DHI-QAR COMBINED CYCLE GAS TURBINE POWER PLANT PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT

Republic of IRAQ
Ministry of Electricity

ENKA UK

SEPTEMBER 2018

ANKARA

DHI-QAR COMBINED CYCLE GAS TURBINE POWER PLANT PROJECT

ESIA REPORT

Version	Revision	Date	Prepared by					Checked by	Approved by
Draft	A.2	December 13, 2017	Evren Arı Chemist, Env. Expert	Elçin Kaya Sociologist	Celal Denizli Biologist, Ecologist	Y. Çelikel Social Expert	Z. Çeliker Env. Eng.	Turgay Eser Env. Eng.	G. Ozenirler Env. Eng, M.Sc.
Draft	A.3	February 20, 2018	Evren Arı Chemist, Env. Expert	Elçin Kaya Sociologist	Celal Denizli Biologist, Ecologist	Y. Çelikel Social Expert	Z. Çeliker Env. Eng.	Turgay Eser Env. Eng.	G. Ozenirler Env. Eng, M.Sc.
Draft	A.4	March 29, 2018	Evren Arı Chemist, Env. Expert	Elçin Kaya Sociologist	Celal Denizli Biologist, Ecologist	Y. Çelikel Social Expert	Z. Çeliker Env. Eng.	Turgay Eser Env. Eng.	G. Ozenirler Env. Eng, M.Sc.
Final	C.0	May 16, 2018	Z. Çeliker Env. Eng.	Elçin Kaya Sociologist	Celal Denizli Biologist, Ecologist	Y. Çelikel Social Expert		Turgay Eser Env. Eng.	G. Ozenirler Env. Eng, M.Sc.
Final	C.1	June 22, 2018	Z. Çeliker Env. Eng.	Elçin Kaya Sociologist	Celal Denizli Biologist, Ecologist	Y. Çelikel Social Expert		Turgay Eser Env. Eng.	G. Ozenirler Env. Eng, M.Sc.
Final	C.2	July 20, 2018	Z. Çeliker Env. Eng.	Elçin Kaya Sociologist	Celal Denizli Biologist, Ecologist	Y. Çelikel Social Expert		Turgay Eser Env. Eng.	G. Ozenirler Env. Eng, M.Sc.
Final	C.3	September 11, 2018	Z. Çeliker Env. Eng.	Elçin Kaya Sociologist	Celal Denizli Biologist, Ecologist	Y. Çelikel Social Expert		Turgay Eser Env. Eng.	G. Ozenirler Env. Eng, M.Sc.

Revision Codes: A: Draft, B: Final Draft, C: Final

Project No: 17/002

September 2018

Client:

General Electric (Switzerland) GmbH
Brown Boveri Strasse 7
5400 Switzerland

Client:

ENKA UK Construction Limited
7 HENRIETTA STREET. C/0
REDFERN LEGAL LLP.
LONDON. WC2E 8PS

Consultant:

2U1K INTERNATIONAL LTD.
PS 6 - 3rd Floor, The Meydan Office Tower
Meydan Road, P.O. Box 450676
Dubai – UAE
☎: +90 (533) 283-6569

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

2U1K	2U1K Engineering and Consultancy Inc.
ºC	Degrees Celsius
AoI	Area of Influence
ACC	Air-Cooled Condenser
BOD	Biological Oxygen Demand
BoP	Balance of Plant
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
COD	Chemical Oxygen Demand
DoE	Department of Environment
CCGT	Combined Cycle Gas Turbine
dB	Decibel – a logarithmic measure of sound
dBA	A-weighted sound level in decibels
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EP	Equator Principles
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
GW	Gigawatts
GWh	Gigawatts hour
h	Hour
ha	Hectare
HR	Human Resources
HRSG	Heat Recovery Steam Generator
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
IFI	International Financial Institution
kW	kilo Watt
L	Litre
MoE	Ministry of Electricity
MoEn	Ministry of Environment
MoO	Ministry of Oil
MW	Mega Watt

OECD	Organisation for Economic Co-operation and Development
OHS	Occupational Health and Safety
OHTL	Overhead Transmission Line
PM	Particulate Matter
PAH	Polycyclic Aromatic Hydrocarbon
SEP	Stakeholder Engagement Plan
SS	Suspended Solids
TDS	Total Dissolved Solids
THC	Total Hydrocarbon

1 INTRODUCTION

ENKA UK Construction Ltd. (ENKA) and General Electric Switzerland GmbH and Alstom Middle East Iraq (collectively referred to as "GE") plan to develop and construct the '*Dhi-Qar Combined Cycle Gas Turbine (CCGT) Power Plant Project'* (hereinafter referred to as 'the Project') which will have a gross capacity of 750 MW and will be located in Nasiriyah City in Dhi-Qar Governorate, 200 km northwest of Basra, in Southern Iraq.

The Project is planned in two phases: In Phase 1, the Power Plant will be constructed as a simple cycle power plant, which will include four Gas Turbines and will have a total capacity of 432.8MW. In Phase 2, a Steam Turbine and four Heat Recovery Steam Generators (HRSG) with a capacity of 236.5 MW will be added to the Project.

The Gas Turbines have been purchased by Ministry of Electricity ("MoE" hereinafter referred to as the "Employer") as part of a Mega-Deal between the Government of Iraq and GE. GE will serve as Engineering, Procurement, and Construction (EPC) Contractor and ENKA, GE"s Nominated Subcontractor, will be responsible for installing and commissioning the Project. After commissioning MoE will own and operate the Project. The Dhi-Qar Combined Cycle Gas Turbine Power Plant will be the first combined cycle project to be owned and operated by the MoE of Iraq.

The aim of the Project is to generate electricity from natural gas and liquid fuel resources of the state in order to provide energy for the growing demand of Iraq.

The Employer plans to apply to international financial institutions namely Overseas Private Investment Corporation (OPIC) and Export Credits Guarantee Department of UK Government[1] (UKEF) for potential project financing. Consequently, the Project is committed to follow OPIC Environmental and Social Policy Statement, relevant national environmental legislation and regulations and international environmental and social guidelines and standards, including, but not limited to, International Finance Corporation (IFC) Performance Standards (PS) and Guidelines of the World Bank Group. On behalf of the Employer, GE and ENKA have retained 2U1K International Limited to prepare this Environmental and Social Impact Assessment (ESIA) report to be submitted the potential lenders.

Site mobilization for the Project was started in August 2017. Phase 1 of the Project is planned to be completed in 20 months. Phase 2 will start during the last 4 months of Phase 1 and is expected to be completed in 34 months.

[1]UK Export Finance (UKEF) determines whether applications for support fall within the scope of the OECD Common Approaches and Equator Principles for funding. If so, UKEF then categorizes projects and benchmarks Environmental, Social, Human Rights (ESHR)

The Project will be located on a 30 ha site, which is owned by the Government of Iraq and has been allocated to the MoE. The Project will employ a dual fuel system, which will consist of natural gas and liquid fuel (Crude Oil + Light Distillate Oil). Natural gas is planned to be supplied from the North Rumila pipeline, crude oil fuel will be supplied from the Nasiriyah Oil Field and light distillate oil will be transported to the Project by tankers. Connection from the crude oil pipeline to the plant will be approximately 10 m to the east and connection from the natural gas pipeline will be 70 m to the south.

Energy generated by the Project will be exported to the national grid through a 1 km in length 400 kV OHTL located between the 400/132/11 kV Substation of the Project and the Nasiriyah Thermal Power Plant. Water supplies used during operation of the Project will be drawn from the Euphrates River, which is located less than 1 km from the Project site, and wastewater generated by the Project will be discharged back into the Euphrates River after being treated.

1.1 Objectives of the ESIA

The purpose of this ESIA study is to identify and assess the potential impacts of the Project on the physical, biological, social and cultural environment during construction and operation phases. The ESIA Report describes the Project, and the impacts that are predicted to be incurred on environmental and social baseline conditions, and explains how the Project has been designed and how it will be implemented in order to minimize its adverse impacts and maximize its benefits.

1.2 ESIA Report Structure

The remainder of this report is structured as follows:

Chapter 2: Project Description. Describes the Project, including the background to its development and gives details of its design, construction and operation;

Chapter 3: Project Alternatives. Describes the site selection criteria for the Project, and assesses energy generation alternatives, fuel alternatives and no project alternative.

Chapter 4: Legal Framework. Outlines the policy, legal and administrative context for the ESIA. This includes the legal requirements for the Project, international treaties and conventions, corporate standards and program requirements (specifically those of IFC).

Chapter 5: Environmental and Social Baseline. Outlines the existing physical, biological, social and cultural baseline characteristics in the Project's Area of Influence are described environmental and social baseline studies conducted for the Project as well as including physical, biological and socio economic baseline.

Chapter 6: Impact Assessment. Describes the methodology used for the assessment of impacts associated with the Project, as well as the process followed to identify mitigation and enhancement measures and then assign residual impact significance.

The results of the impact assessment are then presented under the following impact headings:

- Air Quality;
- Noise;
- Water, Soil and Groundwater;
- Hazardous Materials;
- Hazardous and Non-Hazardous Waste;
- Community Health and Safety;
- Biological Environment;
- National Economy;
- Land Use;
- Local Economy and Livelihood
- Labor Influx;
- Interaction with the Locals;
- Occupational Health and Safety;
- Community Health and Safety;
- Cultural Heritage;

After which, the cumulative impacts of the Project with other projects in the area of influence are examined if necessary.

Chapter 7: Stakeholder Engagement. Outlines stakeholder engagement approach for the Project, defines stakeholder identification, presents previous and planned stakeholder engagement activities.

Chapter 8: Environmental and Social Management and Monitoring Plan. Introduces the Environmental and Social Management and Monitoring Plan which presents the mitigation measures for the identified environmental and social impacts with the proposed monitoring activities and responsible parties.

Chapter 9: Environmental & Social Management System. Describes the capacity and resources of the Project to manage the identified environmental and social risks related with the Project.

2 PROJECT DESCRIPTION

ENKA, as the nominated sub-contractor, and General Electric Switzerland GmbH and Alstom Middle East Iraq (collectively referred to as "GE") as the EPC Contractor plan to develop and construct a combined cycle gas-fired turbine power plant with a gross capacity of 750 MW, which will be located in Nasiriyah City in Dhi-Qar Governorate, 200 km northwest of Basra, in Southern Iraq. The Project will be constructed on a turnkey basis and will be operated by the Ministry of Electricity (MoE) after commissioning. A general project overview, followed by more in-depth details regarding the Project's location, schedule, rationale, facilities and area of influence are provided in the following sections.

2.1 Project Overview

The Project involves the construction and operation of a 750 MW combined cycle power plant with four (4) GE-9 type gas turbines, (4) Heat Recovery Steam Generators (HRSG) and one (1) Steam turbine. Air Cooled Condenser System (ACC) will be employed for the cooling purposes of the Project. Water required for Project purposes will be supplied from the Euphrates River.

The Project will be developed and constructed in two phases. In Phase-1, the Power Plant will operate as a simple cycle plant and will have a nameplate capacity of 432.8 MW. In Phase 2, the Project will be converted into a combined cycle power project and will have a gross capacity of 750 MW.

The investment phases of the Project are provided below in Table **2-1**.

Table 2-1 Investment Phases of the Project

Investment Phase	Units to be Constructed	Installed Capacity	Planned Year of Investment	Duration of Construction (months)
Phase 1	• Four Gas Turbines • 132 kV AIS substation • BoP for Open Cycle	4 x 125 MW	2017	20 months [2]
Phase 2	• HRSG • Steam Turbine • Air Cooled Condenser • Water Steam Cycle • BoP for Combined Cycle • 400 kV GIS	250 MW	2019	18 months

[2] The expected duration of completion of the construction works for Phase 1 might be changed.

Investment Phase	Units to be Constructed	Installed Capacity	Planned Year of Investment	Duration of Construction (months)
	substation			
Total Capacity		750 MW		

The MoE will own and operate the Project and GE will serve as EPC contractor and ENKA as the subcontractor to GE. GE is responsible for procuring the Power Island Equipment i.e. steam turbine generator, HRSG, ACC, main transformers, distributed control system and the switchyard along with conducting performance tests. ENKA will be responsible for the engineering, procurement, construction, commissioning, and startup of the Project. The MoE is responsible for acquiring the land rights and permits for the Project, as well as securing interconnection agreement and water supply for the Project. The Iraq Ministry of Oil (MoO) will be responsible for developing and constructing the gas and liquid fuel supply lines as well as the energy transmission lines.

The Project related activities and responsible parties are provided below in Table 2-2.

