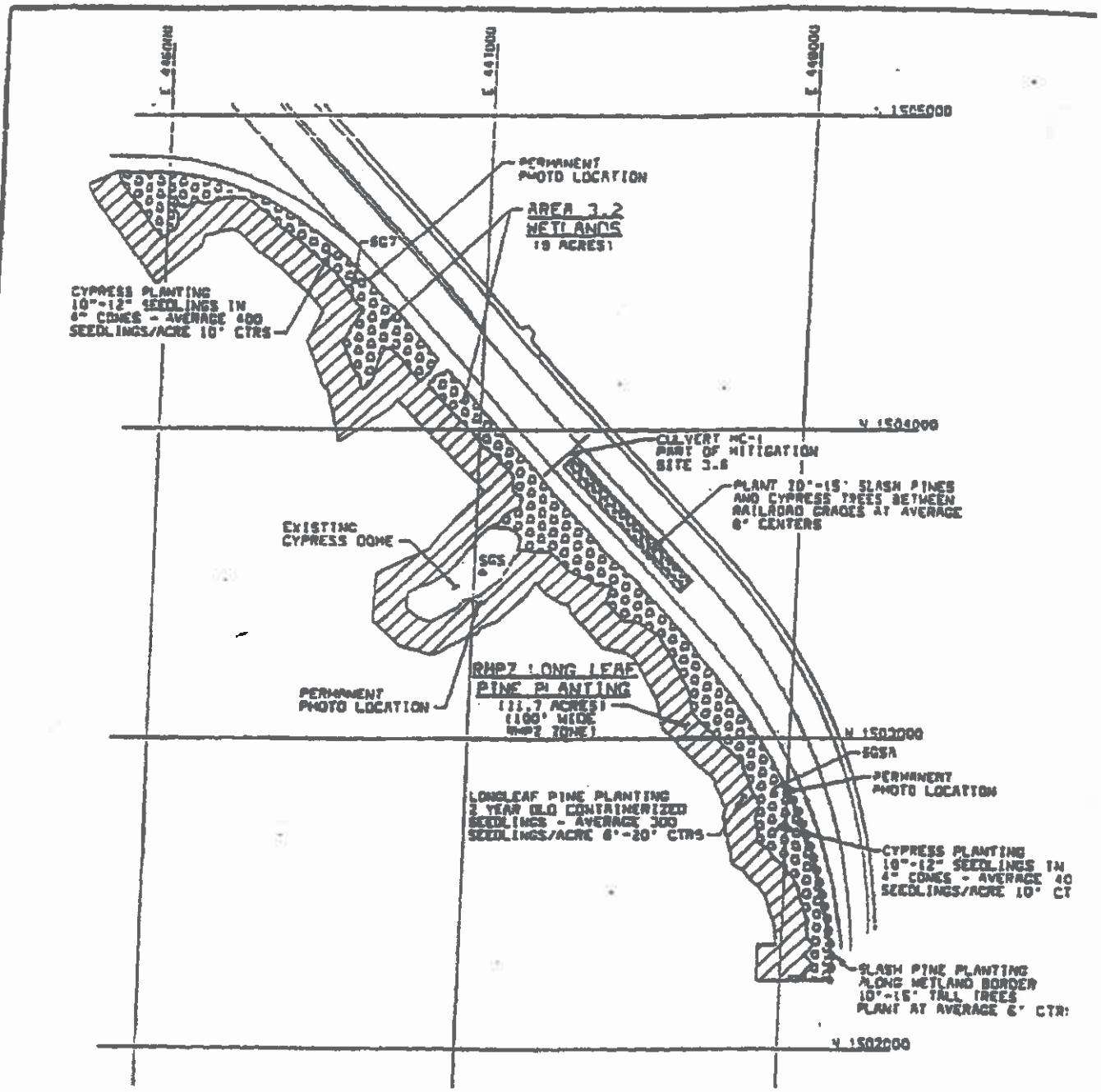

RAILROAD SOUTH (AREA 3.2)

CYPRESS AND SLASH PINE PLANTING, HYDROLOGIC ENHANCEMENT, RHP2 LONG LEAF PINE PLANTING, SJRWMD MITIGATION SITE

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0	02-22-93	INITIAL ISSUE				

ENGINEER | DRAWN

CHECKED | DATE

ORLANDO UTILITIES COMMISSION

STANTON ENERGY CENTER - UNIT 2

PROJECT | DRAWING NUMBER | REV

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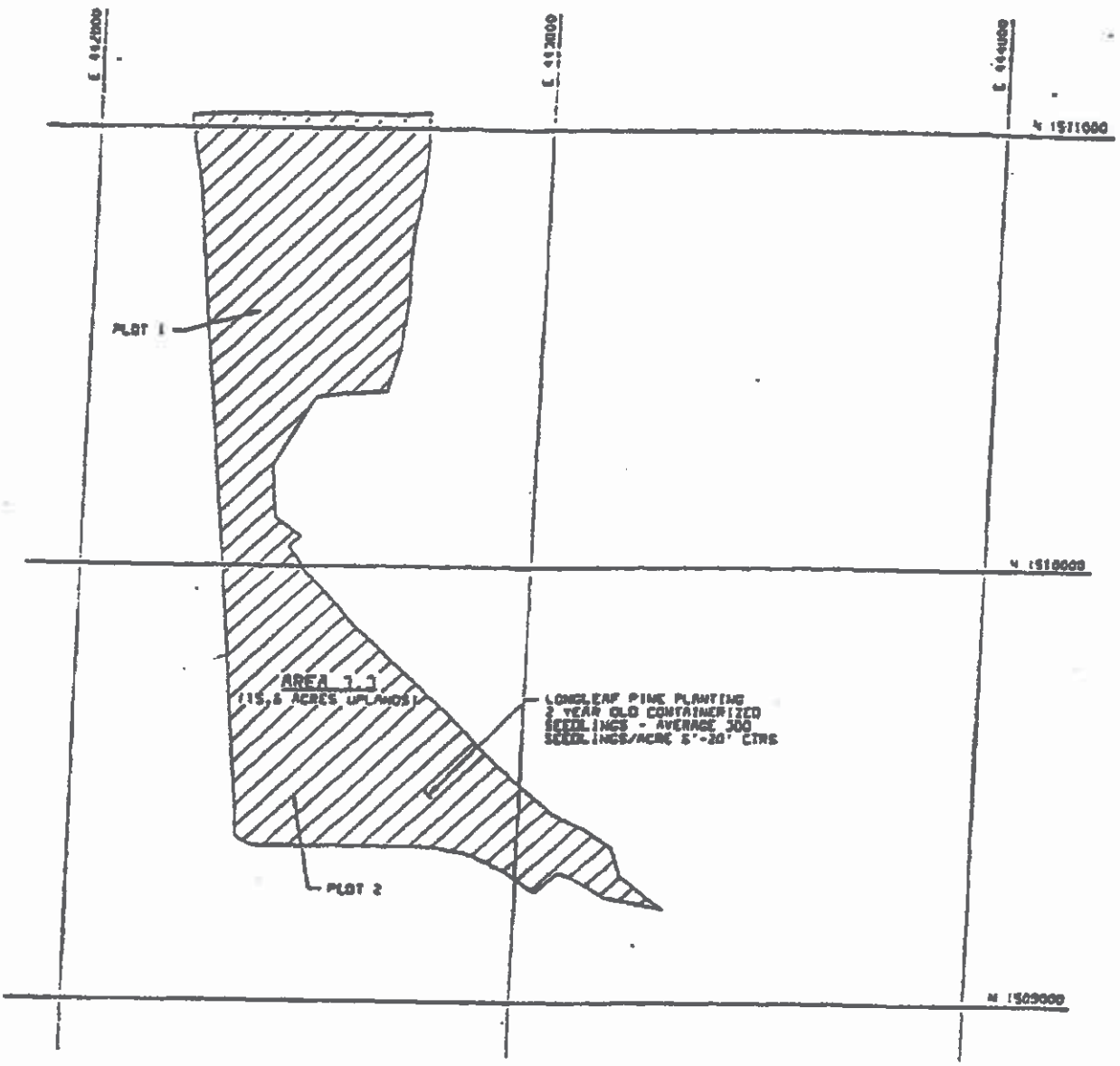

RCW WEST (AREA 3.3)
LONG LEAF PINE PLANTING

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0	02-22-93	INITIAL ISSUE				

ENGINEER | DRAWN JNS | CHECKED | DATE

ORLANDO UTILITIES COMMISSION
STANTON ENERGY CENTER - UNIT 2

PROJECT | DRAWING NUMBER | REV 1

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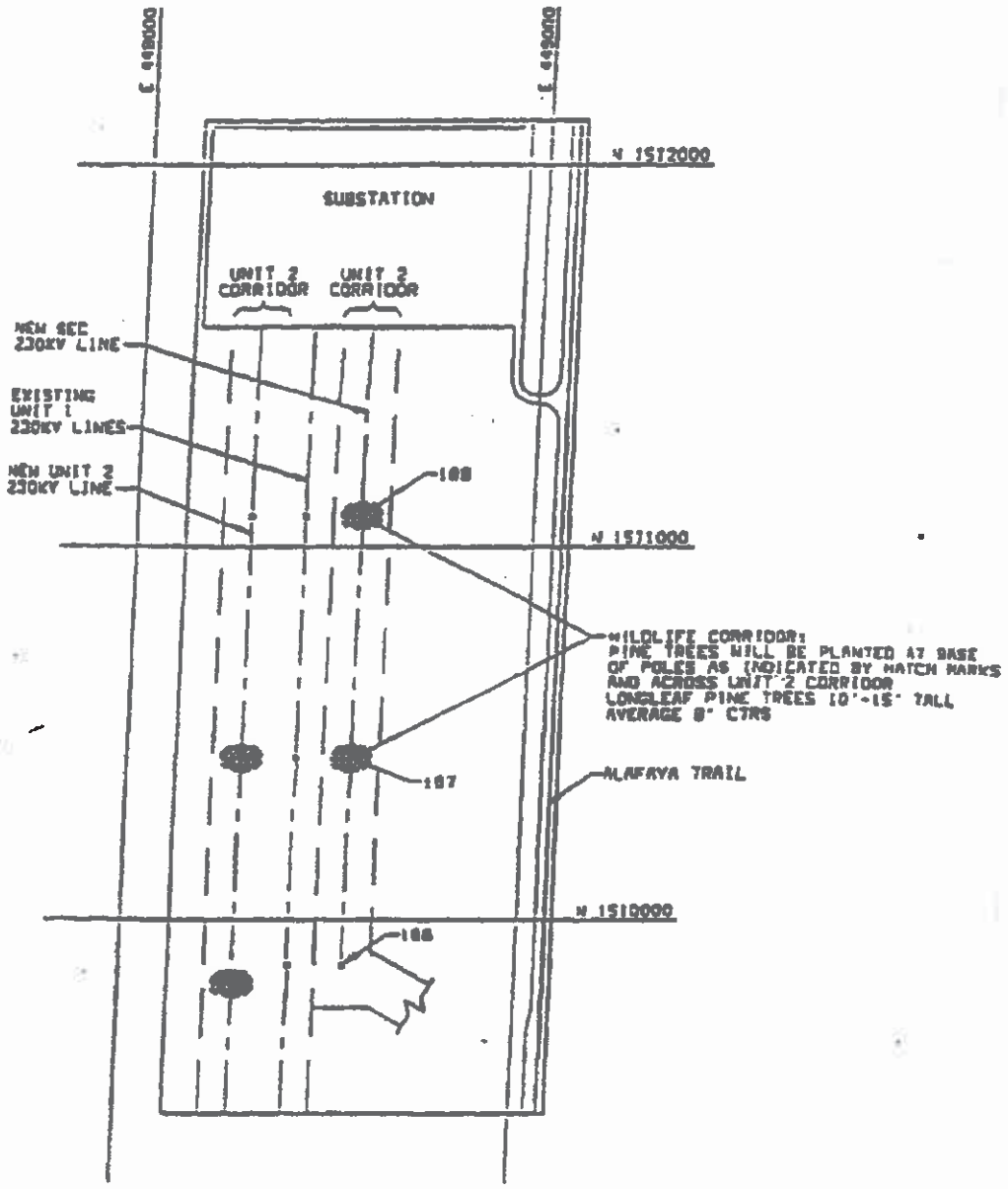

TRANSMISSION LINE NORTH (AREA 3.4)

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ENGINEER | DRAWN JNS | CHECKED | DATE

ORLANDO UTILITIES COMMISSION
STANTON ENERGY CENTER - UNIT 2

PROJECT | DRAWING NUMBER | RE

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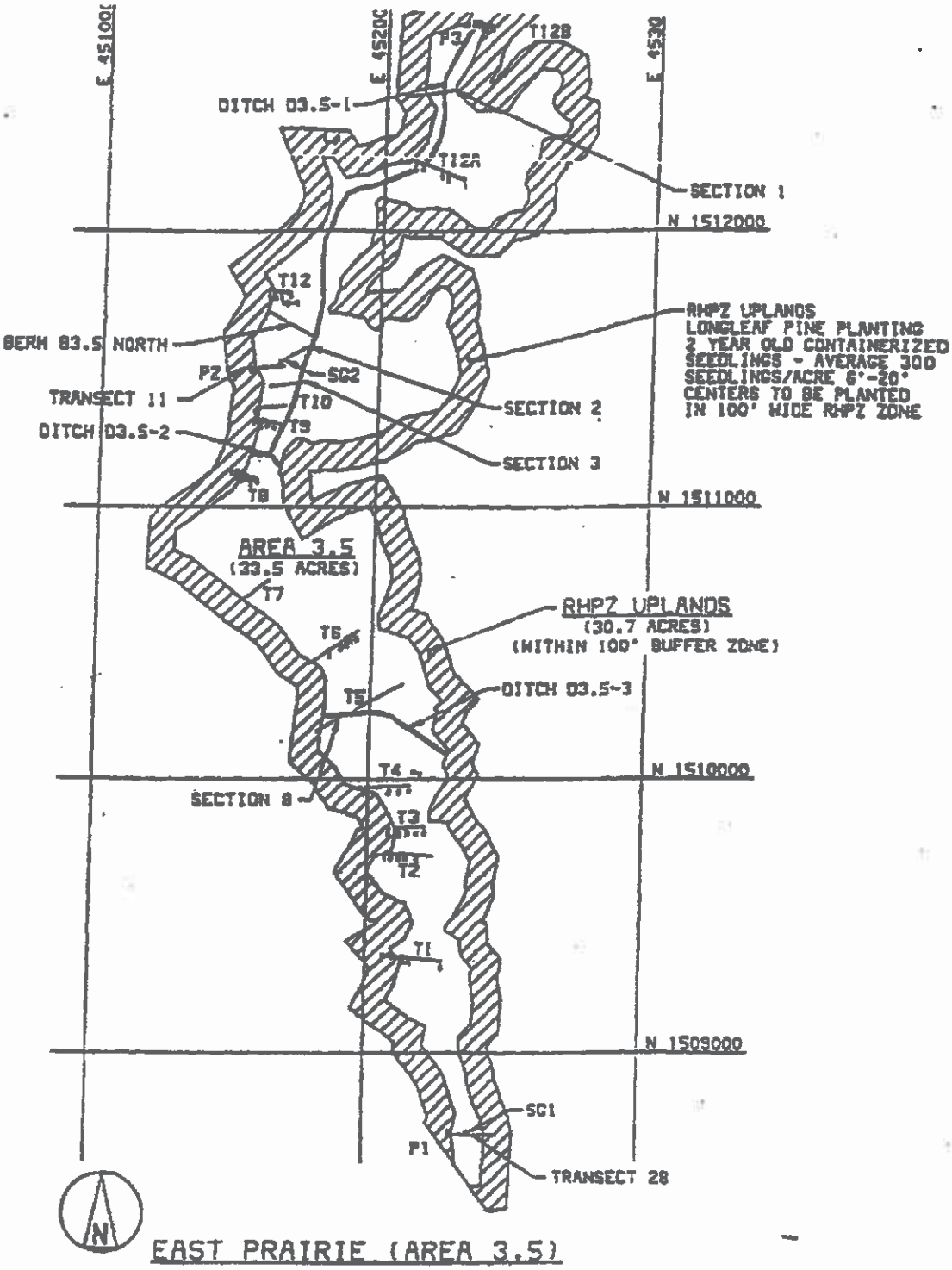

EAST PRAIRIE (AREA 3.5)

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ENGINEER | DRAWN | CHECKED | DATE

ORLANDO UTILITIES COMMISSION
STANTON ENERGY CENTER - UNIT 2

PROJECT | DRAWING NUMBER | REV 2

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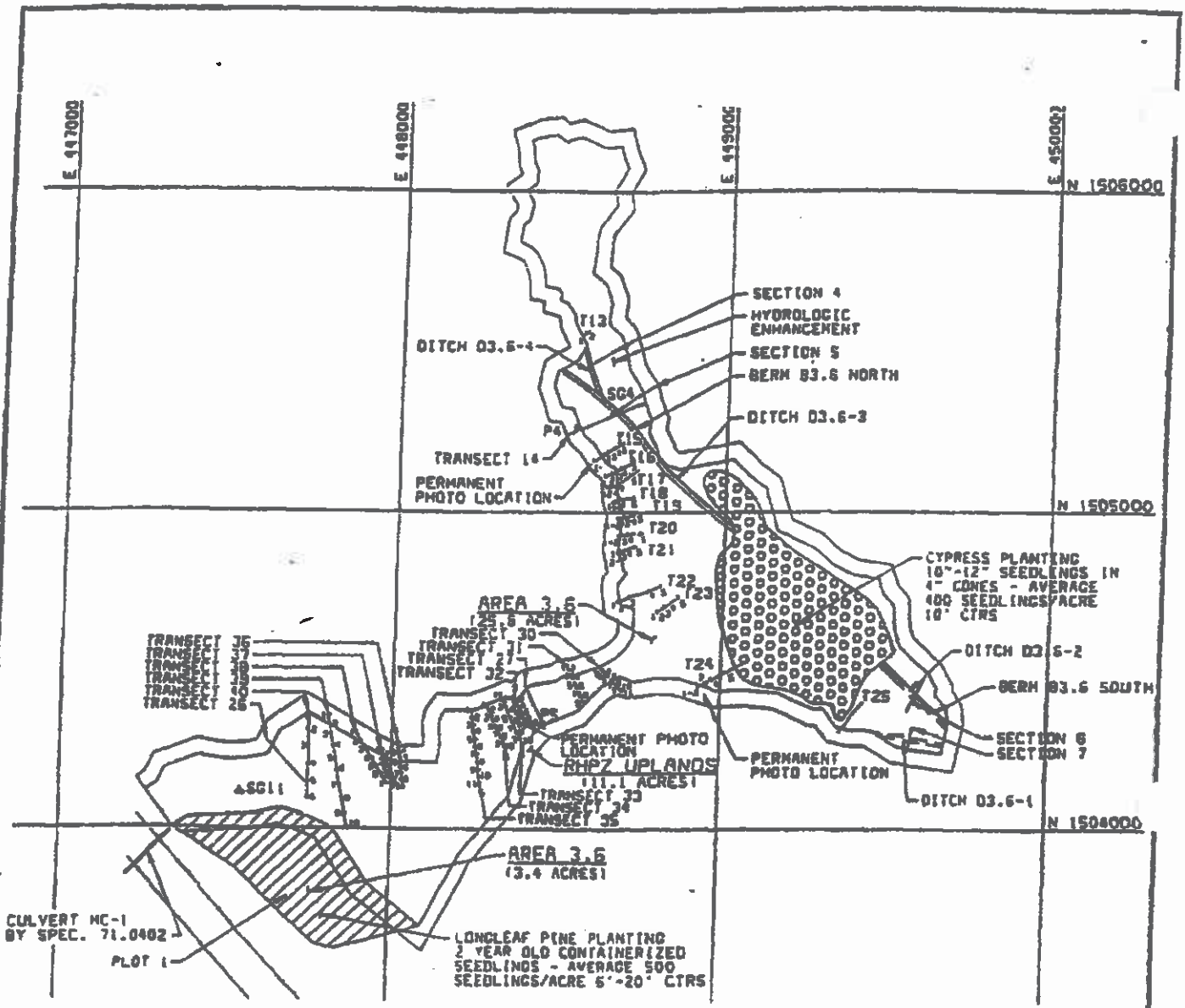

RCD (AREA 3.6)

NOTES:

ALL DITCHES SHOWN TO BE FILLED, ALL BERMS SHOWN TO BE REMOVED.

