Chapter 8 - Ecology

Contents

8 Ecology

8.1 Introduction

This Chapter addresses the natural environment that could be affected by the proposals. It presents a description of the assessment methodology, observed baseline conditions, significant impacts and mitigation proposals relating to the terrestrial and marine ecology and habitats within the potential zone of influence of the proposed development.

The project area comprises three distinct habitat zones:

- **Terrestrial Zone** (Characterised by bare soil and sparse sabkha vegetation);
- **Intertidal Zone** (Characterised by mud flats with limited vegetation and numerous mud-skipper colonies); and
- **Marine Zone** (Characterised by unvegetated bottom sediments and tidal estuarine waters).

Each of these habitat zones is discussed in more detail below. This section of the report is arranged as follows:

- Description of methodology (field surveys, how ecological conservation value has been assigned and impact assessment);
- Description of baseline ecological conditions for land, inter-tidal and marine environments based on desk-based review and field surveys; and
- Impact assessment of the proposed development. Definition of mitigation measures and description of residual impacts.

8.2 Methodology

This section describes the basic principles and references applied to the assessment of ecological conditions and the related impact assessment for the terminal project. The information provided within this chapter in terms of specific conditions observed on the site is based largely on site walkovers undertaken in August and September 2014 and the prior remote sensing habitat surveys completed as part of the desk study report[1] (the latter are described in the desk-based report).

[1] WTPS Iraq Oil Terminal Desk Study, Earth & Marine Environmental Consultants, August 2014, REF: 014-1287 REV00

8.2.1 Field Surveys

The land and intertidal field surveys comprised walk-over surveys targeting the vegetated areas and bare areas and the field survey results are based on visual observation. No samples were collected. For the marine survey, sampling of water and sediment was undertaken at five locations opposite the project site (within the main water channel) and laboratory based species identification was undertaken on the collected samples by Basra University ecological specialists. The sediment samples were obtained using a Van Veen Sediment Sampler and the water samples using a Niskin discrete depth sampler (see *Chapter 7 – Water Quality* for a fuller description of these techniques).

The sample locations for the marine survey are identified below.

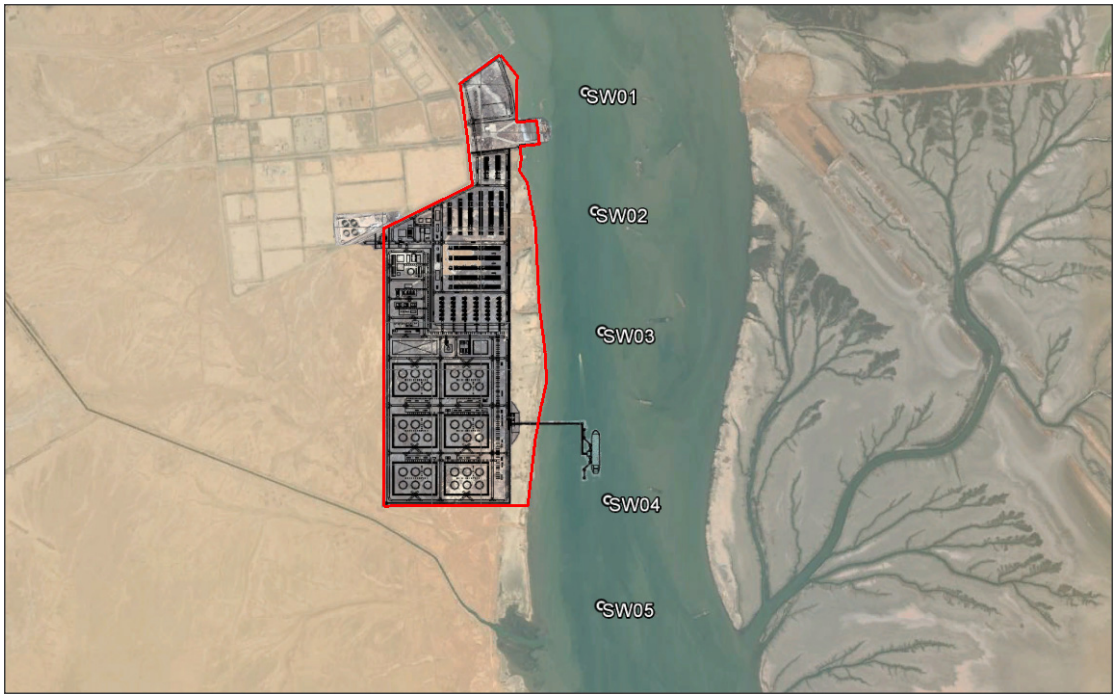


Figure 8.1: *Water and sediment sampling locations (Marine Ecology)*

8.2.2 Determining Conservation Value

Assigning values to habitats and species assists in identifying those of particular ecological conservation value and aids in the development of suitable mitigation and management opportunities. However, the lack of local and national Biodiversity, Species and Habitat Action Plans within Iraq results in a reliance on other published literature resources to assign the conservation value.

In the absence of a rigorous Iraqi system for designating ecological sites and protective status for species, the species status from the International Union for Conservation of Nature (IUCN) Red List, where available, along with available scientific literature has been used in identifying the species conservation value that may be present in the study area.

In consideration of the above, the species recorded within the sites boundaries have been assigned conservation values as per *Table* **8.1***8.1* below:

Table 8.1: Conservation Values

Value	Description
Very High	Internationally important and/or rare. Decreasing worldwide population and localized world breeding population.
High	Nationally important and/or rare. Decreasing worldwide population and localized breeding population.
Medium	Regionally important and/or rare. Stable population worldwide and nationally.
Low (or Lower)	Locally common and Nationally Abundant. Stable/Increasing population.
Negligible	Locally/Regionally/Internationally abundant with increasing population.

These descriptions have been used in the assessment of baseline ecological quality and sensitivity.

8.2.3 Ecological Impact Assessment

Following the completion of the baseline survey, the data gathered was used to undertake an Ecological Impact Assessment of the proposed development in accordance with the following technical guidelines:

- Guidelines for Ecological Impact Assessment: Terrestrial, Freshwater and Coastal (2006). Institute of Ecology and Environment Management (IEEM); and
- Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (2010). Institute of Ecology and Environment Management.

Whilst not country specific, the IEEM Ecological Impact Assessment guidelines focus purely on the potential impacts of any proposed activity on the ecological features of a given area.

As a result, the guidelines have been utilized in preference of generic Environmental Impact Assessment Guidelines

8.2.4 Legislation

Currently, the protection of all environmental features within the country of Iraq falls under Iraqi Law of Protection and Improvement of the Environment, No. 27 of 2009 which came in to force in 2010. This Law aims to improve and to protect the environment by handling the damages, protecting the public health and the natural resources within Iraq.

The Ministry of Environment (MoE), and through cooperation with other Ministries, is charged with establishing the duties and responsibilities for the protection and improvement of the environment.

In accordance with the Law, clean technologies must be utilized and organisations are to establish suitable environmental policies. The use of sensors for pollution monitoring and control is recommended as well as the incorporation and use of renewable energy technologies.

Key points of the Law include:

- An Environmental Impact Assessment shall be done for any new project in the country;
- Protection of water sources from pollution;
- Regulating effluent discharge whether they are of domestic, industrial or agricultural origin;
- Regulation of air pollution and noise reduction;
- Earth protection;
- Biodiversity protection;
- Management of hazardous waste;
- Protection of the environment from pollution resulting from exploration and extraction of oil and natural gas;
- Establishment of an environmental protection fund; rewards; compensation for damages; and
- Penal provisions.

This Law supersedes Law No. 3 of 1997 on the protection and improvement of the environment.

8.3 Terrestrial Ecology Baseline Conditions

This section of the report deals with the species and habitat types identified on the land area of the proposed project (above the high water mark).

