
SAMAWA COMBINED CYCLE GAS TURBINE POWER PLANT PROJECT

ECOLOGICAL SURVEY FINAL REPORT



APRIL 2018
ANKARA



SMAWA COMBINED CYCLE GAS TURBINE POWER PLANT PROJECT

ECOLOGICAL ASSESMENT REPORT

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Executive Summary

The planned Samawa Combined Cycle Gas Turbine (CCGT) Power Plant Project is on habitats where the entire terrestrial ecosystem is dominant. However, it is planned to take intake water from an irrigation channel that feeds on Hammar Lake and is separated from the Euphrates River. This channel is approximately 600 m northeast from the Project Site. Depending on these characteristics, generally short lived, herbaceous plants are widely distributed at the Project Area that is named the desert habitat/landscape. The desert habitat/landscape represents the majority of the area of Iraq, and extends mainly along the western parts of Iraq. However, there are some deserts above the area between the rivers Tigris and Euphrates and above the areas to the east of the Tigris. This habitat harbours a wide spectrum of flora and fauna that is adapted to the extremely dry and hot conditions in Iraq, in addition to the shortage of the precipitation especially over the current decades.

In the scope of the ESIA Study, floristic site surveys are conducted within the project site and its vicinity. According to these surveys, there is no endemic plant species have been found in the project site. However, the conservation status of plant the species found in the project site are Least Concern (LC) according to IUCN. Thus, no conservation measure is suggested in ESIA. In addition, there is no record of species that have status of protected, extinct or under threat.

In the in order to define aquatic life and terrestrial fauna, field surveys and literature searches are conducted. As a result of this study, 3 amphibian, 9 reptile, 49 bird and 17 mammal species are identified as most likely to exist in the proposed project site, water intake area and its vicinity. Among the mammalian species *Myotis capaccinii* (Small-fingered Bat) is classified as VU (Vulnerable) category and the other mammals are not classified as threatened species (VU, EN, CR) according to IUCN. Among the 49 species of the birds, there are a few bird species are recorded at the Project Site, in which, many of the species are observed from the water intake area and its vicinity. In this Report, all the bird species is classified as LC (Least Concern) category according to IUCN Red List. The Project site is not located on a major migration route. In addition, there are no endemic, vanished, threatened or under conservation bird species. *Rafetus euphraticus* (Euphrates Soft-shell Turtle) is classified as EN (Endangered) category according to IUCN Red List. However, *Rafetus euphraticus* (Euphrates Soft-shell Turtle) is abundant and widely seen in Tigris and Euphrates. All amphibian species that are likely to exist in the water intake area of Project site and its close vicinity are not classified under protection criteria according to IUCN Red List.

Six species (*Alburnus mossulensis*, *Carassius aurata*, *Carasobarbus luteus*, *Luciobarbus esocinus*, *Liza abu Oreochromis* sp.) of Cyprinidae (Carps), Mugilidae (Mullet) and Cichlidae family were identified in the project area carried out in September 2017. Besides, *Capoeta barroisi*, *Carasobarbus kosswigi* and *Luciobarbus esocinus* are under protected species

according to the IUCN Red list and categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.

These circumstances gathered and constitute the main reason of low biodiversity. Therefore, the negative effects of the proposed plant project are expected to be very limited.

1. INTRODUCTION

1.1. Background of the Project

ENKA UK Construction Ltd. (Project Subcontractor) has retained 2U1K International Limited to prepare Environmental and Social Impact Assessment (ESIA) Study for the Samawa Combined Cycle Gas Turbine (CCGT) Project located in Iraq.

Terrestrial ecology has been studied in order to identify the existing biological conditions including various species inhabiting at the natural habitats at the proposed site and its vicinity for the Samawa CCGT Power Plant Project. In this context, to identify the terrestrial and the aquatic flora and fauna inventories of the Project Site, the ecological surveys were conducted on May, July and September of 2017.

This Report is aimed at revealing the findings of the above field study. The faunal and floral characteristics of the project area have been evaluated in detail along with the 3-term field work (spring, summer and autumn) in which various fauna and flora species can be observed. Critical habitats and species have been put forward and the measures to be taken in the following periods of construction and operation are mentioned in the Report.

1.2. Purpose and Scope of ESIA

The Subcontractor, ENKA, plans to apply international finance institutions (IFS) for financing of the proposed Project. Therefore, ENKA has initiated this ESIA to be prepared according to the Equator Principles (EP). The “Equator Principles” is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. The Equator Principles are based on the International Finance Corporation’s (IFC) Environmental and Social Safeguard Policies. Thus, this report also complies with IFCs guidelines that are referred by the EP.

The purpose of the ESIA is to identify potential environmental impacts of the Project to the local ecosystem during construction, operation and decommissioning phases of the Project. The ESIA also aims at providing mitigation measures to eliminate potential adverse impacts and propose a management and monitoring plan. The ESIA evaluates potential impacts in terms of additionally caused by the Project. Thus, a biodiversity baseline data is also assessed within the scope of the ESIA. The ESIA was carried in the following stages:

- Description of the existing (baseline) biodiversity conditions within the project area.
- Identification and characterization of biodiversity during construction, operation and decommissioning phases of the Project.
- Assessment of the environmental impacts of the Project.

- Identification of mitigation measures that minimize or eliminate potential impacts on flora and fauna.
- Provision of plans for monitoring programs, auditing and feedback.
- Environmental management plan.
- Requirements under Iraq laws and regulations, applicable international treaties and agreements.
- Protection and conservation of biodiversity, including endangered species and sensitive, ecosystems in modified, natural and critical habitats, and identification of legally protected areas.

1.3. Project Categorization

According to the Equator Principle 1, the project is categorized based on the magnitude of its potential impacts and risks in accordance with the environmental screening criteria of the IFC Performance Standard 6.

The project is regarded as Category A project since the project potentially expected to have “adverse impacts that may be sensitive, irreversible, and diverse”, with attributes such as direct pollutant discharges large enough to cause degradation of air, water, or soil; large-scale physical disturbance of the site or surroundings; use of hazardous materials in more than incidental quantities; and other significant social disturbances with potential limited adverse social or environmental impacts that are few in number, generally site specific, largely reversible, and readily addressed through mitigation measures.

2. LEGAL FRAMEWORK

International Framework

The national and international legislation and also standards and guidelines are considered in the course of the implementation of the biodiversity studies at the project site and assessment of the results of terrestrial and aquatic flora and fauna research studies.

Iraq is party to several conventions related with biodiversity:

- UN Convention on Biological Diversity (1997) and Cartagena Protocol on Bio-safety (2004)
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR) (1994)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1996)

CITES

CITES is the Convention on International Trade in Endangered Species of Wild Fauna and Flora. CITES is an international agreement between 164 nations (including Iraq) and its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES principles depend on the sustainable trade fundamental that is significant for protection of the ecologic resources (a vast array of wildlife products derived from a great quantity of live animals and plants, products additive to the food, exotic leather goods, etc.) in the future.

IUCN Red List of Threatened Species

International Union for Conservation of Nature (IUCN) Red List is published to draw attention to the species whose population is under risk or threatened. IUCN includes the species to the Red List after researching the reasons causing decrease in its population. IUCN Red List categories are given below:

- EX: Extinct
- EW: Extinct in the Wild
- CR: Critically Endangered
- EN: Endangered
- VU: Vulnerable
- NT: Near Threatened
- LC: Least Concern
- DD: Data Deficient
- NE: Not Evaluated

Red Book of Flora in Iraq (Flora of Iraq; Guest, 1966), which is prepared as per the 1994 IUCN Red List Categories and Criteria, is used during the determination of risk status of the flora species in the study area.

IFC Performance Standard 6

International Finance Corporation (IFC) is a member of the World Bank Group and finances the private sector. IFC applies Performance Standards (PS) to define IFC clients' responsibilities for managing their environmental and social risks. Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.

National Laws and Regulations

Laws and regulations on biodiversity conservation are given below:

- Law No 27 of 2009 for Protection and Improvement of Environment

National Environmental Plans and Programs

In order to achieve international partnership in the unified environmental work and to preserve environment under its global framework and perspective, Iraq has acceded, or is acceding, to following international agreements and conventions:

1. The Montreal Protocol and the Vienna Convention for the Protection of the Ozone Layer
2. United Nations Convention to combat Desertification (UNCCD)
3. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal
4. The Convention on Biological Diversity
5. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
6. United Nations Framework Convention on Climate Change (UNFCCC)
7. The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
8. Stockholm Convention on Persistent Organic Pollutants
9. RAMSAR Convention on wetlands
10. Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines

11. The Convention on the Conservation of Migratory Species
12. Kyoto Protocol
13. International Union for Conservation of Nature (IUCN)
14. Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction

Legally Protected Sites and Key Biodiversity Areas in Iraq

Key Biodiversity Areas (KBAs) are places of international importance for their biological diversity. Their conservation is often achieved through protected area networks and other legal protections. They are identified nationally using simple, standardized criteria, based on their importance in maintaining habitats and populations of species.