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4	06-11-93	REVISED PER FDER COMMENTS				
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1	04-05-93	REVISED PER FDER COMMENTS				
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ENGINEER | DRAWN

CHECKED | DATE

ORLANDO UTILITIES COMMISSION
STANTON ENERGY CENTER - UNIT 2

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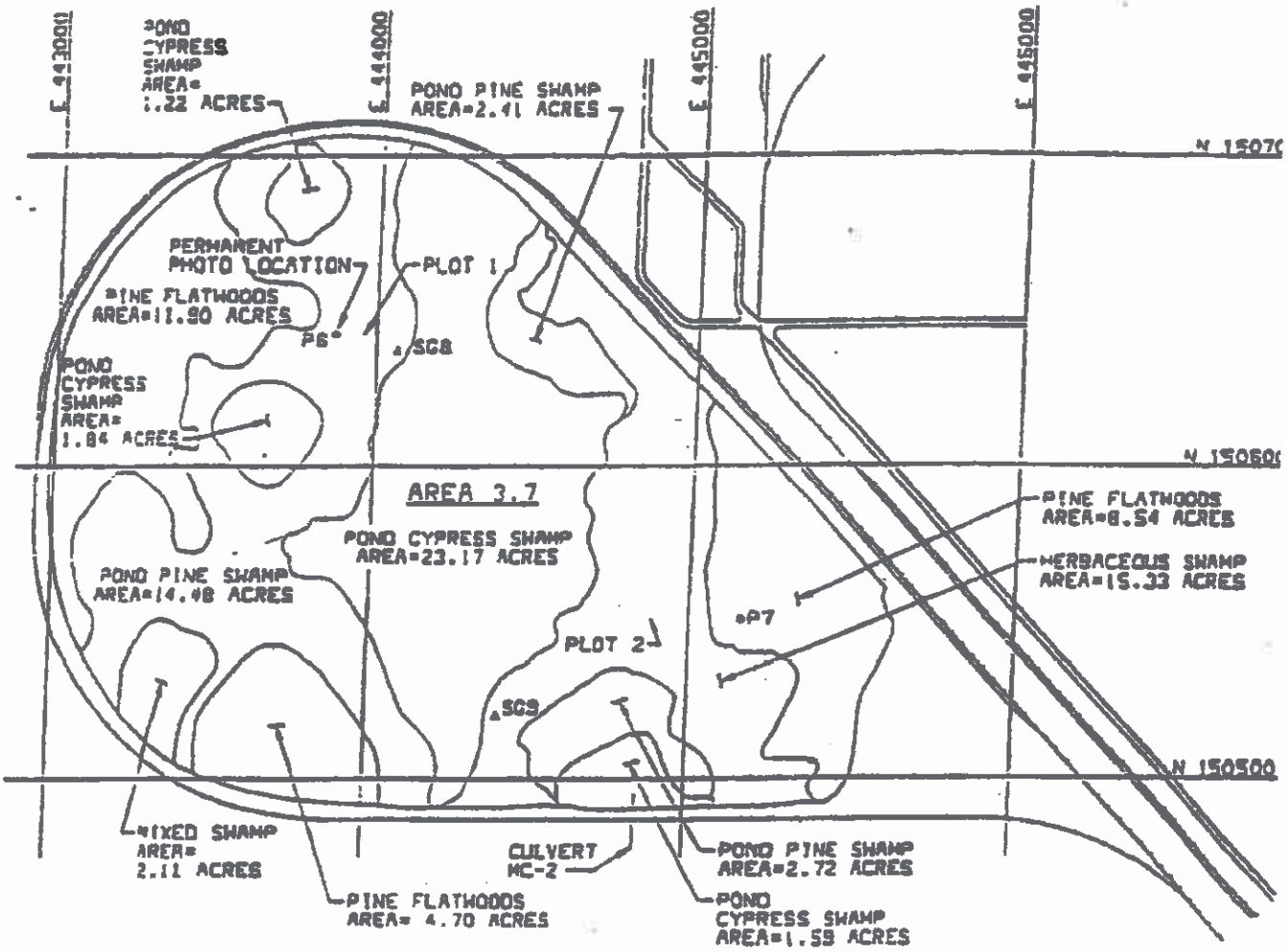

RAILROAD LOOP (AREA 3.7)

(HYDROLOGIC ENHANCEMENT)
SFWMD MITIGATION AREA

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ENGINEER | DRAWN
CHECKED | DATE

ORLANDO UTILITIES COMMISSION
STANTON ENERGY CENTER - UNIT 2

PROJECT | DRAWING NUMBER | REV 1

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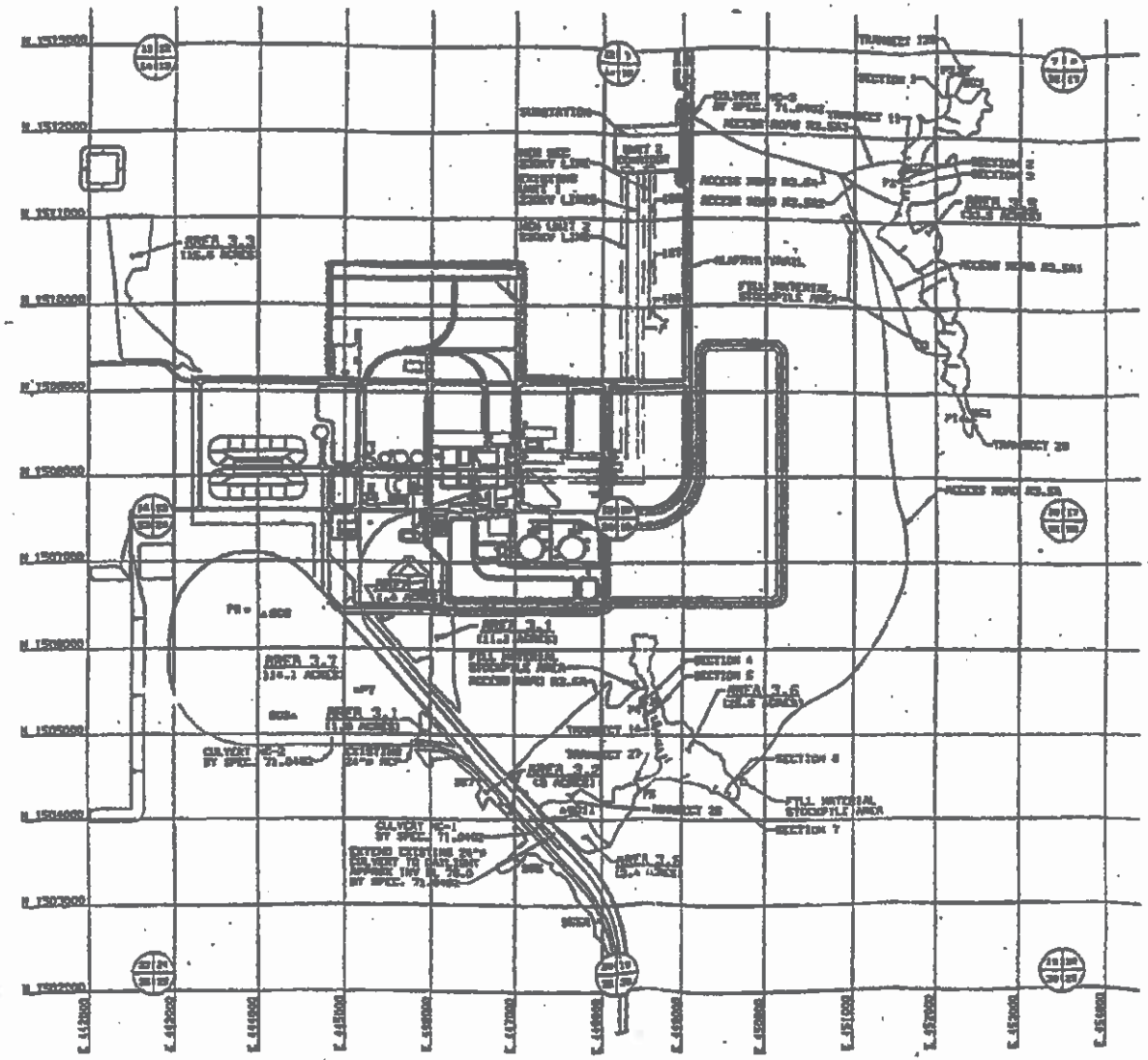

POST, BUCKLEY, SCHUH & JERNIGAN INC

MITIGATION SITE OVERALL PLAN

FIGURE 1

APPENDIX G

LOCATION OF

PERMANENT PHOTOGRAPHIC PLOTS

Orlando Utilities Commission
Stanton Energy Center Unit 2
Mitigation Monitoring Permanent Photo Locations

Mitigation Site	Location	Instructions
3.1 (North)	East end of cypress planting area; northern portion of area 20m south and 10m east of single mature pine tree	Panoramic photos including cypress planting area
3.1 (South)	Southern end of mitigation area, south of cypress dome; longleaf pine planting area	Panoramic photos including pine planting area
3.2 (North)	On RR berm, 13.5m east of staff gauge S7	Panoramic photos of cypress planting area
3.2 (Cypress Dome)	On wetland border aligned with transect across center of cypress dome, 23m south of staff gauge S2	Panoramic photos of pine planting area and cypress dome
3.2 (South)	On RR berm, 9m east-northeast of staff gauge 5A	Panoramic photos of cypress planting area
3.3	Northwest corner of site	Panoramic photos of pine planting area
3.3	Southwest corner of site	Panoramic photos of pine planting area
3.5 (North)	At transect 12B	Panoramic photos generally facing south, taken from filled ditch
3.5 (South)	At transect 5	Panoramic photos taken from west end of transect
3.6E (North)	At transect 15	Panoramic photos taken from west end of transect
3.6E (South)	At transect 24	Panoramic photos taken from west end of transect
3.6	Near piezometer 5	Panoramic photos facing into wetland enhancement area
3.7	Near piezometer 6	360° Panoramic photos
3.7	Near piezometer 7	360° Panoramic photos

ATTACHMENT 5

The Curtis H. Stanton Energy Center Red-cockaded Woodpeckers Habitat Management Plan, Dated July 8, 2005, Revised March 2006

Appendix 4

THE CURTIS H. STANTON ENERGY CENTER, RED-COCKADED WOODPECKERS HABITAT MANAGEMENT PLAN

Prepared By:

DeLotelle and Guthrie, Inc.
1220 S. W. 96th Street
Gainesville, Florida 32607

July 8, 2005
Revised March 2006

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EXECUTIVE SUMMARY

The red-cockaded woodpecker (*Picoides borealis*), a state listed species of special concern and federally listed endangered species, was first observed on the proposed Curtis H. Stanton Energy Center (SEC site) in 1980. During the early 1980s, nine occupied clusters (roosting habitat) were found on the SEC site while 16 occupied clusters occurred in other areas north of the Bee Line Expressway. Presently, there are 13 occupied clusters remaining north of the Bee Line Expressway plus 10 other occupied clusters located on the TM-Ranch about 4 miles southeast of the SEC site. Six occupied clusters currently remain on the SEC site.

Orlando Utilities Commission (OUC) prepared and implemented a red-cockaded woodpecker management plan and monitoring program in 1981 to improve the chances of long-term survival of the species on the SEC site. The 1981 plan plus updates in the 1993 plan, consisted of both a regular prescribed burning program and monitoring activities studying red-cockaded woodpecker habitat use and demographics (DeLotelle and Guthrie and Black & Veatch, 1993 and DeLotelle and Epting 2000). In 1993 as part of the mitigation program for Unit II construction, the original 1981 Red-cockaded Woodpecker Management Plan was revised to incorporate new developments in management strategies for the mesic longleaf pine ecosystem (Black & Veatch and DeLotelle and Guthrie, Inc., 1992). The 1993 management plan contained most elements of the 1981 plan with additional plans for wetland restoration and planting of cypress trees (*Taxodium distichum*) in selected areas. Longleaf pine (*Pinus palustris*) was planted in selected upland areas for future foraging habitat. The revised monitoring plan of 1993 called for evaluating red-cockaded woodpecker survival, fledging success, and other demographic factors.

The following mitigation and enhancement plan is proposed to offset losses in mitigation areas from the gas pipeline installation in the southern utilities corridor and from the removal of planted pine along the northern transmission line corridor between the substation and Pope Road. OUC will be implementing additional measures above the practices outlined the 1981 and 1993 reports to aid in increasing the number of red-cockaded woodpecker clusters on the SEC site and ultimately to enhance the viability of the Orange County red-cockaded population. These actions include a cluster creation

project, exotic species removal, and bird translocation. Cluster creation will consist of constructing three artificial clusters each with four artificial cavities plus augmentation in each of six occupied clusters as needed. The artificial clusters will be developed in historic cluster sites and will have enhanced habitats after the removal of nuisance plants and mid-story shrubs. If natural dispersal is unsuccessful, bird translocations will be performed.

1.0 INTRODUCTION

As part of the Conditions of Unit I Site Certification Agreement (SCA), specifically conditions XXXI, Orlando Utilities Commission (OUC), Florida Municipal Power Agency (FMPA), and Kissimmee Utility Authority (KUA), agreed to manage approximately 2,000 acres of the Curtis H. Stanton Energy Center (SEC) for the benefit of the on-site, red-cockaded woodpeckers (*Picoides borealis*). These conditions were carried forward as a condition for the construction of Unit II. OUC prepared and implemented a management plan and monitoring program in 1981 and updated it in 1993, namely The Red-cockaded Woodpecker Management Plan, to improve the chances of long-term survival of the species on the SEC site (OUC, 1981 and 1993 update). In addition, OUC funded planting programs; as detailed in The Joint Agency Mitigation and Monitoring Plan (JAMMP), which were designed to mitigate wetland and upland impacts associated with the construction of the Unit II transmission line and alternate access road.

Since the development of these plans, advances have been made in the knowledge of on-site and regional red-cockaded woodpecker populations as a result of studies primarily supported by OUC. Other knowledge gained about the species requirements have led to changes in some management practices, e.g., the Red-cockaded Woodpecker (*Picoides borealis)* Recovery Plan: Second Edition, 2003. Accordingly, the 1981 and 1993 Red-cockaded Woodpecker Management Plan will be revised to reflect these new management practices.

This following update reflects recent changes in red-cockaded woodpecker management strategies and addresses the mitigation requirements of the Unit 2 Conditions of Certification (COC) as provided in the JAMMP. This plan will also detail compensation measures for the loss of the mitigation pine planting areas of longleaf pine both in the certified north/south, associated, facilities corridor and under the transmission line between the substation and Pope Road. These actions include:

(1) a statement of the habitat function and description provided for the managed area;

(2) a schedule of fire management utilizing a Florida State Certified Burn Specialist, that includes a description of burn conditions, burn frequency, and measures taken to avoid the spread of wildfire;

(3) measures to eradicate exotic vegetation from both wetlands and uplands;

(4) other enhancement activities such as ground cover enhancement, artificial cavity augmentation, and bird translocations; and

(5) persons and/or the company responsible for the management plan.

1.1 Overall Project History

Certification studies commencing in 1980 for the SEC site included the evaluation of endangered and threatened wildlife species. Several endangered and threatened wildlife species including the red-cockaded woodpecker occurred on-site and in surrounding habitats. During the initial field surveys, nine occupied clusters were observed on-site with an additional 16 occupied clusters located off-site in the northern area of the Big Econlockhatchee Basin (Big Econ). Prior to the initial SCA in 1982, red-cockaded woodpeckers were not known to occur in the area. In response to discussions with the Florida Fish and Wildlife Conservation Commission (FFWCC, formerly Florida Game and Fresh Water Fish Commission [FGFWFC]) and the U. S. Fish and Wildlife Service (FWS), a management plan and long-term monitoring program for red-cockaded woodpeckers were developed as part of the informal review for SEC I (DeLotelle and Newman 1981). Because of mitigation actions and new developments in management strategies for the mesic longleaf pine ecosystem, the original 1981 Red-cockaded Woodpecker Management Plan was revised in 1993 during the certification process for SEC II. On-site groups were studied continuously as part of the monitoring program with additional groups in surrounding areas studied during the certification process for SEC I & II and for other projects in the Big Econ basin.

1.2 Unit I History

OUC initiated discussions with the FGFWFC and FWS in 1980 to develop mitigation and management options that minimized impacts of Unit I construction on red-cockaded woodpeckers. OUC made major siting changes during the site design phase including both the 1) relocation of the make-up water supply pond and solid waste disposal area and 2) a complete rotation of the entire power block and associated facilities from a north to south orientation to an east-west alignment. These mitigation procedures were implemented to avoid cavity trees and to protect the higher quality pine habitat. Such actions resulted in increased cost; but, less impact on the red-cockaded woodpecker habitat.

In addition, the 1981 Red-cockaded Woodpecker Management Plan was developed in consultation with the FGFWFC and FWS as part of the Unit I SCA for the Florida Department of Environmental Regulation (FDER). The objectives of the 1981 management plan were to:

(1) identify the distribution and abundance of red-cockaded woodpeckers in the area;

(2) map and determine the status of existing clusters and cavity trees on-site as well as in the surrounding areas;

(3) map potential cluster sites and foraging habitats on-site;

(4) develop a fire management schedule for the mesic longleaf pine flatwoods ecosystem in the undeveloped portions of the site; and

(5) propose a long-term monitoring plan for the site's red-cockaded woodpeckers.

As stipulated in Condition XXXI for the Certification of Unit I, the Red-cockaded Woodpecker Management Plan will be implemented for the life of the facility on about 2,000 acres of longleaf pine flatwoods. The life of the SEC site can be expected to extend well into this century. Approximately, 1100 acres of the site was dedicated to power plant related activities, including additional Units II, III, and IV.

1.3 Unit II Project Description

Unit II at the SEC site involved the construction of an additional coal-fired, steam electric generating unit and associated facilities. Unit II required nine acres of previously cleared and graded land located immediately north of the SEC Unit I facility. Unit II also included a 14-mile long, 230 kV transmission line and a two-mile long, alternate access road. Both the transmission line and alternate access road were located in the certified north/south associated facilities corridor. The selected route was chosen specifically to have as little impact as possible on both upland and wetland communities. The transmission line runs south from the on-site substation, parallels the northern, eastern and southern side of the make-up water supply pond, extends south across a cleared area, and then proceeds southeasterly along the railroad spur within the certified associated facilities corridor. The alternate access road parallels the eastern side of the existing railroad from the southern edge of the power block near the coal handling facility to the Bee Line Expressway, about 2 miles to the south.

The alternate access road was constructed first and had minor impacts on red-cockaded woodpecker habitat (DeLotelle and Guthrie, Inc and Black & Veatch, 1993). Together, the transmission line and alternate access road impacted about 80 longleaf pine trees in red-cockaded woodpecker territories on the SEC site; however, none of the impacts were to cavity trees.

As a result of anticipated impacts from Unit II construction to uplands and wetlands, the JAMMP was developed to enhance wetland and upland areas in the managed area on the SEC site (Black and Veatch and DeLotelle and Guthrie, Inc., 1992). The plan called for extensive planting of longleaf pine in upland habitats, planting of slash pine (*P.elliotii*) in the associated facilities corridor, and planting of pond cypress (*Taxodium distichum*) in wetlands. Longleaf pines were to be planted in selected areas to promote flight corridors for passage across cleared transmission line/railroad corridors. Ditch filling, contouring, and other restoration efforts restored the historical hydroperiods of several wetland systems. Several dirt roads were maintained to improve access to the mitigation sites. These mitigation access roads were selected so as not to impact mitigation sites, cavity trees, or the flatwoods ecosystem and ran along existing woods roads. Monitoring of the mitigation activities specified in the JAMMP was performed annually by OUC.

1.4 Unit II Impacts and Further Habitat Loss

Mitigation lands for Unit II construction included planting areas for longleaf pine and pond cypress, as well as ditch plugging areas for wetland enhancement on the SEC site. Mitigation for red-cockaded woodpeckers in the form of pine tree planting occurred in several areas, including strips along the transmission line corridor to the north and the access corridor south of the main facility at the SEC site (Figure 1). These tree-planting areas were created to provide pine habitat for crossing the access corridor by red-cockaded woodpeckers and other wildlife. Several of these pine tree-planting areas were removed during the construction of a permitted gas pipeline along the southern access corridor and (see Figures 2 and 4) all planted pine trees under the transmission line in the northern corridor were removed or are planned for removal. In the north corridor, the planted trees had grown to a height where OUC viewed the failure of the transmission line as imminent and had OUC maintenance department remove, on an emergency basis, several patches of planted trees that were the greatest threat. OUC determined that all planted pines along the northern corridor are potential hazards to the transmission lines and are to be removed. These areas were planted as a result of mitigation for loss of natural pine habitat from the construction activities for Unit II. The following update and enhancement activities are proposed to offset losses in mitigation areas from the existing and pending removal of planted pine in both the gas pipeline and the northern transmission line corridors.

1.5 Land Management Perspective

During the early-to-late 1900's the SEC site was managed for cattle, timber, and hunting. During this period, the local landowners or lessees conducted winter prescribed burns, including the years of 1980 and 1982. OUC's fire management schedule for the SEC site was implemented after construction of Unit I and included control burns over the entire site continuing through 2004. Six controlled burns have been conducted during this monitoring period by OUC. Since the property was purchased by OUC, other activities in most of the management area have generally been restricted; thus, good conditions have been maintained for continued development of the longleaf pine ecosystem and enhancement of red-cockaded woodpecker habitat.

Although still a problem during fire activities, saw palmetto (*Serenoa repens*) seems to be less abundant and the wiregrass community more extensive than during pre-construction monitoring. As a result of the fire management practices, several good recruitment classes have occurred since 1982 and longleaf pine regeneration in the managed area is greater than prior to 1984. Many former sparsely treed areas now include a well established, younger-age class of longleaf pine. Other areas on-site still have a much-reduced density of longleaf pine from historical timber management practices. Habitat conditions on the SEC site appear to be similar to other non-disturbed portions of the Big Econ basin (Brown et al., 1989); however, the site includes a much greater percentage of older aged longleaf pine than most of the surrounding areas. The TM-Ranch, about eight miles to the southeast, is the obvious exception and includes many old longleaf pines and consequently a red-cockaded woodpecker population similar to the SEC site.