8.3.1 Baseline Conditions – Desk Study

It is important to recognise that the ecological field surveys are only a snapshot of what could be present on the site in terms of species, but the desk based study gives an indication of what could be present based on the observed habitat types and literature reviews. This is described below. The wider area generally (Southern Iraq coastal zone) comprises three key terrestrial habitat types: cultivated land (irrigated Agriculture/Farms), alluvial plains and sabkha (see *Figure 8.2*). In the vicinity of the project site itself it is sabkha that dominates**.**

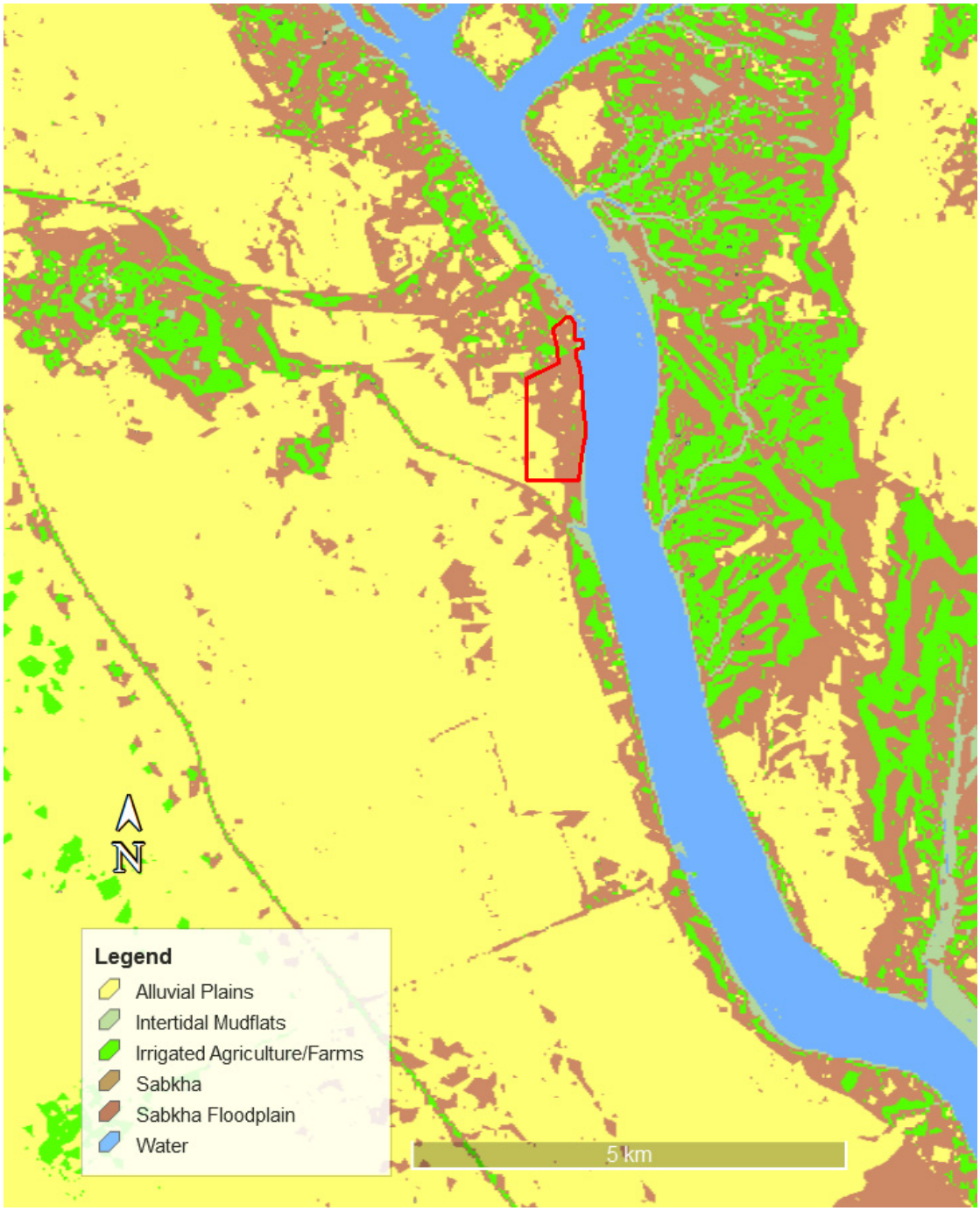


Figure 8.2: *Remote sensing habitat mapping showing habitat types*

Sabkha

Sabkha based habitats are a hyper saline, vegetative poor habitat. Where vegetation does exist, it is predominantly found around the fringes of the habitat and primarily comprises of high salt tolerant, halophytic species of the families Boraginaceae, Chenopdiaceae and Zygophyllaceae. Whilst void of vegetation, sabkha habitats are known for supporting various species of mammal, reptiles and birds.

Mammals

The nature of the study area and associated high anthropogenic activity potentially limits the number of native mammal species likely to be present. It is probable that those species which do exist within the study area, are to some degree tolerant to the existing activities. *Table 8.2* provides the status of mammals likely to exist within or in close proximity to the study area.

Table 8.2: Possible Mammal Species within the Study Area

Common Name	Latin Name	IUCN Red List
Wild Boar	*Sus scrofa*	Least Concern
Wild Dog	*Canis lupus*	Not Listed
Red Fox	*Vulpes*	Least Concern
Cape Hare	*Lepus capensis*	Least Concern
Lesser Jerboa	*Jaculus jaculus*	Least Concern
Egyptian Jerboa	*Allactaga euphratica*	Near Threatened
Cheesman's Gerbil	*Gerbillus cheesmanii*	Least Concern
Black Rat	*Rattus rattus*	Least Concern
Brown Rat	*Rattus norvegicus*	Least Concern
House Mouse	*Muscus muscus*	Least Concern
Source: www.iucnredlist.org		

The habitats associated throughout the study area, comprising predominantly of Sabkha and Alluvial Plains, have the ability to support small mammal species, in particular, rodents. Species of gerbil, namely Cheesman's Gerbil (*Gerbillus cheesmani*), are likely to be present.

This species of gerbil is commonly found throughout Iraq and Arabia and due to a stable population and wide spread distribution, it is listed as Least Concern on the IUCN Red List[2].

Similarly, alluvial plains habitats are known to support populations of Lesser Jerboa (*Jaculus jaculus*). The population of this species throughout Iraq and Arabia is stable and in combination with its wide spread distribution, it is listed as Least Concern on the IUCN Red List[3]. A member of the Jerboa Family, Euphrates Jerboa (*Allactaga euphratica*), possibly exists in Iraq, however there have been no recent confirmations. Populations of Euphrates Jerboa is always lower when found in areas populated by Lesser Jerboa[4]. This species is currently listed as Near Threatened on the IUCN Red List due to a decreasing population and distribution throughout Arabia.

Small rodent species inclusive of Brown Rat (*Rattus norvegicus*), Black Rat (*Rattus rattus*) and House Mouse (*Muscus muscus*) are likely to be present within the study area, particularly near areas of human habitation or activities such as wharf sites and industrial areas.

Recordings of possible fox tracks during a site visit by EAME staff indicate a potential presence in the area. The highly disturbed nature of the site and close proximity to human activity indicates that the species most likely to occur is that of Arabian Red Fox (*Vulpes vulpes*). Arabian Red Fox are more tolerant of human presence and increased levels of disturbance compared to other fox species. It should also be noted that there are feral dogs in the area too so it is possible these small tracks are from a juvenile feral dog.

8.3.2 Baseline Conditions - Fieldwork

A baseline survey was completed by EAME staff during August and September 2014. The purpose of the walk-over survey was to assess the terrestrial areas of the proposed Terminal and identify vegetation coverage, habitat type and observe any potential ecologically sensitive receptors. The project site itself shows signs of anthropogenic impacts including disused port facilities, fly tipping/dumping, off road vehicle activities, earthworks, dredging disposal and the remnant signs of war (e.g. tank emplacements, defensive mounds, etc). These activities would lead to disturbance of natural habitats that could develop but there are no signs of cultivation or agricultural activity on the project site.

[2] Gerbillus cheesmani. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. Shenbrot, G. & Amr, Z. 2008. <www.iucnredlist.org>. Downloaded on 23 February 2012

[3] *Jaculus jaculus*. The IUCN Red List of Threatened Species, Amori, G., Hutterer, R., Kryštufek, B., Yigit, N., Mitsain, G., Palomo, L.J. & Aulagnier, S. 2008. Version 2014.3

[4] *Allactaga euphratica*. The IUCN Red List of Threatened Species. Kryštufek, B. 2008. Version 2014.3

Habitats

The survey undertaken throughout the project site identified the following habitat types:

- Coastal Sabkha; and
- Vegetated Coastal Strip.

