AMENDMENT

TO THE

HABITAT CONSERVATION PLAN

FOR INCIDENTAL TAKE PERMIT TE104073-2

ISSUED TO

SAN FRANCISCO WIND FARM, LLC

FOR

CONSTRUCTION OF A COMMERCIAL WIND ENERGY PROJECT

IN

GUAYANILLA, PUERTO RICO

Revised 10 January 2013 to Include the Puerto Rican Crested Toad (PRCT)

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FOR:

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1. INTRODUCTION

This amendment to the 2005 Habitat Conservation Plan (HCP) for the WindMar RE Project (now known as the San Francisco Wind Farm, which as of 19 November 2012 is designated as holding Incidental Take Permit TE104073-2) at Guayanilla, Puerto Rico is to address the project's impact on the Puerto Rican Crested Toad (*Peltophryne lemur*). The 2005 HCP (Guarnaccia, 2005) remains in effect for the species covered therein. The only potential conflicts between conservation measures for the toad (hereafter PRCT) and those previously laid out for other species of concern are addressed in sections 2.c.iv. and 3.a.iii. below.

The analysis of the PRCT presented below was prepared by Robert Powell, Ph.D. Dr. Powell has been conducting research on the amphibians and reptiles of the West Indies for over 25 years, with a special interest in how human-mediated alterations of habitats affect native species. He is co-author or co-editor of eight books (including *Natural History of West Indian Reptiles and Amphibians* with Robert W. Henderson) and hundreds of peer-reviewed publications, the vast majority of which concern West Indian species. John Guarnaccia, environmental consultant to WindMar, developed the section on incidental take in consultation with the USFWS CESFO (Caribbean Ecological Services Field Office).

The PRCT is listed as Threatened under the U.S. Endangered Species Act (USFWS, 2008), as Endangered under DNER Regulation 6766 (2004), and as Critically Endangered on the IUCN Red List (Hedges et al., 2004; Angulo, 2010). Until 2008, in southern Puerto Rico, this species had been recorded only in the Guánica State Forest and one adjacent locality (Ciénaga). The proposed site of the Ventana portion of the San Francisco Wind Farm is immediately east of and contiguous with the Guánica State Forest.

The PRCT was not addressed in the 2005 HCP because the population on the Ventana property had not been discovered. Barber (2009) described the discovery of this population on 29 March 2008, when a single male PRCT was found by biologists searching for bats. Subsequently, after heavy rains in September of that year, a PRCT breeding event occurred in the wetlands within the Ventana portion of the project. The breeding pond at Ventana is approximately 4.8 km (3 mi) east of Tamarindo, which had previously been thought to be the only major breeding site for the PRCT in the Guánica State Forest. Hundreds of toadlets (metamorphs with SVL ≤15 mm) were observed in October 2008 by USFWS biologists. Barber (2009) indicated that the newly discovered group of toads is likely part of a metapopulation in Guánica.

Once the PRCT was discovered breeding in the Ventana Pond, USFWS reevaluated the situation and concluded that conservation measures in the 2005 HCP, plus additional measures outlined in its letter of 28 October 2009 to WindMar, would be adequate to avoid incidental take of the PRCT. That assumption, however, was based on the belief that movements of PRCTs were largely restricted to the ravine that fed into the pond. A breeding event in August–September 2011 provided evidence that toadlet dispersal also occurred outside of the ravine, including the adjacent uplands of Ventana. On 2 February 2012, USFWS suspended the Incidental Take Permit (ITP) only in Ventana (i.e., the suspension did not affect the project in Punta Verraco and Cerro Toro), until the PRCT could be incorporated into the HCP and ITP.

Figure 1. Ventana site plan

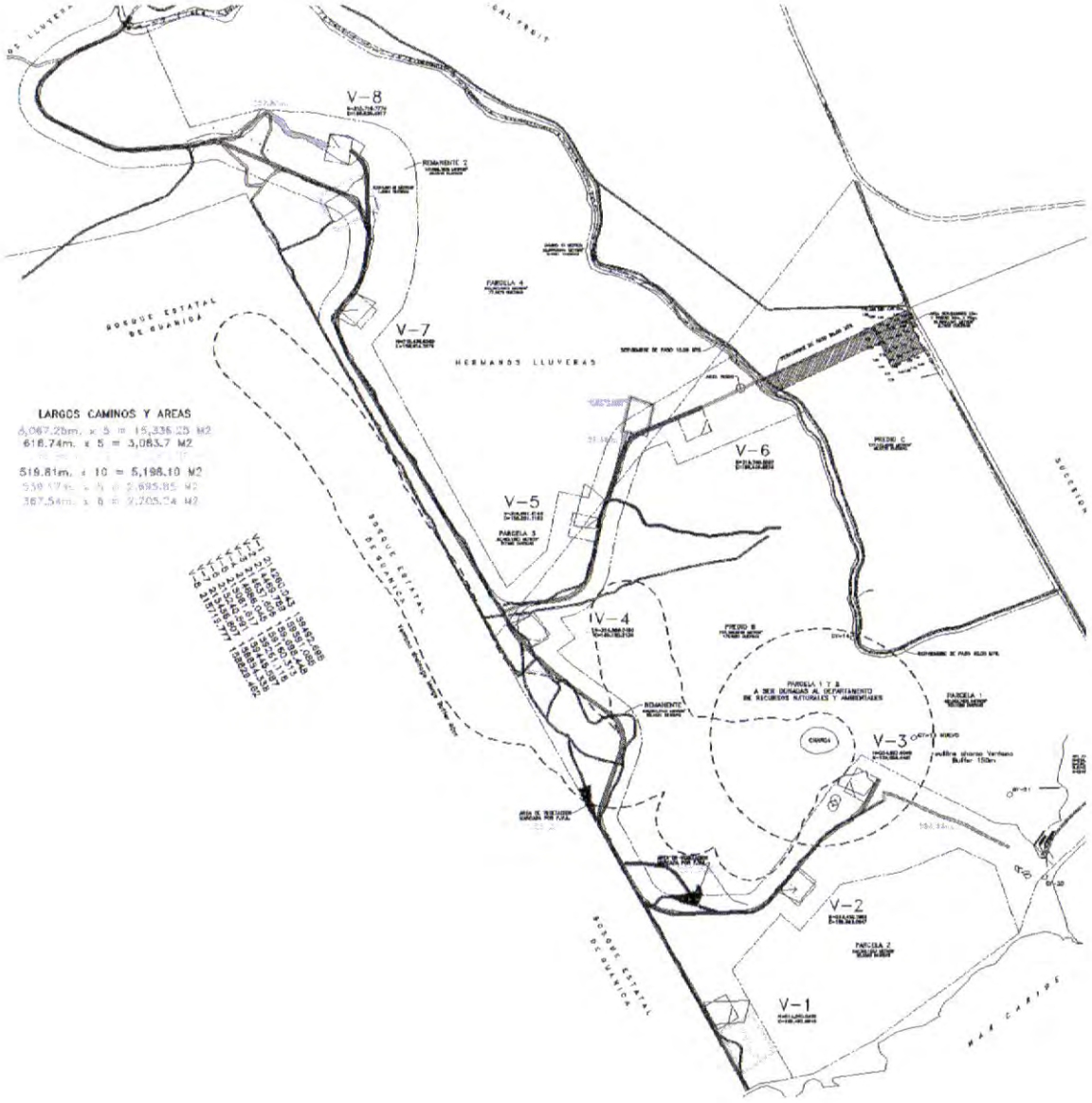

Table 1. Dry forest impacts versus mitigation in the Ventana property

	Feb 2005 HCP (Tables 9 and 13)		HCP amendment		
Category	**Detail**	**Area (ha)**	**Detail**	**Area (ha)**	**Color code in Fig. 1**
Wind farm area		79.00		79.00	
Existing roads in Feb 2005 HCP to service wind farm	3600 x 5 m	-1.80	3067 m x 5 m	-1.53	
Existing roads in Feb 2005 HCP to be abandoned in new plan	Subsequent to Feb 2005 HCP		617 m x 5 m	-0.31	
Other existing roads previous to Feb 2005 HCP	Not accounted for in Feb 2005 HCP		2242 m x 5 m	-1.12	
Total dry forest prior to construction	**A**	**77.20**	**A**	**76.04**	
Impacts to dry forest					
Roads					
Existing roads widened to 10 m	3600 x 5 m	1.80	3067 m * 5 m	1.53	
New roads at 10 m width	500 m * 10 m	0.50	520 m * 10 m	0.52	
Exploratory road from V-3 turbine to SE corner	Subsequent to Feb 2005 HCP		284 m * 5 m	0.14	
Road to previous V-6 turbine location	Subsequent to Feb 2005 HCP		27 m * 5 m	0.01	
Alternate access to V-8 turbine	Subsequent to Feb 2005 HCP		228 m * 5 m	0.11	
Connection from V-6 turbine to substation	Subsequent to Feb 2005 HCP		108 m * 6 m	0.06	
Subtotal roads	**B**	*2.30*	**B**	*2.37*	
Turbine construction and staging areas					
Turbine construction areas	9 @ 0.2 ha/turbine	1.80	8 @ 0.2 ha/turbine	1.60	
Old V-6 turbine site abandoned in favor of new V-6 site (already cleared)	Subsequent to Feb 2005 HCP		1 @ 0.2 ha/turbine	0.20	Outlined
Staging areas	2 @ 0.5 ha each	1.00	None required	0.00	Outlined
Subtotal turbine construction and staging areas	**C**	*2.80*	**C**	*1.80*	
Total dry forest impacted	**B + C**	**5.10**	**B + C**	**4.19**	
Dry forest not impacted	**A - (B + C)**	**72.10**	**A - (B + C)**	**71.85**	
Mitigation of dry forest impacts					
Road margins to grow in	4100 m * 5 m	2.05	3587 m * 5 m	1.79	

Roads abandoned and to be revegetated	Subsequent to Feb 2005 HCP		3398 m * 5 m	1.70	
Old V-6 turbine site to be revegetated	Subsequent to Feb 2005 HCP		1 @ 0.2 ha/turbine	0.20	Outlined
Staging areas to grow in	2 @ 0.4 ha each	0.80	None required	0.00	Outlined
Construction areas to grow in	9 @ 1760 m^2/turbine	1.58	8 @ 1760 m^2/turbine	1.41	
Total mitigation	**D**	**4.43**	**D**	**5.10**	
Dry forest after mitigation	**A - (B + C) + D**	**76.53**	**A - (B + C) + D**	**76.95**	
Gain/loss in dry forest	**D - (B + C)**	**-0.67**	**D - (B + C)**	**0.91**	
Conservation donation to DNER	**E**	**67.00**	**E**	**67.00**	
Net gain in protection	**E + [D - (B + C)]**	**66.33**	**E + [D - (B + C)]**	**67.91**	

Changes made in site plan to accommodate PRCT:

* Removal of turbine 20, which was inside the 60-m buffer zone along intermittent stream.
* Relocation of turbines 17 (now V-3), 18 (V-2), 22 (V-6), 23 (V-4), and 25 (V-8) to reduce road construction.

