## **Monitoring Plan**

**Construction period**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Environmental item** | **Item to be monitored** | **Monitoring site** | **Frequency** | **Method** | **Party in charge** |
| **Air quality** | H2S - CO2 | 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 |
| C:\Users\jovaler\AppData\Local\Temp\Dashboard-1.png | | | | | |
| **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 |
| C:\Users\jovaler\AppData\Local\Temp\Dashboard-2.png | | | | | |
|  | | | | | |
| **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 |
|  | | | | | |
| **Water quality** | 1. Oils and grease, | Outlet of the settling basin (construction work effluents). Only in the presence of machinery in the project area (AP) | 1. 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 |
|  | | | | | |
| **Water quality** | 1. Hexavalent chrome (Cr+6), and Mercury (Hg) and COD | NOT APPLICABLE (NA) | NOT APPLICABLE (NA) | -------- |  |
|  | | | | | |
| **Water quality** | 1. 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 |
|  | | | | | |
| **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. | | | | |
| **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, April – September 2019.**   |  |  |  |  | | --- | --- | --- | --- | | **Group** | **State of conservation** | | | | **Amphibian** | **CITES** | **IUCN** | **MINAE N° 40548- Regulations** | | *Agalychnis callidryas* | II |  | RP | | *Craugastor fitzingeri* |  |  |  | | *Diasporus diastema* |  |  |  | | *Engystomops pustulosus* |  |  | RP | | *Leptodactylus savagei* |  |  |  | | *Lithobates forreri* |  |  |  | | *Lithobates taylori* |  |  |  | | *Lithobates warszewitschii* |  |  |  | | *Pristimantis ridens* |  |  |  | | *Rhinella horribilis* |  |  |  | | *Sachatamia albomaculata* |  |  |  | | *Smilisca baudinii* |  |  |  | | *Smilisca sordida* |  |  |  | | **Birds** |  |  |  | | *Amaurospiza concolor* |  |  |  | | *Amazilia rutila* | II |  | RP | | *Amazilia saucerrottei* | II |  | RP | | *Amazona albifrons* | II |  | RP | | *Amazona autumnalis* | II |  | RP | | *Ammodramus savannarum* |  |  |  | | *Arremonops conirostris* |  |  |  | | *Arremonops rufivirgatus* |  |  |  | | *Attila spadiceus* |  |  |  | | *Aulacorhynchus prasinus* |  |  |  | | *Basileuterus culicivorus* |  |  |  | | *Basileuterus rufifrons* |  |  |  | | *Brotogeris jugularis* | II |  | RP | | Burhinus bistriatus |  |  |  | | *Buteo plagiatus* | II |  | RP | | *Calocitta formosa* |  |  | RP | | *Campylopterus hemileucurus* | II |  | RP | | *Cantorchilus modestus* |  |  |  | | *Caracara cheriway* | II |  | RP | | *Cathartes aura* |  |  |  | | *Catharus mexicanus* |  |  |  | | *Catharus ustulatus* |  |  |  | | *Chiroxiphia linearis* |  |  |  | | *Chlorostilbon canivetii* | II |  | RP | | *Ciccaba virgata* | II |  | RP | | *Colinus cristatus* |  |  |  | | *Columbina passerina* |  |  |  | | *Coragyps atratus* |  |  |  | | *Crax rubra* | III | VU | RP | | *Crotophaga sulcirostris* |  |  |  | | *Crypturellus cinnamomeus* |  |  |  | | *Dendrocincla homochroa* |  |  |  | | *Dendrocolaptes sanctithomae* |  |  |  | | *Dendrocygna autumnalis* |  |  |  | | *Elanus leucurus* | II |  | RP | | *Empidonax minimus* |  |  |  | | *Eucometis penicillata* |  |  |  | | *Eumomota superciliosa* |  |  |  | | *Eupherusa nigriventris* |  |  |  | | *Euphonia affinis* |  |  |  | | *Euphonia hirundinacea* |  |  |  | | *Eupsittula canicularis* | II |  | RP | | *Galbula ruficauda* |  |  |  | | *Geothlypis poliocephala* |  |  |  | | *Habia fuscicauda* |  |  |  | | *Henicorhina leucophrys* |  |  |  | | *Henicorhina leucosticta* |  |  |  | | *Herpetotheres cachinnans* | II |  | RP | | *Hylocichla mustelina* |  | NT |  | | *Hylophilus decurtatus* |  |  |  | | *Hylophylax naevioides* |  |  |  | | *Lepidocolaptes souleyetii* |  |  |  | | *Leptotila verreauxi* |  |  |  | | *Megascops cooperi* | II |  | RP | | *Melanerpes hoffmannii* |  |  |  | | *Microcerculus philomela* |  |  |  | | *Mionectes oleagineus* |  |  |  | | *Momotus lessonii* |  |  |  | | *Morococcyx erythropygus* |  |  |  | | *Myadestes melanops* |  |  |  | | *Myiarchus nuttingi* |  |  |  | | *Myiarchus