Coastal Sabkha

Coastal sabkha habitat is located throughout the site and, as a result of the hyper saline soil conditions, it is mainly devoid of any vegetation. Where vegetation was recorded, the species *Atriplex* sp and *Salsola* sp were noted (see *Photograph 8.1*). Vegetation coverage across the site was estimated to be less than 5% of the site as a whole, but where it did occur it was concentrated in dense patches with open space between (as illustrated below).

Photograph 8.1: *Sparsely vegetated Sabkha plain*

Other than feral dogs, no mammals were observed on the site. Birds were also absent from the land areas of the site (as opposed to the intertidal area described below). Overall the terrestrial habitat was found to be a poor quality, low diversity habitat of no great ecological significance.

8.4 Intertidal Ecology Baseline Conditions

This section describes the species and habitat types associated with the intertidal area. This is the strip of land between the high and low water mark which is subjected to twice daily tidal inundation and thus spends alternating periods submerged and exposed.

The most notable aspect of the intertidal zones along the Iraqi coast are that they are important sites for wading birds and are internationally recognised for such.

Khor Al-Zubair Port Protected Area

There are two Important Bird Areas (IBA) located within the Khor Al-Zubair Port study area. Firstly, Khor Al-Zubair IBA is located to the north east of the site, as shown on *Figure 8.3*. This site was allocated IBA Status by BirdLife International in 2001 for its importance in providing suitable habitat to water birds[5]. This site, approximately 40km south east of Basra, comprises of an extensive tidal inlet and associated intertidal mudflats located at the head of the Arabian Gulf[5].

In addition to being internationally recognized as an IBA by BirdLIfe International, during 2009, a series of surveys were undertaken to identify sites as Key Biodiversity Conservation Areas. The outcome of the survey highlighted that Khor Al-Zubair be included as one of Iraq's Key Biodiversity Areas[6].

The second IBA, Khor Abdullah, is located along the coast of Iraq. This location comprises of approximately 90,000 hectares (ha) swampy grass-flats and approximately 36,000ha of intertidal mudflats and was nominated in 2001 to be incorporated into BirdLIfe International as an IBA[7].

The huge expanses of suitable habitat resulted in the site being recognized as internationally important for populations of Eurasian Curlew (*Numenius arquata*), Crab Plover (*Dromas ardeola*) and Gull Billed Tern (*Gelochelidon nilotica*)[7].

Furthermore, the site supports resident populations of Iraq Babbler (*Turdoides altirostris*) as well as 1% or more of the recorded global population of wintering African Sacred Ibis (*Threskiornis aethiopicus*)[8].

[5] Endemic Bird Areas factsheet: Mesopotamian Marshes. Birdlife International. Downloaded from http://www.birdlife.org on 22/01/2014
[6] Key Biodiversity Site of Iraq: 2010 Site Review. Bachmann, A. Chappell, B. Elliott, N. & Matti, N. Nature Iraq. 2011
[7] Important Bird Areas factsheet: Khawr Al Zubair. Birdlife International. Downloaded from http://www.birdlife.org on 22/01/2014
[8] Important Bird Areas in the Middle East. Evans, M. BirdLife International. 1994

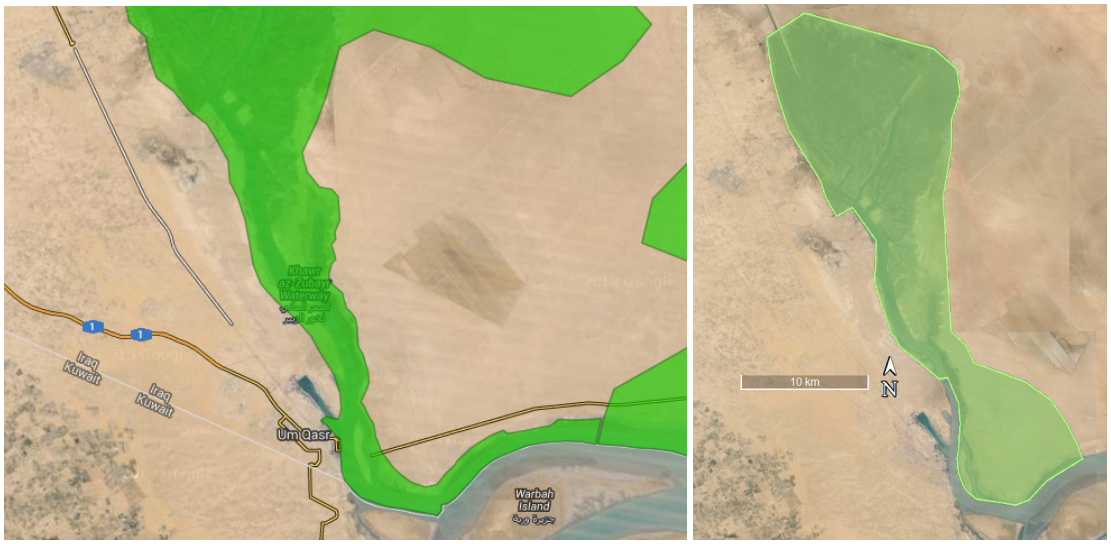


Figure 8.3: *KAZ Important Bird Area (IBA) and Key Biodiversity Area (KBA)*

Birds

As part of a biodiversity study undertaken by Nature Iraq in 2009 for the Khor Al-Zubair area, a total of 27 species of bird were recorded (see *Table 8.3*). With the exception of two species, Greater Spotted Eagle (Vulnerable) and Eurasian Curlew (Near Threatened), all birds recorded within the survey area are considered as species of Least Concern.

BirdLife International currently estimate that the global population of Greater Spotted Eagle range between 5,000 and 13,000 mature birds. Due to the limited population, believed to be declining from extensive habitat loss and persecution, it is listed as Vulnerable by BirdLife International[9]. Similarly, declines in populations of Eurasian Curlew have been recorded in several key populations, as a result, the species is as Near Threatened by BirdLife International[10].

The findings of the survey indicate that common species of water bird are present within the site boundaries and include Grey Heron (*Ardea cinerea*), Little Egrets (*Egretta garzetta*), Western Reef Heron (*Egretta gularis*), Kentish Plovers (*Charadrius alexandrinus*), Common Sandpipers (*Actitis hypoleucos*) Slender-billed Gull (*Larus genei*), Gull-billed Tern

[9] Species factsheet: Aquila clanga. Downloaded from http://www.birdlife.org on 28/02/2012. Recommended citation for factsheets for more than one species: BirdLife International (2012) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 28/02/2012.
[10] Species factsheet: Numenius arquata. Downloaded from http://www.birdlife.org on 28/02/2012. Recommended citation for factsheets for more than one species: BirdLife International (2012) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 28/02/2012

(*Gelochelidon* [Sterna] *nilotica*), Caspian Tern (*Hydroprogne* [Sterna] *caspia*) and Little Tern (*Sternula* [Sterna] *albifrons*)[11].

In the addition to the above, the survey identified the presence of approximately 50 adult Crab Plover (*Dromas ardeola*). Preliminary findings indicate that previously, this species of bird might not have been recorded in the south of Iraq at Khor Al-Zubair and Ras Al Beesha[11]. Whilst listed as a species of Least Concern by BirdLife International, it is regionally important with the wintering population throughout Arabia consisting of approximately 5,000 birds[12].

