

**Search of the Puerto Rican crested toad (*Peltophryne lemur*)
and coquí llanero (*Eleutherodactylus juanariveroi*) in areas proposed for the
construction of *Vía Verde***

For:

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SUMMARY

The government of Puerto Rico, through the Puerto Rico Electric Power Authority, proposes the construction of a pipeline that would run from the Eco-Electric plant in Guayanilla, southwestern Puerto Rico, to Central Palo Seco in the municipality of Cataño. The project is known as *Vía Verde* and will have a total length of 92 miles. As part of environmental assessment required for the construction of the project, it was necessary to conduct a study to determine the presence of the Puerto Rican crested toad (*Peltophryne lemur*) and coquí llanero (*Eleutherodactylus juanariveroi*) in specific sections within the proposed alignment of the pipeline. Both species are considered endangered. Although the study areas meet many of the habitat requirements for the crested toad, during the search period no individuals of this species were found. However, this study documents the presence of a new location for the coquí llanero.

INTRODUCTION

The government of Puerto Rico, through the Puerto Rico Electric Power Authority, proposes the construction of a 24-inches diameter steel pipe to transport natural gas from the Eco-Electric plant in Guayanilla, southwestern Puerto Rico to Central Palo Seco in the municipality of Cataño. This project is known as *Vía Verde* and will have a total length of 92 miles, running through the municipalities of Peñuelas, Adjuntas, Utuado, Arecibo, Barceloneta, Manatí, Vega Baja, Vega Alta, Dorado, Toa Baja, Cataño, Bayamón and Guaynabo.

Construction of the project includes cleaning of right of way, digging trenches, installing pipe and testing the pipe installed. The right of way to be established during construction will be 150 feet wide along the entire alignment and include areas of maintenance and operation. Within this right of way, 50 feet will be for permanent operational maintenance of the pipeline. This 50-foot transect will be kept free of deep-rooted vegetation and any construction. According to the environmental impact statement (EIS), the remainder of the maintenance right of way will be reforested. On the other hand, the trenches will have a depth of five to six feet and a width of four to five feet. The same excavated material will be used to cover the installed pipe.

As indicated in the EIS, the proposed project will cross roads and water bodies. To minimize the impact in both cases, boring will be used under roads and water bodies (Section 1.2, pages 10 and 11). In these areas, the right of way will be greater than 150 feet and less than 300 feet. The areas affected by the construction of *Vía Verde* will be restored. In the case of wetlands, vegetation to be impacted or removed will be mitigated once finished the construction. However, in forested areas the right of way will be kept free of vegetation.

As part of the environmental requirements for the proposed project, an inventory of the flora and fauna elements was conducted along the proposed alignment. However, due to the magnitude of the project and the diversity of habitats through which it crosses, it becomes necessary to supplement the information related to specific wildlife species previously identified by regulatory agencies. Among the species of interest are the Puerto Rican crested toad (*Peltophryne lemur*) and coquí llanero (*Eleutherodactylus juanariveroi*). In regard to the crested toad, the project would impact an area in the municipality of Peñuelas that has been identified as potential habitat for the species. In addition, *Vía Verde* is proposed to cross historical crested toad sites, in northern Puerto Rico, specifically in the municipalities of Manatí and Vega Baja.

Some of these areas are also listed as potential habitat for the species (USFWS 1992). In the case of coquí llanero, the pipeline would traverse wetland areas in the municipality of Toa Baja, that has been identified as potential habitat for the species. The purpose of this report is to present the findings on efforts to document the presence of crested toad and coquí llanero in three areas within the proposed alignment for the *Vía Verde* project.

Description of target species

Crested toad

Individuals of crested toad are medium-sized (64-120 mm, SVL), characterized by supraorbital crests and a long upturned snout (Figure 1). Its dorsal color is brown-blackish with white or yellow marbling; females are off-white in the ventral area, while males are yellowish. The species exhibits sexual dimorphism, females being larger than males (120 mm females, 85 mm males), in addition females have prominent cephalic crests and lack nuptial pads on the first fingers (Rivero 1998).

The crested toad is the only species of toad endemic to Puerto Rico and Virgin Gorda. On Virgin Gorda, the species has not been observed in the last three decades and is now considered extinct (Díaz-Lameiro et al. 2010). In Puerto Rico, the historical distribution of the species is associated with lowland limestone forest in both the north and south parts of the Island. Historical records in the north include locations in the municipalities of Isabela, Quebradillas, Arecibo, Barceloneta, Bayamón, and Vega Baja, whereas in the south the species is known for the municipalities of Guánica and Coamo (USFWS 1992, Díaz-Lameiro et al. 2010). The species was considered extinct in Puerto Rico until it was rediscovered in Isabela in 1966 (García Díaz 1967), and in Quebradillas in 1974 (Rivero 1980). In southern Puerto Rico the crested toad was rediscovered in 1984 in the Guánica National Forest (Moreno 1985). Currently, the only known wild populations of this species are located in Guánica, Guayanilla and Yauco. In 2006 the species was reintroduced at El Tallonal Private Reserve in Arecibo, and 2007 tadpoles were released in the municipality of Coamo. At present, *P. lemur* is listed as an endangered species by the U.S. Fish and Wildlife Service and the Puerto Rico Department of Environment and Natural Resources. In addition, the species is on the red list of threatened species of the International Union for the Conservation of Nature (IUCN 2009).

The habitat of *P. lemur* is associated with humid, arid or semiarid limestone forests, characterized by a high content of cavities and cracks in soil with good drainage and diverse vegetation (USFWS 1992). Areas of runoff accumulation or permanent ponds that serve for breeding are essential components of habitat for the species. The period of greatest activity of the species is during the rainy season, specifically after heavy rain, when both males and females leave their refuges and travel long distances to get to the permanent or temporary pools where

individuals congregate to breed (USFW 1992, Rivero 1998). The crested toad has the ability to travel about two miles from cavities and crevices used as retreat sites in the wooded hills (Moreno 1985, Lentini 1992, Johnson 2001).

Coquí Llanero

The coquí llanero (*Eleutherodactylus juanariveroi*) was discovered in 2004 in seasonally flooded herbaceous wetland in the municipality of Toa Baja. This species is the smallest of the genus *Eleutherodactylus* on the Island. Adults are 15 mm in body length on average (Ríos-López and Thomas 2007). Its color ranges from yellow to yellowish brown with a light, longitudinal, reversed comma mark on each side; its mid-dorsal zone is broadly bifurcated and has two conspicuous post-tympanic glands (Figure 2). The call consists of a series of short high pitched notes with call duration varying from 4 to 21 seconds. The calling activity starts at sunset and decreases before midnight.

The coquí llanero is characterized by the smallest geographical distribution of all frogs in Puerto Rico. The only known population, is located in the Sabana Seca, Ingenio Ward within the Sabana Seca U.S. Naval Security Group Activity property and the Caribbean Primate Research Center in the municipality of Toa Baja. The species is considered a habitat specialist, limited to a 180 hectares of seasonally flooded palustrine wetland at 17 m (55.8 ft) above sea level on limestone formation (Ríos-López and Thomas 2007). The 25% of the wetland vegetation consists of two rare species of ferns, *Blechnum serrulatum* (Blechnaceae), *Thelypteris interrupta* (Thelypteridaceae) and *Sagittaria lancifolia* (Alismataceae), a plant where the coquí llanero lays its eggs. This species has been designated as critically endangered (DRNA 2007) and its habitat has been designated as Essential Critical Habitat (DNER 2007).

METHODOLOGY

Crested toad

The search was focused in three sections within the *Vía Verde* project alignment that are considered part of the historical distribution of the species. One of these locations is in the municipality of Peñuelas and the other two are located in the municipalities of Manatí and Vega Baja. Prior to the field visits, a simple water flow accumulation model was developed using geographic information system (GIS). For the development of the model, digital elevation maps for Puerto Rico were used, each built with 30-meter cells. Using the spatial analysis hydrology tool, a flow management tool was applied to create a grid using the elevation information. The numerical model uses this information to calculate what flow would follow the raindrops falling on each plot. As a result of this analysis, maps that identified the areas where the accumulation of water will occur were created (Figures 3, 4 and 5). This tool is frequently used to identify watersheds, streams and rivers, among others. All water accumulation areas indicated by the model that were located in the proposed alignment of *Vía Verde* were identified. Then, all those areas were visited and the search was narrowed to 100 feet to each side of the proposed alignment. All areas identified were visited during the day, which allowed identifying the landscape and its associated habitat. In addition, visits were carried out at night to detect the species. During the visits, substrates such as small caves and rock shelters were searched actively. The presence of cavities and cracks in the limestone are of vital importance for this species, as it provides hydrated places where the crested toad can hide during the day (Matos-Torres 2003). Moreover, tadpoles were searched and identified in all areas where pools were identified. All visits were conducted between the months of November and December 2010.

Coquí Llanero

For the coquí llanero, habitat assessment and search for the species was conducted along the proposed alignment of the project in the municipality of Toa Baja. Prior to the field visits, equidistant points on the aerial photo were set along the proposed alignment and were used as search reference (Figure 6). Visits were conducted during daylight in December 2010 and day and night during the month of January and February 2011. In addition, playback calls were used during night to encourage males to vocalize.

RESULTS AND DISCUSSION

Crested toad

No individuals of crested toad were either observed or heard during the visits conducted to determine the presence of the species in the study areas (Table 1). Tadpoles of the species were not observed on any of the temporary and permanent ponds found throughout the areas studied. However, the presence of the toad in those areas cannot be categorically discarded because the search coincided with the period of low activity for the species and therefore, the probability of detection was significantly reduced. The active period for the species coincides with the rainy season, when males and females leave their places of refuge to breed in permanent or temporary ponds (USFW 1992, Rivero 1998). Furthermore, amphibians are ectotherms and their nocturnal activity is determined by air temperature, where activity increases with higher temperatures (Lampo and Bayliss 1996, Duellman and Trueb 1994).

As part of efforts to increase the chances of finding the species, a flow accumulation model was used. The model identified a total of 27 sites within a range of approximately 200 feet along the search sections in the pipeline alignment. Of these, 5 accumulation areas were in the south (Figure 7), 9 on Vega Baja (Figure 8) and 14 in the path of Manatí (Figure 11). All areas were visited and evaluated according to the habitat requirements of the species. Many of the habitat requirements of the species such as continuous limestone forest areas, caves and crevices between rocks and temporary ponds were present in the visited areas (USFW 1992). In addition, the sites visited are within the historical distribution range of the species in both north and south of the Island (USFWS 1992). Below is a description of the sites identified as potential for the presence of the species.

South Section

Of the five areas identified by the model in the south, three have the potential to be habitat for the species (Figure 7). Area 1 and 5 hold water intermittently and both are surrounded by dry forest. Area 2 consists of two permanent ponds surrounded by dry forest. The areas have a separation of thirty feet among them but lies within the same channel. The ponds are being used by the common toad (*Rhynella marina*) and white-lip frog (*Leptodactylus albilabris*). During the visits, adult and tadpoles of both species were observed.

Vega Baja Section

The flow accumulation model identified 9 areas within the proposed route along the Vega Baja section (Figure 8). Within the visited areas a permanent artificial pond was identified as potential breeding place for the species, the pond is near the accumulation area number two. This pond is located in a flat area about 75 m away from the nearest haystack hill and is surrounded by pastures (Figure 9). In this pond, tadpoles of the common toad were observed. However, in this section, the area with the greatest potential for occurrence of the species is located between points 5 and 6 (see Figure 8). This area consists of a sinkhole that flows into an intermittent streambed which forms small temporary ponds during rain periods (Figure 10). This site is within part of a limestone forest that is in good condition, and is characterized by a large number of cavities and leaf litter (see Figure 10). The sinkhole runs between the haystack hills, connecting with other streambeds until reaches a residence backyard. These forests are part of the limestone area where individuals of crested toad had been observed in the past (Bird-Picó and Binet, personal communication).

Manatí Section

In this section the model of flow accumulation identified a total of 14 areas (Figure 11). Of these, the areas 6, 7 and 12 contain potential habitat for the crested toad. Area 6 consists of a sinkhole that collects runoff water. It is surrounded by limestone forest and contains cavities that can serve as retreat sites for the species. Area 7 is a sinkhole with a small permanent pond in which tadpoles of white-lipped frog were observed. This area is surrounded by both limestone forest and open areas. Finally, the area 12 is a sinkhole that collects runoff water forming small intermittent ponds. This area is adjacent on one side to a haystack hill and to an abandoned agricultural field on the other side. All ponds contained tadpoles of the white-lipped frog.

During visits to this section, the presence of the Puerto Rico boa (*Epicrates inornatus*) was documented in two locations (Figure 12). In one of the places, a dead juvenile individual, probably attacked by a predator, was found (Figure 13). In addition, at least one individual of *Ottoschulzia rhodoxylon* was observed on the top of one of the haystack hills (Figure 12).

Coquí llanero

The studied section can be described as heterogeneous in terms of its vegetation. The area extends from road PR-165 to the south of road PR- 867, and comprises a mosaic of herbaceous wetland and upland. The dominant vegetation in these areas was improved pastures, cattail (*Typha domingensis*) and black mimosa (*Mimosa pigra*). In terms of the amphibian community, the common coquí (*Eleutherodactylus coqui*), the Antillean coquí (*Eleutherodactylus antillensis*), whistling coquí (*Eleutherodactylus cochranae*), white-lip frog (*Leptodactylus albilabris*) and common Scinax (*Scinax rubra*; introduced to the Island in 1988), were the most commonly observed and/or heard. The coquí llanero was neither heard nor observed in this area during the study. The area near point three was not visited for safety reasons. An illegal drug dealer was operating in this site.

The section that runs from road PR-867 and ends in road PR-165 to the north is mostly comprised by areas of improved pastures, interrupted by canals and lagoons populated by *Panicum aquaticum*, *Cyperus giganteus*, *Eichhornia crassipes*, *Alternanthera philoxeroides* and *Pistia stratiotes*, among others. Closer to the coast, in addition to areas covered by grass, there are groups of trees and shrubs that include almond, coconut palms and mangroves, among others. During visits to this portion of the section, the presence of at least six individuals of the coquí llanero was detected (Figure 6). The species was heard in the grassy vegetation along the sides of the water channel. This site represents the first location for the coquí llanero outside of the habitat originally described for the species.

CONCLUSION

Study areas were monitored between November and December 2010 for the detection of the Puerto Rican crested toad, and extended until February for the presence of the coquí llanero. The crested toad was not detected during that period neither in the north nor in the south of the Island. However, the presence of the toad in those areas cannot be categorically discarded since the habitat is suitable for the species. Moreover, the areas that were monitored are within the historical range of this species. In terms of the coquí llanero, the species was detected in December and January along the side of one of the channels that runs through the study area in the municipality of Toa Baja.

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Appendix

Figure 1. Photo of a male of crested toad (*Peltophryne lemur*). Photo: Alberto R. Puente-Rolón



Figure 2. Photo of a male of the coquí llanero (*Eleutherodactylus juanariveroi*).
Source: Ríos López, 2007.



Figura 3. Aerial photo showing the water flow accumulation model for Peñuelas section.

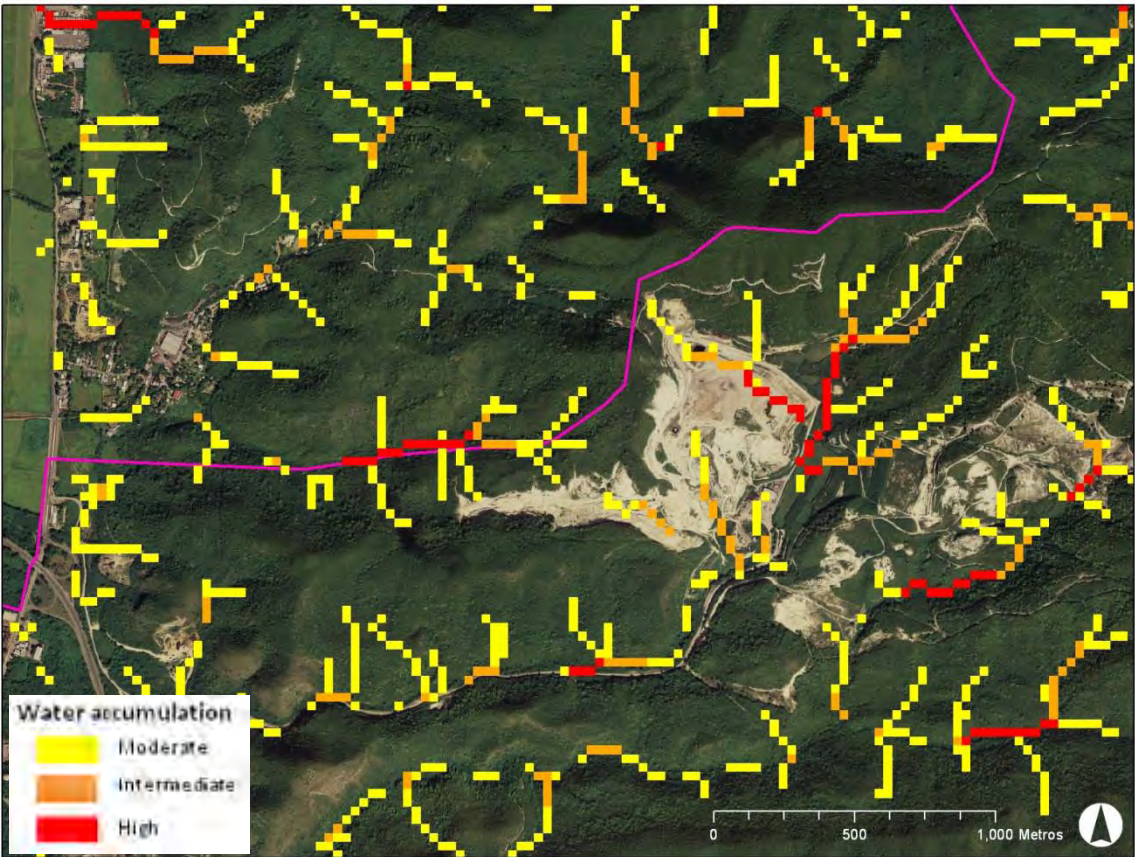


Figure 4. Aerial photo showing the water flow accumulation model for Vega Baja section.

