



**PACIFIC HUNT ENERGY**

---



# Seismic survey of onshore Block PSC H

REPORT

**BIODIVERSITY ACTION PLAN**

**Artelia Myanmar/Artelia Eau & Environnement**

**RSE International Department**

Parkside One Building (CCI F-M) 271-273

Bagaya Street, Sanchaung Township

YANGON, MYANMAR

Tel. : +33 (0)9 62 72 95 94



## QUALITY SHEET

<i>Project description</i>	
<b>Project name</b>	<b>Seismic survey of Onshore Block PSC H</b>
<b>Project N°</b>	<b>8512429</b>
<b>Client</b>	<b>PACIFIC HUNT ENERGY</b>
<b>Project location</b>	<b>The Republic of the Union of Myanmar</b>
<b>Document type</b>	<b>Report</b>
<b>Document name</b>	<b>8512429_PHE-BAP_Sismis survey Block PSC H</b>

<i>List of version</i>					
<b>Version N°</b>	<b>Date</b>	<b>Description</b>	<b>Author</b>	<b>Reviewed by</b>	<b>Approved by</b>
1	18/10/2017	Draft report issue for comments	M.Bremond	G.Capdevielle	G.Capdevielle
2	06/11/2017	Final report	M.Bremond	G.Capdevielle	G.Capdevielle
3	07/11/2017	Final report	M.Bremond	G.Capdevielle	G.Capdevielle

**ARTELIA Eau & Environnement**  
RSE International Department  
Parkside One Building (CCI F-M) 271-273  
Bagaya Street, Sanchaung Township  
YANGON, MYANMAR  
Tel. : +33 (0)9 62 72 95 94

## TABLE OF CONTENT

<b>1. BIODIVERSITY ACTION PLAN</b>	<b>2</b>
1.1. OBJECTIVES	2
1.2. BAP PERIMETER AND ORGANISATION	2
<b>2. PROJECT DESCRIPTION</b>	<b>3</b>
2.1. PROJECT BACKGROUND	3
2.2. PROPOSED LOCATION	3
2.3. SEISMIC SURVEY	5
<b>3. ECOLOGICAL ISSUES IN THE PROJECT AREA</b>	<b>5</b>
3.1. LOCATION AND BRIEF DESCRIPTION OF THE PROJECT AREA	5
3.2. ECOLOGICAL ISSUES	6
3.2.1. Methodology	6
3.2.2. Key habitats	6
3.2.3. Plant species	7
3.2.4. Fauna species	8
3.3. EMBLEMATIC SPECIES AND ASSOCIATED IMPACTS	8
3.3.1. Impact factors	8
3.3.2. Emblematic species in the project area	9
3.3.2.1. PLANT SPECIES	10
3.3.2.2. BIRD SPECIES	12
3.3.2.3. HERPETOFAUNA SPECIES	19
3.3.2.4. MAMMAL SPECIES	21
3.3.2.5. FISH SPECIES	24
3.4. SPECIES ISSUES FOR THIS PROJECT	26
<b>4. MEASURES SHEETS</b>	<b>36</b>

## TABLES

TABL. 1 - LENGTH OF THE PROPOSAL 2D SEISMIC LINES	4
TABL. 2 - SCOPING MATRIX FOR FAUNA AND FLORA (BIOLOGICAL ENVIRONMENT)	9

## FIGURES

<b>FIG. 1.</b> BLOCK H AND SOUTH CORE AREA I	3
<b>FIG. 2.</b> PROPOSED SEISMIC LINES	4
<b>FIG. 3.</b> HABITAT MAP OF BLOCK H	7

## 1. BIODIVERSITY ACTION PLAN

An Environmental Impact Study Assessment (ESIA) was performed in 2015 concerning a seismic exploration survey on the onshore PSC H operated by Pacific Hunt Energy (PHE). PHE has commissioned Environmental Resources Management (ERM) to undertake this ESIA.

With the view to make the Environmental and Social Management Plan of PSC H more operational, in particular for fauna and flora items, a Biodiversity Action Plan (BAP) is proposed to be developed in order to strengthen the mitigation measures proposed in the ESIA.

A BAP is an internationally recognized program addressing threatened species and habitat and is designed to protect and restore biological systems. The original impetus for these plans derives from the 1992 Convention on Biological Diversity (CBD). Myanmar became party of this Convention in 1994.

### 1.1. OBJECTIVES

A Biodiversity Action Plan is a plan to conserve or enhance biodiversity, more specifically a set of future actions that will lead to the conservation or enhancement of biodiversity.

The biodiversity baseline, conservation actions and mitigation measures in this BAP supplement the information in the ESIA. Additional conservation opportunities/actions have also been identified during the BAP process, but this document also includes actions required under the Environmental and Social Management Plan (ESMP) which covers environmental measures that are relevant to the protection of biodiversity.

The conservation objectives and actions in this BAP have been developed to (i) protect and conserve the terrestrial biodiversity, (ii) ensure the systematic implementation of the mitigation hierarchy i.e. avoid, reduce (minimise), and offset and (iii) cover the different project phases. Moreover, details on planning, environmental organisation, traceability and distribution of tasks and responsibilities are provided.

### 1.2. BAP PERIMETER AND ORGANISATION

The BAP perimeter covers the environmental fields impacted by the project in a temporary or permanent manner, including terrestrial and aquatic domain.

The principal elements of this BAP include:

- A synthesis of the project elements,
- The inventories of biological information for selected species or habitat,
- The conservation status of species within species ecosystems,
- The species sensitivity relating to the impacts of the project,
- Timelines, monitoring, reporting and responsibilities for implementing the BAP.

The description of the impacts and measures related to a (or several) specific(s) habitat(s) and/or specie(s) is presented in the form of data sheets.

## 2. PROJECT DESCRIPTION

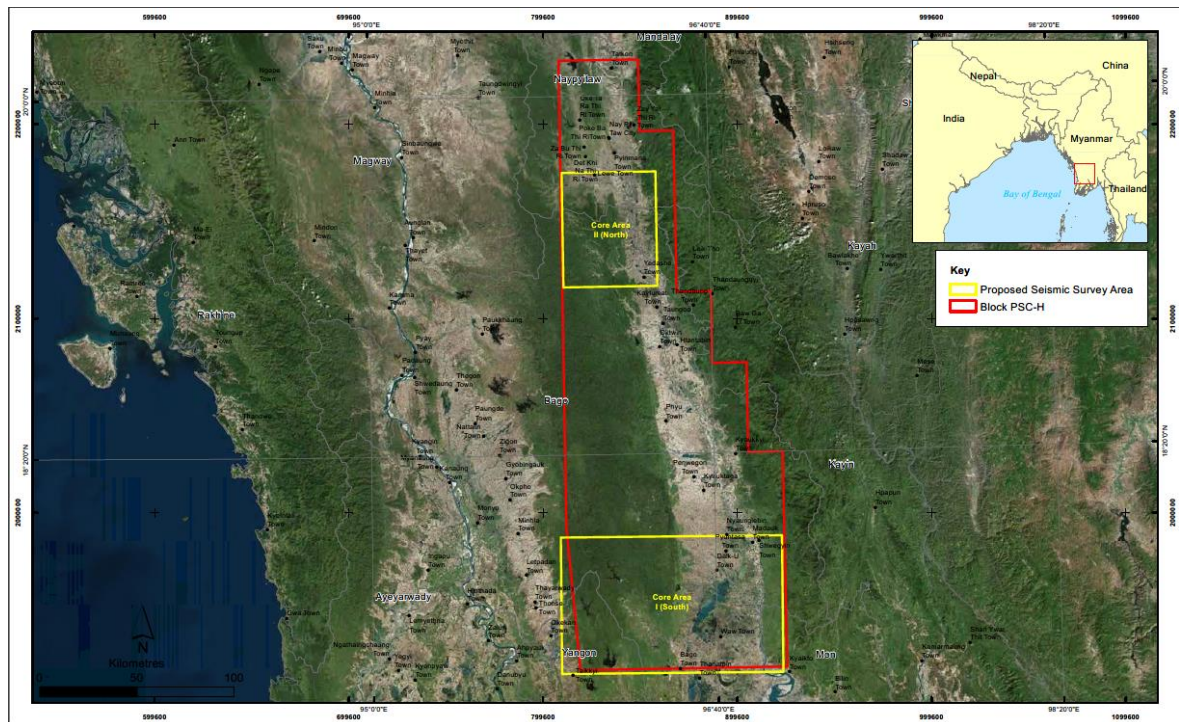
The section provides a synthesis of the onshore seismic survey conducted across PSC H as described in the ESIA of the project.

### 2.1. PROJECT BACKGROUND

PSC H is located in Bago Region in southern Myanmar (cf. Fig. 1). PHE is planning to undertake Two-Dimensional (2D) seismic exploration survey across PSC H to determine the prospect.