Table 8.3: Bird Species Recorded at Khor Al-Zubair by Nature Iraq

Common Name	Latin Name	BirdLife International
Black-crowned Night Heron	*Nycticorax nycticorax*	Least Concern
Squacco Heron	*Ardeola ralloides*	Least Concern
Grey Heron	*Ardea cinerea*	Least Concern
Purple Heron	*Ardea purpurea*	Least Concern
Little Egret	*Egretta garzetta*	Least Concern
Western Reef Heron	*Egretta gularis*	Least Concern
Great Cormorant	*Phalacrocorax carbo*	Least Concern
Marsh Harrier	*Circus aeruginosus*	Least Concern
Hen Harrier	*Circus cyaneus*	Least Concern
Greater Spotted Eagle	*Aquila clanga*	Vulnerable
Little Ringed Plover	*Charadrius dubius*	Least Concern
Kentish Plover	*Charadrius alexandrinus*	Least Concern
Eurasian Curlew	*Numenius arquata*	Near Threatened
Ruff	*Philomachus pugnax*	Least Concern
Armenian Gull	*Larus armenicus*	Least Concern
Black headed Gull	*Larus ridibundus*	Least Concern
Gull billed Tern	*Gelochelidon [Sterna] nilotica*	Least Concern

[11] Key Biodiversity Survey of Southern Iraq Site Review: Winter & Summer 08 Survey. Nature Iraq. Abdulhasan N. A & Salim, M. A. 2008

[12] Breeding Birds of the United Arab Emirates. Aspinall, S. 2010. Emirates Printing Press.

Table 8.3: Bird Species Recorded at Khor Al-Zubair by Nature Iraq		
Common Name	**Latin Name**	**BirdLife International**
Caspian Tern	*Hydroprogne [Sterna] caspia*	Least Concern
Collared Dove	*Streptopelia decaocto*	Least Concern
White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern
Grey Shrike	*Lanius sp.*	Least Concern
Rook	*Corvus frugilegus*	Least Concern
Crested Lark	*Galerida cristata*	Least Concern
Graceful Prinia	*Prinia gracilis*	Least Concern
House Sparrow	*Passer domesticus*	Least Concern
Spanish Sparrow	*Passer hispaniolensis*	Least Concern
Dead Sea Sparrow	*Passer moabiticus*	Least Concern
Reference: www.natureiraq.org		

Finally, other studies completed by EAME throughout the Faw region of Iraq identified resident or wintering species, inclusive of Black-winged Stilt (*Himantopus himantopus*), Grey Heron (*Ardea cinerea*), Purple Heron (*Ardea purpurea*), Little Egret (*Egretta garzetta*), Mesopotamian Crow (*Corvus capellanus*), White Wagtail (*Motacilla alba*) and House Sparrow (*Passer domesticus*).

Reptiles

Iraq has approximately 77 terrestrial reptile species, however, due to a significant lack of information regarding their distribution, range and population, most are not classified on the IUCN Red List. Of those that are classified, all are listed as species of Least Concern due to a wide distribution and stable population. Desert Monitor (*Varanus griseus*) is listed as an Appendix I CITES species and of conservation importance. However, given that this species favours sand dune based habitats, it is unlikely that it will be present within the survey area.

A study undertaken by EAME during 2011 in Fao identified the sole presence of Shokars Sand Racer (*Psammophis schokari*). A non-poisonous diurnal species of snake, Schokari's Racer predates on insects and small mammals[13].

Reptiles that could potentially exist within the study area include geckoes, diurnal lizards and snakes. *Table 8.4* provides the status of reptiles that are likely to exist within the sites boundaries.

Table 8.4: Possible Reptile Species within the Study Area

Common Name	Latin Name	IUCN Red List
Baluch Rock Gecko	*Bunopus tuberculatus*	Least Concern
Slevin's Sand Gecko	*Stenodactylus slevini*	Least Concern
Schmidt's Fringed Toed Lizard	*Acanthodactylus schmidti*	Least Concern
Short Nosed Desert Lizard	*Mesalina brevirostris*	Least Concern
Schokari Sand Race	*Psammophis schokari*	Least Concern
Source: www.iucnredlist.org		

Field Study Observations (Reptiles)

No reptile species were observed on the site during any of the survey activities.

Field Study Observations - Flora

A narrow coastal strip (approximately 20m wide) comprising of the species *Atriplex* sp and *Salsola* sp was located between the high tide mark and the existing Sabkha habitat. This habitat type is important in supporting native species of fauna, in particular reptiles and bird species. Vegetation coverage was estimated between 2 - 5%. The intertidal zone supported dense stands of *Arthrocnemum macrostachyum*, a species of Chenopod commonly found throughout the Gulf (*Photograph 8.2*)[14].

[13] Snakes of Arabia: A Field Guide to the Snakes of the Arabian Peninsula and its Shores. Arabian Heritage Guides. Egan, D. 2007

[14] Wildflowers of the UAE. ERWDA. Jongbloed, M. 2003

Photograph 8.2: *Exposed vegetated intertidal zone at low tide revealing Arthrocnemum macrostachyum community*

The field survey identified four species of flora, all belonging to the Chenopod family. All species are recognized plants of hypersaline soil conditions and regularly associated with coastal and Sabkha habitats.

The species *Arthrocnemum macrostachyum* was recorded within the intertidal zone of the site. A species commonly found throughout the Persian Gulf, it is regularly recorded within, or in close proximity to, intertidal zones.

Similarly, the species *Atriplex leucoclada* and *Salsola sp* are commonly found throughout coastal and hyper saline environs in the Middle East and Gulf region[14].

Table 8.5: Flora Species Recorded On-site

Family	Species Name	Annual/Perennial
Chenopodiaceae	*Arthrocnemum macrostachyum*	Perennial
	Atriplex leucoclada	Perennial
	Bienertia cycloptera	Annual
	Salsola sp	Perennial

These species are present in dense stands extending along the full length of the intertidal zone, but only around 20m wide at the widest point.

Field Study Observations - Mammals

The survey of the study area identified the presence of two mammal species. Signs of feral dog and camel were recorded during the September 2014 survey period. *Table 8.6* provides details on the species identified during the survey and their IUCN Red List status.

Table 8.6: Mammal Species Recorded On-site

Common Name	Latin Name	IUCN 2014 status
Feral Dog	*Canis lupus*	Not Listed
Camel	*Camelus sp.*	Not Listed

Source: IUCN Red List 2012: www.iucnredlist.org

Tracks of both feral dog and wild camel were recorded within the proposed development site (*Photograph 8.3*). Whilst no sightings were recorded, based on the evidence obtained, the populations within the area are expected to be small. Furthermore, both species are likely to be introduced to the area. As a result of both species recognized as introduced species, they are not listed on the IUCN Red List.

Photograph 8.3: *Dog tracks recorded across the intertidal zone*

Field Study Observations - Birds

The survey recorded a total of three bird species during the site visit undertaken in September. Details on the species recorded are provided in *Table 8.7* along with the BirdLife International Status.

Table 8.7: Bird Species Conservation Value

Common Name	Latin Name	BirdLife 2014 International Value
Purple Heron	*Ardea purpurea*	Least Concern
Western Reef Egret	*Egretta gularis*	Least Concern
Black-winged Stilt	*Himantopus*	Least Concern
Source: BirdLife International: www.birdlife.org		

The bird species recorded within the sites boundaries are all considered common resident species associated with coastal and intertidal areas throughout Iraq. Western Reef Egret (*Egretta gularis*) was recorded through sightings along the intertidal zone at low tide. A common wader species in the Middle East, populations of this species have benefitted from an increase in agricultural activities located near coastal environs.

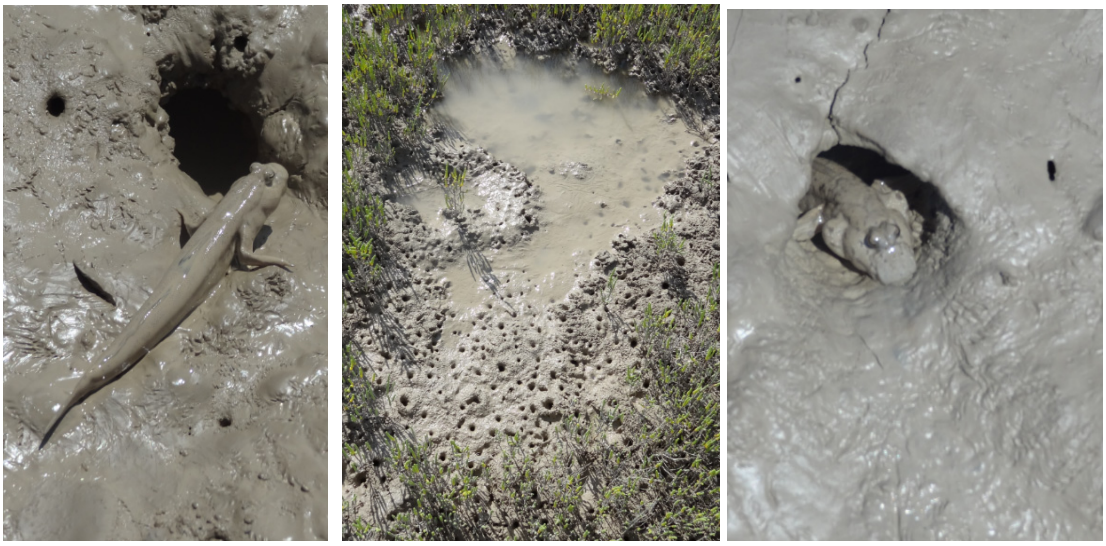
Single sightings of both Black-winged Stilt (*Himantopus himantopus*) and Purple Heron (*Ardea purpurea*) were recorded within the proposed site area. Both species were noted at Low Tide.