Table 2. Impacts and revegetation (in hectares) proposed by San Francisco Wind Farm, LLC, in the Ventana property

Project footprint	Detail (see Table 1)	Project footprint	Dry forest impacted	Dry forest permanently lost	Dry forest revegetated	
Existing roads conditioned to 10 m	3067 m * 10 m	3.1	1.5	0.0	1.5	
New roads conditioned to 10 m	520 m * 10 m	0.5	0.5	0.3	0.3	
Total roads conditioned to 10 m	**3587 m * 10 m**	**3.6**	**2.1**	**0.3**	**1.8**	**A**
Turbine construction areas to be conditioned	8 @ 0.2 ha/turbine	1.6	1.6	0.2	1.4	**B**
Connection from V-6 to substation	108 m * 6 m	0.1	0.1	0.1	0.0	**C**
Total impacts and mitigation in project footprint		**5.3**	**3.7**	**0.5**	**3.2**	**A+B+C**
Areas outside of project footprint						
Exploratory road from V-3 turbone to SE corner	284 m * 5 m		0.1	0.0	0.1	
Road to previous V-6 turbine location	27 m * 5 m		0.0	0.0	0.0	
Alternate access to V-8 turbine	228 m * 5 m		0.1	0.0	0.1	
Old V-6 turbine site abandonded in favor of new V-6 site	1 @ 0.2 ha		0.2	0.0	0.2	
Total impacts and mitigation outside of project footprint			**0.5**	**0.0**	**0.5**	**D**
Pre-project roads to be abandoned and revegetated	**2857 m * 5m**		**0.0**	**0.0**	**1.4**	**E**
Total impacts and mitigation		**5.3**	**4.2**	**0.5**	**5.1**	**A+B+C+D+E**

Conditioning to remove potential PRCT refugia	5.3
Dry forest affected outside of project footprint	0.5
Total affected area	5.8
Total dry forest revegetated	5.1
Net habitat lost	0.7

In light of the precarious conservation status of the PRCT, the discovery of another major breeding site is important for the management of the species at Guánica. Consequently, this amendment will spell out plans to address the following biological objectives and goals:

Objectives: (1) Implement the project in a manner that will guarantee the minimum possible impact on the PRCT. (2) Supplement the project by employing strategies to enhance the population size and breeding success of the PRCT at Ventana. (3) Initiate a monitoring and adaptive management program with the potential to conserve the Ventana population of the PRCT well into the future.

Goals: (1) Achieve no net loss of biodiversity at Ventana. (2) Enhance the quality of the dry forest habitat. (3) Promote management of native species (including the PRCT).

This amendment also treats the federally endangered plant, *Mitracarpus polycladus*, the population of which appears to have increased as vegetation has been removed to align roads in the southwestern portion of the property along the border with the Guánica State Forest. This is discussed in section 2.g. below

2. IDENTIFYING PROJECT IMPACTS

a. **Delineation of Project Boundaries:** The PRCT has been found only in the Punta Ventana section of the proposed wind farm, the boundaries of which are indicated in Fig. 1. Consequently, this amendment pertains solely to that area.

b. **Collection and Synthesis of Biological Data:** The PRCT has always been considered rare (reviewed in USFWS, 2009), but efforts to conserve the species are ongoing and a PRCT Recovery Working Group is actively engaged in efforts that include enhancement of the species' habitat and breeding ponds, removal of competitors and predators from breeding ponds and adjacent habitat, evaluation of new re-introduction sites, design and construction of rearing and breeding ponds, release of tadpoles, and education. Nevertheless, current recovery criteria lack sufficient information on the species' distribution, habitat requirements, and life history (USFWS, 2009). The discovery of a PRCT breeding population at Punta Ventana (Barber, 2009) provides an opportunity to expand our information of the species and better manage what might well be a single metapopulation in the Guánica State Forest.

However, the newly discovered site at Ventana and the other main breeding site at Tamarindo (in the Guánica State Forest) are near the shore and vulnerable to saltwater incursions during tropical weather systems such as hurricanes. This will only be exacerbated with rising sea levels. Other threats to the PRCT (USFWS, 2009) include habitat destruction or alteration throughout much of the species' range (which USFWS [2009] assessed as moderate), human activities and fires (moderate), and contamination of breeding ponds with pesticides and herbicides (moderate). Predation by natural predators such as lizards and birds probably has little effect, but could become a significant factor if populations are dramatically reduced by other factors. However, predation by invasive mammalian carnivores (mongooses, rats, and feral cats and dogs) and predation by and competition with Cane Toads (*Rhinella marina*) and Bullfrogs (*Lithobates catesbeianus*) are potentially severe. The threat of chytridiomycosis is not

considered a major threat to the PRCT at this time, but populations should continue to be monitored.

Based on discussions with Carlos Pacheco (USFWS) and Alfonso Silva Lee (WindMar biologist) during a site visit on 25–26 February 2012, the Ventana pond is the primary breeding site in the wind farm area, although toads might also use smaller, temporary, and adventitiously exploited pools (e.g., Dodd and Cade, 1998) at other locations within Guánica and Ventana in particular. Observations of water persisting in such pools for periods exceeding the larval period of the toads (14–21+ days) and the discovery of very small toadlets at considerable distances from the pond are suggestive of other breeding sites.

Alfonso Silva has regularly conducted PRCT surveys in the Ventana section of the property approximately every two weeks for over a year. His method for surveying is described in Appendix A and summarized here. He and an assistant normally survey for three consecutive nights, slowly walking three routes that cover the wind farm's roads and 8 turbine sites, as well as other areas, such as the Ventana pond and adjacent ravine (see Fig. 1 in Appendix A). When toadlets are present, surveys are conducted during the day, because Silva has found that toadlets are more active and visible in upland areas during daylight hours.

Silva began conducting regular surveys on 17 September 2011, after a breeding event at the Ventana pond was discovered by USFWS in late August 2011. His surveys have documented toadlet dispersal after breeding events in 2011 and 2012, as well as the abundance of toads (adults and subadults) in areas where the wind farm will be constructed. As will be seen in the section below on incidental take, we have used these survey data to calculate incidental take of PRCT toads and toadlets as a result of the construction and operation of the wind farm.

With respect to sexing and aging toads, Silva classified as adult female any toad >60 mm that showed no trace of yellow coloration. He classified as adult male any toad >60 mm that showed some yellowish background color, sometimes very noticeable. He classified toads <60 mm as subadults, because under that length, toads never showed a yellowish background color that would allow differentiation.

Based on Silva's surveys, this is the annual pattern we have documented at Ventana. It spans two breeding events.

Adult and subadult PRCTs appear to reside year round in the lower ravine adjacent to the Ventana pond. These individuals live in solution holes and under boulders and may be found on humid nights, particularly after rains, when they venture from refugia to feed, or after abundant rains to breed at the pond. These resident toads were first discovered on 1 February 2012, and have since been found regularly (mean of 30.1 ± 6.1 in 18 surveys). Silva's maximum count was 100 adults and subadults on 7 August 2012, including 48 males, 28 females, and 24 individuals of undetermined sex. During dry conditions, these toads do not emerge at night.

On most nights, most toads in the lower ravine appear to be males and subadults. Females have only been found during or after breeding events. That males reside next to the pond is not surprising, given that the jumble of boulders

provides excellent estivating habitat and that competition to mate with females must place a premium on locating near the pond. Where females reside remains somewhat of a mystery. They may also estivate under boulders adjacent to the pond, venturing out only when conditions are right for breeding, or they may arrive from upland areas when cued by low-pressure systems and heavy rains. With respect to the latter hypothesis, Silva has only found subadults (35–45 mm) in the upper ravine, where one would expect to occasionally find females moving to and from the pond. In other words, migratory movements of adult females to the pond have yet to be documented, but more frequent search intervals, particularly when breeding is most likely, are needed to determine the origin of the bulk of female breeders.

In the upland areas where the wind farm will be constructed, toads are relatively scarce (see Figs. 3 and 4 in Appendix A). In 18 night surveys, they have been found regularly in the vicinity of the V-3 turbine (8 records) and near the junction of the main access road and the road that enters the Guánica State Forest (11 records). They have not been encountered at turbine sites other than V-3, and only eight have been recorded along other road sections, which measure 3.6 km.

In upland areas, toads that are clearly females are regularly found. Of 28 records of toads in upland areas, 8 (29%) have been diagnosed as females. These include six records of females 79–93 mm in length on the road leading into the Guánica State Forest, which is outside the footprint of the wind farm. One of those individuals (dubbed Popeye Lady because of a swollen eyelid) was found twice. Two females 73–76 mm in length have been found in the vicinity of the V-3 turbine.

Fifteen records have documented the presence of toads behind Ventana beach at the base of the cliff and two additional records show toads in uplands near Punta Ventana itself (see Fig. 4 in Appendix A). Both of these areas are outside the footprint of the wind farm.

Note that adult toads have never been found during daylight surveys. This is probably because they spend daylight hours hidden under rocks or in solution holes, from which they venture out only at night. Nonetheless, adult toads might be abroad during the day during heavy rains associated with breeding.

With regard to toadlet dispersal into the wind farm area, Silva has followed two breeding events, both occurring in late August (2011 and 2012) after heavy rains. These events were confirmed by the presence of egg masses and tadpoles in the Ventana pond. Additional evidence suggested that toads bred in isolated depressions elsewhere, when rains in August 2011 kept depressions continuously flooded for more than three weeks.

Silva recorded maximum densities of 100–400 toadlets/m^2 when toadlets were emerging from the Ventana pond on the nights of 26 and 27 August 2012 (a few of which were observed to have been consumed by an adult PRCT within the mass of toadlets). On the night of 27 August, he observed toadlets scaling the slope that led to the Ventana uplands in the vicinity of the V-3 turbine site, recording densities of 1–15 toadlets/m^2 on the slope.

On 13 September 2012, densities of 0.2–1.6 toadlets/m^2 were recorded in the vicinity of the V-3 turbine site and the farthest toadlet from the pond had nearly

reached the V-2 turbine site, some 150 m from the pond. Densities around the V-3 turbine were much reduced in surveys on 26 September–1 October 2012 and 9–11 October 2012, but dispersal was recorded to halfway between the V-1 and V-2 turbines (3 toadlets) and to the main road that crosses the upper section of the ravine that feeds the Ventana pond (8-17 toadlets along road within 40 m of the ravine).

2011 saw a much larger breeding event. Small numbers of toadlets were recorded at the sites of turbines V-1 to V-6 (see Fig. 2 in Appendix A). Additional records were along the main road servicing the wind farm area to about 150 m north of the V-4 turbine site. Those individuals were the farthest recorded from the pond (~700 m). By the time of surveys on 30 November–2 December 2011, approximately three months after the breeding event, toadlets could no longer be found. In neither year were toadlets found at the sites of turbines V-7 and V-8.

The comparison between years shows that dispersal events are variable with respect to the number of toadlets dispersing, the range they cover, and the length of time they are present at sufficiently high densities to be found.

Surveys have also encountered Cane Toads in the lower ravine area next to the pond and in upland areas of Ventana. As of 19 September 2012, more than 100 have been eliminated during Silva's surveys. Because Cane Toads are voracious predators as well as likely competitors of PRCTs (see Meshaka and Powell, 2009 for a review of a similar situation with a native toad in southern Florida), removing them is important because it relaxes predation and presumably competitive pressures on PRCT toads and toadlets and improves PRCT survival.