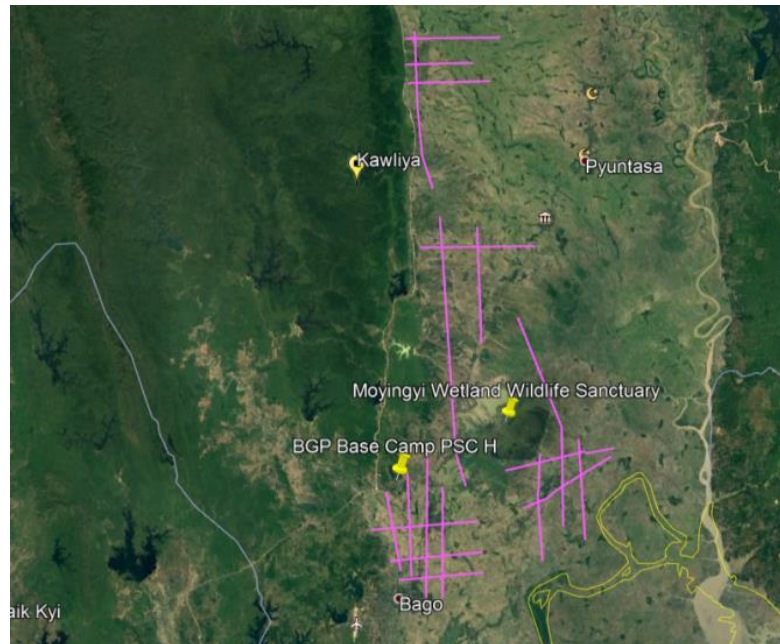
### 2.2. PROPOSED LOCATION

Locations of the proposed seismic survey lines within PSCH are shown in Fig. 1, within the Core Area I (South - 8,000 km<sup>2</sup>). Expected nineteen seismic lines are defined in the Fig. 2.



SOURCE: SEISMIC SURVEY OF ONSHORE BLOCK H. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT (26 FEBRUARY 2015). ERM

**Fig. 1. Block H and South Core Area I**



SOURCE: PHE. OCTOBER 2017

**Fig. 2.** Proposed seismic lines

**Tabl. 1 -** Length of the proposal 2D seismic lines

Proposed seismic line	Length (km)
17PHE-H04	12.9
17PHE-H05	11.1
17PHE-H06	21.7
17PHE-H07a	15.7
17PHE-H08	15.8
17PHE-H09a	36.7
17PHE-H10	14.6
17PHE-H11	29.3
17PHE-H12	13.6
17PHE-H13	15.3
17PHE-H14	13.9
17PHE-H15a	19.7
17PHE-H16	14.8
17PHE-H17	14.6
17PHE-H18	12.6
17PHE-H19	11.4
17PHE-H20	14
17PHE-H21	10.8
17PHE-H22	9.2
TOTAL	307.7

### **2.3. SEISMIC SURVEY**

Seismic surveying is an oil and gas prospecting method based on the analysis of seismic waves reflected on the different substrata. The principle is to create an acoustic wave (a shock) on the surface and measure the echo return time using a series of recorders also placed on the surface. The information gained will enable the profile of the various substrata to be drawn and therefore their ability to determine a reservoir of hydrocarbons (oil or gas).

The seismic survey within PSC H will be carrying out with vibroseis trucks. A train of acoustic waves is generated in the ground for a short period of time (6 to 12 seconds). The emitted acoustic waves are reflected on the interfaces between two types of rocks and recorded by a geophone system positioned along the seismic line. These geophones are placed on either side of the source. The data received are then transmitted to the recording truck.

Existing road, existing river transportation route and facilities along Sittaung River will be used. No new road is expected to be built for the project. Nevertheless, during the seismic survey phase, vegetation clearance and creation of access track may take place for placement of seismic sources and sensors.



SOURCE: [HTTP://GEOSEARCHISLE.INFO](http://geosearchisle.info)

## **3. ECOLOGICAL ISSUES IN THE PROJECT AREA**

### **3.1. LOCATION AND BRIEF DESCRIPTION OF THE PROJECT AREA**

The information on ecological issues presented in the ESIA baseline has been obtained mainly through baseline field surveys, interviews and focus group discussions, and a little with desktop research. Significant information gaps existed on the biological environment elements found in the literature review. This literature shows that forests cover about 40% of the total land area, but this forest is under threat in the Bago Region due to change in land use rapid growth in population: deforestation process is an ongoing issue. The main sources of surface water within PSC H are noted to be the Sittaung River and dams reservoirs. The Sittaung River is expected to be contaminated principally from agriculture inputs, boat vessel emissions, mining activities and surface run-off.

A protected area, Moyingyi Wetland, is partly located within the seismic survey area (Core Area I (South)) of PSC H. The site supports several wetland habitats which were considered with high ecological value for resident and migratory waterbirds. More than 20 aquatic plants are present, including Kaing grass and Nwaysaba (*Oxyza officinalis*), especially in the shallow areas of the site which are breeding grounds for

water birds. A total of 130 bird species, 20 reptile species, 9 amphibian species, 45 fish species and 30 insects species are recorded by the sanctuary office within the wetland. The proposed **seismic lines avoid** the Moyingyi Wetland.

To complete the literature review baseline field surveys were conducted in January 2015 (dry season) within PSC H. It should be noted that surveys were only conducted at locations which were accessible by vehicular means / via footpath.

## **3.2. ECOLOGICAL ISSUES**

### **3.2.1. Methodology**

The information presented has been obtained through desktop research on secondary information and primary data collection through baseline field surveys, interviews and focus group discussions. Baseline field surveys were conducted in January 2015 (dry season) within PSC H.

Regarding methodology for habitats and vegetation (including trees) survey, habitats were mapped based on publicly available aerial photos and field identification. Representative areas of each habitat type were surveyed on foot. Plant species of each habitat type encountered and their relative abundance were recorded with special attention to rare or protected species

The avifauna communities of each habitat types within the study area were surveyed using the qualitative transect count method. During the survey, all birds seen or heard from either sides of the transect were identified to species where possible with their relative abundance noted. Signs of breeding (e.g. nests, recently fledged juveniles) within the study area were also recorded, if any. Observations were made using binoculars and photographic records were taken, if possible. Special attention was paid to wetland dependent and migratory birds.

Herpetofauna survey was conducted through direct observation and active searching in all habitat types in potential hiding places such as amongst leaf litter, inside holes, under stones and logs within the study area. Particular attention was given to streams and watercourses. Auditory detection of species-specific calls was also used to survey frogs and toads. During the surveys, all reptiles and amphibians sighted and heard were recorded. Interviews were also conducted with villagers to gather information of the herpetofauna species they found within the study area.

As most mammals often occur at low densities, all sightings, tracks, and signs of mammals (including droppings) were actively searched along the survey transects during the field survey. Interviews were also conducted with villagers to gather information of the mammal species they found within the study area.

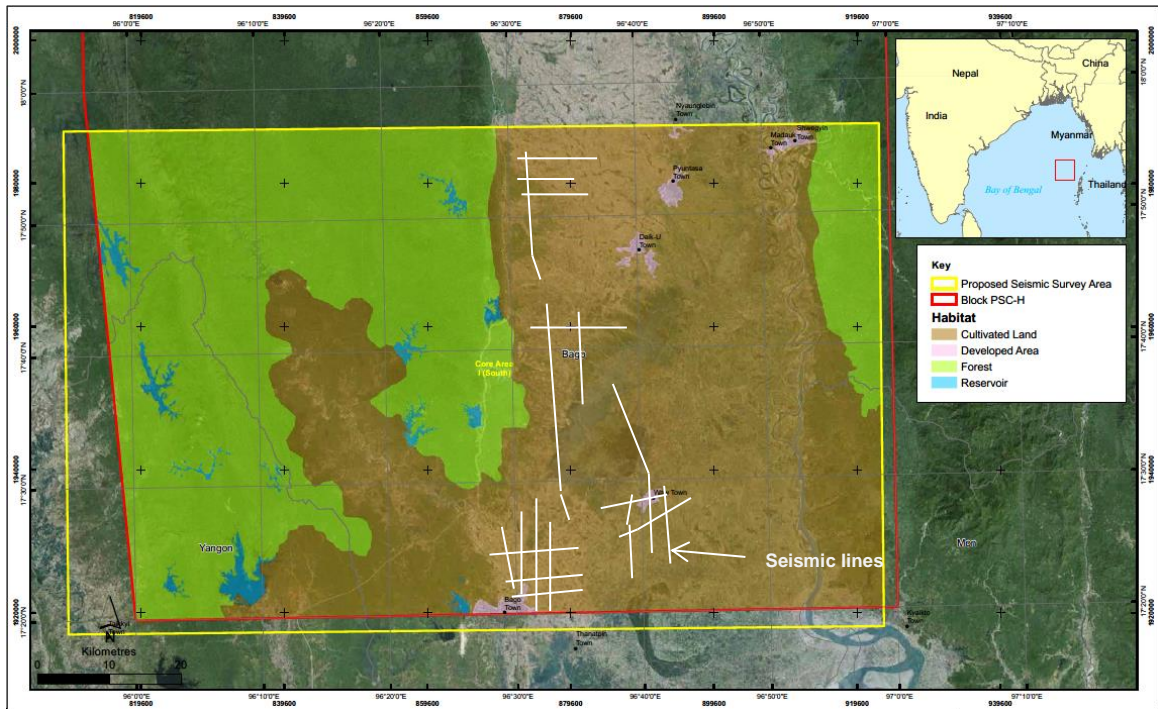
Fishes were collected with the help of local fishermen within the study area by using local fishing gears (e.g. fish traps, gill nets etc) to obtain a qualitative species list. Fish species which could not be identified in the field were preserved in 10% formalin solution and sent to laboratory for later identification.

### **3.2.2. Key habitats**

The study area (PSC-H) was found to comprise four (4) key habitat types, including cultivated land, developed area, forests, woodland, shrubland and streams or rivers. Forest and cultivated land are the main habitat types within the study area, covering 49.04% and 46.78% of study area, respectively.

Seismic lines are entirely located in cultivated area, as shown in the following map.





**Fig. 3. Habitat map of Block H**

SOURCE: SEISMIC SURVEY OF ONSHORE BLOCK H. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT (26 FEBRUARY 2015). ERM

The various habitats of the study area present ecological issues summarized below:

The **forest habitat** is the largest area within the study area and mainly occupies the western side and is found to be mainly restricted to the areas with hilly terrain and is relatively undisturbed from human activities. Nevertheless all forests within the study area are considered as with **high ecological value / receptor sensitivity with regard to its naturalness, size and the presence of sensitive fauna**. No seismic acquisition is planned in this type of habitat.