The population of birds observed in the intertidal area over the course of the project was small (often only one or two birds were seen during each site visit). So whilst the area provides foraging habitat for birds, it is not extensively inhabited.

Photograph 8.4: *Egret and Heron observed on project site*

Benthic Communities

The most abundant species dwelling in the intertidal are mudskippers (*periophthalmus gracilis*). The mudskipper colonies are virtually ubiquitous across the intertidal zone both within the vegetation zones and in the unvegetated exposed mud (see photographs below).



Photograph 8.5: *Mudskippers and extensive colonies (burrows) in intertidal zone*

These amphibious fish are common along the entire foreshore and tidal creeks around the Iraqi coast and are not considered to be threatened or endangered.

The only other species identied in the inter-tidal zone was a crab species (fiddler crab, *paraleptuca sindensis*), but these were only observed in small numbers typically sheltering under debris on the shore.

Photoraph 8.6: *Fiddler Crabs observed in project site intertidal zone*

8.5 Marine Ecology

Although the majority of the project assets and associated disturbance are land (or shoreline) based, given that there will be some in-water assets (the jetty) and associated construction activities, it is also important to consider the marine ecology.

8.5.1 Field Survey

EAME undertook sampling at the same five locations as the surface water and sediment sampling. All sampling was undertaken on the 13th September 2014 from a vessel which was audited and pre-approved by EAME. The collected samples were processed and analysed at Basra University. The results are presented below.

Phytoplankton

At each location, a phytoplankton sample was collected at the surface and bottom depth (1m above the river bed) using a Niskin Water Sampler. The samples were preserved with formalin solution and were visually assessed using microscopes equipped with Differential Interface Contrast. The species were identified using up-to-date identification keys and a species count was also undertaken.

Zooplankton

Zooplankton was collected using a 0.5m bongo net. The net was lowered to approximately 1m above the river bed and then hauled back to the surface through the water column to collect a composite sample through the entire water profile. The contents of the net were rinsed into a dedicated collection bottle and preserved with formalin.

Photograph 8.7: *Zooplankton, Sediment and Phytoplankton sampling devices*

At the university laboratory, the examination of samples was undertaken using stereo microscopes and the identification of species of the different groups using appropriate published keys and literature. The species density was determined by taking sub-samples of 10ml to a Bogrov tray for counting. All species were identified and counted and the number of individuals/m^3 calculated.

Benthic Animals

Sampling for benthic organisms was undertaken using a Van Veen Sediment Sampler. Two grab samples were taken at each of the five sampling locations to obtain sufficient volume of sample for examination and the colour and visual appearance of the sediment samples was recorded. The sediment samples were then sieved through a 0.5mm mesh and preserved with formalin solution. The samples were then refrigerated and stored prior to despatch to the laboratory for analysis (identification and species count).

Photograph 8.8: *Illustrating the range of sediment types from sandy gritty sediment with numerous shells to soft fine silt with no shells or inclusions*

Sea Birds

During the marine biology sampling survey, all survey staff remained vigilant for the appearance of sea-birds. A record of all such sightings and a description of the birds observed was made and is described in the intertidal section.

8.5.2 Baseline Data

Sampling Locations

The marine ecology samples were obtained from the same positions as the sediment and surface water samples.

Phytoplankton

The phytoplankton was dominated by the following species:

- *Actinocyclus octonarius* Ehr.
- *Coscinodiscus oculus-iridis* Her.
- *Coscinodiscus* spp.
- *Campylodiscus clypeus* Her.
- *C. noricus* ex tz
- *Cyclotella* sp
- *Planktoniella sol* (Wallich) Schutt 1893

- *Rhizosolenia imbricata* Brightwell
- *Thalassionema nitzschioides* Grun
- *Protoperidinium* depressum

The following species were also encountered but their occurrence was rare:

- *Gomphotheca sinensis* (Skvortzow)Hen.&Sims
- *Surirlla gemma* Her.
- *S. striatula* Turp.
- *Pleurosigma* sp.
- *Dinophysis caudata* Saville-Kent

Table 8.11 presents total cell count for each sampling location:

Table 8.11: Total Phytoplankton Cell Count

Species	SW01: 1.0m	SW01: 12.7m	SW02: 1.0m	SW02: 3.3m	SW03: 1.0m	SW03: 5.1m	SW04: 1.0m	SW04: 10.0m	SW05: 1.0m	SW05: 11.0m
Bacillariophyceae									40	20
Actinocyclus octonarius Ehr.	40	20	40	10	40	10	20			
Campylodiscus clypeus Her.			160		30		40			
C. daemelinus			10				30			
C. echeneis			30				20			
C. noricus ex Ktz	40	20				20	10		20	40
Coscinodiscus asteromphalus Ehr.	20			10	10					
C. mariginatus.	10	10		10					20	10
C. oculus-iridis Her.	100			10	140	20	60	160	40	
C. radiatus Her	20			10						

Table 8.11: Total Phytoplankton Cell Count

Species	SW01: 1.0m	SW01: 12.7m	SW02: 1.0m	SW02: 3.3m	SW03: 1.0m	SW03: 5.1m	SW04: 1.0m	SW04: 10.0m	SW05: 1.0m	SW05: 11.0m
Cyclotella sp	60	20		10	80		30	20	20	10
Dactyliosolen fragilissimus Husle 1996	20									
Ditylum brightweellii (T.West)Grun.e	20									
Gomphotheca sinensis(Skvortzow) Hen.&Sims			60				30	40		
Gyrosigma sp.	10		10							
Lauderia annulata Cleve	10		10							
Nitzschia sigma (Kuetz.) W.Smith										
Planktoniella sol (Wallich) Schutt 1893	80		120	20	60	20	60	80	60	
Pleurosigma sp W.Smith			20	10					20	
Proboscia alata (Brightwell) Sundström 1986			20							
Pseudo-nitzschia (Grun ex Cleve) Hasle	10									
Rhizosolenia alata forma indica Gran			10		10	10				
Rhizosolenia imbricate	10		10		10			10	40	10
Rhizosolenia clevei Sund.1984	10		10		10					
Rhizosolenia	10	10	10		10		10			

Table 8.11: Total Phytoplankton Cell Count

Species	SW01: 1.0m	SW01: 12.7m	SW02: 1.0m	SW02: 3.3m	SW03: 1.0m	SW03: 5.1m	SW04: 1.0m	SW04: 10.0m	SW05: 1.0m	SW05: 11.0m
setigera Brightwell 1858										
Surirlla gemma Her.	10		30							
S. striatula Turp.	10		20							
Syndra ulna (Nitzsch) Ehrenberg	10		50	30				20		
Thalassionema nitzschioides Grun.	50			80			40	20		10
T. frauenfeldii (Grun) Hallegraeff 1986				10						
Dinophysis caudata Sav.-Kent	10									10
Dinophysis miles										
Protoperidinium obtusum	10			10	10					
Protoperidinium depressum				10	10	20	20	10	20	
Total	**560**	**80**	**620**	**230**	**600**	**100**	**370**	**360**	**280**	**110**

In all cases except SW04, the species abundance of the shallow sample is greater than that of the deeper sample. This is to be expected given that the turbidity levels in these waters are high so light scattering (which provides the energy for phytoplankton) will be more limited at depth than the surface. There is, however, no significant difference between the sample locations per se. This is probably due to the twice daily tides which are strong and which will cause dynamic mixing of the water. Furthermore, there are no greatly differing land uses that would have notable localized impacts on the water quality adjacent to them (e.g. sewage outfall or agricultural run-off).