Table 2-2 Project Related Activities and Responsible Parties

Scope of Work	Provided By	Notes
Securing the permits and land allocation outside the Project Site i.e. pump station location for water intake and also for wastewater discharge	MoE	-
Supply of Crude Oil by pipeline to the site boundaries	MoO	-
Supply of Light Distillate Oil (LDO) by truck to the site boundaries	MoO	-
Supply of natural gas by pipeline to the site boundaries	MoO	-
(3MW) Energy Available for Construction Activities On Site	MoE	-
132kV/400 kV grid available for Project operations	MoE	-
Interconnection with the electrical system for provisional electric feeding during plant construction	Subcontractor	The MoE will provide 11kV or 33kV with 3MVA capacity connection (s) within 100 m of site boundary with necessary permits.
Provision of security outside site boundaries	MoE	-
Raw water intake, pumping station & pipe lines including discharge of effluent water to the Euphrates River	Subcontractor	Water will be taken from Euphrates River at a distance of approximately 1 km.
All provisional buildings and services, including electric feeding with diesel generators, needed during construction phase of the Project	Subcontractor	-
Construction of all plant roads, paved areas, parking, paths and landscaping within the borders of the Project Site	Subcontractor	-
Testing of raw water characteristics and	Subcontractor	-

Scope of Work	Provided By	Notes
treatment for Project purposes		
Access road to the Project Site boundaries	Subcontractor	Access road with a length of 500m will be constructed from the main road to the plant.
Demolition of existing structures on the route of transmission lines.	MoE	The MoE will remove existing towers and transmission lines crossing the site.
Drainage system, water treatment pits and oily-water treatment tanks and effluent basin for chemical & oily water waste	Subcontractor	-
Security services within the Power Plant during construction	Subcontractor	-
Utility pipe and other underground works	Subcontractor	-
Storm, sewage, oily and plant drainage systems	Subcontractor	-
Buildings including earthworks, excavation and filling works (except piling), foundation works and complete with internal services such as air conditioning, ventilation, lighting and sockets water distribution, potable water skids, black water system	Subcontractor	-

Air emissions generated from the Plant will be monitored by a Continuous Emissions Monitoring Systems (CEMS), which will be installed on each stack of the plant. Schedule for maintenance of the steam turbine and gas turbine will be as follows:

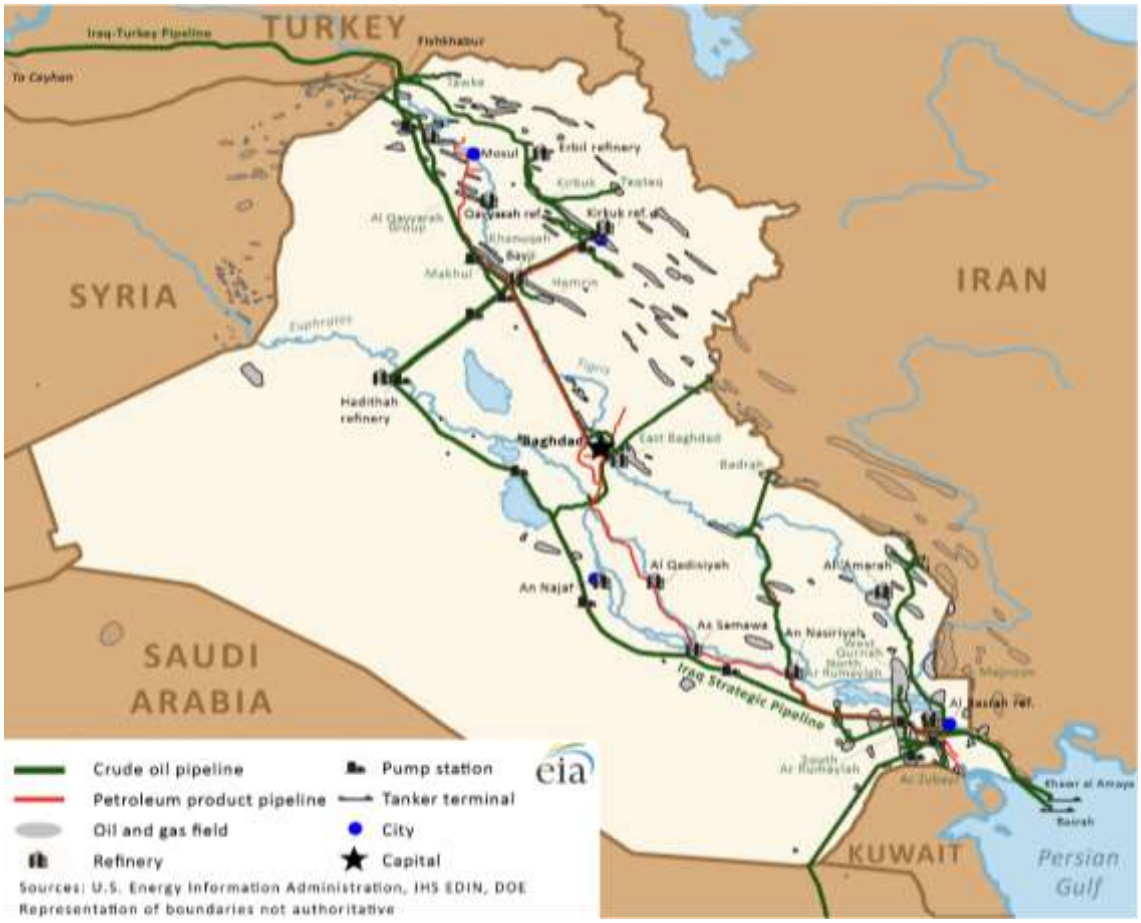
Table 2-3 Maintenance Schedule

Scope of Work	Period
Steam turbine	
Minor inspection	24,000 Factored Hours
Major inspection	48,000 Factored Hours
For gas turbine	
Hot Gas Path inspection	8,000 Factored Hours
Major inspection	48,000 Factored Hours

Air emissions, which will be generated by the Project, have been determined by air quality dispersion modelling. The study was conducted both for the use of liquid fuel and natural gas.

2.2 Project Rationale

The U.S. Energy Information Administration's Country Analysis Brief for Iraq, which was last updated on April 28, 2016, indicates that Iraq is the second-largest crude oil producer in the Organization of the Petroleum Exporting Countries (OPEC) after Saudi Arabia, and it holds the world's fifth-largest proved crude oil reserves after Venezuela, Saudi Arabia, Canada, and Iran. Most of Iraq's major known fields are producing or in development, although much of its known hydrocarbon resources have not been fully exploited. Iraq was the world's fourth-largest natural gas-flaring country in 2014, as more than half of its gross natural gas production was flared. Natural gas is flared because of insufficient pipelines and other infrastructure to transport and store it for consumption and/or export. Iraq's oil and natural gas infrastructure is presented below in Figure 2-1.



Source: Iraq Energy Outlook, International Energy Agency, October 2012

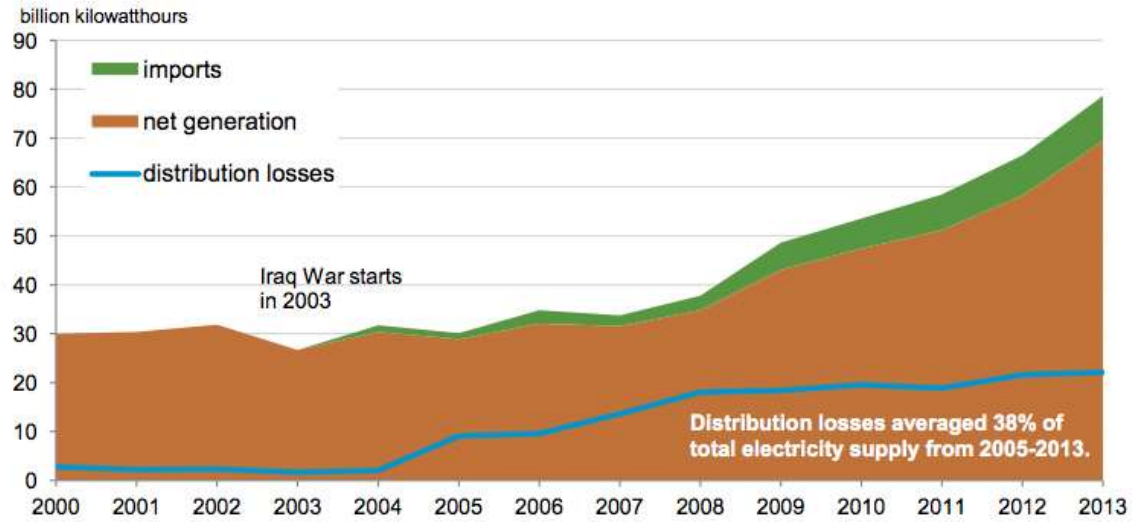
Figure 2-1 Iraq's Oil and Natural Gas Infrastructure

Iraq's economy heavily depends on oil revenues, such that crude oil export revenues accounted for 93% of Iraq's total government revenues in 2014, according to the International Monetary Fund (IMF). In 2015, Iraq (excluding the Kurdistan Regional Government) earned less in crude oil export revenues, compared to the earnings in 2014, despite a substantial increase in export volumes. The expansion of onshore pumping and

storage infrastructure in the south, improvements in crude oil quality as Basra Light and Basra Heavy were marketed separately starting in mid-2015, and an increase to the Kurdistan Regional Government's (KRG) pipeline capacity in the north all contributed to the production growth in Iraq (U.S. Energy Information Administration (EIA), 2016).

Large-scale increases in oil production would also require large increases in electric power generation. Like many developing countries in the Middle East and North Africa, Iraq faces a sharply rising demand for power. Iraq has struggled to meet its power needs during the Iraq war and for the post-war period, with shortages common across the country. Although Iraq's electricity generation capacity has increased, electricity generation expansion has slowed because of the economic crisis in the wake of the war against the Islamic State of Iraq and the Levant (ISIL) in northern Iraq that began in mid-2014 and low oil prices (U.S. Energy Information Administration (EIA), 2016).

Iraq's electricity supply totalled almost 79 billion kWh in 2013, of which more than 69 billion kWh was generated through the domestic power plants and more than 9 billion kWh was imported from Iran and Turkey. Electricity net generation in Iraq grew by an annual average of 15% from 2009 to 2013, recovering from the 2003 dip in electricity generation associated with the start of the Iraq war. Although electricity net generation in Iraq has increased from 2009 to 2013, distribution losses have also increased. From 2005 to 2013, distribution losses averaged 38% of the total electricity supply. Iraq's distribution system, outside the Iraqi Kurdistan Region, has deteriorated because of poor design, lack of maintenance, and electricity theft, resulting in large distribution losses, low voltage levels, and frequent disconnections. The electricity net generation, imports and distribution losses in Iraq are demonstrated in Figure 2-2 below (U.S. Energy Information Administration (EIA), 2016).



Source: Country Analysis Brief for Iraq, U.S. Energy Information Administration, April 2016

Figure 2-2 Electricity Net Generation, Imports and Distribution Losses in Iraq

The U.S. Energy Information Administration's Country Analysis Brief for Iraq states that peak summer demand has typically exceeded actual generation by almost 50%, causing power shortages, particularly in southern Iraq, referring to a website article published in 2011. It further indicates that Iraqi households and businesses must rely on expensive off-grid, private diesel-fuelled generators to address the shortfall, with those in Baghdad alone providing an additional 1 GW of capacity, referring to a website article published in 2012. A study of Iraq's electricity sector shows that about $40 billion in revenue is lost each year because the country lacks the electricity supply needed to stimulate more business activity from various economic sectors, including agriculture, commerce, and tourism.

Iraq set aggressive targets in the past to increase electricity generation, but actual outcomes have fallen short. Iraq's Ministry of Electricity's master plan set a target to install 24.4 GW of new generating capacity between 2012 and 2017. The plan is similar to Iraq's Integrated National Energy Strategy (INES), released in 2013. INES proposed to increase generation capacity in Iraq (outside of the Iraqi Kurdistan Region) by 22 GW in 2016 from 7 GW in 2012 by adding steam and natural gas turbines that can run on fuel oil in case of natural gas shortages. The additional 22 GW in 2016 was the estimated amount needed to meet summer peak demand, which includes a 15% reserve margin. Iraq planned to spend at least $27 billion by 2017 on developing its electricity sector, with about half of the funding earmarked to upgrade the transmission and distribution systems. Iraq also anticipated to stop importing electricity by the end of 2016 if these expansions are made. However, Iraq is behind schedule on the electricity plan. The ISIL offensive that started in mid-2014, along with the sustained low oil prices, has squeezed Iraq financially, slowing down the plans to reduce power shortages and decrease electricity imports (U.S. Energy Information Administration (EIA), 2016).

Several different approaches have been used in order to achieve a rapid build up of Iraq's power generation capacity. In 2008, the Ministry of Electricity procured a large number of gas turbines under so-called "Mega Deals" from GE and Siemens.

Dhi-Qar CCGT Power Plant is one of the new power plants that will be established under the contract between GE and the Ministry of Electricity, where GE will supply turbines and other equipment as well as provide aid with engineering, procurement and construction (Egan, 2017).

2.3 Project Location

The Project will be established in Nasiriyah City in Dhi-Qar Governorate, 200 km northwest of Basra, in Southern Iraq. The Project will be located on a rural area of 30 ha which is owned by the Governorate and has been allocated to the MoE for the Project purposes. The Power Plant will cover an area of 294,281 m^2.

The coordinates and location of the Project Site is provided below in Table 2-4.

Table 2-4 Coordinates of the Project Site (UTM Zone: 38 R)

Corners	East	North
C1	612850	3433729
C2	612863	3433287
C3	613650	3433657
C4	613662	3433363

The Project Site is surrounded by the Primary Road No. 7 to the north, the Baghdad-Basra railway to the north and a 400 kV transmission line to the west. The Nasiriyah Thermal Power Plant is located less than 1 km to the north of the Project and the Dhi-Qar Refinery is located approximately 4.7 km to the south east to the Project site. The closest water source to the Project site is the Euphrates River at 1 km to the north.

The closest settlements to the Project are the villages of Auejah (0.5km to the south), Al-Mahmud (1.5km to the north east), Al-Agir (2km to the west) and Al-Sadah (2.5km to the west).

Figure 2-3 below presents the location of the Project Site and the Area of Influence (AoI) for the environmental impacts.