Cultivated habitat is the second largest habitat type found within study area with mainly paddy field cultivated with Asian Rice (*Oryza sativa L*). This habitat, as developed area, is regarded as **man-made, disturbed habitat with low ecological value / receptor sensitivity**. Several reservoirs exist in the study area and provide aquatic habitats. With regard to its man-made nature, this habitat is also considered as with **low ecological value**.

### 3.2.3. Plant species

A total of forty plant species were recorded in the study area, with the higher number in forest habitat. Most of these plant species are regarded as common and widespread species with no recognised conservation interest.

In the forest, a total of thirty-one plant species were recorded, but only one *Dipterocarpus alatus* is being considered as an endangered species in the 2015 IUCN red list.

Eleven plant species were recorded in cultivated land, dominated by *Oryza sativa L* (Asian rice). Except the Dahat Teak (*Tectona hamiltoniana*) considered as an endangered species in Myanmar, no plant species with conservation interest was found.

A total of fourteen plant species was found within the developed area of the Study Area and 4 in the reservoirs, but none is recognised with conservation interest.

#### **3.2.4. Fauna species**

A total of seventy-six bird species were recorded during the survey period within the Study Area. The abundance of birds was noted to be higher in cultivated land and developed area while the species' richness was the highest in forest habitat with a total of thirty-five species recorded.

According to the 2015 IUCN Red List of Threatened Species, Grey-headed Parakeet (*Psittacula finschii*) and Hooded Treepie (*Crypsirina cucullata*), are considered as near-threatened species. These species were found at the forest habitat of the study area. While the first one is suspected to be undergoing a moderately rapid population decline due to habitat loss and trapping pressure, the second one, which is a Myanmar endemic species, is considered common. Moreover, two other endemic and protected bird species in Myanmar, Burmese Bushlark (*Mirafra microptera*) and White-throated Babbler (*Turdoides gularis*), were recorded at forest habitat and cultivated land.

During the herpetofauna survey, six amphibian species and ten reptile species were recorded. As for avifauna and plant species, richness of herpetofauna is highest in the forest area. Several species of recognised conservation interest were recorded of which the most sensitive are the Burmese Python (*Python molurus*), which is considered vulnerable in the IUCN red list, and the Indian Black Turtle (*Melanochelys trijuga*).

Twenty mammal species were recorded within the study area. According to villagers, most mammal species were reported within the forest many of which are recognized with a conservation status. All these sensitive species are already affected, sometimes significantly, due to human activities in particular in forest areas. Habitat loss / degradation and illegal hunting are the main threats on the mammal fauna. Nevertheless, most of these are very mobile and are able to quickly flee to a more quiet and safe environment.

Fishes were collected with the help of local fishermen within the study area by using local fishing gears (e.g. fish traps, gill nets etc.) to obtain a qualitative species list. Twenty-three fish species were recorded during this survey. Main of these was commercially fish. Only the Common carp (*Cyprinus carpio*) and Mrigal Carp (*Cirrhinus cirrhosis*) are considered vulnerable fish species by the IUCN red list. They are threatened by river regulation and hybridisation with introduced stocks, as Mrigal carp. In addition, Butter Catfish (*Ompok bimaculatus*) and Wallago (*Wallago attu*) were considered near threatened.

### **3.3. EMBLEMATIC SPECIES AND ASSOCIATED IMPACTS**

#### **3.3.1. Impact factors**

For this project, several activities are expected to impact flora and fauna. These activities are the following:

**Tabl. 2 - Scoping matrix for fauna and flora (biological environment)**

Project activities	Receptors	Terrestrial habitat & flora	Terrestrial fauna	Aquatic habitat and flora	Aquatic fauna
Preparation and mobilization (all phase)					
(1) Labour, equipment and services supply					
(2) Site preparation/ clearance & creation of access routes and lines					
(3) Solid and liquid discharges and wastewater					
Seismic surveying					
(4) Transportation/installation of equipment and supplies					
(5) Low level noise and vibration (daylight hours)					
Close out phase					
(7) Removal of access routes, etc & reinstatement					
Accidental events					
(8) Spills/leaks					
(9) Fires and explosions					

**3.3.2. Emblematic species in the project area**

All emblematic species identified in the project area and named in the ESIA report<sup>1</sup> are quoted in the following table. The reason and origin for the designation as emblematic status is explained every time, as well as, the species’ sensitivity related to the project impacts.

In the table above, coloured boxes highlight species with the most important issues, which are then developed in species sheet in the § 3.4 Species issues for this project.

NB: Tables below present species recorded during the field mission. Most of them live in forest area, but as a precautionary measure, these species are taken in account in our analysis.

<sup>1</sup>SEISMIC SURVEY OF ONSHORE BLOCK H. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT (26 FEBRUARY 2015). ERM

3.3.2.1. PLANT SPECIES

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Anacardiaceae	Mangifera indica	Thayet	DD	-	Developed area	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X				X	X	X	X	X
Apiaceae	Centella asiatica	Myin-hkwa	LC	-	Cultivated land	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X				X	X	X	X	X
Araceae	Colocasia esculenta	Pein	LC	-	River	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid) - SM due do to drilling (if close to river) / crossed on foot by the workers	Reducing the impact		X				X	X	X	X	X
Asteraceae	Eclipta alba	Kyeik hman	LC	-	Cultivated land	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X				X	X	X	X	X
Dipterocarpaceae	Shorea obtusa	Thit Yin	LC/LR	-	Forest area	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) - forest fragmentation <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X				X	X	X	X	X
Dipterocarpaceae	Shorea siamensis	Ingyin	LC/LR	-	Forest area	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) - forest fragmentation <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X				X	X	X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation	
			IUCN red list (1)	Other														
Dipterocarpaceae	Dipterocarpus alatus	Kanyin	EN	-	Forest area Known to be threatened due to habitat loss	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) - forest fragmentation <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact Safeguard of individual species		X					X	X	X	X	X
Dipterocarpaceae	Dipterocarpus tuberculatus Roxb.	In	LC/LR	-	Forest area	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) - forest fragmentation <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X					X	X	X	X	X
Fabaceae	Dalbergia kurzii	Thit pok	LC	-	Forest area	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) - forest fragmentation <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X					X	X	X	X	X
Fabaceae	Mimosa pudica	Hti-ka-yone	LC	-	Cultivated land	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X					X	X	X	X	X
Lamiaceae	Tectona hamiltoniana	Dahat Teak	-	Endangered Myanmar	Cultivated land	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact Safeguard of individual species		X					X	X	X	X	X
Poaceae	Dendrocalamus giganteus	Wa-bo	LC	-	Forest area	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) - forest fragmentation <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X					X	X	X	X	X
Rhamnaceae	Ziziphus jujuba	Zee / red date	LC	-	Cultivated land	<u>Clearance for seismic lines/drilling area:</u> - potentially plants species destruction (permanent) - reduction of its habitat (temporary) <u>Habitat modification:</u> - accidental event - waste discharges (solid & liquid)	Reducing the impact		X					X	X	X	X	X

(1) 2017 IUCN red list

3.3.2.2. BIRD SPECIES

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Accipitridae	Milvus migrans	Black kite	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Accipitridae	Accipiter badius	Shikra	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Accipitridae	Circus melanoleucos	Pied Harrier	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Aegithinae	Common Iora	Aegithina tiphia	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Alaudidae	Mirafra microptera	Burmese Bushlark	LC	Protected in Myanmar	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact	X	X						X	X	X
Apodidae	Cypsiurus balasiensis	Asian Palm-swift	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Ardeidae	Ardea alba	Great Egret	LC	-	River	<u>Habitat reduction/disturbance</u> : - loss of trees during clearing phase - freshwater disturbance (feeding area) - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Ardeidae	Egretta garzetta	Little Egret	LC	-	River	<u>Habitat reduction/disturbance</u> : - loss of trees during clearing phase - freshwater disturbance (feeding area) - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Ardeidae	Ardeola bacchus	Chinese pond-heron	LC	-	River	<u>Habitat reduction/disturbance</u> : - loss of trees during clearing phase - freshwater disturbance (feeding area) - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Artamidae	Artamus fuscus	Ashy Woodswallow	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Campephagidae	Coracina macei	Large Cuckoo-shrike	LC	-	Preference for forest areas, forest clearance for agriculture and logging are likely to be affecting it throughout its range. This species is also particularly susceptible to hunting pressure as it is large and visit predictable feeding sites (such as fruiting trees). It is also probably affected by pet trade	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance - Hunting pressure increase	Reducing the impact	X	X						X	X	X
Charadriinae	Vanellus indicus	Red-wattled Lapwing	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Chloropseidae	Chloropsis aurifrons	Golden-fronted Leafbird	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Cisticolidae	Prinia flaviventris	Yellow-bellied Prinia	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Columbidae	Streptopelia orientalis	Oriental Turtle Dove	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Columbidae	Streptopelia tranquebarica	Red-Collared Dove	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Columbidae	Columba livia	Common Pigeon	LC	-	Developed area	- Noise disturbance	Reducing the impact		X						X	X	X
Coraciidae	Coracias benghalensis	Indian Roller	LC	-	Developed area	- Noise disturbance	Reducing the impact		X						X	X	X
Corvidae	Crypsirina cucullata	Hooded Treepie	NT	-	Developed area	- Noise disturbance	Reducing the impact		X						X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Corvidae	Rufous Treepie	Dendrocitta vagabunda	LC	-	Endemic to the dry zone of central Myanmar. Common species but important population decrease due to habitat loss through agricultural development. This species is noted to occur in occurs in dry dipterocarp forest, dry thorn scrub forest, secondary growth and the edge of agricultural land in the lowlands to 1,000 m elevation.	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact	X	X						X	X	X
Corvinae	Corvus splendens	House Crow	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Cuculidae	Cacomantis merulinus	Plaintive Cuckoo	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Cuculidae	Centropus sinensis	Greater Coucal	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Dicruidae	Dicrurus macrocercus	Black Drongo	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Dicruidae	Dicrurus leucophaeus	Ashy Drongo	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Dicruidae	Dicrurus paradiseus	Greater Racket-tailed Drongo	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Estrildinae	Lonchura punctulata	Scaly-breasted Munia	LC	-	Cultivated land	- Habitat reduction : loss of crops and bush during clearing phase - Potential species destroyed: in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X



Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Estrildinae	Lonchura atricapilla	Chestnut Munia	LC	-	Cultivated land	- Habitat reduction : loss of crops and bush during clearing phase - Potential species destroyed: in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Halcyonidae	Halcyon smyrnensis	White-throated Kingfisher	LC	-	River	<u>Habitat reduction/disturbance</u> : - loss of trees during clearing phase - freshwater disturbance (feeding area) - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Halcyonidae	Alcedo atthis	Common Kingfisher	LC	-	River	<u>Habitat reduction/disturbance</u> : - loss of trees during clearing phase - freshwater disturbance (feeding area) - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Hirundinidae	Hirundo rustica	Barn Swallow	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Jacaniidae	Metopidius indicus	Bronze-winged Jacana	LC	-	Developed area & cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Laniidae	Lanius cristatus	Brown Shrike	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Laniidae	Lanius tephronotus	Grey-back Shrike	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Laniidae	Lanius collurioides	Burmese Shrike	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Megalaimidae	Psilopogon lineatus	Lineated Barbet	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Megalaimidae	Psilopogon haemacephalus	Coppersmith Barbet	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Meropidae	Merops orientalis	Little green bee-eater	LC	-	Developed area	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Motacillinae	Motacilla alba	White Wagtail	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Muscicapidae	Copsychus saularis	Oriental Magpie-Robin	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Muscicapidae	Phoenicurus aureus	Daurian Redstart	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Muscicapidae	Saxicola caprata	Pie Bushchat	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Oriolidae	Oriolus xanthornus	Black-hooded Oriole	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Passeridae	Passer montanus	Eurasian Tree-sparrow	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Passeridae	Passer domesticus	House Sparrow	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Passeridae	Passer flaveolus	Plain-back sparrow	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Phalacrocoracida	Phalacrocorax niger	Little Cormorant	LC	-	River	<u>Habitat reduction/disturbance</u> : - loss of trees during clearing phase - freshwater disturbance (feeding area) - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Phalacrocoracida	Anthracoceros albirostris	Oriental Pied Hornbill	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Phasianidae	Gallus gallus	Red junglefowl	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Phasianidae	Lophura leucomelanos	Kalij Pheasant	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Picidae	Dryocopus javensis	White-bellied Woodpecker	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Picidae	Micropternus brachyurus	Rufous Woodpecker	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Picidae	Chrysocolaptes lucidus	Greater Flameback	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Psittacidae	Psittacula finshii	Grey-headed Parakeet	NT	CITES Appendix II	Native species in Myanmar and countries around. This species is suspected to be undergoing a moderately rapid population decline due to habitat loss and trapping pressure. In Myanmar, this species has, however, been described as common in deciduous forest and partly cultivated areas	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance - Hunting pressure increase	Reducing the impact	X	X						X	X	X
Pycnonotidae	Pycnonotus jocosus	Red-Whiskered Bulbul	LC	-	Cultivated land	- Habitat reduction : loss of crops and bush during clearing phase - Potential species destroyed: in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Pycnonotidae	Pycnonotus cafer	Red-Vented Bul Bul	LC	-	Cultivated land	- Habitat reduction : loss of crops and bush during clearing phase - Potential species destroyed: in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			UICN red list (1)	Other													
Pycnontidae	Pycnonotus blanfordi	Streak-eared Bul Bul	LC	-	Cultivated land	- Habitat reduction : loss of crops and bush during clearing phase - Potential species destroyed: in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Rallidae	Gallicrex cinerea	Watercock	LC	-	River	<u>Habitat reduction/disturbance</u> : - loss of trees during clearing phase - freshwater disturbance (feeding area) - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Sittidae	Sitta frontalis	Velvet-Fronted Nuthatch	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Strigidae	Athene brama	Spotted Owlet	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Strigidae	Glaucidium cuculoides	Asian Barred Owlet	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Sturnidae	Gracula religiosa	Hill Myna	LC	CITES Appendix II	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact	X	X						X	X	X
Sturnidae	Gracupica contra	Asian Pied Starling	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Sturnidae	Acridotheres tristis	Common Myna	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Sturnidae	Acridotheres fuscus	Jungle Myna	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Sturnidae	Acridotheres cristatellus	Crested Myna	LC	-	Forest area	- <u>Habitat reduction</u> : loss of trees during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			IUCN red list (1)	Other													
Sylviidae	Orthotomus sutorius	Common Tailorbird	LC	-	Cultivated land	- Habitat reduction : loss of crops and bush during clearing phase - Potential species destroyed: in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X
Timalidae	Turdoides gularis	White-throated Babbler	LC	Protected in Myanmar	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact	X	X						X	X	X
Upupidae	Common Hoopoe	Upupa epops	LC	-	Cultivated land	- <u>Habitat reduction</u> : loss of crops and bush during clearing phase - <u>Potential species destroyed</u> : in particular during breeding period (during clearing activities) - Noise disturbance	Reducing the impact		X						X	X	X

(1) 2017 IUCN red list

### 3.3.2.3. HERPETOFAUNA SPECIES

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			IUCN red list (1)	Other													
Bufo	Bufo melanostictus	Common Toad	LC	-	Cultivated land & developed area	- Habitat disturbance during clearing phase - Death/injuries if fall in the borehole or buried during clearing activities - Noise disturbance	Reducing the impact	X		X				X	X	X	X
Colubridae	Enhydryis enhydryis	Striped Water Snake	LC	-	Forest area	- Habitat disturbance during clearing phase - Death/injuries: could be buried during clearing phase - Noise disturbance	Reducing the impact	X		X				X	X	X	X
Dicroglossidae	Fejervarya limnocharis	Cricket Frog/ Asian Grass Frog	LC	-	Cultivated land	- Habitat disturbance during clearing phase - Death/injuries if fall in the shot hole or buried during clearing activities - Noise disturbance	Reducing the impact	X		X				X	X	X	X
Elapidae	Bungarus fasciatus	Banded Krait	LC	-	Cultivated land	- Habitat disturbance during clearing phase - Death/injuries: could be buried during clearing phase - Noise disturbance	Reducing the impact	X		X				X	X	X	X
Elapidae	Naja kaouthia	Monocellate cobra	LC	-	All	- Habitat disturbance during clearing phase - Death/injuries: could be buried during clearing phase - Noise disturbance	Reducing the impact	X		X				X	X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation	
			IUCN red list (1)	Other														
Geoemydidae	Melanochelys trijuga	Indian Black Turtle	LR/NT	CITES Appendix II	The population of this species in Myanmar is even presumed to be vulnerable or endangered It is reported by the villagers to be found in the forest habitat type	- Habitat disturbance during clearing phase and crossing river - Death/injuries during clearing phase, due to their low mobility and with the borehole - Noise disturbance	Reducing the impact Safeguard of individual species	X		X					X	X	X	X
Microhylidae	Kaloula pulchra	Painted Bull Frog	LC	-	Developed area	- Habitat disturbance during clearing phase - Death/injuries if fall in the shot holl or buried during clearing activities - Noise disturbance	Reducing the impact	X		X					X	X	X	X
Phytonidae	Python molurus	Burmese Python	VU	CITES Appendix II	Declining population due to harvesting for its skin, traditional medicine and pet trade, as well as habitat degradation. Could be found in all four habitat types.	- Habitat disturbance during clearing phase (soil and trees) - Death/injuries: could be buried during clearing phase - Increase hunting pressure - Noise disturbance	Reducing the impact Safeguard of individual species	X		X					X	X	X	X
Ranidae	Humerana humeralis	Groaning Frog	LC	-	Cultivated land	- Habitat disturbance during clearing phase - Death/injuries if fall in the boreholl or buried during clearing activities - Noise disturbance	Reducing the impact	X		X					X	X	X	X
Rhacophoridae	Polypedates maculatus	Spotted Tree Frog/ Himalayan Tree Frog	LC	-	Cultivated land	- Habitat disturbance during clearing phase - Death/injuries if fall in the boreholl or buried during clearing activities - Noise disturbance	Reducing the impact	X		X					X	X	X	X