Zooplankton

A full breakdown of the zooplankton species found at SW01 is detailed in *Table 8.12*:

Table 8.12: SW01 Total Number of Individuals/ml and Percentage of Zooplankton

Species	Individuals per ml	% of Population
COPEPODA		
CALANOIDA		
Acartia (Acartilla) faoensis	10	3.5
Acartia (Odontacartia) pacifica	90	31.6
Bestiolina Arabica	35	12.3
Paracalanus sp.	15	5
Parvocalanus sp.	10	3.5
Eucalanus sp.	5	1.76
Temora sp.	0	0
Labidocera sp.	5	1.76
Nauplii – Copepoda	20	7.0
Copepodite Stages	60	21.1
Harpacticoid	0	0
Microsetella sp.	5	1.76
Cyclopoid	1	0.35
Oithiona spp.	5	1.76
Total of Copepoda	261	91.91
Total of Calanoida	250	88.02
Other Zooplankton		
Oikopleura sp.	6	2.1
Sagitta sp.	4	1.4
Isopoda	1	0.35
Megalop larvae	0	0

Table 8.12: SW01 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
Polychaeta adult	0	0
Polychaeta lavae	4	1.4
Mysids	1	0.35
Ostracoda	2	0.7
Cirripedia larvae	5	1.7
Total of others	23	8.09
Final total	**284**	

A full breakdown of the zooplankton species found at SW02 is detailed in *Table 8.13*:

Table 8.13: SW02 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
COPEPODA		
CALANOIDA		
Acartia (Acartilla) faoensis	12	3.45
Acartia(Odontacartia) pacifica	76	21.9
Bestiolina Arabica	33	9.51
Paracalanus sp.	24	6.91
Parvocalanus sp.	20	5.76
Eucalanus sp.	24	6.91
Temora sp.	0	0
Labidocera sp.	3	0.86
Nauplii – Copepoda	25	7.2
Copepodite Stages	68	19.59
Harpacticoid	8	2.3

Table 8.13: SW02 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
Microsetella sp.	15	4.32
Cyclopoid	18	5.18
Oithiona spp.	4	1.15
Total of Copepoda	330	95.1
Total of Calanoida	285	82.13
Other Zooplankton		
Oikopleura sp.	4	1.15
Sagitta sp.	1	0.288
Isopoda	0	0
Megalop larvae	0	0
Polychaeta adult	0	0
Polychaeta lavae	6	1.72
Mysids	2	0.57
Ostracoda	1	0.288
Cirripedia larvae	3	0.86
Total of others	17	4.899
Final total	**347**	

A full breakdown of the zooplankton species found at SW03 is detailed in *Table 8.14*:

Table 8.14: SW03 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
COPEPODA		
CALANOIDA		

Table 8.14: SW03 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
Acartia (Acartilla) faoensis	32	8.39
Acartia(Odontacartia) pacifica	100	26.24
Bestiolina Arabica	45	11.81
Paracalanus sp.	12	3.14
Parvocalanus sp.	5	1.31
Eucalanus sp.	15	3.93
Temora sp.	8	2.0
Labidocera sp.	5	1.31
Nauplii – Copepoda	38	9.97
Copepodite Stages	44	11.54
Harpacticoid	9	
Microsetella sp.	15	0.49
Cyclopoid	7	
Oithiona spp.	0	12.37
Total of Copepoda	335	87.92
Total of Calanoida	304	79.79
Other Zooplankton		
Oikopleura sp.	9	2.36
Sagitta sp.	0	0
Shrimp larvae	8	2.0
Isopoda	1	0.26
Megalop larvae	0	0
Polychaeta adult	1	0.26
Polychaeta lavae	8	2.0
Mysids	1	0.26

Table 8.14: SW03 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
Ostracoda	6	1.57
Cirripedia larvae	12	3.14
Total of others	46	
Final total	**381**	

A full breakdown of the zooplankton species found at SW04 is detailed in *Table 8.15*:

Table 8.15: SW04 Total Number of Individuals/ml and percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
COPEPODA		
CALANOIDA		
Acartia (Acartilla) faoensis	25	8.65
Acartia (Odontacartia) pacifica	52	17.99
Bestiolina Arabica	39	13.49
Paracalanus sp.	17	5.88
Parvocalanus sp.	11	3.81
Eucalanus sp.	13	4.50
Temora sp.	9	3.11
Labidocera sp.	0	0
Nauplii – Copepoda	21	7.27
Copepodite Stages	42	14.53
Harpacticoid	0	0
Microsetella sp.	8	2.77
Cyclopoid	3	1.04
Oithiona spp.	7	2.42

Table 8.15: SW04 Total Number of Individuals/ml and percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
Total of Copepoda	247	85.47
Total of Calanoida	229	79.23
Other Zooplankton		
Oikopleura sp.	7	2.42
Sagitta sp.	2	0.69
Isopoda	0	0.00
Megalop larvae	14	4.84
Polychaeta adult	0	0.00
Polychaeta lavae	7	2.42
Mysids	1	0.35
Ostracoda	0	0
Cirripedia larvae	11	3.81
Total of others	42	14.53
Final total	**289**	

A full breakdown of the zooplankton species found at SW05 is detailed in *Table 8.16*:

Table 8.16: SW05 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
COPEPODA		
CALANOIDA		
Acartia (Acartilla) faoensis	15	8.08
Acartia (Odontacartia) pacifica	40	21.5
Bestiolina Arabica	25	13.44
Paracalanus sp.	10	5.37

Table 8.16: SW05 Total Number of Individuals/ml and Percentage of Zooplankton		
Species	**Individuals per ml**	**% of Population**
Parvocalanus sp.	5	2.68
Eucalanus sp.	5	2.68
Temora sp.	4	2.15
Labidocera sp.	0	0
Nauplii – Copepoda	12	6.45
Copepodite Stages	20	10.75
Harpacticoid	0	0
Microsetella sp.	5	2.68
Cyclopoid	1	0.537
Oithiona spp.	5	2.68
Total of Copepoda	147	79.032
Total of Calanoida	136	73.118
Other Zooplankton		
Oikopleura sp.	5	2.68
Sagitta sp.	1	0.537
Isopoda	0	0
Megalop larvae	10	5.37
Polychaeta adult	1	0.537
Polychaeta lavae	8	4.3
Mysids	1	0.537
Ostracoda	0	0
Cirripedia larvae	13	6.98
Total of others	39	20.967
Final total	**186**	

The populations of Zooplankton are typical of seawater in this locality (*c.f. JICA Sealine Project – Environmental Baseline Survey 2011*). The high turbidity levels in the water body here (and especially closer to the shore) will limit productivity and species diversity as light penetration (and hence energy source) is poor in these waters. Also there is little in the way of agricultural runoff in this area which would provide nutrients to the water body. There is no notable difference between the sample locations, which is not surprising given the strong tidal currents and associated mixing of water. No stratification was identified during the water quality survey supporting this view.

Benthic Animals

The results of the analysis of benthic samples are presented in *Table 8.17* below.

Table 8.17: Benthic Species Present at Each Location

Groups	SW01	SW02	SW03	SW04	SW05
Gastropoda	*Priinella conica*		X	X	X
		Cerithium scabridum			
Scaphopoda	*Dentalium octangulatum*	*Dentalium octangulatum*			
Bivalve	*Paphia gallus*	*Paphia gallus*			
	Diplodonta globosa				
	Gari roseus				
	Meretrix				
	Brachidontes emarginatus	*Brachidontes emarginatus*			
	Brachidontes variabilis				
	Trapezium sublaevigatum				
	Aspidopholas cf. ovum				

Table 8.17: Benthic Species Present at Each Location					
Groups	**SW01**	**SW02**	**SW03**	**SW04**	**SW05**
	Abra cadabra	*Abra cadabra*			
	Angulus sp.				
		Marcia hiantina			

In each case a decent volume of sample was returned, however, only samples SW01 and SW02 contained any identifiable species, indicating that the biomass within the benthic sediments is low. This again is to be expected as the area is subjected to strong tidal currents with heavy sediment loads and a fluid sediment bed. It is also close to the main navigation channel where dredging takes place and so is a disturbed environment.