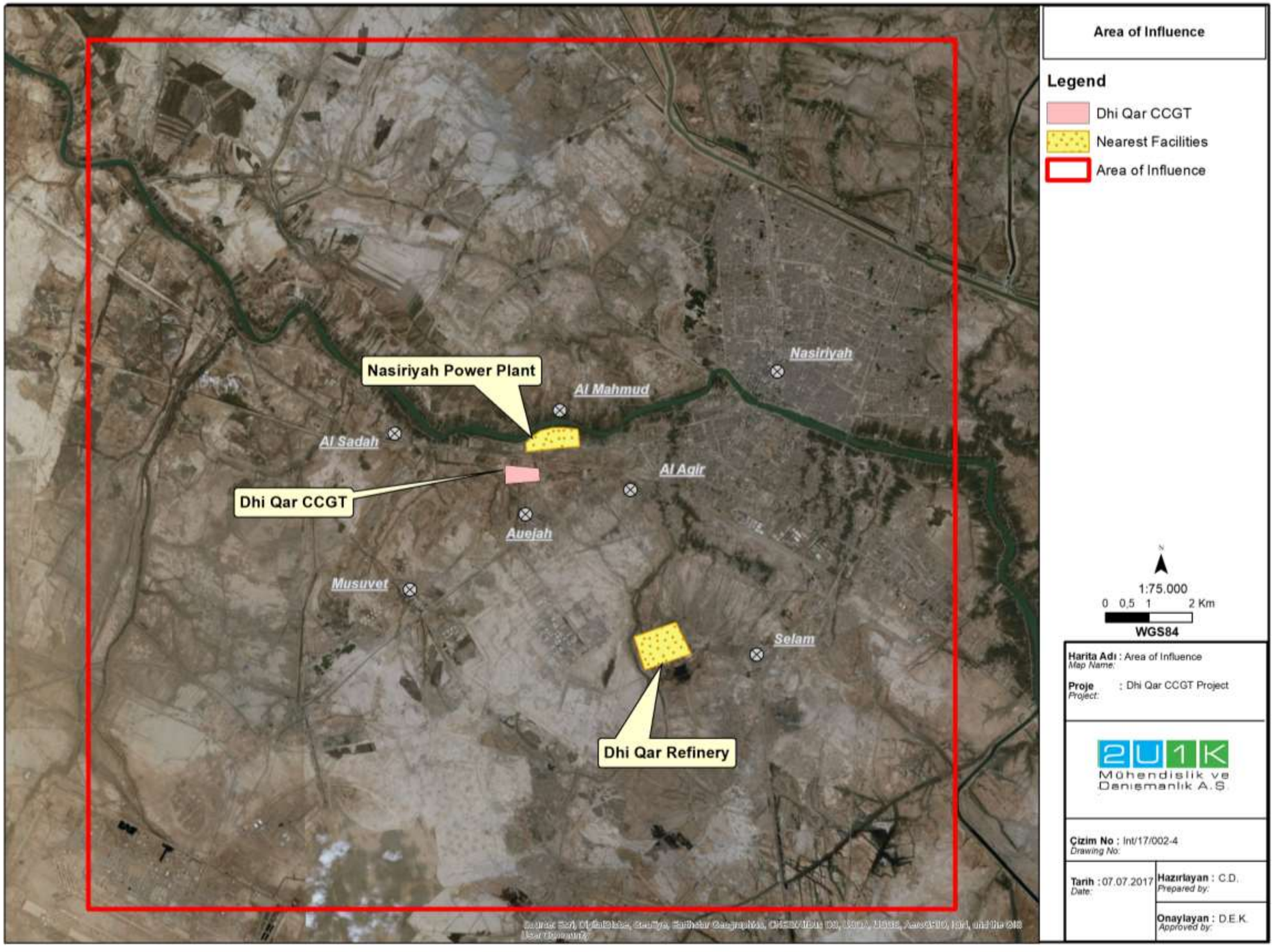


Figure 2-3 Location of the Project Site and the Area of Influence (AoI) for the Environmental Impacts

2.4 Project Facilities

The Project will be comprised of four GE MS9001E type, 50 Hz gas turbines, one steam turbine, four heat recovery steam generators, an air cooled condenser, a water treatment plant, a sewage treatment plant, an oily water treatment plant, a wastewater treatment plant, a switchyard, seven crude oil and three light distillate oil storage tanks. The general layout of the Project is presented in Appendix-A.

Power Plant

The Power Plant will be constructed in two phases, initially in simple cycle mode and afterwards converted to combined cycle by adding steam tail (ADD-ON) and associated equipment. The expected duration of completion of the construction works for the simple cycle mode might be changed. In simple cycle mode, there will be four gas turbines, a 132 kV AIS substation and Balance of Plant (BoP) for open cycle. For the combined cycle phase; HRSG, steam turbine, air-cooled condenser, BoP for combined cycle and 440 kV GIS substation will be established.

The main components of the Project, which are Combined Cycle Gas Combustion System, and Air Cooled Condenser System, Water Treatment System and Wastewater Treatment System, are briefly explained below.

Gas turbines will be connected to the heat recovery steam generators to convert the output exhaust energy by steam turbine. The combination of water and steam will be employed in order to increase thermal efficiency and energy production. A schematic process of a CCGT power plant is given below in Figure 2-4.

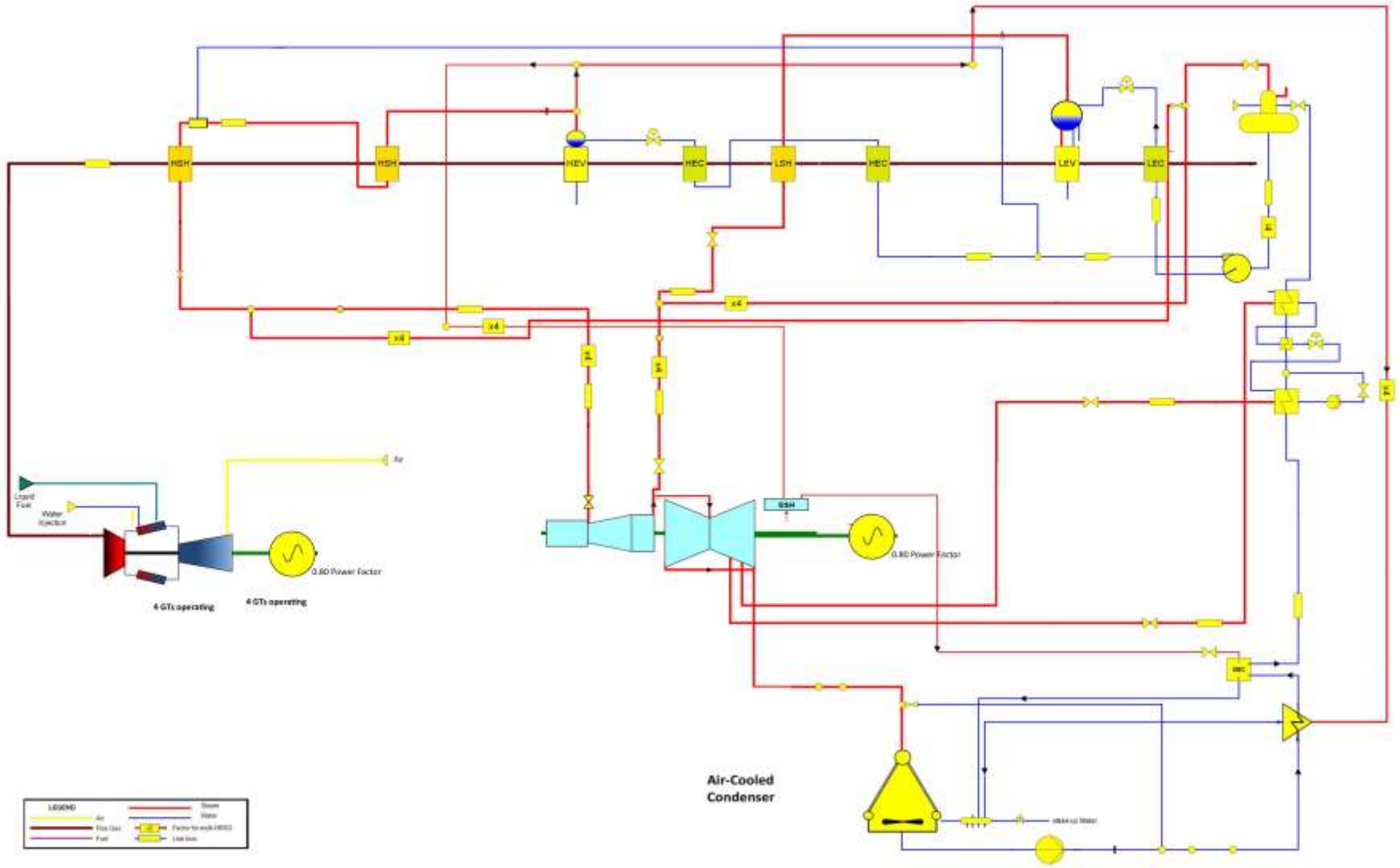


Figure 2-4 Schematic Process of a CCGT Power Plant

Air Cooled Condenser

Given the lack of water in the region, an Air-Cooled Condenser System (ACC) will be used for the Project. ACC system to be used for the Project is provided below in Figure 2-5.

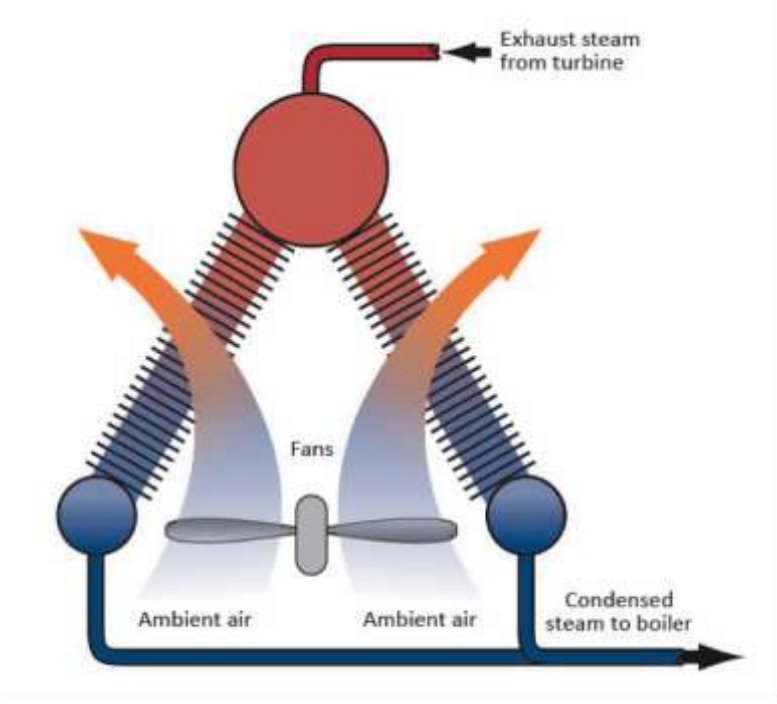


Figure 2-5 Schematic Process of the Air Cooled Condenser System

ACC system with multiple streets, which contain of multiple condenser modules designed for the heat load will be employed for the Power Plant. Each module will consist of the following equipment:

- Steel structure,
- Steam header and condensate collectors,
- Heat exchanger tubes (aluminium clad carbon steel) arranged in tube bundles and modules,
- Air moving system (fans, gear, drive),
- Condenser air removal by steam jet ejector (start-up and service).

Water Treatment Plant

Water required for the Project will be provided from the Euphrates River. A Water Treatment Plant (WTP) will be used to generate potable water and demineralized water. WTP will comprise of a pre-treatment system with 260 - 270 m^3/h capacity, demineralization system with 3x60 m^3/h capacity and potable water system of 2.5 m^3/h capacity.

Treated water generated at the WTP will be transferred to a fire-water storage tank, a demin water tank and a potable water tank.

WTP will treat incoming water so that it meets the following specifications:

Table 2-5 Water Quality Parameters for WTP

Water Quality Parameters	
Pre-treatment outlet	
Total suspended solids	<30 ppm (suitable quality to feed UF system)
Demineralized water	
Sodium	<5 ppb
Chloride	<3 ppb
Sulphate	<3 ppb
Reactive silica as SiO_2	<10 ppb
Iron	undetectable
TOC	<100 ppb
Dissolved solids	<50 ppb
Conductivity at 25°C	<0.1 µS/cm
Potable water	
Total dissolved solids	< 350 ppm
Total Hardness	< 100 ppm as $CaCO_3$
Free chlorine	0,5 ppm

Wastewater Treatment Plant

A temporary sanitary wastewater treatment plant will be used at the site during the construction phase of the Project.

For the operation phase of the Project, a complete Domestic Sewage Treatment Plant (DSTP) with a flow rate of 50 m^3/day for continuous operation will be established for the Project. DSTP will have a capacity for treatment of wastewater of 200 people.

Inlet design parameters of DSTP are as follows:

Table 2-6 Inlet Design Parameters of DSTP

Inlet Design Parameters	
Population Equivalent	200 persons
Water Consumption	220lt/person/day
Wastewater Flow Rate	50 m^3/day
Unit BOD5 load	60g/person/day

Also an Oily Water Treatment Plant with a capacity of 15 m^3/h continuous flow rate will be established for the Power Plant.

Inlet design parameters for the oily water treatment plant are as follows:

Table 2-7 Inlet Design Parameters of Oily Water Treatment Plant

Inlet Design Parameters	
Oil and grease	~500 mg/l
Total suspended solids (T.S.S.)	~200 mg/l
pH	6 - 10
Wastewater Flow Rate	15 m^3/hour

Fuel

The Power Plant will employ a dual fuel system. Natural gas will be used as the primary fuel while light distillate oil and crude oil will be used as back up fuels.

Natural Gas

The MoE has committed to make natural gas available by February 2019 to support commissioning of 2xGT Frame 9 and by June 2019 to support full operation of 2xGT Frame 9 (target summer 2019).

Natural gas required for the Power Plant will be supplied from the North Rumila national 42-inch pipeline through an interconnection pipeline of about 70 m length to be constructed by the Ministry of Oil (MoO). According to the letter dated 28/08/2018 no. 2008/108/4 from the Oil Pipelines Company within the MoO of the Republic of Iraq, which is provided in Appendix-B, the necessary site surveys for the interconnection pipeline have been completed and the Oil Pipelines Company is committed to proceed with the construction works. The piece of land through which this interconnection pipeline will pass, is owned by the MoE.

Estimated gas criteria at the tapping point within the boundaries of the plant are as follows:

- Maximum pressure: 40 bar(g)
- Minimum pressure : 31.5 bar(g) (Fuel Gas Compressor will be provided by the MoE if required)
- Max. required gas flow: 145 tonnes/hour
- Gas line pressure design: 70 bar(g)
- Gas temperature: 35°C to 40°C (max)

Composition of the natural gas to be provided by the MoO to be used for energy generation is given below in Table 2-8.

Table 2-8 Composition of Natural Gas

Compound	Mole %
Nitrogen	1.029
Carbon Dioxide	0.281
Hydrogen Sulfide	Nil*
Sulphur	Nil*
Methane	79.672
Ethane	17.193
Propane	1.456
Iso Butane	0.151
Normal Butane	0.182
Neo Pentane	-
Iso Pentane	0.017
Normal Pentane	0.015
Hexanes	0.004
Heptanes	-
Octanes	-
Nonanes	-
Decanes	-
TOTAL	100.00

*none

Crude Oil

The tendering process for the crude oil pipeline has been implemented by the MoO. The Power Plant will be supplied with crude oil by February 2019 if not earlier.

Crude oil conditions at the site boundaries will be as follows:

- Operating crude oil pressure : 2.5 - 3 barg/min
- Operating crude oil temperature : >10°C above wax melting point of crude oil
- Operating crude oil flow : 51,000 BOPD (Barrels of Oil/Day-for two days consumption where maximum daily consumption is 25,500 BOPD)

The average parameters of the crude oil from the Nasiriyah-Mishrif Crude Oil Field are provided below in Table 2-9.