Scientific data collection and analysis play a highly influential role in underpinning the conservation and management of the KBAs. Because of a rigorous application of internationally agreed ornithological, non-avian fauna and botanical criteria, the global importance of the network of sites identified in this document is assured. Each site meets or exceeds the required, often quantitative, selection thresholds and the global standardization of the criteria facilitates comparison between sites at local, national and regional levels. Internationally many countries have legal and institutional frameworks for the designation and conservation of protected areas. Of the 82 KBAs identified in Iraq to date, currently five are wholly or partly under some form of protection by national law, and an additional two have local or regional protection, but these leaves 75 sites (over 90%) currently unprotected. The total area of the KBA sites covers almost 30,000 square kilometres, about 7% of Iraq. The effective protection and management of these sites over a relatively low percentage of the area of the country is a realistic goal that would make a significant contribution to the conservation of many bird species and other fauna and flora in Iraq. Governments, intergovernmental institutions, non-governmental organizations, the private sector and other stakeholders can use the KBAs identified in this work as the building blocks for the conservation of a national network of internationally important sites.

3. PROJECT DESCRIPTION and STUDY AREA

Iraq is bordered by Iran, Kuwait, Saudi Arabia, Jordan, Syria and Turkey. Its vegetation is roughly described as follows: about the 80 % of the country is desert, about 15 % is steppe, and about 5 % is forest and high mountain scrub. The country can be divided into four main biogeographical regions. The vegetation and landscapes are closely related with each other.

Samawa CCGT Project is located in Lower Mesopotamia. This Region is the flat flood plain of the Tigris and Euphrates rivers. The Study Area is approximately 8 km south of Euphrates River. However, there is a channel in which flowing to Hammar Lake close to Project Site which intake water is planning to be taken from this channel (see Figure 3-1). There are extensive areas of permanent or seasonal shallow lakes, including the Hammar Lake.

The Region is bounded by the north and north-eastern border of Iraq with rolling plains intersected by many, deep, well-watered valleys and gorges. Altitude varies from 500 m to over 3,500 m. There is only about 4 % of natural forest left in Iraq, nearly all of them exist in this Region, and mostly are over-exploited and overgrazed.

Iraq contains portions of the five terrestrial eco-regions identified as;

1. Tigris-Euphrates alluvial salt marsh;
2. Arabian Desert and East Sahero-Arabian Xeric Shrublands;
3. Mesopotamian Shrub Desert;
4. Middle-East Steppe; and
5. Zagros Mountains Forest Steppe.

The Project Area is mainly within or close to Tigris-Euphrates alluvial salt marsh eco-region. The eco-region is part of a former cradle of civilization (Mesopotamia), and it is surrounded by a vast region of desert and xeric shrubland. This complex of shallow freshwater lakes, swamps, marshes, and seasonally inundated plains is among the most important wintering areas for migratory birds in Eurasia.



Figure 3-1. Channel that feeds on Hammar Lake and is separated from the Euphrates River (App. 600 m away from the proposed power plant site but will include the water intake and discharge structures to serve for the project)

3.1. Study Area

The Project will be established in Samawa City in Al-Muthanna Governorate, 293 km northwest of Basra, in Southern Iraq. The area of Project Site vegetation is in a highly infertile area with almost no topsoil scraped and / or eroded.

The Google Earth view of the Project Area is shown in Figure 3-2 and some photographs from the project area are given in Figure 3-3.

The closest point to the Mesopotamian marshlands area to the Project Site is approximately 12 km away. This vast area of marshland is home to many species of aquatic plants, fish and water birds. However, there are industrial facilities around the planned Project Site. Therefore, the area is under intense anthropogenic pressure (see Figure 3-4).



Figure 3-2. Google Earth View of the Project Area



Figure 3-3. Project Area



Figure 3-4. Anthropogenic Pressure (Agriculture)

3.2. Protected Areas and Key Biodiversity Areas

There are two main protected areas in southern Iraq: proposed Mesopotamia Marshlands National Park and Hawizeh Ramsar Wetland indicated. Proposed Mesopotamia Marshlands National Park is located downstream of Euphrates River. The boundary of the above-mentioned proposed national park has not been drawn but the distance from the Project Site is about 50 km.

Twelve of the wetlands of lower Mesopotamia were listed as wetlands of international importance by Carp (1980), and all 19 of the wetlands described as Sites 13 to 31 have been identified as "Important Bird Areas" by BirdLife International (Evans, 1994). BirdLife International has also identified the Mesopotamian marshes of Iraq as an "Endemic Bird Area", i.e. an important concentration of bird biodiversity where habitat destruction would cause disproportionately large numbers of species extinctions (ICBP, 1992). The marshes qualify as one of only 221 Endemic Bird Areas in the world, and one of only 11 which are wholly or largely non-marine wetlands, because they support almost the entire world population of two species, the Basrah Reed Warbler (*Acrocephalus griseldis*) and Iraq Babbler (*Turdoides altirostris*).

3.2.1. Haur Lafta IBA and KBA

Site description

An isolated haur c.5 km north of the River Euphrates and c.80 km west-north-west of Nasiriya, fed by floodwater from the Euphrates.

Key biodiversity

The site was listed as a wetland of international importance by Carp (1980), and was considered by Scott and Carp (1982) to be possibly of great importance for wintering waterbirds, but there is no specific ornithological information available.

Non-bird biodiversity: No information available to BirdLife International.

Pressure/threats to key biodiversity

No conservation measures are known to have been taken. The site may have suffered major habitat degradation or destruction following the decline in the flow of the Euphrates since the 1970s (see site 039), however, there is no other information on current threats and no conservation measures are known to have been proposed.



Figure 3-5. Map of Samawa Power Plant area and Haur Lafta IBA- KBA

4. ASSESSMENT METHODOLOGIES

Biodiversity studies were carried out in line with the line and point transect method throughout the planned project area.

4.1. Floristic Survey Methods

The assessment of vegetation was conducted to provide information on:

- floristic composition;
- plant species including the presence or absence of species;
- profile of the vegetation type; and
- inventory of economic plants including any crops of medicinal value.

The identification of species was conducted both in situ and ex situ. Representative samples of plant species were collected and prepared as standard herbarium species, to serve as a record of the vegetative composition of the area and identification of those species not identified in the field.

A combination of line and belt transect were used for the rapid assessment of the vegetation types. The belt transects used a 10 m by 5 m plot size. The sampling included locations at either end of the proposed Project Site with all area sampled in total during the three seasons. The same sampling transects were also chosen during the all three seasons to include the proposed Site in addition to the southern and south-eastern portions of the Project Site. Figure 4-2 illustrates the sampling locations for surveying vegetation. Water intake area of the proposed Project Site flora is characterised by a combination of river side marches vegetation.

The Study Area in particular is also characterised by human activities that have impacted upon the vegetation structure. This is a result of non-intensive agricultural activity, the construction and use of roads, dwellings and other structures and footpaths.

This Report was prepared following the evaluation of the plants collected during the field studies carried out between the periods of; 22-28 May 2017, 27 July-1 August 2017 and 13-16 September 2017 in the project area of the Samawa CCGT. The area to be used as Project Site and the route to be used as cooling water for the power plant have been assessed. Plants collected by the field study were preserved according to the appropriate herbarium techniques, and the dried plants were made ready for diagnosis. 'FLORA OF IRAQ' was used for species identification. Samples for each plant species were taken in the field study in order to achieve their diagnosis.



Figure 4-1. Sampling Flora Components in Samawa CCGT Power Plant Project Site

4.2. Terrestrial Fauna Survey Methods

Methodology followed in faunistic studies is highlighted below in general terms, and details are presented in following sections.

- Fauna assessment is comprised of the mammalian (Mammalian), birds (Aves), reptile (Reptilian), amphibian (Amphibian) groups, and covers the areas that can be affected during the operation phase of the project. In addition to the area of influence, fauna assessments also consider neighboring areas for possible, similar and suitable alternative habitats such that fauna species could move.
- The study area is extended in cases where a different fauna element is encountered due to variable topography and/or vegetation structure.
- Baseline data is collected by means of field surveys, literature reviews and interviews with the local people (questionnaires) is also utilized.
- While determining the animal species and the existence of habitats for the choices of fauna, several indicators have been used such as nest-youngster-vomit-footprint of these species (especially in the determination of the bird and large mammal species), feces-food residues-burrow hole (especially in determination of mammals), skin-horn-shield and bone pieces.

- No hunting-killing was performed during the identification of species during the faunistic site surveys.
- Camera traps have been used in order to detect large (such as fox, marten, pig) and medium-sized mammals (such as squirrel, weasel), improved optic devices for diagnosis of bird species, and voice recorders for bats. Small mammalians, reptiles and amphibians have been detected by the use of insect nets, live traps (Shermann trap) and the animals captured for diagnosis were set free. Line transect and point counting methods have been used in bird diagnosis.
- Observations and non-living material in nature (especially dead reptile individuals and/or skin, shield pieces found on site) are used particularly for reptile and small mammalian species and literature information on fauna elements of these areas, previously collected museum materials, local people and animal specimens taxidermized by amateurs contributed to the prepared lists.
- 1/25,000 scaled maps and satellite images are used during fauna site surveys. Furthermore, GPS is used to detect the elevations and geographical coordinates during mapping studies.
- Site surveys were started early in the morning and continued till sunset.
- Site surveys could not have carried out at night for nocturnal species (especially bats and big mammals and snakes) because of the security limitations of the Region.
- Data on biotopes, biogenetic protection areas, endemic species, endangered species and wildlife habitats are collected and evaluated.
- The scientific name, its existence at the project site or/and outside the project site, relative population density, endemism status and existence and suitability of the alternative areas in the close proximity are included for each species in the prepared species list tables.
- IUCN Red List and CITES lists are used in determining the international risk categories of the fauna elements.