These data, generated during surveys conducted at Ventana by Alfonso Silva Lee, correspond closely with the few published reports on the species (summarized in Henderson and Powell, 2009; Díaz-Lameiro et al., 2010). Habitat has been characterized as lowland, semiarid, limestone karst formations with well drained soil (Rivero et al., 1980) and "semi-arid, rocky areas of seasonal evergreen forest" (Angulo, 2010). Breeding aggregations are heavily male-biased (4:1); females respond to calling males, enter and leave ponds during one night; toads might travel as much as 4 linear km from the breeding pond (Moreno and Canals in Miller, 1985). Metamorphosis in nature occurs in 25 days (Moreno and Canals in Miller, 1985) or 76–80 days (Rivero et al., 1980), but possibly in as few as 14 days (C. Pacheco, USFWS, pers. comm.).

c. **Determination of Proposed Activities:** Actions within the planning area that are likely to result in incidental take, are reasonably certain to occur over the life of the permit, and for which the applicant has some form of control include: (1) habitat removal/disturbance during construction, and (2) the possibility of roadkills as a result of vehicle circulation. Thus, incidental take can occur two ways: (1) by removing toads and toadlets that could be harmed (technically, harassment), and (2) by killing them. Please note that the Incidental Take Permit (ITP, # TE104073-2) that resulted from the 2005 HCP was originally issued on 8 September 2006. This permit remains in effect until 30 September 2046; thus, approximately 35 years remain on the permit.

Note that nearly all directly impacted areas have already been cleared of dry forest vegetation (although some regrowth is evident except directly on roads).

Also note that the original site plan for Ventana (see 2005 HCP) was modified in 2009 to reduce impacts, particularly on the PRCT. Originally, 4.1 km of roads had been planned to access nine turbines in Ventana, but in the revised site plan (see Fig. 1), the number of turbines was reduced by one (entirely removing a turbine from the 60-m buffer zone recommended by USFWS along the intermittent stream) and five other turbines were relocated. These changes reduced the length of access roads to service turbines by 12%, from 4.1 km to 3.6 km (green and red roads in Table 1; this table was modified from Tables 9 and 13 of the 2005 HCP). These changes also allowed 2.9 km of existing roads (purple and yellow roads in Table 1 and Fig. 1) to be abandoned and begin succession to dry forest. Other roads to be abandoned (coded in blue in Table 1 and Fig. 1) included an exploratory road from turbine V-3 to the southeast corner of the uplands. In addition, two staging areas that would have impacted 1 ha of dry forest in Ventana were removed from the site plan before they were cleared. Consequently, impacts to dry forest in Ventana have been reduced 18%, from 5.1 ha in the 2005 HCP to 4.2 ha in the present plan (Table 1, calculation B + C). All habitat saved from the impacts is likely to represent suitable PRCT habitat.

With respect to incidental take of PRCTs, construction can be divided into two phases: (1) conditioning of roads and turbine sites, and (2) construction of turbines. The difference is that habitat effects are limited to the conditioning phase, when rocks and solution holes in which toads could conceivably seek refuge or estivate are ground into smooth surfaces or filled. Once roads and turbine sites have been conditioned, the ability to find PRCT toads and toadlets, remove them from harm, and block their access to danger areas using barriers increases considerably, because they will stand out more on smooth, homogenous surfaces and those surfaces will allow placement of barriers. We use these phases when we present our incidental take calculations below.

The construction of the wind farm (activities i–v below) will require 3–6 months, unless the project is for some reason delayed.

i. **Conditioning of roads:** As may be seen in Table 1, 3.6 km of roads 10 m in width (green and red roads in Table 1 and Fig. 1) have already been cleared to access the eight turbine sites in Ventana. 3.1 km of those roads (coded green) existed prior to the project at 5-m width (since widened to 10-m width), and 0.5 km (coded red) were established at 10-m width during the construction phase preceding this amendment. The new roads include realignments to avoid two patches of *Mitracarpus* that USFWS had identified. Roads have not yet been conditioned; i.e., leveled sideways with rock-crushing equipment and fill to within 1% to permit cranes and trucks to travel over them safely. Road conditioning will occur upon approval of this amendment, according to the amendment's conditions. Note that 0.5 km of other roads (coded blue) have been abandoned; thus, they will not be conditioned and will be revegetated. In summary, conditioning of roads will affect 3.6 ha of potential refugia habitat of the PRCT (Table 2).

ii. **Conditioning of turbine construction sites:** The eight construction sites were cleared of dry forest in 2009, but significant regrowth has occurred since then. In addition, an alternate site for turbine V-6 (outlined in blue) was

abandoned and is in the process of revegetation. At the eight turbine sites that will proceed, vegetation will need to be cut back again, and the construction sites will need to be conditioned to support the tall cranes that are required. The footprint for the eight turbine construction sites is 1.6 ha, which represents 38% of the total affected area of 4.2 ha of dry forest in Ventana Tables 1 and 2). Please note that WindMar offered to relocate the V-3 turbine about 50 m to outside the 150-m buffer zone around Ventana pond, but upon examination in the field on 8 May 2012, USFWS biologists recommended that the V-3 construction site remain where it had been, as moving it would have affected more dry forest habitat. However, following the recommendation of USFWS biologists, the location of the turbine itself will be moved from the eastern corner to the western corner of the site. In summary, the conditioning of turbine sites will affect 1.6 ha of potential refugia habitat of the PRCT (Table 2).

iii. **Excavation and construction of turbine bases:** After sites are conditioned, excavation of turbine bases will entail additional movement of soil and rock within the conditioned sites. This action affects 240 m^2 of each turbine construction site, or a total of 0.2 ha (all within the areas that will be conditioned for turbine construction sites).

iv. **Excavation of trenches for turbine interconnection:** To avoid avian electrocution or collisions with transmission lines, these will be buried in trenches. However, to minimize the impact on the PRCT, all trenches will follow roads that have been conditioned. Trenches in the middle of roads will not increase the area affected, since it is already included in 2.c.i. or 2.c.ii. above.

Trenching and the laying of cable will happen together so that trenches can be promptly backfilled, thereby minimizing exposure of PRCTs and other wildlife to falling in. Workers will be trained to cover exposed trenches with tarps or surround openings with erosion barrier at the end of the work day, as well as to examine holes the first thing in the morning for PRCTs that may have fallen in. If a PRCT is encountered, a biologist on site or specially trained worker will be called to remove it for relocation to the base of the ravine by the Ventana pond, which has quality habitat that supports a resident population of PRCTs. Toads will be removed in a covered 5-gallon bucket that is perforated for air circulation and contains a small amount of water in the bottom for moisture.

The connection from the V-6 turbine to a substation to the east would require a trench in a 6-m wide corridor that would traverse approximately 108 m of dry forest and 260 m of adjacent, highly disturbed lowland habitat (orange coded road in Fig. 1, Table 1; see also Table 2 as this activity is part of the project footprint). An alternative would be to elevate this line on poles, but this option would still require removing the dry forest below. If the elevated line option were to be employed, it would be equipped with flight diverters to reduce electrocution and collision risks with large birds such as Red-tailed Hawks (*Buteo jamaicensis*) and Turkey Vultures (*Cathartes aura*). Consequently, effects beyond those already associated with roads will be

minimal, restricted to creating a 108-m corridor 6-m wide in dry forest habitat for either an underground or elevated line. Regardless of the method chosen, once the line is in place, the disturbed area will be allowed to recover (selective planting of native vegetation combined with natural vegetation).

Every effort will be made not to clear the 0.1 ha of dry forest habitat in the corridor from the V-6 turbine to the lowlands during the nesting season of the Puerto Rican Nightjar (*Caprimulgus noctitherus*). If habitat modification is strictly necessary during the nightjar nesting season, San Francisco Wind Farm will coordinate with the Service prior to conducting the activity.

v. **Road traffic during construction:** Over a 3–6 month period, unless the project is for some reason delayed, trucks, cranes, and other equipment will be moving along roads and in construction sites. Traffic volume will be relatively high during this period, estimated at 25–50 vehicle trips per day.

vi. **Road traffic subsequent to construction for the life of the project:** Turbines will need to be regularly maintained and occasionally repaired. Maintenance and repair visits will occur only during daylight hours and will usually be accomplished with light trucks. Traffic volume will likely range from zero to five trips per day. Traffic at night, when toads are most active, will not occur, except during an emergency.

Emergencies require special consideration. They would include a human life at risk, fire, vandalism, or other such event that would require vehicles to enter the Ventana wind farm area unexpectedly and at very short notice. Emergencies may result in take when they: (1) occur at night when toads may be present in the project footprint, or (2) during the day when entry is required into an area where toadlets are dispersing. Given that emergencies are beyond San Francisco Wind Farm's control, cannot be predicted, would occur at extremely low frequencies, and would not necessarily occur at night or coincide with a toadlet dispersal event, the incidental take that might occur from them cannot be calculated.

vii. **Replacement of generator and rotors in 20 years:** The turbines are rated to operate for 20 years, when their rotors and internal parts (generator, gear box, and other mechanical and electrical equipment) require replacement. A small crane is required to lower and hoist the 7.5-ton, 40-m rotor blades, but only a 5-m road width and 100 m^2 of clearing at the base of the turbine will be necessary. Full replacement of turbines, including towers, would take place in 40 years, but that action would require a new HCP.

d. **Determination of Anticipated Incidental Take Levels:** We use Alfonso Silva's survey data to establish metrics for incidental take, because those data are the best information available for the calculation purposes. Silva's surveys spanned two breeding events and were conducted approximately every two weeks. They are summarized in 2.b. above and in Appendix A.

Note that all calculations are based on the 5.3 ha of the 79 ha of the Ventana property that fall within the project footprint (Table 2). These 5.3 ha include 3.6 ha of roads (3.6 km of conditioned roads 10 m wide), 1.6 ha of turbine sites (8 conditioned sites at 0.2 ha each), and 0.1 ha in the corridor (108 m by 6 m) for the

interconnection corridor through dry forest from the V-6 turbine to the substation (Table 2).

As explained in 2.c., project activities can be divided into phases. Once roads and turbine sites have been conditioned, all habitat effects will have been accomplished and the ability to find PRCTs, remove them from harm, and set up avoidance measures, such as barriers, will increase considerably. Thus, we separate incidental take during conditioning, when refugia in upland areas will be affected, from incidental take post-conditioning. We also divide the post-conditioning period into: (1) construction period, and (2) operations/maintenance period.

Table 3. Adult and subadult PRCTs discovered in surveys along 3.6 km of project roads[1]

Survey #	Dates	Day	Night
1	17-19 Sep 2011	0	
2	30 Sep 2011	0	
3	19-21 Oct 2011	0	
4	28-30 Oct 2011	0	
5	30 Nov-2 Dec 2011	0	
6	13-16 Dec 2011		0
7	28 Dec 2011-3 Jan 2012		1
8	16-18 Jan 2011		0
9	31 Jan-2 Feb 2012		1
10	14-16 Feb 2012		1
11	12-14 Mar 2012		0
12	20-22 Mar 2012	0	
13	29-30 Mar 2012		1
14	10-12 Apr 2012		4
15	25-27 Apr 2012		0
16	8-10 May 2012		4
17	22-24 May 2012		3
18	4-6 Jun 2012		0
19	19-22 Jun 2012		1
20	5-7 Jul 2012		1
21	24-26 Jul 2012		0
22	6-8 Aug 2012		1
23	24-28 Aug 2012		3
24	11-15 Sep 2012	0	
25	25 Sep-1 Oct 2012	0	0
26	9-11 Oct 2012	0	
	Samples	9	18
	Toads found	0	21
	mean ± SE	0	1.17 ± 0.33
	95% CI	0	0.48 to 1.85

[1] Included were 8 toads found in the vicinity of the V-3 turbine, because they were at the edge or just within the project footprint, and excluded were 6 toads found on the road into the Guánica State Forest, because they were well outside the project footprint.