In addition to habitat management, numerous monitoring studies have been conducted on the SEC site since 1980. To date, the following studies have been conducted:

(1) reproductive studies, annually 1980-2004;

(2) area wide population monitoring studies in addition to the above in 1981, 1983, 1986, 1988, and 1995-2004;

(3) home range, habitat evaluation and use, and territory size studies in 1981-84 and 1986-87;

(4) population turnover studies, annually from 1980-2004; and

(5) cavity tree use studies, annually 1980-2004.

(6) population status in areas north of the Beeline Expressway was determined through 2004.

FIGURE 1. Location of Red-cockaded Woodpecker Clusters in East Orange County, OUC, Orlando, Florida, 2005

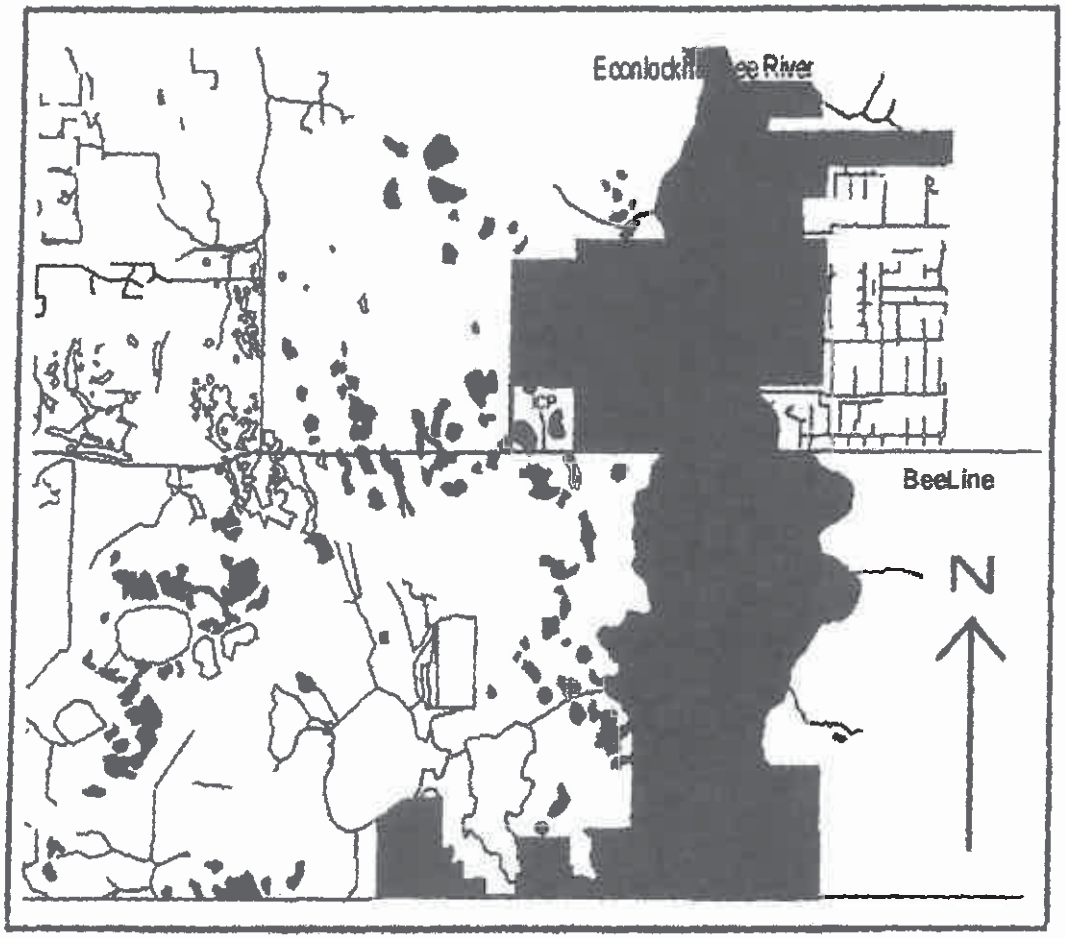
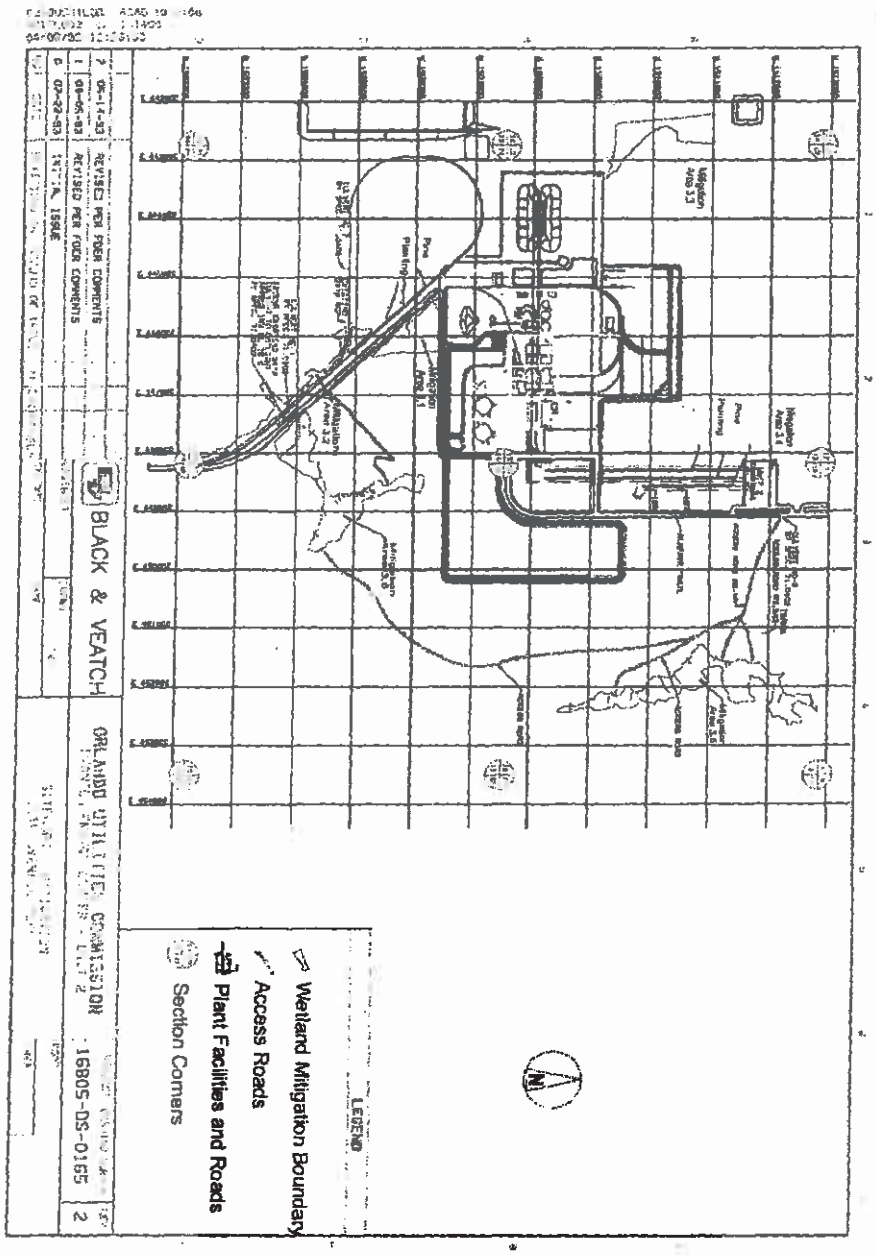


Figure 2. Location of Mitigation Areas and Pine Tree Planting Areas for Unit II Construction, SEC, OUC, Orlando, Florida, 2005



Data from these studies have contributed substantially to the knowledge of the biology and habitat requirements of the red-cockaded woodpecker. The findings and published literature from these studies have been used for development strategies on other projects in the area and by the FWS in the producing habitat protection guidelines for the red-cockaded woodpecker in the southeast United States and central Florida (See Red-cockaded Woodpecker Recovery Plan, 2003).

2.0 HABITAT AND POPULATION STATUS

The primary goal of the management and enhancement plan as described in Sections 3.0 and 4.0 of this report is to maintain and improve conditions capable of supporting red-cockaded woodpeckers on the SEC site. The following section describes the habitat within the red-cockaded woodpecker management area and provides a broad overview of the current population status on the SEC site in relation to the total red-cockaded woodpecker population in the area.

2.1 Habitat

Habitat within the red-cockaded woodpecker management area on the SEC site consists of mesic longleaf pine flatwoods, cypress domes and strands, bayheads, wet prairies and xeric oak scrub. Mesic longleaf pine flatwoods occur throughout north and central Florida southward to near Lake Okeechobee. Uplands within the management area have an overstory dominated by longleaf pine. The overstory in the wetter habitats often includes pond pine (*P. serotina*) and a few slash pines in scattered areas. The shrub layer in the flatwoods consists of saw palmetto, stagger bush (*Lyonia fruticosa*), fetterbush (*L.lucida*) and gallberry (*Ilex glabra*). The open pine canopy allows the development of a rich savannah-like ground cover of herbaceous species (Myers and Ewel, 1990) including wiregrass species (*Aristida stricta* and *A. spiciformis*), beakrush (*Rhynchospora fascicularis*), and bluestem (*Andropogon virginicus*) (DeLotelle and Guthrie 2000).

Longleaf pine density is generally low within the management area, averaging about 10,051 stems per territory (Table 1). Nesting home ranges contain a mean of 4,237 pine stems, with a mean diameter-at-breast-height (dbh) of 9 inches. Pine stands in territories average 50 stems/acre with a weighted mean age of 55 years. The average pine basal area per territory is 2,961 square feet, which includes about 3,401 stems with a minimal 9-inch, dbh. Tree heights reach up to 50 feet with those over 90 years-of-age averaging 38.4 feet. The most abundant age class (30-40 years) averages 31.5 feet in height. Although the data has been partially updated since 1980, no complete sampling of pine stand densities and age profiles has been conducted recently.

TABLE1. Population and Habitat Characteristics for Eleven Groups of Red-cockaded Woodpeckers on the 2,000-acre management area at the SEC site, Florida, 2005

Group ID	Group Size*	Mean Reproduction All Years	Mean Reproduction 2000-2004	N =Years	Pine Basal Area (FT^2)	Total Pine Stems**	Territory Size (Acres)
+A	2	1.33	0.00	3	3,551	14,709	383
+B	2	1.00	0.00	1	3,131	13,547	363
++C	3	0.80	0.00	4	2,195	8,818	251
++D	3	1.00	0.00	5	2,593	8,733	261
C/D	3	0.95	2.00	19	3,195	8,366	236
E	3	0.92	2.25	24	4,333	13,490	299
F	2	1.00	1.25	24	3,177	10,418	255
G	2	1.00	1.00	24	2,673	6,452	215
H	3	1.00	1.00	24	2,465	6,317	234
+I	3	1.30	0.00	9	3,778	10,961	239
#X	2	0.93	0.25	19	2,163	10,237	398
On-Site Average	2.55	1.02	1.38	14.3	3,023	10,211	285
Off-Site 13Groups	2.44	1.11	1.34	6.1 45 Group Years	-	-	-

* *Predominant group size during the breeding season for the study period.*
** *Includes all pine stems more than three inches in diameter at breast height in each territory.*
\+ *Territories were abandoned prior to the end of the study period.*
++ *Territories and groups combined during 1986.*
\# *Territory abandoned in 1981 and occupied again in 1986.*

2.2 Study Area

The OUC site is approximately 3,280 acres and is located 8.5 miles southeast of Orlando, Florida in the Floridian section of the Atlantic Coastal Plain. Approximately 1100 acres are dedicated to power generation and associated facilities while the remaining 2000 acres are set-aside for the RCW management area. Situated in eastern Orange County, the site is in the Big Econ Basin between the Little and Big Econ Rivers and south of U.S. Highway 50. The Big Econ Basin is approximately 950 square miles. The Big Econ flows from south to north and water quality is good while that of the Little Econ is poor (Brown *et al.* 1989). Surface drainage of the SEC site flows easterly toward the Big Econ via the Hart and Cowpen Branches and an unnamed tributary (Figure 3). These are head water streams to the Big Econ and have had portions of their drainage impacted by pre-SEC construction of swells, ditches, and fire lanes to promote more rapid drainage and to control both wild and prescription fires. Uplands

account for about 87 % and wetlands (Figure 4) about 13% of the 2000-acre red-cockaded woodpecker management area on the SEC site.

The 2000-acre management area on the SEC site occurs in the mesic longleaf pine flatwoods within the Big Econ Basin. Most central Florida flatwoods have lower pine densities than north Florida flatwoods (Shapiro 1983, DeLotelle *et al.* 1983, Bowman *et al.* 1997, Myers and Ewel 1990). Because of the flat topography and the underlying organic hardpan, these central Florida flatwoods often have standing water during most of the wet season. Numerous shallow depressions that retain much of the rainfall during the summer months are present. These interconnected depressions, aligned in a north-south direction provide natural drainage for the Basin during the wet season, although they are usually dry during the spring and fall. Hydroperiods of these depressions are sufficient to have allowed cypress (*Taxodium distichum var. nutans*) forests and wet prairie vegetation to develop. Scrubby flatwoods also occur in the Basin on slightly elevated ridges. These interspersed mesic longleaf pine and scrubby flatwoods along with scrub-oak communities are found in a southeasterly direction along an unnamed sand ridge from just past Yeehaw Junction down to within several miles of Fort Drum, Florida.

The over-story of these flatwoods consists almost entirely of longleaf pine. Many age classes are represented in the Econ Basin with several trees greater than 170 years of age. A few pond and slash pines occur near wetlands. The shrub layer includes saw palmetto, stagger bush, fetterbush, and gallberry. The open pine canopy promotes the development of a rich savannah-like ground cover of herbaceous species (Myers and Ewel, 1990) including wiregrass, lopsided Indian grass (*Sorghastrum secundum*), beakrush, and bluestem. The scrubby flatwoods includes a shrub layer of myrtle oak (*Quercus myrtifolia*), sand live oak (*Q. geminata*), and tarflower (*Befaria racemosa*) while the ground cover contains many of the same species as the pine flatwoods.

Figure 3. **Aerial Photograph Showing Waterways on the SEC and Surrounding Areas, OUC, Orlando, Florida, 2005.**

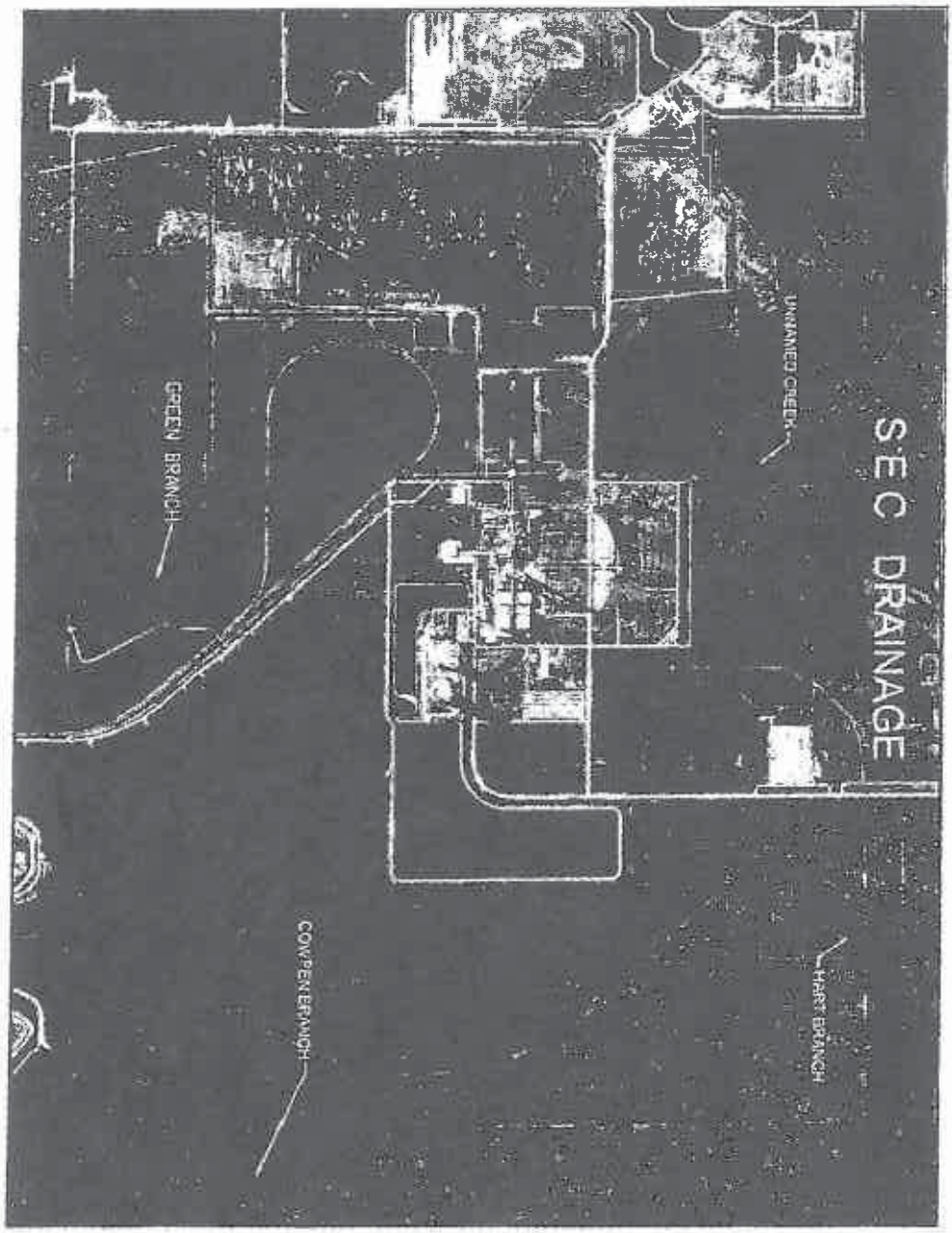
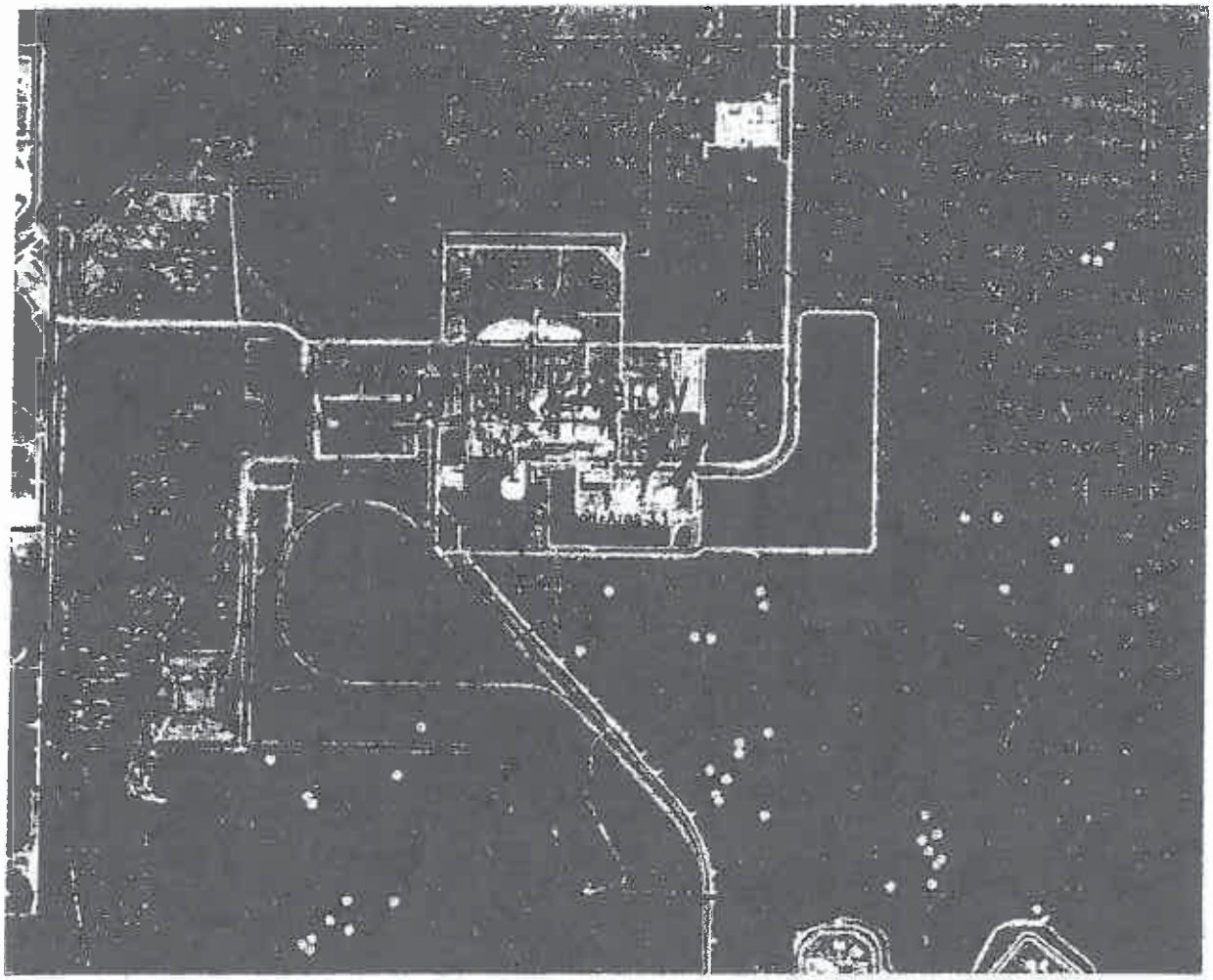


Figure 4. Aerial Photograph Showing Cluster and Artificial Cluster Locations and Major Vegetation types on the SEC and Surrounding Areas, OUC, Orlando, Florida, 2005.



