

1.1 MONITORING PLAN

Construction period

Environmental item	Item to be monitored	Monitoring site	Frequency	Method	Party in charge
Air quality	H ₂ S - CO ₂	Borinquen Hotel and 4 sites (north, south, east and west) on the well base boundary	During testing period (weeks-one month): every three month (quarterly) and permanent monitoring station	Field measurement	ICE

Air Quality Monitoring - CAMPO GEOTERMICO BORINQUEN

Site	CO2 Min	CO2 Avg	CO2 Max	CO2 Std	H2S Min	H2S Avg	H2S Max	H2S Std
CAÑAS DULCES	230	306	438	5,000	0.000	0.000	0.000	0.010
CASA MAQUINAS BORINQUEN	226	285	356	5,000	0.000	0.000	0.001	0.010
HOTEL BORINQUEN	227	270	343	5,000	0.000	0.000	0.000	0.010
HOTEL BUENA VISTA	226	280	370	5,000	0.000	0.000	0.002	0.010
PGB-02	241	241	241	5,000	0.000	0.000	0.000	0.010
PGB-03	310	322	335	5,000	0.000	0.001	0.001	0.010
PLB-02	235	279	353	5,000	0.000	0.000	0.002	0.010
PLB-03	226	296	364	5,000	0.000	0.001	0.013	0.010
PLB-05	217	266	350	5,000	0.000	0.007	0.030	0.010
PLB-09	228	284	356	5,000	0.000	0.000	0.001	0.010
POBLADO BUENA VISTA	224	290	397	5,000	0.000	0.000	0.000	0.010

Environmental item	Item to be monitored	Monitoring site	Frequency	Method	Party in charge
Noise	Noise level	Borinquen Hotel, one site on the well base boundary (in the hotel direction), and 4 sites (north, south, east and west) in the vicinity of the power plant site.	During testing period (weeks-one month): once/week During power plant construction: monthly (with peak time for each construction job taken into account)	Field measurement	ICE

Noise - CAMPO GEOTERMICO BORINQUEN				
Site	Noise Min	Noise Avg	Noise Max	Noise Std
CAÑAS DULCES	35	39	45	65
CASA MAQUINAS BORINQUEN	32	35	38	65
HOTEL BORINQUEN	33	37	46	65
HOTEL BUENA VISTA	33	35	37	65
PGB-02	60	60	60	65
PGB-03	46	47	48	65
PLB-02	53	62	69	65
PLB-03	33	37	57	65
PLB-05	33	45	74	65
PLB-09	33	40	56	65
POBLADO BUENA VISTA	34	38	46	65

Environmental item	Item to be monitored	Monitoring site	Frequency	Method	Party in charge
Water quality	1) pH, Electric conductivity (EC), Chlorides (Cl-)	Upper and lower streams of the Salitral rivers, upper and lower streams within the project area (AP) of the creek running.	1) During testing period: twice/testing period (weeks-one month)	Laboratory analysis of collected samples	ICE and External laboratory to hire by ICE

Attachment 2

Geothermal Field	CG-BRQ
Monitored variable	pH Lab.

Site	Max.	Min.	Avg.
CG-BRQ --- NACIENTE DOS QUEBRADAS	7,86	5,99	6,9
CG-BRQ --- NACIENTE NAVARIT	7,83	5,71	6,8
CG-BRQ --- QUEBRADA GATA	8,12	5,36	7,2
CG-BRQ --- QUEBRADA TENCHA (PBR11)	7,81	5,76	6,9
CG-BRQ --- RIO SALITRAL	8,34	6,04	7,5
CG-BRQ --- RIO TIZATE	8,39	6,72	7,8
CG-BRQ --- TERMAL LOS PEDERNALES	7,28	5,95	6,7
CG-BRQ --- TOMA AGUA LAS LILAS	7,01	5,9	6,7
CG-BRQ --- TOMA DE AGUA PLB-02	7,97	4,66	7,3
CG-BRQ --- TOMA DE AGUA PLB-05	7,55	5,8	7,1
CG-BRQ --- LAGUNA DE ALMACENAMIENTO	7,64	7,64	7,64
Total general	8,39	4,66	7,3

Geothermal Field	CG-BRQ
Monitored variable	Cond. ($\mu\text{S/cm}$)