(1) 2017 IUCN red list

3.3.2.4. MAMMAL SPECIES

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			IUCN red list <sup>(1)</sup>	Other													
Canidae	Cuon alpinus	Dhole	EN	CITES Appendix II	Forest area - Declining population. 2,500 mature individuals. The main threats include ongoing habitat loss, depletion of prey base, interspecific competition, persecution and possibly disease transfer from domestic and feral dogs.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Canidae	Canis aureus	Golden jackal	LC	-	Forest area.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Cercopithecidae	Macaca mulatta	Rhesus Macaque	LC	CITES Appendix II	Forest area.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Cervidae	Muntiacus muntjak	Red Muntjac	LC	Seasonally Protected	Forest area.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Elephantidae	Elephas maximus	Asian Elephant	EN	CITES Appendix I	Forest area. Threats: habitat loss / degradation, poaching. Overall population decline of at least 50% last 60 years.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Felidae	Pardofelis marmorata	Marbled Cat	NT	CITES Appendix I	Forest-dependent so the severe deforestation is the main threat. 10,000 mature individuals.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure <u>Habitat disturbance:</u> - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Felidae	Prionailurus bengalensis	Leopard Cat	LC	CITES Appendix II	Forest area.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance <u>Habitat disturbance:</u> - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Felidae	Felis chaus	Jungle Cat	LC	-	Forest area.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance <u>Habitat disturbance:</u> - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Histricidae	Hystrix brachyura	Malayan Porcupine	LC	-	Forest area.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure - Death/injuries if fall in the shot holl or buried during clearing activities - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			IUCN red list <sup>(1)</sup>	Other													
Loridae	Nycticebus coucang	Greater slow loris	VU	CITES Appendix I	Forest area The decline is mainly due to harvesting for pet trade and extensive habitat loss	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure - Death/injuries during clearing phase, due to their low mobility - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact Safeguard of individual species	X	X	X					X	X	X
Manidae	Manis pentadactyla	Chinese pangolin	CR	CITES Appendix II Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)	Forest area Drastically declined due to high levels of poaching for meat and scales, both targeted and untargeted. Found in various habitat: primary and secondary tropical forests, limestone forests, bamboo forests, broad-leaf and coniferous forests, grasslands and agricultural fields	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure / poaching - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact Safeguard of individual species	X	X	X					X	X	X
Manidae	Manis javanica	Sunda Pangolin	CR	CITES Appendix II Wildlife and Protected Areas Law (1994) Completely Protected Animal in Myanmar	Forest area High levels of hunting and poaching for its meat. Population has declined by 80% in 21 years and is expected to continue at the same rate. The population in central and southern Myanmar is thought to be eradicated from lowland areas due to human agricultural expansion and hunting	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure / poaching - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact Safeguard of individual species	X	X	X					X	X	X
Mustelidae	Arctonyx collaris	Hog Badger	VU	-	Forest area Population in Myanmar may be severely threatened, but more research and monitoring is needed to quantitatively determine the effect of exploitation on the population	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X	X					X	X	X
Sciuridae	Callosciurus erythraeus	Pallas's squirrel	LC	-	Forest area, developed area & cultivated land	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Suidae	Sus scrofa	Eurasian Wild pig	LC	-	Forest area.	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X



Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			IUCN red list <sup>(1)</sup>	Other													
Ursidae	Helarctos malayanus	Sun Bear	VU	CITES Appendix I	Forest area. It is forest-dependent and hence habitat loss/fragmentation due to deforestation is a severe threat to this species. It is believed that the population has declined more than 30% over the last 30 years and is expected to continue	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Increase of hunting pressure - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Viverridae	Arctictis binturong	Binturong	VU	-	Forest area. Affected by over-exploitation, shrinkage in distribution, habitat destruction and degradation, and wildlife trade. Habitat loss is reported to be the predominant factor of the population decline	- Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X	X					X	X	X
Viverridae	Paradoxurus hermaphrodites	Common Palm Civet	LC	-	Forest area.	- Death/injuries if fall in the shot holl - Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X
Viverridae	Viverricula indica	Small Indian Civet	LC	Totally protected under the Wildlife Act of 1994	Forest area.	- Death/injuries if fall in the shot holl - Noise: from workers and activities as drilling and explosive (temporary): behaviour disturbance - Habitat fragmentation due to clearing activities (temporary)	Reducing the impact	X	X						X	X	X

(1) 2017 IUCN red list



3.3.2.5. FISH SPECIES

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation
			IUCN red list <sup>(1)</sup>	Other													
Anabantidae	Anabas testudineus	Climbing perch	DD	-	Pyin Bone Gyi market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Bagridae	Mystus vittatus	Striped dwarf catfish	LC	-	Kyiksakaw market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Belonidae	Xenentodon cancula	Freshwater garfish	LC	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Channidae	Channa striata	Snakehead Murrel	LC	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Clariidae	Clarias batrachus	Walking catfish	LC	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Cobitidae	Lepidocephali chthys berdmorei	Burmese loach	LC	-	Kyiksakaw market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Cyprinidae	Common carp	Cyprinus carpio	VU	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Cyprinidae	Cirrhinus mrigala	Mrigal carp	LC	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Cyprinidae	Catla catla	Catla	LC	-	Kyiksakaw market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Cyprinidae	Systemus rubripinnis	Javaen barb	DD	-	Kyiksakaw market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X
Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	-	Kyiksakaw market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X

Family	Binomial name	Common name	Conservatory status		Habitat	Predicted impact (without measures implementation)	Type of measure	Planning and period issues	Vegetation clearing organisation	Displacement / scaring system for fauna species	River crossing	Drilling organisation and management	Erosion and run-off management	Rehabilitation	Implementation of an Environmental Unit	Management system	Formation	
			IUCN red list <sup>(1)</sup>	Other														
Gobiidae	Glossogobius giurus	Tank goby	LC	-	Pyin Bone Gyi market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X	X
Mastacembelidae	Macrogobius zebrinus	Zebra spiny eel	LC	-	Pyin Bone Gyi market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X	X
Notopteridae	Notopterus notopterus	Bronze featherback	LC	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X	X
Schilbeidae	Silonia silonia	Silond catfish	LC	-	Pyin Bone Gyi market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X	X
Siluridae	Wallago attu	Wallago	NT	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X	X
Siluridae	Ompok bimaculatus	Butter catfish	NT	-	Moyingyi Ramsar site	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X	X
Synbranchidae	Monopterus albus	Asian swamp eel	LC	-	Pyin Bone Gyi market	- Increase of fishing - Habitat modification during clearing phase, river crossing and drilling phase - Increase SM: erosion of disturbed area - Destruction of potential spawning area	Reducing the impact	X			X		X	X	X	X	X	X

(1) 2017 IUCN red list

### 3.4. SPECIES ISSUES FOR THIS PROJECT

TREES – 2 species	
<b><u>Species, protection status and photo</u></b>	
<p><b>Kanyin</b> (<i>Dipterocarpus alatus</i>) – Endangered in the IUCN red list</p>  <p><i>Naturalist.org</i></p>	<p><b>Dahat teak</b> (<i>Tectona hamiltoniana</i>)- Endangered in Myanmar</p>  <p><i>Wikipedia</i></p>
<b><u>Ecology of the species</u></b>	
<p><i>Dipterocarpus alatus</i> is a medium-sized to fairly large tree of up to 40 m tall (sometimes more), bole tall, straight, cylindrical, branchless up to 20 m, up to 150 cm in diameter.</p> <p><i>D. alatus</i> is native to both evergreen and dry deciduous forests.</p>	<p>They are large trees, growing to 30–40 m (90–120 ft.) tall, deciduous in the dry season. Daha teak is a local endemic species confined to Myanmar.</p>
<b><u>Impacts for the species to the project</u></b>	
<p>Two kinds of impact related to vegetation clearing during the preparation of the layout could be identified, depending on the project area. Several individuals could be cut for the creation of the seismic line in the cultivated land, on 1.5 m-width, or during development of road and work camps.</p> <ul style="list-style-type: none"> <li>-Temporary impact: reduction of the habitat and forest fragmentation</li> <li>- Permanent impact: potentially emblematic plant species destruction if they are on the right-of-way</li> </ul> <p>Various indirect impacts may result from vegetation clearing: landscape in high slope area, pollution of the streams due to suspended sediment carried by surface run-off and destabilization of rivers banks.</p> <p>Moreover, accidental event (fire or poor management of liquid discharges and waste) may result in disturbance/degradation of the habitat.</p>	
<b><u>Note</u></b>	
<p>Note that the impacts for these two tree species also apply for all trees of the project area concerned by the seismic layout right-of-way.</p>	

**CULTIVATED AREA BIRDS – 2 species**

**Species, protection status and photo**

**White throated babbler** (*Turdoides gularis*) – Least Concern in the IUCN red list and Protected in Myanmar



Wikipedia

**Burmese Bushlark** (*Mirafra microptera*) – Least Concern in the IUCN red list and Protected in Myanmar



Oiseaux.net

**Ecology of the species**

Species endemic to Myanmar, the global population size has not been quantified, but the species is described as common. It seems to be a bird of cultivated area.

Breeding season almost all year with a peak from March to May. The nest is placed in a bush, a hedge or even in trelliswork on house verandas.

Although the global population of the Burmese bush lark has not yet been quantified, it is believed to be locally numerous within its sizable range in central Myanmar, where it is endemic.

The Burmese bush lark is a common denizen of a variety of habitats, including grasslands, fallow farm fields, sandy areas, and arable land, especially those with some trees and shrubs.

Breeding season is little studied. It seems often to begin in late March, but the main period is mainly from May to June and may continue until October.

**Impacts for the species to the project**

Due to their high mobility, birds in general are not really impacted directly by the project. They will be temporarily affected by noise related to workers, clearing and drilling activities. They will move to similar habitat and will return once the disturbance is over.

The loss of crops and bush during clearing phase reduces their habitat; nevertheless it is common in the project area. During the operation time, these birds species can find easily a favourable temporary environment.

The main issue for the birds concerns the reproduction period. During the bird nesting period, nests and eggs are found in bushes or on the ground (ground-nesting – potentially on crops), but the clearing activities and crop destruction for the layout opening and the workers trampling during the survey may induce injuries or death of chick and destruction of the eggs.

**Note**

The above mentioned impacts also apply to other bird species found in cultivated areas.

**FOREST BIRDS – 3 species**

**Species, protection status and photo**

**Hooded Treepie** (*Crypsirina cucullata*) – Near Threatened in the IUCN red list



*Oriental bird images*

**Ecology of the species**

Endemic to the dry zone of central Myanmar. Common species but important population decrease due to habitat loss through agricultural development.