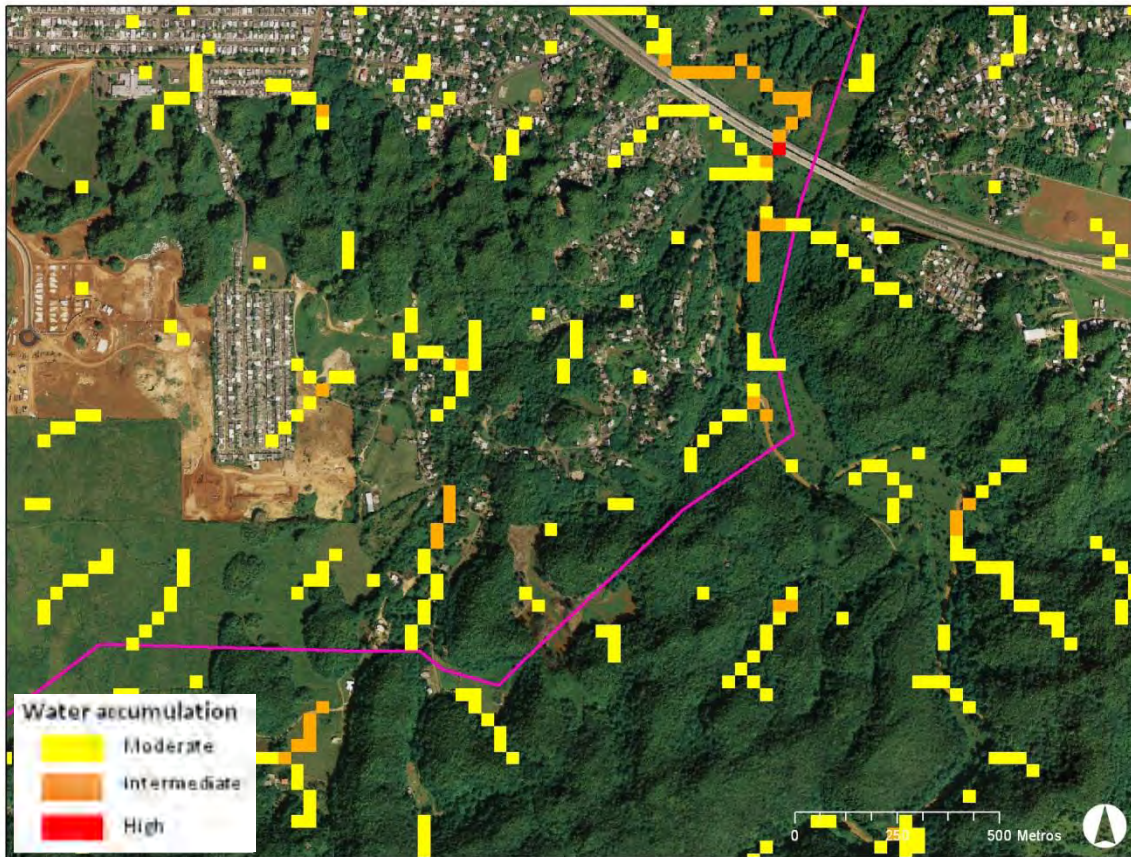


Figure 5. Aerial photo showing the water flow accumulation model for Manatí section.

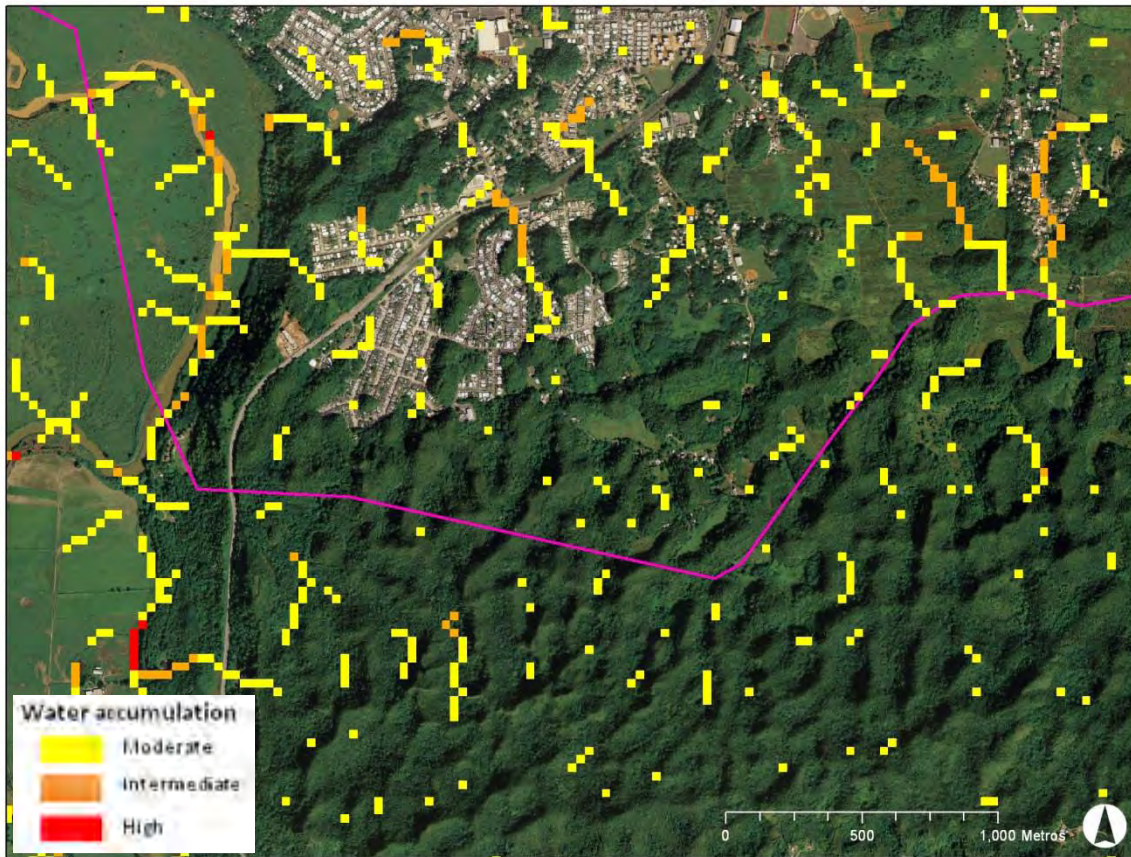


Figure 6. Aerial photo of the section studied at the municipality of Toa Baja. Points 1-9 were used as reference points within the alignment. The blue dot in the figure point out the locality where the species was heard.



Figure 7. Aerial photo of Peñuelas section showing the areas of accumulation that were identified for the search of the crested toad and the permanent ponds identified as potential reproduction areas for the species (ponds are represented by blue points).

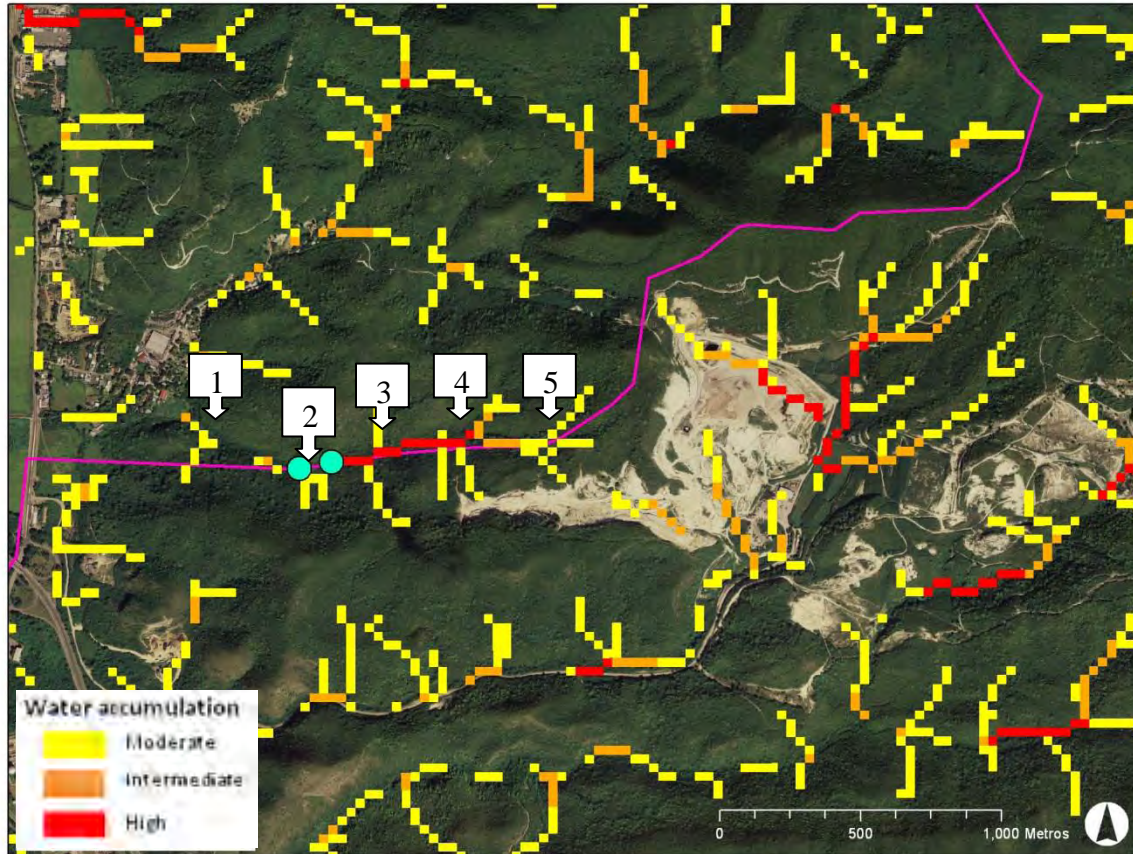


Figure 8. Aerial photo of Vega Baja section showing the areas of accumulation that were identified for the search of the crested toad.

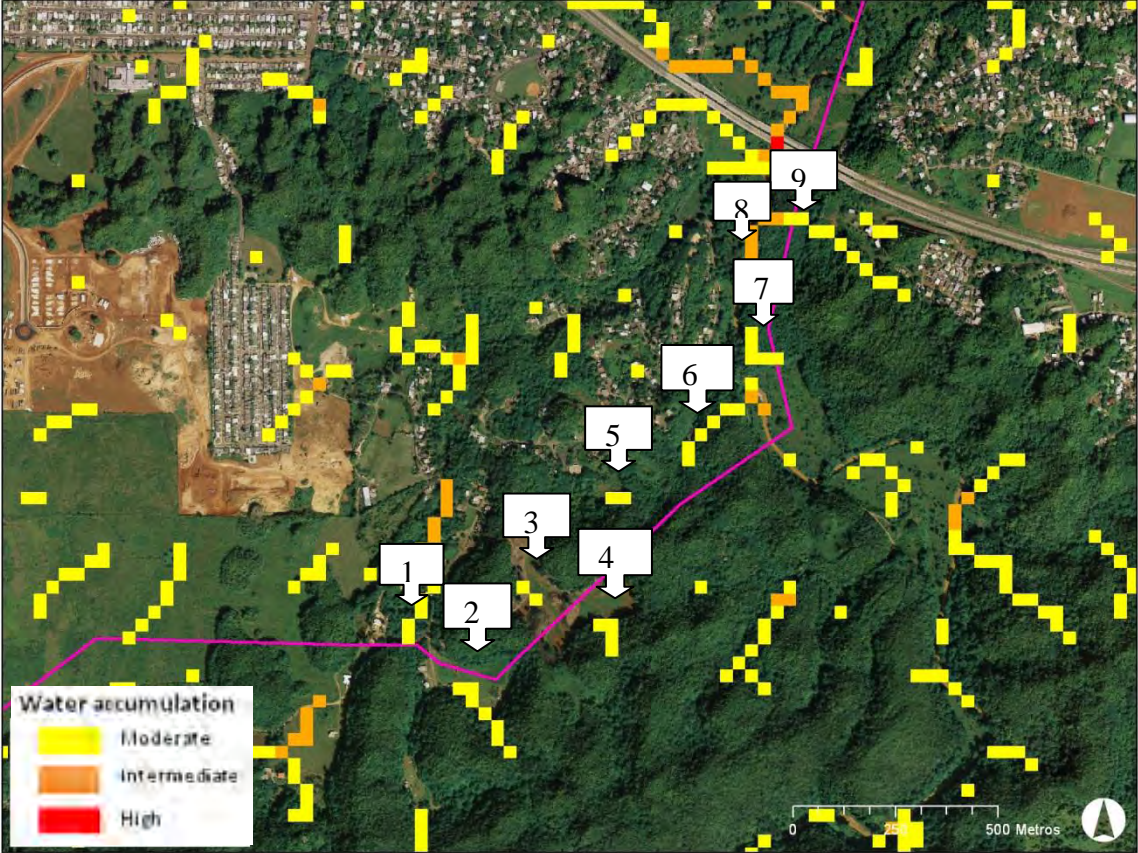


Figure 9. Photo of the artificial pond found near the second water accumulation area.



Figure 10. Photos showing the area between point 5 and 6, these areas were identified as potential habitat for the crested toad.

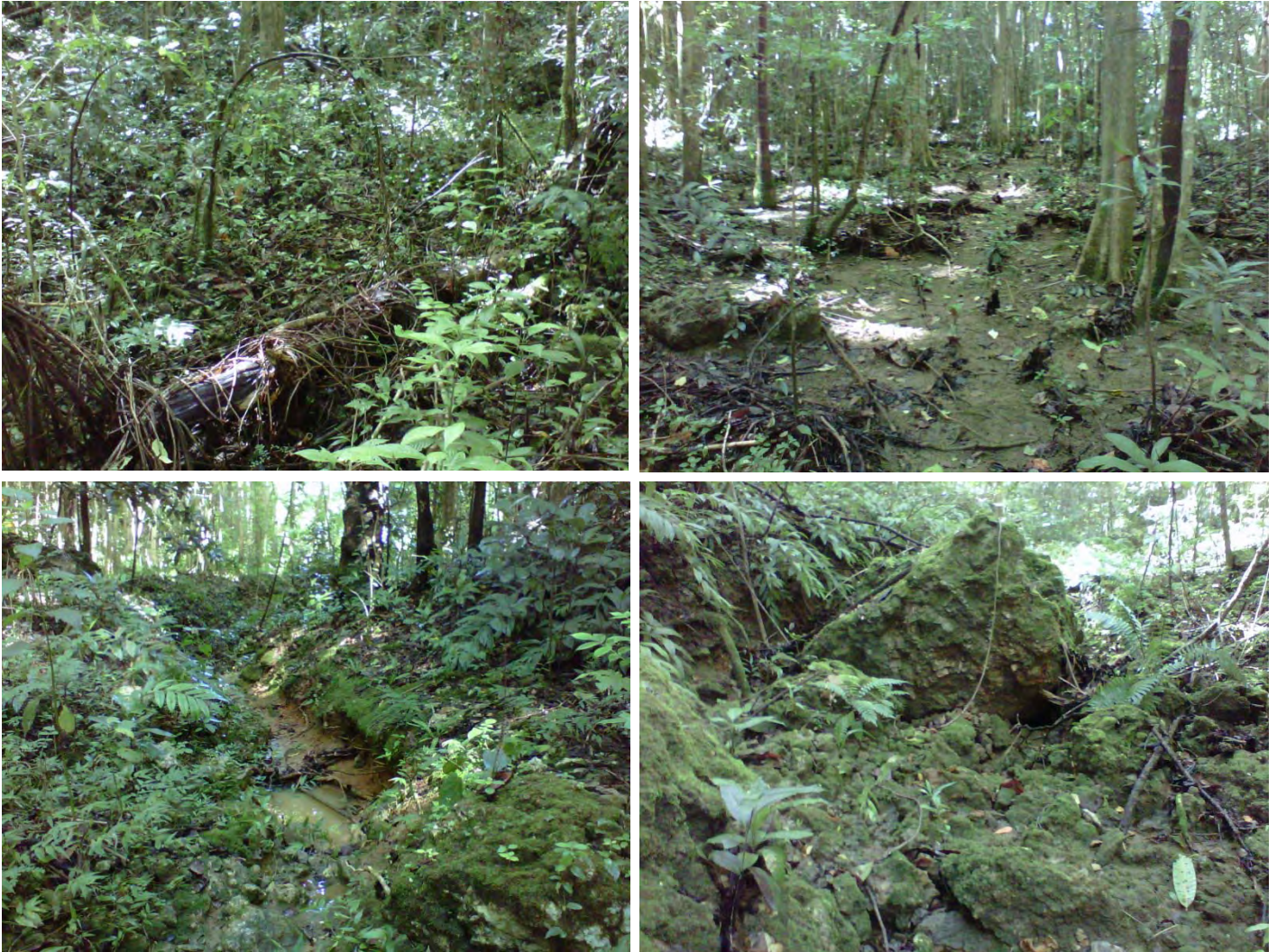


Figure 11. Aerial photo of Vega Baja section showing the areas of accumulation that were identified for the search of the crested toad.

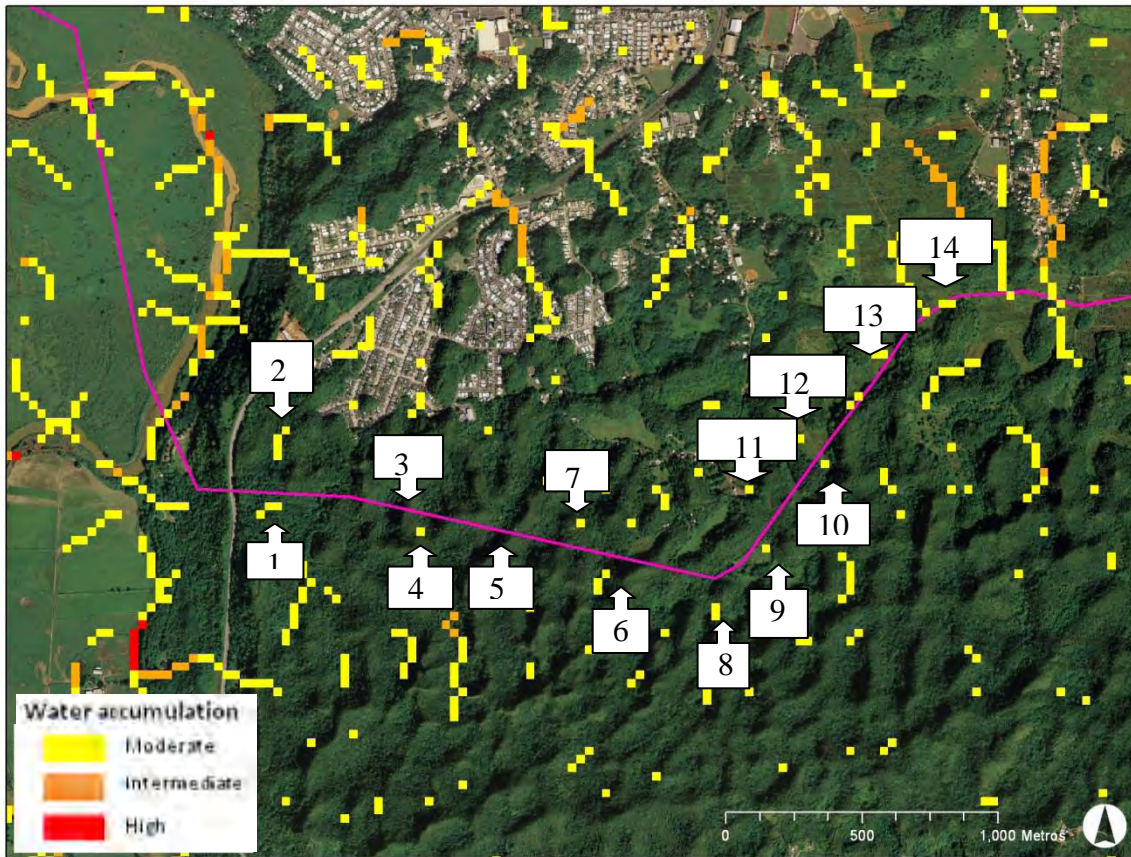


Figure 12. Aerial photo showing the localities of the Puerto Rican boa (blue points) and *Ottoschulzia rhodoxylon* (blue triangle).