Methodologies of each fauna class applied during faunistic studies are summarized in general terms as follows:

Amphibians

Site surveys were conducted at suitable habitats at the Project Site and similar habitats in the vicinity of the area, which species may move in case their current habitats are disturbed by the project activities.

Surveys for amphibian species (salamander and frogs) were carried out at habitats (puddles, irrigation channels, arcs, humid areas, etc.) suitable for the amphibians to feed, shelter and

breed. Observations were concentrated especially at temporary riparian zones and the sites where the water flow is very low and/or stagnant.

The nest-egg-tadpole and the adult individuals of the salamander and frogs were surveyed at these areas. The bottoms of plants and stones were checked. Some species were identified visually and some were captured by catcher rod without giving any harm. Captured individuals were set free after identification and taking their photos.

Reptiles

Site surveys were conducted mostly at areas with rocky-stony habitats and tree hollows to detect the reptile species (turtles, lizards and snakes). Individuals of reptile species and burrows, eggs and youngsters were surveyed at these areas. The bottoms of plants and stones were checked, the detected species were identified via observation and/or these individuals were captured by hand and catcher rod without giving any damage. Captured individuals were set free after identification and taking their photos.

Birds

Site surveys were conducted at suitable habitats at the Project Site and alternative areas to detect the bird species at the Biodiversity Study Area. The nests, eggs, youngster and adult birds were surveyed at these areas. The biological activities of the birds (breeding, feeding, movements, etc.) at these areas were recorded. The photographs of individuals of observed bird species were taken as much as possible.

Mammals

Comprehensive studies were performed at the Project Site and suitable habitats in close vicinity with the intention to determine the mammalian species. During the studies, four camera traps have been used for the determination of the big and medium-sized mammals and voice recorders were used for finding bats. Nets and live traps (Sherman trap) are used for the diagnosis of small mammalian species. Photographs from the field survey are presented in this Report.

In addition to direct observation of the individuals of small and big mammal species, their traces and signs (feces-horn, bone, etc.) are also surveyed. The photographs of individuals of detected mammal species were taken as much as possible.

- **Camera trap Surveys:** Camera traps were placed at one location that are suitable for wildlife to detect big (such as fox, marten, pig) and medium-sized mammals (such as squirrel, weasel) and camera trap images were recorded.

- **Sherman Trap Surveys:** Live traps (Sherman traps) were placed at two distinct locations that are suitable for wildlife at the Project Site and its close vicinity to detect small (such as rodents, insectivore) and captured mammalian species were recorded.
- **Bat Surveys:** two devices that record the ultrasonic bat voices are used to detect the bat species that are active at night (nocturnal) at the Project Site. The sonograms of the bat voices recorded by these devices were analyzed and the bat species at the Project Site and its close vicinity were detected.



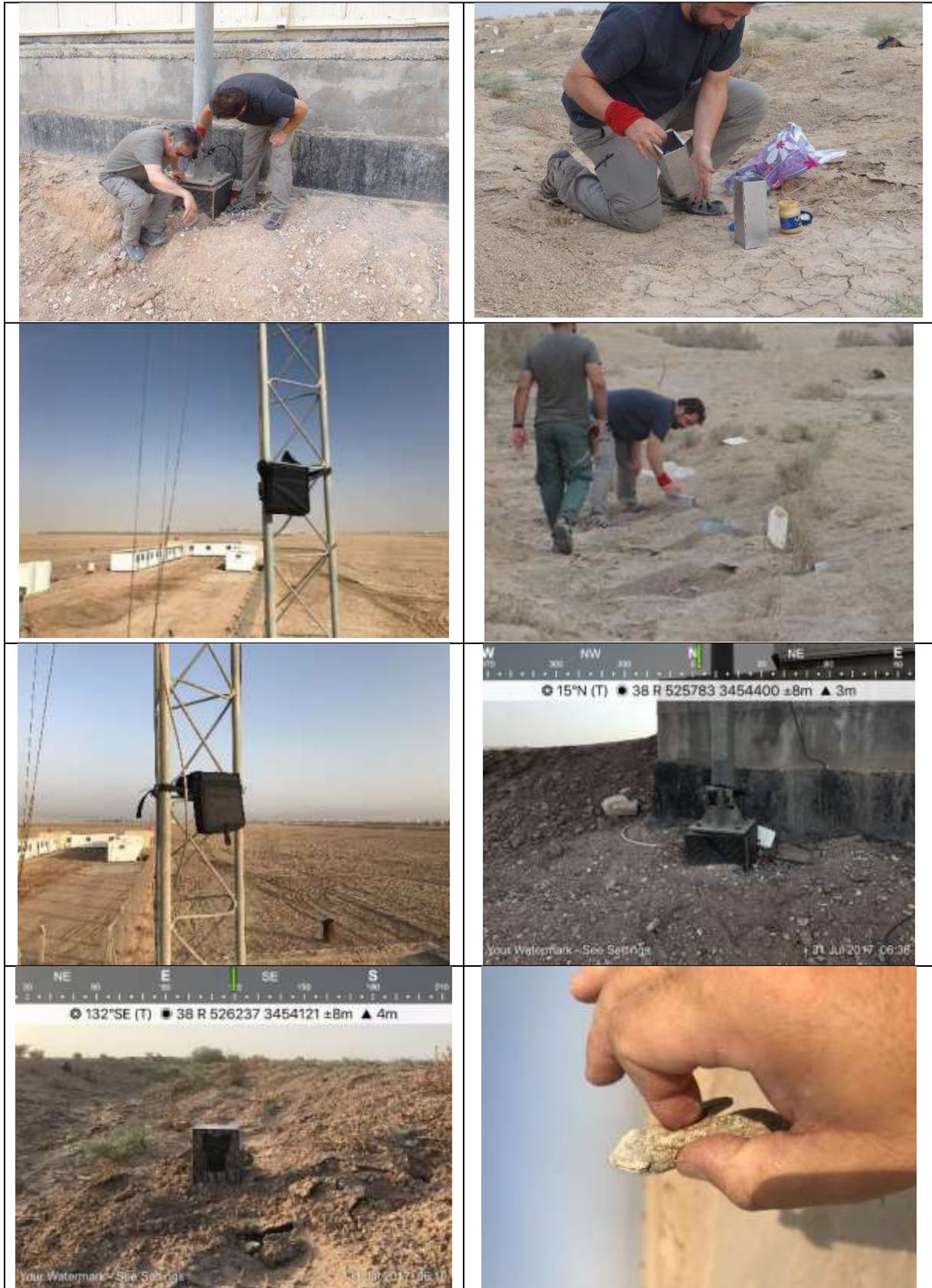


Figure 4-3. Sampling Fauna Components in Samawa CCGT Power Plant Project Site

4.3. Aquatic Flora and Fauna Survey Methods

The Project is located in Samawa region of Iraq. The water intake structure and discharge of the Project located in the Samawa region is provided from an irrigation channel that feeds on Hammar Lake and is separated from the Euphrates River.

In order to determine the aquatic fauna existing in the Project Area, a field study was carried out in May, July and September 2017 and the results obtained were interpreted to evaluate the effect of the project on the aquatic ecosystem.

Euphrates River is the longest river in southwest Asia. It is 2,800 km long. It is one of the two main constituents of the Tigris-Euphrates river system. The river rises in Turkey and flows southeast across Syria and through Iraq. Formed by the confluence of the Karasu and Murat rivers in Turkey and the Euphrates descends between major ranges of the Taurus Mountains to the Syrian plateau. It then flows through western and central Iraq to unite with the Tigris River and continues, as Shatt Al-Arab, to the Persian Gulf.

Two sampling points were selected in the study area to represent the Project Area (see Figure 4-4). When these sampling points are determined, the water intake and discharge points are taken into account.



Figure 4-4. Aquatic Sampling Points of Project Area

Aquatic ecosystems are composed of phytoplanktonic organisms (free or bound algae), zooplanktonic and benthic organisms which are fed on them which are called primary and secondary consumers, and fishes both fed on phytoplanktonic organisms, zooplanktonic and benthic organisms, and called as tertiary consumers.

Through this context, the basic rings of the food chain in the aquatic ecosystem are algae (bound forms and freeforms-phytoplanktonic organisms), zooplanktonic organisms, benthic organisms and fish. Changes in the aquatic systems may cause changes on these creatures.

Given the nature of the Project, the groups that will be most affected by the planned conversion plant are benthic organisms and fishes. For this reason, benthic organisms and fish were studied in the study. The methods for sampling the aquatic organisms mentioned above are given below.

Benthic Organisms

Benthic organisms were collected from the sand and gravel slime areas, from the mud, pebbles and rocky areas under the stones, and were found at the family and / or genus level in the field and laboratory (Figure 4-5).



Figure 4-5. Sampling of Benthic organisms

Fishes

Fish specimens, an important indicator of aquatic vertebrate animals, have been obtained by professional fishermen. Nets with various pores and fyke net were used to collect fish specimens (see Figure 4-6). The fish samples were identified on the field and left to the river system.



Figure 4-6. Sampling of Fishes

Sennika, 1943; Mann, 1962; Needham and Needham, 1962; Macan, 1982; Quigley, 1977; Pennak, 1978; Illies, 1978; Elliot and Mann, 1979; Biro, 1981; Edington, 1981; Bellman, 1988; Glöer, 1992 and Ludwig, 1993 are used to identify benthic organisms. Besides, Brian Coad website for used to check fishes of Iraq.