We first treat incidental take of toads (adults and subadults), then incidental take of toadlets.

i. **Incidental take of toads:** Based on Alfonso Silva's data, we have conservatively estimated the density of adult and subadult PRCTs in upland areas of the Ventana site at 2.1 toads/ha. Here is the basis for that estimate.

Table 3 provides the results of toads found during 26 ~biweekly surveys from 17 September 2011 to 11 October 2012 of roads and turbine sites within the project footprint. Not included in the number of toads recorded were six found along the road that enters the Guánica State Forest, because those toads were well outside the project footprint. Note that surveys during the 2011 toadlet dispersal event were conducted during the day, but beginning on 13 December 2012, when toadlets could no longer be found, nighttime surveys were instituted, and 18 nighttime samples were conducted. Note that no adult or subadult toads were ever found during the day (Table 3). At night, the mean number of toads found within the project footprint was 1.17 ± 0.33 toads (mean ± SE). The 95% Confidence Interval of this mean ranged from 0.48 to 1.85 toads (Table 3).

We limited the search area used in the density calculation to 1.8 ha, which represented the 5-m width of the 3.6 km of project roads that were easily searchable, unlike road margins and turbine sites, where secondary regrowth made finding toads more difficult (A. Silva, pers. comm.).

Continuing in a conservative vein, we also assume that the efficiency of Silva and his assistant in finding toads along pre-conditioned roads was 50%. In other words, for each toad they found, one was missed.

Thus, using a 1.8-ha search area, the upper 95% confidence of 1.85 toads, and a searcher efficiency rate of 50% (1.85 toads divided by 1.8-ha search area divided by 0.50 searcher efficiency), we arrive at a conservative density estimate of 2.1 toads/ha in the project footprint. This translates to 12 toads within the project footprint of 5.3 ha (2.1 toads/ha multiplied by 5.3 ha and rounded up to the next integer).

Table 4. Approximate percent of substrates at Ventana turbine sites consisting of limestone bedrock with solutions holes. These data were generated during on-site surveys conducted by Alfonso Silva Lee and Robert Powell on 26 February 2012.

Turbine	Percent Limestone Bedrock	Comments
V-1	10–15	Nearly all outside area to be excavated
V-2	~25	About 20% of bedrock in area to be excavated
V-3	~5	All outside area to be excavated
V-4	~5	All outside area to be excavated
V-5	10–15	All outside area to be excavated
V-6	<10	All outside area to be excavated
V-7	~20	All outside area to be excavated
V-8	~30	Nearly all outside area to be excavated

Even though turbine sites could not be surveyed as effectively as roads, we believe the density estimate also fits turbine sites because, upon examination, very few refugia for PRCTs appeared to be available. On 26 February 2012, Powell and Silva surveyed each turbine site for limestone bedrock and solution holes (Table 4). Percentages of such habitat were small. Moreover, at the V-3 turbine site, the only turbine site where PRCTs had been found (8 records), quality habitat was outside the area to be conditioned.

With respect to incidental take, the conditioning phase is expected to affect 12 toads inhabiting or otherwise using the project footprint of 5.3 ha. To minimize the loss of toads, qualified searchers (i.e., Alfonso Silva and his assistants) will search for toads the night before conditioning activities are scheduled in a particular section of road or turbine site. Searchers will conduct searches by slowly walking parallel transects 5 m apart multiple times. Thus, the centerline and edges of road segments will be walked, as well as transects 5 m apart at turbine sites.

We estimate that these searches will encounter as many as 6 toads (50% searcher efficiency), which, as discussed above, will be removed in perforated buckets with a small amount of water for moisture to the lower ravine by Ventana pond (i.e., incidental take by harassment). The other 6 toads are expected to be lost to conditioning activities that remove all refugia within the project footprint (Table 5).

Once conditioning is accomplished, the visibility of toads entering roads and turbine sites increases considerably, because surfaces will be smooth. We conservatively estimate that searcher efficiency will increase to 90% or greater on conditioned surfaces. Construction activities that could conceivably affect PRCTs include considerable transit of construction vehicles, excavation and construction of turbine bases, construction of turbines with cranes, and the excavation and filling of trenches that will contain interconnection cables. These activities, however, will only occur during daylight hours on days commonly with no precipitation, when, according to our data, toads are not abroad (Table 3). No toads are expected to remain in the project footprint post-conditioning as those areas will be totally exposed, in effect without any suitable PRCT refugia.

Workers will be trained to look for toads and notify a biologist on staff, or other specially trained worker, in the unlikely event that one is discovered within the project footprint during the day. A likely cause of a toad being found within the footprint would be if one fell into an excavation, such as the excavation required for turbine bases or for interconnection trenches. To guard against that possibility, workers will be instructed to cover excavations with tarps or surround them with erosion control barriers at the end of the workday. At the beginning of the workday, they will check excavations for toads and other wildlife that may have fallen in. If a toad is found, a biologist on call or a specially trained worker will collect it in a perforated buckets with a small amount of water for moisture and move the toad to the lower ravine near the Ventana pond. Workers will also check rock and dirt piles for toads before work commences. If biologists judge that certain piles are attractive to

toads as refugia, those piles will be surrounded by erosion control barriers to limit toad access.

With respect to how many toads may be at risk during construction, our best available density estimate is 2.1 toads/ha, or 12 toads within the 5.3-ha footprint (see above). The avoidance measures described above should greatly limit the possibility of incidental take. Nonetheless, given that some take may occur, to be safe we request that take during the post-conditioning construction phase also be set at 12 toads, but with up to 10 taken by harassment (i.e., removal) and up to two taken by loss (Table 5).

During the operations phase of the project, toads are not expected to be present within the project footprint during the day, because no suitable refugia will be found in conditioned roads and turbine sites. Given conditioned surfaces, should a toad be present on a road surface, it would be plainly visible. Thus, maintenance workers will be instructed to drive slowly (at less than 25 mph [40 kph]) and be on the lookout for toads. If a toad is seen, it will be avoided and reported.

At night, however, toads may be present within the project footprint. Given that the wind farm will be monitored by remote surveillance at night, vehicles will not enter the Ventana section of the wind farm at night except in an emergency, such as a human life at risk, fire, vandalism, or other such event. Given that emergencies are beyond San Francisco Wind Farm's control, cannot be predicted, would occur at extremely low frequencies, and would not necessarily occur at night, the incidental take that might occur from them cannot be calculated.

In the event that an emergency occurs, San Francisco Wind Farm will notify USFWS of the emergency visit the following day. In addition, San Francisco Wind Farm personnel will search roads the following day for toad carcasses. Carcasses that are not clearly cane toads will be collected for analysis.

With respect to incidental take of toads during operations, it is expected to be near zero, as toads are normally not abroad by day and there will be no vehicular access to the wind farm at night (other than emergencies). To be safe, however, we request an annual take of 12 toads based on the density estimate used above, with as many as 10 toad removed from harm and as many as two lost (Table 5). Toads that are removed will be placed just outside of the project footprint in the direction they were moving or oriented.

ii. **Incidental take of toadlets:** Toadlet dispersal events are predictable. They coincide with heavy rains that attract adult PRCTs to the Ventana pond to breed. That successful breeding has taken place can be confirmed by the presence of egg masses. Once tadpoles emerge from eggs, toadlets may be expected to disperse from the pond roughly two-three weeks later. As noted in 2.b., dispersal events at Ventana are variable with respect to the number of toadlets dispersing, the range they cover, and length of time they are present at high enough densities to be found.

Given the expense of constructing and maintaining wind turbines, it is important that San Francisco Wind Farm have clear rules governing: (1) when

it must halt conditioning, construction, or maintenance activities to allow a toadlet dispersal event to pass and dissipate, (2) when those activities can resume, and (3) which areas are affected.

Alfonso Silva's surveys, which are the best available information on the Ventana PRCT population, have demonstrated that toadlet densities can easily be determined through searches by counting the number of toadlets found in defined areas, such as in 0.2-ha turbine sites or along road segments. He has found that toadlet densities decrease to 50 toadlets/ha densities within weeks after a dispersal wave goes through. We believe that a density of 50 toadlets/ha would be an acceptable metric for determining when conditioning, construction, and operations can resume in a given area. 50 toads/ha represents a take of 265 toadlets per reproductive event in the 5.3-ha project footprint (Table 5; 50 toadlets/ha multiplied by 5.3 ha). This level of take per reproductive event is unlikely to cause a discernible population effect given that many thousands of toadlets disperse during each event.

Depending on the project phase, however, searchers' efficiency at finding toadlets varies, being relatively low in pre-conditioned areas and relatively high in conditioned areas. Moreover, once areas are conditioned, erosion-control barriers can be erected to exclude toadlets from areas where they may be harmed.

When a toadlet dispersal event is anticipated, conditioning, construction, or operations will stop when the toadlet dispersal front is detected within 100 m of work areas. In other words, any activities at the V-3 turbine will cease as soon as toadlets are documented to leave the breeding pond (because it is roughly 100 m from the pond). In other areas, however, project-related activities will continue until the dispersal event is found to approach within 100 m. The location of the dispersal front will be monitored by daily searches.

Once the dispersal front has passed an area, project-related activities will resume once toadlet density drops to 50 toadlets/ha or less. This represents 10 toadlets in a 0.2-ha turbine site or 10 toadlets in a 200-m section of road that is 10-m wide. Given that searcher efficiency varies, depending on the substrate, we conservatively estimate searcher efficiency at 10% in pre-conditioned areas and 50% in post-conditioned areas. Thus, at a pre-conditioned turbine site, finding only one toadlet would represent a density of 50 toadlets/ha (0.2-ha turbine site multiplied by 50 toadlets/ha multiplied by 10% searcher efficiency). The one toadlet would be removed to safety and the 9 toadlets assumed not to have been found would be lost to conditioning.

Toadlets removed to safety will be moved to a location 100-200 m beyond in the direction they were moving. This should put them beyond the project footprint.

At a post-conditioned turbine site, where searcher efficiency is very conservatively estimated at 50%, finding 5 toadlets would represent a density of 50 toadlets/ha (0.2-ha turbine site multiplied by 50 toadlets/ha multiplied by 50% searcher efficiency). Thus, for every five toadlets removed to safety, five would be assumed to have been lost. Please note that our estimates of searcher efficiency are very conservative. If we can document greater

efficiencies (e.g., if we can demonstrate that we are finding 90% or more of toadlets within a 0.2-ha turbine site), we will discuss adjusting the searcher efficiency percentages with USFWS.

It is important to note that, once areas are conditioned, erosion-control barriers can be erected to exclude toadlets from entering a turbine site, thereby minimizing take. The same can be done along road segments. Given that erosion-control barriers must be erected along roads and at the edges of turbine sites during construction, toadlet take should largely be reduced .

During the operations phase, turbine maintenance will be scheduled so that turbines likely to be affected by dispersal events (e.g., V-3) will be maintained before dispersal fronts reach them. Those turbines will again be reachable for maintenance some weeks later once dispersal fronts pass and toadlet densities decrease to 50 toadlets/ha or less. Nonetheless, San Francisco Wind Farm can also erect erosion-control barriers temporarily to exclude toadlets from specified areas if densities are somewhat greater than 50 toadlets/ha. That strategy may be employed when it is no longer recommendable to defer maintenance. Those cases will be documented and brought to the attention of the USFWS.

In the event of an emergency, such as a human life at risk, fire, vandalism, or other such event, vehicles may need to enter areas where toadlets are present at densities greater than 50 toadlets/ha. Given that emergencies are beyond San Francisco Wind Farm's control, cannot be predicted, would occur at extremely low frequencies, and would not necessarily coincide with a toadlet dispersal event, the incidental take that might occur from them cannot be calculated.