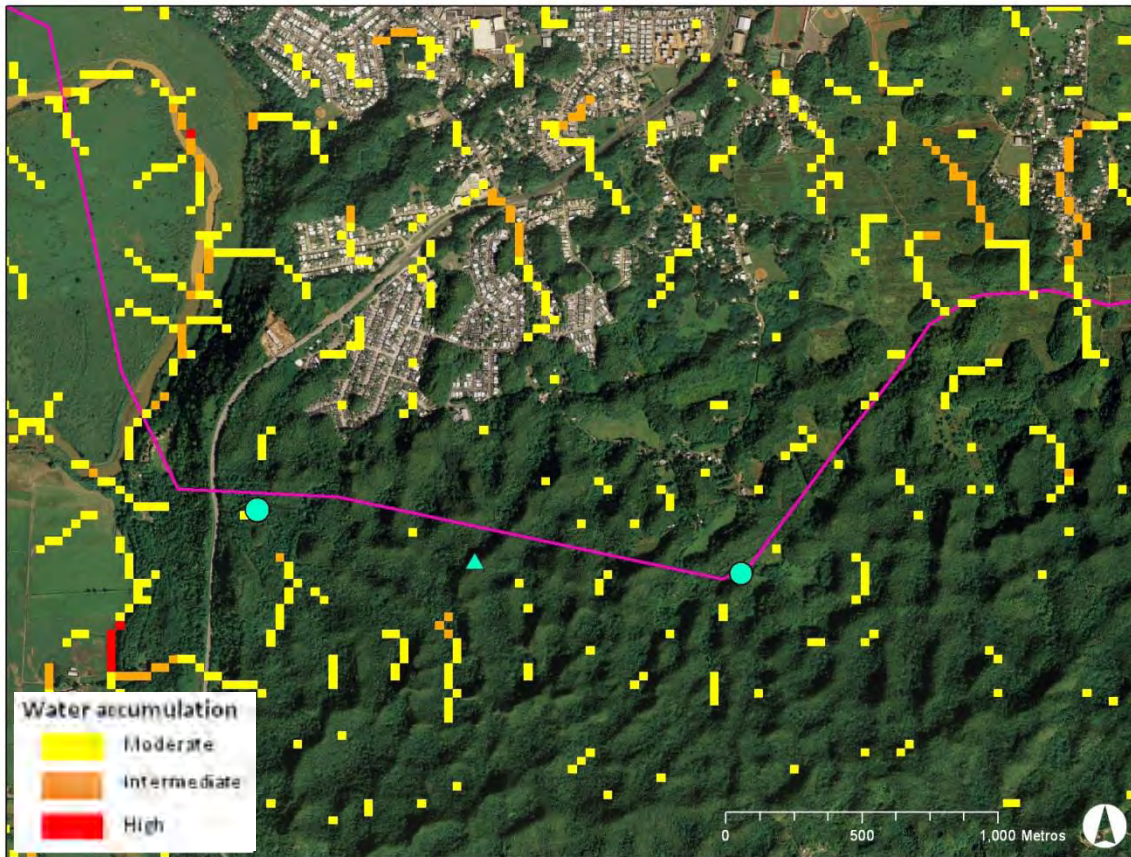


Figure 13. Photo of the dead individual of the Puerto Rican boa that was found at the Manatí section.



Table 1. Dates of visits.

Section	Date
Crested toad	
South	November 19, 2010
	November 20, 2010
	December 4, 2010
	December 11, 2010
	December 13, 2010
Vega Baja	December 1, 2010
	December 20, 2010
	December 27, 2010
Manatí	December 2, 2010
	December 15, 2010
	December 28, 2010
Coquí llanero	
Toa Baja	December 30, 2010
	January 10, 2011
	January 31, 2011
	February 16, 2011

DESCRIPTION OF IMPACTS TO THE PUERTO RICAN BOA (*Epicrates inornatus*) HABITAT

Vía Verde Natural Gas Pipeline Project

Prepared for:

Puerto Rico Energy and Power Authority

Prepared by:



Environmental Studies,
Permitting and Consulting

22 de febrero de 2011

Description of the Puerto Rican boa

The Puerto Rican boa is a member of the Boidae family. The genus (*Epicrates*) is distributed in South America, Central America, and the Greater Antilles. The Puerto Rican boa, *E. inornatus*, is endemic to Puerto Rico. This species can be found in altitudes that range from sea level to about 400 m above sea level (USFWS, 1986). This boa tolerates a wide variety of habitat types ranging from wet montane to subtropical dry forest (Rivero, 1998), however, it is most often found in the northern limestone karst belt from western Carolina to Aguadilla (USFWS, 1986). The least probable areas where the boa is found are in the drier regions of southern Puerto Rico, although there are reports of captures in these areas.

The Puerto Rican boa can grow up to a length of 6 to 7 feet, which makes it the largest snake inhabiting the Puerto Rico island shelf (USFWS, 1986). The coloration of this species can be varied. In some cases individuals can pose from 66 to 73 dark dorsal spots or lines, in others the individual does not pose any dorsal markings (Joglar, 2005) at all. Juveniles have reddish brown ground color with numerous pronounced markings (USFWS, 1986). The color variation of this species is from tan to dark brown (Rivero, 1998). The mandible area of *E. inornatus* is wide in comparison with other genus that exist in Puerto Rico.

The Puerto Rican boa is found on the ground or in trees. *E. inornatus* is a nocturnal species, but can be found during the day in open areas, areas with abundant sunlight, and at the borders of forests (Joglar, 2005). The Puerto Rican boa (*E. inornatus*) is not venomous and like the rest of the Boidae family it is a constrictor, therefore it kills its prey by wrapping around it and using its powerful muscles to cause asphyxia. The diet of *E. inornatus* consists of rats, mice, birds, small mammals including bats, and lizards.

Methodology

The methodology described in this section was used to estimate the areas of Puerto Rican boa habitat that could be affected by the construction and operation of the Via Verde Pipeline.

A screening using GIS technology was used to identify the areas where *E. inornatus* could be present (including all forested areas), given that these areas show the common habitat characteristics of this species. Using the measurement tool of the GIS software we were able to estimate the length where the pipeline route would affect the habitat of the Puerto Rican boa. These segments were then multiplied by 100 feet, and then by 50 feet to respectively obtain the area of temporary and permanent impact to the boa's habitat.

Impacts to the Puerto Rican boa's habitat

The routes of the Vía Verde pipeline will temporarily (100-foot Right-of-Way) affect 307.48 acres of potential *Epicrates inornatus* habitat during the construction phase of the project. Permanent (50-foot Right-of-Way) impact was estimated at 153.69 acres.

However, impacts to *E. inornatus* habitat areas are probably reduced due to the fact that forested areas in the Municipality of Peñuelas show other conditions that are not part of the typical habitat of this species. In fact, the Caribbean Endangered Species Map, published by the U.S. Fish and Wildlife Service, does not include this species for the Municipality of Peñuelas. If the Peñuelas area is not taken into account, the temporary impacts to the boa's habitat will be 199.79 acres. The permanent impact to this specie's habitat will be 99.86 acres.

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**PRELIMINARY
POPULATION ASSESSMENT OF THE PUERTO RICAN NIGHTJAR
(CAPRIMULGUS NOCTITHERUS)
AT THE VIA VERDE PROPOSED RIGHT OF WAY
PEÑUELAS, PUERTO RICO**

Prepared for
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INTRODUCTION

On February 2011, *Asesores Ambientales y Educativos Inc.*, retained professional services to conduct a Population Assessment to determine the presence, if any, and population index of the caprimulgid bird Puerto Rican Nightjar (*Caprimulgus noctitherus*), a federally listed endangered species in the proposed Vía Verde Right of Way (ROW), at the Guayanilla Hills in Peñuelas, Puerto Rico. **Figure 1** presents the approximate location of the study area on the Peñuelas USGS Topographic Map. The PR Nightjar was detected in the proposed Vía Verde ROW during the population assessment study. This report summarizes the project approach, field activities and findings of the project.

SPECIES DESCRIPTION

The Puerto Rican Nightjar is small nocturnal bird with fluffy variegated plumage mottled dark brown black and gray, closely resembling the forest leaf litter. It has a white band across the throat and white spots near the end of the tail feathers. Males have an external white band in the tail, visible only during flight. It captures flying insect prey by sallying from perches well above the ground. Individuals often use favorite perches for foraging.

Nesting occurs from late February to early July, peaking from April to June. Males call throughout the year with a minimum during September and October and peaking during April and May. With an average clutch size of two eggs, the Nightjar nests on a depression built on the leaf litter. The incubation period lasts approximately 19 days and both parents participate in incubation and brooding. The youth abandon the nest by the 14th day after hatching.

Currently, Nightjars are locally found only in the dry limestone forest of Southwestern Puerto Rico.

PROJECT APPROACH

The purpose of the population assessment was to obtain factual population information by conducting preliminary dawn and dusk surveys along established transect routes where point count stations were located, and broadcasting a taped PR Nightjar song to entice call-back behavior from male individuals during surveys.

The population assessment included a review of available information, site visits to establish appropriate transect routes and point count stations, and conducting dawn and dusk surveys on each station. Transect routes, and point count station (PCS) locations were established in coordination between the United States Fish and Wildlife Service (USFWS) and the project consultants.

METHODOLOGY

Seven point count locations were established along three transect routes located along the proposed Vía Verde ROW. PCS locations were distributed as follows; one in the North, four in the Center and two in the South transect routes, as agreed with the USFWS.

The initial PCS location in each transect route was located at least 100 meters from the forest edge as defined by the predominant vegetation following an agreement with the USFWS. All PCS locations were clearly marked with surveyor's flagging tape at intervals of at least 160 meters. **Figure No. 1**, shows PCS locations as determined with a Global Position System Receiver (Garmin GPSmap 76C x) for georeferencing. In the field, distance between PCS locations was measured with a surveyor's measuring tape.

On the evening of February 20th, the three experienced bird field survey observers who participated in this investigation met at the study area to become attuned and approximately matched with Nightjar call loudness at varying distances up to around 75 meters. In addition, an evaluation of the efficiency of tape recorders at a broadcasting

distance of about 75 meters was conducted. Although there is an inherent error present in estimating distances during field surveys, the conclusion on whether nightjars are present on the ROW should not be affected. During practice trials, all observers reported hearing the broadcasted calls in all cases, including different tape recorder models.

Since the purpose of this study is to estimate the number of singing males within the selected transect routes along the proposed Vía Verde ROW, taped recording broadcast levels were considered adequate so as not attract individuals from outside the designated 75 meter PCS radius.

The described method utilizes a one minute recorded tape broadcasting of the call of a male Nightjar after a listening period of two minutes. Another two minutes listening period is conducted after the tape broadcast. Presumably, males that remain silent during the first listening period are enticed into singing after the broadcast. In this study the maximum number of Nightjars heard at each transect route will be reported regardless of the listening period (before or after the taped broadcast).

Field surveys began on February 21 and ended on March 2, 2011. Each PCS was surveyed a total of three dawn and three dusk sessions. An attempt was made to survey each PCS by the same observer, to minimize inter-observer variability. This may result in a systematic bias, but overall study findings should remain unaffected.

Field survey methodology followed R. González, 2010. After arriving at the prescribed PCS, each observer recorded the time of the first Nightjar heard. PCS's surveys were conducted simultaneously with each observer recording the first calling Nightjar independently. The observer then waited a period of five minutes. At the end of the five minute period, observers recorded during two minutes each singing male Nightjar within a 75 meter radius around the PCS. This was followed by a one minute broadcast of a taped recording of a male singing Nightjar. After the tape broadcast each singing Nightjar male within a two minute period was recorded, as described above. As an aid

in discerning different individual Nightjars, each observer noted the compass direction of each Nightjar heard. After the last two minute period described above, the survey session was considered completed.

STUDY AREA

The study area is a tract of land of undulating and hilly mature secondary dry forest of varying height and dominant tree species, interspersed with *Leucaena sp.* stands. The understory is made up mainly of plants scarcely one inch in diameter at breast height, with an occasional tree of considerably larger diameter. In general, the understory is devoid of a leafy stratum. The terrain is characteristically rugged, with occasionally exposed, weathered limestone and shallow soils overlain by humus. Leaf litter varied in thickness to a maximum of about 2 inches. The Vía Verde ROW is approximately 100 feet wide and traverses the forest types in this area a distance of approximately three miles according to information supplied by *Asesores Ambientales y Educativos Inc.* The study area is considered Nightjar habitat by the DNER and the USFWS, as confirmed by previous research.

FIELD ACTIVITIES

Field reconnaissance was conducted prior to the establishment of transect routes for this study. The USFWS participated in the field reconnaissance and assisted in the selection of transect routes. In addition, experienced USFWS personnel were present during one of the Nightjar count sessions (dusk, February 23, 2011).

Fixed PCS Nightjar counts were conducted along trails established by the contractor following the proposed Vía Verde ROW. Footpaths were accessed via tertiary roads (North route) and dirt roads.

The seven PCS's, distributed among the three transect routes were surveyed a total of three dawns and three dusks each, beginning the dusk of February 21 and ending on

the dawn of March 2, 2011.

Counts were conducted during cool clear nights with moonlight of declining luminosity throughout the sampling period. On February the 21th, the moon was decreasing in luminosity from the Full Moon which occurred on February 18. The maximum luminosity of the moon on February 21, based on existing tables was 87.4% with moonrise occurring at 10:06 pm and the Three Quarter Moon for Puerto Rico, occurred at 07:09 pm on February 24. By the end of the sampling period, on March the 2nd, moon luminosity had decreased from the 3rd Quarter phase to 4.7%. **Table 1** shows details of moon stages during the sampling period. During the field investigation, wind varied from slight to moderate breezes and no significant rain was recorded in the study area or during surveys.

The North transect route consisted of one PCS at 100 meters from the forest edge. This PCS was designated N1. The Center transect route consisted of four PCS located at 160 meter intervals with the first station located at a 100 meters from the forest edge. These were designated as C1 through C4. The South transect route consisted of two PCS designated S1 and S2. S1 was located at 100 meters from the forest edge. Sampling station S2 was located approximately 190 meter from S1 to account for the extreme undulating topography of the area. This was made to ensure that no single bird was counted simultaneously on the two stations and to avoid overlapping of the 75 meter radius circles of the adjacent PCS's. Stations were georeferenced with a global positioning unit (GPS), as described above.

Each observer reached their respective PCS about 1.5 hour before sunrise and approximately 1 hour before sunset. After reaching the PCS, each observer followed the methodology described above. Summarized results of the PCS counts are shown on **Table 2**.

RESULTS

Following the above described methodology, results of this study found that Nightjars are found within the proposed Vía Verde ROW. Nightjars were heard calling at each PCS location, except during the morning sessions at PCS C3 in the Center transect route. Furthermore, individual sessions where no Nightjars were detected tended to occur in the morning (**Table 2**). The only evening session where no Nightjars were detected occurred in the Center PCS C3 on February 24.

Overall a total of 66 Nightjars were detected in all seven PCS locations during this study. This total does not represent individual Nightjars, since the results of the three morning and three evening sessions, at all PCS locations were pooled. The same individual bird may have been detected more than once in different survey sessions.

Henceforth, the *maximum* number of Nightjars detected is reported as representing the *minimum* number of individuals in each transect route, since other individuals may be present and not singing. Furthermore, results indicate the maximum number counted in all three morning and evening sessions, respectively, as the maximum count is the relevant figure in this study.

Summarized descriptions of results for each transect route follow (**Table 2**):

The reported number of Nightjars represents the maximum detected for each route across all morning and evening sessions, respectively.

North transect route (a single PCS location) - During the morning sessions two Nightjars were the maximum number heard. During the evening sessions the maximum number of Nightjars heard was also two.

Center transect route (four PCS locations) - During the morning sessions across all four PCS locations three Nightjars were the maximum number heard. During the evening sessions the maximum number heard was five.

South transect route (two PCS locations) - During the morning sessions across the two PCS locations three Nightjars were the maximum number heard. During the evening sessions the maximum number heard was four.

Table 1. Moon stages during the sampling period.

Date	Moonrise	Moonset	Illuminated Phase
Feb 21, 2011	- 10:06 PM	9:01 AM -	87.4%
Feb 22, 2011	- 11:08 PM	9:48 AM -	78.2%
Feb 23, 2011		10:38 AM	67.5%
Feb 24, 2011	12:09 AM	11:30 AM	56.3% 3Q at 7:27 PM
Feb 25, 2011	1:09 AM	12:25 PM	45.1%
Feb 26, 2011	2:05 AM	1:20 PM	34.4%
Feb 27, 2011	2:56 AM	2:16 PM	24.8%
Feb 28, 2011	3:44 AM	3:10 PM	16.4%
Mar 1, 2011	4:27 AM	4:02 PM	9.7%
Mar 2, 2011	5:06 AM	4:53 PM	4.7%

Table 2. Results for each transect route
North Transect Route

CPS Sta.	Date	First Call	Before Recording	After Recording
N1	27-Feb-11	5:48 AM	0	0
N1	28-Feb-11	5:57 AM	1	0
N1	1-Mar-11	5:45 AM	2	1
N1	26-Feb-11	6:43 PM	1	2
N1	27-Feb-11	6:37 PM	2	0
N1	28-Feb-11	6:36 PM	1	0

Table 2. (Cont.) Results for each transect route**Center Transect Route**

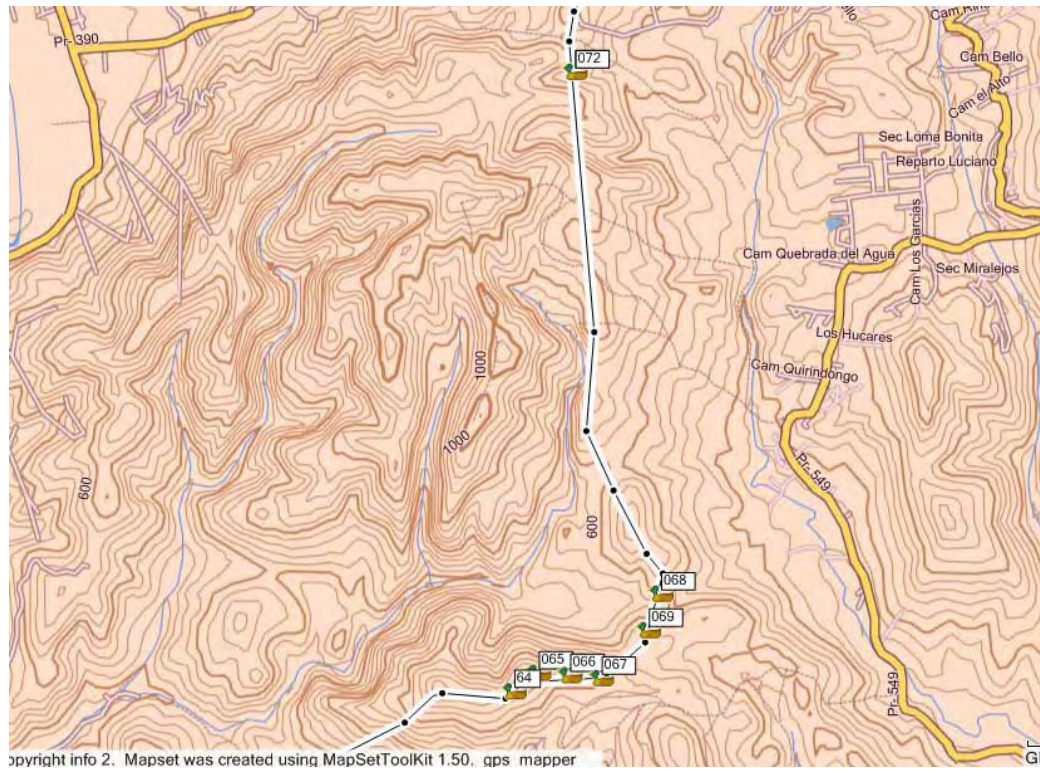
CPS Sta.	Date	First Call	Before Recording	After Recording
C1	22-Feb-11	5:45AM	0	0
C1	24-Feb-11	5:35AM	1	1
C1	25-Feb-11	5:35AM	0	1
C1	21-Feb-11	6:49 PM	1	0
C1	23-Feb-11	6:40 PM	1	0
C1	24-Feb-11	6:52 PM	0	1
C2	22-Feb-11	5:45 AM	2	1
C2	24-Feb-11	5:25 AM	1	1
C2	1-Mar-11	5:26 AM	0	0
C2	21-Feb-11	6:45 PM	0	2
C2	23-Feb-11	6:44 PM	0	1
C2	28-Feb-11	6:41 PM	2	1
C3	24-Feb-11	5:30 AM	0	0
C3	25-Feb-11	5:29 AM	0	0
C3	28-Feb-11	5:35 AM	0	0
C3	23-Feb-11	6:35 PM	0	2
C3	24-Feb-11	6:49 PM	0	0
C3	27-Feb-11	6:46 PM	0	2
C4	25-Feb-11	5:25 AM	0	1
C4	28-Feb-11	5:39 AM	0	1
C4	1-Mar-11	5:40 AM	0	1
C4	24-Feb-11	6:42 PM	3	2
C4	27-Feb-11	6:43 PM	0	3
C4	28-Feb-11	6:41 PM	2	1

Table 2. (Cont.) Results for each transect route

South Transect Route

CPS Sta.	Date	First Call	Before Recording	After Recording
S1	23-Feb-11	5:45 AM	0	0
S1	26-Feb-11	5:25 AM	1	0
S1	27-Feb-11	5:51 AM	0	0
S1	22-Feb-11	6:40 PM	0	1
S1	25-Feb-11	6:42 PM	2	1
S1	26-Feb-11	6:41 PM	2	1
S2	23-Feb-11	5:48 AM	0	1
S2	26-Feb-11	5:30 AM	1	1
S2	27-Feb-11	5:45 AM	1	2
S2	22-Feb-11	6:25 PM	0	1
S2	25-Feb-11	6:43 PM	0	3
S2	26-Feb-11	6:44 PM	3	1

Fig. 1. Approximate location of the study area.