5. SURVEY FINDINGS

5.1. Floristic Findings

The Project area is referred to as the central alluvial plain of the lower Mesopotamian region. The project area covers delta and saline alluvial soil. (Figure 5-1 to 5-5).

The Project Area is also covered with wet, wide areas where rivers and their tributaries are almost lost. The groundwater level is so close to the surface and even is above the surface at some points. Therefore, the water above the surface is uncontrolled and cause the area to become marsh. The species recorded at these areas were mostly belonging to Chenopodiaceae, Fabaceae, Poaceae families. In addition, some species belonging to the Characeae and Potamogetonaceae families were also recorded in the pond where the plant will receive the cooling water. However, species of the Frankeniaceae, Tamaricaceae, Caryophyllaceae, Fabaceae, Poaceae and Capparaceae families were also recorded.

The dominant species in the Project Area were *Halocnemum strobilaceum* (Pall.) Bieb. and *Tamarix aucherana* (DC. ex Walp.) Baum. *Aeluropus lagopoides* (L.) Trin. ex Thw. var. *Lagopoides* also joined with small populations to this community in some local parts.



Figure 5-1 Seasonal marshes in the Samawa project area (May 2017)



Figure 5-2 Seasonal marshes in the Samawa project area (July 2017)



Figure 5-3 Seasonal marshes in the Samawa project area (July 2017)



Figure 5-4 Seasonal marshes in the Samawa project area (September 2017)



Figure 5-5 Seasonal marshes in the Samawa project area (September 2017)

The floristic list (plant species) identified by the field studies within the Project Area were given in the Annex-1 Table 1. No species was added to the floristic list by the field studies carried out in 14 July-16 September 2017 in the Project Area.



Figure 5-6 The drainage channel which the power plant cooling water will be abstracted within SAMAWA project.



Figure 5-7 *Aeluropus lagopoides* (L.) Trin. ex Thw. Var. *lagopoides*



Figure 5-8 *Tamarix aucherana* (DC. ex Walp.) Baum.



Figure 5-9 *Alhagi graecorum* Boiss.



Figure 5-10 *Phragmites australis* (Cav.) Trin. ex Steud.

5.2. Terrestrial Fauna Findings

The list of species detected during the site surveys carried out in May, July and September 2017 are presented separately for each fauna group in the subsequent sections. In these tables, the systematic categories (Phylum-Family), Latin and English names, International (IUCN, CITES) risk and protection status of these fauna species are presented together with data sources.

Amphibians

3 amphibian species were formerly detected. It was stated in the former reports that *Pelophylax ridibundus* (Eurasian Marsh frog) is detected via observations. During the site survey performed in July 2017, no amphibian species were encountered during observations in addition to *Pelophylax ridibundus* species (Annex 1-Table 3).

There is no permanent rivers and puddles suitable for amphibians to lay eggs inside the Project area. But the water intake survey area has suitable areas for breeding and sheltering for the amphibian species dependent on water. There are no endemic species among the amphibians recorded at the survey area.

According to the European Red List of IUCN, only *Bufo variabilis* is evaluated as “DD: Data Deficient” category and all remaining species are in LC (Least Concern) category. The risk and protection status and the amphibian species are given in Annex 1-Table 3.

Reptiles

13 reptile species were detected during the former surveys conducted ,n May 2017. Among these species, only *Natrix natrix* is included in observation-based lists from the water intake area near the Euphrates; other species are listed from the literature and expert opinion. During the survey conducted in July 2017, no reptile species were identified and 5 species are removed from the list in accordance with literature data and habitat suitability information. However, during the last visit to the Project Site, there was one more reptile species from the water intake area of the project.

As a result, a total of 9 reptile species have been listed at the Project Site and water intake area. Among these species, *Rafetus euphraticus* (Euphrates Soft-shell Turtle) is classified as EN (Endangered) category according to IUCN Red List. However, *Rafetus euphraticus* (Euphrates Soft-shell Turtle) is abundant and widely seen in Tigris and Euphrates. There are no endemic species among the reptile species recorded at the Project Site and its vicinity. The risk and protection status of the reptile species are detected on site are given in Annex 1-Table 4.

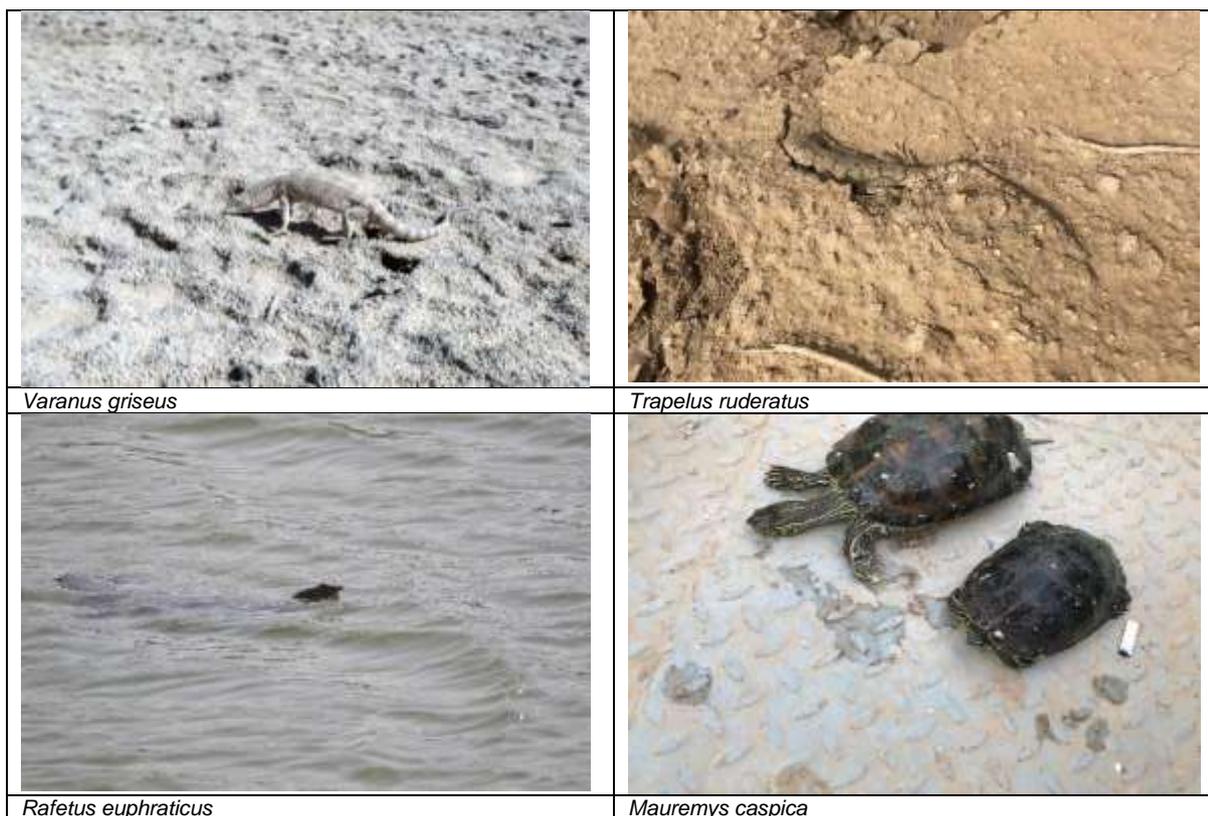


Figure 5-11 Reptile species observed in the study area.

Birds

A total of 50 bird species were reported at the Project Site as per the site survey carried out in May 2017, literature data and habitat suitability study. 48 of these species have been listed during the site surveys in July 2017, and no additional species have been identified. At the last visit to the Project Site one more bird species were recorded from the marshes near Euphrates. 10 different bird species were detected at the observations during the site survey in the project area. The assessment of bird species is made considering the revised version of the bird list of the first study that includes 50 bird species. In addition, the species having potential to breed at the area are presented in Annex 1-Table 5. There are no endemic species for the Project Site. The photographs of several species identified during the surveys are presented in the report.

	
<p><i>Pycnonotus leucotis</i></p>	<p><i>Ceryle rudis</i></p>
	
<p><i>Ardea alba</i></p>	<p><i>Vanellus indicus</i></p>
	
<p><i>Ardea cinerea</i></p>	<p><i>Halcyon smyrnensis</i></p>



Figure 5-12 Bird species observed in the study area.

Mammals

29 mammalian species were detected during the previous study belongs to field studies, literatures and habitat suitability. 12 species have been removed from the list as a result of site survey in July 2017. One bat species is excluded by expert opinion, resulting in a list of 17 mammalian species in the Project Site and water intake area.

Among the detected 17 mammalian species, they are all common and not threatened species, as well as rare and protected species. *Myotis capaccinii* listed as VU (Vulnerable) in IUCN criteria. *Allactaga euphratica* and *Lutra lutra* are listed as NT (Near threatened) in

IUCN criteria. The other 14 mammalian species recorded in the Project Site and water intake area are listed as LC (Least Concern).

Please see Annex 1-Table 6 for the list of baseline fauna species in the project area. Photos of some terrestrial vertebrate are given below.



Figure 5-13 Mammal species observed in the study area.