Table 5. Incidental take of PRCT toads and toadlets by removal and loss within the 5.3 ha project footprint during project phases

	Project phase		
	3-6 months		~35 years
	Conditioning	Construction	Operations
Toads			
Removal (harassment)	6	10	10/year
Loss	6	2	2/year
	12	12	12/year
Toadlets			
Removal (harassment)	27/reproductive event	133/reproductive event	133/reproductive event
Loss	238/reproductive event	132/reproductive event	132/reproductive event
	265/reproductive event	265/reproductive event	265/reproductive event

iii. **Requested incidental take:** Table 5 summarizes incidental take of PRCTs by removal and loss during the different project phases. The formulas for developing and adjusting these estimates are described in the text above. In developing these estimates, a number of mitigation measures were assumed,

such as surveys prior to construction, surveys to substantiate toadlet densities, etc.

e. **Coordinating the HCP with Section 7 of the ESA:** No action authorized by a federal agency (e.g., USFWS) is allowed to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. In fact, the mitigation program (see below) is likely to enhance the probability that the PRCT will survive into the foreseeable future.

   In the case of the PRCT, no critical habitat has been designated. Neither indirect nor direct effects are likely to jeopardize the continued existence of the PRCT at Ventana or throughout the Guánica State Forest. Amphibians produce large numbers of eggs (e.g., one adult female PRCT produced 15,761 eggs during one breeding episode; Rivero et al., 1980). Although mortality of eggs, larvae, and metamorphs is high (only ~1% of eggs are likely to result in toads reaching maturity; Moreno and Canals in Miller, 1985) and somewhat lower for adults (e.g., Duellman and Trueb, 1986), barring catastrophic stochastic events, the reproductive potential of PRCTs (like those of other species employing r-selection life history strategies; e.g., Reznick et al., 2002) is geared to compensate for those losses. Consequently, the Ventana population is almost certainly able to withstand the losses allowed for in Table 5.

f. **Addressing Indirect Project Effects:** The 2005 HCP addressed indirect effects of the project. The indirect effects accruing from the reduction in fossil-fuel generated electricity will almost certainly have the same beneficial effects on the PRCT as on birds at the site. However, the negative indirect effects on birds are unlikely to affect the PRCT in any substantive fashion. Modification of habitat is restricted to a very small percentage of the property that is used by the PRCT almost exclusively for migration and dispersion. Consequently, the negative impact of such actions on the Ventana population of PRCTs is likely to be negligible, albeit potentially important in light of the current conservation status of the species.

   Invasive plants (especially grasses) exploiting the modified habitat might marginally increase the risk of fire, but see mitigation plans (below) for dealing with invasive species (including plants). Also, this slight increase in risk is almost certainly offset by the reality that the roads will serve as firebreaks, dramatically reducing the risk of fires spreading across the property or into the Guánica State Forest. Unregulated human access to the area could have substantially negative indirect effects on the PRCT (e.g., habitat disturbances and degradation), but are unlikely if access is controlled as planned (see the following sections on mitigation and minimization). In fact, a potential negative could be reversed if effective environmental educational efforts are directed at persons attracted to the site by an interest in the sustainable energy project.

g. **Consideration of Plants in the HCP and Permit:** The 2005 HCP addressed these concerns. Abandonment of unused roads, restriction on human access, efforts to control invasive species, plus the reclamation/reforestation efforts of areas dramatically disturbed during construction are likely to increase the proportion of native and endemic species in the community, which is

consequently more likely to resemble the natural dry forest community. Nonetheless, the population of the federally endangered *Mitracarpus polycladus* that occurs on the Ventana property was not specifically considered. This species is a rare native plant associated with habitat edges in dry forests that appears to have benefitted where vegetation was scraped along roads and invasive competitors have not [yet] become established. Such habitats typically are exploited intensively by invasives (many of them grasses), which will be actively controlled at the site (see below).

At the request of the USFWS, WindMar realigned the access road in the southwestern portion of the property along the border with the Guánica State Forest to avoid two naturally occurring clusters of *M. polycladus* that were present prior to clearing but appear to have flourished at least in part as a result of clearing. Nonetheless, the species has consequently spread to the newly cleared areas. We anticipate that *M. polycladus* will spread further with construction. San Francisco Wind Farm's program to control invasive species, as well as the use of roads as fire brakes, are likely to ensure that the project does not jeopardize the plant.

h. Addressing Effects on Critical Habitat: To our knowledge, no critical habitat considerations apply to the PRCT or any other species at Ventana.

3. MITIGATION PROGRAM

The following mitigation actions have been proposed by the USFWS, WindMar (employees and consultants), and Diane Barber of the PRCT Recovery Group. These actions are in addition to the surveys described in section 2.d. Collectively, they should more than compensate for the incidental take being requested. These actions include those previously described in the 2005 HCP that might affect the PRCT.

a. Avoidance

i. Rezoning the property to allow for a wind farm will prevent extensive destruction of the area's dry forest if the R-0 zoning for single-family residences on 2-acre lots were implemented. The assumption here is that the development of a residential area would have a much greater negative impact on toads using the Ventana uplands than the wind farm with turbines and access roads.

ii. Generation of >100 million annual kWh of electricity by the wind farm will avoid emissions of greenhouse gases, consumption of water for cooling traditional power plants, and reduce the threat of oil spills. Although not restricted to just this site, traditional power plants emit considerably more pollution than a wind farm.

iii. Efforts to schedule construction for periods not coinciding with PRCT breeding events and concomitant migrations and dispersions will reduce the frequency of encounters in most instances. Using competent biologists to search for toads prior to and during construction will further reduce the likelihood of construction activities affecting individual toads. With one exception, all dry forest to be removed for wind-farm construction has already been removed. The exception is a 108-m long corridor 6 m wide from the V-6 turbine to the adjacent lowland area for the purpose of connecting the wind

farm to the substation. As noted above, this connection will be by either excavating a trench to bury the line (San Francisco Wind Farm's preferred method) or excavating holes every 30 m to erect an aerial line. Either option requires removing 648 m^2 of dry forest during the construction period, and the straight-line route will impact the least habitat. With respect to the PRCT, clearing is best done in the dry season when the likelihood of breeding events and dispersal are lowest. However, with respect to the Puerto Rican Nightjar (*Caprimulgus noctitherus*), an ITP condition calls for clearing vegetation outside its nesting season – i.e., not during 24 February–5 August. San Francisco Wind Farm will make every effort not to clear the 0.1 ha of dry forest habitat in the corridor from the V-6 turbine to the lowlands during the nesting season of the Puerto Rican Nightjar. If habitat modification is strictly necessary during the nightjar-nesting season, San Francisco Wind Farm will coordinate with the Service prior to conducting the activity.

iv. During the operations/maintenance phase, limiting access to areas where toadlet dispersal is occurring until densities can be documented at 50 toadlets/ha or less will avoid roadkills of toadlets dispersing after metamorphosis.

v. The intermittent stream that flows into Ventana Pond has created a ravine that appears to be near-optimal habitat for PRCTs outside of breeding events. PRCTs probably also use the ravine to reach the pond. To avoid any negative impact during construction and beyond, a 60-m buffer has been established along the intermittent stream. Designated by USFWS in its letter of 28 October 2009 to WindMar, this buffer is based on what Semlitsch and Bodie (2003) described as core habitat for amphibians and reptiles adjacent to a stream or drainage. As a result of this buffer designation, WindMar reduced the number of turbines in the Ventana property from nine to eight, entirely removing turbine 20, which was located in the drainage basin.

As noted above, WindMar offered to move the V-3 turbine outside a 150-m buffer zone that USFWS designated around the Ventana breeding pond, but based on a field assessment, USFWS recommended that the turbine construction site not be moved since habitat degraded by charcoal production had already been cleared and moving the turbine would have affected more dry forest habitat. Nonetheless, based on the recommendation of the USFWS, the location of the turbine itself has been moved within the construction site to avoid excessive impacts on the PRCT.

b. Minimization

i. Use of existing roads whenever possible will minimize the impact on dry forest habitat, substantially reducing the clearing of habitat compared to the construction of all new roads (for the amounts of existing and new roads necessary at the site, see Tables 1 and 2).

ii. Using eight instead of nine turbines reduces the number of sites and total area that will need to be conditioned and excavated (see Tables 1 and 2 for a details of the affected areas).

iii. Because the PRCT, like most toads (e.g., Higginbotham, 1939), is primarily nocturnal, most activities and even access to the site will be restricted to

daylight hours (exceptions only for emergencies). This is especially important if essential maintenance is necessary when toadlets are dispersing after metamorphosis. Roadkills are much more likely at night, when adult and subadult toads may be difficult to see on the roads.

iv. Because toadlet dispersion from breeding sites is unlikely to be random (e.g., DeMaynadier and Hunter, 1999) and, at this site, many but not all of the movements appear to be closely associated with the ravine above Ventana Pond (see Appendix A, Figs. 2–4, for sightings of toads between 30 October 2011 and 11 October 2012), all efforts will be made to reduce negative effects on the ravine. In this regard, a 60-m buffer zone along the intermittent stream will protect the ravine. Where the access road crosses the upper portion of the ravine (17.96563, -66.81752), a suitable bridge or culvert (e.g., Langton, 1989) will allow free movement of toads under the road. "Wings" to either side will serve to funnel toads into the underpass and prevent the animals using this dispersal corridor from crossing the road. The bridge or culvert will be detailed in the engineering plans to be approved by the USFWS and appropriate Commonwealth agencies. Also, when necessary, barriers (e.g., erosion fences) will prevent construction work near the edges of the ravine from affecting it. Toads/toadlets in the portion of the Ventana property not associated with the pond and the ravine are likely to be transients that will be protected by suspending construction and/or access of vehicles into the area when migrations and dispersions have been documented to peak in association with breeding events.

c. Rectification

i. All affected areas will be checked again for listed species of plants. Vegetation will be cleared in a manner that will allow rapid recovery. All new roads and turbine construction sites will scrape vegetation at the surface, leaving rootstalks intact. This results in vigorous regrowth of preexisting vegetation. Allowing regrowth of road edges, turning areas, turbine construction areas, rotor construction areas, and abandoned roads more than compensates for the 4.2 ha of anticipated impact to dry forest (see Tables 1 and 2). To assure recovery, invasive vegetation will be actively controlled in recovering areas (see below).

ii. The monitoring of project impacts and their mitigation will promote scientific research of biotic communities at the site and throughout the region; of particular interest, of course, is new knowledge of basic PRCT biology. San Francisco Wind Farm will facilitate this research by providing lodging and workspace for staff and visiting researchers in a building to be constructed in the nearby quarry area. That building will also house staff to monitor and maintain the wind farm.

d. Reduction

i. A permanent program was implemented in 2007 to control invasive mammalian predators. Traps set at the site for mongooses, rats, and feral cats and dogs will continue to reduce predation on the PRCT, Puerto Rican Nightjar, *Anolis cooki*, and other native species. Staff researchers maintain

traplines and record all data pertaining to predator abundance (i.e., locations, seasonal fluctuations, etc.) and prey.

ii. Cane Toads (*Rhinella marina*) are invasives that have been implicated as competitors with and predators of the PRCT. Persons trained in distinguishing these introduced toads from the endemic PRCT will eliminate Cane Toads whenever encountered. Bullfrogs (*Lithobates catesbeianus*) and Cuban Treefrogs (*Osteopilus septentrionalis*) have not been observed at Ventana. If discovered in the future, they also will be removed whenever encountered. All removals of exotic amphibians will be recorded. The ongoing control of these invasive competitors and predators will undoubtedly have a positive impact on the PRCT population. As noted above, Alfonso Silva and his assistants eliminated more than 100 Cane Toads during surveys in 2011-2012. Research (see below) will include efforts to assess the effects on the PRCTs at Ventana.

iii. *Mitracarpus polycladus* is a native opportunist that exploits natural and human-mediated clearings, but cannot successfully compete with Guinea Grass (*Megathyrsus maximum*) and other invasive plants, such as *Leucaena leucocephala*. Consequently, an active monitoring and eradication effort will target exotic plants by uprooting them or, when conditions allow, using low concentrations of systemic, biodegradable herbicides, such as Roundup®. To prevent inadvertent administration to non-target species and contamination of soil or water, Roundup® will only be administered manually by a trained technician using Pump 'N Go® Sprayer (or equivalent). Proper use of a sprayer that is equipped with an extendable wand to provide accuracy and prevent overspray will assure that the herbicide is sprayed only on target species. Spraying will be limited to wind-still periods to prevent drift and dry periods to avoid runoff. Once applied, Roundup® dries quickly, after which the area is safe for humans and animals (www.scotts.com/). If a better method of controlling invasive plants can be identified, it will be employed in lieu of using Roundup® under even very carefully regulated conditions.