Table 2-9 Crude Oil Parameters

Test	Average Value
Sulfur content (%wt)	3.86
Appearance	Black/Homogenous Liquid
Density at 15°C (kg/L)	0.8875
Specific Gravity at 50/60°F	0.8890
API Gravity at 60°F	27.8
Pour Point °C (max upper)	-36
Pour Point °C (min lower)	Below -36
Cloud Point	-
Flash Point	Below -5
BS & Water (%vol)	0.05
Sediment by Extraction (%wt)	0.01
Water Content (%vol)	< 0.05
Ash Content (%wt)	0.015
Wax Content (%wt)	< 5
Asphaltene (%wt)	4.0
Salt Content (PTB)	3.8
Reid Vapour Pressure at 100 °F (psi)	8.62
Kinematic Viscosity at 20 °C (cSt)	29.48
Kinematic Viscosity at 40 °C (cSt)	13.95
Kinematic Viscosity at 100 °C (cSt)	4.156
Hydrogen Sulphide (ppm Wt)	< 1
Mercaptan Sulphur (ppm Wt)	< 1
Total Nitrogen (mg/kg)	1,500
Basic Nitrogen (%wt)	0.020
Nickel (ppm Wt)	15
Vanadium (ppm Wt)	63
Iron (ppm Wt)	1
Aluminium (ppm Wt)	< 5
Tin (ppm Wt)	< 1
Sodium (ppm Wt)	4
Manganese (ppm Wt)	< 1
Zinc (ppm Wt)	< 1
Molybdenum (ppm Wt)	< 1
Lead (ppm Wt)	< 1
Calcium (ppm Wt)	2
Magnesium (ppm Wt)	1
Chromium (ppm Wt)	< 1
Copper (ppm Wt)	< 1
Total Acid Number (mgKOH/g)	0.158
UOP K Factor	-
Carbon Residue (%wt)	6.78
Copper Corrosion Test at 40 °C, 3 hours	1a

Light Distillate Oil

Light Distillate Oil (LDO) will be transported by trucks to the Project site and stored in 2 tanks, each with a storage capacity of 9,436 m^3. These tanks will be located within the Power Plant area provided with concrete berms for secondary containment. The analysis results for LDO, which will be used at the Power Plant, are presented below in Table 2-10.

Table 2-10 Light Distillate Oil Analysis Results

Test	Average Value
Specific gravity at 15.6 °C	0.83077
Viscosity at 37.8 °C	6 Cst
Viscosity at 50 °C	5 Cst
Pour Point	(-) 9 °C
Flash point (PM)	Minimum 54 °C
Sulphur Content (% Wt)	1 %
Rams-Bottom C.R. (% Wt) (on 10% Res.)	0.2 %
Distilled at 350 °C (%V)	85 %
Diesel Index	55
Cetane No.	Minimum 53
Gross Calorific value	10.800 kcal/ kg
Ash (% Wt)	0.01
Sodium + Potassium	< 1 ppm

Adequate heating systems, heat tracing and pipe and skids insulation will be applied where required in order to reduce the potential increase in the LDO viscosity during low ambient temperature conditions.

Fuel Storage Tanks

Storage tanks for crude oil and light distillate oil will be available at the Plant for power generation. There will be 2 LDO storage tanks of 9,436 m^3 capacity each, which will provide the fuel required for power generation for 2.5 days and 1 LDO storage tank of 150 m^3 capacity for the Plant users.

There will be 2 raw crude oil storage tanks of 8,025 m^3 capacity each which will provide 2 days of fuel for the Plant consumption, 2 certified crude oil storage tanks of 1,355 m^3 capacity each for 8 hours of the Fuel Oil Treatment Plant (FOTP) operation and 3 treated crude oil storage tanks of 4,015 m^3 capacity each for 1 day of the Plant consumption.

The fuel storage tanks will be equipped with concrete berms for secondary containment.

Access Road

An access road of about 500 m will be connected to the main road, which is located north of the Project area.

ETL

The energy generated by the Power Plant will be exported by a 1 km length 400 kV OHTL which will connect 400/132/11 kV substation of the Power Plant to the substation of the Nasiriyah Thermal Power Plant. One other option for the connection of the Power Plant to the national grid will be through 176 km length OHTL between the Power Plant and the 400 kV substation at the north of Nasiriyah. Both transmission lines are planned to be utilized for the Project in the future.

As per the letter dated 14/08/2018 no. 3526 of the Ministry of Electricity (MoE) of the Republic of Iraq, the MoE is committed to complete the related 132 kV and 400 kV OHTL for the Power Plant before March 31, 2019. The subject letter is presented in Appendix-C.

2.5 Shipment of the Equipment

Heavy and oversized equipment will be transported from the Umm-Qasr Port to the Project area. The transportation route will cover 350.67 km starting at the port and passing through Safwan-Zubair DGS-Tuba-Rumaila-Nasiriyah-Strategy Road-Al Kidhir-Batha to the Project. This transportation route is shown below in Figure 2-6.

Source: Route Survey Report, Ibrakom, 2017

Figure 2-6 Transport Route of Heavy Equipment

2.6 Project Construction

Construction phase of the Project will include the preparation of site, excavation activities for the foundation of the plant and auxillary facilities, access road, construction of the energy transmission line and fuel pipeline and installation of the main units (gas turbines, steam turbines, compressors and generators), campsite and auxiliary units such as fuel tanks, water supply and wastewater treatment facilities as well as the administrative buildings and warehouses. The site preparation activities including the construction of an access road, establishment of a campsite and electricity infrastructure prior to commencement of the construction activities, have been completed.

The Project will be established on an area of barren lands, therefore there will be no tree cutting. Topsoil will be stripped and temporarily stored at the Project Site for future use in landscaping works. Topsoil will be covered to prevent erosion during temporary storage. The total amount of excavation material during construction activities is expected to be about 200,000 m^3 for the Project. Excavated soil will be used for filling purposes later during construction activities.

Construction materials and equipment will be temporarily stored at the Project site during the construction phase. The list of the construction equipment is provided below in Table 2-11.

Table 2-11 Construction Equipment

Equipment	Number of Equipment
Agricultural Tractor	3
Agricultural Tractors Trailer	1
Air Compressor	7
Backhoe Loader	2
Boom Truck	5
Compactor	5
Mixing Plant	1
Concrete Pump	2
Crawler Excavator	2
Wheeled Excavator	1
Rough Terrain Crane	6
All Terrain Crane	5
Crawler Crane	1
Tower Crane	1
Dump Trucks	3
Fire Fighting Truck	1
Flatbed Trailers	3
Flood Lights	13
Telehandler	2
Forklift	1
Sewage Vacuum Truck	1
Garbage Truck	1
Generator	12
Jeep	2
Lowbed Trailer	1
Manlift	18
Manlift Scissors	2
'Skid Steer Loaders-Bobcat	2
'Steel Bar Bending Machines	6
'Truck Mixers	6
Truck Tractors	3
Vibration Rollers	2
Water Trucks	2
Weighing Platform	1
Wheel Loader	2
'Drilling Rig	2
Vibratory Hammer With Powerpack	2
'Crawler Crane	1
'Drilling Rig	1
Piling Rig	1
Crawler Crane	1
Vibro Hammer With Powerpack	1
'Wacker Light Tower	4
'Test Profile L8 Mt	1

Site mobilization including the construction of access road, campsite and electricity infrastructure for construction activities and site preparation activities for campsite commenced in August 2017. Phase 1 is planned to be completed in 16 months, including the last 4 months for commissioning. Phase 2 will start during the last 4 months of Phase I commissioning and construction of Phase 2 is expected to be completed in 34 months including the last 4 months, which will be devoted to commissioning.

Maximum number of workers employed during construction of the Project will be 1773.

Water used for construction and potable water during construction will be sourced from the Euphrates River. Domestic wastewater generated during construction will be discharged to the Euphrates River after being treated by a waste treatment plant.

Electricity required for construction activities will be provided from the Nasiriyah Thermal Power Plant which is located about 1 km away from the Project site.

The summarized work programme for the Dhi-Qar CCGT Power Plant Project covering the milestones up to the commencement date and the Project milestones is presented in Table 2-12**Error! Reference source not found.** below. The detailed work programme is given in Appendix-D.

Table 2-12 Summarized Work Programme for the Dhi-Qar CCGT Power Plant Project

Activity ID	Activity Name	Original Duration	Start	Finish
Milestones up to the Commencement Date		1043	20 January 2017 A	31 August 2020
Employer Milestones		1043	05 February 2017	31 August 2020
A1002	Contract Signature	0	05 February 2017	
A0001	Effective Date	0	05 February 2017	
A1001	UXO Clearance Certificate Available	19	05 February 2017	28 February 2017
A1005	Partial Access of Site by Employer for Soil Investigation	0		28 February 2017
A6650	LC Issued Per Site (As per Article 3.2 of Contract Agreement)	0		15 May 2017
A6660	Sovereign Guarantees (As per Article 3.2 of Contract Agreement)	0		15 May 2017
A6710	Approval of Final Soil Report by Employer	11	06 June 2017	20 June 2017
A6690	Full Site Access	0		22 June 2017
A6700	Provision of Security	0		22 June 2017
A6688	Completion of Relocation of Existing OHL (Overhead Transmission Line)	0		22 June 2017

Activity ID	Activity Name	Original Duration	Start	Finish
A6730	Piling Requirement Analysis - Employer Validation (No Pile)	0		30 June 2017
A9001	Commencement Date	0		20 January 2018
A1022	132 kV - Completion of Dhi-Qar CCPP - Aredo (T.T) (MOE)	0		30 June 2019
A17780	132 kV - Completion of Aredo - Old Nasiriyah (T.T) (MOE)	0		30 June 2019
A17790	132 kV - Completion of Dhi-Qar CCPP - Zaquora - Industrial Nasiriyah (MOE)	0		30 June 2019
A17701	Al Nasiriyah Gas Station 400 kV – Al Nasiriyah Thermal Line-Wasat 400 to be linked to Dhi-Qar Combined Cycle Power Plant with a line 2 km long	0		31 August 2019
A17760	Al Nasiriyah Gas Station 400 kV – Al Nasiriyah Thermal Line- Dhi-Qar Combined Cycle Power Plant (second line) 2 km long	0		31 August 2019
A17770	Al Nasiriyah Gas Station 400 kV - Completion of Dhi-Qar CCPP - Muthana 400 (MoE)	0		31 August 2019
A17740	132 kV - Completion of Dhi-Qar CCPP - Bltahaa (MOE)	0		31 March 2020
A17800	132 kV - Completion of Dhi-Qar CCPP - East Nasiriyah (MOE)	0		31 March 2020
A1012	Al Nasiriyah Gas Station 400 kV - Completion of Dhi-Qar CCPP - Rumyla IPP (MoE)	0		31 August 2020
Contractor Milestones		117	20 January 2017 A	30 June 2017
A6740	Submittal of Performance Bond	0		
A6750	Site Mobilization for Soil Investigation	8	01 March 2017	10 March 2017
A17710	Site Survey Approval	0		07 March 2017
A6770	Soil Investigation / Field Test	5	11 March 2017	17 March 2017
A6780	Soil Investigation / Laboratory Testing	5	17 March 2017	23 March 2017
A6760	Site Geo-tech Analysis	41	23 March 2017	13 May 2017
A7270	Soil Investigation Final Report Received by Contractor	14	13 May 2017	27 May 2017
A7272	Soil Investigation Final Report Review & Submit to the Employer	10	27 May 2017	06 June 2017
A7290	Submission of Piling Analysis (No Pile) to the Employer	12	01 June 2017	16 June 2017
A7280	Approval of Final Soil Report by the Employer	14	06 June 2017	20 June 2017
A7300	Approval of Piling Analysis (No Pile) by Employer	11	16 June 2017	30 June 2017

Activity ID	Activity Name	Original Duration	Start	Finish
Project Milestones		**1221**	**11 February 2018**	**16 April 2022**
A1730	Client Kick-off Meeting	0	11 February 2018	
A6820	Submission of the Program of Performance	0		29 July 2018
A6830	End of Pre-Commissioning of the First Simple Cycle Unit	0		11 July 2019
A6840	Start of Commissioning for the First Simple Cycle Unit	0		11 July 2019
A6850	End of Commissioning for All Units - Simple Cycle	0		24 October 2019
A6860	Issuing of Operational Acceptance Certificate - Simple Cycle	0		31 October 2019
A6870	Issuing of Operational Acceptance Certificate - Add-on	0		16 April 2021
A6880	Issuing of the Final Acceptance Certificate	0		16 April 2022
A6890	Defect Liability Period	0		16 April 2022
Employer Milestones		1144	02 May 2017	01 April 2021
A17720	Site Preparation / Access Road	0		02 May 2017
A17730	Establishment of a Campsite	0		14 May 2017
A1010	Full Site Access as per Contract Agreement	0		20 January 2018
A4111	Financial Closure	0		01 July 2018
A2000	Gas Turbines Available at Site and Ready for Erection and Commissioning	0		02 July 2018
A2800	MV (3 MW) Energy Available for Construction Activities On Site	0	01 September 2018	
A4130	Crude Oil (CO) / HFO Available at Site Boundaries	0	01 March 2019	
A5290	132 kV Grid Available for Energization	0	01 March 2019	
A5293	Natural Gas (NG) Available at Site Boundaries	0	01 March 2019	
A5292	Light Diesel Oil (LDO) Available by Truck	0	16 March 2019	
A5296	400 kV Grid Available	0	31 July 2019	
A5580	GT1 Available for Diverter Damper Installation	74	01 November 2019	01 February 2020
A5590	GT2 Available for Diverter Damper Installation	74	16 November 2019	16 February 2020

Activity ID	Activity Name	Original Duration	Start	Finish
A5600	GT3 Available for Diverter Damper Installation	74	01.Dec.19	02.Mar.20
A5610	GT4 Available for Diverter Damper Installation	74	16.Dec.19	17.Mar.20
A7910	GT 1 to 4 Available for CC Conversion, Including HRSG Cleaning	220	30.Jun.20	01.Apr.21
A7909	Unrestricted Access to GT #1,2,3,4	0	30.Jun.20	
Contractor Milestones		596	29 October 2018	12 November 2020
A4510	Foundation Available for 132 kV AIS	0		29 October 2018
A6160	Electrical & Control building Available for Equipment Installation	0		14 February 2019
A6162	132 kV AIS Ready	0		01 August 2019
A6420	400 kV GIS Ready	0		12 November 2020
Mobilization		374	16 May 2017	26 August 2018
Block No. 1		1198	12 March 2017	16 April 2021
GTG		700	31 May 2017	23 October 2019
GT Exh. Diverter Damper		484	01 July 2018	26 February 2020
GT Main transformers		336	01 July 2018	25 August 2019
HRSG		734	01 July 2018	03 January 2021
Steam Turbine/Generator		734	01 July 2018	03 January 2021
HV Switchyard		1086	19 April 2017	04 January 2021
Switchyard Auto Transformers		621	01 July 2018	15 August 2020
ST Main transformers		784	01 July 2018	07 March 2021
Electrical & Control Building		216	01 July 2018	28 March 2019
MV Switchgear		266	01 July 2018	30 May 2019
DC / UPS (Simple Cycle)		230	01 July 2018	15 April 2019
Black Start Diesel Generator		254	01 July 2018	15 May 2019
LV MCC & LOAD CENTER (Simple Cycle)		242	01 July 2018	30 April 2019

Activity ID	Activity Name	Original Duration	Start	Finish
HV Switchyard Control Building		255	01 July 2018	16 May 2019
Service Transformer-1 (132 /6.9 kV)		266	01 July 2018	30 May 2019
Service Transformer-2 (132 /6.9 kV)		290	01 July 2018	29 June 2019
Plant BOP		1086	12 March 2017	28 November 2020
Add-on Commissioning		83	03 January 2021	16 April 2021

2.7 Project Operation

The following activities will occur during the operation phase of the Project:

- Natural gas delivery to the plant from the North Rumila pipeline;
- Crude oil delivery to the plant from the Nasiriyah Oil Field national pipeline;
- Transportation of LDO from the Nasiriyah Oil Field to the Project site by tankers and storage at the Project site;
- Continuous monitoring of electricity generator system and gas and steam turbine activities;
- Transmission of electricity produced by the electricity transmission network;
- Water treatment for Power Plant operations and wastewater treatment; and
- Maintenance of the Project.