***2011 Survey Report for the Endangered
Puerto Rican Parrot***

***Via Verde Project
Puerto Rico***



Prepared for:

***Assesores Ambientales y Educativos
&
Puerto Rico Electric Power Authority***

By:

***Tetra Tech, Inc.
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March 2011

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1.0 INTRODUCTION

1.1 Project Overview

This report describes the results pertaining to the endangered Puerto Rican parrot (*Amazona vittata*) along the proposed Via Verde Pipeline (Project area) within the municipalities of Manati, Utuado, and Adjuntas, Puerto Rico. The objective of these surveys was to document occurrence of three endangered species; Puerto Rican parrot, the Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*) and the Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*) within two focal areas of concern. A separate report has been prepared for the broad-winged hawk and the sharp-shinned hawk. Puerto Rican parrots are federally endangered and protected under the Endangered Species Act. The Puerto Rican parrot is restricted to two forested areas of Puerto Rico. The El Yunque National Forest was host to the only remnant population of parrots (Snyder et al. 1987, White et al. 2005) until 20 parrots were released into the Rio Abajo in 2006. The bird survey was designed provide a baseline dataset on these endangered species in forested areas of concern within the Project area. These data may provide useful information to help minimize potential environmental impacts from the proposed Project.

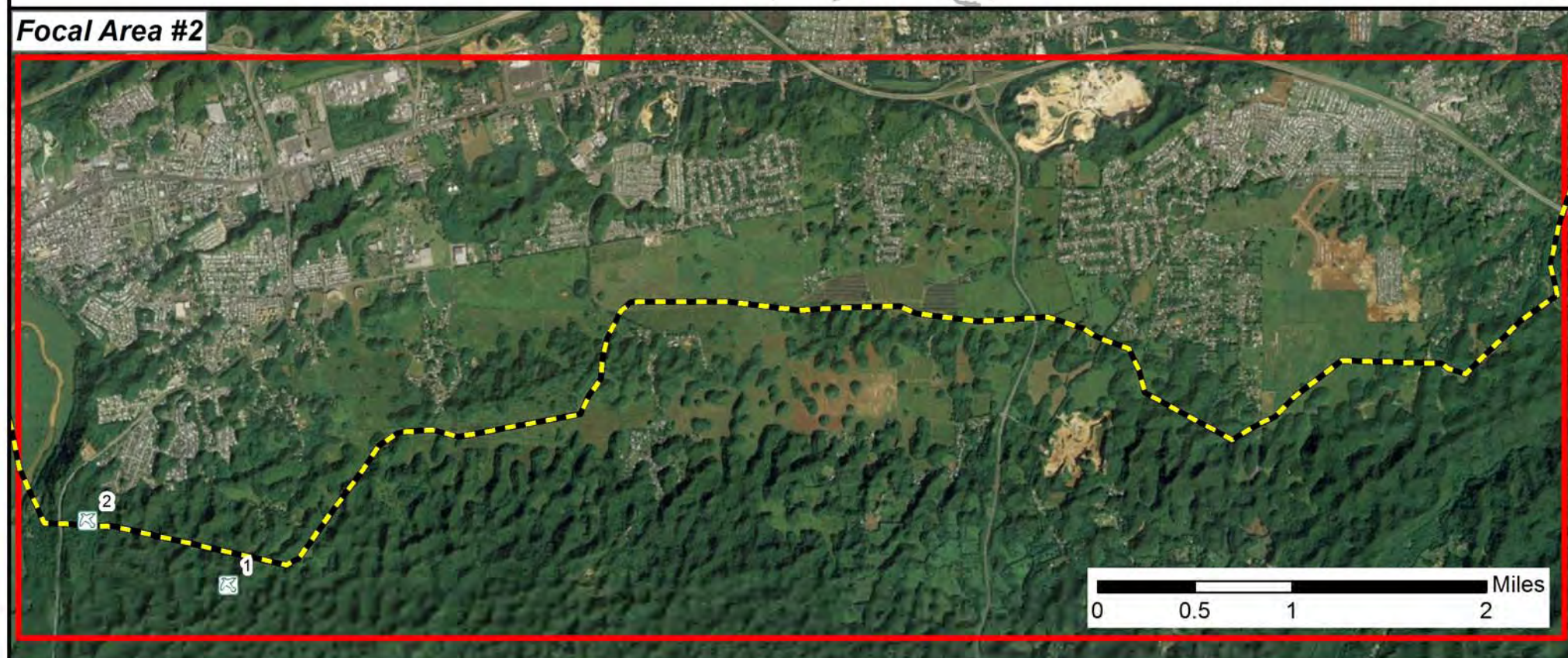
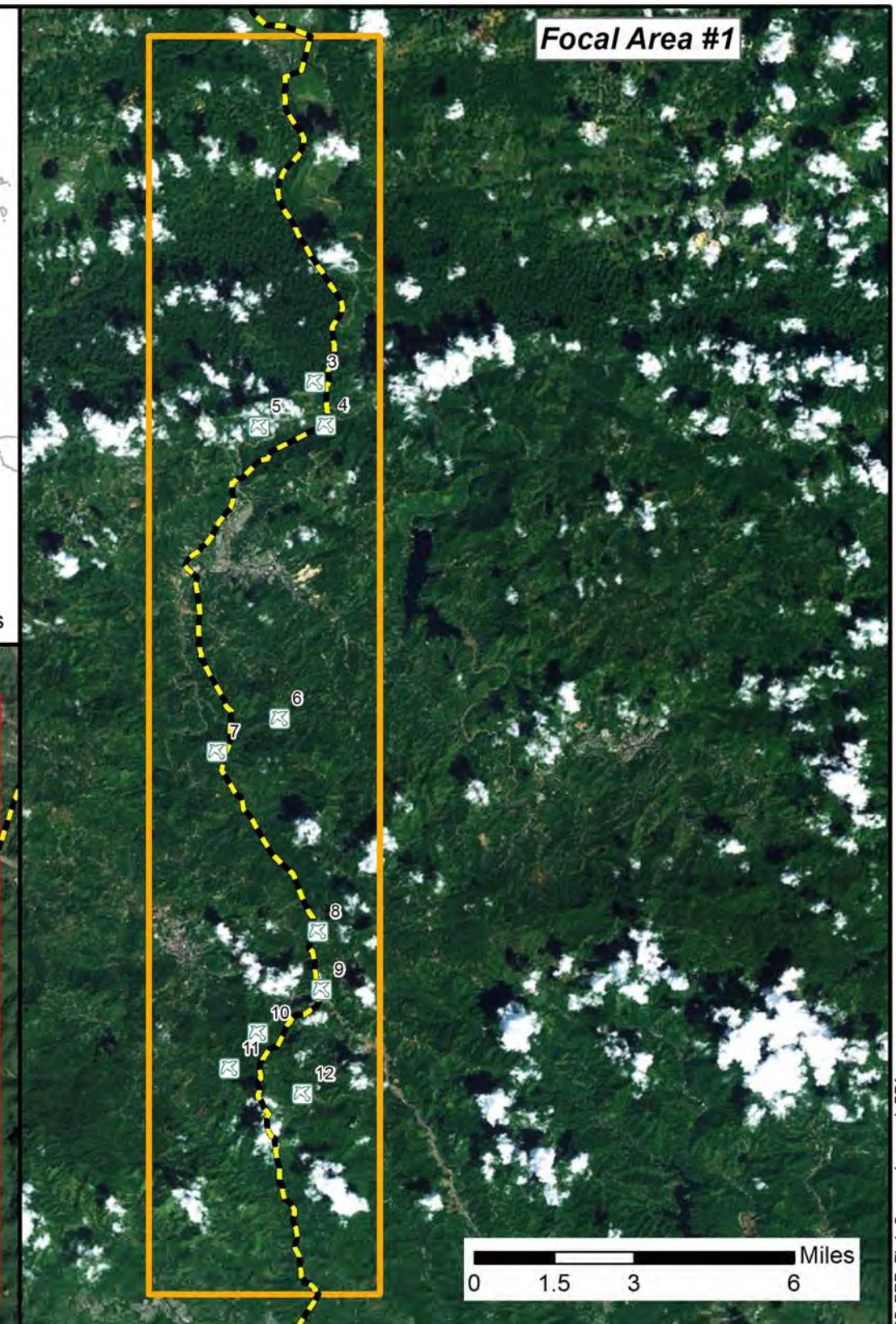
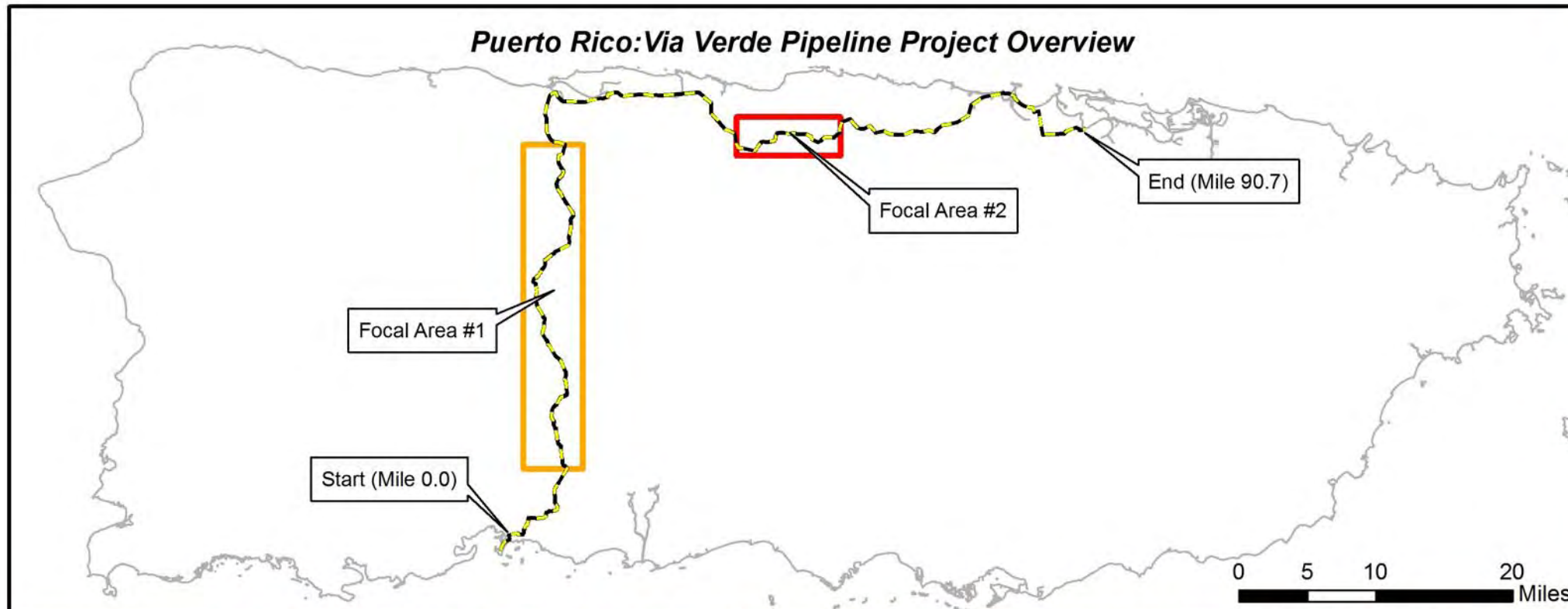
1.2 Project Area Description

The Puerto Rico Electric Power Authority (PREPA) is proposing to construct a 24 inch diameter natural gas pipeline (Via Verde) originating from the municipality of Peñuelas and crossing the island through the central mountain region from the south to the north towards San Juan (Figure 1-0). The U.S. Fish and Wildlife Service (USFWS) has commented on the project and has requested surveys for endangered raptors and parrots to be conducted in areas of potential habitat along the pipeline corridor. During consultation, USFWS has stated that it is important to determine the number of breeding territories that may be affected by project construction, as well as the amount of habitat potentially affected. The following report describes how Tetra Tech, Inc. (Tetra Tech) evaluated the Project area for endangered parrots.

1.3 Goal and Objectives

The goal of the surveys was to identify the spatial and temporal use of the Project area by Puerto Rican parrots in addition to endangered raptors during January 2011. Objectives for the Puerto Rican Parrot aspect of the survey were to:

- 1) determine occurrence of endangered parrots within the Project area;
- 2) identify potential nesting territories;
- 3) identify movements of endangered parrots;
- 4) spot map identified territories; and
- 5) calculate percentage of habitat to be impacted in identified territories.



Legend

- Puerto Rico
- Via Verde Pipeline
- Focal Area #1 (Miles 9.6 - 37.6)
- Focal Area #2 (Miles 58.9 - 68.3)
- Final Bird Survey Locations

Survey Location Names	
Manati East (1)	Tangue de Agua (7)
Manati West (2)	Curva (8)
Entrada (3)	Rt 143 (9)
Planta (4)	Foreman Finca (10)
Finca de Raul (5)	West Face (11)
Puente Blanco (6)	East Face (12)



Projection/Coordinate System:
North American Datum of 1983,
Puerto Rico State Plane, US Feet

Sources:
U.S. Dept. of Transportation; World Imagery
(<http://services.arcgisonline.com/arcgis/services>)

Figure 1.
Final Bird Survey Locations
Via Verde Pipeline Project

Prepared For:
Asesores Ambientales y Educativos

Prepared By: TETRA TECH Date: 03/03/2011

2.0 METHODS

Tetra Tech biologists conducted birds surveys for parrots, broad-winged hawks, and sharp-shinned hawks from observation points in forested areas within the Project area (Figure 1.0). Areas selected for surveys were identified during an initial biological evaluation (Focal Areas 1 and 2) and ground-truthed during a site-reconnaissance trip in December 2010. After consultation with USFWS on survey design, bird surveys were conducted from 12 observation points located within forested sections of the Project area during the month of January 2011. Each observation point was surveyed twice during the survey period of January 12–January 28, 2011 for a total of 24 surveys. Bird survey methodology was modeled upon previous broad-winged hawk and sharp-shinned hawk studies conducted on the island of Puerto Rico (Rivera-Milan 1995, Delannoy 1997, Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006). This survey methodology is also applicable for identifying presence/absence of parrots.

Surveys were designed to cover areas identified to have potential habitat in both the karst and central mountain regions. Potential habitat of concern was identified through a desktop biological evaluation and confirmed through USFWS consultation as well as a site-reconnaissance survey to the Project area in December 2010. Representative photos of observation points within the central mountain region and within the northern karst region are shown in Figure 2-0 and Figure 2-1.

Bird surveys were conducted by one to two biologists from the morning to early afternoon hours (~0700 to ~1300). One to three survey locations were covered on a daily basis. All surveys were conducted on days with suitable weather conditions (i.e., minimal precipitation and fog).

Biologist used high quality binoculars (10x42 mm), spotting scopes (15–46x60 mm), and range finders to record data on species composition, habitat use patterns, and movements of endangered raptors and parrots in the Project area. Field identification references included *A Guide to the Birds of Puerto Rico* by Raffaele 1989. Focal species were spot-mapped and their global positioning system (GPS) position was recorded on field maps.

Tetra Tech compiled all data from the January surveys and prepared the following biological survey results and discussion for the Puerto Rican Parrot. This report contains all relevant information including maps of survey observation points. This information can be used by Assessores Ambientales y Educativos (AAE), PREPA, and the USFWS to determine the anticipated effects on the Puerto Rican Parrot by the Via Verde Project.



Figure 2-0. View looking northeast of Rio Ajbajo Forest southern border from Point 5 (Fina de Raul).



Figure 2-1. View looking southwest from Point 5 (Fina de Raul).

3.0 RESULTS AND DISCUSSION

During 12 days between January 12 and January 27, 2011, 24 bird surveys taken from 12 observation points resulted in 144 hours of direct, visual observation (Table 3-0). All surveys were conducted in good weather days.

Table 3-0. Summary of survey effort during January 2011 bird surveys, Via Verde Project.