5.3. Aquatic Flora and Fauna Survey

Benthic organisms

In aquatic habitats, the bottom (sediment, rash, macrophytes, filamentous algae) contains organisms that have passed at least part of their life. The concept of benthic organisms includes neuston and forms embedded in the bottom. Benthic invertebrates are at the top of the following groups in terms of learning the current state of the aquatic environment due to their limited ability to move and monitoring the changes taking place over time.

This region of the Euphrates River shows brackish nature. For this reason, marine and brackish water benthic species were found in the field. *Balanus* sp., Diptera larvae and May fly from Arthropoda phylum, *Bela* sp. from Mollusca phylum identified in the field study carried out both in May 2017, July 2017 and September 2017 (see Figure 8).

Generally, there are not found endangered and need to be protected species in benthic organisms.



Figure 5-14 *Balanus* sp. and *Bela* sp.

Fishes

Fish are important biological components in the upper tract of the food chain in aquatic systems. The fish that are fed with algae, zooplankton or benthic creatures are located in the uppermost chain of the water chain. The fish that are eco-fed with algae, zooplankton or benthic creatures are located in the uppermost chain of the water chain. Some species are as ecologically important as their economic importance.

The freshwater fishes, especially of the Euphrates-Tigris system are dominated by the Cyprinidae (Carp) family. There are few catfish (Siluridae) and spiny eel (Mastacembelidae)

in the basin. Recently, some exotic species such as *Carassius auratus*, *Ctenopharyngodon idella* and *Oreochromis sp.* are found in the river. This part of the river is brackish features and *Liza abu* from Mugilidae family population is relatively high.

Six species (*Alburnus mossulensis*, *Carassius auratus*, *Carasobarbus luteus*, *Luciobarbus esocinus*, *Liza abu*, *Oreochromis sp.*) of Cyprinidae (Carp), Mugilidae (Mullet) and Cichlidae family were identified in the project area (see Figure 5-15; Figure 5-16). In addition, juvenile fish have been observed in coastal areas of the river in both projected sites



Figure 5-15 *Carasobarbus luteus*.



Figure 5-16 *Luciobarbus esocinus*

Endemism and conservation status of species identified and likely to be found in the Euphrates River are given in Annex-1 Table 2. When we examined the table, we see that *Carassius auratus*, *Oreochromis sp.* and *Ctenopharyngodon idella* are the exotic species. Besides, *Capoeta barroisi*, *Carasobarbus kosswigi* and *Luciobarbus esocinus* are under protected species according to the IUCN Red list and categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively. In the projected site population density of *Alburnus mossulensis* (Bleak), *Liza abu* (Abu Mullet) and *Carrasius auratus* (Goldfish) are high in the projected site.

Mahdi (1962) also expressed that *Alburnus*, *Squalius* (Syn: *Leuciscus*), *Luciobarbus* (before within *Barbus* genus) were highly found in the river system whereas the population density of

Capoeta (Syn: Varicorhinus), Chondrostoma from Cyprinidae, Silurus (catfish) from Siluridae and Mastacembelus (spiny-eel) from Mastacembelidae family were relatively low in the river.

5.3.1. Water Quality

Rapidly increasing industrialization, population growth and distorted urbanization pollute the aquatic environments. Water quality parameters which is an important subject for understanding the pollution and its affects has reached primary importance in developed and a number of developing countries. The prevention of pollution at source, the precautionary principle and the prior licensing of wastewater discharges by competent authorities have become key elements of successful policies for preventing, controlling and reducing inputs of hazardous substances, nutrients and other water pollutants from point sources into aquatic ecosystems. Power Plant such as thermal power plant, hydroelectric power plant, combined cycle power plant can have cause a decrease in population, especially since prevent reproductive behavior of some species living and breeding in rivers. For this reason biological and physico-chemical properties of aquatic environments should be examined together.

Euphrates River Flood Channel located in Project Area is brackish water features. Because of the brackish water features of the river, except electrical conductivity, others (such as dissolved oxygen, pH, temperature, phosphate and nitrogen, turbidity, etc.) are important parameters for aquatic organisms. Some physico-chemical parameters analysed in the Project Site is given in Table 5-1

Table 5-1. Some physico-chemical parameters of Euphrates River in Samawa Project Site

Surface Water		upstream	downstream
Parameter	Unit	N-29958	N-29959
Ammonium nitrogen	mg/L	0,05	0,068
BOD	mg/L	12	11
Dissolved oxygen	mg/L	6,92	6,29
Electrical conductivity	µS/cm	3920	3420
COD	mg/L	35	34
Nitrate nitrogen	mg/L	1,02	1,08
pH	-	8,05	8,05
Total Nitrogen	mg/L	1,76	1,79
Total Phosphate	mg/L	0,14	0,107
Water Temperature	°C	30,2	30

In case any construction sources impact on rivers and/or streams within the scope of the Project, following criteria of water quality could be taken into consideration and should be monitored for the continuity of aquatic organisms.

- Water temperature is one of the most important factors impacting the life in aquatic ecosystems and it changes according to seasons, circulation of air and depth. Increase in temperature decrease the gas solubility (such as oxygen and corbondioxide) in water. In addition, increase in temperature can cause change in density and also viscosity of water. Besides, temperature affects species distribution, feeding, spawning and general behavior. Most species of Cyprinidae (carps) stop feeding behavior when the temperature drops under 8-10°C, and start breeding at temperatures above 15°C (*Nikolskii, 1963*).
- Dissolved oxygen (DO₂) is another parameter that is recommended to be continuously monitored during the construction and operation phases of the Project. It is quite important for organisms that are dependent on aerobic metabolism. Amount of dissolved oxygen decreases with increasing temperature and organic matter concentrations. It increases with increasing air pressure. In addition, factors like salinity and flow rate also affect amount of dissolved oxygen (*Wetzel, 1983*). *Bremond et Vuichard (1973)*, states that for Cyprinidae to survive in a habitat the dissolved oxygen concentration should be at least 5 mg/l.
- Electrical conductivity (EC) value, which defines the electrical transmission capability of water ions, and it is directly changes with many parameters such as anion, cation, salt density, temperature, akcalinity, dissolved solids in the water. Besides, *Bremond et Vuichard (1973)* states that electrical conductivity is an indicator of dissolved matter and fluctuates between 150 and 750 µS/cm in inland waters suitable for fish species. When it reaches a concentration of 3,000 µS/cm, it causes disruption of ecological balance in water.
- One of the water quality parameters is pH, which is an indicator of acidic and basic characteristics of water. It is very important in terms of fish life and productivity. Inland fish usually prefer pH levels between 6.5 and 8.5.

6. IMPACT ON BIODIVERSITY

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is biological or cultural (i.e. the marine environment or a coral reef), its importance (local, regional, national or international) and sensitivity to the specific type of impact are considered. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The universal sensitivity of receptor is low, medium and high.

For ecological impacts, sensitivity is assigned as low, medium or high based on the conservation importance of habitats and species. For the sensitivity of individual species, Table 6-1 presents the criteria for deciding on the value or sensitivity of individual species.

Table 6-1 Biological and Species Value / Sensitivity Criteria

Value / Sensitivity	Low	Medium	High
Criteria	Not protected or listed as common / abundant; or not critical to other ecosystem functions (e.g. key prey species to other species).	Not protected or listed but may be a species common globally but rare in South Africa with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.	Specifically protected under Iraq legislation and/or international conventions e.g. CITIES Listed as rare, threatened or endangered e.g. IUCN

The above criteria should be applied with a degree of caution. Seasonal variations and species lifecycle stage should be taken into account when considering species sensitivity. For example, a population might be deemed as more sensitive during the breeding/spawning and nursery periods. This table uses listing of species (IUCN) or protection as an indication of the level of threat that this species experiences within the broader ecosystem (global, regional, local). This is used to provide a judgement of the importance of affecting this species in the context of project-level changes.

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance rating will be determined, using the matrix provided in Table 6-2

Table 6-2 Impact Significance

		Sensitivity / Vulnerability / Importance of Resource / Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. There is blow provides a context for what the various impact significance ratings signify.

An impact of negligible significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be ‘imperceptible’ or is indistinguishable from natural background variations.

An impact of minor significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of moderate significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable. This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the longterm or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted. An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

No further floral impacts are anticipated on the power plant site as a result of decommissioning activities. Should the project be removed during the decommissioning phase, the floral impacts along the Project Site would mirror that of the construction phase.

The water intake area towards the Euphrates coast is deemed to have the highest sensitivity on account of the better condition of the vegetation and sensitivity of the habitat within this area, but the extent of sensitive marshland area on the existing proposed route is low, and the remaining habitat is historically overgrazed and fairly degraded in places.

The natural but highly disturbed and transformed vegetation of the power plant is considered low sensitivity, given the low cover and low diversity.

Baseline conditions in the Project area can be summarized as follows:

- Although there are potentially 17 different terrestrial mammals in the area, there has been significant transformation and a lower number are likely to be present.
- Habitat variety is limited and most of species are listed from the Euphrates River side where is water intake area of the project.
- The following mammals were observed during the site visit: Desert Hedgehog, Common Pipistrelle, Kuhl's Pipistrelle, Indian Gerbil, House Mouse, Euphrates Jerboa, Arabian Hare and Red Fox.
- The majority of mammals are smaller mammals and tolerant of habitat fragmentation.
- Long-fingered Bat is listed as VU. Euphrates Jerboa and Eurasian Otter are listed as NT.
- Given the Project area is previously transformed, there is a lack of cover and adequate food resources for the Sundevall's Jird. Euphrates Jerboa is potentially present with a low likelihood, given the low vegetation cover.
- The area proposed for the Project is characterised as the Tigris Euphrates Alluvial Salt Marsh habitat unit. Bounded by deserts and dry shrubland, this region is characterized by marshlands and seasonally inundated plains in a basin covered by recent (Pleistocene and Holocene) alluvial deposits and forming a vast inland delta of the Euphrates, Tigris, and Karun Rivers. Here the waters of Turkey, Syria, Iraq and the western mountains of Iran collect before entering the Gulf. The climate is subtropical, hot, and arid. Some small sections of the South Iran Nubo-Sindian Desert and Semi-Desert ecoregion extend into the border region of Iraq from Iran (National Report on Biodiversity in Iraq, July 2010).