The design life of the Project is 25 years. The Project will be operated and maintained by the MoE.

500 people are expected to be employed by the Project during its operations.

Water required for operation of the Project will be sourced from the Euphrates River and used for both domestic and industrial purposes following treatment in the Project's water treatment plant.

Domestic wastewater generated during operation of the Project will be discharged to the Euphrates River after being treated in the Project's Domestic Sewage Treatment Plant.

Industrial wastewater generated during operation of the Project will be discharged to the Euphrates River after being treated in the Project's Oily Water Treatment Plant.

2.8 Area of Influence and Associated Facilities

The Area of Influence (AoI) is an important element in assessing environmental and social impacts of a proposed development project, because it helps define the scope of the environmental and social assessment to be done. According to the definition given in Performance Standard 1 of the IFC, the AoI encompasses, as appropriate:

- The area likely to be affected by: (i) the project[3] and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;[4] (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.[5]
- Cumulative impacts[6] that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

The AoI for the Project was determined separately for environmental and social impacts.

AoI for Environmental Impacts

The most important aspect that was considered when determining the AoI was the impact area regarding the air pollutant emissions which are expected to have impact on a wider area than the other impacts of the Project such as noise or impacts on surface water and soil. In this respect, a 12 km x 12 km area was chosen to perform the air quality dispersion modeling for air emissions that will be generated due to the Project. The size of the chosen area depends upon the types of the sources, mass of the emissions, and types of the pollutants being emitted as well as the topography and meteorological conditions of the area. As a general approach, the modeling domain is calculated as having a radius of 50 times of the

[3] *Examples include the project's sites, the immediate airshed and watershed, or transport corridors.*

[4] *Examples include power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, construction camps, and contaminated land (e.g., soil, groundwater, surface water, and sediments).*

[5] *Associated facilities may include railways, roads, captive power plants or transmission lines, pipelines, utilities, warehouses, and logistics terminals.*

[6] *Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities. Examples of cumulative impacts include: incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways.*

stack height from the stack center for the Project (for the combined cycle operation, the modeling domain was calculated as having a radius of 2.65 km). It was expanded to a 12 km x 12 km area to encompass all of the sources and receptors. Accordingly, the AoI includes the following receptors of interest, which are Auejah on the south (0.5 km), Al-Mahmud on the north-east (1.5 km), Al-Agir on the west (2 km) and Al-Sadah on the west (2.5 km) that will be directly affected due to the Project activities.

Regarding noise impacts, Qarya Kadhim El Hafaz, Nasiriyah, Auejah and Al-Sadah Villages are included in the AoI.

For the impacts on surface water and groundwater, Euphrates River, which is at a distance of about 500 m, is included in the AoI.

Groundwater and soil impacts are assessed within the borders of the Project site.

The AoI also includes the connection of the plant with the crude oil transport pipeline from the Nasiriyah Oil Field pipeline, with the natural gas transport pipeline from the North Rumila pipeline and with the energy transmission line. Moreover, the AoI covers the transportation route of 350.67 km for heavy and oversized equipment from the Umm-Qasr Port through Safwan-Zubair DGS-Tuba-Rumaila-Nasiriyah-Strategy Road-Al Kidhir-Batha to the Project site. The AoI for the environmental impacts is displayed in Figure 2-3.

AoI for Social Impacts

The AoI is determined by considering the impacts related to transportation activities, the hiring and use of laborers during construction and operation of the Project, noise generated during construction and operation of the Project, land use, dust generation and air quality impacts related to construction and operation activities.

The nearest settlements to the Project Site will be considered as the first impact zone. In other words, locals in the first impact zone may experience direct impacts from the Project. Excavation and construction works will cause dust and noise emission, in which Aujeah (distanced 0.5 km to the Project Site) and Al-Mahmud (distanced 1.5 km to the Project Site) may experience dust and noise impacts during the construction phase of the Project. Therefore, first impact zone includes the Aeujah and Al-Mahmud villages which are within a 2 km radius around the Project Site.

The second impact zone includes the Al-Agir and Al-Sadah villages, which are within a 5 km radius of the Project site. Inhabitants' within the second impact zone may experience indirect Project impacts such as direct and indirect job opportunities, providing goods and services to the Project and Project employees. Inhabitants in the first impact zone are more likely to experience impacts related to community health and safety than inhabitants located in the second impact zone. Further information on these impacts can be found in Section 6.5 (Impacts on Social Environment) of the ESIA Report.

Nasiriyah Central Prison, located 3.5 km away from the Project Site will also be taken into consideration as an AoI during the assessment of social impacts of the Project.

The AoI for the social impacts is displayed below in **Figure 2-7**.

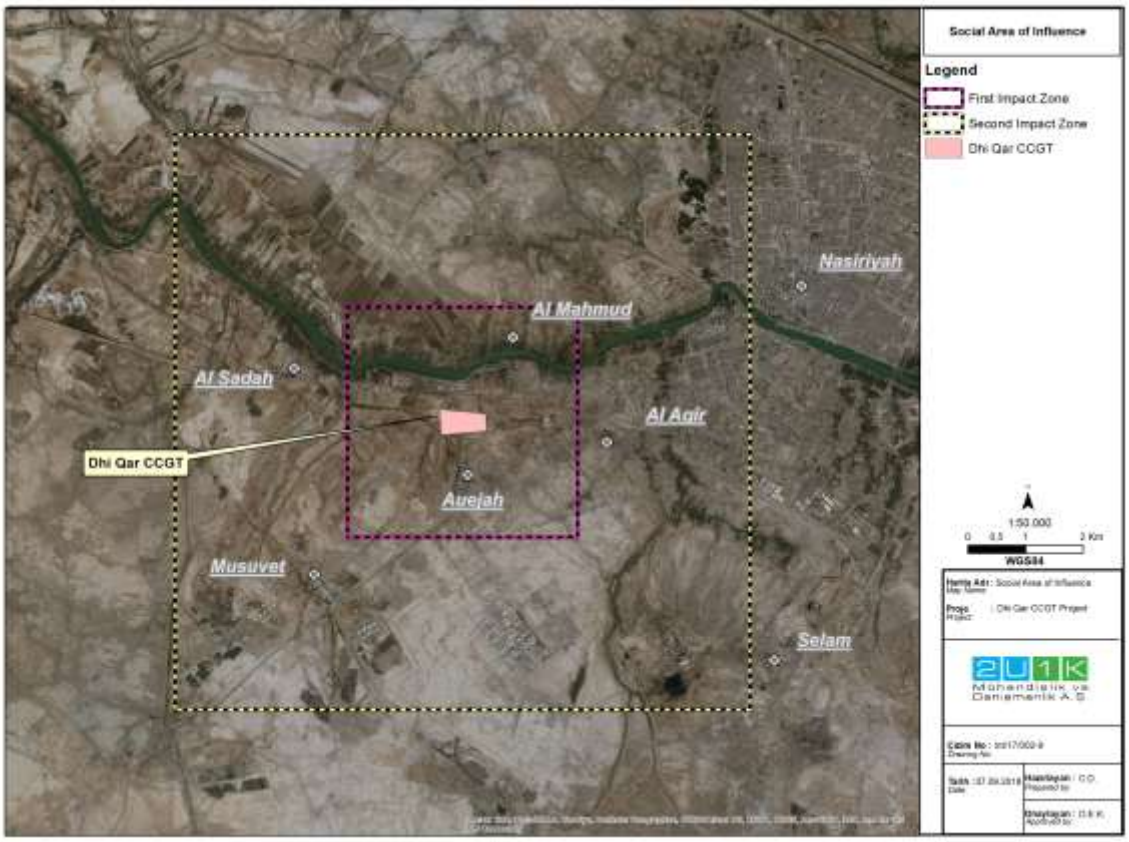


Figure 2-7 Location of the Area of Influence (AoI) for the Social Impacts

As stated, the allocation of the Project Site causes no land acquisition. The Project will not cause physical or economical displacement. Furthermore, according to the information gathered from the social baseline, the majority of the households in the AoI do not rely upon farming or other land-based production activities for their livelihoods. Furthermore, none of the local population has expressed any concerns about potential impacts that land acquisition activities may cause in the future.

Associated Facilities:

Associated facilities of the Project are the energy transmission line and natural gas and crude oil transmission lines. Natural gas pipeline, which will transport natural gas from the North Rumila field to the Project and the crude oil pipeline, which will transport crude oil from the Nasiriyah Oil Field to the Project are considered associated facilities. Connection from the crude oil pipeline to the plant will be approximately 10 m to the east and connection from the natural gas pipeline will be 70 m to the south. Regarding the length of the proposed fuel supply pipelines significant impact is not expected, however potential impacts are assessed

within the Project assessment. The interconnection with the fuel supply pipelines is presented below in Figure 2-7.

The power generated by the Power Plant is planned to be connected to the national grid through a 1 km OHTL1 from Nasiriyah Thermal Power Plant. One other option for the connection to the national grid will be through 176 km length OHTL between the Project and the 400 kV substation at the north of Nasiriyah. The energy transmission lines are provided below in Figure 2-8. It is planned to utilize both transmission lines for the Project in the future.

Although the proposed routes are provided, design details have not been defined yet. The establishment of the OHTL is the responsibility of MoE and EPC commitment starts after the connection of the transmission line to the Power Plant. Once the details of the energy transmission lines are finalized, a separate ESIA will be conducted by the MoE.