Date	Observation Point	Observation Point	Observation Point	Daily Survey Effort
1/12/2011	Point 1 (Manati West)	<i>Vega Baja survey*</i>		1
1/13/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/14/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/17/2011	Point 8 (Curva)	Point 9 (Rt 143)	Point 10 (Foreman)	3
1/18/2011	Point 11 (West Face)			1
1/19/2011	Point 12 (East Face)	Point 1 (Manati West)	Point 2 (Manati East)	3
1/20/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/21/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/24/2011	Point 8 (Curva)	Point 9 (Rt 143)		2
1/25/2011	Point 10 (Foreman)	Point 12 (East Face)		2
1/26/2011	Point 11 (West Face)			1
1/27/2011	Point 1 (Manati West)	Point 2 (Manati East)		2
<i>*Not included in survey total</i>			Survey Total	24

There were 3 observation points located near the Rio Abajo Forest southeastern boundary (Point 3, Point 4, and Point 5) where the closest population of Puerto Rican parrots resides in relation to the footprint of the Via Verde Project Area (Figure 1). These 3 points had excellent viewsheds of the forested slopes that border the Rio Grande de Arecibo and the Rio Abajo Forest. No Puerto Rican Parrots were observed or heard during the surveys at any of the observation points. There were at least 4 to 5 pairs of Red-tailed hawks (*Buteo jamaicensis jamaicensis*), a natural predator of Puerto Rican parrot (Snyder et al. 1987, White et al. 2005), observed within the viewshed of these three observation points. The home range and habitat use patterns of the Puerto Rican parrot from the Rio Abajo population is still unknown but currently being studied. The high density of Red-tailed Hawks observed, juxtaposition of Highway 10, and fragmented habitat blocks that compose the landscape along the southeastern boundary of Rio Abajo Forest, may impede or deter Puerto Rican parrots from using these forested blocks in great frequency.

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***2011 Endangered Raptor Survey Report for
the Puerto Rican Broad-winged Hawk and
Puerto Rican Sharp-shinned Hawk***

***Via Verde Project
Puerto Rico***



Prepared for:

***Assesores Ambientales y Educativos
&
Puerto Rico Electric Power Authority***

By:

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February 2011

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1.0 INTRODUCTION

1.1 Project Overview

This report describes the results from the endangered raptor surveys along the proposed location of the Via Verde Pipeline (Project area) within the municipalities of Manati, Utuado, and Adjuntas, Puerto Rico. The function of these surveys was to document occurrence of the Puerto Rican broad-winged hawk (*Buteo platypterus brunnescens*) and Puerto Rican sharp-shinned hawk (*Accipiter striatus venator*) within the two focal areas of concern. Both endangered raptors are non-migratory and remain on Puerto Rico year-round. They are federally endangered and protected under the Endangered Species Act. The endangered raptor surveys provide a baseline dataset on these species in forested areas of concern within the Project area. These data may provide useful information to help minimize potential environmental impacts from the proposed Project.

1.2 Project Area Description

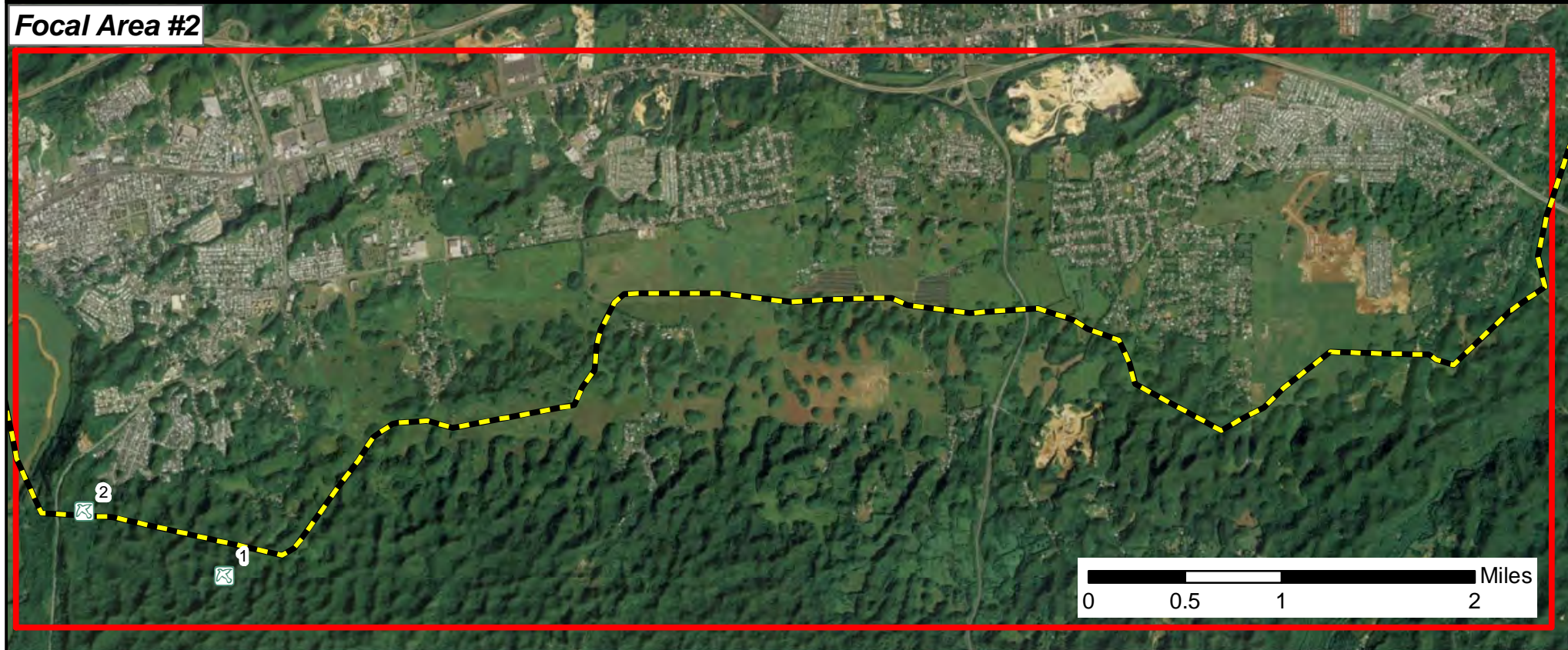
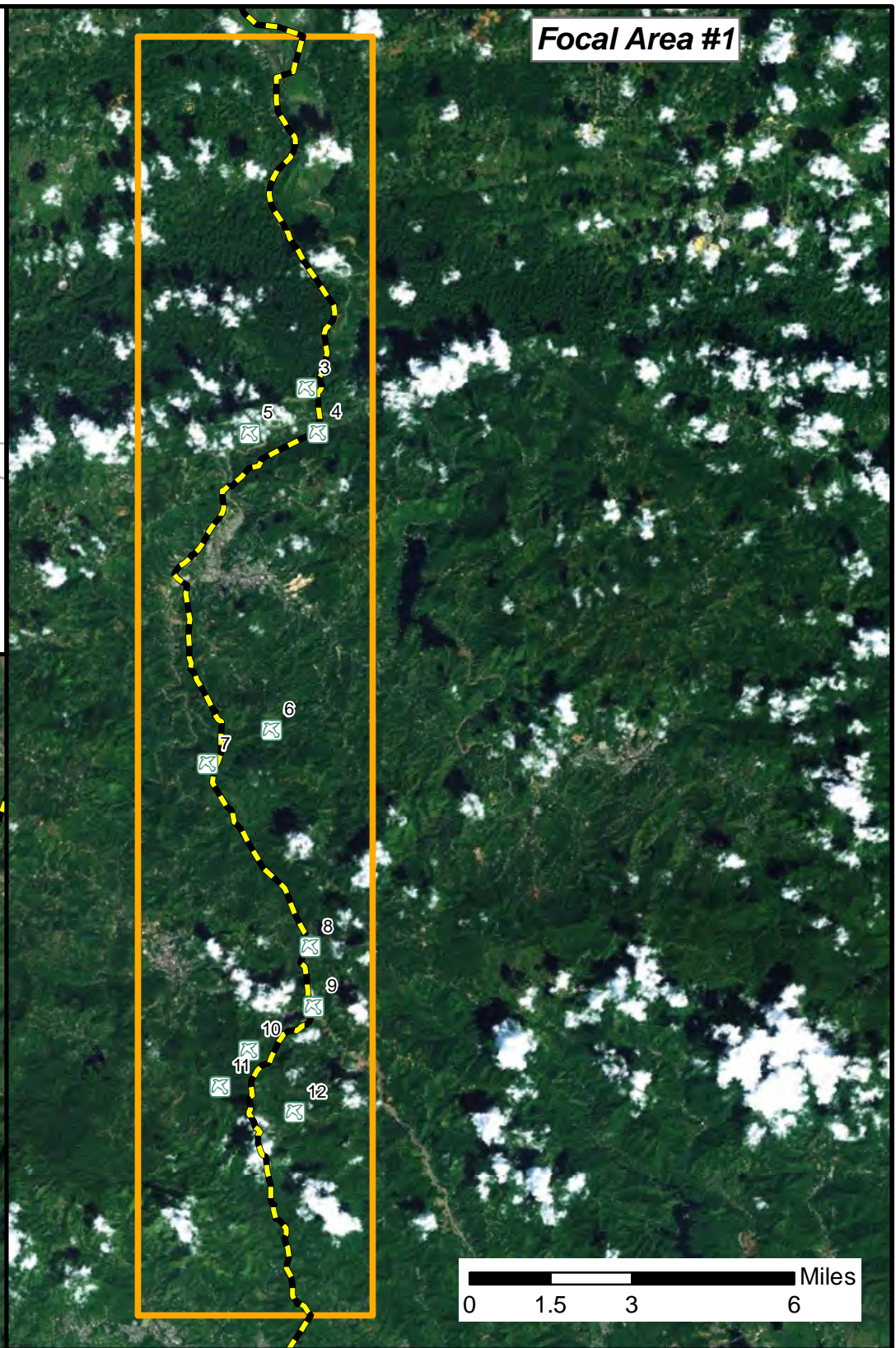
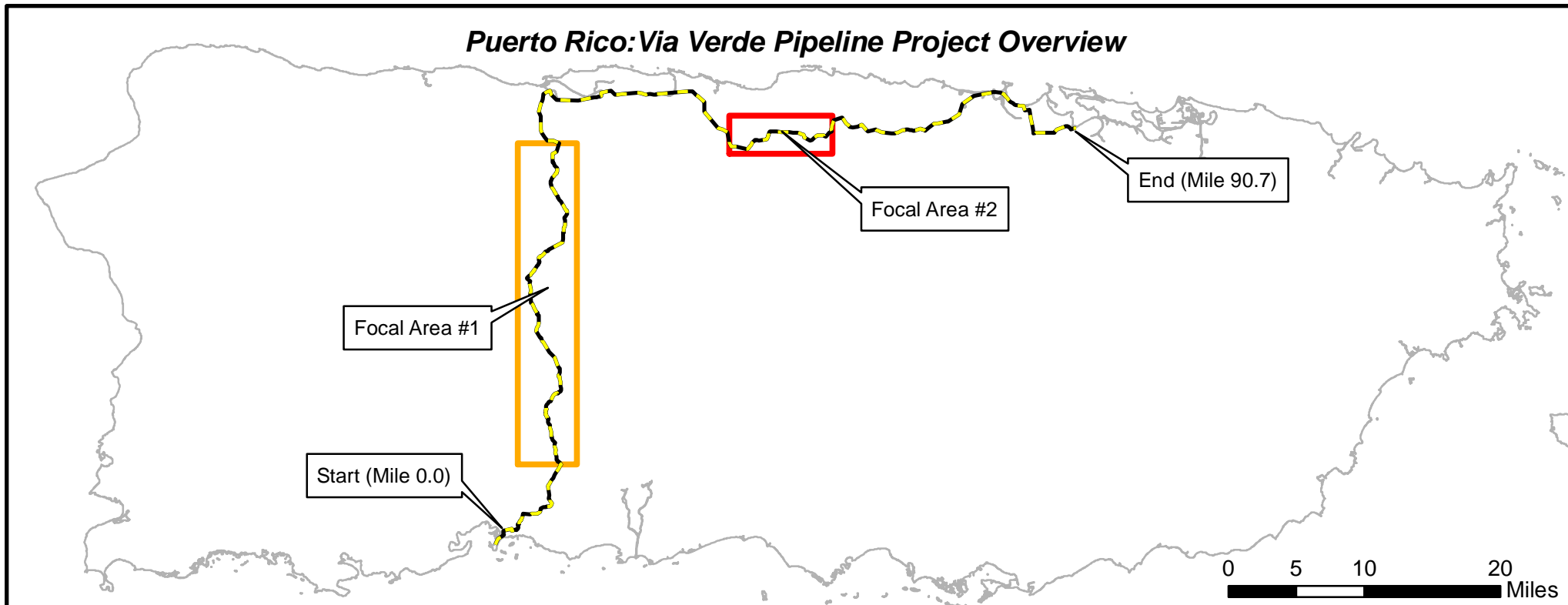
The Puerto Rico Electric Power Authority (PREPA) is proposing to construct a 24 inch diameter natural gas pipeline (Via Verde) originating from the municipality of Peñuelas and crossing the island through the central mountain region from the south to the north towards San Juan (Figure 1-0). The U.S. Fish and Wildlife Service (USFWS) has commented on the project and has requested surveys for endangered raptors to be conducted in areas of potential habitat along the pipeline corridor. During consultation, USFWS has stated that it is important to determine the number of breeding territories that may be affected by project construction, as well as the amount of habitat potentially affected. Until further studies demonstrate otherwise, the USFWS assumes that suitable habitat within the proposed pipeline corridor is occupied by endangered raptors for breeding, and potential take may be anticipated in those areas. The following report describes how Tetra Tech, Inc. (Tetra Tech) evaluated the Project area for endangered raptors.

1.3 Goal and Objectives

The goal of the surveys was to identify the spatial and temporal use of the Project area by Puerto Rican Broad-winged hawks and Puerto Rican sharp-shinned hawks during January 2011. Objectives for the raptor survey were to:

- 1) determine occurrence of endangered raptors within the Project area;
- 2) identify potential nesting territories and conduct nest searches;
- 3) identify movements of endangered raptors;
- 4) spot map identified territories; and
- 5) calculate percentage of habitat to be impacted in identified territories.

Puerto Rico: Via Verde Pipeline Project Overview



Legend

- Puerto Rico
- Via Verde Pipeline
- Endangered Raptors Focal Area #1 (Miles 9.6 - 37.6)
- Endangered Raptors Focal Area #2 (Miles 58.9 - 68.3)
- Final Raptor Survey Locations

Survey Location Names	
Manati East (1)	Tangue de Agua (7)
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Projection/Coordinate System:
North American Datum of 1983,
Puerto Rico State Plane, US Feet

Sources:
U.S. Dept. of Transportation; World Imagery
(<http://services.arcgisonline.com/arcgis/services>)

Figure 1-0.
Final Raptor Survey Locations
Via Verde Pipeline Project

Prepared For:
Asesores Ambientales y Educativos

Prepared By: TETRA TECH

Date:
01/25/2011

2.0 METHODS

Tetra Tech biologists conducted raptor surveys for broad-winged hawks and sharp-shinned hawks from observation points in forested areas within the Project area (Figure 1.0). Areas selected for surveys were identified during an initial biological evaluation (Focal Areas 1 and 2) and ground-truthed during a site-reconnaissance trip in December 2010. After consultation with USFWS on survey design, raptor surveys were conducted from 12 observation points located within forested sections of the Project area during the month of January 2011. Each observation point was surveyed twice during the survey period of January 12–January 28, 2011 for a total of 24 surveys; both species are engaged in epigamic and territorial aerial displays during this time period. Raptor survey methodology was modeled upon previous broad-winged hawk and sharp-shinned hawk studies conducted on the island of Puerto Rico (Rivera-Milan 1995, Delannoy 1997, Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006).

Surveys were designed to cover areas identified to have potential habitat in both the karst and central mountain regions. Potential habitat of concern was identified through a desktop biological evaluation and confirmed through USFWS consultation as well as a site-reconnaissance survey to the Project area in December 2010. Representative photos of observation points within the central mountain region and within the northern karst region are shown in Figure 2-0 and Figure 2-1.

Raptor surveys were conducted by one to two biologists from the morning to early afternoon hours (~0700 to ~1300) when both species of raptors are engaged in aerial displays above the canopy. One to three survey locations were covered on a daily basis. All surveys were conducted on days with suitable weather conditions (i.e., minimal precipitation and fog).

Biologist used high quality binoculars (10x42 mm), spotting scopes (15–46x60 mm), and range finders to record data on species composition, habitat use patterns, and movements of endangered raptors in the Project area. Field identification references included Raffaele (1989), Wheeler and Clark (1995), Dunne et al. (1988), Clark and Wheeler (2001), and Liguori (2005). Raptors were spot-mapped and their global positioning system (GPS) position was recorded on field maps. If a surveyed area confirmed courtship display behavior of either broad-winged hawk and/or sharp-shinned hawk, biologists conducted areas searches to further evaluate those habitats for the presence of a nest site.

Tetra Tech compiled all data from the January surveys and prepared the following biological survey results and discussion. This report contains all relevant information including maps of survey observation points and raptor spot maps. This information can be used by Assessores Ambientales y Educativos (AAE), PREPA, and the USFWS to determine the anticipated effects on these species by the Via Verde Project.



Figure 2-0. View looking east of the central mountain region from Point 7 (Water tank).



Figure 2-1. View looking west of the northern karst region from Point 1 (Manati East).

3.0 RESULTS

During 12 days between January 12 and January 27, 2011, 24 raptor surveys taken from 12 observation points resulted in 144 hours of direct, visual observation (Table 3-0). A total of four sharp-shinned hawks and one broad-winged hawk were observed from five different observation points (Table 3-1). All sightings were of adult birds.

Table 3-0. Summary of survey effort during January 2011 raptor surveys, Via Verde Project.

Date	Observation Point	Observation Point	Observation Point	Survey Effort
1/12/2011	Point 1 (Manati West)	<i>Vega Baja survey*</i>		1
1/13/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/14/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/17/2011	Point 8 (Curva)	Point 9 (Rt 143)	Point 10 (Foreman)	3
1/18/2011	Point 11 (West Face)			1
1/19/2011	Point 12 (East Face)	Point 1 (Manati West)	Point 2 (Manati East)	3
1/20/2011	Point 3 (Entrada)	Point 4 (Planta)	Point 5 (Finca Raul)	3
1/21/2011	Point 6 (Puente Blanco)	Point 7 (Water tank)		2
1/24/2011	Point 8 (Curva)	Point 9 (Rt 143)		2
1/25/2011	Point 10 (Foreman)	Point 12 (East Face)		2
1/26/2011	Point 11 (West Face)			1
1/27/2011	Point 1 (Manati West)	Point 2 (Manati East)		2
<i>*Not included in survey total</i>			Survey Total	24

Table 3-1. Summary of endangered raptor observations, Via Verde Project.

Date	Broad-winged Hawk	Sharp-shinned Hawk	Observation Point
1/12/2011		X	Point 1 (Manati West)
1/13/2011		X	Point 3 (Entrada)
1/13/2011	X		Point 4 (Planta)
1/17/2011		X	Point 10 (Foreman)
1/25/2011		X	Point 12 (East Face)

All five of the endangered raptors observed were sighted flying in close proximity to (<600 feet) or within the Project area. The locations and movements of these raptors are plotted in Figures 3-0 to Figure 3-4. No territorial or epigamic displays were observed. The chronology of raptor observations is as follows:

- On January 12, 2011 at 1015 hour, an adult sharp-shinned hawk adult was observed from Point 1 (Manati West). The bird appeared to be hunting as it flew east to west above the canopy until it perched for <2 minutes on top of a mogote about 1,000 feet east of the observation point. The adult then dove east from its perch out of sight.
- On January 13, 2011 at 0802 hour, an adult broad-winged hawk was observed from Point 4 (Planta) as it vocalized and flew low above the canopy south of Highway 10, just west of the Project area.
- On January 13, 2011 at 0920 hour, a sharp-shinned hawk adult was observed from Point 3 (Entrada). The bird moved west to east then perched near Point 3 (Entrada).
- On January 17, 2011 at 0705 hour, an adult sharp-shinned hawk flew east to west low over the canopy of a Sierra Palm Forest near Point 10 (Foreman). The bird was observed for approximately 30 seconds.
- On January 25, 2011 at 0730 hour, an adult sharp-shinned hawk vocalized as it flew north to south low over the canopy near the ridge of Cerro Garrote near Point 12 (East Face).