Site	Max.	Min.	Avg.
CG-BRQ --- NACIENTE DOS QUEBRADAS	210,9	97	157,1
CG-BRQ --- NACIENTE NAVARIT	245,4	148,9	184,6
CG-BRQ --- QUEBRADA GATA	348	115,4	218,6
CG-BRQ --- QUEBRADA TENCHA (PBR11)	263	74,5	144,7
CG-BRQ --- RIO SALITRAL	328	80,8	170,4
CG-BRQ --- RIO TIZATE	306,5	127,4	223,5
CG-BRQ --- TERMAL LOS PEDERNALES	185,9	138,7	161,6
CG-BRQ --- TOMA AGUA LAS LILAS	189	141,5	178,1
CG-BRQ --- TOMA DE AGUA PLB-02	432,3	70,6	134,4
CG-BRQ --- TOMA DE AGUA PLB-05	241,1	78,8	136,2
CG-BRQ --- LAGUNA DE ALMACENAMIENTO	558	558	558
Total general	558	70,6	174,3

Attachment 2

Geothermal Field	CG-BRQ
Monitored variable	Cl- (ppm)

Site	Max.	Min.	Avg.
CG-BRQ --- NACIENTE DOS QUEBRADAS	8	2,5	4,3
CG-BRQ --- NACIENTE NAVARIT	7,8	2	4,2
CG-BRQ --- QUEBRADA GATA	12,2	1,31	6,0
CG-BRQ --- QUEBRADA TENCHA (PBR11)	11,3	1,8	4,9
CG-BRQ --- RIO SALITRAL	27,94	2,41	6,6
CG-BRQ --- RIO TIZATE	16,1	5,2	9,1
CG-BRQ --- TERMAL LOS PEDERNALES	4,72	2,64	3,2
CG-BRQ --- TOMA AGUA LAS LILAS	11,5	3,79	5,6
CG-BRQ --- TOMA DE AGUA PLB-02	7,49	3,04	4,7
CG-BRQ --- TOMA DE AGUA PLB-05	13,1	2,38	4,6
CG-BRQ --- LAGUNA DE ALMACENAMIENTO	7,69	7,69	7,69
Total general	27,94	1,31	6,0

Water quality	2) Oils and grease,	Outlet of the settling basin (construction work effluents). Only in the presence of machinery in the project area (AP)	2) Oils and grease, every six months (semester) After 2 years, the continuation of monitoring will be reconsidered based on opinions of professional experts.)	Laboratory analysis of collected samples	ICE and External laboratory to hire by ICE

Site	Oils and grease (mg/L)		
	Standard 50 mg/L	Min	Max
Q. Gata Abajo	<0,2		8
Q. Gata Arriba	<0,2		<1
Río Salitral Abajo	<0,2		4
Río Salitral Arriba	<0,2		<1
Río Tizate Abajo	<0,2		<1
Río Tizate Arriba	<0,2		<1
Tencha Abajo	<0,2		<1
Tencha Arriba	<0,2		<1
Toma PLB-02	<0,2		<1
Toma PLB-05	<0,2		<1

Attachment 2

Water quality	3) Hexavalent chrome (Cr+6), and Mercury (Hg) and COD	NOT APPLICABLE (NA)	NOT APPLICABLE (NA)	-----	
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Water quality	4) Arsenic (As)	Only in drinking water intakes	every six months (semester) After 2 years, the continuation of monitoring will be reconsidered based on opinions of professional experts.)	Laboratory analysis of collected samples	ICE and External laboratory to hire by ICE
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Site	Arsenic (mg/L)	
Standard 0,01 mg/L	Min	Max
Plantel Curubandé	<1	<2

Environmental item	Item to be monitored	Monitoring site	Frequency	Method	Party in charge
Soil	Complete analysis - Cadmium (Cd), Lead (Pb), As, Cr ⁺⁶ , Hg, etc.	Four points in the vicinity of a representative geothermal field	One year before construction starts, and once five years after operation starts	Laboratory analysis of collected samples	ICE
		Four points in the vicinity of the power plant site	One year before construction starts, and once five years after operation starts		
Not applicable for this period. Monitoring in 2020.					