- The habitat unit around the Site is homogenous, lacking structural and compositional variation, and does not support a high diversity and abundance of bird species.
- The study area has already been subject to varying degrees of disturbance and degradation caused by past and present land-use practises such as agriculture and industry, due to its close proximity to the city of Samawa.
- The proposed development is in 50 km far to the Haur Lafta Important Bird and Biodiversity Areas (IBAs) which have been identified in terms of the Important Bird and Biodiversity Areas Programme.
- According to the field observations, 9 reptiles have been recorded in the study area, which corresponds well with distribution records from the literature.
- As with mammals, a large proportion of these are not likely to occur at the Site on account of a lack of suitable habitat and in particular the lack of any rocky outcrops.
- Species observed during the Site visit include Horny-scaled Agama, which was observed to be abundant at the site. The Desert Monitor and the Grass Snake were also observed at the Site.
- During the field study, one listed species is known from the water intake area Euphrates Soft-shell Turtle which is listed as Endangered.
- The Site lies within or near the range of 3 amphibian species, which along with the general lack of water or wetlands at the site suggests that frog diversity is likely to be fairly low.
- The only listed species which may occur at the Project Site is the Green Toad, which is restricted to low lying flat or gently undulating areas with poorly drained clay or loamy soils. Given the sandy soils at the site and the lack of suitable pans for breeding, it is not likely that this species occurs at the site.
- Species that are likely to occur at the Site are those likely to be less dependent on perennial water. Therefore, three possible amphibia species are also found in the area of water intake.

6.1. Impact Description and Significance: Construction

6.1.1. Impact Description

The key impact during construction is the potential loss of vegetation cover over the 30 ha site Project Site, the roads to Project Site. Some clearing may be required for the construction of the buildings. The removal of vegetation and soil in the site clearance could result in an alteration of the surface water run-off regime. This could result in sedimentation of surface drainage networks, which will impact upon the quality of natural water systems and ultimately the biological systems that use these water bodies (IFC, 2007).

Vegetation clearing may allow for opportunistic grass species (and any other species) to generate in place of the original floral species, resulting in the potential loss of vegetation. However, this will not likely affect the overall population of species in the broader area.

The change in floral species will also impact upon the availability of the relevant habitats for faunal species. However, the lack of protected plant species in the area of the Project and the fact that the vegetation is very poor do not constitute a threat in terms of plant species in the vicinity.

The potential fragmentation of habitats may also occur in the study area. It is also important to note that any ground species that are cleared will affect bird species in the area of study. However, the planned project area is thought to be at a minimal level due to the small number of surface-bound bird species, the small area of 30 ha in area, the lack of wetlands and the surrounding areas containing more efficient areas for birds.

During the three seasons baseline studies a small 'light' marsh area was observed with a Project Site. This pond, which is quite small in the project area, is not used by terrestrial vertebrate species. No terrestrial vertebrate species has been observed in this pond. Specifically, this pond considerable source (and habitat) for faunal species particularly insects. The increased presence of traffic and people on site will also act as a barrier to any faunal species that are normally mobile in the area.

Other activities which will contribute to impacts on biodiversity include construction lighting, including high mast lighting for activities and dust emissions.

6.1.2. Impact Significance

The impacts on biodiversity will be negative and restricted to the site and the immediate local surroundings. Although some of the impacts will be reversible over the long term, the loss of habitat will be permanent. The magnitude of the impact will therefore be moderate.

The study area consists of agriculture areas and poor steppe fields used for grazing. The habitats in the study area have been previously disturbed and are not protected. There is no protected floral and faunal species, identified on the Site. Furthermore, some critical species were identified in the water intake area according to the IUCN's Red List. The water intake area is on the edge of the Euphrates River, considering the size of the river, it has a sustainable ecosystem structure.

The significance of the impact on biodiversity during construction is therefore considered to be minor-moderate prior to mitigation.

It should be noted that, with an increase in distance from the Project Site, it cannot be inferred that the impacts will decline. This is due to the reason that ecosystems are intricately related and are sets of open systems in which physical, chemical, and biological processes form interactive subsystems (Environmental Lab, 2011). Thus, the impacts of the Project must not only be assessed in the direct proximity of the Project, but the impacts on water bodies that are further afield must be considered, particularly for the drainage and disposal of water. It is anticipated that, this will have more of a long-term impact.

6.2. Impact Description and Significance: Operation

6.2.1. Impact Description

During the operation phase, there will be an increase in the noise levels in the study area. In addition, any lighting that will be used in the area during night time operations may also disturb faunal nocturnal activities. This may result in faunal species relocating away from the immediate vicinity of the site, and thus increasing competition on the peripheries of the study area. Wastewater floor drains, and other water drains from the equipment will be routed into a storm water system and discharged to the surrounding area via a moat located outside of the site. This may have a negative impact on water quality and affect faunal species.

Some vehicles are expected to be used during operation, which may disrupt wildlife corridors, decrease the movement of certain species in the area, and delay migration. This would be particularly relevant for fox (*Vulpes* species), that were observed in the Study Area.

6.2.2. Impact Significance

The impacts during the operational phase are likely to be local and continuous. The magnitude is therefore considered to be negligible - low.

As analysed for the construction phase, the sensitivity of the environment is considered to be high. The significance of the negative impacts on biodiversity during operation is considered to be of minor – moderate significance.

6.3. Impact Description and Significance: Decommissioning

6.3.1. Impact Description

All infrastructure (including the cables and pylon for the connection to the Transformer centre) will be dismantled. Machinery, steel and dismantled materials will be recycled where possible and disposed of at licensed disposal sites.

In the short-term, the noise, dust and vehicle emissions generated during decommissioning may be similar to those observed during construction. Potential impacts may also relate to contamination from incorrect disposal of wastes generated during decommissioning. In the long-term, however, particularly if the site is rehabilitated, the ecological health and biodiversity could be restored over time.

6.3.2. Impact Significance

The impact of the Project on the biodiversity during decommissioning will be negative, temporary and local. The magnitude of the impact is therefore considered to be low.

The sensitivity of the receptor is expected to remain the same as for the other Project phases, ie high.

The impacts during decommissioning are therefore judged to be of moderate significance prior to mitigation.

6.4. Impact Description and Significance: Summary

A summary of the impacts of the Project on biodiversity is included in Table 6-3 below.

Table 6-3. Summary of Impact Significance Pre-mitigation

Phase	Impact	Significance (pre-mitigation)
Construction	Clearing of vegetation and habitat, disturbance of fauna due to noise, dust, traffic and potential contamination of soil and water	Minor-Moderate Negative
Operation	Disturbance of fauna due to noise, dust, traffic	Minor-Moderate Negative
Decommissioning	Disturbance of fauna due to noise, dust, traffic and potential contamination of soil and water	Moderate Negative

7. MITIGATION MEASURES AND RESIDUAL IMPACTS

7.1. Construction

The following mitigation measures shall be implemented in the construction phase of the Project:

- 8 different plant species were found with extensive spread at planned Project Area and the water intake area. The area to be built has very poor vegetation. No endemic species have been found and no plant species are under protection. A small number of plants in the project area of about 30 ha will not be an issue in terms of planting when the neighboring habitats of the destruction are thought to be richer as vegetation. Therefore, there is no need to take any precautions in terms of the construction of the project.
- Demarcate all areas to be cleared with construction tape or similar material.
- ECO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially in the vicinity of sensitive features.
- All vehicles to remain on demarcated roads and no driving in the veld should be allowed except where necessary along the Project Site route during construction when all vehicles should follow the same track.
- Sensitive habitat features should be avoided.
- All vehicles at the Site should adhere to a low speed limit to avoid collisions with fauna such as tortoises.
- Personnel should not be allowed to roam into the veld.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.
- No activity should be allowed in the veld between sunset and sunrise.
- Any dangerous fauna (snakes, scorpions etc) that are encountered during construction should not be handled or molested by the construction staff and the ECO or other suitably qualified persons should be contacted to remove the animals to safety.
- No litter, food or other foreign material should be thrown or left around the site and should be placed in demarcated and fenced rubbish and litter areas.