tuberculifer* |  |  |  | | *Myiarchus tyrannulus* |  |  |  | | *Myioborus miniatus* |  |  |  | | *Myiodynastes luteiventris* |  |  |  | | *Myiodynastes maculatus* |  |  |  | | *Myiozetetes similis* |  |  |  | | *Nyctibius jamaicensis* |  |  |  | | *Nyctidromus albicollis* |  |  |  | | *Patagioenas fasciata* |  |  |  | | *Patagioenas flavirostris* |  |  |  | | *Penelope purpurascens* | III |  | RP | | *Peucaea ruficauda* |  |  |  | | *Phaethornis longirostris* | II |  | RP | | *Phaethornis striigularis* | II |  | RP | | *Piaya cayana* |  |  |  | | *Pitangus sulphuratus* |  |  |  | | *Psarocolius montezuma* |  |  |  | | *Pseudastur albicollis* | II |  | RP | | *Psilorhinus morio* |  |  |  | | *Pteroglossus torquatus* |  |  |  | | *Pulsatrix perspicillata* | II |  | RP | | *Ramphastos sulfuratus* | II |  | RP | | *Ramphocaenus melanurus* |  |  |  | | *Sporophila torqueola* |  |  |  | | *Streptoprocne zonaris* |  |  |  | | *Sturnella magna* |  |  |  | | *Thryophilus pleurostictus* |  |  |  | | *Thryophilus rufalbus* |  |  |  | | *Tinamus major* |  | NT | RP | | *Trogon melanocephalus* |  |  |  | | *Turdus assimilis* |  |  |  | | *Turdus grayi* |  |  |  | | *Turdus obsoletus* |  |  |  | | *Turdus plebejus* |  |  |  | | *Vireo flavifrons* |  |  |  | | *Volatinia jacarina* |  |  |  | | *Zenaida asiatica* |  |  |  | | *Zenaida macroura* |  |  |  | | **Mammals (Visual, Sherman, Mist nets and Camera trap)** |  |  |  | | *Alouatta palliata* | I |  | EN | | *Ateles geoffroyi* | I | EN | EN | | *Canis latrans* |  |  |  | | *Cebus imitator* | II |  | RP | | *Didelphis marsupialis* |  |  |  | | *Didelphis virginiana* |  |  |  | | *Heteromys salvini* |  |  |  | | *Nasua narica* | III |  |  | | *Odocoileus virginianus* |  |  |  | | *Ototylomys phyllotis* |  |  |  | | *Potos flavus* | III |  |  | | *Proechimys semispinosus* |  |  |  | | *Puma concolor* | I |  | EN | | *Sciurus deppei* | III |  | RP | | *Sciurus variegatoides* |  |  |  | | *Sphiggurus mexicanus* | III |  |  | | *Sylvilagus floridanus* |  |  |  | | *Tapirus bairdii* | I | EN | EN | | *Tayassu pecari* | II | VU | EN | | *Tylomys watsoni* |  |  |  | | *Artibeus jamaicensis* |  |  | RP | | *Artibeus lituratus* |  |  |  | | *Artibeus phaeotis* |  |  |  | | *Artibeus toltecus* |  |  |  | | *Artibeus watsoni* |  |  |  | | *Carollia castanea* |  |  |  | | *Carollia perspicillata* |  |  |  | | *Carollia sowelli* |  |  |  | | *Carollia subrufa* |  |  |  | | *Desmodus rotundus* |  |  |  | | *Glossophaga commissarisi* |  |  |  | | *Glossophaga soricina* |  |  |  | | *Micronycteris microtis* |  |  |  | | *Myotis albescens* |  |  |  | | *Myotis keaysi* |  |  |  | | *Platyrrhinus helleri* |  |  |  | | *Pteronotus mesoamericanus* |  |  |  | | *Rhogeessa bickhami* |  |  |  | | *Cabassous centralis* |  |  | RP | | *Caluromys derbianus* |  |  |  | | *Conepatus semistriatus* |  |  |  | | *Cuniculus paca* | III |  | RP | | *Dasyprocta punctata* | III |  |  | | *Dasypus novemcinctus* |  |  |  | | *Leopardus pardalis* | I |  | EN | | *Ototylomys phyllotis* |  |  |  | | *Panthera onca* | I | NT | EN | | *Pecari tajacu* | II |  | RP | | *Tamandua mexicana* |  |  |  | | **Reptiles** |  |  |  | | *Boa imperator* | II | RP |  | | *Bothrops asper* |  |  |  | | *Coleonyx mitratus* |  | RP |  | | *Corytophanes cristatus* |  |  |  | | *Ctenosaura similis* |  |  |  | | *Gymnophthalmus speciosus* |  |  |  | | *Holcosus festivus* |  |  |  | | *Holcosus undulatus* |  |  |  | | *Norops biporcatus* |  |  |  | | *Norops capito* |  |  |  | | *Norops cupreus* |  |  |  | | *Oxybelis aeneus* |  |  |  | | *Porthidium ophryomegas* |  |  |  | | *Sceloporus malachiticus* |  |  |  | | *Sibon anthracops* |  |  |  | | *Sphenomorphus cherriei* |  |  |  |   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. April-september, 2019.**  **Monitoring birds.**  \\10.149.70.64\Data_RGE\GE\Gest-Soc-Ambiental\FOTOS-GMA\Gest_Biologia\2019\Borinquen\Monitoreo_fauna\Diurno_Aves_ruido\SETIEMBRE\T1\IMG_9438.JPG  **Distribution of flora species by habits registered in the Borinquen Geothermal Field. March 2014 – september 2019.** | | | | |
| **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).