A special effort will be made to maintain natural populations of *Mitracarpus*. These populations will be indicated by USFWS botanists.

iv. Access roads to the wind turbine sites will serve as fire brakes, thereby decreasing the threat of fire in dry forest habitat.

v. The San Francisco Wind Farm project will draw people interested in seeing wind turbines up close. San Francisco Wind Farm will use this opportunity to educate visitors about renewable energy and the plants and wildlife of southwestern Puerto Rico by controlling site access to carefully regulated and accompanied tours. San Francisco Wind Farm will also produce educational materials to be used in schools, community centers, and hotels.

e. Compensation

i. WindMar will make a conservation donation of 67 ha (see Table 1) to the Department of Natural and Environmental Resources (DNER) of the Commonwealth of Puerto Rico. The donation will protect >80% of the Ventana property in perpetuity. Excluded from the donation will be access roads, wind turbine placements, and other areas. A donation of 172 ha has already been granted to DNER in the Cerro Toro and Punta Verraco sections

of the wind farm.

Active and passive reforestation is projected to result in 5.1 ha of dry forest (Table 1, D). This is 119% of the 4.2 ha of dry forest habitat (Table 1, B + C) that has already been removed except for 0.06 ha to connect the V-6 turbine with the substation. The conservation donation, however, compensates for the loss of dry forest at a rate of 16:1 (67 ha of conservation donation for 4.2 ha of impact).

ii. San Francisco Wind Farm will fund those elements of a monitoring program proposed by Diane Barber on behalf of the PRCT Recovery Group that pertain to the Ventana site or the presumed Guánica metapopulation. This program is likely to increase knowledge of PRCT use of Ventana. Consequently, adaptive management measures will likely need to be implemented (see below).

4. MONITORING AND ADAPTIVE MANAGEMENT MEASURES

Diane Barber, PRCT Species Survival Plan Coordinator for the Association of Zoos and Aquariums, has drafted a proposal for a monitoring program that San Francisco Wind Farm would fund or implement. Pertinent elements of that proposal will be supplemented by two potentially promising adaptive management measures.

Relatively little is known about the PRCT and especially about the Ventana population and its use of surrounding dry forest habitat. Consequently, a major goal of the proposed monitoring program is centered on the need to generate knowledge of the species' basic biological attributes including: (1) Population size and density; (2) primary habitat (foraging areas, breeding sites, and refugia); (3) estimates of home range sizes; (4) identification of migration routes and dispersal patterns; and (5) documenting calling characteristics in relation to environmental cues. Some specific components shall include:

a. Genetics: The Ventana population is in close proximity to populations at Tamarindo and Ciénaga, with all three possibly comprising a single metapopulation. Management methods could vary considerably if dealing with three separate populations instead of one metapopulation. A genetic study is proposed to address whether recent genetic migration has occurred between these sites. Some previously collected tissues are available, but additional samples will need to be collected from Ventana and Ciénaga. According to Diane Barber, the projected time frame for this study is 6 months.

b. Primary Field Monitoring Project at Ventana: A field biologist (possibly one or a series of graduate students from one of the University of Puerto Rico campuses) should visit the Ventana site at least once per week for a period of at least six months corresponding with the rainy season (June to December). The number of visits could be increased to 3–5 per week during breeding events or extended into other months when weather monitoring is indicative of potential PRCT activity. This person should employ standardized monitoring protocols and work under permits issued by the DNER and USFWS. Data collected should include weather conditions, breeding activities, and miscellaneous natural history observations, with the overall goal of better understanding the basic biology of the PRCT at Ventana. Depending on the weather and intensity of breeding events in a given year, this component might be extended to several years (or even the life of the project).

A complementary study would involve tracking movements while using PIT tags and radio transmitters in sufficiently large individuals and visible implant elastomers or visible implant alphanumeric tags in juveniles as well as adults (see review in Osbourn et al., 2011). All GPS waypoints will be integrated into GIS overlays.

c. **Audio-monitoring and Bd testing:** Supplementing the primary field monitoring studies are ongoing testing for the presence of *Bd* (*Batrachochytrium dendrobatidis* = chytrid fungus) and monitoring of weather conditions from an on-site weather station with remote monitoring capabilities and audio-monitoring of PRCT breeding activity via permanent audio recording systems installed at Ventana. These will not only alert site personnel and researchers to the onset of PRCT breeding activities, but will in themselves provide valuable data on conditions that trigger breeding events, numbers of calling males, duration of calling periods, and associations with weather conditions and other possible triggers.

d. **Supplementary Monitoring Project at Ciénaga:** Since 200 ha near Ciénaga were acquired by the DNER in 2003 (USFWS, 2009) and breeding activity in this population was observed in 2010, few data have accumulated regarding habitat use and movement patterns. A field biologist (possibly the same person as conducting the primary monitoring project at Ventana) will assess the status and activity of this population.

e. **Adaptive Management Measures:** Two adaptive management measures are proposed, both with the potential of improving habitat for the PRCT. Implementation will be in addition to all other measures described in this document and restoration and enhancement of coastal vegetation and the breeding pond in case of a saltwater incursion associated with a major weather event (e.g., hurricane).

   i. **Alternative breeding sites:** Because the Ventana Pond is vulnerable to seawater incursions during tropical storms (e.g., hurricanes), and such events are likely to become increasingly frequent with rising sea levels, alternative breeding sites at higher elevations will be necessary to maintain the PRCT population at Ventana. Because the extent to which the population adventitiously exploits smaller, temporary pools throughout the area is unknown, monitoring an artificial pool constructed in an obvious migration route would provide the data necessary for determining if such sites are used, to what extent they are used, and whether they could serve as alternative breeding sites if the utility of the Ventana Pond is compromised by incursions of saltwater. Because the ravine above the Ventana Pond apparently serves as a migration corridor, temporary natural pools have been observed in the ravine, and it is reasonable to assume that toads moving to the breeding site at the pond would exploit other suitable sites if encountered, constructing a pool capable of holding water long enough to assure metamorphosis would provide the opportunity to test those assumptions. The pool constructed in the ravine above the road crossing at a site that currently holds water for short periods during heavy rains (17.96622, -66.81843) should be large enough to hold sufficient water (might require a liner) to last a minimum of 21 days (although

supplemental water could be provided since a water line for fire-fighting purposes will be present). However, the pool should also be equipped with a drainage valve that would permit drainage so it would not fill with sediment and would not become an essentially permanent landscape feature that could be used by Cane Toads, which are now much reduced through an effort to eliminate them. If the pool is used by the PRCT, additional pools of similar construction could be installed throughout the ravine (and possibly in other locations at Ventana). This might also serve as a test for the possibility of installing a new breeding pond at Tamarindo, where the main pool used by the PRCT is similarly vulnerable to seawater incursions (USFWS, 2009) as well as to pollution emanating from the adjacent parking area.

Monitoring potential pool use by PRCTs will be part of the research program (see below) and in the case of an emergency (i.e., saltwater incursion compromising the efficacy of the lowland pond as a breeding site) could provide invaluable insurance against the loss of one or more generations of toads.

ii. **Artificial retreats:** In addition to shelters beneath rocks and deadfall and miscellaneous retreats such as those provided by animal burrows, toads are known to use solution holes in limestone bedrock and other cracks and crevices in rocks as refugia. However, we do not know which of these are used over long periods as aestivation sites and which are used only as short-term shelters during migration and dispersal. Also, although we believe that such refugia are abundant in the ravine, we lack information on the abundance of suitable shelters on nearby upland ridges. Especially, dispersing toadlets are known to move across these ridges. Providing additional retreats could increase toadlet survival during dispersion (especially if breeding events are followed by extremely dry periods). Also, although speculative, if PRCTs use artificial refugia adjacent to the turbine sites or along roads, this could serve to deter toads and toadlets from venturing onto the roads or turbine sites. Conditioning roads and turbine construction sites and staging areas will provide a ready supply of boulders that could be used to create artificial retreats in the form of boulder piles. Monitoring the use of these shelters by toads using drift fence arrays capable of funneling individuals moving either in or out of the piles into traps could provide evidence favoring management plans that provide for artificial retreats. If such evidence emerges, additional boulder piles (or other artificial retreats) could be employed in areas used by toads to enhance survival. Even adults are vulnerable to predators in and around breeding sites where artificial refugia could also be installed. Concrete shelters at Gabia were used by toadlets (C. Pacheco, pers. commun.), suggesting that this might be a worthwhile approach for conserving toads when concentrated at breeding sites or in migrating groups of toadlets (e.g., USFWS, 2009).

Additional benefits might accrue if *Anolis cooki*, which is associated with rock piles in exposed situations (Marcellini et al., 1985), would make use of the boulder piles.

Boulder piles will be placed near turbine sites or along roads where they will not be disrupted during extensive activities when turbines are serviced 20 years into the project.

5. UNFORESEEN CIRCUMSTANCES/EXTRAORDINARY CIRCUMSTANCES

The Incidental Take Permit that San Francisco Wind Farm has been granted will remain in effect until 30 September 2046. Given that PRCT biology is presently poorly known, research is featured in the mitigation plan to improve knowledge of the species and an adaptive management program has been proposed (see section 4.e.i.).

Nonetheless, unforeseen circumstances might arise that will require consultation and problem-solving among San Francisco Wind Farm or its successor, the USFWS, and DNER. San Francisco Wind Farm's Incidental Take Permit (ITP) states, "If, during the implementation of the HCP and adherence to this Permit, a significant unanticipated situation occurs that would have a serious effect on the species covered by this Permit or on the ability of the Permittee to continue the effective implementation of the HCP and/or adherence to this Permit, the Permittee shall undertake actions described in Chapter 10 (Unforeseen Circumstances) of the HCP."

6. FUNDING

As soon as this amendment is approved, San Francisco Wind Farm will commit $50,000 to support the montoring/adaptive management plan outlined above in 4.a–e. When the PRCT is added to the species covered in San Francisco Wind Farm's Incidental Take Permit (ITP), then research projects focused on it will be able to apply to the $100,000 research fund (Condition 12 of the ITP) that San Francisco Wind Farm will establish within one year of the first delivery of electricity.