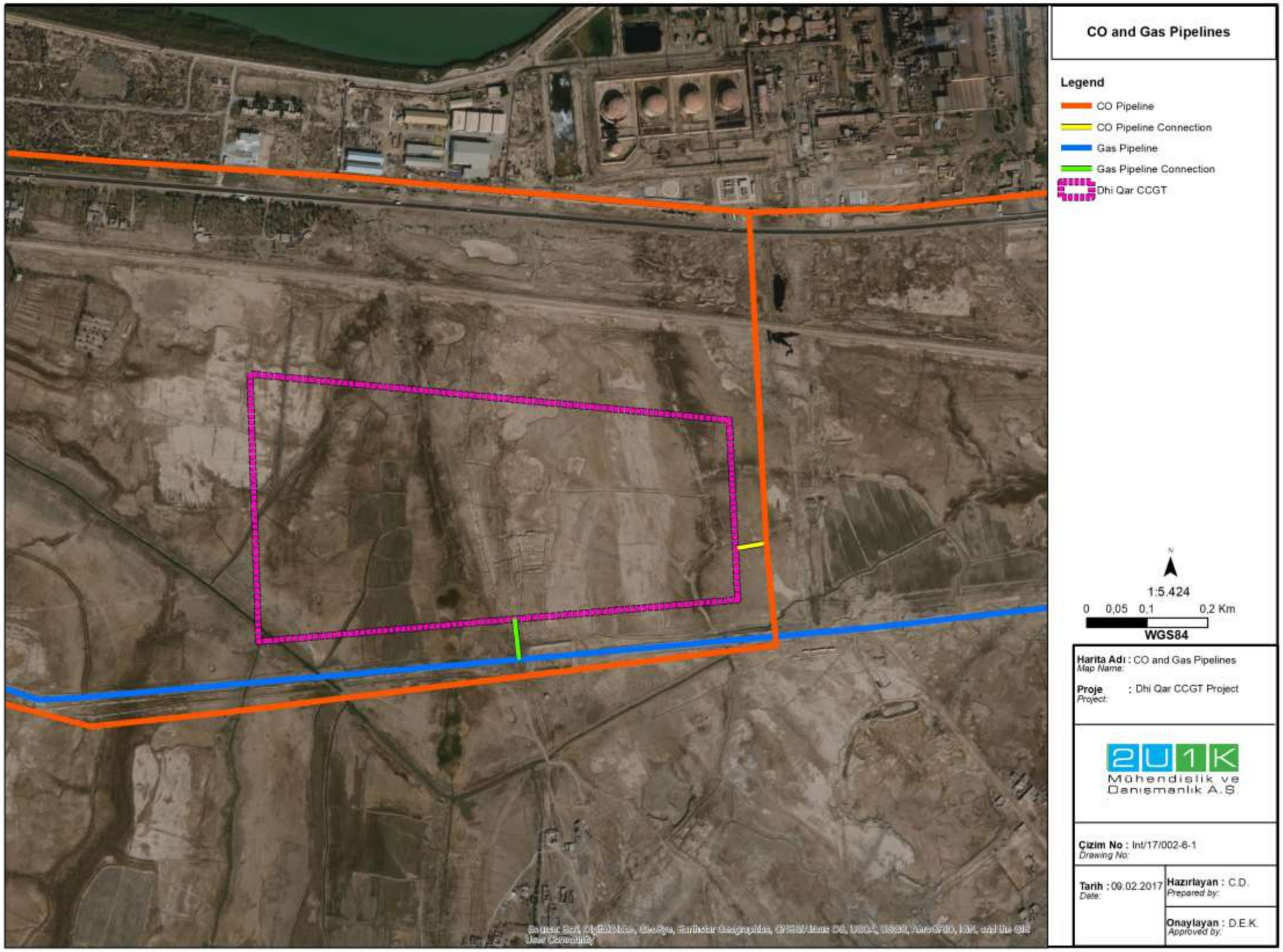


Figure 2-8 Interconnection with the Fuel Supply Pipelines

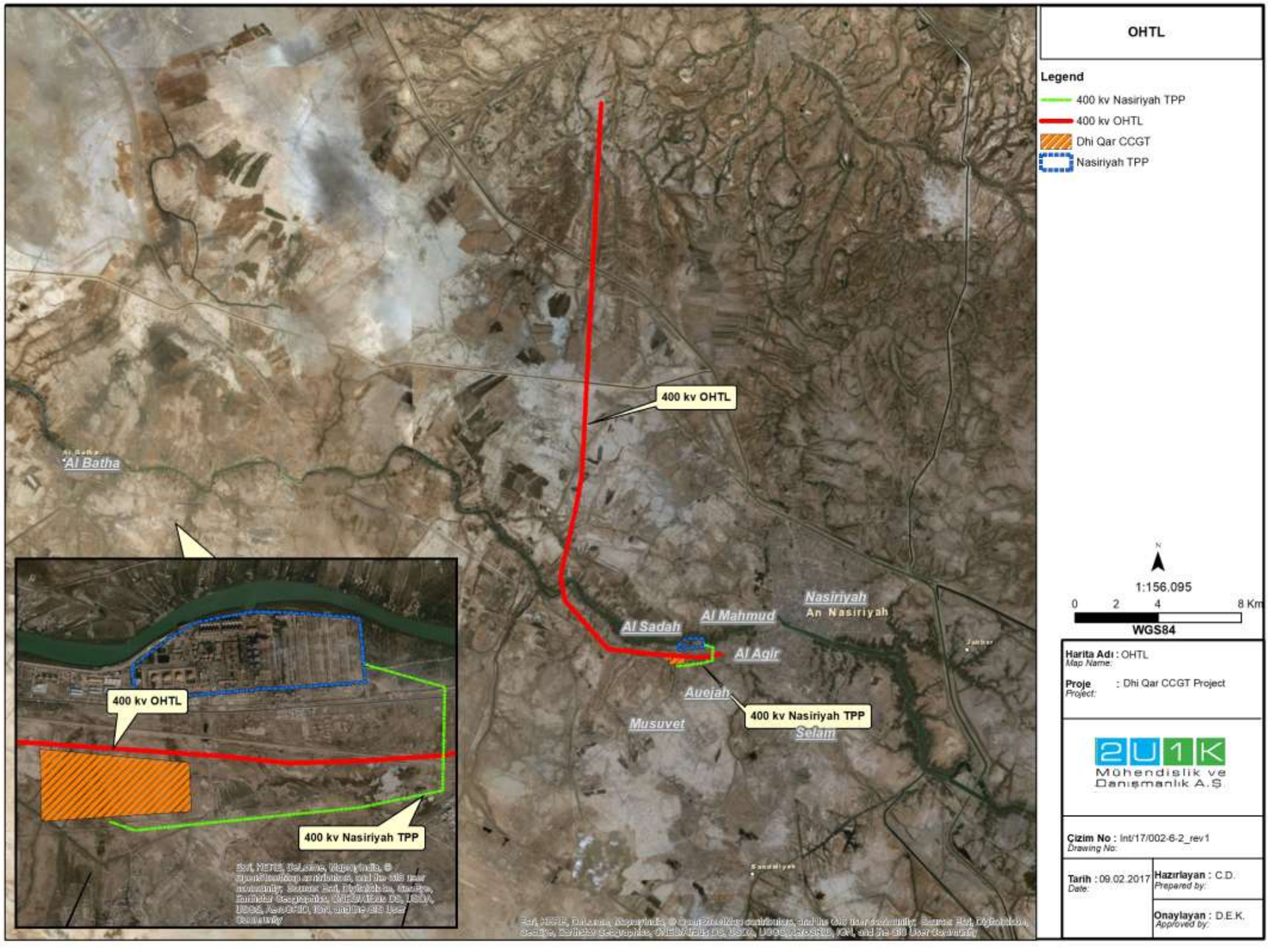


Figure 2-9 Energy Transmission Lines

3 PROJECT ALTERNATIVES

Project alternatives have been considered with respect to the following criteria:

- Site Location;
- Other Energy Generation Alternatives;
- Fuel Alternatives; and
- No Project Alternative

3.1 Site Location

Site selection process for the Project included two sites based mainly on the following selection criteria below:

- Land acquisition;
- Proximity to settlements;
- Proximity to fuel supply;
- Proximity to grid connection; and
- Proximity to water supply.

Besides the criteria listed above, elevation, terrain properties, seismic conditions, accessibility and man-power, and protected areas around the Project Site have also been considered for site selection. The alternatives were evaluated both in terms of elevated costs and environmental and social impacts.

Two alternative sites were discussed between the Subcontractor and the MoE for which the coordinates are presented below in Table 3-1.

Table 3-1 Coordinates of Site Alternatives (UTM Zone: 38 R)

Description	Project Corners	Coordinates	
		East	North
Alternative 1- Project Site	P1	612863	3433287
	P2	612850	3433729
	P3	613662	3433363
	P4	613650	3433657
Alternative 2- Project Site	P1	612817	3431913
	P2	612804	3432355
	P3	613616	3431989
	P4	613604	3432283

Satellite image of the alternative sites are also provided below in Figure 3-1.

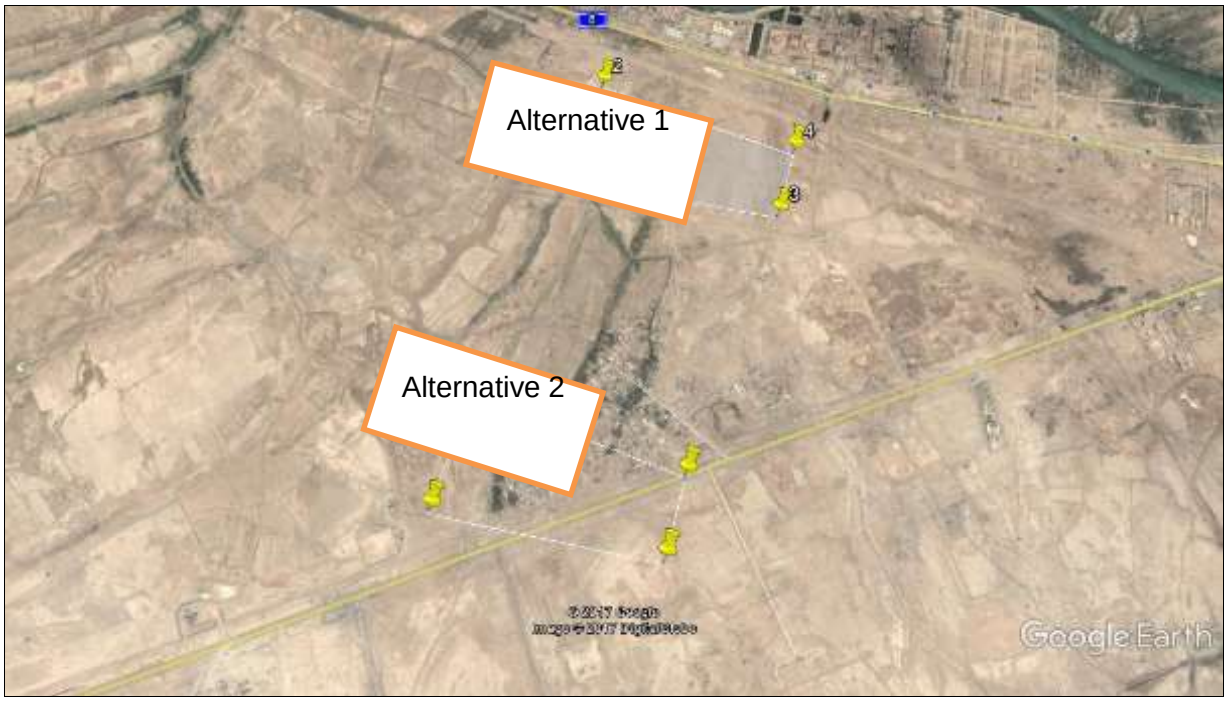


Figure 3-1 Satellite Image Showing Project Site Alternatives

Land use and ownership have been important issues during site selection process. In order to avoid involuntary resettlement, alternative sites were selected from lands owned by the Governorate with barren features.

As seen in the figure above neither of the alternatives causes involuntary resettlement. Regarding distance to the settlements, Alternative 1 is at a distant location than the second one.

Geographically, the alternatives show similar features to each other. Both recommended sites are at acceptable distance from the Euphrates River regarding water intake and discharge, while the first one is closer. In terms of prevailing wind direction, distance from fault and also from protected areas two sites are in similar conditions.

In terms of accessibility to the national grid, first site alternative is closer to Nasiriyah Thermal Power Plant with the utilization of OHL1.

Upon MoE's own final feasibility analysis based on cost efficiency, infrastructure conditions and possible impacts to the social conditions as well as the environment Alternative 1 was selected as the Project site.

3.2 Energy Generation Alternatives

Electricity can be generated from various resources, including thermal power, hydropower, tidal power, geothermal energy, wind power and solar energy. However not all of these resources can be used to supply reliable and continuous energy. Hydropower, wind and solar power are renewable resources and they are highly dependent on the availability of the respective natural resource, and this availability of these resources can vary greatly over time and as frequently as throughout a given day. Thermal power, on the other hand, can be used to generate electricity more reliably provided that a certain amount of fuel, i.e. annual demand, is secured. Hence, it is selected as primary source of energy in many countries. Some other types of energy generation are highly dependent on geographical conditions such as geothermal energy and tidal power.

Energy generation alternatives are evaluated mainly according to the governmental policies and long- term planning. Local demand, transmission losses and site alternatives are considered during the selection of energy generation alternatives.

Given Iraq's abundant supply of oil and natural gas and the need to meet the Country's increasing electricity demand, the development of the Dhi-Qar Power Plant Project is a logical response.

Iraqis estimated to have the fifth largest proven oil reserves and the 13th-largest proven gas reserves in the world, as well as vast potential for further discoveries. These resources can support the country's growing need for electricity. The Project will use natural gas as its primary fuel and crude oil and light distillate fuel as back-up fuels.

The Project will be erected as a simple cycle power plant and then converted to a combined cycle power plant with the addition of HRSGs and steam turbine inlatter phases. A combined-cycle power system recovers waste heat from the turbine exhaust to generate steam. The steam from waste heat is run through a steam turbine to provide supplemental electricity.

3.3 Fuel Alternatives

Crude oil, natural gas and light distillate oil are planned to be used by the Project. Since air emissions generated by the Project are likely to have a significant environmental impact, air quality modelling studies were conducted to assess air impacts from the Project when using these different fuels.

Since the Project is committed to comply with IFC Guideline limit values, air quality modelling studies were conducted in order to estimate the air emissions due to the combustion of natural gas and liquid fuel with different sulphur content. According to the modelling studies air emissions due to the combustion of natural gas and liquid fuel with sulphur content of maximum 0.5% comply with the IFC Guideline values. Therefore natural gas will be the primary fuel and crude oil and light distillate oil will be used as back-up fuels. Regarding the supply of fuel, natural gas has been confirmed to be the primary fuel for the Dhi-Qar Project as per Letter No. 13660 dated 23.11.2017 of the Directorate General for Gas Power Plants Projects of the Iraqi Ministry of Electricity.

Among a number of techniques to prevent and/or reduce the NO_x emissions such as low excess air firing, air staging, flue-gas recirculation (FGR) or exhaust gas recirculation (EGR), reduction of combustion air temperature, low-NO_x burners, dry low-NO_x (DLN) burners, water/steam addition, selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR), the low-NO_x combustion technique will be used to reduce NO_x emissions. The technique consists of a combination of internal engine modifications, e.g. combustion and fuel injection optimisation (the very late fuel injection timing in combination with early inlet air valve closing), turbocharging or Miller cycle. Retarding the start of the injection to reduce the firing pressure is a simple way of reducing NO_x emissions. It reduces the peak combustion temperature level and, in response, the combustion process progressively moves into the expansion process. In the injection retard method, the burning temperature peak is lowered. Initially, the drawback of this method was the increased specific fuel consumption, so, in order to re-establish low fuel consumption, the compression ratio of the engine was increased as a countermeasure, resulting in lower NO_x emissions and no penalty in terms of fuel consumption. By implementing the low-NO_x combustion concept in combination with the Miller concept, NO emissions have been reduced by up to about 40 % in today's engines compared to the same engine type at the beginning of 1990s, whilst maintaining high efficiency. Feedback from the industry on the Miller concept implementation suggests a typical NO_x reduction closer to 30%, which is strongly dependent on the type of engine and on the performance of the turbo compressor. For a modern engine, the NO_x reduction achieved by retarding the start of the injection might be around 10% (applicability dependent on engine type) but, due to the increased fuel consumption, this technique is rarely used as the sole measure (Lecomte, et al., 2017).

Flue-Gas Desulphurization (FGD) was not preferred for the Project since FGD is not technically feasible for gas-fired combined cycle systems. The efficiency of combined cycle system cannot be achieved with FGD due to the heat drop at the burners.

3.4 No-Project Alternative

As discussed in the Section 2.2 “Project Rationale”, around 90% of Iraqi households use diesel generators to supplement the electricity generated by the public electricity generation network. Even with the use of non-grid generation the average availability of electricity was limited to around eleven to nineteen hours per day varying across the country in 2011. The Dhi-Qar CCGT Project is expected by the MoE to improve grid capability of the state by increasing generation efficiency, capacity and creating enough margin in the supply/demand gap to provide opportunities for growth in the scope of “Mega Deals”. Accordingly, the Project will add to the number of combined cycle power plants relied upon by the Country’s National Network. Therefore ‘no project’ alternative is not considered to be a possibility given Iraq’s electricity supply deficit in the country.