8.6 Project Site Conservation Value Assessment

Habitat Conservation Value

The habitats identified within the site boundaries have all been significantly affected by anthropogenic activities. The limited vegetative cover afforded by the hyper-saline Sabkha habitat provides limited support for species of fauna on land and the intertidal area is similarly sparsely vegetated and disturbed by debris that has accumulated on the beach or been deposited there as part of the wreck clearance activities.

Where vegetation is present, it is primarily dominated by a small range of species. As a result of the significant disturbance throughout the area, the habitats support limited floristic cover, with those species identified during the September survey comprising of common halophytic species. As a result of the highly disturbed habitat and limited species coverage, the conservation value of habitats within the proposed development area are identified as **Low to Negligible**.

The marine environment is similarly of **Low to Negligible** conservation value in terms of the benthic communities which comprise mainly silty substrate with no reefs, corals, mangroves, etc. The marine environment itself if highly dynamic and could support a wide range of fish, mammal and plankton species, although shipping, dredging and high turbidity levels will limit this compared to the more open waters of the Arabian Gulf and less turbid coastal zones of some of the Gulf states. Nonetheless, this is the most ecologically interesting and

sensitive aspect of the project area natural environment and would have a conservation value of **Low**.

Terrestrial and Intertidal Flora

A total of four plant species were identified during the baseline survey. *Table* **8.18***8.18* provides a list of the flora species recorded during the baseline surveys and the assigned conservation values.

Table 8.18: Floristic Species Conservation Value

Family	Species Recorded	Conservation Value
Chenopodiaceae	*Arthrocnemum macrostachyum*	Low
	Atriplex leucoclada	Low
	Bienertia cycloptera	Low
	Salsola sp	Low

All species recorded are considered common throughout the region and across hyper-saline coastal environments. The species identified are quick to colonise disturbed habitats. The wide distribution of the above species throughout coastal, intertidal and sabkha habitats in the Gulf accompanied by the limited distribution within the survey area results in an ecological conservation value of **Low** being applied.

Land Mammals

The survey recorded the presence of two mammal species within the proposed development area. *Table 8.19* provides a list of the mammal recorded along with their IUCN Red List Status and Conservation Value.

Table 8.19: Mammal Species Conservation Value

Common Name	Latin Name	IUCN 2014 status	Conservation Value
Feral Dog	*Canis lupus*	Not Listed	Negligible
Camel	*Camelus sp.*	Not Listed	Negligible
Source: IUCN Red List 2012: www.iucnredlist.org			

Feral dog is not listed on the IUCN Red List and are the likely result of abandoned pets. The increase in feral dog populations throughout the Middle East is of serious concern due to the potential spread of disease and safety concerns for human where interactions are inevitable. The diet of feral dogs is highly variable, where it is known to forage within rubbish dumps, predate on native species or take livestock. The size of population in any given area is wholly reliant on its surroundings. However, the expansion of human settlements, a lack of natural predators and an increase in available food items has assisted in populations of feral dog growing.

Camels are primarily associated with animal husbandry in the Middle East, where they are farmed for milk, meat and activities inclusive of racing. As a result of being utilized for animal husbandry purposes, populations of this species have exploded in the past 30 years with an improvement of agricultural areas and availability of clean water.

Both feral dog and camel are not listed on the IUCN Red List due to populations primarily resulting from escaped, domesticated animals. As a result, both these species are recognized as mammals of **Negligible Conservation Value**.

Birds

A total of three bird species were recorded during the baseline survey for the proposed port development. *Table 8.20* provides a list of all birds recorded indicating their local and international status along with their Conservation Value.

The bird species recorded during the baseline survey are all considered to be common resident, common breeding resident and/or common migratory species in Iraq. Similarly, all species are listed as Birds of Least Concern on the BirdLife International Database.

Populations of both Black-winged Stilt and Western Reef Egret are recognized as increasing and stable respectively. Populations of both species have benefitted from development of landscape and agricultural activities in the region, especially activities such as irrigation of crops. Both species have large global ranges and this accompanied with stable to growing populations, the species are listed as Least Concern by BirdLife International.

However, populations of Purple Heron on a global scale are decreasing, with habitat destruction recognized as the key threat to breeding grounds. Key areas of habitat include reed beds, where Purple Heron will construct nests and also predate on fish species. However, as a result of the species large range and whilst recognizing a decline in population, it is not considered to be rapidly approaching the threshold of Vulnerable, this species is listed as Least Concern by BirdLife International.

The expansive range of these species in Iraq and globally, accompanied by stable to growing populations results in a **Low Conservation Value** being applied.

Table 8.20: Bird Species Conservation Value

Common Name	Latin Name	BirdLife 2012 International Value	Conservation Value
Purple Heron	*Ardea purpurea*	Least Concern	Low
Western Reef Egret	*Egretta gularis*	Least Concern	Low
Black-winged Stilt	*Himantopus*	Least Concern	Low
Source: BirdLife International: www.birdlife.org			

Marine Flora and Fauna

The marine environment clearly displays populations of zooplankton and phytoplankton that in turn will provide an important food and energy sources for fish, crustacean and in turn marine mammals. EAME interviewed several fishermen working in the area about marine mammals and they said that in their living memory that had not seen or caught any in their nets in Khor Al-Zubair, but they have been observed out in the open gulf on rare occasions. Similar findings have arisen in other Iraqi coastal studies EAME has undertaken and it seems reasonable to conclude that there is not a significant presence of marine mammals in the Khor Al-Zubair. As such given the relatively low abundance and diversity of plankton species and the river only being able to support a small artisanal (drift net and shore net) fishing community, the habitat conservation value in this regard is similarly deemed as **Low**.

8.6.1 Ecological Baseline Summary

Considering all of the above observed and inferred components of the natural environment around the project site, the overall conclusion is that the area has a negligible to low conservation value and the ecological sensitivity of the site in terms of species, habitat and regional importance is **low**.

8.7 Impact Assessment

Introduction

The following ecological impact assessment of the proposed development is focused on the terrestrial, intertidal and marine components of the project site collectively.

Construction Impacts

The construction activities that could have an impact on the ecology within the proposed development site include:

- Earthworks – clearing and levelling of the site;
- Installation of the temporary construction facilities (e.g. offices, parking areas);
- Installation of the security fence/barrier;
- Construction of Material Laydown Areas;
- Construction of roads;
- Movement of construction vehicles and operation of machinery;
- Provision of a fully functioning temporary residential accommodation;
- Piling (onshore and off-shore);
- Noise and vibration disturbance;
- Debris clearance; and
- Increase in Dust, Light and Pollution.

These activities have been assessed against the baseline ecological features identified during the surveys to assess the potential impacts on the ecology of the area.

Terrestrial Habitats

Construction works will require the levelling and clearing of an already highly disturbed area of habitat. The habitats identified within the survey area support limited, common species of flora and fauna, all of which are recognized as Low Conservation Value. Whilst the activities will involve the clearing and modification of the habitat within the survey area, the

existing anthropogenic impacts and low value of the habitat result in a **Negligible Impact** during construction.

Terrestrial Flora

Direct impacts of the proposed port construction are related to the clearing process that will take place within the survey area. As recognized within the baseline survey, the existing habitats within the survey area support limited, common and widespread species of flora which is sparsely present on the site. It is therefore expected that a **Low Impact** will occur from construction.

Land Mammals

Both feral dogs and camels are highly mobile, adaptive species found throughout disturbed habitats in close proximity to human settlements within Iraq. Populations of both species have benefitted greatly from an increase in urbanization and agricultural activities within the country. Whilst it is expected that the construction works will displace the species from the immediate area, such displacement will have a very minor, localised effect on the population. Populations of both species are recognized as introduced and of negligible conservation value. As a result, the effects of the construction activities are expected to have a **No Significant Impact** on the population present.