Its natural habitats are subtropical or tropical moist lowland forests and subtropical or tropical dry shrubland.

It nests in a small tree or in a shrub and lays 2 or 4 eggs between May and June.

**Psittacula finshii** (*Grey-headed Parakeet*) - Near Threatened in the IUCN red list and Appendix II of CITES



*Hbw*

**Hill Myna** (*Gracula religiosa*) – Least Concern in the IUCN red list and Appendix II of CITES



*Oiseaux.net*

**Ecology of the species**

Native species in Myanmar and countries around. It resides on deciduous forest hillsides, farmland with scattered trees. The grey headed parakeet has a widely varied diet of different species of leaf buds, seeds, fruit, berries, and flowers.

After their breeding season from January–March, females often lay a clutch of 4-5 eggs.

The grey-headed parakeet is often captured in the exotic bird trade and many are locally kept as pets.

This species occurs in moist or semi-evergreen forest in lowlands, hills and mountains. It is known for its ability to mimic noises including human speech.

The breeding season for the Hill myna varies slightly depending on range, but most breed in April-July. A monogamous pair searches for a small hole in a tree at the forest edge.

**Impacts for the species to the project**

Due to their high mobility, birds in general are not really impacted directly by the project. They will be temporarily affected by noise related to workers, clearing and drilling activities. They will move to similar habitat and will return once the disturbance is over.

The loss of trees during clearing phase reduces their habitat; nevertheless it is common in the project area. During the operation time, forest birds can easily find a favourable temporary environment.

The main issue for the birds concerns the reproduction period. During the bird nesting period, nests and eggs are found in the trees, but the felling these trees for the layout opening may induce injuries or death of chick or eggs.

**Note**

The above mentioned impacts also apply to the other forest birds encountered in the project area. Bird are highly mobile species, thus these species also could be encountered in cultivated land.

**SNAKE – 1 species**

**Species, protection status and photo**

**Burmese Python** (*Python molurus*) – Vulnerable in the IUCN red list and Appendix II of CITES



*reptile-database.reptarium*

**Ecology of the species**

Indian pythons are found in a variety of habitats including rainforests, river valleys, woodlands, scrublands, grassy marshes, and semi rocky foothills. They are usually found in habitats with areas that can provide sufficient cover. This species is never found very far from water sources, and seems to prefer very damp terrain.

These snakes are primarily found on the ground, but will sometimes climb trees.

During colder months, starting in October and ending in February, pythons stay hidden and will usually enter a brief period of hibernation until the temperature rises again.

**Impacts for the species to the project**

During clearing and drilling activities, snakes may become injured, killed or buried as they seek refuge in a tree or below ground to avoid ground disturbances. Deaths of a few individual animals will have little effect upon populations unless they are from a small population of a rare species.

Project activities will generate a variety of noise sources. The most significant noise and vibration pollution will be generated by the vibroseis trucks and workers' presence. This noise could disturb the species and cause them to feel unsafe. Nevertheless, this aspect is temporary.

Several snake species, Burmese python in particular, are hunted for its skin. The presence of numerous local workers may increase the hunting pressure on these species if they are encountered during the survey.

**Note**

The above mentioned impacts also apply to other snake species encountered in the project area. Nevertheless, snakes may be in transit and pass through cropland.



**TURTLES – 1 species**

**Species, protection status and photo**

**Indian Black Turtle** (*Melanochelys trijuga*) – Near Threatened in the IUCN red list and in the Appendix II of CITES



*Wikipedia*

**Ecology of the species**

The Indian black turtle (*Melanochelys trijuga*) or Indian pond terrapin is a medium-sized freshwater turtle species found in South Asia. It inhabits a variety of water bodies including ponds, marshes streams, rivers and artificial water bodies. The species is most active during early morning and evening, spending most of the day basking in the sun. The Indian black turtle breeds in the ground during the wet season, between August and October. Eggs have an incubation period of 60–65 days, hatching during summer.

This species is under pressure, mostly due to hunting for consumption and pet trade.

**Impacts for the species to the project**

During clearing and drilling activities, turtles may become injured, killed or buried as they seek refuge in water or below ground to avoid ground disturbances. Moreover due to their low mobility, the species which are on the layout cannot escape the area the same way as birds or large mammals.

The species could also get injured because of shot holes: the little fauna may fall into or be trapped in a borehole, implying potential injuries.

Project activities will generate a variety of noise sources. The most significant noise and vibration pollution will be generated by the vibroseis trucks and workers' presence. This noise could disturb the species and make them feel unsafe. Nevertheless, this aspect is temporary.

**Note**

The above mentioned impacts also apply to other turtle species encountered in the project area, in particular close to wetland area.

**BINTURONG – 1 species**

**Species, protection status and photo**

**Binturong** (*Arctictis binturong*) – Vulnerable in the IUCN red list



*Wikipedia*

**Ecology of the species**

The ecology of this species is poorly known and might vary between areas; information about diel activity is conflicting. Binturongs are confined to tall forest and are active during the day and at night. The binturong is essentially arboreal where they climb skilfully, albeit slowly, progressing with equal ease and confidence. Nevertheless, it is a heavy species and must descend to the ground to go from one tree to another. When threatened, the binturong will usually flee into a nearby tree.

There doesn't seem to be a reproductive season for binturongs, because they mate throughout the year. There is, however, an increase in births from January to March.

Major threats to the binturong are habitat loss and degradation of forests through logging and conversion of forests to non-forest land-uses.

**Impacts for the species to the project**

Direct death or injury of individuals during habitat clearing. Arboreal species may incur increased mortality from clearing if they are in the trees during the trees' felling.

Workers and vibroseis truck will generate noise, causing disturbance on fauna behavior. Due to its temporary aspects and the fact that the species is able to move easily this impact is negligible, except if the disturbance occurs during reproduction period or with young.

**Note**

Binturong lives in the forest area and the seismic survey is conducted in cultivated area, thus these mammals are not expected to be seen in the cropland.

**PANGOLIN – 2 species**

**Species, protection status and photo**

**Chinese pangolin (*Manis pentadactyla*)** – Critically Endangered in the IUCN red list, Appendix II of CITES and Wildlife and Protected Areas Law (1994)



Wikipedia

**Sunda Pangolin (*Manis javanica*)** – Critically Endangered in the IUCN red list, Appendix II of CITES and Wildlife and Protected Areas Law (1994) Completely Protected Animal in Myanmar.



Wikipedia

**Ecology of the species**

Chinese pangolins are rather secretive, nocturnal creatures. They move very slowly and are known for their nonaggressive behavior. The Chinese pangolin digs long burrows in the ground, which they use to sleep and hunt for termites although it is fully capable of climbing trees and, like other pangolins, swims well. Pangolins can be found in primary and secondary tropical forest.

The Chinese pangolin reproduces in late spring to early autumn and gives birth usually from late in the autumn to early spring. The period of maternal care is approximately three to four months.

Pangolins as a genus are among the most heavily poached and exploited protected animals. Like other pangolin species, the Chinese pangolin is hunted for its skin, scales, and meat, used in clothing manufacture and traditional medicine

It prefers forested habitats (primary, secondary, and scrub forest) and plantations (rubber, palm oil). A large part of its life is spent in trees, it is a more arboreal species than the Chinese pangolin. They often climb to access ants nests in trees. They sleep in hollows either in, or at the base of, trees, but have also been known to dig burrows in soil.

Pangolins give birth annually to one or two offspring. They breed in the autumn, and females give birth in the winter burrow. Parental care is given for about three months.

Pangolins as a genus are among the most heavily poached and exploited protected animals. Like other pangolin species, the Sunda pangolin is hunted for its skin, scales, and meat, used in clothing manufacture and traditional medicine.

**Impacts for the species to the project**

Pangolins are a low-mobility species, so they are very vulnerable during the clearing phase: they are not able to escape rapidly to a safe environment. Moreover, Sunda Pangolin is known to climb in trees and live at the base of trees, thus they could be injured during the felling of trees.

Noise generated by the seismic survey (using of vibroseis trucks) will be localized and short term. Nevertheless if a Pangolin is close to the work area, noise is likely to disturb it, in particular if it is during the reproduction period or parental care.

Lastly, presence of workers could increase the hunting pressure, already strongly present for these species.

**Note**

The above mentioned impacts also apply to the other low-mobility species encountered in the project area, such as the Greater slow loris. Moreover, these species lives in the forest area and the seismic survey is conducted in cultivated area, thus these mammals are not expected to be seen in the cropland.

**BALISAUR – 1 species**

**Species, protection status and photo**

**Hog Badger (*Arctonyx collaris*)** – Vulnerable in the IUCN red list



*Wikipedia*

**Ecology of the species**

The hog badger is active by day and not very wary of humans. Greater Hog Badger is active throughout the day and night, and it is a ground-dwelling species. This species occurs across a wide variety of habitats, from heavy forest (both deciduous and evergreen) to the non-forested 'countryside'; this includes grassland-dominated floodplains.

Relatively little is known of its mating behaviour, although mating has been reported to take place in May in the wild. Many sources suggest that, as with many other species of the mustelid family, delayed implantation takes place; this is when the fertilised egg is not immediately implanted in the wall of the uterus, but is suspended in a state of dormancy for a time, allowing the young to be born in March or February when food is in abundant supply.

As a forest-dwelling animal, the major threat to the hog badger is large-scale deforestation.

**Impacts for the species to the project**

Balisaur do not appear to be afraid of human presence. This implies potential injuries if they stay on the layout during the clearing phase.

Noise generated by the seismic survey (using of vibroseis truck) will be localized and short term. Nevertheless if a Balisaur is close to the work area, noise is likely to disturb it.

Lastly, presence of workers could increase the hunting pressure, in particular if they not flee.