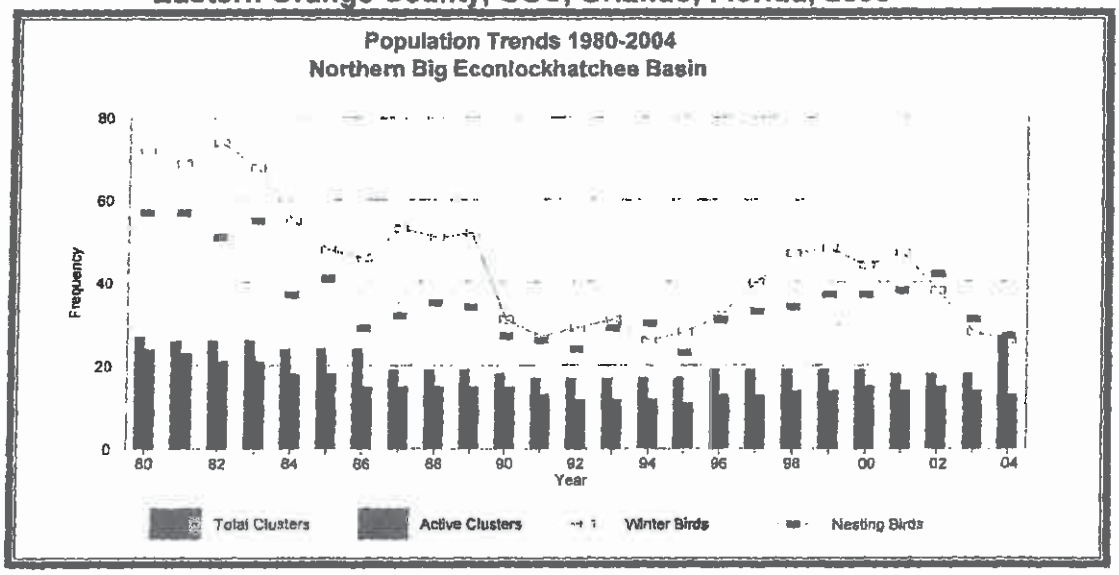
These central Florida flatwoods were historically used for timber, turpentine production, and cattle grazing (Myers and Ewel 1991). These activities had a profound and lasting affect on this ecosystem, mainly as a result of the alteration of natural fire regimes and removal of pine seed sources. Fires were set in the fall and winter to stimulate growth of herbaceous plants for the cattle. This fire schedule, used until the development of the SEC site and purchases of the Hal Scott Preserve by the St. Johns River Water Management District and Orange County, affected pine recruitment in two ways. First, fall and winter burns often destroyed the pine seeds before they germinated or killed the young seedlings prior to development of their fire-resistant grass stage. Second, pine seeds require bare soil to germinate; however, the fall and winter fires cleared the herbaceous ground cover when pines were not dropping seeds. These alterations apparently caused some areas to experience slow pine regeneration. One upland area in the northwest section of the SEC site has had little pine recruitment since 1969 and has maintained a very low pine density; however, this may be due to other agricultural and industrial activities on the site. In other sections, densities in unlogged areas ranged up to about 500 trees per acre near riparian areas with density generally reduced away from wetlands and in logged areas. Prior to power plant construction, winter burns were set during 2-to-3 year intervals for range management purposes.

2.3 Population Status

The core population north of the Bee Line Expressway, which includes the red-cockaded woodpeckers on the SEC site, declined from 25 occupied clusters in 1980 to 11 by 1995, increased to 15 by 2000, and declined to 13 occupied clusters by 2004 (Figure 5). On the SEC site only three clusters were abandoned during this period; a reduction from nine occupied clusters in 1980 to six occupied clusters in 1993. Of the eight clusters north of the Bee Line Expressway that were abandoned, five were clear-cut or the foraging habitat was eliminated, and three were abandoned. Three of the most recent abandonment's apparently resulted from demographic factors, namely low reproduction and high adult turnover. Excluding the recent addition of artificial clusters on the Hal Scott Preserve, the ratio of occupied to abandoned clusters in the entire core population north of the Beeline Expressway has declined from 92% in 1980 to 72% by 2004.

The number of red-cockaded woodpecker groups in the northern Basin (Figure 4) declined (54.4%) from the early 1980s through the mid-1990s, increased in the late 1990s, but has declined precipitously since 2001 (Figure 5). The midwinter population including adults, fledglings, floaters, and helpers, declined by 64% from 1982-1991, increased during the late 1990s, but likewise declined during the early 2000s. Territories in these down years primarily contained mostly the resident breeders. Reductions in the number of breeding groups occurred during most of these down years: in the mid-1980s, the early 1990s, and the early 2000s.

Figure 5. Population Trends in the Red-cockaded Woodpecker Population in Eastern Orange County, OUC, Orlando, Florida, 2005

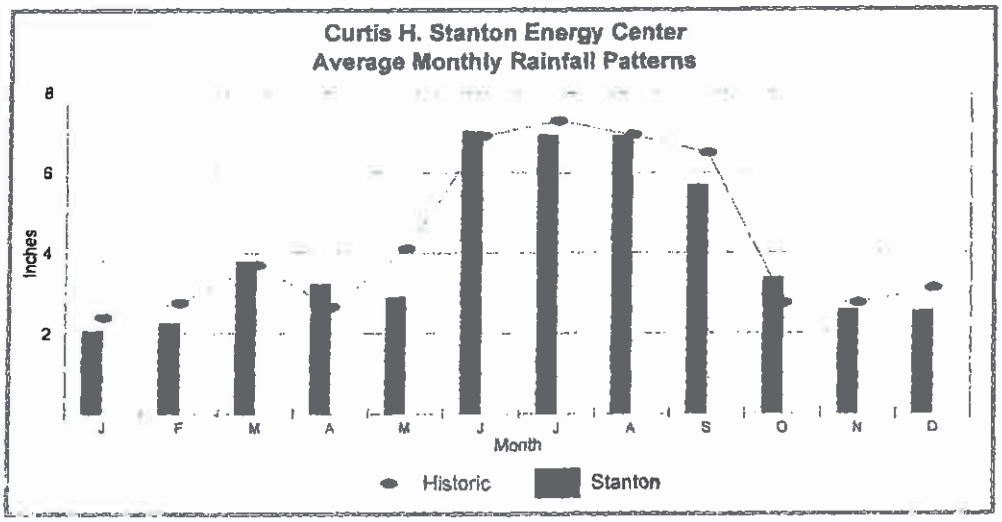


2.4 Weather

Central Florida has a humid, subtropical climate with an average rainfall of 51.2 inches per year. The interior, mid-peninsula of Florida often has more dry periods than north, south, or coastal areas (Jordan 1984). Yearly rainfall on the SEC site varied (range 37.4 to 64.5 inches per year) over the last 21 years averaging slightly less (50.03 inches) than the long-term yearly average. Ten of the 21 years were above the long-term average while 11 years were below historic averages. Slightly drier conditions (47.9 inches per year) existed from 1979 to 1990 while slightly wetter conditions

prevailed after 1990 (53.9 inches per year). Extremely dry years occurred in 1990 and 1993, and very wet years occurred in 1994 and 1997. More than half the annual rainfall (27.2 inches for the historic average and 27.0 inches for the SEC site) fell during the rainy season from June through September (Figure 6). Drought conditions often occurred during the early spring months (January through May, 14.5 inches of rain). Reviewing historic averages reveals the month of May was the most deficient in rainfall with April and October having the greatest surplus (Figure 6).

Figure 6. Summary of Average Monthly Rainfall on the SEC and Surrounding Areas, OUC, Orlando, Florida, 2005.



3.0 MANAGEMENT PRACTICES AND IMPLEMENTATION

3.1 Introduction

For the red-cockaded woodpeckers, restoration of good quality habitat is vital to the recovery of the species. Loss of habitat was primary among the original causes of decline. Generally, optimum habitat conditions for red-cockaded woodpeckers occur in open woodlands, which in the pine flatwoods of Central Florida equates to longleaf pine flatwoods/wire grass communities. The longleaf pine ecosystem is famous for its highly diverse groundcovers. In fact, this fire-dependent habitat contains nearly one quarter of all the plant species in North America. As the vegetation approaches the climax stage, the hardwood encroachment eventually results in the abandonment of clusters and population decline or extirpation. The longleaf pine ecosystem is a fire sub-climax stage maintained by regular fire intervals; frequent burning, regardless of the season, is paramount for continued maintenance of this community. Early to mid-growing season burning is optimum as it 1) promotes wiregrass, herbaceous flowering and seeding, and longleaf pine recruitment; 2) tends to decrease the abundance of hardwoods and shrub mid-story; and 3) has less damage to the herbaceous layer and soils than mechanical clearing. Late growing season (Oct. to Nov.) fire may have detrimental impacts on over-story pines and is not as effective in reducing mid-story rootstock or promoting native groundcovers as the early to mid-growing season burns. In fact, some research suggests that late dormant season (mid-Nov. to Jan.) burns may be more effective than late growing season burns in reducing hardwoods and restoring herbaceous groundcovers. When considering the establishment of the longleaf-wiregrass sere, it should be noted that as fuel loads accumulate, the intensity of the fire increases and optimum burning times are shifted towards the winter where cooler air temperatures and steadier weather patterns prevail thereby providing maximum fire control and minimal longleaf pine mortality.

This revision of the management procedures for the SEC site red-cockaded woodpecker management area is similar to the 1981 and 1993 management plans in that it focuses on protecting existing clusters and provides acceptable foraging areas within red-cockaded woodpecker habitats. The major activity necessary to promote a healthy red-cockaded woodpecker population is a burning program that maintains a vegetative structure of low grasses and herbaceous layer, little midstory, and a canopy

of longleaf pine. Exotic vegetation such as cogon grass (*Imperata cylindrica*) needs direct intervention for removal using herbicidal control. A species-specific control method will be developed to deal with the elimination of cogon grass and a report provided at the end of the second year of treatment. Patches with taller growth of saw palmetto will be controlled by mechanical means in selected areas and by a shortened burn rotation interval. A pine stand and habitat map will be developed based on aerial and field reconnaissance as described below. Following this assessment, an evaluation will be conducted every five years to assess all described habitat conditions and exotic species control. A yearly report on the red-cockaded woodpecker population and a five-year report will be provided to the agencies.

The habitat enhancement plan will be accomplished by implementing the following:

(1) a burning program with a goal of maintaining a sub-climax stage of vegetation consisting of a wiregrass and herbaceous understory, a diminished shrub midstory, and an open canopy of longleaf pine;

(2) an exotic species control program that consists of determining the distribution of the exotic encroachments and the ensuing eradication of the exotics by the application of applicable herbicide treatments; and

(3) a saw palmetto control program consisting of the roller chopping or mowing of areas with excessive growth of saw palmetto.

3.2 Timber Management Goals

Timber management practices described in the 1981 plan and the planting program, described in the JAMMP have allowed pine stem density to increase in many portions of the management area; however, some areas still have low stem counts. Pine regeneration via natural recruitment should substantially increase during the next 20 to 30 years.

The 2003 USFWS Red-cockaded Woodpecker Recovery Plan (p. 188) describes optimum habitat as having the following longleaf pine densities: 1) longleaf pine greater than or equal to 14" dbh should have a minimum of 20 ft^2/acre, 2) longleaf pine greater than or equal to 10" dbh and less than 14" dbh should have a maximum of 40 ft^2/acre,

and 3) longleaf pine less than 10" dbh should have a maximum of 10 ft^2/acre with less than 20 stems/acre. The burning program as detailed in this document, is intended to establish and maintain these densities for the longleaf pine-wiregrass community. Timber surveys will be performed on a 5-year period to assess the longleaf pine/wiregrass densities and determine the effectiveness of the burning program.

Criteria that are more applicable to central Florida are under review and development to reflect conditions of the region (Costa and DeLotelle, unpublished analysis). To meet central Florida standards or achieve the minimum managed stability criteria and manage toward the desired future conditions for red-cockaded woodpecker habitat within the property, i.e., central Florida habitats, management activities will be undertaken as follows.

(1) For the home range habitat, provide each group of red-cockaded woodpeckers a minimum of 3,000 ft^2 of pine basal area (BA), counting only those pine stands in suitable habitat that, for this standard only, have each of the following characteristics:

a) at least 2,000 ft^2 of BA in trees 9 in dbh or larger;

b) at least 1,000 ft^2 of BA in trees larger than four and less than nine inches dbh; and

c) open recruitment stands of pine. Dense stands of recruitment pine will be reduced should they become a problem; however, it is expected that the frequent burning program will naturally provide adequate thinning of small dbh pine.

(2) Provide a minimum of 75 acres of foraging habitat. This minimum requires at least 40 ft^2 of BA/acre to achieve a total of 3,000 ft^2 of BA; however, if the BA per acre is less than 40 ft^2, additional acreage/territory (foraging partition) will be required to achieve 3,000 ft^2 total BA with the caveat that no more than 300 acres/red-cockaded woodpecker group may be designated as foraging habitat.

(3) Pine stands that are suitable for foraging habitat must have all of the following characteristics:

a) longleaf pine with 2,000 ft^2 BA for trees with an 9 inch minimum dbh, i.e., at least 30 years old; however, up to 1,000 ft^2 of BA of the total stand may be in trees 4 to less than 9 inches dbh (20-29 years old).

b) an average pine BA of all 4-inch dbh and larger trees between 40 and 70 ft^2. Currently, stand BA in some areas of the south-central Florida Recovery Unit average less than 40 square feet of BA/acre in 4 to 9 dbh pines; with some as low as 10 ft^2 BA/acre. These low BA conditions are primarily a result of poor recruitment, i.e., few good seed crops and inadequate (frequency and season) prescribed burning programs. Even in good conditions, control fires may jump into the crown, which results in higher tree mortality than desired. During the past 15 years, several recruitment classes have become established, and sites with adequate prescribed burning stand BA are increasing throughout the region.

c) no hardwood midstory or if a hardwood midstory is present it is sparse and less than 7 feet in height: the midstory will be controlled by fire or mechanical means.

d) after the larger dbh class trees reach the optimum habitat levels as defined in the 2003 USFWS RCW Recovery Plan (p. 188), total stand BA above 100 ft^2/acre will be reduced to a minimum 70 ft^2/acre by the thinning of trees primarily with a dbh of 9 inches or less.

e) foraging habitat stands will be within 0.50 miles of the cluster center and preferably within 0.25 miles. Foraging habitat stands cannot be separated from one another by more than 200 feet of non-foraging habitat, e.g., rights-of-way, clear-cut or forest stands less than 30 years of age, hardwood dominated stands, agricultural fields, etc.

f) frequent prescribed burning of foraging habitat during the growing season will be applied. The development and protection of a herbaceous groundcover will facilitate the prescribed burning and will greatly benefit the red-cockaded woodpeckers.

The habitat characteristics that have been described, support a large meta-population of red-cockaded woodpeckers in the Big Econ Basin and additional isolated

populations throughout the central Florida area (DeLotelle *et al.* in press and Bowman *et al.* 1997). Research to date supports the designation of foraging habitat that will result in stable or increasing populations, as described above. The SEC site would be a further test of the applicability of these guidelines to expand existing populations with intensive cluster management. The RCW Recovery Plan stresses the importance of adequate stand structure. Pine stands cannot be considered suitable as foraging habitat unless they have an "open" character. A pine stand that is 20 years in age with open structure will qualify as suitable foraging habitat. If such a stand has not been prescribed burned or otherwise treated to control the hardwood mid-story and has not been thinned to a basal area of 70 ft^2/acre or less, it will not satisfy the "open" condition criterion. At present, dense stands of young pine and pine/hardwood do not occur on-site and thus are not an issue of concern. Stand quality, as measured by an open structure, is a critical factor in determining the suitability and use of foraging habitat.

The desired future condition for red-cockaded woodpeckers foraging habitat stands is for the 3,000 ft^2 BA to be composed of 9-inch dbh tree and larger. Management activities should be implemented to achieve this goal. Most sites will be capable of growing trees this size, at least at moderate stand densities, e. g., 30-60 ft^2 BA /acre. In addition to the longleaf pine stands, foraging studies indicate that cypress domes constitute an important habitat for on-site red-cockaded woodpeckers. Prior to the construction of Unit I at the SEC site, wildfires sporadically resulted in extensive burning in the cypress domes. These hot fires made some cypress domes unsuitable as foraging sites for extended periods; however, now that a controlled fire program is in effect and natural site drainage has been restored in selected areas, the detrimental effects of the hot cypress dome burning have been reduced. Measures to restore natural site drainage in selected areas were described in the 1993 JAMMP and are now complete.

This revised management plan is expected to provide conditions favorable to maintaining a mesic longleaf pine ecosystem and thereby provide optimum habitat conditions for the red-cockaded woodpeckers as well as other wildlife that is characteristic of this habitat type.

3.3 Red-cockaded Woodpecker Management Area

The Red-cockaded Woodpecker Management Area consists of approximately 2,000 acres of undeveloped lands on the SEC site. The management area is defined, as stipulated in the SEC Unit II Conditions of Certification, as all lands depicted on Figure 4.2 of the August 1981 Red-cockaded Woodpecker Management Plan, except for the area specifically identified as "construction impact of proposed Units I, II, III, and IV. Figure 7 of this plan is identical to Figure 4.2 of the August 1981 Red-cockaded Woodpecker Management Plan. The roads shown in Figure 7 will be maintained for dry and wet season travel along with the access road to the Hall Scott Preserve on the east side and the weather station on the south end of the SEC site. These roads are necessary for access and fire control.

The Red-cockaded Woodpecker Management Area will continue to be managed for the benefit of the red-cockaded woodpecker, in accordance with Condition XXXI of the SCA granted to OUC by the FDER Sitting Board on December 14, 1982. If additional uses of the management area are required for the operation of the power plant, these uses will be approved in accordance with the procedures identified in the Florida Power Plant Siting Act and by the FWS prior to their implementation.

3.4 Management Objectives

OUC will implement the management activities described in Section 3.2 to achieve the following objectives:

(1) prohibit unnecessary disturbances in areas managed for red-cockaded woodpeckers;

(2) protect all existing, both occupied and abandoned, and new cavity trees;

(3) protect clusters, including surrounding trees, to ensure future replacement cavity trees and to serve as a buffer zone to disturbances;

(4) ensure that each occupied cluster has at least four suitable roost cavities;

(5) where necessary, protect each nest cavity from climbing predators;

(6) provide for future clusters in the remaining forest stands through appropriate timber management

(7) maintain or improve foraging habitat through appropriate timber management and a controlled fire program;

(8) provide contiguous habitat between clusters and foraging habitat with habitat breaks no larger than presently exist;

(9) conduct a regular, prescribed burning program;

(10) maintain the perimeter firebreak system to control prescribed burns and to prevent the spread of wildfire;

(11) establish an exotic weed control program for the elimination of cogon grass, other exotic plant species, and possible future contamination by other exotic species;

(12) allow all previously disturbed areas (those associated with pre-construction activities) not scheduled for tree planting within the management area to reseed naturally with pine;

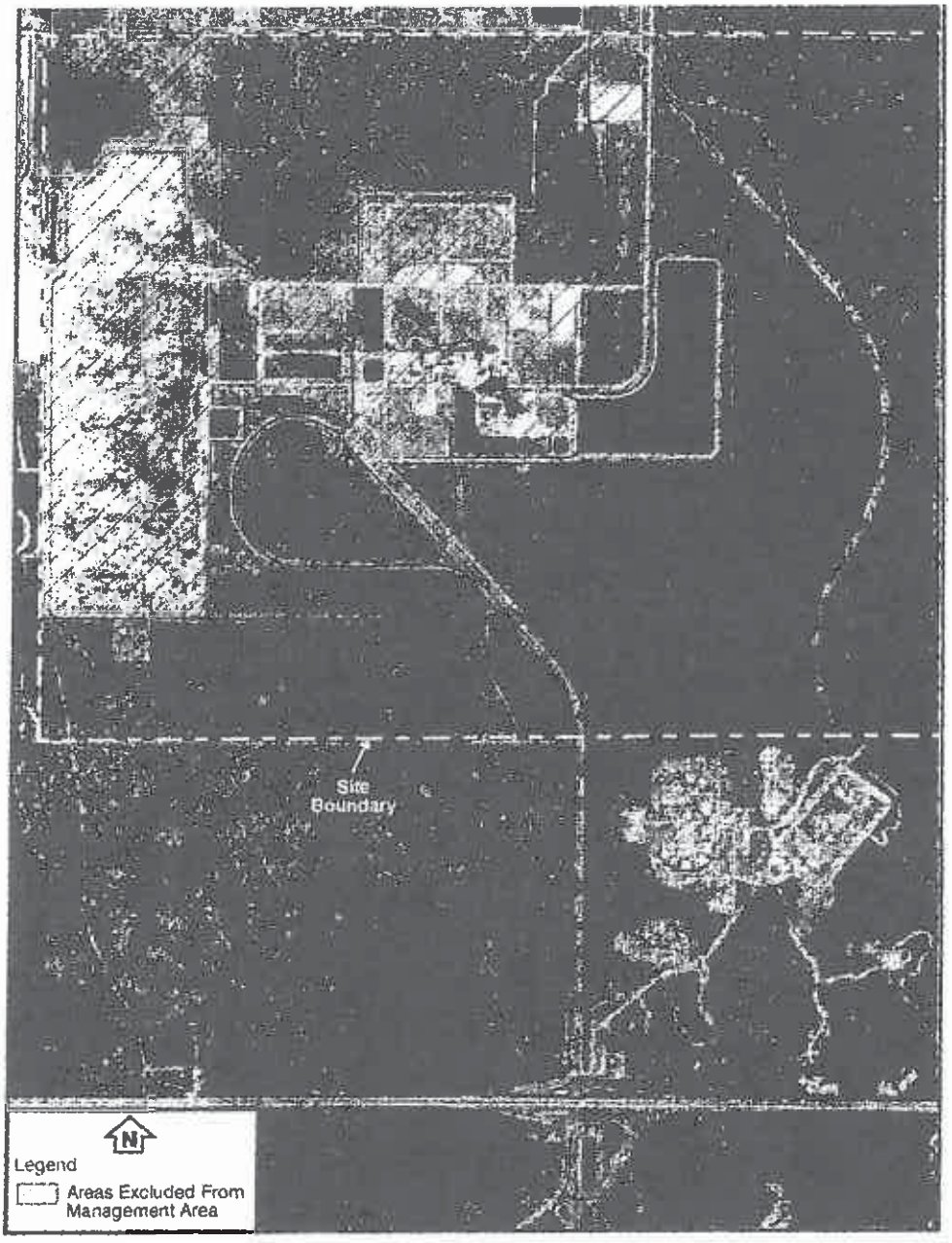
(13) conduct on-site monitoring of red-cockaded woodpecker survivorship, population status, and fledgling success; and

(14) establish an enhancement plan for providing ground cover improvement by reducing tall patches of saw palmetto growth.