On the other hand the Project has environmental impacts such as impact on air quality, surface water, biological environment and etc., which would not have occurred in the absence of the Project. However in terms of employment opportunities, no project alternative will provide the economic and social benefits offered by the Project.

4 LEGAL FRAMEWORK

This Chapter describes the national and international legislation, standards and guidelines that are relevant to the Project and this ESIA.

4.1 National Legislation

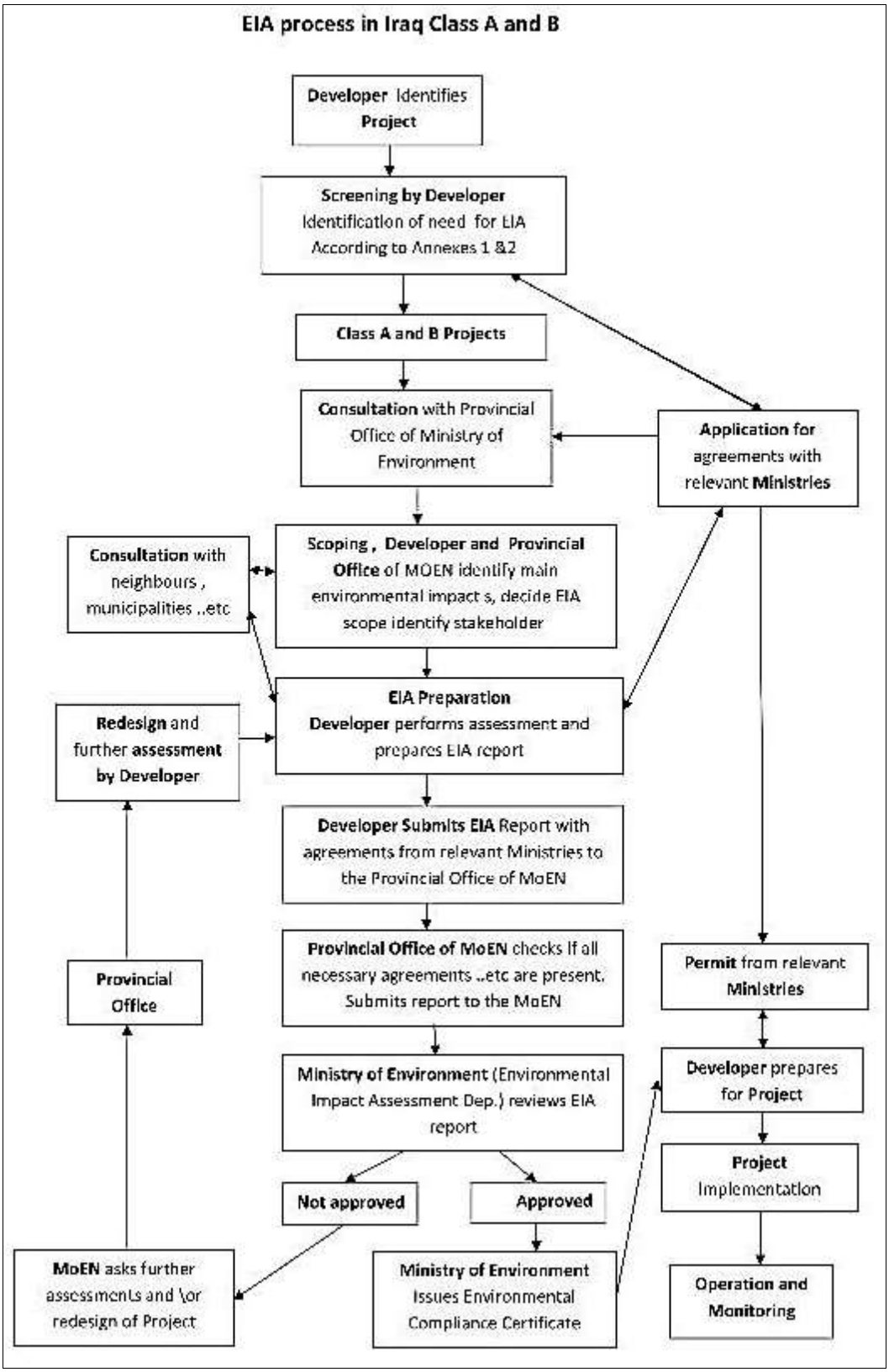
Key national laws and regulations presented in this section include the legal requirements to reduce the potential environmental impacts that may arise from the construction and operational activities of the Project. National legislation related to the Project is presented in the following sections under relevant subtopics.

The Ministry of Environment (MoEN) was established by the Coalition Provisional Authority through Order No. 44 in November 2003 in order to protect and conserve Iraq's environment, The MoEN is the governmental institution responsible for implementing the state's Environment Protection and Improvement (EPI) policy, and since its inception, the MoEN has taken its role seriously given the Government of Iraq's strong commitment to preserving the Country's natural resources and protecting its environment. Prior to 2003, the environmental tasks in Iraq, i.e. legislative, regulatory and executive tasks, had no real sponsor and been subject to political will.

National Environmental Strategy and Action Plan (NESAP) for Iraq (2013–2017) issued by the Iraqi Government takes into consideration the environmental impacts from development projects. Previous development plans failed to make environmental protection a priority and as a result, inadequate consideration was given to environmental impacts and natural resource protection when developing the Country's economic development plans.

Environmental Impact Assessment

The Law on Environmental Protection and Improvement (No. 27 of 2009) is the primary environmental legislation in Iraq. Chapter 4 of the Laws specifies a number of detailed provisions that investment projects are subjected to comply. Table 4-1 presents the Environmental Impact Assessment (EIA) Process of Iraq.



Source: (MoEN, 2010)

Figure 4-1 Local EIA Process

Article 10 of Chapter 4 of the Iraqi Law on Environmental Protection and Improvement describes the requirement for an EIA prior to the commencement of a Project.

According to Article 10, an EIA must include the following:

- Determine the positive and negative impacts of the Project on the environment;
- Detail the proposed methods to avoid and treat the causes of pollution in order to achieve compliance with environmental regulations and instructions;
- Propose contingencies for pollution emergencies and potential precautions;
- Detail possible alternative technology with less impact on the environment and the rational use of resources;
- Detail provisions to reduce and recycle waste, where possible; and
- Provide an assessment of the environmental feasibility of the project and an estimate of the cost of pollution relative to production.

In terms of the categorization of the development projects in Iraq, projects are divided into three categories as:

Environment Polluting Activities Category A: Those activities with severe pollution to the environment and include large industrial or agricultural projects which has severe impacts on the quality of environment and effects large areas. Such activities should be located away from residential areas.

Environment Polluting Activities Category B: This Category relates to those activities, which have less potential to result in pollution than those mentioned in Category A. Such activities include industrial, agricultural or other activities that may result in site contamination, which can be controlled. Therefore, such activities can be established in city boundaries and within the development plots allocated for them, provided that pollution control equipment / treatment units are installed in accordance with relevant national regulations.

Environment Polluting Activities Category C: This category relates to activities, which cause minor levels of pollution that can be treated. Such activities can therefore be established within and outside of the city boundaries, without any limitation, in accordance with the given provisions. This also allows farm owners to set up environmentally non-polluting industries within their farms (Environmental Regulations for Industrial, Agricultural and Service Projects).

The key permits have been obtained for the Project from the authorities listed below:

- Urban Planning Authority,
- Nasiriyah Governorate Investment Commission,
- Public Property Authority,
- Oil Pipelines Directorate,
- Ministry of Electricity / Nasiriyah Governorate Electricity Authority,
- Roads and Bridges Authority,
- Archaeology Authority,
- Ministry of Agriculture,
- Tourism Authority,
- Water Resources Authority,
- Nasiriyah Environment Authority,
- Development Planning Authority,
- Governorate Municipality.

The list of the other national environment, health and safety (EHS) legislation with which the Project will comply, is presented below in Table 4-1.

Table 4-1 Iraqi EHS Legislation Related to the Project

Legislation	Publication Date / Code & Number	Description
Forest Law	2009 – Law No. 30 (formerly 1955 – Law No. 75)	Forests are divided into three categories: state forest; wakif forest (endowed forest); and private forest. The provisions of this law, Except those on technical and administrative supervision, shall apply to state forests. Article 9 thereof reads: Trees in private sector forests may not be cut in the following circumstances, unless for technical necessity and in return of a fair compensation (Dr. Yadgar Kamal Ahmmad, 2012)
Cities Land Use	1965 – Law No. 64	According to Article 1, The objective of land payment shall be to insure through economic methods rational use of lands, to form resources for carrying out measures of land organization, improvement of land quality and land conservancy, as well as of social development of the territory (Japan International Cooperation Agency , 2011).
Rangelands and their Protection	1965 – Law No. 106	This law measures to organize grazing and to improve rangers outside the areas irrigated by rivers, prohibit tree or shrub cutting or hay making for commercial or agricultural purposes without a license. Prohibit grazing in certain areas in certain periods for preservation and improvement, and prohibit grazing in some areas of ranges selected through studies for range improvement.
Noise Protection and Control.	Law No. 41 of 2015	Noise Prevention Law aims to prevent the excessive noise in public places. The regulations prevent broadcasting in public places that may disturb peace between 10 p.m. and 8 a.m. According to Article 16 related to the prevention of high levels of noise above permissible limits in the operation of machinery,

Legislation	Publication Date / Code & Number	Description
		equipment, horns and loudspeakers. Power plant should prevent excessive noise (International Labour Organization)
System of Rivers and Other Water Resources Protection from Pollution	1967 – Law No. 25	Power Plant is subject to preventing contamination to rivers and public water bodies. The act regulates wastewater discharges and provides physical, biological, and chemical guidelines for water quality. Also, the regulation requires the protection of public water bodies from pollution. Article 7 prohibits discharge of wastewater of an activity into public water if either the absorbed vital oxygen trapped or floating materials exceed the rates, determined by the Health Authority by virtue of any other instruction given by the Minster of Health or his nominee (Dr. Yadgar Kamal Ahmmad, 2012).
Fishing, Exploitation and Protection of Living Aquatic Species.	1976 – Law No. 48	This law presents requirements to preserve aquaculture in public water. Public water means internal public water, which includes rivers, lakes, marshes, water reservoirs, fish farms, swamps both permanent and temporary; as well as drainages, streams, ponds, common gulfs, creeks and regional water and their marshes, swamps, ponds, and gulfs (United Nations Information Portal on Multilateral Environmental Agreements).
Law on the Protection of Wild Animals and Birds	2010 – Law No. 17 (formerly 1979 – Law No. 21)	Protection of Wild Animals and Birds No. 21 of 1979 states that Ministry of Agriculture issues the list of protected species of animals and birds, prohibited zones, hunting seasons, hunting gears and methods (Article 5). The law prohibits the collective hunting of wild animals and birds, hunting of wild animals with cars or aero planes and using automatic guns machine guns (Article 6). The hunting of wild animals must be authorized by the Minister of Agriculture and Land Reclamation (Article 8) (Food and Agriculture Organization of the United Nations).
Protection and Improvement of Environment	1997 – Law No. 3 (formerly 1986 Law No. 79)	Aim of this law is to protect and improve the environment, including protection of terrestrial, water, air, biodiversity from pollution and reduce its effects on health, the environment and other natural resources. The law aims also at protecting and improving the environment through elimination and treatment of existing damages or damages likely to be caused. It also aims at preserving public health, natural resources, biodiversity as well as natural and cultural heritage, in coordination with the relevant authorities in a manner that ensures sustainable development through International and Regional cooperation in this regard (Japan International Cooperation Agency , 2011).
Maintenance of Networks of Irrigation and Drainage	1995 – Law No.12	This law qualifies irrigation networks, provides provisions for management and maintenance of irrigation and drainage networks including natural rivers and water basins and provides for the establishment of public body called the general for the operation of irrigation projects (Food and Agriculture Organization of the United Nations).
Water Systems Protection	2001 – Law No. 2	For the purposes of these regulations, water is considered common according to the definitions below (Article 1) : **A**. Rivers and their tributaries, **B**. Streams, the waterways and canals, whether main, subordinate or secondary, **C**. Drainages and estuaries, **D**. Surfaces of water including lakes, marshes, ponds and bogs, **E**. Underground water including springs and wells, **G**. Pools and other watery reservoirs **H**. Valleys' water **I.** Regional water According to, Article 2 provisions of the Regulation shall apply to every public or private establishment, factory or workshop, as well as to every industrial, agricultural or serviceable activity in the

Legislation	Publication Date / Code & Number	Description
		socialist, mixed, cooperative or private sectors. Each one of the above shall be called (a location) for the purposes of these regulations in order to protect water resources from pollution and improve its quality by purifying it from contaminating factors which are discharged from such (locations) (Japan International Cooperation Agency , 2011) .
Updates Regulation No. 67, Regulate the regions for collecting debris (landfills).	2009 – Law No. 29 (1986-Regulation No. 76)	Directive No. (67) of 1986 Regulating the Debris Collection Areas: debris disposable should be done in areas with stable geology and avoid siting near particularly vulnerable or sensitive ecosystems and groundwater and surface water resources (Ministry of Construction, Housing, Municipalities and Public Works of Iraq, 2017).
Law of Forests and Woodlots	2009 – Law No. 30	The Forests and Woodlots Law prohibits clear-cutting along watersheds or around water sources, and planting and Care of Trees and Windbreaks for Industrial Purposes (Justice Sector Training, Research and Coordination (JUSTRAC), 2016).

4.1.1 Iraqi Legislation on Labour and Community Health and Safety

Project-related Iraqi legislation on Labour and Community Health and Safety is presented below in Table 4-2.