Moreover, the balisaur lives in the forest area and the seismic survey is conducted in cultivated area, thus these mammals are not expected to be seen in the cropland.

**Note**

Balisaur lives in the forest area and the seismic survey is conducted in cultivated area, thus these mammals are not expected to be seen in the cropland.

**FISH – 19 species**

**Species, protection status and photo**

**Common carp** (*Cyprinus carpio*) – Vulnerable in the IUCN red list



Wikipedia

**Ecology of the species**

Little information is available on river environment and fish habitat.

**Impacts for the species to the project**

The erosion of disturbed areas (during clearing phase) of ground is likely to result in sediment runoff down gradient into the streams.

Increased sediment loading could alter the natural physical conditions (water quality and form) of streams in such a way that diminishes their capacity to support aquatic ecosystems. Potential changes include increased turbidity of the water as well as sedimentation, with subsequent changes to the quality and diversity of habitats (substrates) available to aquatic species.

Moreover, clearing riparian flora could make the banks unstable.

The riparian and aquatic ecosystems are adapted to certain flow and water supply conditions. Abstraction of surface water from the nearby tributary could alter river flow volumes and thus disturb the ecosystem. As no water from the streams is required for the project, no impact is anticipated on tributaries water volume.

Workers and vibroseis trucks could cross watercourses.

## 4. MEASURES SHEETS

<b>Measure Code</b>	
<b>PLANNING AND PERIOD ISSUES</b>	
<b>MAR - 1</b>	
<b>Project phase</b> <b>Preparation survey: clearing phase</b>	<b>Concerned habitat and/or species</b> All avifauna, herpetofauna and mammals species during their birth period and parental care period.
<b>Measure type (ERC)</b> <b>A - R</b> <i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i>	Nevertheless, several species are more concerned due to their sensitivity (threatened species), and this applies specially for species detailed in the data sheets of the §. 3.4.
<b>Objective (s)</b> Understanding the species' ecological cycles enables optimizing the timetable for carrying out the work and avoiding destruction of individual species in forest environment. This measure applies to wildlife on the layout right of way.	
<b>Measure description</b> The clearing and brushing phase is a key moment for this project, because of the risk of a significant impact on the forest environment and associated fauna. This measure concerns both forest and bush environment.  Generally, the more sensitive periods for the forest and bush species are reproduction/nesting/birth/parental care periods. Other periods like hibernation for herpetofauna need to be taken in consideration, as their physiological state does not allow them to flee from danger. See the table below for the periods.  Thus, the choice of the relevant period is essential to avoiding or reducing the impact on the fauna. January-March period seems to be the least favourable, with the birth of low mammals like pangolin and birds' nesting. The sensitivity is less important during other months, except between April and August and November / December when more care should be taken (with ecologist advice).  The choice of the best period must be included in each measure.	
<b>Monitoring and reporting</b> Monitoring and external review by the environmental unit.	
<b>Environmental organization and responsibilities</b> Responsibility of the Company in charge of the clearing activity. Final validation by PHE	

	Common name	Binomial name	Sensitive period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avifauna	Burmese Bushlark	Mirafr microptera	LC - Protected in Myanmar Mainly breeding period between May and June												
	Hooded Treepie	Crypsirina cucullata	NT Eggs between May and June												
	Grey-headed Parakeet	Psittacula	NT - CITES Apx II Breeding season from January to March												
	Hill Myna	Gracula religiosa	LC - CITES Apx II Most breed in April-July												
	White-throated Babbler	Turdoides gularis	LC - Protected in Myanmar Breeding all the year with a peak between March to May												
Herpetofauna	Indian Black Turtle	Melanochelys trijuga	VU - CITES Apx II Reproduction period all the year. Hibernation between October and February												
	Burmese Python	Python molurus	NT - CITES Apx II The breeding season is between August to October												
Mammals	Chinese pangolin	Manis pentadactyla	EN - CITES Apx II - Wildlife and Protected Areas Law Birth usually late in autumn to early spring Maternal care of 3 to 4 months												
	Sunda Pangolin	Manis javanica	CR - CITES Apx II - Wildlife and Protected Areas Law Birth usually in winter Maternal care of 3 months												
	Hog Badger	Arctonyx collaris	VU Births in March / February												
	Binturong	Artictis binturong	VU Reproductive season all the year but increase of births from January to March												
Fish	Common carp	Cyprinus carpio	VU	?	?	?	?	?	?	?	?	?	?	?	?

Favourable intervention
Defavourable intervention period
Possible intervention, with ecologist agreement

NB : As mentioned in the sheets species above, these sensitive species are not really expected to occurs close the seismic acquisition due to the survey will operate in cultivated area and not in the forest area, that is their habitat.

<p><b>Measure Code</b></p> <p><b>VEGETATION CLEARING/BRUSHING AND ORGANISATION</b></p>	<p><b>MR - 1</b></p>
<p><b>Project phase</b></p> <p><b>Preparation survey: clearing phase</b></p>	<p><b>Concerned habitat and/or species</b></p> <p>Directed concerned habitats are the habitats of the project area, forest, cultivated land, developed area and river. Indirectly, species living in these habitats could be affected by the clearing activities. Sensitive tree species.</p>
<p><b>Measure type (ERC)</b></p> <p><b>R</b></p> <p><i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i></p>	
<p><b>Objective (s)</b></p> <p>Limit cleared areas to the essential minimum for the project, to minimize impacts on the associated tree species and fauna.</p>	
<p><b>Measure description</b></p> <p><u>Preliminary investigations</u></p> <p>A key to minimizing the impacts to the forest is to be able to recognise the ecological (and/or economic) value of the bush, hedge, groves and individual trees. Preliminary investigations to identify the position and height of individual trees/groves/hedges/ bush with sensitive issues will be carried out as a support tool for precisely locating areas to be cleared with minimum impact.</p> <p>A specialist with a suitable background in one of the natural sciences (biology, forestry...) accompanied by a local guide will further evaluate site conditions prior to any clearing operations. Trees worth preserving will be identified (e.g. particularly protected species, commercially harvested species –which usually end up being rare due to overharvesting, trees used by birds or mammals, etc.), entered into the GIS and tagged for preserving. If possible, clearing activities should be performed before the nesting periods and the nests creation. If not, special attention will be given for the trees to cut.</p> <p><u>Clearing technic</u></p> <p>Even if the project takes place in cultivated land, large trees, bush, hedges or groves could be encountered and located in the right-of-way of the layout. As much as possible trees will be circumvent, but if not possible it must be cut down (to accommodate largest vehicles as vibroseis trucks). The width of seismic lines will be no greater than 3 or 4 meters. Little clearing is expected, however, where necessary, the following conditions will apply:</p> <p>For smaller trees, the ones with harder woods and with more crooked shapes (a sign of long age and slow growth) will be preserved in priority. Insofar as possible, the individuals to be preserved will be identified. Trees with diameter above 20 cm will not be cut.</p> <p>All trees shall be felled using controlled directional felling techniques to minimize damage, felling them away from where they could get entangled in the remaining canopy. Vines shall be cut prior to felling when this helps preserve better control of the felling.</p> <p>Then, only manual (chainsaw and hand tools) felling will be authorized. Consider using dollies for moving logs rather than dragging them.</p> <p>For the rehabilitation of critical areas and workers' training, see relevant measures sheet (MA2 and MR5).        No clearing will be performed in the protected area (wetland).</p>	



**Monitoring and reporting**

- the number of preserved trees
- the respect of the trees markup (only the trees with mark will be cut down)
- Photographic monitoring will be performed: photograph before and during operations, followed by photograph after site restoration.

**Environmental organization and responsibilities**

Activities implemented by the Company in charge of the clearing activity and fauna experts.  
Environmental unit will monitor the measures.

<p><b>Measure Code</b></p> <p><b>DISPLACEMENT / SCARING SYSTEM FOR FAUNA SPECIES</b></p>	<p><b>MR - 2</b></p>
<p><b>Project phase</b></p> <p><b>Clearing survey</b></p>	<p><b>Concerned habitat and/or species</b></p> <p>Nests of avifauna (displacement)</p>
<p><b>Measure type (ERC)</b></p> <p><b>R</b></p> <p><i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i></p>	<p>Low mammals species and herpetofauna for displacement Large mammals species for scaring system</p>
<p><b>Objective (s)</b></p> <p>Reducing accidental deaths or injuries to individual species, young and nests, in particular for sensitive species, by moving the species or making them flee.</p>	
<p><b>Measure description</b></p> <p><i>Preliminary investigation</i></p> <p>Just before the crew clearing, fauna experts have two responsibilities:</p> <ul style="list-style-type: none"> <li>- scaring system for birds, herpetofauna and mammals. Note that the noise generated by the operations and workers' presence already allows high mobile species (birds, large mammals, monkeys) to flee. Note that the project mainly occurs in cultivated area where monkeys and large mammals are not really expected to see.</li> <li>- displacement of low mobility species and herpetofauna: sensitive species encountered on the layout will be captured and released ASAP (in particular species unsuitable to captivity) in a suitable place, similar habitat as those currently used with enough food and free of poaching (the whole block is regarded as similar habitat). Moreover, it is also recommended to check the immediate vicinity of shot hole locations for presence of low mobility fauna, such as turtles, and if found they will be relocated to a safe distance away from the drilling activity.</li> </ul> <p>During this activity, all burrows and cavity-nesting in the trees encountered on the layout right-of-way will be checked to ensure that it is empty if the trees need to be cut or if drilling must be carried out nearby. For trees with cavities, a "soft felling" procedure will be implemented.</p> <p><i>Every morning</i></p> <p>Just before the beginning of the day, fauna experts will check the layout or the drilling location to ensure that no individuals have come back during the night.</p> <p><i>Other</i></p> <p>If the fauna experts involved in this displacement procedure are hunters, the risk of poaching is high. It is highly desirable to recruit paid ecologists/experts.</p>	
<p><b>Monitoring and reporting</b></p> <p>Reporting :</p> <ul style="list-style-type: none"> <li>- number of displaced individual species</li> <li>- population monitoring on their new place</li> </ul>	
<p><b>Environmental organization and responsibilities</b></p> <p>Realisation by the fauna experts</p> <p>Implementation and monitoring by PHE (environmental unit)</p>	