3.5 Implementation

OUC will be responsible for implementing the management practices discussed below. Qualified biologists will be retained to monitor the red-cockaded woodpecker population in accordance with the 2003 Red-cockaded Woodpecker Recovery Plan and monitor the success of the management plan and practices.

Figure 7. **The Red-cockaded Woodpecker Management Area and Projected Development Areas, including Units 3 and 4 for the SEC, OUC, Orlando, Florida, 2005.**



CURTIS H. STANTON ENERGY CENTER
RED-COCKADED WOODPECKER MANAGEMENT AREA

3.5.1 Controlling Disturbance

Construction contractors will be briefed as required on their legal obligations under the Endangered Species Act and regulations of the FGFWFC. This briefing will include information on the limits of construction, activities required to comply with stated construction plans, and construction constraints as described in the Mitigation Plan Construction Constraints (Appendix E of the JAMMP). OUC or their consultant will monitor construction activities.

All cluster areas and buffer zones will be conspicuously marked prior to any construction. Cavity trees close to construction activities will be fenced and marked with endangered species posters. Where possible, a 200-foot buffer zone will be established around each cavity tree close to construction activities. Some cavity trees are located immediately adjacent to unimproved dirt roads that will be used during mitigation activities or population monitoring; no adverse impacts are expected to occur. There are no known construction activities expected to occur within 200 feet of any RCW clusters on the Stanton site.

3.5.2 Timber Control

No timber will be harvested within the management area, unless required for improving habitat for the red-cockaded woodpeckers. Pine trees will be allowed to reach senescence and die. Any harvesting will be approved by the FGFWFC and FWS prior to the harvest.

Potential replacement cavity trees and cluster sites, as well as younger pines within each cluster area will be retained. Young pines may be removed to keep cavities clear of obstruction. Currently all cavity trees are located in open stands of pine with relatively few hardwoods; thus, there is no immediate need for stand improvement thinning in cluster sites. Abandoned cavity trees and snags in the management area will be retained to provide roosting and nesting sites for kleptoparasites. The burning program outlined in this document should promote pine regeneration by natural recruitment.

3.5.3 Fire Management

The burning program that will be implemented on the red-cockaded woodpecker management area is outlined in this section. It includes a description of the schedule, frequency of burns, burn conditions, and means of controlling wildfire. Burns, which have been conducted every three to five years, occurred in the mid 1980s, 1990-91, 1993, 1998, and 2003.

3.5.3.1 Burn Schedule and Frequency. The red-cockaded woodpecker management area will be divided into areas and alternately burned on a two-year rotation to reduce saw palmetto growth and provide optimum habitat conditions. Since the seasonality of the burn has an impact on the vegetation, Table 2 is provided to indicate the burn season preference. Burning will usually be performed during the optimum season as shown in the Table 2; however, some intentional variation will occur and other factors, e.g., short and long-term weather conditions, fuel loading, etc., may dictate burns during seasons other than the optimum listed above. New pine planting areas or recruitment areas will be burned on the same schedule as the remaining portions of the management area. Burns will be by ground ignition, primarily using backing fires to minimize vegetation mortality; however, variable conditions may dictate flanking or in extreme cases, head firing techniques.

Table 2. Burn Preference According to Rank Order for Effects on Habitat Condition and Red-cockaded Woodpeckers, SEC, 2005.

Burn Season Rating	Rank	Months	Comments
Optimum	1	February to April	Wiregrass & longleaf pine response is best in spring
Preferred	2	May to June	RCW nesting season[1]
Satisfactory	3	July to September	High water and heat
Least Satisfactory	4	October to mid-November	High stress on longleaf pines
Special Conditions	N/A	Mid-November to January	Heavy fuel loads

Note: Burning during the nesting season requires additional clearing around the cavity trees.

3.5.3.2 Burn Conditions and Control of Wildfire. A Florida State Certified Burn Specialist will conduct prescribed burns. Two of the most important factors that ensure a successful cool summer burn are soil moisture and relative humidity. Fuel moisture is a function of relative humidity, rainfall, and temperature (Mobeley et al. 1978). Burns will not be conducted when soils and leaf litter are completely dry. When possible, burns will be conducted as soon as possible (one to three days) following a storm event, preferably one producing a 0.5 to 1 inch rainfall. Likewise, relative humidity should be moderate to high and not lower than 20 percent. A moderate breeze is also desired to prevent the fire from reaching the tree crown. After initiation of this frequent burning program, fuel loads should be sufficiently reduced such that a cooler and more controllable burn is more easily achieved.

A fire break of about 20 feet in width, completely encircling the red-cockaded woodpecker management area and adjacent to the SEC site perimeter fence, is presently maintained by OUC. This firebreak will be disked annually and immediately prior to any controlled burn. Other unimproved roads exist within the interior of the management area and may serve as additional firebreaks. Because of drainage concerns, plantings within the Riparian Habitat Protection Areas, described in the JAMMP, will not be protected with firebreaks. Other measures, such as backfires, may be used to prevent seedling mortality in these areas. All vegetation around cavity trees will be mowed to a height of no greater than 1 foot for a radial distance of 20 feet. If the control burn is set during the nesting season, the clearing will be for a radial distance of 50 feet. All clearing will be performed by hand or by a low impact mower towed with a rubber-tired tractor.

3.5.4 Exotic Vegetation Control

Herbicides and pesticides toxic to wildlife will not be used in any part of the red-cockaded woodpecker territories. Spot applications of an approved herbicide may be used in the areas of pine tree plantings or wetlands, if necessary, to remove or control exotic or undesired invasive species.

The extensive invasion of cogon grass will ultimately replace most native ground cover species. Cogon grass occurs initially as spots of 1 meter or more in size, but later may occupy much larger areas as the plant spreads throughout the herbaceous ground

layer. The species out competes most other herbaceous species and promotes very hot fires when burned. To eliminate this exotic species, a program will be instituted to delineate, map, and eradicate the plants with appropriate herbicides. To determine major areas of cogon grass, a qualified biologist will review a recent aerial photograph of the site and follow-up with a field examination to refine the locations of this invasive grass. A finial map will then be developed and a contractor will be retained to eliminate this species. The initial treatments during the first year will be made in the fall, if possible, with periodic treatments as needed. Inspections of each spot or area will be made to determine the necessity for retreatments during the second year. Annual inspections will occur until the species is eliminated; thereafter, re-inspections will be conducted every five years to further assess the success of the elimination plan. Retreatments will be conducted, if needed and a determination will be made as to the best assessment interval; however, the assessment interval will not be longer than every five years. At the end of the second year of treatment a report will be provided to the respective agencies. The five-year sampling and assessment report will include results and recommendation from the cogon grass evaluation.

Presently, to control cogon grass contractors will apply arsenal at 1% by volume from a low volume spray unit. This concentration is well under the max label rate of 6 pints per acre. In the thickest areas, 4 pints per acre max may be used. For the Chinese tallow and the Brazilian pepper (should it occur on-site), 79% high-grade oil, 20% Garlon 4, 1% Stalker will be used as a basal bark treatment.

3.5.5 Population Monitoring Studies

OUC will also continue the yearly red-cockaded woodpecker monitoring study using the guidelines established in the 2003 Red-cockaded Woodpecker Recovery Plan. Monitoring studies will include annual winter banding of all unbanded adults and juveniles that remain within the population. Annual inspections will also be made of nest trees each week during the nesting season to assess nesting and fledgling success. Nestlings will be banded at this time. Nest trees with low or insufficient resin flow will be wrapped with material to protect against climbing snakes. Population estimates will be determined for the winter and nesting season. Cavity trees and cavities will also be inspected to determine the number of suitable cavities in each

cluster. The location and status will be recorded using GPS coordinates. Based on these inspections, the consultant will determine the need for population enhancement translocations and the necessity for additional cavity inserts in these existing clusters. At least four usable cavities will be maintained in each cluster using artificial cavities, if necessary. Translocations of young birds to the site will be conducted as described below in Chapter 4.0.

3.5.6 Pine Habitat Condition Monitoring

An assessment of the habitat conditions on the entire site has not been made since the mid-1980s (DeLotelle et al 1987). Habitat conditions will be evaluated to determine pine stand age and densities across the management area using previously applied techniques (DeLotelle et al 1987, DeLotelle et al 1995, also see Hooper et al 1982). An aerial photograph will be used to determine new pine stands and will be compared to historic conditions (1980) of pine stands. Once the pine stands and other habitats are determined from aerial photographs for the SEC site, a field evaluation will be made. Data will be collected by placing one to five plots in each stand with the number of plots per stand based on the stand size. A 100 by 100 foot plot will be laid out to count all pine stems and take diameter measurements on 10% of the trees over three inches in diameter. Seedlings will be counted separately. Five increment cores will be taken in mature pines to evaluate age and ten-year growth of pines. This will be used to develop a report and pine stand map for the SEC site and provided to Florida Department of Environmental Protection (FDEP), USFWS, and FFWCC. This evaluation and report will be updated every five years and provided to these agencies.

3.5.7 Ground Cover Enhancement Plan

Overall, habitat conditions for the Red-cockaded Woodpecker have improved with the implementation of the fire management program and the addition of several recruitment classes of longleaf pine on the SEC site. While the ground cover on the SEC site is in reasonably good condition, it has deteriorated over the last 10-15 years compared to historic conditions. A healthy and extensive herbaceous ground cover is important for the support of the insect fauna. In order to maintain and improve conditions for red-cockaded woodpeckers several activities should be undertaken to enhance the ground cover conditions. The largest activity will be the establishment of an intensive fire program to maintain the seral longleaf pine and wiregrass community. Mechanical control of the saw palmetto will also be required, as the overgrowth and continued expansion of saw palmetto will diminish these aspects of the forest ecosystem.

The primary focus of the plan on mechanical control of palmetto growth will be to develop a map with the occurrence of problem areas, which will be treated as appropriate. These areas will be located on aerial photographs and followed-up with on-site inspections. All existing and artificial clusters will be inspected for palmetto growth. A map will be produced to denote each area that does not meet the criteria listed below and will then be used to evaluate the necessity of roller chopping the various pine habitats. It is recommended that an 18-inch diameter by 5.5 feet long roller chopper be used (Outcault, pers.comm. 2005). No tandem choppers will be used on-site. A heavy-duty bush hog may be employed in place of the roller chopper provided there are no stumps. The initial treatment could include roller chopping or bush hogging in selected areas followed by a fire interval of every two years to reduce the buildup of saw palmetto. A suggested route for roller chopping will be provided that will involve the least damage to grasses and other components of the ground cover.

Mechanical control should occur in the fall of the year with one small roller chop as described above. A bush hog operation or cutover with a large mower behind a tractor should be undertaken in cluster areas with problems. No treaded equipment will be allowed in any cavity tree areas. Roller chopping or bush hogging in the remaining areas may be employed to reduce palmetto growth and promote the herbaceous growth. This is best accomplished in the fall or winter when conditions are relatively dry

in the foraging habitat areas. The path of the roller chopper should be circular or rounded at the ends so as not to damage ground cover by plowing into topsoil. Sharp angle turns must not be used in ground cover areas. Once again, conditions must be dry to meet this objective.

3.5.8 Vegetation Delineation, Mapping, and Eradication

The various habitats essential for the red-cockaded woodpeckers will be surveyed to determine the extent of encroachment by undesirable vegetation. First, an inventory of the management area (review of aerial photographs followed by field verification) will be undertaken to determine the locations and extent of the areas that require corrective action. Although not a major problem at this point, any areas with popcorn tree (*Sapium sebiferum*) should also be noted for elimination. Once the location and extent of the various encroaching species is determined, elimination and suppressing measures will be implemented. The height of saw palmetto in the various habitats will be the determining factor for its suppression as outlined in Table 3 below.

a) Cavity Tree Cluster areas:

prior to initiating ground surveys, aerial photographs of all areas will be reviewed, and then cavity tree cluster areas will be verified in the field to determine the extent of exotics and saw palmetto. Problem areas will be mapped and corrective action noted.

b) Foraging areas:

an approach similar to that used in cavity tree cluster sites will be employed in foraging habitat areas as well. Areas with a number of dead pines will be of particular interest and will be investigated.

c) Wetland fringes in Upland Habitats:

wetland fringe areas, which often have particularly high growth of saw palmetto, will also be investigated. If the areas are not extensive, no corrective action will be undertaken but a few areas are expected to need improvement.

d) Remainder of Property:

the remainder of the flatwoods will be treated in a similar fashion to the wetland fringe areas above.

Table 3. Criteria for the Institution of Mechanical Control of Saw Palmetto in Red-cockaded Woodpecker Habitats on the SEC Site

AREA	**Maximum Stem Growth of Palmetto Above Ground Surface**	**Treatment Method**
Cluster Areas	1.5 feet	Hand or bush hog
Foraging Areas	1.5 to 2 feet	Roller chopping
Wetland Fringe	2 to 3 feet	Roller chopping or fire frequency
Remainder of Property	2 to 3 feet	Roller chopping or fire frequency

4.0 POPULATION ENHANCEMENTS AND CLUSTER CREATION

The east Orange County red-cockaded woodpecker population was one of four within Florida identified by the FGFWFC as needing a conservation plan to ensure further protection (Cox *et al.*, 1995). The action described below will aid in increasing the number of groups on the SEC site and ultimately in enhancing the viability of the Orange County red-cockaded woodpecker population. This plan first includes a portion for the creation of a recruitment cluster followed by a translocation program with sub-adult birds. A comprehensive plan for the enhancement of foraging habitat was described in section 3.0 and will require a number of years to be successful. Other additional enhancement aspects of the management plan are intended to mitigate for losses of the planted pine trees associated with both the construction of the gas pipeline along the alternate access road corridor to the south and the transmission line maintenance operations in the corridor to the north between the substation and Pope road.

4.1 Cluster Creation for Recruitment of Sub-adults

Three cluster sites (A1, B1, and D1) will be provisioned each with four artificial cavities, in different segments of the population (Figure 1). Within each artificial cluster area, four cavity inserts will be installed in proximity to each other in trees ranging in age between 50 and 150 years and with a diameter of 14 inches or more (Table 4). These clusters will be inspected during seasonal surveys and any required maintenance will be performed. All recruitment cluster sites, except the C1 area, are abandoned clusters that were occupied by red-cockaded woodpeckers through the 1980s. These artificial cluster sites were selected based on the proximity of the surrounding groups of red-cockaded woodpeckers and the availability of potential cavity trees, i.e., those with diameters of 14 inches or more. Each cluster and the surrounding foraging habitat have been evaluated to determine if enough foraging resources were present to meet the needs of central Florida red-cockaded woodpeckers (See DeLotelle and Epting 1992 and DeLotelle et al. 1995, also see guidelines in Section 3.2). Additional artificial

cavities may be placed in any natural cluster that is deficient in usable cavities. Although four cluster sites are available only three were chosen: A1, B1, and D1, for artificial cavity augmentation.

Table 4. Artificial Cluster Sites for Cavity Inserts and Description of Surrounding Foraging Habitat, SEC, Orlando, Florida, 2003.

Cluster ID and Description	*Old Trees**	*Number of 60 to 80 Year Old Trees***	*Age/Density of Foraging Habitat*	*Number of Pines and Basal Area in 200 Acres*	*Management Needed in Cluster Areas*
A1 Artificial Site	Numerous old trees	6@14" dbh or larger trees	58 years & 59 per acre	12,400 pine trees 6,550 ft^2	Bush-hog near all cavity trees
B1 Artificial Site	14/ Many in 50 to 80 age class	12@14" dbh or larger trees	48 years & 82 per acre	13,400 pine trees 6,130 ft^2	Bush-hog near several cavity trees
C1 Abandoned Site	Numerous old trees	7@14" dbh or larger trees	39 years & 52 per acre	8,500 pine trees 3,682 ft^2	Hand clean around all cavity trees
D1 Abandoned Site	Numerous old trees	7@14" dbh or larger trees	41 years & 71 per acre	11,700 pine trees 5,082 ft^2	Bush-hog some pf cluster area, Hand clean remainder

**Old-remnant trees are easily identified by the presence of large flattop crown and few if any limbs on the bole of the tree. All trees exceed 100 years of age based on numerous increment core bores taken from these type trees in the Big Econ Basin.*

*** This is the primary age and size class of live pine trees used for artificial cavity inserts in the Big Econ Basin and other central Florida Flatwoods sites.*

4.2 Monitoring Activities.

Annual monitoring studies and reproductive success will be used to assess the status of the existing red-cockaded woodpeckers groups. These studies will continue over the life of the facility. The monitoring studies will include periodic inspections to determine if dispersing red-cockaded woodpeckers are using any of the artificial clusters as roosting sites. Artificial cavities will also be inspected to ensure that there are no leaks and to clean any undesired nest material. If solitary birds are found living

in these recruitment clusters, other red-cockaded woodpeckers of the opposite sex will be translocated to potentially form a new breeding group in these clusters.

It is anticipated the new dispersing birds that take residency in these artificial clusters will primarily be young males; thus, a young female would be translocated to these sites. The bird will be placed in the new cavity on the night of its capture or free-released if captured and released on the same morning. Other combinations of translocation activities over the intervening monitoring years may occur. No more than two birds from the surrounding area will be translocated in any one year. No translocations from surrounding groups will occur during years of low reproduction. The three artificial cluster sites and cavities will be visited at least twice during each nesting season to determine occupancy, reproductive status, and reproductive success. Cluster creation and occupation shall be considered a success when a pair of red-cockaded woodpeckers have occupied the site for one complete year or have reproduced successfully. Reproduction is successful when eggs, nestlings, or fledglings from the new group are observed.

4.3 Translocation Activities

If at the end of the first year, no dispersals have occurred into the three artificial clusters, attempts will be made to obtain birds for translocation from other populations of red-cockaded woodpeckers in the southeast by attending the translocation meeting in Tallahassee, Florida with the purpose of securing bird(s) for translocation. Birds to be translocated will be placed in artificial cavities, screened, and released in the morning. If a bird is obtained for translocation, monitoring will occur as detailed in Section 4.2.

4.4 Implementation Schedule for Artificial Cavity Installations

The following schedule for artificial cluster sites is proposed to implement the procedures outlined above. Recruitment clusters with inserts will be constructed in three locations as previously described. All shrubs, including palmetto and wax-myrtle (*Myrica cenifera),* will be mowed for a minimum radius of 50 feet around all cavity trees within the artificial sites and all dead limbs or other dying vegetation will be removed from the vicinity of these cavity trees to ensure a low flame height during control burns. The following activities should be performed:

(1) prescribed burns in these red-cockaded woodpeckers habitats should be conducted on a regular basis as in the remaining forest management fire schedule;

(2) monitoring of artificial cavities to determine their continued suitability as roost sites for red-cockaded woodpeckers;

(3) monitoring of remaining red-cockaded woodpeckers groups on the SEC site for reproduction and possible translocation of young-of-the-year;

(4) annual monitoring and translocation activities until successful occupation and reproduction in the artificial cluster sites has occurred; and

(5) inspection for debris, predators, or competitors of the roost cavities occupied by the breeding males and females prior to each year's inspections of artificial cavities during the spring.