Birds

All bird species recorded during the terrestrial ecology survey are considered to be of Low Conservation Value. The species identified within this area are recognized as common resident, breeding species with stable to growing populations globally. Species inclusive of Black-winged Stilt and Western Reef Egret have benefited considerably from the increase in urban landscaping and provision of irrigation agricultural areas within the Middle East.

Whilst construction activities are likely to result in temporary displacement of the above mentioned species, it is highly unlikely that such activities will have detrimental effects on the populations of these birds within Iraq and on a global level.

Given the stable, growing populations of the bird species identified and the low conservation values of the species, the proposed construction works for the port project will result in a **Low Impact** on the identified bird species.

Land Reptiles

Whilst the survey did not identify any reptile species, it is possible that small diurnal lizards occur within the survey area. However, even if reptiles occurred, it is expected that the

populations within the survey area are very low. As a result of the anticipated low populations and small construction area within a highly disturbed habitat, it is concluded that the development will result in a **Low Impact** on reptile populations.

Marine Flora and Fauna

The piling and associated construction works will inevitably disturb the river bed and cause mobilisation of sediments as well as displace the sediment where they interact. The environment is already highly turbid with a high suspended sediment load. The temporary construction activities are not likely to make a notable contribution to the sediment load that already exists. Furthermore, the sediments that will be directly impacted by the piles have already been established as having negligible benthic communities present. The species that have been found in any sort of abundance in the marine environment are phytoplankton and zooplankton which are mobile and move with the water body (as would any fish species). These would thus not be physically impacted by the construction activities in or on the water line. The mudskipper colonies directly in the piling zones would be displaced and disturbed and the existing burrows destroyed, but relatively speaking the percentage of these burrows lost is small in surface area terms and the entire inter-tidal area is colonised so will readily adapt to the zones between the piles. The only impact scenario would be if water quality itself was impaired by the construction works, but as has already been established the construction impact will be physical. Consequently the construction impact on marine flora and fauna is considered to be a **Low Impact**.

In conclusion, the construction phase of the project is not expected to have any adverse ecological impact.

Operational Impacts

The operational activities that could impact on the terrestrial ecology within the proposed development area include:

- Increased road traffic resulting in road kill accidents;
- Artificial lighting and light pollution of the area;
- Noise and vibration disturbance associated with plant, equipment and vessels;
- Vehicle Emissions reducing air quality; and
- Physical barriers resulting in habitat fragmentation.

These activities have been assessed against the baseline ecological features identified during the surveys to assess the potential impacts on the ecology of the area from operational activities.

Terrestrial Habitats

During operation, it is unlikely that any further impacts will be associated with surrounding habitats as there are no notable species present to be disturbed. Furthermore, the area identified for the development will only result in the loss of an already highly disturbed habitat. Whilst it is recognized that the operation of the port will result in a permanent barrier restricting the movement of species, given the findings of the baseline surveys, the site supports limited species of flora and fauna all of which are recognized as common. It is anticipated that the operational impacts of the port development will be **Negligible**.

Terrestrial Flora

Any clearance of flora will take place during the construction phase. During operation, the terrestrial component of the port facility will comprise of hardstanding, limiting the establishment of species of flora. However, opportunistic species may colonise road side verges or bare patches of soil left undeveloped. The significant lack of species coverage and recognized as common species of negligible conservation value, the operational impacts of the port on flora in the area is considered to be **Negligible**.

Land Mammals

The greatest impact to those species identified within the sites boundary during the operation of the port will be caused by a barrier effect of the establishment of new roads, fences and associated infrastructure. However, the use of the land is very sporadic and it does not represent a significant habitat or colony. An increase in traffic the surrounding area is likely to result in an increase in road kill accidents, but the species abundance is so low that this too will be of very low impact. Whilst both feral dog and camel will tend to avoid the road, occasional road kill accidents are expected to occur. The impact of such accidental mortality is considered to have a **Negligible Impact** on the population of both species in the area.

A result of increased noise and light pollution on the development is expected to impact the populations of both species within the operational area. An increase in noise and light is likely to cause an initial displacement, however, it is noted that feral dogs are highly adaptable and likely to become habituated to such conditions. It is expected that they will return to the area resulting in a **Low Impact** on the mammals along the route. Similarly, the

ongoing activities within the area are likely to displace camels to other areas near the site. It should also be remembered that no species of conservation value were observed.

Birds

As a result of the project, species that congregate near man-made developments i.e. port facilities inclusive of doves, sparrows and gulls are likely to inhabit the area. All have stable, increasing populations throughout the Middle East and species of dove and sparrow can be recognized as pest species. As a result, it is concluded that an increase in road traffic and potential road kills will have **Negligible Impacts** on the bird species and populations identified.

Impacts from noise and air pollution can affect birds, however as the baseline survey results indicate, the majority of species identified throughout the survey area are considered to be common breeding species that are widespread throughout the country and region. It is concluded that the operation of the facility will have a **Low Impact** on the bird population in the surrounding area.

An increase in lighting throughout the proposed development will result in illuminated conditions during the night time periods. As noted during the survey, species composition during the survey was limited. It is expected that the increase in light pollution will have a **Low Impact** on the bird population in the surrounding area.

Land Reptiles

Similarly to mammals, the greatest impact that will be experienced by reptiles during the operational phase will be the creation of a new ecological barrier to movement between habitats used for shelter, breeding and feeding.

Impacts on populations of lizards primarily associated with coastal fringe habitats are expected to increase as vehicle activities increase in the area. However, it is highly likely that the existing populations are limited, and as a result of the significant disturbance in the area, comprise of common species. The development of the road is not envisaged to cause any adverse impacts on populations within the area.

An increase in noise and light during the operational phase of the road project, due to increased vehicle movements and artificial lighting will result in possible displacement, altered behaviour and potentially affect breeding of reptile species. An increase of light throughout the road corridor is likely to affect nocturnal species of reptile, primarily gecko. However, it has been noted in certain studies that an increase in light on road side habitats ultimately led to an increase in invertebrates, the primary source for many gecko

populations. As a result of an increase in food source, species have become habituated to conditions where non-natural light sources provide favourable foraging habitats, such as road side verges.

The effects of road and highway noise on reptiles is an unknown factor. Whilst it is recognized that vibrations and noise may have an impact on the movements of reptiles, those studies undertaken on roads indicate that species are unlikely to be affected by an increase in volumes. Studies undertaken in the USA indicate that a variety of reptile species happily coexist in close proximity to major highways and transport infrastructure schemes. Findings of the studies indicate that lack of reptiles in close proximity to roads is possibly attributed to road kills, rather than a noise barrier effect primarily owing to their lack of hearing. As a result, it is recognized that an increase in noise on the surrounding reptile populations during operation will result in a **Low Impact**.

Marine Flora and Fauna

Once developed the berth facilities will be a fixed feature and the marine ecology will adapt around them. The species present in the area are also adapted to anthropogenic noise and vibration from the existing port facilities and will quickly adapt to the new facilities. Similarly the presence of large vessels and the running of engines, etc is already a feature of the baseline environment and the shipping associated with the new berth will not alter this environment substantially. Consequently, the operational aspects of the development are considered to have a **Low Impact** on the marine environment.

8.7.1 Mitigation Measures

In order to minimise the impacts previously described, albeit of low significance, the following mitigation measures are recommended:

- Landscaping to comprise of native species and no irrigated vegetation;
- Clearing activities restricted to the construction corridor only;
- Minimisation of construction working area and activities, especially in the inter-tidal zone;
- A strict no approach policy to wildlife;
- Management of feral dog populations in accordance with suitable animal control procedures;

- Fencing of the construction area and no activities inclusive of driving or walking outside of the area to take place; and

- Compilation of a Construction Environmental Management Plan (CEMP) to set out pollution prevention and environmental protection measures associated with the construction activities.

8.7.2 Residual Impacts

Following the implication of the above mitigation measures, the findings of the report indicate that the proposed Terminal construction will have a **Negligible Impact** on the terrestrial, intertidal and marine ecology within the development and immediate surrounding area.

It is recognized that a loss of habitat will still occur throughout the development site, however the habitat being directly impacted is considered to be of Low Ecological Value. Additionally, the floristic species impacted are common and widespread throughout the area.