<p><b>Measure Code</b></p> <p><b>RIVER CROSSING</b></p>	<p><b>MR - 3</b></p>
<p><b>Project phase</b></p> <p><b>Seismic surveying</b></p>	<p><b>Concerned habitat and/or species</b></p>
<p><b>Measure type (ERC)</b></p> <p><b>R</b></p> <p><i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i></p>	<p>Riparian vegetation</p> <p>Fish species</p>
<p><b>Objective (s)</b></p> <p>Preserve aquatic habitats and water quality by optimizing the river crossing.</p>	
<p><b>Measure description</b></p> <p><u>Additional investigation</u></p> <p>Little information regarding the river habitat is known; several investigations should be conducted by experts and an ecologist before the beginning of the clearing survey. These investigations provide information on:</p> <ul style="list-style-type: none"> <li>- Rivers conditions and flow</li> <li>- Existing spawning areas</li> <li>- Type of riparian vegetation.</li> </ul> <p>After the survey, this measure will have to be updated with the new elements.</p> <p><u>General guidelines</u></p> <p>The seismic lines will cross various creeks as well as a number of watercourses, some of which may be seasonal and not necessarily flowing at the time of the survey. The project involves only pedestrian traffic across these watercourses; no large engine is expected to drive directly through. Aquatic habitats may be disturbed locally and turbidity may increase as a result of suspended sediment generated at the crossing locations or from the sediment load of runoff from the seismic lines. Watercourse beds or water flow rates may also be modified if no care is taken:</p> <ul style="list-style-type: none"> <li>- Conduct preliminary field reconnaissance ahead of the team to choose suitable thalweg crossing places limiting the risk of increasing turbidity, interrupting water flows, destroying spawning areas and destabilizing the banks (see clearing vegetation measure sheet – MR1).</li> <li>- Favour crossing techniques, which conserve natural water flow and do not modify watercourses</li> <li>- Use existing bridge if any</li> <li>- Choose insensitive water material, as wood logged, to construct the rivers crossings.</li> </ul>	
<p><b>Monitoring and reporting</b></p> <ul style="list-style-type: none"> <li>- monitoring of the riverbank stability</li> <li>- water quality monitoring in specific point</li> </ul>	
<p><b>Environmental organization and responsibilities</b></p> <p>Responsibilities of the Company in charge of the clearing phase and seismic survey.        Implementation and monitoring by PHE (environmental unit)</p>	

<b>Measure Code</b>  <b>EROSION AND RUN-OFF MANAGEMENT</b>	<b>MR - 4</b>
<b>Project phase</b>  <b>Preparation survey (clearing phase) + seismic surveying</b>	<b>Concerned habitat and/or species</b>
<b>Measure type (ERC)</b>  <b>R</b>  <i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i>	All areas with an erosion risk, as cultivated area or river and banks habitats and fauna associated
<b>Objective (s)</b> Avoid sediment runoff down gradient into watercourses due to the erosion of disturbed areas of ground (after clearing, for example) for no change in the quality and diversity of habitats (substrates) available to aquatic species.	
<b>Measure description</b> Riverbanks (no matter how large is the stream), and slope could be the areas the most affected by erosion and run-off issues. Cultivated areas are particularly concerned by this issues because of the soil is already exposed (bare soil). Moreover, the used of vibroseis trucks could be severely affect the soil with the wheel tracking. Several actions to limit these problems could be implemented: <ul style="list-style-type: none"> <li>- Area susceptible to erosion will be not completely cleared area (see Measure sheets "Vegetation clearing and organisation" - MR1 and "river crossing" – MR3), low vegetation is maintained, as stumps on riverbanks. Preserve a minimum of vegetation allow reducing run-off and blocking sediment.</li> <li>- Respect existing drainage patterns, particularly during ground preparation on sloping areas. Felling debris shall not be abandoned on stripped soil as they tend to cause erosion locally.</li> <li>- Create a temporary drainage system with rainwater collection system to avoid uncontrolled run-off water and mud slides and treat it before discharges in the environment.</li> </ul> In disturbed areas, where this issue is important, two options may be used, depending on the risk and in discussion with an ecologist: <ul style="list-style-type: none"> <li>- cover the concerned area with a geotextile membrane fixed into the ground (high risk area)</li> <li>- pack topsoil on bare ground without particular protection.</li> </ul>	
<b>Monitoring and reporting</b> A post-operational survey will be conducted to ensure that there are no pending erosion control issues	
<b>Environmental organization and responsibilities</b> Responsibilities and realisation of the Company in charge of the clearing in collaboration with the ecologist. Implementation and monitoring by PHE (environmental unit)	

<p><b>Measure Code</b></p> <p><b>IMPLEMENTATION OF AN ENVIRONMENTAL UNIT</b></p>	<p><b>MAc - 1</b></p>
<p><b>Project phase</b></p> <p><b>Pre-survey</b></p>	<p><b>Concerned habitat and/or species</b></p>
<p><b>Measure type (ERC)</b></p> <p><b>Ac</b></p> <p><i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i></p>	<p>All</p>
<p><b>Objective (s)</b></p> <p>Establish an operational team in charge of monitoring the good application of proposed environmental mitigation measures.</p>	
<p><b>Measure description</b></p> <p>The environmental unit is composed of several experts:</p> <ul style="list-style-type: none"> <li>- The ecologist / environmental expert named by PHE who is in charge of all the supervision of the BAP and monitoring and reporting of the implemented measures. He is the first contact person between PHE and other experts / team leaders. He is also coordinating the experts' group and he interfaces with local administration.</li> <li>- Fauna and flora experts who support the ecologist. They have the specific knowledge regarding particular taxa. These experts are with the work teams, on the work area. They have an important function during the clearing phase and also during the rehabilitation phase.</li> </ul>	
<p><b>Environmental organization and responsibilities</b></p> <p>Implementation by PHE environmental unit</p>	

<b>Measure Code</b>	
<b>MANAGEMENT SYSTEM</b>	<b>MAcM 1</b>
<b>Project phase</b>	<b>Concerned habitat and/or species</b>
<b>All</b>	
<b>Measure type (ERC)</b>	All
<b>Ac - S</b> <i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i>	
<b>Objective (s)</b> Establishing monitoring and reporting tools for the implementation of mitigation measures and checking whether it is functioning correctly, and if not, propose corrective action.	
<b>Measure description</b>  All documentation will be created to report and monitor all implemented measures. The first document of the management system is the BAP, which contains all measures dedicated to this project. Then, it will find monitoring tools for implementing mitigation measures and reporting tools such as action reporting sheets and monthly reports.	
<b>Environmental organization and responsibilities</b> Implementation and monitoring by ecologist / environment expert	

<b>Measure Code</b>	
<b>TRAINING</b>	<b>MAc - 2</b>
<b>Project phase</b>	<b>Concerned habitat and/or species</b>
<b>Pre-survey</b>	
<b>Measure type (ERC)</b>	All
<b>Ac</b> <i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i>	
<b>Objective (s)</b>	
Increase workers' awareness on environmental issues on the project area and regarding the project. Give workers necessary requirements for biodiversity measures implementation in an efficient way.	
<b>Measure description</b>	
Ensure awareness for teams involved in the survey (i) prior to commencement of operations and (ii) at various moments during the operational phase. Environmental issues and measures will be presented using visual aids. Following points need to be addressed (not exhaustive): - waste management - sensitives fauna species in the project area - hunting and fishing ban - etc...	
<b>Monitoring and reporting</b>	
Number of workers sensitized Number of induction training performed during operational phase	
<b>Environmental organization and responsibilities</b>	
Implementation and monitoring by PHE (environmental unit)	

<b>Measure Code</b> <b>REHABILITATION</b>	<b>MR - 5</b>
<b>Project phase</b> <b>Close out survey</b>	<b>Concerned habitat and/or species</b>
<b>Measure type (ERC)</b> <b>R</b> <i>Avoid/Reduce/Compensate (ARC) - Monitored (M) - Accompanying (Ac)</i>	All
<b>Objective (s)</b> The purpose of restoration is to define the measures to be implemented at the end of the seismic survey. These measures will allow, at seismic survey influence zone scale, the rehabilitation the ecological functions of this zone.	
<b>Measure description</b> The rehabilitation of all damaged sites during the survey includes: <ul style="list-style-type: none"> <li>- Backfilled using original material in excavations and borings to avoid injuries of small fauna.</li> <li>- Sites will be reinstated to their original drainage condition at the end of the seismic survey, including the removal of all bridging at stream crossings. Natural drainage of the area should also be restored, where possible to ensure that the lines do not turn into drainage channels.</li> <li>- Stream banks will be rehabilitated. The stability of the banks will be checked.</li> <li>- If arrangements were built to facilitate the river crossing, they will be dismantled.</li> <li>- All waste will be collected and disposed of properly</li> <li>- Rehabilitation of initial topographic/hydrographic conditions if disturbed</li> <li>- All wheels tracks on farmland will be rehabilitated</li> </ul>	
<b>Monitoring and reporting</b> Photographs taken before, during and after the operation	
<b>Environmental organization and responsibilities</b> Realisation by the Company in charge of the clearing and seismic survey. Responsibilities and monitoring by PHE (environmental unit)	

oOo