5.0 REPORTS

The following reports will be provided for the duration of the plant. Copies will be furnished to each of the respective agencies as shown in Table 5.

Table 5 Report Schedule for Management Plan Activities for the next Five-Years and Beyond, Curtis H. Stanton Energy Center, 2005

Report Name	Frequency	Due Date	Duration	Comments
RCW monitoring	Annual	August 2005	Life of Plant	Demographics-reproduction, etc.
Exotic species Control	Annual[1]	July 2007	Two years, as needed	Success of control, reapplication
Habitat Survey	Five Year Intervals	March 2006	Updated Every 5 years	Comparison with historic data
Saw palmetto reduction	One-two year	July 2007	Two years, as needed	As needed
Five Monitoring	Every 5 years	August, 2010	Covers all data collected	Summary of all completed studies
Fish & Wildlife Annual Monitoring Report	Annually	January 31, each year	Life of Facility	Required

Notes:

A five-year summary report will cover red-cockaded woodpecker demographics, the status of exotic and nuisance plant or animal species, and pine habitat characteristics. This report will include a recommendation to maintain eradication of exotic species over the next five years.

1) Report frequency will be annual until exotics are eradicated; thereafter, frequency will be on a five-year interval.

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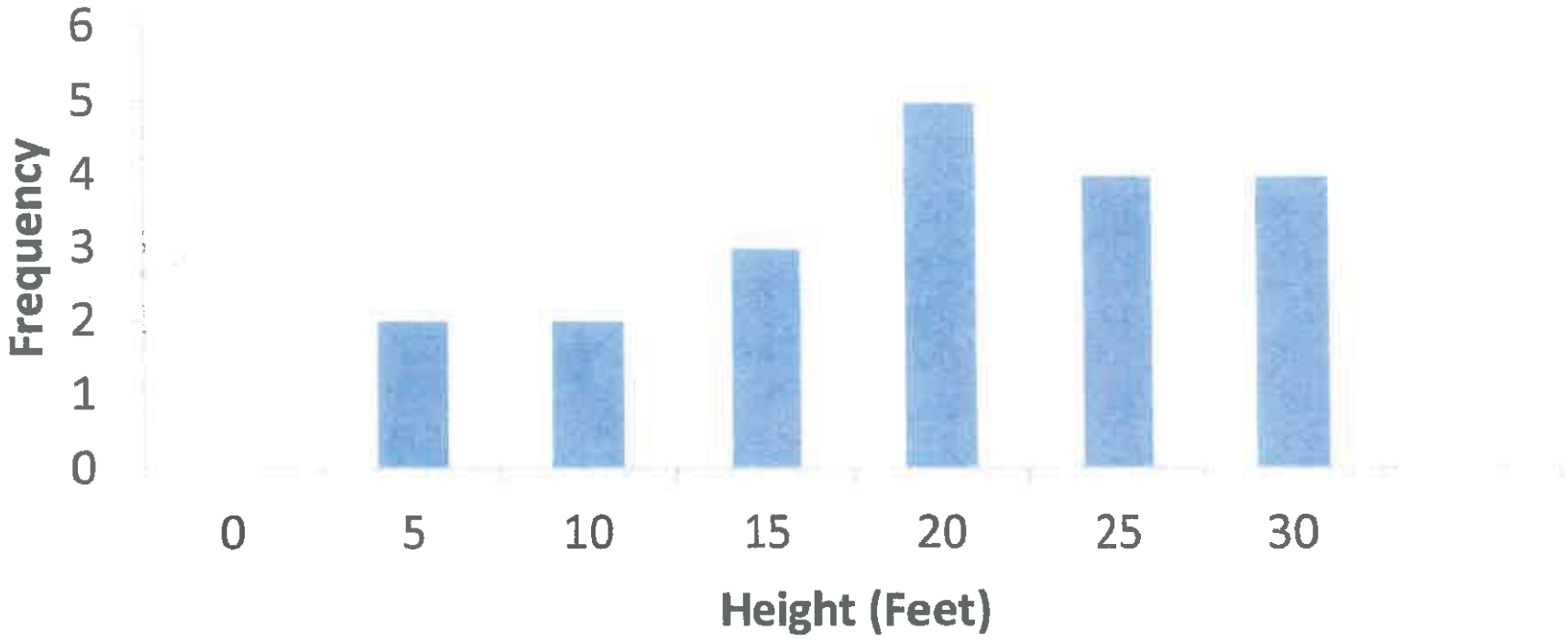
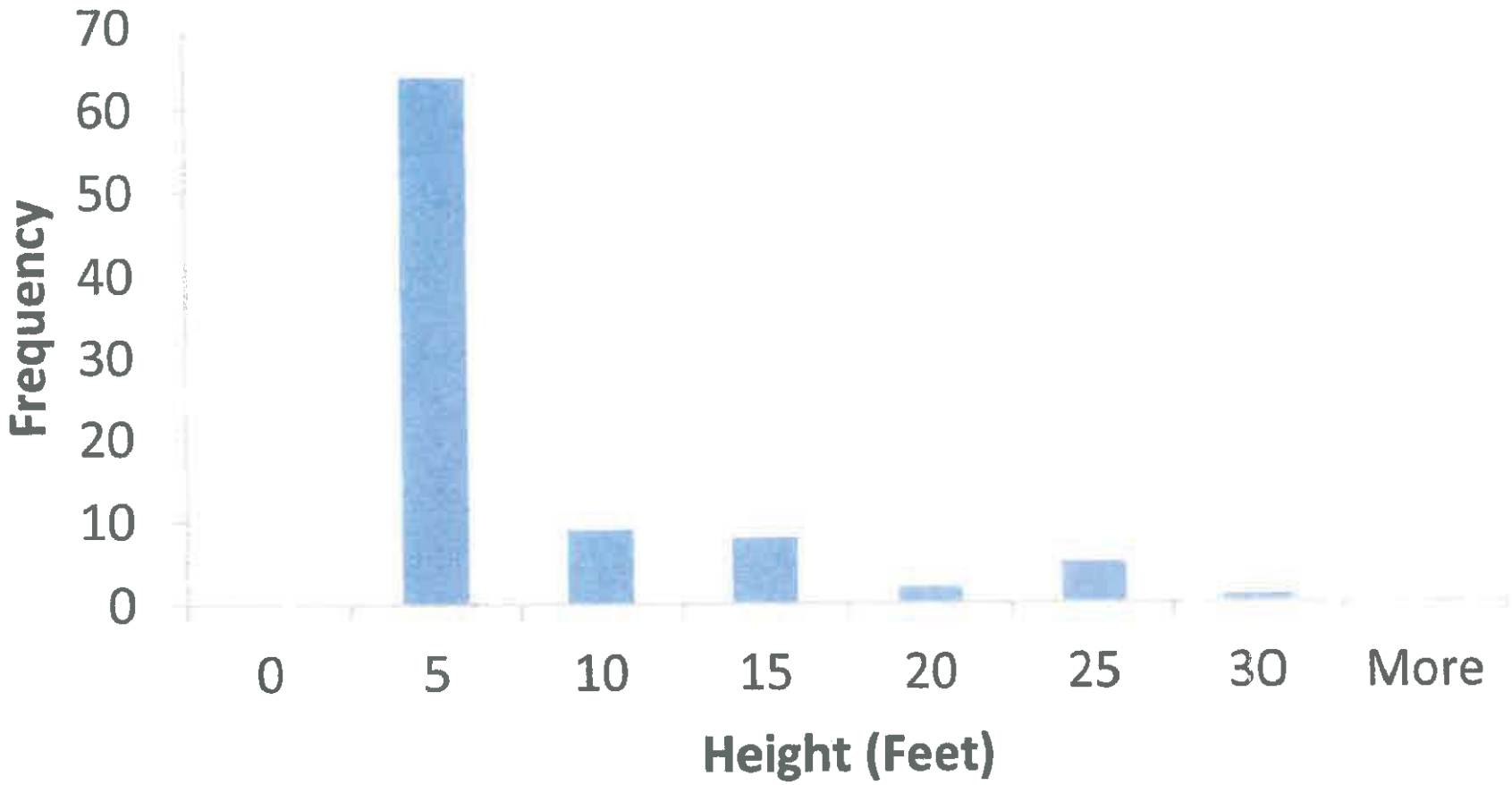
ATTACHMENT 6