Attachment 2

Environmental item	Item to be monitored	Monitoring site	Frequency	Method	Party in charge
Fauna and flora	Plants and animals (birds, amphibians, reptiles, and mammals)	Area in the vicinity of wells and power plant site, the project site side of the national park, and gallery forest along the Salitral river	Monthly (with rainy and dry seasons, breeding seasons, etc. taken into account)	Visual observation records and photographs	ICE

Results of monitoring and state of conservation of species. July, august and september 2020.

Group	State of conservation		
	CITES	IUCN	MINAE N° 40548-Regulations
Amphibian			
<i>Agalychnis callidryas</i>	II		RP
<i>Bolitoglossa striatula</i>			
<i>Cochranella granulosa</i>			
<i>Craugastor fitzingeri</i>			
<i>Craugastor fitzingeri</i>			
<i>Craugastor mimus</i>			RP
<i>Engystomops pustulosus</i>			RP
<i>Hypopachus variolosus</i>			
<i>Incilius coccifer</i>			
<i>Lithobates forreri</i>			
<i>Lithobates warszewitschii</i>			
<i>Pristimantis ridens</i>			
Birds			
<i>Amazilia saucerrottei</i>	II		RP
<i>Amazona albifrons</i>	II		RP
<i>Arremonops conirostris</i>			
<i>Arremonops rufivirgatus</i>			
<i>Basileuterus rufifrons</i>			
<i>Brotogeris jugularis</i>	II		RP
<i>Burhinus bistriatus</i>	III		
<i>Buteo plagiatus</i>	II		RP
<i>Calocitta formosa</i>			
<i>Campephilus guatemalensis</i>			
<i>Campylorhynchus rufinucha</i>			
<i>Cantorchilus modestus</i>			
<i>Cathartes aura</i>			
<i>Ceratopipra mentalis</i>			
<i>Chiroxiphia linearis</i>			
<i>Chlorostilbon canivetii</i>	II		RP
<i>Ciccaba virgata</i>	II		RP
<i>Columbina inca</i>			

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<i>Coragyps atratus</i>			
<i>Crax rubra</i>	III	VU	RP
<i>Crotophaga sulcirostris</i>			
<i>Crypturellus cinnamomeus</i>			
<i>Cyanerpes cyaneus</i>			
<i>Eucometis penicillata</i>			
<i>Eumomota superciliosa</i>			
<i>Euphonia hirundinacea</i>			
<i>Euphonia luteicapilla</i>			
<i>Eupsittula canicularis</i>	II		RP
<i>Galbula ruficauda</i>			
<i>Geothlypis poliocephala</i>			
<i>Habia fuscicauda</i>			
<i>Henicorhina leucophrys</i>			
<i>Herpetotheres cachinnans</i>	II		RP
<i>Hylocharis eliciae</i>	II		RP
<i>Leiothlypis peregrina</i>			
<i>Lepidocolaptes souleyetii</i>			
<i>Leptotila verreauxi</i>			
<i>Megascops cooperi</i>	II		RP
<i>Melanerpes hoffmannii</i>			
<i>Momotus lessonii</i>			
<i>Morococcyx erythropygus</i>			
<i>Myiarchus crinitus</i>			
<i>Myiarchus tuberculifer</i>			
<i>Myiarchus tyrannulus</i>			
<i>Myiothlypis fulvicauda</i>			
<i>Myiozetetes similis</i>			
<i>Nyctidromus albicollis</i>			
<i>Passerina caerulea</i>			
<i>Patagioenas flavirostris</i>			
<i>Penelope purpurascens</i>	III		RP
<i>Peucaea ruficauda</i>			
<i>Piaya cayana</i>			
<i>Psarocolius montezuma</i>			
<i>Pseudastur albicollis</i>	II		RP
<i>Psilorhinus morio</i>			
<i>Pteroglossus torquatus</i>			