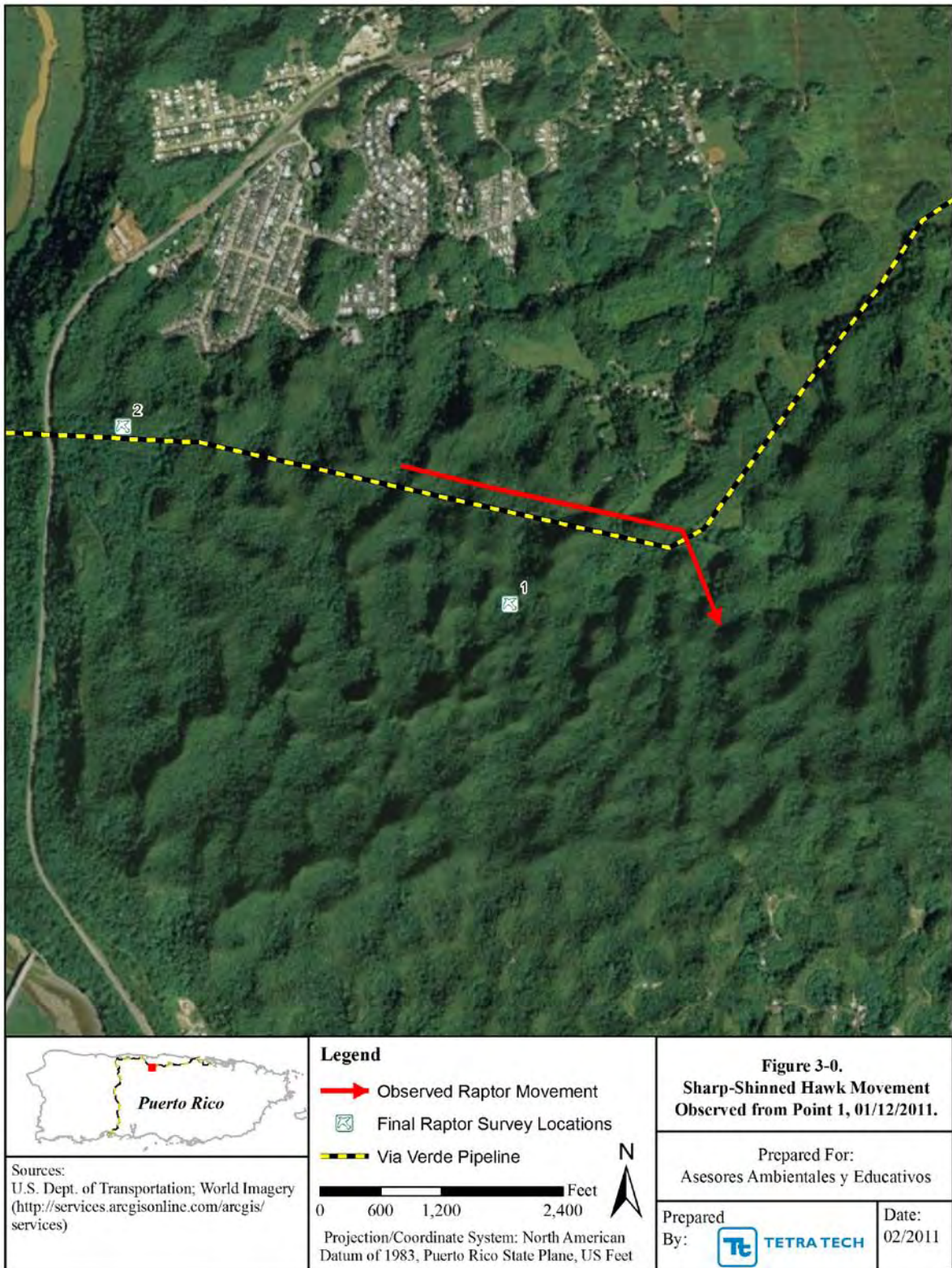
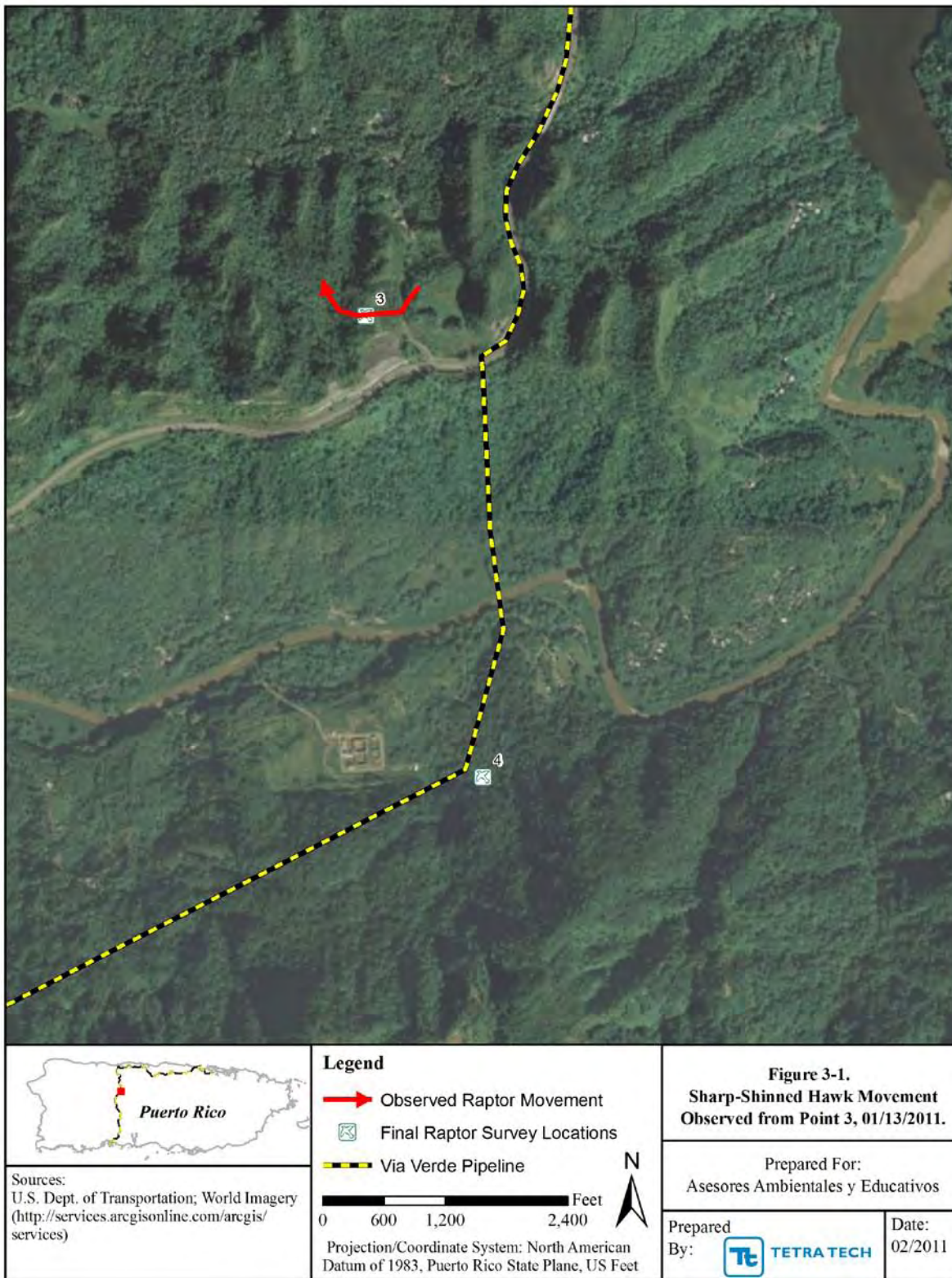
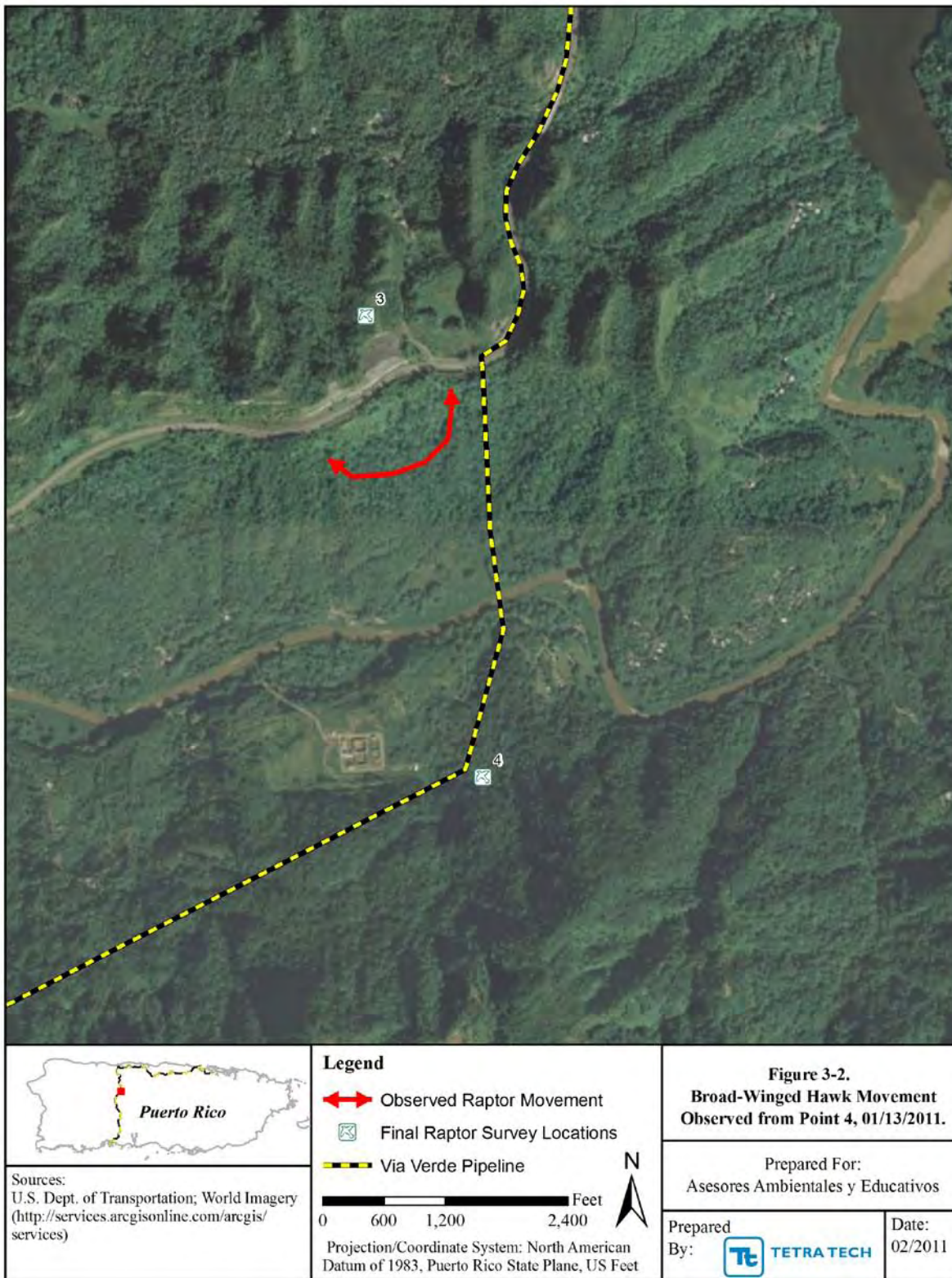


Figure 3-0. Sharp-shinned hawk movement observed from Point 1 on January 12, 2011.



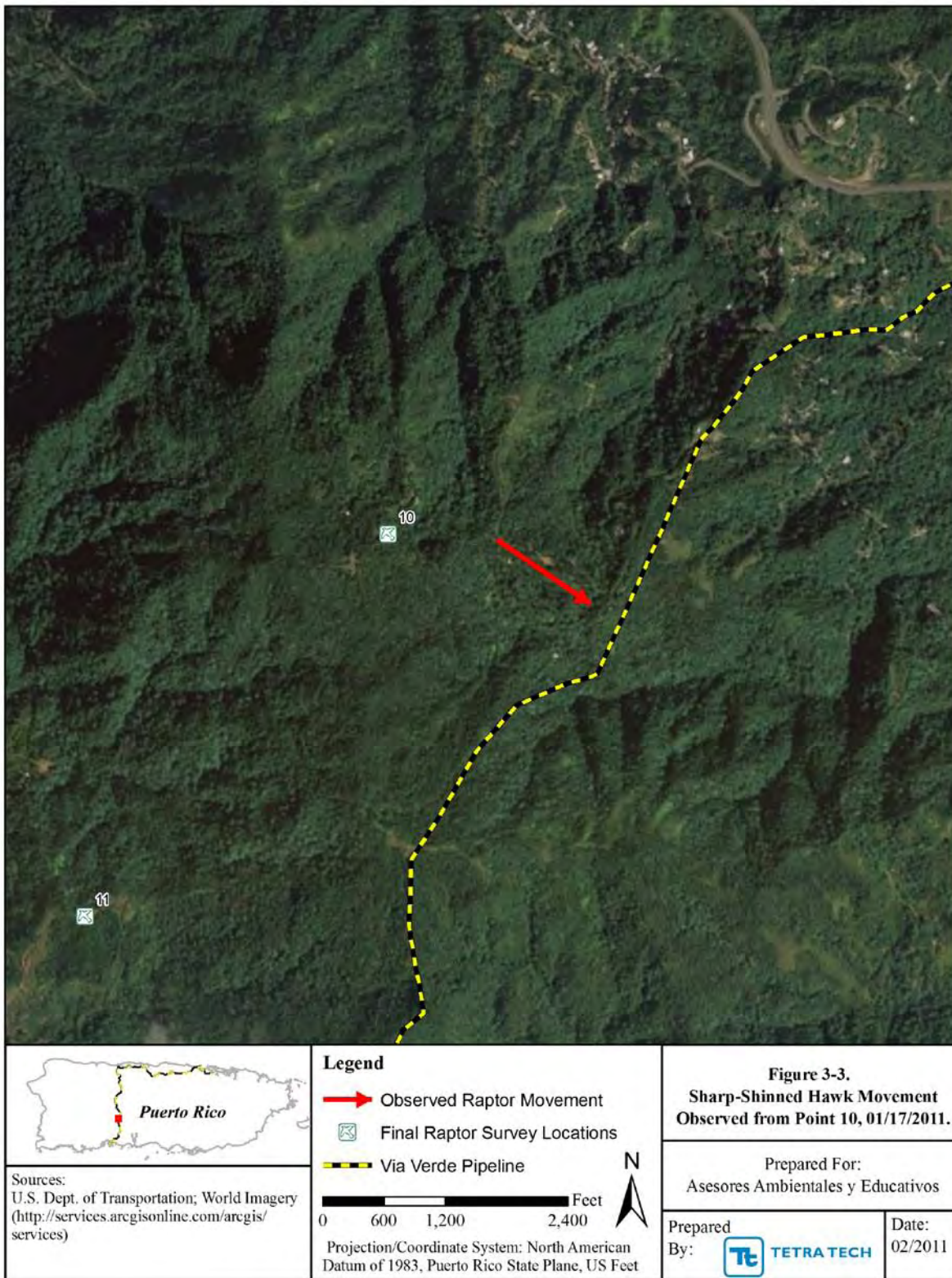
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Figure 3-1. Sharp-shinned hawk movement observed from Point 3 on January 13, 2011.



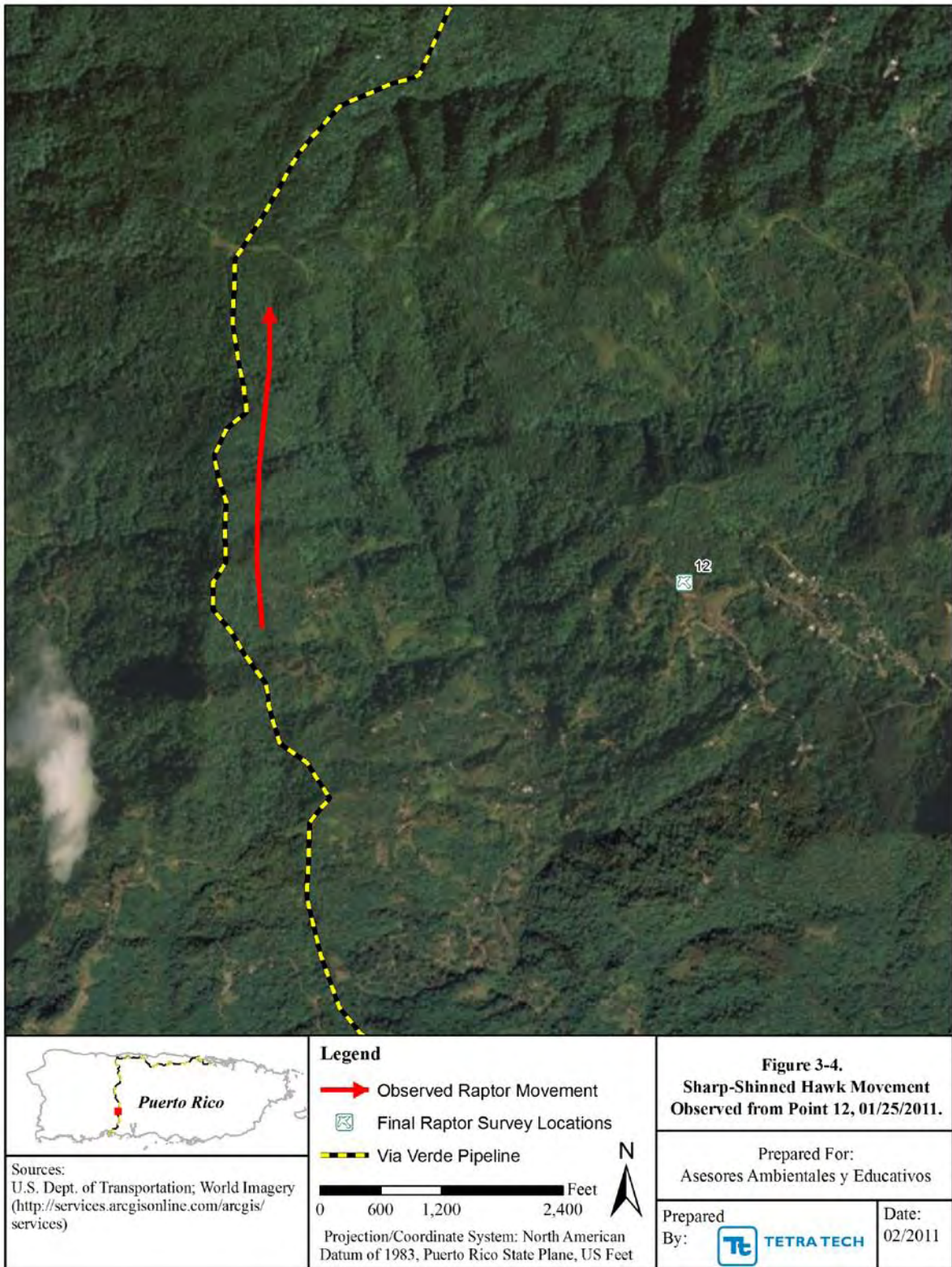
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Figure 3-2. Broad-winged hawk movement observed from Point 4 on January 13, 2011.