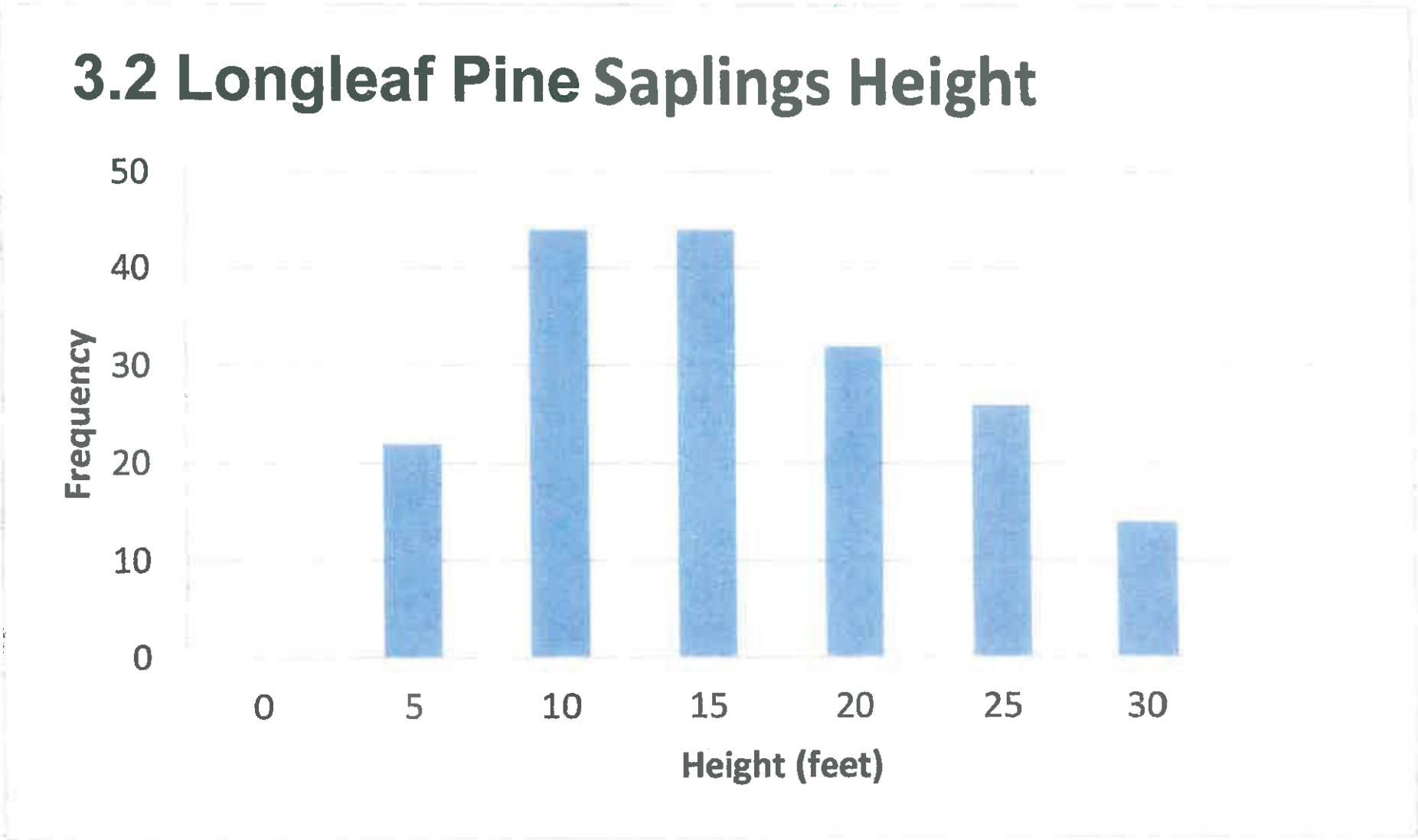
Histograms of Sapling Heights

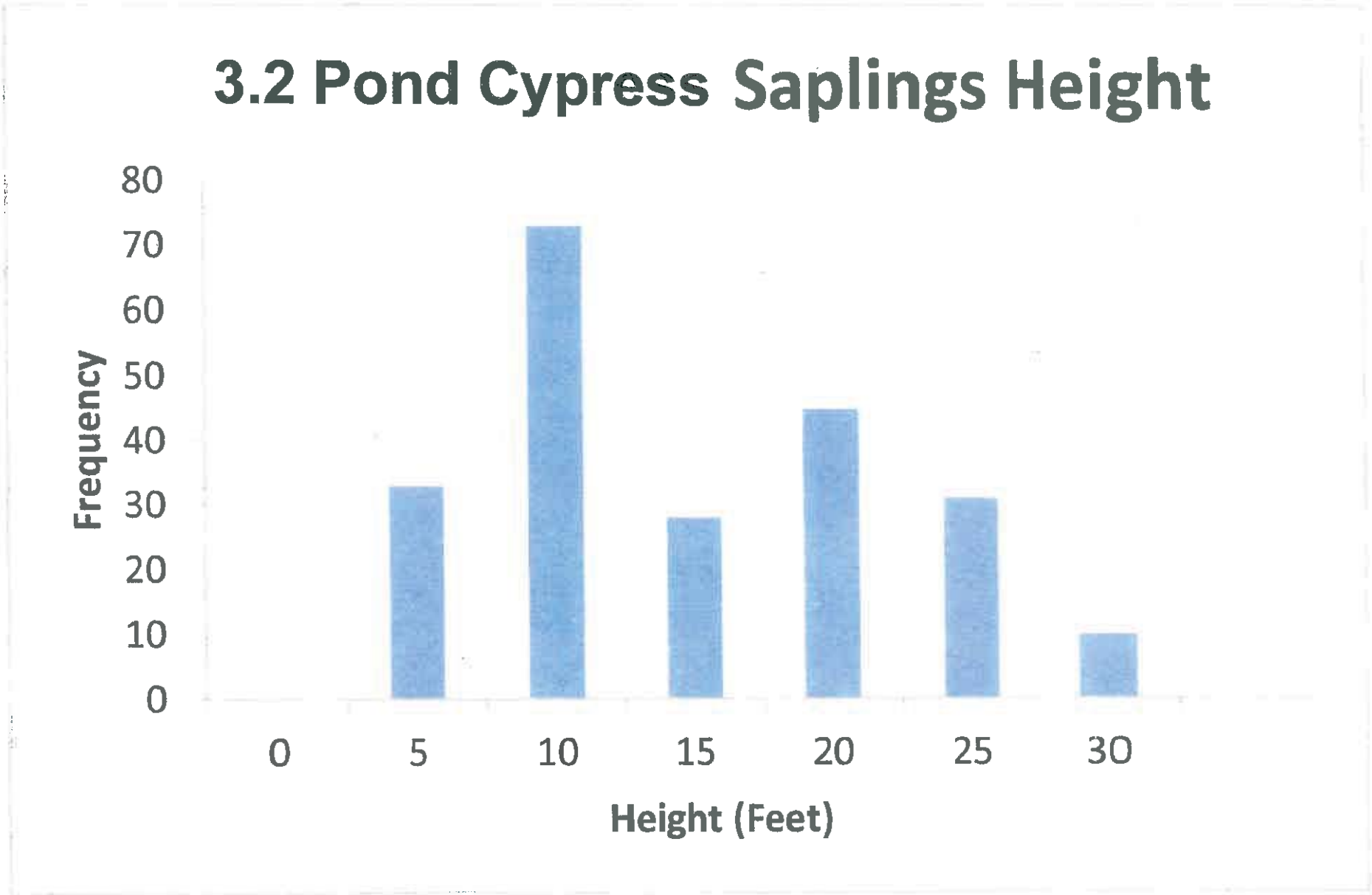
3.1 Longleaf Pine Sapling Height



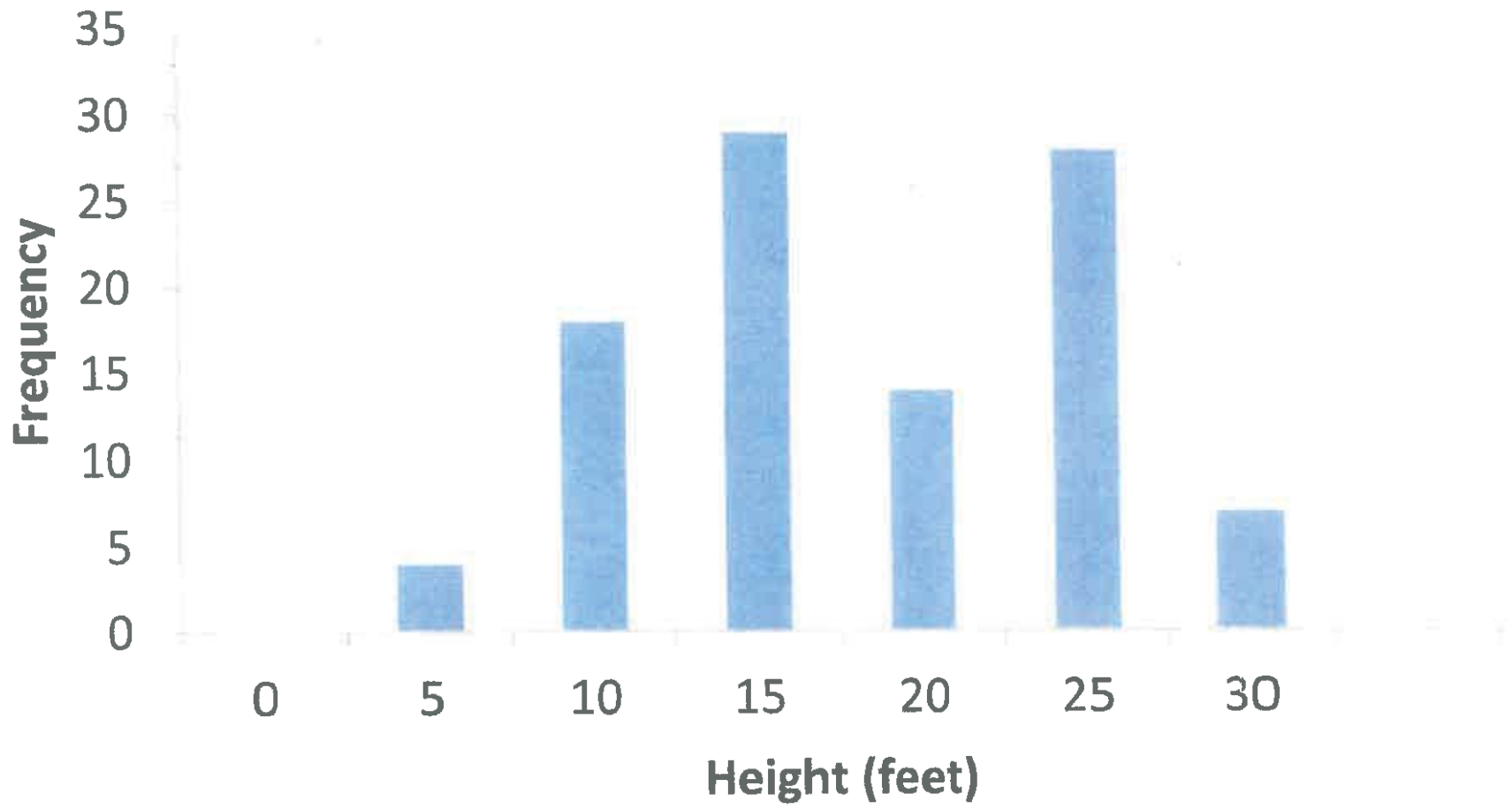
3.1 Pond Cypress Sapling Height

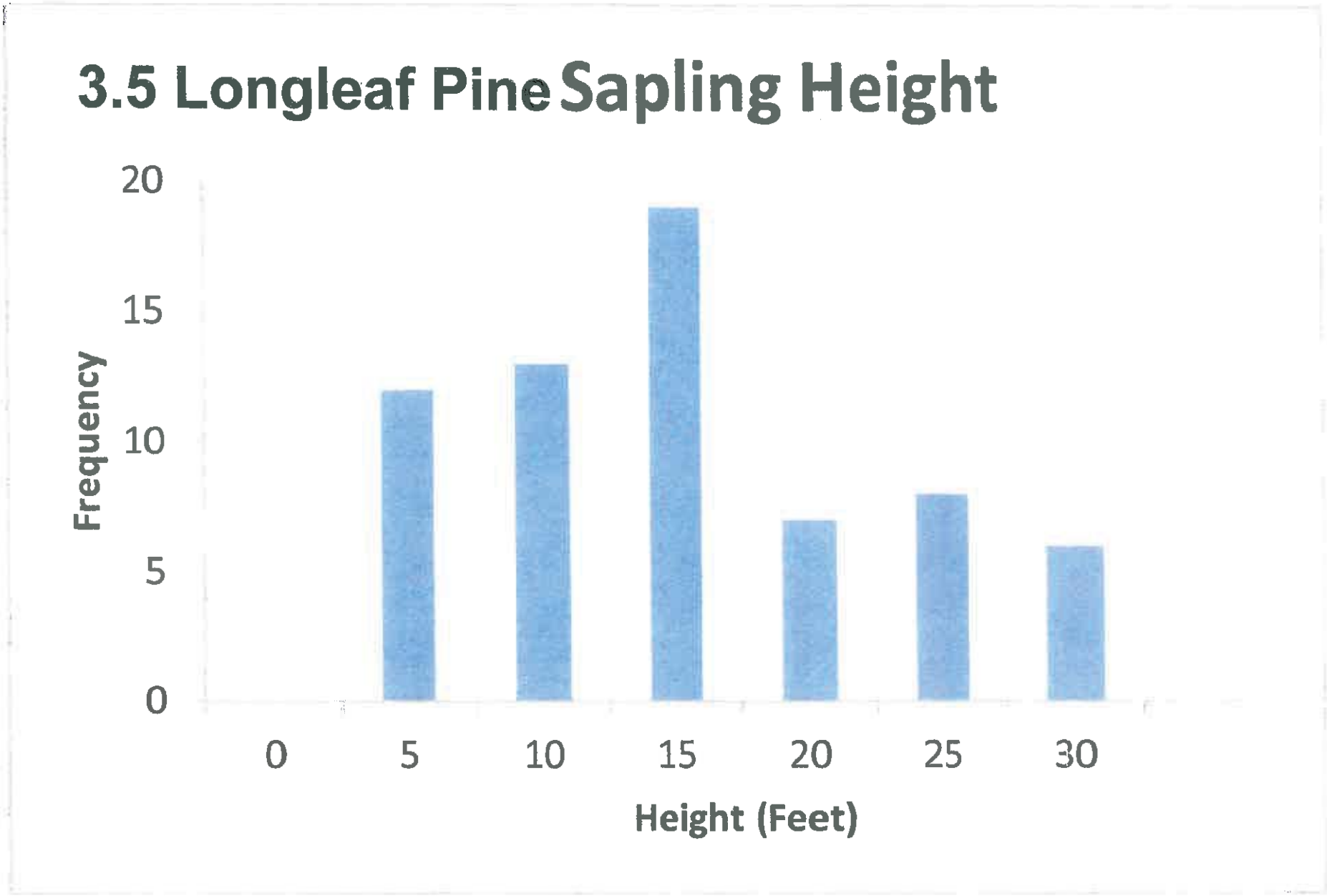


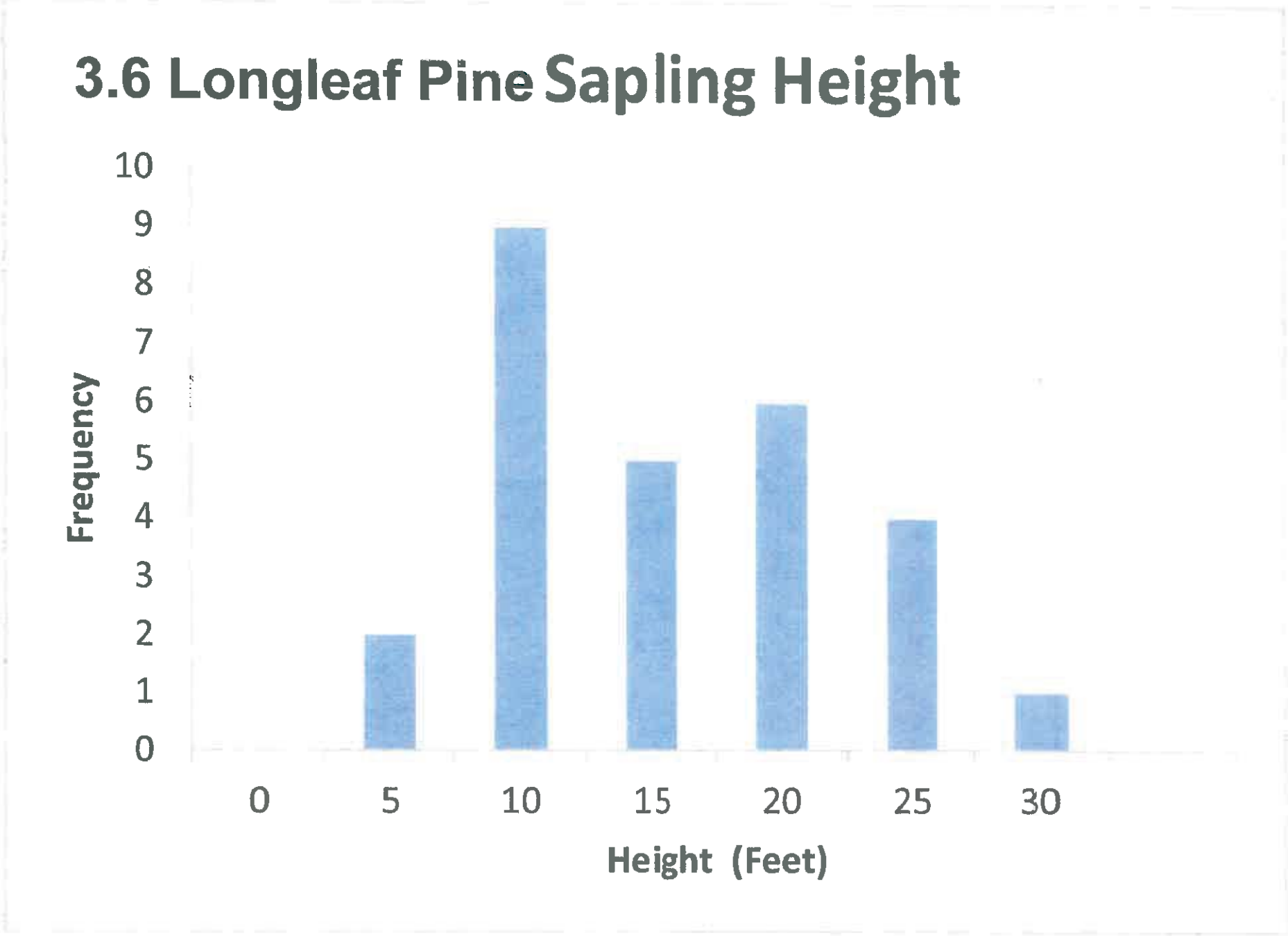

3.2 Longleaf Pine Saplings Height
50
40
30
20
10
0
Frequency
0
5
10
15
20
25
30
Height (feet)


3.2 Pond Cypress Saplings Height
Frequency
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Height (Feet)

3.3 Longleaf Pine Sapling Height




3.5 Longleaf Pine Sapling Height
Frequency
20
15
10
5
0
0
5
10
15
20
25
30
Height (Feet)


3.6 Longleaf Pine Sapling Height
Frequency
10
9
8
7
6
5
4
3
2
1
0
0
5
10
15
20
25
30
Height (Feet)

ATTACHMENT 7

Tree Mitigation Area and Timber Stand Sample Plot Photographs

1. Tree Regeneration Area 3.1 – Pond Cypress south edge facing west

2. Tree Regeneration Area 3.1 – Pond Cypress central pool

3. Tree Regeneration Area 3.1 – Pond Cypress central pool

4. Tree Regeneration Area 3.1 – Pond Cypress south edge facing east, note planted cypress sapling with pink flagging tape at center-left

5. Tree Regeneration Area 3.1 – Long Leaf Pine east edge facing south

6. Tree Regeneration Area 3.1 – Long Leaf Pine east edge facing east

7. Tree Regeneration Area 3.1 – Long Leaf Pine Seedling

8. Tree Regeneration Area 3.1 – Long Leaf Pine east edge facing north, note Gopher Tortoise Burrow

9. Tree Regeneration Area 3.1 – Long Leaf Pine northeast corner

10. Tree Regeneration Area 3.1 – Long Leaf Pine north-central portion facing east, with recent fire and new herbaceous growth

1. Tree Regeneration Area 3.2 – Plot 3.2-3

2. Tree Regeneration Area 3.2 – Plot 3.2-32

3. Tree Regeneration Area 3.2 – Plot 3.2-12

4. Tree Regeneration Area 3.2 – Plot 3.2-20

1. Tree Regeneration Area 3.2 – Plot 3.2C-22

2. Tree Regeneration Area 3.2 – Plot 3.2C-27

3. Tree Regeneration Area 3.2 – Plot 3.2C-7

4. Tree Regeneration Area 3.2 – *Calopogon barbatus* orchid near 3.2C-16

5. Tree Regeneration Area 3.2 – Plot 3.2C-16

6. Tree Regeneration Area 3.2 – Plot 3.2C-25, minor hog rut damage to groundcover

1. Tree Regeneration Area 3.3 – Plot 3.3-24

2. Tree Regeneration Area 3.3 – Plot 3.3-5

3. Tree Regeneration Area 3.3 – Plot 3.3-37

4. Tree Regeneration Area 3.3 – Plot 3.3-53

1. Tree Regeneration Area 3.5 – Plot 3.5-21

2. Tree Regeneration Area 3.5 – Plot 3.5-26

3. Tree Regeneration Area 3.5 – Plot 3.5-51

4. Tree Regeneration Area 3.5 – Plot 3.5-33

5. Tree Regeneration Area 3.5 – Plot 3.5-08; note high density seedlings/saplings

6. Tree Regeneration Area 3.5 – Plot 3.5-03

1. Tree Regeneration Area 3.6 – Plot 3.6-12

2. Tree Regeneration Area 3.6 – Plot 3.6-7

3. Tree Regeneration Area 3.6 – Plot 3.6-23

4. Tree Regeneration Area 3.6 – Plot 3.6-22

Stanton Energy Center
2012 USFWS Annual Monitoring

Panoramic Photo Station 3.1 North

March 2013

Stanton Energy Center
2012 USFWS Annual Monitoring

Panoramic Photo Station 3.1 South

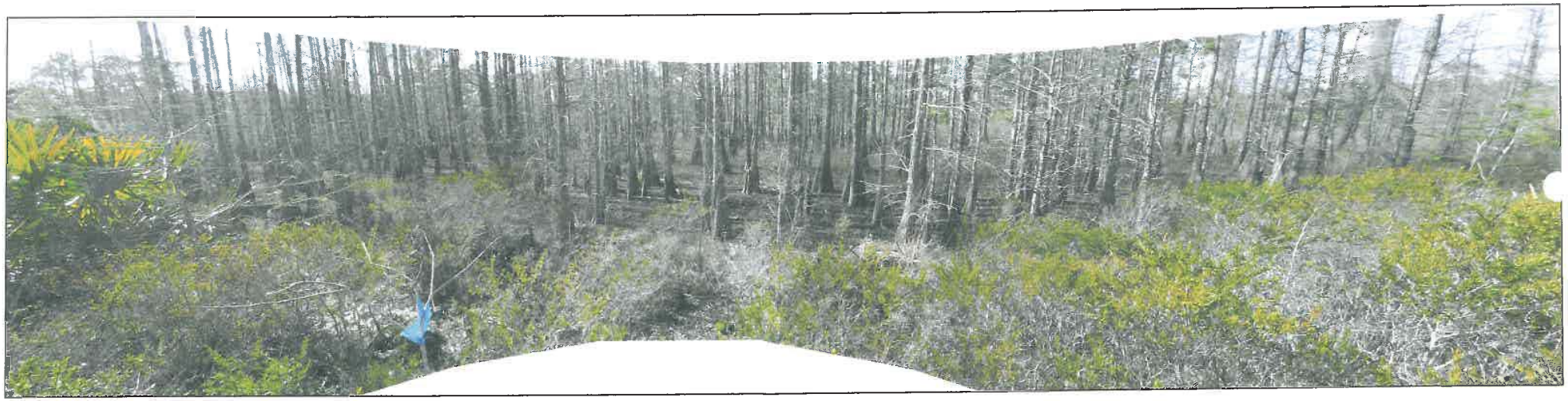
March 2013

Stanton Energy Center
2012 USFWS Annual Monitoring

Panoramic Photo Station 3.2 North

March 2013

Stanton Energy Center
2012 USFWS Annual Monitoring



Panoramic Photo Station 3.2 Cypress Dome

March 2013

Stanton Energy Center
2012 USFWS Annual Monitoring

Panoramic Photo Station 3.2 South

March 2013

Stanton Energy Center
2012 USFWS Annual Monitoring

Panoramic Photo Station 3.3 Northwest

March 2013

Stanton Energy Center
2012 USFWS Annual Monitoring

Panoramic Photo Station 3.3 Southwest

March 2013

ATTACHMENT 8

Previous SEC Fish & Wildlife Annual Monitoring Reports and RCW Status Reports

Previous SEC Fish & Wildlife Annual Monitoring Reports and RCW Status Reports are included on the enclosed CD ROM.

ATTACHMENT 9

A Quantitative Method for Habitat Description (James, 1970)

Warning Concerning Copyright Restrictions

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A Quantitative Method of Habitat Description

Frances C. James and Henry Herman Shugart, Jr.***

Two programs sponsored by the National Audubon Society are directed at making mixed-species estimates of bird populations in terms of 100 acres of fairly uniform habitat. These are the Breeding-Bird Census (Hall 1964), started in 1936, and the Winter Bird-Population Study (Kolb, 1965), started in 1948. Although the field techniques differ between these two types of studies, the results published in *Audubon Field Notes* look much alike. They consist of brief accounts of the location and characteristics of a study plot and a summary list of bird species present in order of their decreasing abundance. Bird counts are followed by estimates of the number that would be expected in 100 acres of similar vegetation (number of territorial male birds only in the case of the Breeding-Bird Census). Some estimates of aspects of the vegetation, such as average tree size, percent canopy cover, and percent of tree species distribution in the canopy, accompany descriptions of the area. But until now no standard technique for obtaining vegetation data has been recommended. Since the sampling procedure may influence the results, comparisons between studies as presently reported are unreliable. However, if quantitative vegetation data could be obtained in a simple and regular manner, the usefulness of both the Breeding-Bird Censuses and the Winter Bird-Population Studies would be increased many fold. Variation in sizes and other characteristics of territories of a species in different habitats could be related to variation in the structure of the vegetation. Comparisons between the avifaunas of different areas, or among successional sequences within one area over the years, could be interpreted in terms of gradients in types of habitat. We suggest below a simple method for quantitative habitat description which we have found useful. We offer sample data and summary sheets and comparisons with other methods.

* Department of Zoology, University of Arkansas, Fayetteville, Ark., 72701
** Present address: Department of Zoology, University of Georgia, Athens, Ga.

It is clear that the structure of the vegetation required by any particular bird species is quite specific (Dumas 1950, Marshall, 1957, Oelke 1966). Although it is impossible to know whether a bird actually selects a specific area because of its structure, independently of other qualities, ornithologists have often assumed this to be the case (Lack 1933, 1937; Lack and Venables 1939; Svärdson 1949; Tinbergen 1951; and others). They assume further that birds have species-specific psychological preferences for certain visual combinations of the structure of the environment. If bird distribution within a continent is based in any significant part on adaptation to various factors of a heterogeneous environment, surely the extra time required to obtain quantitative habitat descriptions to accompany bird population studies would be well spent. For examples of several interesting approaches to the analysis of this type of data see Bond (1957), Beals (1960) and Tramer (1969).

FOUR METHODS COMPARED

In the course of an investigation of the habitats of breeding birds in Arkansas, we tried four of the methods recommended by plant ecologists for making quantitative estimates of vegetation. These included *plotless* methods, such as the quarter method (Cottam and Curtis 1956, Phillips 1959) and the wandering quarter method (Catana 1963), and *areal* methods, such as 0.01-acre armlength transects (Rice and Penfound 1955, Penfound and Rice 1957) and 0.1-acre circular plots (Lindsey, Barton and Miles 1958). We tested the field efficiencies of these four methods and compared results with a complete census in an eight-acre tract of upland deciduous woods in the Ozark Plateau.

The plotless methods are based on the principle that the average area occupied by each tree is the reciprocal of the density of

the trees. Transects along compass lines are made through the woods, the species and diameters of the nearest trees within 90 degrees of a specified point (or within a 90° angle bisected by the compass line, in the case of the wandering quarter method) are recorded and distances measured. The sum of the distances divided by the number of trees gives the average distance between trees. The density of trees per acre can be estimated by dividing the numbr of square feet per acre (43,560) by the square of the average distance between trees. Basal area or dominance (an estimate of woody biomass) can be determined from the same data. The basal area of an individual tree is the cross sectional area of the trunk at 4.5 feet from the ground. Knowing the density and size classes of the trees, you can estimate total basal area for the entire tract.

The areal sampling methods are simply ways of sampling small plots of known size and extrapolating to estimate the density and basal area of the whole study plot. Estimations of frequency (a function of both density and evenness of distribution) can be made by finding the percent of the sample plots in which a given species occurs. One-hundredth-acre rectangles are sampled by recording trees intercepted by one's outstretched arms (six feet) while walking along a compass line for 72.5 feet. Tenth-acre circles are sampled by recording trees within 37 feet (radius of a 0.1-acre circle) of a point. This method will be described in more detail below.

Table 1. Average work accomplished in 30 minutes of field effort, recording the species and diameters of trees in an upland Ozark forest in Arkansas.

Sampling method	Number of Units	Number of trees identified and measured
Quarter method	12 quarters	48
Wandering quarter method	40 trees	40
Tenth-acre circles	2 circles	57
Hundredth-acre rectangles	6 rectangles	19

Table 2. Total numbers of trees in eight-acre study plot and percent of total. Names follow Moore (1960).

Common Name	Scientific Name	Total Trees	Trees / Acre	%
Winged Elm	*Ulmus alata*	752	94.0	35.5
Post Oak	*Quercus stellata*	276	34.5	13.0
Black Oak	*Quercus velutina*	194	24.3	9.2
Redbud	*Cercis canadensis*	126	15.8	5.9
Hackberry	*Celtis occidentalis*	121	15.1	5.7
American Elm	*Ulmus americana*	97	12.1	4.6
Slippery Elm	*Ulmus rubra*	95	11.9	4.5
White Ash	*Fraxinus americana*	83	10.4	3.9
Red Mulberry	*Morus rubra*	72	9.0	3.4
Chinkapin Oak	*Quercus muehlenbergii*	44	5.5	2.1
Eastern Red Cedar	*Juniperus virginiana*	39	4.9	1.8
Bitternut Hickory	*Carya cordiformis*	16	2.0	0.8
Flowering Dogwood	*Cornus florida*	15	1.9	0.7
Osage-orange	*Maclura pomifera*	13	1.6	0.6
Honeylocust	*Gleditsia triacanthos*	9	1.1	0.4
White Oak	*Quercus alba*	9	1.1	0.4
Black Hickory	*Carya texana*	9	1.1	0.4
American Plum	*Prunus americana*	8	1.0	0.4
Black Cherry	*Prunus serotina*	7	—	—
Black Walnut	*Juglans nigra*	4	—	—
Privet	*Ligustrum* sp.	2	—	—
Hawthorn	*Crataegus* spp.	2	—	—
Common Persimmon	*Diospyros virginiana*	1	—	—
Rusty Blackhaw	*Viburnum rufidulum*	1	—	—
Southern Red Oak	*Quercus falcata*	1	—	—
Dead tree		122	15.3	5.8
Total		2118	264.8	100%

Table 1 gives the average work accomplished in 30 minutes of field effort by one observer, assuming that he is familiar with the method and the species of trees present in his study area. Also, the amount accomplished will vary with the density of the vegetation and whether the observer has a second person along to record for him. Table 2 gives the results of the complete census of the trees in our study area. This involved marking of each of the eight acres with string, recording the species and diameter of each of 2118 trees greater than three inches in diameter, and dabbing each with paint to show that it had been counted. The area is part of a 45-acre tract on a west-facing slope within the city limits of Fayetteville, Arkansas, and is within one mile of the University of Arkansas. It was originally part of the mixed oak-hickory forest that typifies these sites in the Ozarks. Partial clearing and selective cutting of the largest trees in the early part of this century permitted invasion by pioneer species such as the Winged Elm (*Ulmus alata*), Eastern Red Cedar (*Juniperus virginiana*), Osage-orange (*Maclura pomifera*), American Plum (*Prunus americana*), Honeylocust (*Gleditsia triacanthos*), and Common Persimmon (*Diospyros virginiana*).