- Holes and trenches should not be left open for extended periods of time and should only be dug when needed for immediate construction. Trenches that may stand open for some days should have places where the loose material has been returned to the trench to form an escape ramp present at regular intervals to allow any fauna that fall in to escape.
- If there is any part of the site that needs to be lit at night for security reasons, then this should be with low-UV emitting types which do not attract insects.
- Existing roads for access to be utilised as far as possible.
- Nesting sites to be reported to ECO and monitored to inform further action which may include avoiding the nests if there are eggs or chicks present.
- ECO to be notified of roosting, nesting or breeding sites to inform further action which may include avoiding the nests if there are eggs or chicks present.
- Laydown areas to be as close to the site as possible.
- Disturbance footprint to be restricted.
- Existing roads to be utilised.
- Speed limit of 20 km/h adhered to on internal roads.
- Most of the fish species that exist in Euphrates River and flood channel of Euphrates River belong to family Cyprinidae. The breeding period of this species belongs to this family and for the other species of different families detected during the field surveys is between the months of April and June –peaking in April-. Therefore, it is recommended that construction activities should be carried out carefully and impacts caused by human activities should be minimized especially in April, May and June in order not to harm the species that exist in the river.
- Mixing any chemical substances, that is used in the construction area, in waterbed and/or aquatic ecosystems will be prevented.
- Excavation materials will not be dumped onto riverbed.
- Especially during the breeding season of fish species and macrobenthic organisms (April-June), any intervention on riverbed will be prevented.
- The natural structure of the riparian vegetation will be preserved which forms the spawning and sheltering area for many aquatic organisms.

7.2. Operation

The following mitigation measures shall be implemented in the operation phase of the Project:

- Rehabilitation of Project Site with rescued material and additional species brought in.
- Ongoing alien invasive plant removal within all corridors and on site.
- Personnel should not be allowed to roam into the veld.
- No activity should be allowed in the veld between sunset and sunrise.
- No litter, food or other foreign material should be thrown or left around the site and should be placed in demarcated and fenced rubbish and litter areas.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- Measures to be put in place to discourage nesting on power infrastructure if problematic.
- No shooting, poisoning or harming of birds to control.
- Birds already with eggs and chicks allowed fledging chicks before nests removed.
- Avifaunal specialist input to be sought if cannot be resolved.
- Restricted site access.
- Use of existing roads and enforcement of speed limits.

7.3. Decommissioning

The mitigation measures identified for the decommissioning phase will follow those identified for the construction phase. This is largely due to the fact that the level of disturbance during this phase will mirror that observed during construction.

Focused attention shall be on the re-vegetation of the Study Area, attempting to return the site to its original status. One of the core aims of the mitigation measures implemented during this phase shall be to increase and re-establish the connectivity of native plant and animal populations. The following measures are particularly relevant:

- No further floral impacts are anticipated on the power plant site as a result of decommissioning activities. Should the Power Plants be removed during the decommissioning phase, the floral impacts would mirror that of the construction phase.
- It is envisaged that the impact during the Decommissioning Phase will mirror that experienced for the Construction Phase.
- Demarcate work and demolition areas to avoid unnecessary disruption to biodiversity;
- Ensure that the dust emissions arising from the roads used are minimised; and
- Restore species diversity and structure in the disturbed areas through rehabilitation and revegetation of the site using native floral species (except where non-native species are appropriate). The measures through which this will be achieved should carefully take into consideration the Threatened faunal species identified in the Study area; with the implementation of the mitigation measures during decommissioning, the residual impact magnitude will be insignificant – low and the residual impact on biodiversity will be reduced to insignificant- minor significance.

8. CUMULATIVE IMPACTS

The Project Site is not considered an area of high biodiversity status, some terrestrial and aquatic faunal species of ecological significance were identified and further development such as this Project, contributes to the of conversion from natural/semi-natural to agricultural land and habitat fragmentation within the area.

The development would contribute to habitat loss through transformation and disturbance of vegetation. However this contribution would be minor when the extent of the development is considered together with the sensitivity of the vegetation on site i.e. previous farmed agricultural land. As such, the cumulative impact of this development is considered to have a minor significance without mitigation and a negligible significance if all proposed developments abide by the various mitigation measures prescribed by the respective specialists.

The cumulative impact of all development in the Samawa area and surrounds is likely to impact on fauna through increased habitat loss and fragmentation. Habitat fragmentation can result in the disruption of ecological corridors which aid in faunal dispersal, ensure ecosystem resilience, maintain population connectivity and provide refuge areas.

When provided the mitigation measures in the Report are implemented, there would not be high impacts on a cumulative scale. As such, the cumulative impact of this development is considered to have a moderate significance without mitigation, and a minor significance if all proposed developments abide by the various mitigation measures prescribed by the respective specialists.

The development would contribute to habitat loss through transformation and disturbance of avifauna and their habitats. However this contribution would be minor when the extent of the development is considered. As such, the cumulative impact of this development is considered to have a minor significance without mitigation and a negligible significance if all proposed developments abide by the various mitigation measures prescribed by the respective specialists.

9. GENERAL EVALUATION

The biodiversity field studies covering the three seasons of the region were carried out for the Samawa CCGT.

In summary, several species of the sea grass was observed in the field, and a few species was observed in the breeding populations. The observed species are not protected at national and international level and these species are common in the region and its vicinity.

Preliminary impressions of summer and autumn 2017 field and literature studies are summarized as follows:

- The fact that the Project Area consists of vegetation in poor single areas,
- The birds are located on the migratory route but the birds are not resting and feeding,
- Only a small part of the animal species, which is listed according to the literature information in the project area,
- Haur Lafta has unknown status as IBA. The planned project area is about 50 km northeast of the protection area,
- None of the habitat types of Haur Lafta IBA and KBA just as Wetlands (inland), Artificial - aquatic and Artificial - terrestrial habitats were observed in the project area,
- The most important anthropogenic pressure over the habitats are fisheries / aquaculture, hunting, rangeland / pastureland and agriculture.

As a result, the planned Project is considered to be at a level appropriate for the continuation of construction in terms of biodiversity.

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Annex. 1. Species List

Table 1. Plant Species of the Project Area

Family	Species	English Name	Endemism	Operation Area	Water intake Area
Tamaricaceae	<i>Tamarix aucherana</i> (DC. ex Walp.) Baum.	Salt cedar	-	+	+
Fabaceae	<i>Alhagi graecorum</i> Boiss.	Camelthorn	-	+	+
Chenopodiaceae	<i>Halocnemum strobilaceum</i> (Pall.) Bieb.	Halocnemum	-	+	+
Caharaceae	<i>Chara vulgaris</i> L.	-	-	-	-
Potamogetonaceae	<i>Potamogeton</i> sp.	Pondweed	-	-	+
Poaceae	<i>Aeluropus lagopoides</i> (L.) Trin. ex Thw. Var. <i>lagopoides</i>	Mangrove Grass	-	+	+
	<i>Arundo donax</i> L.	Arundo	-	-	+
	<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Common Reed	-	-	+

Table 2. Fish Species and Conservation Statuses identified and likely to be found in the project area (* Fish species observed in the field study)

FAMILY	GENUS / SPECIES	Name	ENDEMİZM	IUCN RED LIST (2017)
CYPRINIDAE	<i>Acanthobrama marmid</i>	Mesopotamian Bream	Eupharate-Tigris	LC
	<i>Alburnoides cf. bipunctatus</i>	Spirilin	-	DD
	<i>Alburnus caeruleus</i>	Black Spotted Bleak	Qweik; Eupharate-Tigris	LC
	<i>Alburnus mossulensis*</i>	Bleak	Eupharate-Tigris	DD
	<i>Arabibarbus grypus</i>	Shabout	Eupharate-Tigris	DD
	<i>Barbus lacerta</i>	Lizard barbel	Eupharate-Tigris	LC
	<i>Barilius mesopotamicus</i>	Mesopotamian barilius	Eupharate-Tigris	LC
	<i>Capoeta barroisi</i>	Orontes Scraper	Orontes; Eupharate-Tigris	EN
	<i>Capoeta damascina</i>	Levantine scraper	Orontes; Eupharate-Tigris	LC
	<i>Capoeta trutta</i>	Longspine scraper	Eupharate-Tigris	LC
	<i>Carasobarbus kosswigi</i>	Kiss-lip himri	Eupharate-Tigris	VU
	<i>Carasobarbus luteus</i>	Mesopotamian himri	Qweik; Eupharate-Tigris	LC
	<i>Carassius auratus*</i>	Goldfish	Exotic	LC
	<i>Chondrostoma regium</i>	Mesopotamian nase	Qweik; Eupharate-Tigris	LC
	<i>Ctenopharyngodon idella</i>	Grass carp	Exotic	DD
	<i>Cyprinion kais</i>	Smallmouth lotak	Qweik; Eupharate-Tigris	LC
	<i>Cyprinion macrostomum</i>	Largemouth lotak	Qweik; Eupharate-Tigris	LC
	<i>Garra rufa</i>	Red Garra	-	LC
	<i>Garra variabilis</i>	Small-mouth garra	-	LC
	<i>Luciobarbus esocinus</i>	Pike Barbel	Eupharate-Tigris	VU
<i>Squalius cephalus</i>	Chub	-	LC	
BALITORIDAE	<i>Oxynemacheilus argyrograma</i>	Stone Loach	Eupharate-Tigris	LC
CICHLIDAE	<i>Oreochromis sp.*</i>	Tilapia	Exotic	-
MUGILIDAE	<i>Liza abu*</i>	Abu Mullet	Eupharate-Tigris	LC
SILURIDAE	<i>Silurus triostegus</i>	Mesopotamian catfish	Eupharate-Tigris	LC
SISORIDAE	<i>Glyptothorax kurdistanicus</i>	Mesopotamian Sucking Catfish	Eupharate-Tigris	DD