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Figure 3-3. Sharp-shinned hawk movement observed from Point 10 on January 17, 2011.



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Figure 3-4. Sharp-shinned hawk movement observed from Point 12 on January 25, 2011.

4.0 DISCUSSION

During raptor surveys in January 2011, all four sharp-shinned hawks and the only broad-winged hawk observed flew alone (single individual). On two occasions, vocalizations were heard in addition to sighting of the birds. A sharp-shinned hawk vocalized from Point 12 and a broad-winged hawk vocalized from Point 3.

Two of the four sharp-shinned hawk observations were from the karst region (Point 1 and Point 3) while the other two observations occurred at higher altitudes in the central mountain region (Point 10 and Point 12). Sharp-shinned hawks are not known to nest or be frequently observed within the karst regions of Puerto Rico (Rivera-Milan 1995, Delannoy 1997). In the highest elevation forest of the central mountain region, in Adjuntas where the pipeline intersects, we confirmed the presence of sharp-shinned hawks; they were observed flying low over the canopy above Sierra Palm Forests from two different observation points.

Courtship and territorial displays of sharp-shinned hawks have been associated with certain montane habitats within the wet and moist forest life zones in Puerto Rico (Rivera-Milan 1995, Delannoy 1997). Broad-winged hawks have been observed in both the karst and central mountain regions in Puerto Rico (Rivera-Milan 1995, Delannoy and Tossas 2000, Delannoy and Tossas 2002, Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006). The lone broad-winged hawk was observed in the transition zone between the karst forests of Rio Abajo Forest and the central mountains of Utuado. The broad-winged hawk was observed along a slope north of the Rio Grande of Arecibo River and south of Rio Abajo Forest.

The surveys documented the presence of adult birds in their appropriate habitats within or in close proximity to the Project area. However, during the survey period no courtship and territorial display flights, which indicate nesting activity (Delannoy and Cruz 1988, Delannoy 1997, Delannoy and Tossas 2000, and Hengstenberg and Vilella 2005, Vilella and Hengstenberg 2006) and allow researchers to identify territories for active nest searches, were observed. Because nesting territories could not be identified during the 24 surveys in January 2011, an area of impact to nesting territories could not be calculated. Based on previous studies conducted on broad-winged hawks in Puerto Rico, their nesting territory (core area) represents a smaller portion of their overall home range (Vilella and Hengstenberg 2006).

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**VIA VERDE
FEDERALLY LISTED PLANTS SPECIES REPORT**

Prepared by: Asesores Ambientales y Educativos Inc.

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March 2011

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FEDERALLY LISTED PLANTS SPECIES REPORT
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Prepared by: Asesores Ambientales y Educativos Inc.

INTRODUCTION

In November 2010, *Asesores Ambientales y Educativos Inc.* (AAE), retained the professional services of Franklin Axelrod, Ph. D., to conduct a survey for the presence of Federally Listed Plants Species along three segments along the proposed Via Verde Project. After performing the field surveys during the months of November 2010 through March 2011, only 3 individual plants of the species *Ottoschulzia rhodoxylon* (palo de rosa) were found in the Manatí segment. No individuals of any of the other species were encountered in the study areas. Realignment and reduction of the construction footprint at some segments have been suggested by AAE in order to avoid and minimize impact over habitats with the potential presence of federally listed plant species and of other important wildlife.

PROJECT DESCRIPTION

The Via Verde project is a 24-inch natural gas pipeline to be installed between the Peñuelas Ecoelectrica LNG terminal and three Puerto Rico Electric Power Authority (PREPA) power plants along the north coast of Puerto Rico. The pipeline will be buried at 3 feet underground and will have a total length of 92 miles. The required width of the construction right-of-way will be 100 feet, while the operational width of the right-of way-is reduced to 50 feet. On steep slopes and along narrow ridges the construction footprint will be reduced to 60 feet. The purpose of the pipeline is to allow and supply natural gas to three power plants that are currently using more expensive liquid fuels.

In order to minimize environmental and socio-economic impact during construction and/or installation of the Via Verde Pipeline, underground installation methods such as horizontal directional drilling or the bore technique will be utilized at major river crossings, forested wetlands, road crossings and coastal areas.

STUDY AREAS

The following three study areas were identified jointly by the US Fish and Wildlife Service (USFWS) and the PREPA team as potential suitable habitats for federally listed plant species within the project proposed construction right-of-way.

Area 1 - Dry limestone hills in Peñuelas

Between mileposts 4 and 6 (See Figure 1) the proposed alignment crosses a zone of dry limestone forest. The following federally listed plant species may possibly occur along this segment: 1) *Ottoschulzia rhodoxylon* (palo de rosa), 2) *Trichilia triacantha* (bariaco), 3) *Buxus vahlii* (diablito de tres cuernos), 4) *Eugenia woodburyana*, 5) *Catesbaea melanocarpa*, 6) *Cordia rupicola*, 7) *Mitracarpus maxwelliae*, and 8) *Mitracarpus polycladus*.

Area 2 -Central Mountain Range (Volcanic)

Between mileposts 13.5 and 15 (See Figure 1) the proposed alignment crosses a zone of volcanic lower montane wet forest. The following federally listed plant species may possibly occur along this segment: 1) *Thelypteris inabonensis*, 2) *Thelypteris yaucoensis*, 3) *Thelypteris verecunda*, 4) *Juglan sjamaicensis* (nogal), and 5) *Polystichum calderoense*.

Area 3 - Moist Karst (Manatí)

Between mileposts 59 and 60.5 (See Figure 1) the proposed alignment crosses a fraction of the northern karst belt, which is located at the subtropical moist forest life zone. The following federally listed plant species may possibly occur along this segment: 1) *Cordia bellonis*, 2) *Ottoschulzia rhodoxylon* (palo de rosa), 3) *Daphnopsis helleriana*, 4) *Solanum drymophilum* (erubia), 5) *Pleodendron macranthum* (chupacallos), 6) *Myrcia paganii*, 7) *Schoepfia arenaria*, 8) *Tectaria estremerana*, and 9) *Auerodendron pauciflorum*.

Figures 2 and 3 illustrate locations of the study areas and hotspots that were carefully searched.

METHODS

Prior to making a final survey area at the Peñuelas dry limestone study area, a USFWS botanist accompanied Dr. Axelrod and Mr. Yousev García on a preliminary reconnaissance of the target area identified by USFWS. The other two study areas, Manatí and Central Mountains, were not visited by USFWS personnel.

All three study areas were initially visited by Dr. Axelrod accompanied by Mr. García of AAE to identify “hotspots” with greater potential for the presence of listed plant species and to eliminate areas with lesser potential. Prior to Dr. Axelrod visits, the study segments were identified and marked (and sometimes flagged) in the field by Mr. García using a Garmin GPSMAP 60CSx equipment (loaded with the Via Verde Pipeline Alignment) and also geo-referenced on-site using the USGS topographic map and aerial photograph for each area. In order to avoid and/or minimize potential impact on listed species, walking trails along the study areas were prepared by hand with machetes. Also, to avoid and/or minimize impacts on the tops of mogotes (limestone hills), a route alternate to the original alignment was identified and surveyed at the Manatí study area.

After visiting the segments and identifying the hotspots, transects parallel to the axis were prepared for detailed surveys. Transects were located at a distance of from 15 feet to 50 feet from each other, depending on terrain morphology and vegetation density. Finally, each transect was walked and inspected slowly, with frequent stops, by Dr. Axelrod, so that complete coverage could be made within each survey area. The study areas were surveyed during the months of November 2010 through March 2011. Figures 4, 5, 6 and 7 illustrate the GPS track logs of the surveyed areas.

Results

Peñuelas Dry Limestone

The initial survey area proposed by USFWS treated the whole southern section of Peñuelas as one piece; but, after an initial reconnaissance of this area, Dr. Axelrod felt that only the southern third, which happens to be the older section (at least 50 years), had a strong possibility of containing endangered plants. During a preliminary field visit with the USFWS botanist, a rare vine (not currently listed on the federal register) was observed by him in this southern section. This discovery made our team especially careful in going over this section; indeed, several individuals of *Polygala cowellii* (another rare, unlisted plant) were observed, but no listed plants were seen. The middle section was extensively disturbed, evidence by the omnipresence of *Leucaena leucocephala* and *Jasminum fluminense*, and did not warrant further

field surveys. The northern section is composed of woods with a different, younger vegetation (tree diameter much smaller, with fewer older trees) that, in the opinion of Dr. Axelrod, was unlikely to contain the listed endangered species; but, even so, he checked for the presence of listed species and found none.

Volcanic Central Mountain Range

The section in Peñuelas near Cerrote has been disturbed in the recent past (some old and abandoned houses) and is honeycombed with jeep trails. Due to these anthropogenic impacts, the habitat and vegetation are not at all similar to that of areas in which the target species of endangered plants occur elsewhere in the region. For example, *Thelypteris yaucoensis* and *Polystichum calderonensis* are known only from exposed rocky summits of more or less pristine mountains; *Thelypteris inabonensis* occurs in a very moist area near a stream and waterfall; *Thelypteris verecunda* occurs only in a limestone area; all these populations are also many miles outside of the target area. *Juglans jamaicensis* is known from a single population many miles away in a coffee plantation where it is a relict; since this tree was collected in this area over a hundred years ago, it was carefully looked for, but not found. The section in Adjuntas site has been clear-cut more recently and shows evidence of having had extensive coffee planting. That area will be removed from the final survey areas.

Manatí Moist Karst

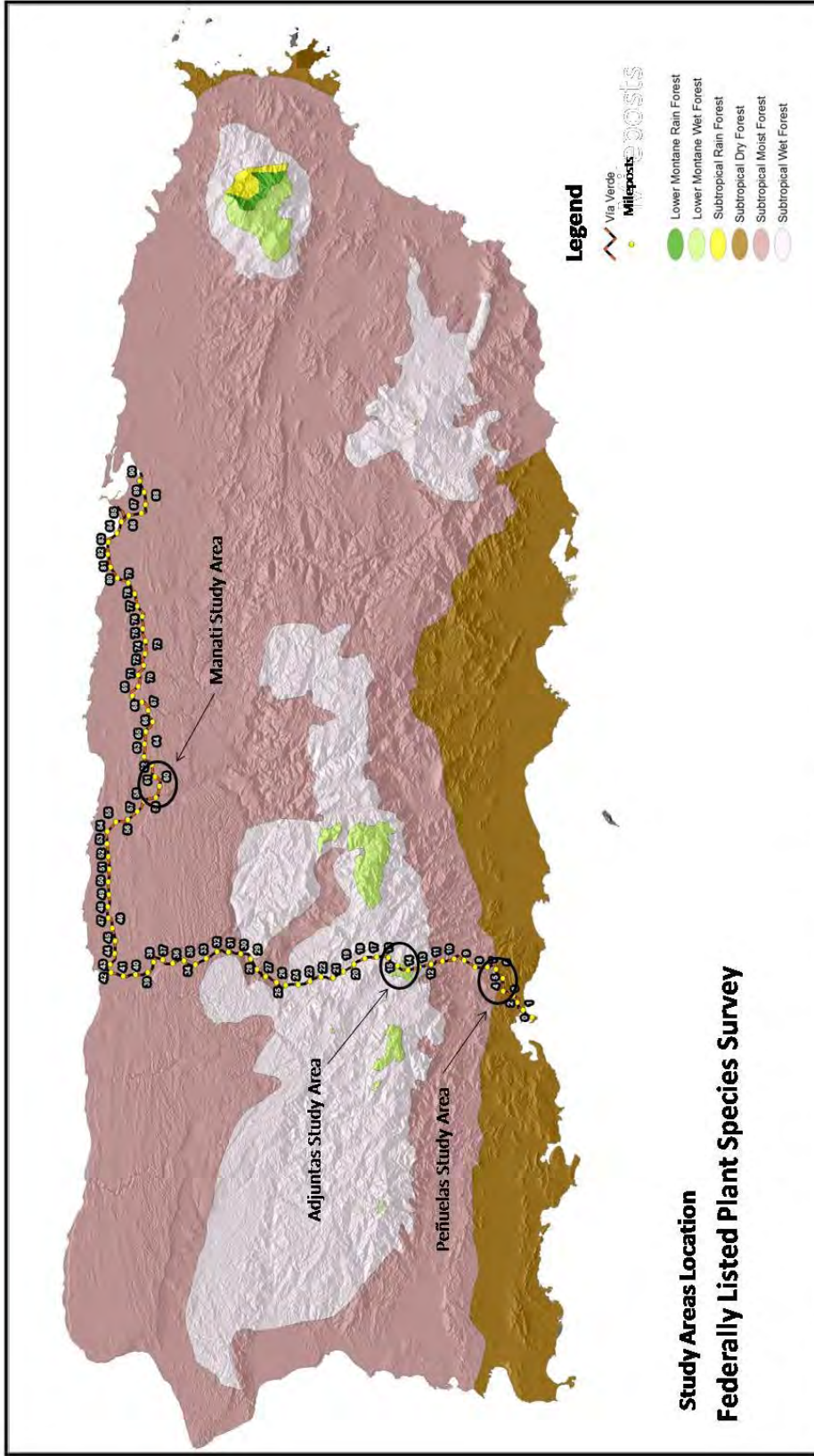
The limestone hill region of Manatí is thoroughly disturbed, evidenced by the extensive occurrence of 'weedy' vegetation - it even includes an old dump at its western end. Due to this disturbance the lower slopes of these hills do not warrant intensive surveys. However, the upper slopes do contain *Ottoschulzia rhodoxylon*. Dr. Axelrod found three different individuals of *Ottoschulzia* in this area; he suspects that more are present. One of the individuals was near the initial alignment and the other two are a little bit further to the north. The latter were found during an inspection for a potential access road that came to be also the final alignment for the gas pipeline. The species will be marked in the field, eliminating any threat to this specie. The geographic coordinates (WGS 84) of the *Ottoschulzia* individuals found will be made available to the USFWS upon request.

Conclusions and Recommendations

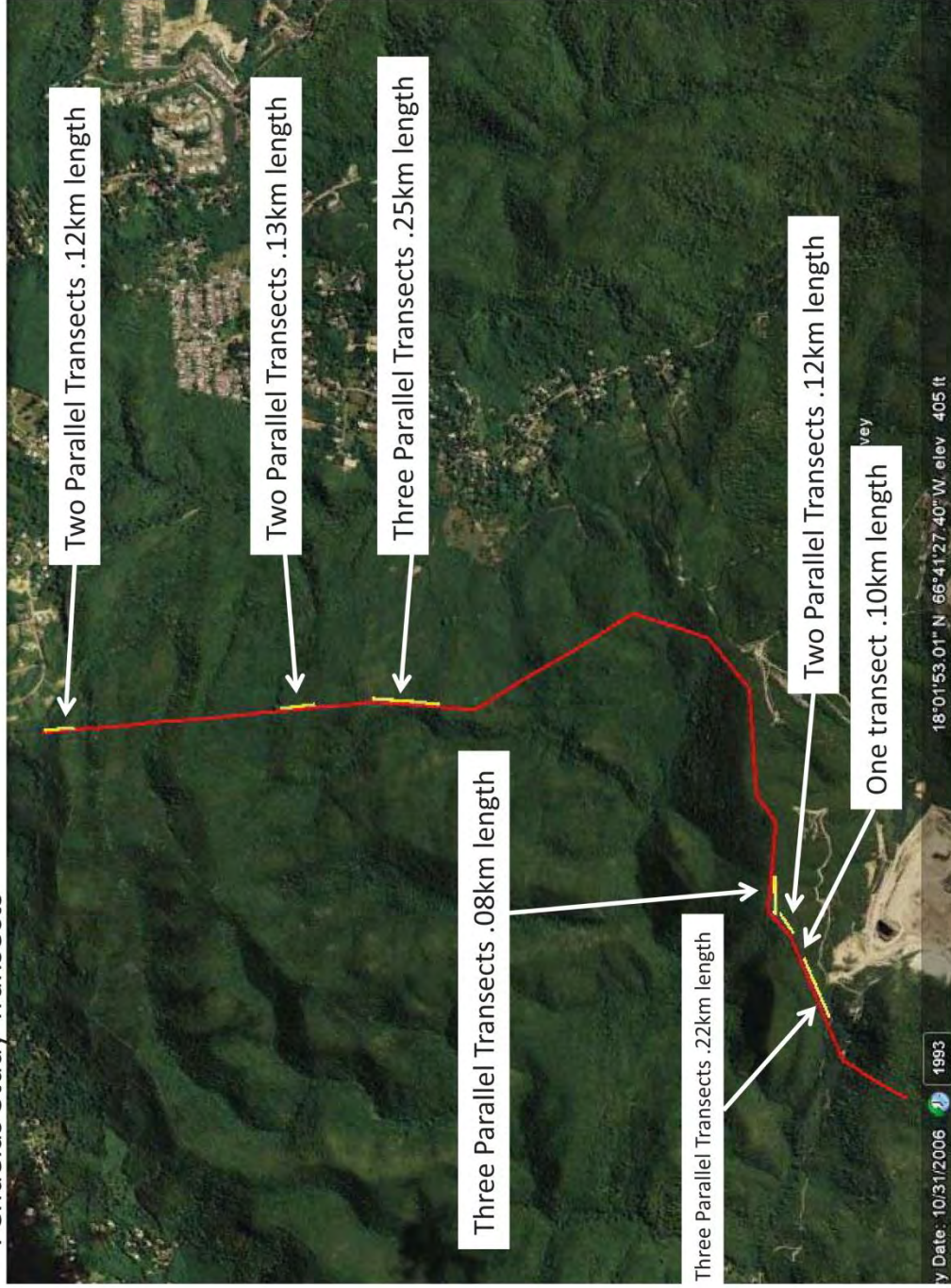
After performing a survey for federally listed species in three segments of the Via Verde gas pipeline project, only *Ottoschulzia rhodoxylon* was found at the Manatí moist karst segment. The rest of the target species were not found. In general, most of the study areas have been subject to human disturbance principally for past agricultural activities and even at potential hotspots – areas where human disturbance seemed minimal – listed plant species were not found.

In order to minimize potential impact to listed plant species and other important wildlife habitats, it is recommended that the construction footprint be minimized and limited in width from 100 feet to 60 feet on steep slopes and along narrow ridges. AAE also recommends that staging areas be located at flatland areas along the alignment that have been colonized by common grasses, *Spathodea campanulata* and *Leucaena leucocephala*.