Figure 1 shows the results of the four sampling procedures in terms of their ability to predict the actual density of trees at the end of a specified period of field effort. Although the study area is small (8 acres), it is heterogeneous, being dominated at one end by small Winged Elms and at the other end by large Post Oaks. As a whole the area is probably more heterogeneous than the average larger areas on which breeding-bird surveys and winter bird-population studies are conducted. Results from the two plotless methods (quarter method and wandering quarter method) tended to overestimate the total tree density and to underestimate the tree density by species. Results from the two areal methods, hundredth-acre rectangles and tenth-acre circles, on the other hand, give fairly accurate estimates of total density and density of single species within two hours of field effort. For study plots in edge habitats hundredth-acre

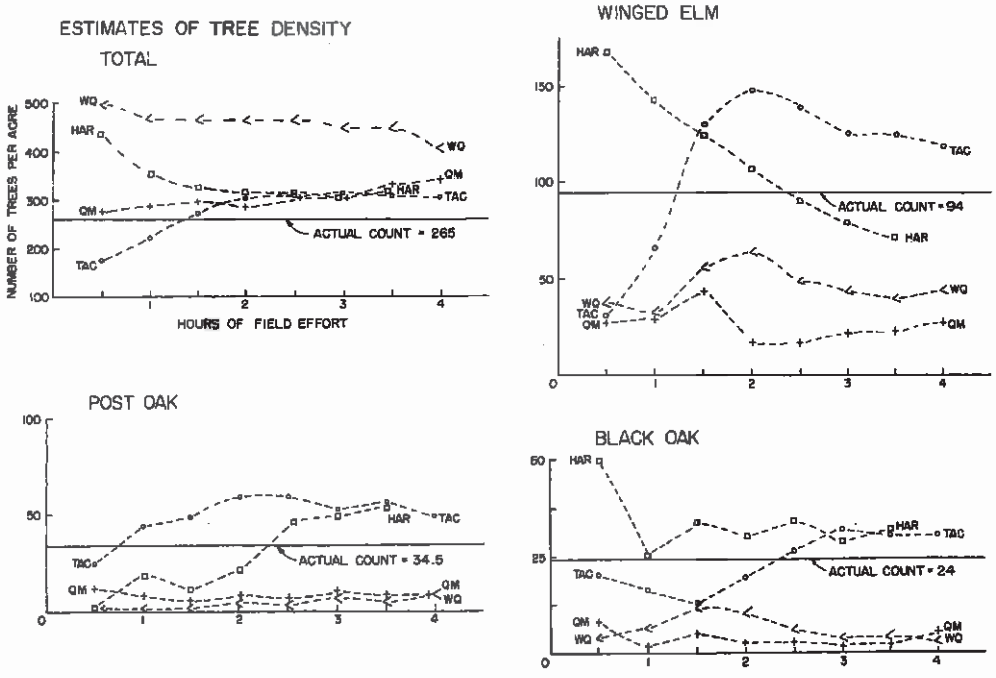

Figure 1. The results of estimates of tree density in terms of the amount of field effort using four sampling procedures. QM quarter method; WQ wandering quarter method; HAR hundredth-acre rectangles; TAC tenth-acre circles.

rectangles (armlength transects) oriented at random would probably be the most appropriate. For studies in forests having a fairly uniform tree distribution, we prefer tenth-acre circles. A description of the procedure for the latter method accompanied by a sample field sheet and summary sheet are given below in the hope that others will try this system of analysis. For our area the sampling of five randomly-chosen tenth-acre circles permitted adequate estimates of the density, dominance (basal area) and frequency (evenness of distribution) of trees in the forest. The totals need only be doubled to transpose the data to estimates per acre. In addition we suggest simple techniques for estimating shrub density, ground cover, canopy cover and canopy height.

The large differences among the relative efficiencies of the four sampling methods deserve comment. Apparently the method used, the size of the plot, and the amount of field effort expended influence the results obtained to an unsuspected degree. With the plotless methods either our sample sizes were too small or we did not take the data properly. Although we tried to pace accurately, the slope of the ground may have affected the length of steps. Also, analysis of data from these methods involves squaring mean distances, and this magnifies small errors. Even though the plotless techniques are mathematically sound, in practice they appear to be less accurate than the areal methods.

PROCEDURE

The only equipment needed for estimating density, basal area, and frequency of trees, canopy height, shrub density, percent ground cover and percent canopy cover is: 1) 2 yardsticks, 2) an ocular tube, 3) a mirror, 4) a level and 5) a clipboard (Figure 2). One yardstick should be brightly colored so that it may be seen easily through the forest. It should have hole in one end with string tied through it, so that the stick can be hung on a twig by the loop.

The most accurate way to measure tree diameters is with calipers or a forester's diameter tape. A simple and convenient substitute, called a Baltimore "reach stick" (Forbes 1955), can be made from the second yardstick. Cut it off at 28 inches and mark a new scale on it according to your reach. This is the distance from the eye to the fist with arm outstretched and head lowered. Use the calibrations in Table 3 which most nearly match

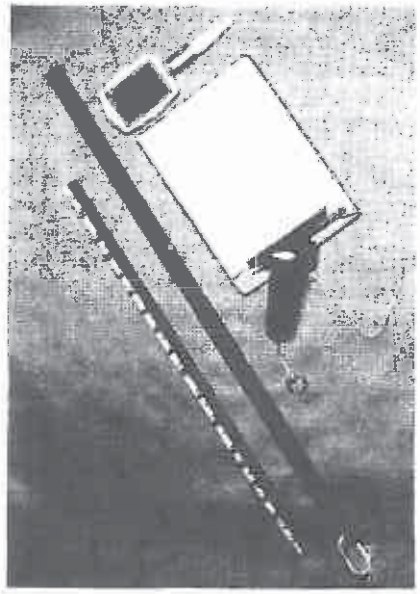

Figure 2. Equipment: 1) Two yardsticks — one with a string loop so that it may be hung on a branch, the other marked with a Biltmore scale for estimating tree diameters; 2) An ocular tube — a sighting device used to estimate ground cover and canopy cover, made from a cardboard cylinder with cross threads taped to one end and a weight suspended from the other; 3) and 4) a mirror with a level taped to it for determinations of canopy height; and 5) a clipboard, pencil and data sheets.

your particular reach. Kurfew Cruising Sticks marked with a Biltmore scale for a reach of 25 inches are available from Forestry Supplies, Inc. (Catalog Number 59740; 205 West Rankin Street, Jackson, Mississippi, 39202) for $3.00 plus tax and shipping charges. The calibrations on the stick are derived from the solution of similar triangles, based on the formula $S = \sqrt{\frac{a\ D^2}{a + D}}$ where S is the graduation on the stick, a is the reach of the observer, and D is the diameter of the tree. If carefully used, this stick is sufficiently accurate for the purposes desired here, and it is much more efficient timewise than any other method. The diameters of standing trees are commonly measured at breast height (DBH), 4½ feet above the ground. Hold the stick horizontally at arm's length and at breast height and read it (with one eye closed) from that height. Lower the eye to the level of the stick, do not raise the stick to eye level. When the left edge of the

SIZE CLASS	CALIBRATIONS ON YARDSTICK 22	24	26	TREE DIAMETER
A	2¾	2¾	2¾	3
B	5¼	5⅜	5⅜	6
C	7⅝	7¾	7¾	9
D	11⅝	11¾	11⅞	15
E	15	15¼	15⅝	21
F	18⅛	18½	18⅞	27
G	20⅞	21⅜	21⅞	33
H	23¾	24½	25⅛	40

Table 3. Calibrations to be marked on the Biltmore "reach stick" for estimating the diameter size classes of trees, adjusted for the distance from the observer's eye to his fist with arm outstretched (see Figures 2, 3A and the text for explanation).

stick is lined up with the left side of the tree, the diameter size class can be read from the right edge (Figure 3A).

Sight the original 36-inch yardstick from a distance of 37 feet (radius of a tenth-acre circle) by holding the "reach stick" vertically at arm's length (Figure 3B). Mark the back side of the "reach stick" accordingly. This will be approximately 1¾ inches from the end. Now, when you hang the first yardstick in the woods at the center of your circle, you can tell whether you are within the area to be sampled by using this simple sighting method. Staying within the circle you can record the species and size classes of trees. Use abbreviated word descriptions for the unknowns and identify the dominant five species later. The information from five 0.1-acre circular plots may be sufficient to estimate tree density, dominance and frequency for the entire area. A simple way to find out whether your sample is adequate is to continue recording until the last two estimates of the total tree density per acre do not differ by more than 25 trees. To obtain estimates of total tree density per acre, multiply the following numbers by the number of trees counted:

Number of Circles	Multiply by
5	2.0
6	1.6
7	1.4
8	1.3
9	1.1
10	1.0

The choice of the centers of the circles must be random. Any attempt to select typical places is likely to be biased. For the Breeding-Bird Census, count the number of tags which mark the corners of acres and subtract the number which occur on the perimeter. For a 100-acre plot marked 1-11

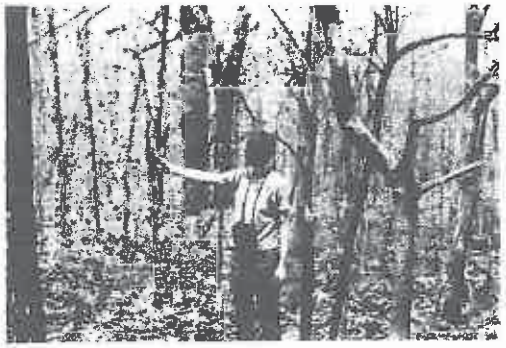

Figure 3. Procedure: A) Holding the "reach stick" at arm's length with the left edge lined up with the left side of the tree, read the diameter size class.

B) If the image of a yardstick suspended from a branch is greater than 1¾ inches, when sighted at armslength against the "reach stick", you are within 37 feet of the yardstick (radius of a 0.1-acre circle).

C) Sight directly upwards through the ocular tube to determine the presence or absence of canopy cover.

D) Sight the ground four feet from the observer to determine the presence of absence of green vegetation on the ground.

E) Holding the mirror level, walk toward a tree until the crown appears in the mirror. Three feet plus the distance from the mirror to the tree equals the height of the tree.

on one axis and A-K on the other, it takes 121 tags to mark a grid of 100 square acres. Of these, 81 are in the interior of the plot. In this case you would make 81 small slips of paper marked B2, B3 . . ., B10; C2, C3, . . ., C10; . . .; J2, J3, . . ., J10. Mix up the slips and draw ten, keeping track of the order in which they were drawn. This will tell you the location of the centers of the sample circles and the order in which to take them. You will probably not need to use all ten. In the case of the Winter Bird-Population Study, mark a grid on your map of the study area, and proceed as above. Determine the locations of the circles by pacing from the edge of the area.

If you prefer to use the metric system, the following conversions can be used:

To convert	*Into*	*Multiply by*
acres	hectares	0.4
feet	meters	0.3
square feet	square meters	0.093
square feet	square centimeters	929.0
inches	centimeters	2.5

The sample circles will have an area of 0.04 hectares and a radius of 11.28 meters. The reach stick can be calibrated in centimeters using the formula given above if centimeters are substituted for inches throughout the procedure.

To estimate shrub density make two transects at right angles to one another across the 0.1-acre circle, counting the number of

FIELD SHEET FOR VEGETATION DATA

LOCATION: Archer Woods — Distance & direction to nearest town having a post office: Fayetteville, Ark.

SIZE: 8 acres — DATE: 9/25/'67 — LATITUDE - LONGITUDE:

DESCRIPTION OF AREA: oak-hickory upland forest

TOPOGRAPHY: west-facing slope

TENTH-ACRE CIRCLES

TREES: (DIAMETER SIZE CLASSES A-H: 3-6, 6-9, 9-15, 15-21, 21-27, 27-33, 33-40, >40)

SPECIES*	Circle 1	Circle 2	Circle 3	Circle 4	Circle 5	Circle 6
1 Winged Elm	AAAAB	C	AAAA BBB	AAABAAAAAAAAA	AAAAAAAAAABBB	AD
2 Dead Tree	ABD	B B	AC	B		
3 Mulberry	AAA				A	
4 White Ash	EE	A	AAAAA		A	D
5 Slippery Elm	AAA		AAAA			
6 Hackberry	A		AB			
7 Redbud	AA	B				A
8 Black Oak	C	AAA	A	A		AAAAAAAAAAA
9 Black Hickory		A	C			A
10 Post Oak		A B D D F		BBBCCCCCCDEF	ABBBB CCC	
Honey Locust		A	A			
Chestnut Oak			C			
White Oak				B	E	
Cedar				C		
Dogwood				A		

SHRUBS: (NUMBER OF WOODY STEMS LESS THAN 3 INCHES d.b.h. INTERCEPTED IN 2 ARMLENGTH TRANSECTS)

Young winged elms mostly	23	33	1	5	14	6	5	13	8	10		

GROUND COVER: (20 RANDOM + OR − SIGHTINGS THROUGH OCULAR TUBE FOR PRESENCE OR ABSENCE OF GREEN VEGETATION)

Symphoricarpus	--+-+----- -------+	---------+ -+-------	+-+-+++-++ ++++-++---	---++--+++ ----+-----	-+-+------ -----+--++
very little grass					

CANOPY COVER: (20 + OR − SIGHTINGS THROUGH OCULAR TUBE FOR PRESENCE OR ABSENCE OF GREEN VEGETATION)

++---------++- --++++++++	++++++++++ ++++++++++	++++++++++ ++++++++++	++++++++++ ++++++++++	++++++++++ ++++++++++

CANOPY HEIGHT: (MAXIMUM CANOPY HEIGHT IN FEET)

40	70	50	45	50	

*Use abbreviated descriptions of trees, shrubs, or herbs to designate species to be identified later (eg. smooth bark, heart-shaped leaf) It is important to identify only the five dominant species

To check the adequacy of the sample: Total number of trees in 5 circles x 2 = 226 = estimated trees/acre

Total number of trees in 6 circles x 1.6 = 210

Difference = 16

If the difference is less than 25 trees, the sample is adequate If it is greater than 25 trees, see procedure

Figure 4. Sample field sheet.

SUMMARY SHEET FOR TENTH-ACRE CIRCLES

NUMBER OF CIRCLES = 5

TREES: DENSITY[1] — SPECIES	NUMBER OF TREES IN ALL CIRCLES BY DIAMETER SIZE CLASS: A 3-6	B 6-9	C 9-15	D 15-21	E 21-27	F 27-33	G 33-40	H[4] >40	TOTAL	TREES/ACRE[2] (BY SPECIES)	RELATIVE DENSITY[3] (BY SPECIES)	BASAL AREA[5] — CROSS SECTIONAL AREA OF THE TRUNK AT 4.5 FT. FROM THE GROUND (d.b.h.): A[6] (0.1)	B (0.3)	C (0.8)	D (1.8)	E (3.1)	F (4.9)	G (7.1)	H 1.005 (d2)	TOTAL BASAL AREA (BY SPECIES; SQ. FT.)	RELATIVE DOMINANCE[7] (BY SPECIES)	FREQUENCY[8] — NO. OF CIRCLES IN WHICH SPECIES OCCURRED	RELATIVE FREQUENCY[9]
1 Winged Elm	30	8	1						39	78	36	3.0	2.4	0.8						6.2	11	4	80
2 Dead Tree	2	4	1	1					8	16	7	0.2	1.2	0.8	1.8					4.0	7	4	80
3 Mulberry	4								4	8	4	0.4								0.4	1	2	40
4 White Ash	7				2				9	18	9	0.7				6.2				6.9	13	4	80
5 Slippery Elm	7								7	14	6	0.7								0.7	1	2	40
6 Hackberry	2	1							3	6	3	0.2	0.3							0.5	1	2	40
7 Redbud	2	1							3	6	4	0.2	0.3							0.5	1	2	40
8 Black Oak	5		1						6	12	5	0.5		0.8						1.3	2	4	80
9 Black Hickory	1		1						2	4	3	0.1		0.8						0.9	2	2	40
10 Post Oak	2	8	9	3	1	2			25	50	22	0.2	2.4	7.2	5.4	3.1	9.8			28.1	51	3	60
Other	3	1	2		1				7	14	7	0.3	0.3	1.6		3.1				5.3	10	·	
TOTALS	65	23	15	4	4	2			113	226	100%	6.5	6.9	12.0	7.2	12.4	9.8			54.8	100%		100%
TREES/ACRE (BY SIZE CLASS)	130	46	30	8	8	4			BASAL AREA (BY SIZE CLASS)			13.0	13.8	24.0	14.4	24.8	19.6						
RELATIVE DENSITY (BY SIZE CLASS)	57	20	11	4	4	2			RELATIVE BASAL AREA (BY SIZE CLASS)			12	13	22	13	22	18						

SHRUBS: Total shrub stems in all transects (2 per circle) x 1000, divided by the number of transects = 23600 Shrub stems per acre

GROUND COVER: Total pluses (+) recorded (20 sightings per circle) x 100, divided by the total number of sightings = 29 % Ground Cover

CANOPY COVER: Total pluses (+) recorded (20 sightings per circle) x 100, divided by the total number of sightings = 90 % Canopy Cover

CANOPY HEIGHT: Average = 51 Range = 40 - 70

NOTES:

[1] Number per unit area

[2] Total trees counted x { 2 if 5 circles; 16 " 6 "; 14 " 7 "; 13 " 8 "; 11 " 9 "; 10 " 10 " }

[3] Relative density is the percent of the total number of trees which are the species in question: number of trees of the species / total number of trees of all species x 100

[4] Give estimated diameter

[5] Basal area is the cross sectional area of the trunk of a tree at 4.5 feet (d.b.h.)

[6] Multiply the number of trees in all circles in size class A times 0.1 (average area in square feet for this size class)

[7] Total basal area of the species / Total basal area of all species x 100

[8] Frequency indicates the evenness of distribution of a species

[9] Number of circles in which the species occurred / Total number of circles x 100

Figure 5. Sample summary and analysis sheet.

woody stems less than three inches in diameter intercepted by your outstretched arms. The total number of shrubs counted in two transects in each of five 0.1-acre circles times 10 equals an estimate of shrub stems per acre.

An ocular tube can be made by taping cross threads across one end of a cardboard cylinder from a roll of bathroom tissue. A weight suspended from the other end will help you sight directly upwards for determinations of canopy cover (Figure 3C). By sighting directly overhead on alternate steps of a transect of the circle you can record 20 plus or minus readings for the presence or absence of canopy cover sighted where the threads cross. Likewise, 20 plus or minus readings, taken at random through the tube held at arm's length and pointed downward about four feet from the observer, can provide a record of the presence or absence of green vegetation on the ground (Figure 3D).

Simple triangulation techniques for estimating canopy height can be found in the Boy Scout Handbook, the Farmers' Almanac and elsewhere. We recommend the following: Tape a small level to a mirror. The level shown in Figure 2 was made from a small vial of water having one air bubble. Holding the mirror at arm's length three feet from the ground, walk toward a tree until the *crown* of the tree appears in the mirror (Figure 3E). Three feet plus the distance from the mirror to the tree equals the height of the tree. If you have determined the length of your step previously, find the number of steps between the mirror and the tree and multiply by the length of your average step. Take one reading in each circle.

Figure 4 is a sample sheet designed for recording data in the field. Figure 5 is a summary and analysis sheet. Information abstracted from the summary sheets could accompany each breeding bird census and winter bird-population study. For example:

> Trees, 3-in. diameter and over, based on five 0.1-acre circular samples, 226 / acre; total basal area 109.6 square feet / acre. Species comprising 90% of the total number of trees [figures after each give number of trees / acre, relative density (%), relative dominance, frequency, in that sequence]: Winged Elm, *Ulmus alata* 78,36,11,80; Post Oak, *Quercus stellata* 50,22,51,40; White Ash, *Fraxinus americana* 18,9, 13,80; Dead trees 16,7,7,80; Slippery Elm, *Ulmus rubra* 14,6,1,40; Black Oak, *Quercus velutina* 12,5,2,80; Red Mulberry, *Morus rubra* 8,4,1,40; Redbud, *Cercis canadensis* 6,4,1,40; Hackberry, *Celtis occidentalis* 6,3,1,40. Trees by diameter size class (figures after each class give number of trees / acre, relative density (%), basal area in square feet / acre, relative dominance): A (3-6 in.) 130, 57, 13.0, 12; B (6-9 in.) 46, 20, 13.8, 13; C (9-15 in.) 30, 11, 24.0, 22; D (15-21 in.) 8, 4, 14.4, 13; E (21-27 in.) 8, 4, 24.8, 22; F (27-33 in.) 4, 2, 19.6, 18. Shrub stems / acre, 23,600; Ground cover 29%; Canopy cover 90%; Average canopy height 51 feet (range 40-70).

The analysis should be repeated every few years in study areas in which the structure of the vegetation is changing markedly. If the National Audubon Society would act as a data bank for the original sheets, and if the data are procured in a regular manner which would permit comparisons later, a file will accumulate that will be potentially useful for other types of habitat analyses in the future. Optimal methods for the quantitative habitat description of grassland, desert, edge and town situations will be recommended in a later paper.

CONCLUSION

We think that the usefulness of the Breeding-Bird Census and the Winter Bird-Population Study would be increased greatly if observers would provide accompanying quantitative data on the structure of the vegetation. By sampling five or more tenth-acre circular plots this information can be obtained with a maximum of accuracy and a minimum of effort. Additional word descriptions of the physiognomy of the area and other non-botanical features will still be valuable.

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EDITORIAL NOTE

As an uninvolved devotee of Audubon Field Notes, our interest in the traditional Breeding Bird Census number was somewhat less than impassioned. It was always our feeling that this was indeed valuable field work, but very poor reading, and after the most casual of perusals we would consign the December number to the files.

Therefore, as editor, we have been required to examine each census word-for-word, and this year we discovered how much fascinating reading is being offered in these pages. This is living documentation, with sometimes dramatic warnings revealed, of the state of our breeding avifauna in sample tracts of North American habitat.

The problem is that there is simply not enough of this research being done. Everywhere in Canada and the United States are neglected regions and habitats that cry out for attention. If we are ever to know our present base-lines of populations and our "normal" densities (which are increasingly precious in seeking to protect those populations and habitats which are threatened), we must enlist a growing corps of volunteers as dedicated as those represented here. This work is not particularly arduous, nor is it technically demanding; it can be done by amateurs; the reward for individuals or groups is the participation in a worthwhile continent-wide endeavor. It is recommended to every serious bird student whether or not affiliated with or sponsored by an institution. Instruction folders are available from this office; there is still time to participate this year in a Winter Bird Population Study, and to add a Breeding Bird Census on the same plot next summer. There is no more valuable field work waiting to be done.—R.S.A.