Table 3 Amphibian Species of the Project Area

Ordo	Familia	Species	English Name	International Protection Categories		ENDEMISM	Within the Project Area	Close Vicinity of the Project Area
				IUCN	CITES			
ANURA	BUFONIDAE	<i>Bufo variabilis</i>	Green Toad	DD	-	-	X	X
	HYALIDAE	<i>Hyla savignyi</i>	Savign's Frog	LC	-	-	-	X
	RANIDAE	<i>Pelophylax ridibundus</i>	Eurasian Marsh frog	LC	-	-	-	X

Table 4. Reptilian Species of the Project Area

Ordo	Familia	Species	English Name	International Protection Categories		ENDEMICISM	Within the Project Area	Close Vicinity of the Project Area
				IUCN	CITES			
TESTUDINES	EMYDIDAE	<i>Mauremys caspica</i>	Striped-neck Terrapin	NE	-	-	-	X
	TRIONICHIDAE	<i>Rafetus euphraticus</i>	Euphrates Soft-shell Turtle	EN	-	-	-	X
SQUAMATA	AGAMIDAE	<i>Trapelus ruderatus</i>	Horny-scaled Agama	LC	-	-	X	X
	VARANIDAE	<i>Varanus griseus</i>	Desert Monitor	NE	ANN-1	-	X	X
		<i>Timon princeps</i>	Zagrosian Lizard	LC	-	-	X	X
	LACERTIDAE	<i>Mesalina brevirostris</i>	Desert Lizard	NE	-	-	X	X
		<i>Natrix natrix</i>	Grass Snake	LC	-	-	-	X
	COLUBRIDAE	<i>Natrix tasellata</i>	Dice Snake	LC	-	-	-	X
VIPERIDAE	<i>Walterinnesia morgani</i>	Desert Black Cobra	NE		-	X	X	

Table 5. Bird Species of the Project Area

Ordo	Familia	Species	English Name	International Protection Categories		ENDEMISM	Within the Project Area	Close Vicinity of the Project Area
				IUCN	CITES			
PODICIPEDIFORMES	PODICIPEDIDAE	<i>Tachybaptus ruficollis</i>	Little Grebe	LC	-		-	X
		<i>Podiceps cristatus</i>	Great crested Grebe	LC	-		-	X
PELECANIFORMES	PHALACROCORACIDAE	<i>Phalacrocorax carbo</i>	Great Cormorant	LC	-		-	X
CICONIIFORMES	ARDEIDAE	<i>Ixobrychus minutus</i>	Common Little Bittern	LC	-		-	X
		<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	LC	-		-	X
		<i>Egretta garzetta</i>	Little Egret	LC	-		-	X
		<i>Ardea alba</i>	Great White Egret	LC	-		-	X
		<i>Ardea cinerea</i>	Grey Heron	LC	-		-	X
ACCIPITRIFORMES	ACCIPITRIDAE	<i>Circus aeruginosus</i>	Western Marsh-harrier	LC	ANN-2		-	X
GRUIFORMES	RALLIDAE	<i>Rallus aquaticus</i>	Water Rail	LC	-		-	X
		<i>Porzana porzana</i>	Spotted Crake	LC	-		-	X
		<i>Porzana parva</i>	Little Crake	LC	-		-	X
		<i>Porzana pusilla</i>	Baillon's Crake	LC	-		-	X
		<i>Crex crex</i>	Corncrake	LC	-		-	X
		<i>Gallinula chloropus</i>	Common Moorhen	LC	-		-	X
		<i>Fulica atra</i>	Common Coot	LC	-		-	X
CHARADRIIFORMES	RECURVIROSTRIDAE	<i>Himantopus himantopus</i>	Black-winged Stilt	LC	-		-	X
	BURHINIDAE	<i>Burhinus oedicephalus</i>	Stone Curlew	LC	-		-	X
	GLAREOLIDAE	<i>Cursorius cursor</i>	Cream-coloured Courser	LC	-		-	X
	CHARADRIIDAE	<i>Vanellus indicus</i>	Red-wattled Lapwing	LC	-		X	X
	LARIDAE	<i>Larus canus</i>	Mew Gull	LC	-		-	X

Ordo	Familia	Species	English Name	International Protection Categories		ENDEMISM	Within the Project Area	Close Vicinity of the Project Area
				IUCN	CITES			
COLUMBIFORMES	COLUMBIDAE	<i>Columba livia</i>	Common Pigeon	LC	-		X	X
		<i>Streptopelia decaocto</i>	Eurasian Collared-dove	LC	-		X	X
		<i>Stigmotopelia senagalensis</i>	Laughing Dove	LC	-		X	X
STRIGIFORMES	STRIGIDAE	<i>Otus scops</i>	Eurasian Scops-owl	LC	ANN-2		X	X
		<i>Athene noctua</i>	Little Owl	LC	ANN-2		X	X
CORACIIFORMES	ALCEDINIDAE	<i>Ceryle rudis</i>	Pied Kingfisher	LC	-		-	X
	ALCEDINIDAE	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	LC	-		-	X
	MEROPIIDAE	<i>Merops persicus</i>	Blue-cheeked Bee-eater	LC	-		X	X
PASSERIFORMES	HIRUNDINIDAE	<i>Riparia riparia</i>	Sand Martin	LC	-		-	X
		<i>Hirundo rustica</i>	Barn Swallow	LC	-		-	X
		<i>Delichon urbicum</i>	Northern House-martin	LC	-		-	X
	MOTACILLIDAE	<i>Motacilla flava</i>	Yellow Wagtail	LC	-		-	X
	PYCNONOTIDAE	<i>Pycnonotus leucotis</i>	White eared bulbul	LC	-		X	X
	TURDIDAE	<i>Luscinia svesica</i>	Bluethroat	LC	-		-	X
		<i>Oenanthe isabellina</i>	Isabelline Wheatear	LC	-		-	X
	SYLVIIDAE	<i>Cettia cetti</i>	Cetti's Warbler	LC	-		-	X
		<i>Sylvia communis</i>	Common Whitethroat Warbler	LC	-		-	X
		<i>Phylloscopus collybita</i>	Common Chiffchaff	LC	-		-	X
		<i>Acrocephalus scirpaceus</i>	Reed Warbler	LC	-		-	X
LANIIDAE	<i>Lanius minor</i>	Lesser Grey Shrike	LC	-		-	X	
	<i>Lanius excubitor</i>	Great Grey Shrike	LC	-		-	X	

Ordo	Familia	Species	English Name	International Protection Categories		ENDEMICISM	Within the Project Area	Close Vicinity of the Project Area
				IUCN	CITES			
	CORVIDAE	<i>Corvus corone</i>	Carrion Crow	LC	-		X	X
		<i>Corvus ruficollis</i>	Brown-necked Raven	LC	-		-	X
	STURNIDAE	<i>Sturnus vulgaris</i>	Starling	LC	-		-	X
	PASSERIDAE	<i>Passer domesticus</i>	House Sparrow	LC	-		X	X
		<i>Passer hispaniolensis</i>	Spanish Sparrow	LC	-		-	X
	FRINGILLIDAE	<i>Carduelis carduelis</i>	Goldfinch	LC	-		-	X
		<i>Rhodopechys obsoleta</i>	Desert Finch	LC	-		-	X
	EMBERIZIDAE	<i>Miliaria calandra</i>	Corn Bunting	LC	-		-	X

Table 6. Mammal Species of the Project Area

Ordo	Familia	Species	English Name	International Protection Categories		ENDEMIISM	Within the Project Area	Close Vicinity of the Project Area
				IUCN	CITES			
ERINACEOMORPHA	ERINACEIDAE	<i>Paraechinus aethiopicus</i>	Desert Hedgehog	LC	-		X	X
SORICOMORPHA	SORICIDAE	<i>Crocidura suaveolens</i>	Lesser Shrew	LC	-	-	-	X
CHIROPTERA	VESPERTILIONIDAE	<i>Myotis capaccinii</i>	Long-fingered Bat	VU	-	-	-	X
		<i>Pipistrellus pipistrellus</i>	Common Pipistrelle	LC	-	-	X	X
		<i>Pipistrellus kuhlii</i>	Kuhl's Pipistrelle	LC	-	-	X	X
		<i>Eptesicus bottae</i>	Botta's Serotine	LC	-	-	-	X
		<i>Otonycteris hemprichi</i>	Desert Long-eared Bat	NE	-	-	-	X
RODENTIA	CRICETIDAE	<i>Tatera indica</i>	Indian Gerbil	LC	-	-	X	X
		<i>Meriones crassus</i>	Sundevall's Jird	LC	-	-	-	X
	MURIDAE	<i>Rattus rattus</i>	Black-House Rat	LC	-	-	-	X
		<i>Mus musculus</i>	House Mouse	LC	-	-	X	X
		<i>Nesokia indica</i>	Short-tailed Bandicoot Rat	LC	-	-	-	X
DIPODIDAE	<i>Allactaga euphratica</i>	Euphrates Jerboa	NT	-	-	X	X	
LOGOMORPHA	LEPORIDAE	<i>Lepus capensis</i>	Arabian Hare	LC	-	-	X	X
CARNIVORA	CANIDAE	<i>Vulpes vulpes</i>	Red Fox	LC	ANN-3	-	X	X
	MUSTELIDAE	<i>Lutra lutra</i>	Eurasian Otter	NT	ANN-1	-	-	X
ARTIODACTYLA	SUIDAE	<i>Sus scrofa</i>	Wild Boar	LC	-	-	-	X

Annex. 2. Photolog