7. ALTERNATIVES ANALYZED

The alternatives considered and described in the 2005 HCP (Guarnaccia, 2005) apply to the PRCT. No additional alternatives were considered.

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APPENDIX A

SUMMAY REPORT
ON THE PRESENCE OF THE CRESTED TOAD,
PELTOPHRYNE LEMUR, ON THE VENTNA SITE OF THE
SAN FRANCISCO WIND FARM, NEAR GUAYANILLA

Alfonso Silva and John Guarnaccia

Upon the discovery in August 2011 of a major breeding event of the Puerto Rican Crested Toad (PRCT), *Peltophryne lemur,* in the Ventana section of the San Francisco Wind Farm property near Guayanilla, surveys began with the aim of understanding the species' distribution. From early September until mid December, Alfonso Silva and an assistant conducted searches during the early morning hours after sunrise, but after 13 December, they began to conduct them after dark with headlamps from about 7:30 pm until midnight. The reason for the shift from daytime surveys to nighttime surveys was that they found that toadlets were much more visible and active during daylight hours, whereas adult and subadult toads could be found only at night. Thus, daytime surveys were the best method for tracking toadlet dispersal events, whereas nighttime surveys were best for understanding toad distribution and abundance.

With respect to sexing and aging toads, a toad was considered an adult female if it was >60 mm and showed no trace of yellow coloration. Toads >60 mm that showed some yellowish background color—sometimes very noticeable—were considered adult males. Toads <60 mm were classified as subadults, because under 60 mm, toads never showed a yellowish background color that would allow differentiation.

Searches were generally conducted on three consecutive mornings or nights so as to cover all areas of the wind farm as well as lowland areas adjacent to the Ventana uplands. As a rule, on the first day/night searches covered the yellow route in Figure 1: from Punta Ventana to Playa Sucia, walking along the upper parts of the cliff, and from Playa Sucia to the turbine sites V1, V2, and V3. From there searches followed the trail leading to Punta Ventana and the area around the sinkholes ("Cueva de los murciélagos").

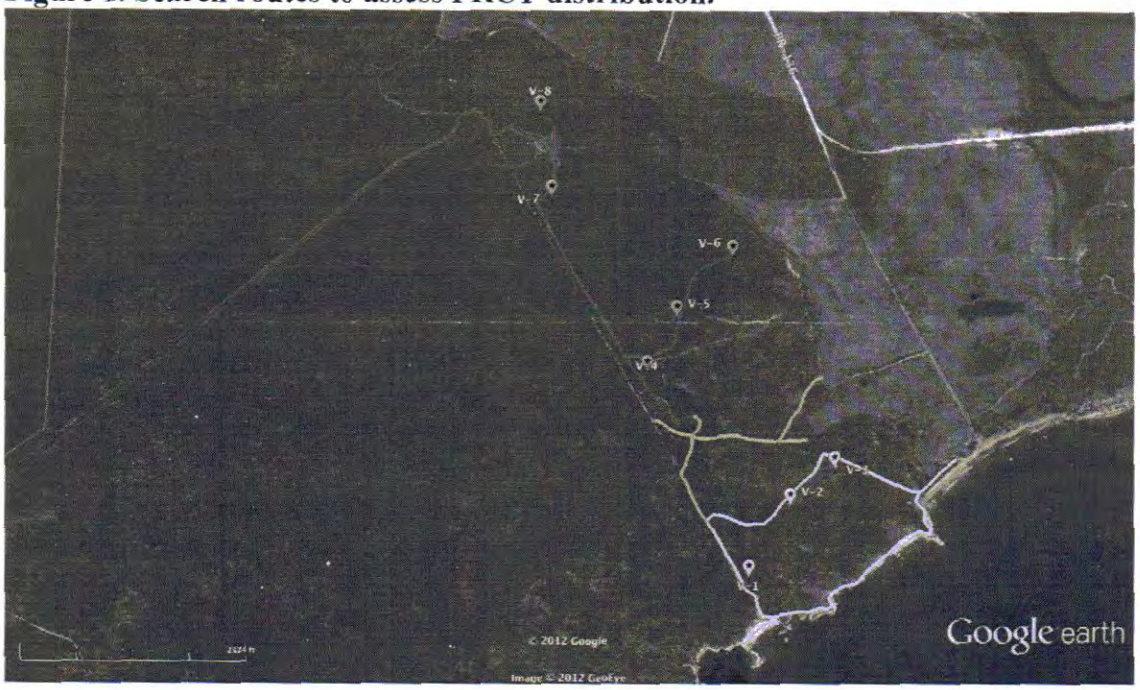
On the second day/night, searches followed the blue route in Figure 1: the low area adjacent to the cliff between the cave with aboriginal paintings and the area adjacent to the large lagoon, and from there up the ravine all the way to its beginning, some four to five hundred meters beyond the crossing of the main dirt road that runs north/south high on the Ventana property. On the way back, searches followed this main dirt road both north and south of the intersection, up to the points belonging to the first and third night searches.

On the third night, searches followed the red route in Figure 1: the northernmost part of the main dirt road, turbine sites V8, V7, V6, V5 and V4, as well as a stretch of about one kilometer of the dirt road that leads into the Bosque Seco property.

The yellow route covered 2.0 km, the blue route 1.1 km, and the red route 3.1 km. On average, these three inspections took, respectively, about three and a half, three, and four hours.

During these searches, either Amador López or Alexander Villa accompanied Silva. Both were adept at finding toads and toadlets.

Figure 1. Search routes to assess PRCT distribution.



A handheld GPS unit was used to record the coordinates of all toads encountered, except for PRCTs found in the area surrounding the lagoon and at the lower parts of the ravine, where they were found to be concentrated. That area is shaped like a capital Y (but with the upper part curved instead of V-shaped). In reports, that area is designated as "lagoon-lower ravine" (for brevity, LLR). It extends from the northernmost tip of the edge of the lagoon (N 17°58.003' and W 066°48.856') to the SE tip of the edge of the lagoon (N 17°57.940' and W 066°48.845') and to a spot about 200 meters up the ravine (N 17°57.942' and W 066°48.975').

Twenty-six reports have been issued so far, spanning the period from 17 September 2011 to 11 October 2012. Results are summarized in the following figures.

FIGURE 2: 17 SEPTEMBER TO 30 OCTOBER 2011

Many toadlets, the majority of which were between 15 and 25 mm long, were found at or near the Ventana property. By far the greatest toadlet concentrations were: (1) at the area where they were originally found behind the beach, (2) along the strip of land adjacent to the cliff, between the small cave with aboriginal paintings and the mouth of Ventana's major ravine, and (3) at the lower reaches of this ravine. During this period, the density of toadlets reached a maximum of about three to five animals per square meter in some spots.

Elsewhere the toadlets were scarce, but one to three or four were found on turbine sites V1 to V6, and along the roads that connect these sites. Also, some individuals were found in the small patch of forest leading from the beach to the upper parts of Punta Ventana, along the trail that runs from there to Playa Sucia, and also at the *Coccoloba* patch on top of Playa Sucia.

No PRCT toadlets were found on or near turbine sites 8 and 7 during these two surveys.

It is perhaps important to note that very small PRCT juveniles—under 15 mm long—were found scattered at *six* different places (Figure 2). One was the spot where the dirt road that went along the contour of the cliff made contact with the mango plantation. A considerable amount of water was deposited there (beyond the San Francisco Wind Farm property) after heavy showers and stayed in place for several weeks. The six places where the tiny PRCTs were found were rather well separated, either by horizontal or vertical distances. It seems reasonable to assume that very small toadlets were not capable of covering such stretches of terrain in short periods of time, and that there must have been an almost equal number of reproduction events.

FIGURE 3: 30 NOVEMBER 2011 TO 16 FEBRUARY 2012

No toadlets were found during daytime surveys on 30 November–2 December 2011. On 13 December 2012, nighttime surveys began. Most PRCTs were found in the lower ravine adjacent to the breeding pond, ranging in size from toadlets 15–25 mm in length to two subadults >55 mm. Outside of the lower ravine, two subadults were found in the vicinity of turbine V-3 and one subadult was found where the main project road crossed the upper ravine.

It is important to underscore that previous to the last survey period it had rained in the area. This revealed a population of juvenile and subadult PRCTs at the lower reaches of the ravine that had not been detected before. On 15 February 2012, 23 were found. Most sat in deep holes of exactly their own size (quite a few of them with their heads out). Others were spotted on the surface of the boulders, still others on the ground.

FIGURE 4: 12 MARCH TO 11 OCTOBER 2012

Toads began to be found regularly in the lower ravine area. In all 18 nighttime surveys, 542 were found for a mean (± Standard Error) of 30.1 ± 6.1 toads per survey (Table 1). The greatest number (100) was found on 7 August 2012 immediately after a breeding event. In upland areas to be affected by wind farm construction and operation (i.e., the project footprint), 21 toads were found in all 18 nighttime surveys, for a mean of 1.17 ± 0.33 toads. Thirty toads were found in nighttime surveys outside of the project footprint and lower ravine. These areas included along the road that entered the Guánica State Forest and at the base of the Ventana cliff.

The first adult female was found on 27 April 2012 along the dirt road that entered the Guánica State Forest. She measured 81 mm and was found again on a subsequent survey. Five females were found in the project footprint for a mean of 0.28 ± 0.11 females per survey (Table 2) and represented 24% of all toads (adults and subadults) found within the project footprint. Females also were recorded in the lower ravine area, but only on 3 of 18 surveys. The high number of females was 28 on 7 August 2012, when a total of 100 adults and subadults were recorded. In other areas, nine females were recorded, representing 30% of all toads.

A toadlet dispersal event was again recorded on 26 August 2012. Silva recorded maximum densities of 100–400 toadlets/m^2 when toadlets were emerging from the Ventana pond on the nights of 26 and 27 August 2012 (a few of which were observed to have been consumed by an adult PRCT within the mass of toadlets). On the night of 27

August, toadlets were observed scaling the slope that led to the Ventana uplands in the vicinity of the V-3 turbine site, recording densities of 1–15 toadlets/m^2 on the slope.

On 13 September 2012, densities of 0.2–1.6 toadlets/m^2 were recorded in the vicinity of the V-3 turbine site and the farthest toadlet from the pond had nearly reached the V-2 turbine site, some 150 m from the pond. Densities around the V-3 turbine were much reduced in surveys on 26 September–1 October 2012 and 9–11 October 2012, but dispersal was recorded to halfway between the V-1 and V-2 turbines (3 toadlets) and to the main road that crosses the upper section of the ravine that feeds the Ventana pond (8-17 toadlets along road within 40 m of the ravine).

Throughout the Ventana uplands, the abundance of animal life can be characterized as low. Insects are scarce, and so are ground and arboreal snails, and both diurnal and nocturnal ground and arboreal lizards. Not more than a few dozen medium-to-large hermit crabs were seen during all survey periods. Snakes were completely absent; and only three times were rodents seen (one of them a rat). Crickets were occasionally common, and very small spiders (that certainly deal with extremely small insects and mites undetected by us) were also a regular feature of the night walks.

All Cane Toads (*Rhinella marina*) encountered were eliminated, for a total of over 100 since surveys began. The species has become notably scarce in the area.

Coordinates where PRCTs have been found since late December 2011 are included in reports. The following figures show those locations.