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<i>Ramphastos sulfuratus</i>	II		RP
<i>Sporophila torqueola</i>			
<i>Sturnella magna</i>			
<i>Tangara lavinia</i>			
<i>Thamnophilus doliatus</i>			
<i>Thryophilus pleurostictus</i>			
<i>Thryophilus rufalbus</i>			
<i>Tiaris olivaceus</i>			
<i>Tityra semifasciata</i>			
<i>Trogon elegans</i>			
<i>Trogon melanocephalus</i>			
<i>Tyrannus melancholicus</i>			
<i>Tyto alba</i>			
<i>Vireo philadelphicus</i>			
<i>Volatinia jacarina</i>			
<i>Zenaida asiatica</i>			
Mammals (Visual, Sherman, Mist nets and Camera trap)			
<i>Alouatta palliata</i>	I		EN
<i>Ateles geoffroyi</i>	I	EN	EN
<i>Conepatus semistriatus</i>			
<i>Cuniculus paca</i>	III		RP
<i>Dasyopus novemcinctus</i>			
<i>Eira barbara</i>	III		
<i>Puma concolor</i>	I		EN
<i>Sciurus deppei</i>			RP
<i>Sciurus variegatoides</i>			
<i>Tapirus bairdii</i>	I	EN	EN
<i>Tayassu pecari</i>	II	VU	EN
<i>Dasyprocta punctata</i>	III		
<i>Didelphis marsupialis</i>			
<i>Leopardus pardalis</i>	I		EN
<i>Nasua narica</i>	III		
<i>Odocoileus virginianus</i>	III		
<i>Ototylomys phyllotis</i>			
<i>Panthera onca</i>	I	NT	PE
<i>Pecari tajacu</i>	II		RP

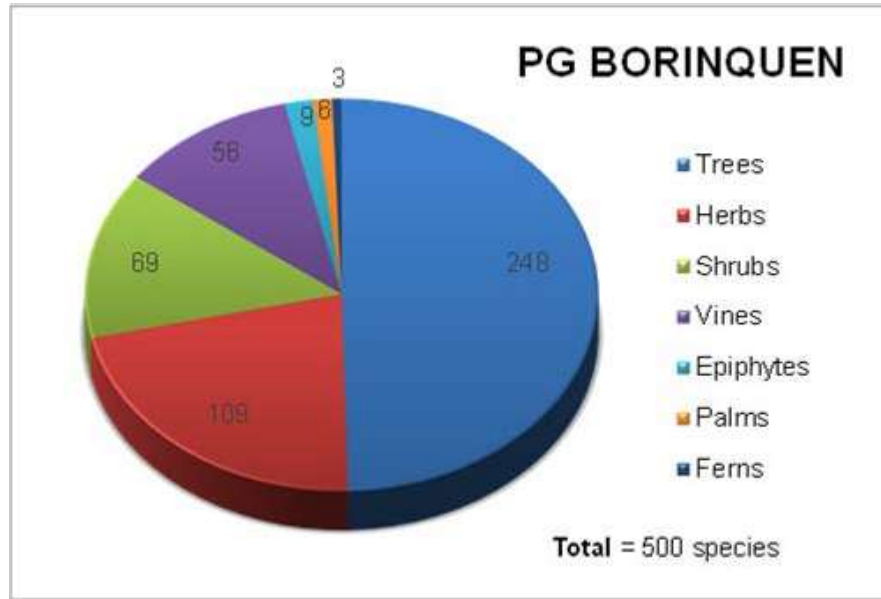
Reptiles			
<i>Boa imperator</i>	II		RP
<i>Bothrops asper</i>			
<i>Ctenosaura similis</i>			
<i>Gymnophthalmus speciosus</i>			
<i>Holcosus festivus</i>			
<i>Holcosus undulatus</i>			
<i>Imantodes gemmistratus</i>			
<i>Micrurus nigrocinctus</i>	III		
<i>Norops cupreus</i>			
<i>Norops oxylophus</i>			
<i>Sceloporus variabilis</i>			
<i>Trimorphodon quadruplex</i>			

I=Appendix I CITES, II=Appendix II CITES, III=Appendix III CITES, IUCN= The International Union for Conservation of Nature, CITES=The Convention on International Trade in Endangered Species of Wild Fauna and Flora, NT= Near Threatened, EN= endangered species, RP= species with reduced or threatened populations, VU= Vulnerable.

Wild animals monitoring. August 2020.
Daytime monitoring



Distribution of flora species by habits registered in the Borinquen Geothermal Field. March 2014 – September 2020.



Environmental item	Item to be monitored	Monitoring site	Frequency	Method	Party in charge
Waste*	Generated amount	Power plant construction site	Monthly	Total of generated amount (weight or volume)	Construction contractor
	Not applicable for this period. In 2021 starts the construction of plant.				

*Appropriate waste management including disposal of sludge will be implemented in accordance with Law for the Integrated Management of Residues (Law 8839), and in reference to Resolution No. 1948-2008-SETENA17 (page26).