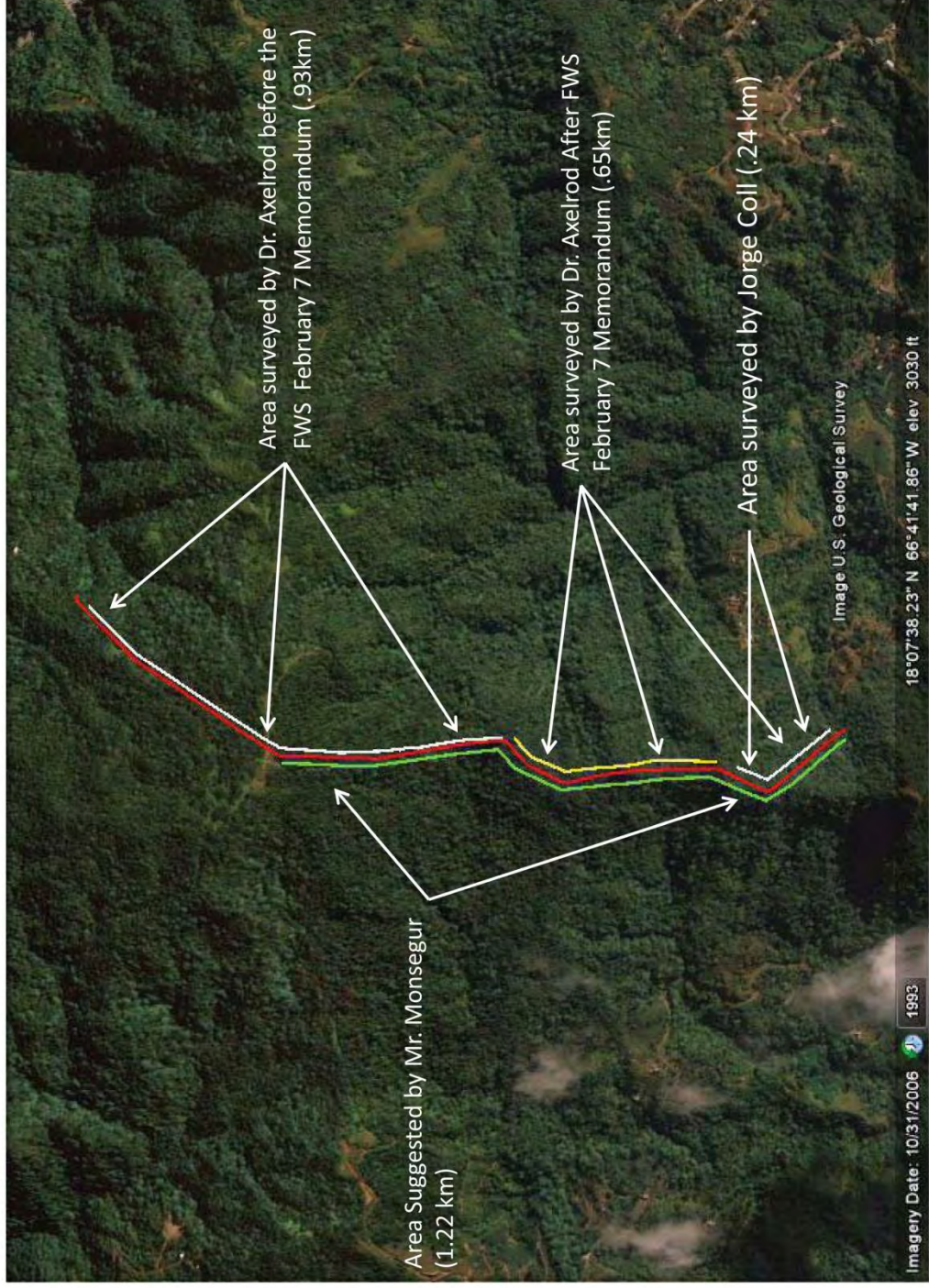
Ottoschulzia individuals should be marked at the field with 'do-not-cut' flagging' and heavy equipment operators should be instructed to watch out for those locations and to preserve the individuals. Finally, it is recommended that biologists be present at the field during land clearing activities to assure that the *Ottoschulzia* are protected and that the construction footprint occurs strictly inside of the studied areas.

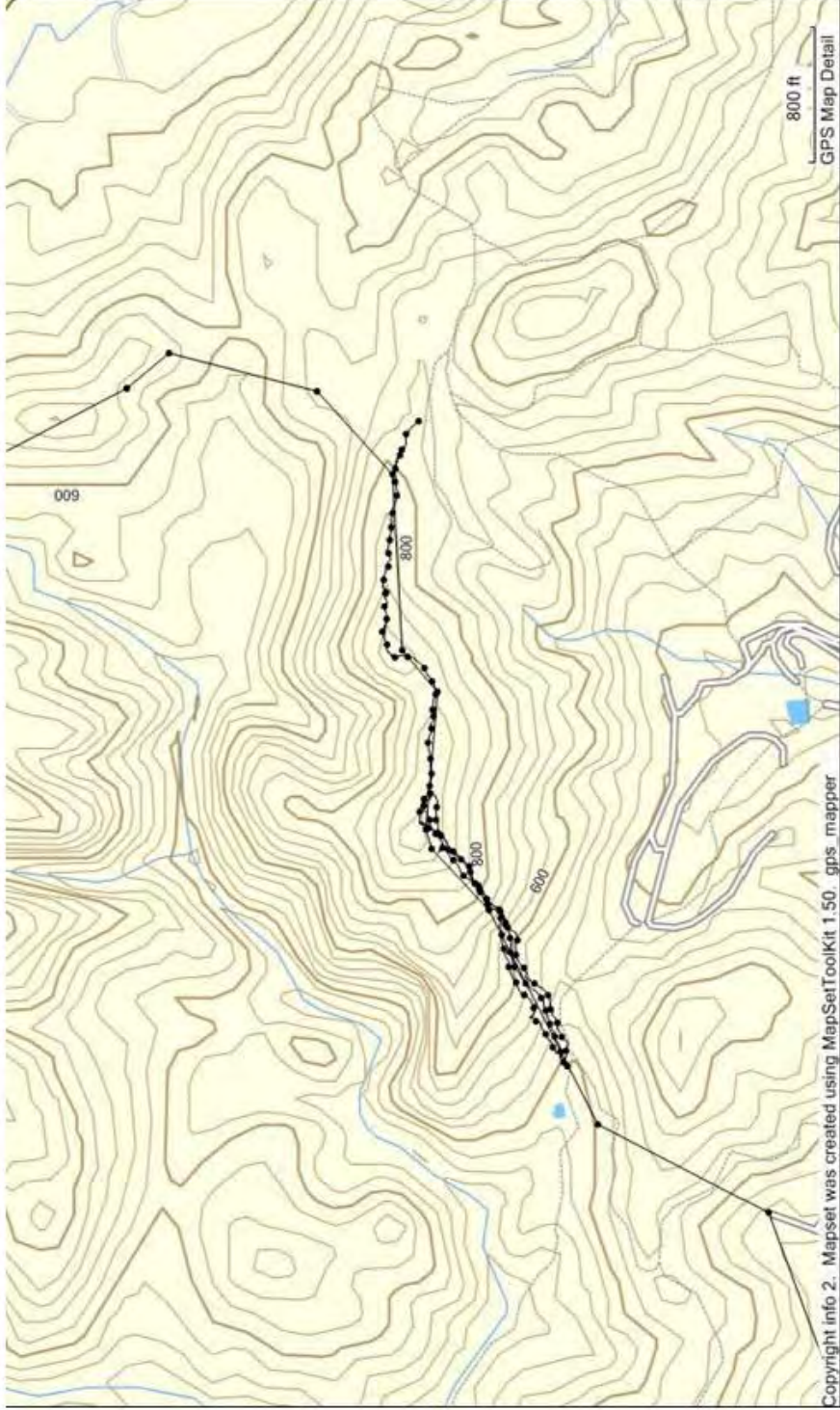


Peñuelas Study Transects

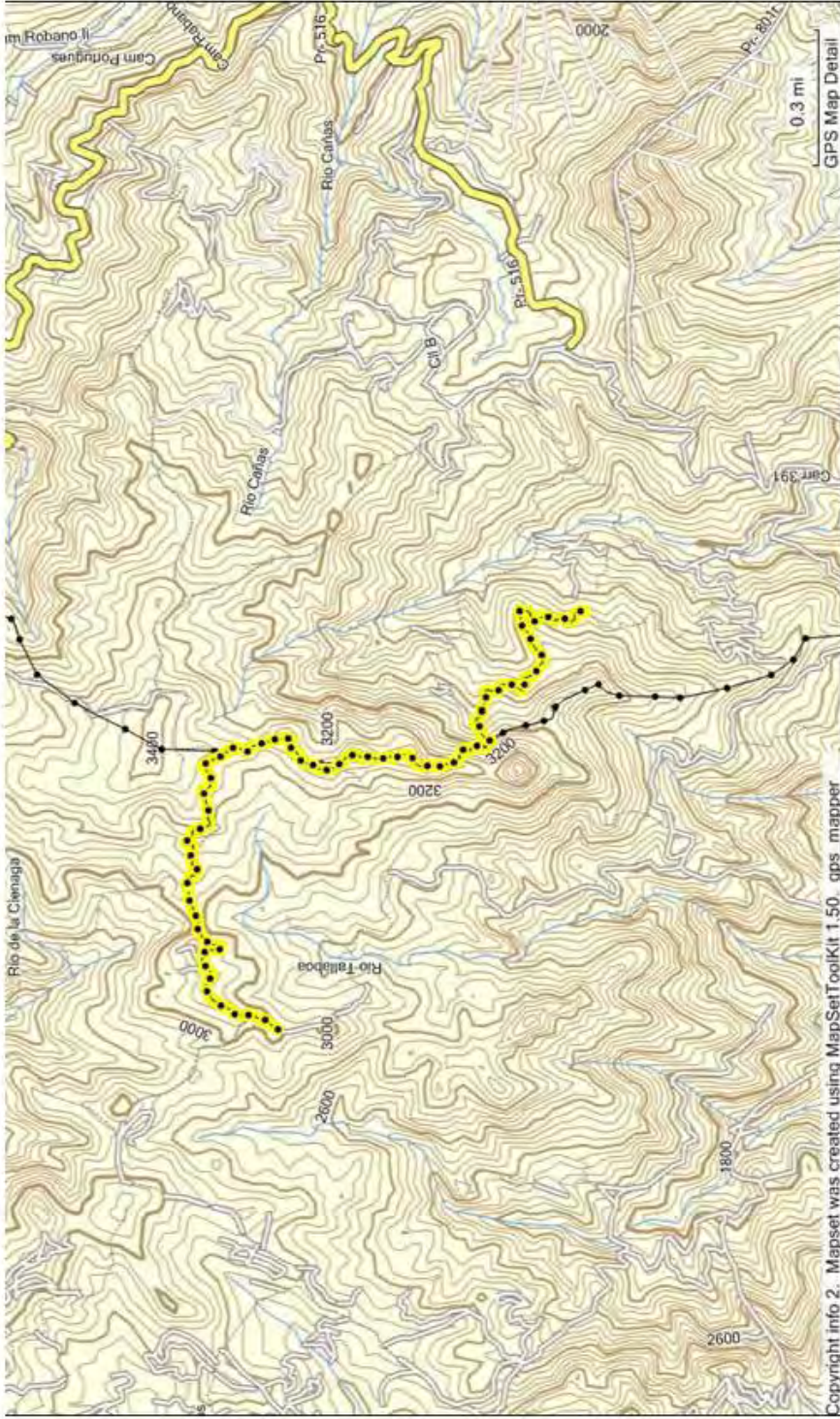


Cerroto Study Area

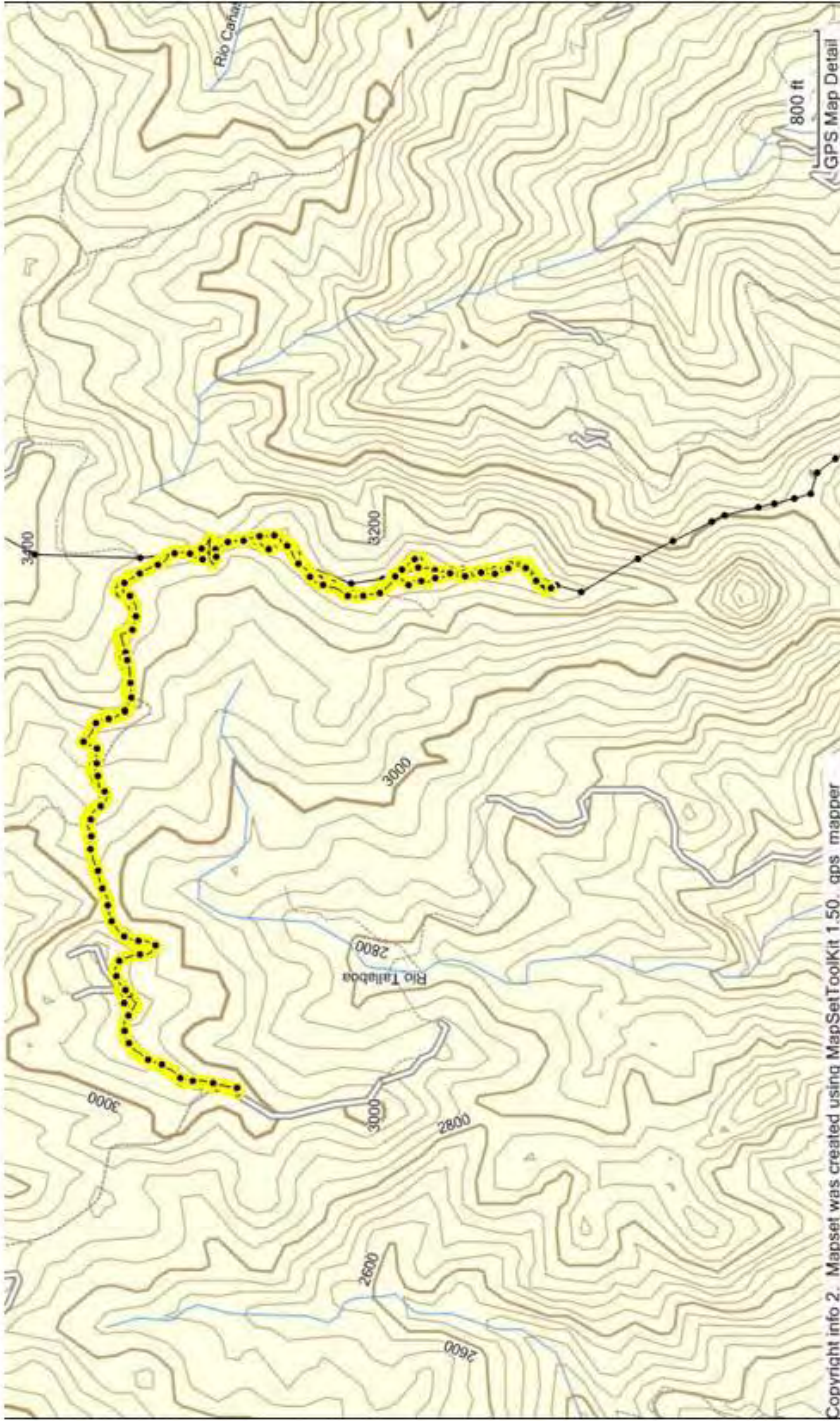




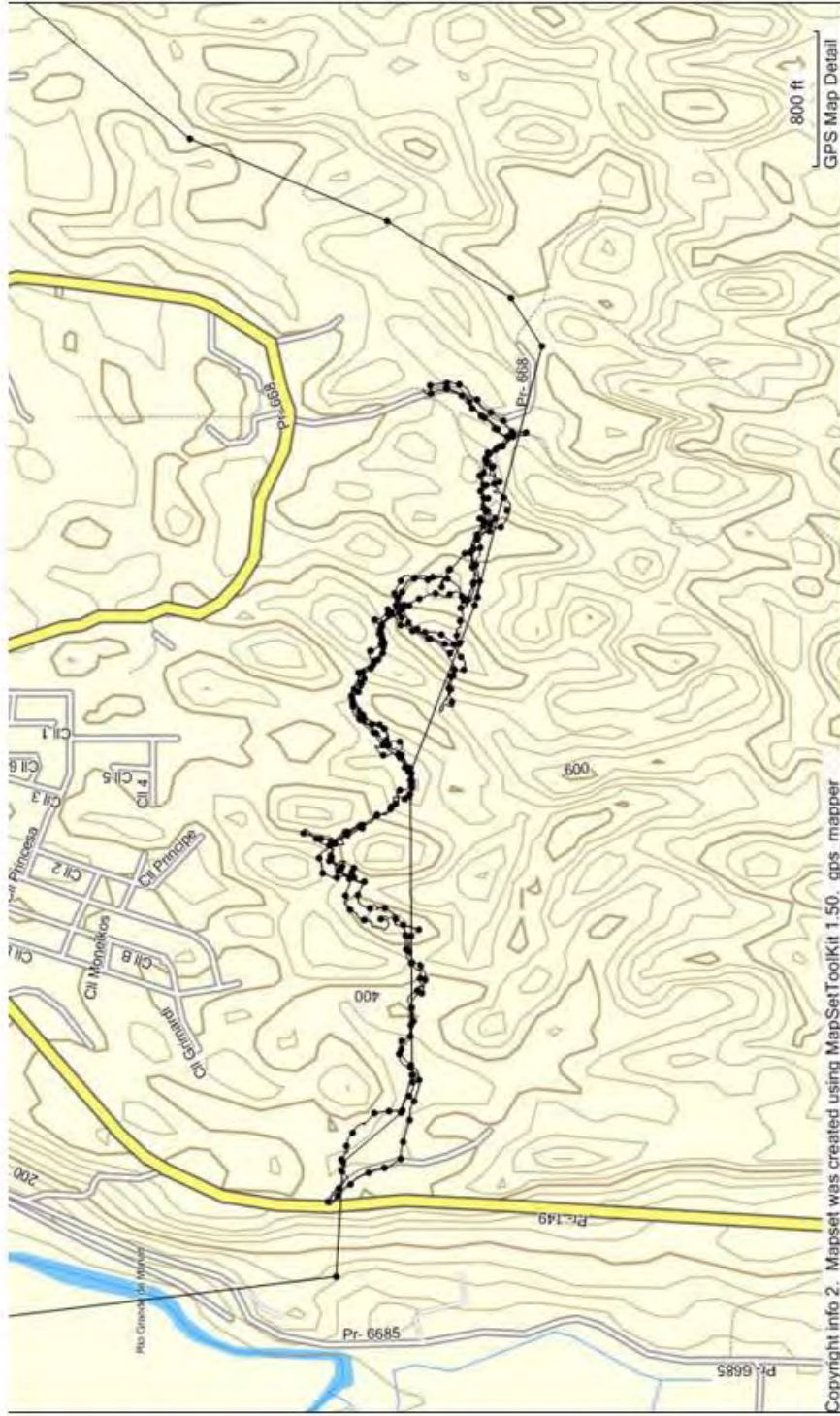
Peñuelas Dry Limestone Study Area GPS Track Log



Cerrote de Peñuelas Study Area GPS Track Log



Cerro Garrote Study Area GPS Track Log



Manatí Karst Study Area GPS Track Log