Figure 2. Distribution of PRCTs found in searches from 17 September to 30 October 2011

Figure 3. Distribution of PRCTs found in searches from 30 November 2011 to 16 February 2012

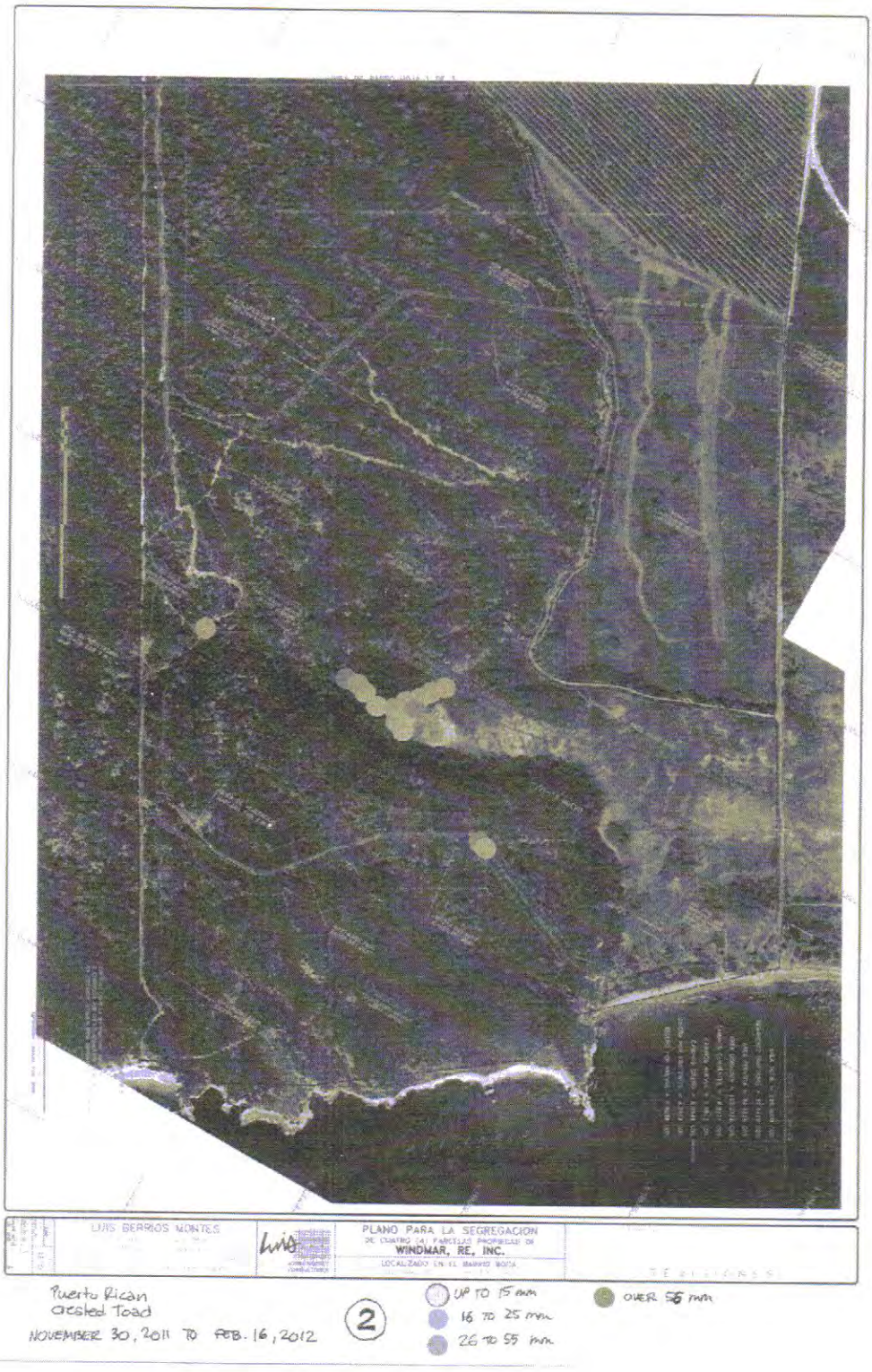


Figure 4. Distribution of adult and subadult PRCTs found in searches from 12 March to 1 October 2012. Note the lower ravine area (green polygon adjacent to the pond). In that area, the icon with the letter J indicates where juveniles emerged in large numbers on the night of 26 August 2012. The icon with the letter M indicates that the maximum number of adults/subadults recorded was 100 (including 28 females) on 7 August 2012. Numbered icons represent the number of toads recorded in each location (generally one).

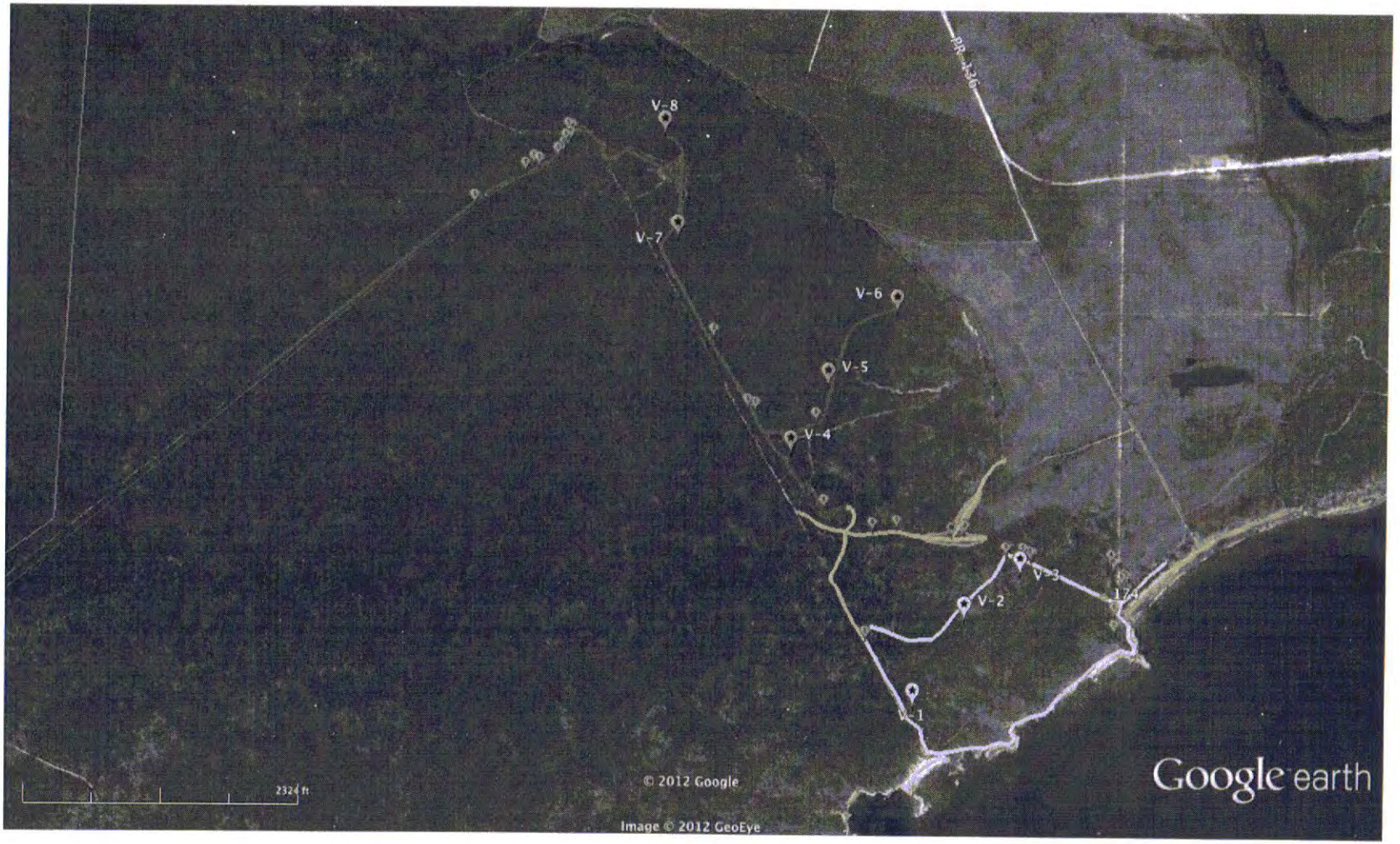


Table 1. Adult and subadult PRCTs discovered in surveys

Survey #	Dates	Day	Project footprint	Night Lower ravine	Other areas	Total
1	17-19 Sep 2011	0				0
2	30 Sep 2011	0				0
3	19-21 Oct 2011	0				0
4	28-30 Oct 2011	0				0
5	30 Nov-2 Dec 2011	0				0
6	13-16 Dec 2011		0	0	0	0
7	28 Dec 2011-3 Jan 2012		1	0	0	1
8	16-18 Jan 2011		0	0	0	0
9	31 Jan-2 Feb 2012		1	7	0	8
10	14-16 Feb 2012		1	23	0	24
11	12-14 Mar 2012		0	30	0	30
12	20-22 Mar 2012	0				0
13	29-30 Mar 2012		1	19	0	20
14	10-12 Apr 2012		4	25	1	30
15	25-27 Apr 2012		0	34	1	35
16	8-10 May 2012		4	44	3	51
17	22-24 May 2012		3	49	6	58
18	4-6 Jun 2012		0	28	1	29
19	19-22 Jun 2012		1	72	5	78
20	5-7 Jul 2012		1	39	3	43
21	24-26 Jul 2012		0	16	0	16
22	6-8 Aug 2012		1	100	1	102
23	24-28 Aug 2012		3	41	9	53
24	11-15 Sep 2012	0				0
25	25 Sep-1 Oct 2012	0	0	15	1	16
26	9-11 Oct 2012	0				0
	Samples	9	18	18	18	26
	Toads found	0	21	542	30	578
	mean ± SE	0	1.17 ± 0.33	30.1 ± 6.1	1.72 ± 0.60	
	95% CI	0	0.48 to 1.85	17.3 to 42.9	0.45 to 3.00	

Table 2. Records of adult female PRCTs in surveys

Survey #	Dates	Day	Project footprint	Night Lower ravine	Other areas	Total
1	17-19 Sep 2011	0				0
2	30 Sep 2011	0				0
3	19-21 Oct 2011	0				0
4	28-30 Oct 2011	0				0
5	30 Nov-2 Dec 2011	0				0
6	13-16 Dec 2011		0	0	0	0
7	28 Dec 2011-3 Jan 2012		0	0	0	0
8	16-18 Jan 2011		0	0	0	0
9	31 Jan-2 Feb 2012		0	0	0	0
10	14-16 Feb 2012		0	0	0	0
11	12-14 Mar 2012		0	0	0	0
12	20-22 Mar 2012	0				0
13	29-30 Mar 2012		0	0	0	0
14	10-12 Apr 2012		0	0	0	0
15	25-27 Apr 2012		0	0	1	1
16	8-10 May 2012		1	0	2	3
17	22-24 May 2012		1	0	0	1
18	4-6 Jun 2012		0	1	1	2
19	19-22 Jun 2012		1	0	1	2
20	5-7 Jul 2012		0	0	0	0
21	24-26 Jul 2012		0	0	0	0
22	6-8 Aug 2012		1	28	1	30
23	24-28 Aug 2012		1	0	3	4
24	11-15 Sep 2012	0				0
25	25 Sep-1 Oct 2012	0	0	2	0	2
26	9-11 Oct 2012	0				0
	Samples	9	18	18	18	26
	Toads found	0	5	31	9	43
	mean ± SE	0	0.28 ± 0.11	1.72 ± 1.55	0.50 ± 0.20	
	95% CI	0	0.05 to 0.51	0 to 4.99	0.07 to 0.93	