Table 4-2 Project-related Iraqi Legislation on Labour and Community Health and Safety

Legislation	Publication Date / Code & Number	Description
Labour Law	2015 – Law No. 37	The Labour Law (outdated the old Labour Law No. 71,dated on 1987) distinguishes between different working arrangements and provides definitions of what is meant by “temporary work”, “casual work”, “part-time work” and “compulsory work” This provides more clarity for both employers and employees in terms of their obligations. The Labour Law applies to any person employed in Iraq (i.e. including Iraqis and foreigners) except public sector employees and security forces.
Public Health Law (Drinking Water Provision, Sanitation and Environmental Monitoring)	1981 – Law No. 89	This Law consists of 106 Articles divided into 5 sections which aim at providing for the enjoyment of citizens' rights to full physical, mental and social fitness and provide safety of drinking water. Amended by Resolution No.54 of 2001, in addition to addressing various issues related to the population health, the Law stipulates the provision of the safety of drinking water and drinking water quality standards (International Labour Organization). Also, the Public Health Law No. 89 of 1981 governs public drinking water quality and standards. Under this law, Article 64 sets out the procedures to be implemented by the state authorities in charge of supplying drinking water to the

Legislation	Publication Date / Code & Number	Description
		citizens. Moreover, Article 65 requires approval from the competent health authorities when planning to conduct studies and suggesting designs for projects of drinking water supply. It further stipulates the submission of information related to the water quality from the source (Dr. Yadgar Kamal Ahmmad, 2012). Pursuant to Sections 3 and 105 of the Public Health Act (No. 89 of 1981), establishes work place procedures designed to minimize vibration and any harmful effects that it might have on workers. Stipulates maximum total daily limits for exposure to vibration.
Iraq joining Convention Concerning the Protection of the World Cultural and Natural Heritage	2008 – Law No.12	The purpose of this convention is to safeguard intangible culture heritage, to ensure respect for the intangible culture heritage of the communities, groups and individuals concerned and to raise awareness at the local, national and international levels of the importance of the intangible culture heritage, and of ensuring mutual appreciation thereof (United Nations Educational, Scientific and Cultural Organization , 2003).
Safe Storage and Handling of Chemicals	1989 – Instruction 4	These instructions detail the requirements for the safe storage and handling of chemicals issued in accordance with the provisions of the 6th and 7th paragraph of Article 3 and Article 105 of the Public Health Law No.89 of 1989. These regulations apply to activities involving manufacture, use, storage or handling of the following chemical types: • Explosive • Flammable • Oxidizing • Toxic chemicals and pesticides • Chemical irritants • Chemical drugs • Radioactive chemicals, corrosive chemicals and carcinogenic chemicals • Inert chemicals (Japan International Cooperation Agency , 2011).
The Law of Antiquities and Heritage	2002 –Law 55	Law No. 55 of 2002 for The Antiquities & Heritage of Iraq defines all movable and immovable antiquities, archeological properties, and artifacts. The Law provides regulations on communication channels upon discovery of the unregistered

Legislation	Publication Date / Code & Number	Description
		antiquities and the measures to be undertaken for the preservation of the historical and archeological sites (The Center for the Environmental Management of Military Lands, Colorado University).

4.1.2 International Conventions and Agreements Ratified by Iraq

A number of international conventions were signed and ratified by the Iraqi Government. According to the fifth National Report to the Convention on Biological Diversity of Iraq, these conventions and treaties are presented below in Table 4-3.

Table 4-3 International Conventions and Agreements Ratified by Iraq

Name of the Convention	Relevancy to the Project
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	The objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as ‘’hazardous wastes’’ based on their origin and/or composition and their characteristics as well as two types of wastes defined as “other wastes’’ –household waste and incinerator ash. The provisions of the Convention focus on: • reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal • restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management, and • regulatory system applying to cases where transboundary movement are permissible
Vienna Convention and Montreal Protocol on Substances that Deplete the Ozone Layer	The Montreal Protocol on Substances that Deplete the Ozone Layer is a protocol under Vienna convention. It was designed to reduce the production and consumption of ozone depleting substances –those listed in the annexes of the protocol in order to reduce their abundance in the atmosphere, and thereby protect the earth’s fragile ozone Layer
UN Convention for Biological Diversity	The convention has three main objectives : • biological diversity conservation • sustainable use of biodiversity • Fair and equitable sharing of the benefits arising from the use of genetic resources. Its overall objective is to encourage actions, which will lead to a sustainable future.
United Nations Framework Convention on Climate	The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant

Change	provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.
United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol	The Kyoto protocol, which follows the afore-mentioned United Nations (UN) framework convention on climate change, is one of the chief instruments for tackling climate change and contains the undertakings entered into by the industrialized countries for global warming.
UN Convention to Combat Desertification	It aims at combating desertification or mitigating the effects of drought in arid semi-arid and dry-humid areas through prevention and/or reduction of land degradation, rehabilitation of partly degraded land, or reclamation of desertification land. The activity contributes to: • protecting or enhancing dry land ecosystems or remedying existing environmental damage; or • integration of desertification concerns with recipient countries' development objectives through institution building, capacity development, strengthening the regulatory and policy framework, or research, or developing countries' efforts to meet their obligations under the convention

Source:(Ministry of Environment of Iraq, 2014).

4.2 International Standards and Guidelines

Lender guidelines, international conventions and agreements ratified by the Islamic Republic of Iraq are provided in the following sections.

4.2.1 Lender Guidelines

As mentioned previously, the proposed Project will be funded by UK Export Finance (UKEF) and Overseas Private Investment Corporation (OPIC). According to Environmental and Social Policy Statement of OPIC, thermal power is examined under Energy Intensive Sectors. Likewise, according to the Environmental and Social Policy Statement of OPIC, projects in Energy Intensive Sectors must meet energy efficiency guidelines and benchmarks established by international organizations, or develop and implement an energy management program to achieve these guidelines and benchmarks within a feasible period of time. In this concern, OPIC, without having its own statement for thermal power plants, refers to IFC Environmental, Health and Safety Guidelines.

4.2.2 UK Export Finance (UKEF)

UK Export Finance (UKEF) is the United Kingdom's Export Credit Agency (ECA). UKEF determines whether applications for support fall within the scope of the OECD Common Approaches and Equator Principles for funding.

The OECD Common Approaches recognizes that the primary role of ECAs is to promote trade in a competitive environment (in contrast to development banks and agencies which focus primarily on development assistance) and that ECAs have a responsibility to consider the positive and negative Environmental, Social and Human Rights ("ESHR") risks and impacts of projects, in particular those insensitive sectors and/or located in or near sensitive areas, and the ESHR risks associated with existing operations, in deciding whether to offer support.

The UKEF then categorizes projects and benchmarks the ESHR. All projects are initially screened to determine whether the project falls under the Guidelines of the Common Approaches (2016) and to categorise them as A (sensitive), B (potential environmental and/or social impact) or C (minimal or no potentially adverse environmental and/or social impacts). Dhi-Qar CCGT Power Plant Project has been categorized as Category A-having significant ESHR impacts during the scoping phase which required conducting an ESIA.

Impact Assessments and Environmental and Social Management Plans produced by the project sponsor against host country laws and the relevant international standards, typically the IFC PSs. UKEF, has also adopted the Equator Principles to promote sustainable environmental, social and human rights decision-making in financing projects. Similarly, Equator Principles refers to IFC Performance Standards on Environmental and Social Sustainability and the World Bank Group Environmental, Health and Safety Guidelines for Thermal Power Plants which are of concern for financial support. UK Export Finance's

assessment of the potential ESHR impacts took account impacts, receptors and issues during the construction and operations phases including but not limited to:

- Health and safety (of workers and local communities)
- Emissions to the atmosphere
- Waste water treatment;
- Waste and hazardous materials management;
- Labour camps;
- Community engagement;
- Grievance mechanisms;
- Emergency Response; and
- Traffic Management.

4.2.3 IFC Performance Standards

The Employer is committed to provide compliance with the pertinent national environmental legislation and international lending requirements of the International Finance Corporation (IFC) Performance Standards (PS) and Guidelines of the World Bank Group. Therefore, this report is based on the relevant IFC Performance Standards (PSs) and World Bank guidelines. The IFC is an international financial institution, which offers investment, advisory, and asset management services to encourage private sector development in projects. It was established in 1956 as the private sector arm of the World Bank Group to advance economic development by investing in strictly for-profit and commercial projects, which reduce poverty and promote development. To provide a means of managing the social and environmental risks and impacts on projects, the IFC has developed Performance Standards on Social and Environmental Sustainability (amended in 2012). The Performance Standards are designed to help avoid, mitigate, and manage risks and impacts as a means of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project level activities. In other words, IFC requires the Project Parties to carry out an environmental and social assessment of Project-related impacts according to the PSs, which are listed as follows:

- PS1: Assessment and Management of Environmental and Social Risks and Impacts;
- PS2: Labour and Working Conditions;
- PS3: Resource Efficiency and Pollution Prevention;
- PS4: Community, Health Safety and Security;
- PS5: Land Acquisition and Involuntary Resettlement;
- PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PS7: Indigenous Peoples; and

- PS8: Cultural Heritage.

PS7 is not applicable for the Project.

The following guidelines of the IFC, which are deemed relevant to the Project, to be followed during the ESIA study are as follows:

- The IFC General EHS Guidelines, dated April 30th, 2007;
- The IFC EHS Guidelines for Thermal Power Plants, dated December 19th, 2008;
- The IFC EHS Guidelines for Electric Power Transmission and Distribution, dated April 30, 2007;
- The IFC and EBRD Workers' Accommodation: processes and standards, dated September 2009.

4.2.4 Equator Principles

The Equator Principles are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk related to certain project finance projects.

This framework is based on the IFC Performance Standards and the World Bank Group EHS Guidelines. Financial Institutions adopt the Equator Principles in order to ensure that financed projects are developed in a manner that is socially responsible and reflects sound environmental management practices. The principles comprise a set of ten broad principles that are underpinned by the environmental and social policies, standards and guidance of the IFC. The Equator Principles are as follows:

- Principle 1: Review and Categorization;
- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: Reporting and Transparency (Equator Principles Financial Institutions, 2013).

4.3 Gaps between Local Legislation and International Guidelines

The most prominent topic, which requires further elaboration in national EIA legislation is "Social Impact Assessment (SIA)". Additional studies and implementations are required in this topic for internationally financed projects to achieve alignment with international standards. For example, implementation of detailed socio-economic surveys at Project Site and the establishment of a Grievance Mechanism are not stipulated by the national EIA legislation. However, these are required by international standards.

All these requirements will be considered and fulfilled within the scope of the Project.

4.4 Project Environmental Standards

This section summarizes national and IFC EHS Guidelines and WHO Guidelines related to the Project. Where there is more than one standard for a parameter, the more stringent one will apply to the Project.

4.4.1 Ambient Air Quality

Project Standards related to ambient air quality have been selected from Iraq's National Ambient Air Quality Standards and IFC General EHS Guidelines as presented together in Table 4-4 below.

Table 4-4 National and International Standards Regarding Ambient Air Quality

Parameter	Averaging Period	Standards			
		Iraqi National Ambient Air Quality Standards		WHO Ambient Air Quality Guidelines ($\mu g/m^3$)	IFC General EHS Guideline Values for Air Emissions and Ambient Air Quality ($\mu g/m^3$)
		$\mu g/m^3$	ppm		
NO_2	1-year	75.3	0.04	40 (guideline)	10 (25 % of guideline)*
	1-hour	-	-	200 (guideline)	50 (25 % of guideline)*
	24-hour	94.1	0.05	-	-
SO_2	24-hour	104.7	0.04	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)	31.25 (25 % of interim target 1)*
	10-minute	-	-	500 (guideline)	125 (25% of guideline)*
	1-hour	261.8	0.1	-	-
	1-year	47.1	0.018	-	-
Particulate Matter (PM_{10})	1-year	-	-	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)	-

	24-hour	150	-	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)	-
Particulate Matter ($PM_{2.5}$)	1-year	-	-	35 (Interim target-1) 25(Interim target-2) 15 (Interim target-3) 10 (guideline)	-
	24-hour	65	-	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)	
	1-hour	15	-	-	-
Total Suspended Particulates	24-hour	350	-	-	-
	1-hour	150	-	-	-
Settled Dust	30 days	10 ton/$km^2$for residential area 20 ton/$km^2$for industrial area	-	-	-
Ozone	8-hour daily maximum	-	-	160 (Interim target-1) 100 (guideline)	
	1-hour	117.8	0.06	-	-
Carbonmonoxide	8-hour	11,452	10	-	-
	1-hour	40,082	35	-	-
Hydrocarbons	3-hour	160	0.24	-	-
Lead	24-hour	2	-	-	-
	3-month	1.5	-	-	-
	1-year	1	-	-	-
Benzene	1-year	0.003 mg/m^3	-	-	-
Dioxane	1-year	0.6 pg/m^3	-	-	-

*Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed. (US EPA Prevention of Significant Deterioration Increments Limits applicable to non-degraded airsheds.)

4.4.2 Air Emissions

Air emission standards according to Iraqi requirements are given below in Table 4-5. Limits provided in IFC EHS Guidelines for Thermal Power Plants are also given in

Table **4-6**.

Table 4-5 Iraqi National Standards for Air Pollutant Emissions (Maximum Allowable Emission Limits of Air Pollutants Emitted from Stationary Sources

Parameter	Source of Emissions*	Max. Allowable Emission Limits (mg/Nm^3)
Visible Emissions	Combustion Sources	250
Opacity	All Sources	20%
Carbon Monoxide (CO)	All Sources	500
Nitrogen Oxides (expressed as Nitrogen Dioxide) (NO_x)	Combustion Sources	70 - 500
Sulphur Dioxide (SO_2)	Combustion Sources	500
Total Suspended Particles(TSP)	Combustion Sources	250
Benzene (C_6H_6)	All Sources	5
Lead and its Compounds (expressed as Lead) (Pb)	All Sources	5
Arsenic and its Compounds (expressed as Arsenic) (As)	All Sources	1
Cadmium and its Compounds (expressed as Cadmium) (Cd)	All Sources	1
Mercury and its Compounds (expressed as Mercury) (Hg)	All Sources	0.5
Chromium and its Compounds (expressed as Chromium) (Cr)	All Sources	5
Vanadium (V)	All Sources	5
Nickel and its Compounds (expressed as Nickel) (Ni)	All Sources	1
Copper and its Compounds (expressed as Copper) (Cu)	All Sources	5
Hydrogen Fluoride (HF)	All Sources	2
Silicon Fluoride (SiF_4)	All Sources	10
Volatile Organic Compounds (VOC)	All Sources	20
Dioxins and Furans	All Sources	1 ng TEQ*/m^3

Table 4-6 Project Standards for Air Emissions as per IFC Guidelines

IFC Environmental, Health, and Safety Guidelines THERMAL POWER PLANTS (Table 6 (B)) Emissions Guidelines (in mg/Nm^3 or as indicated) for Combustion Turbine						
Combustion Technology/Fuel	Particulate Matter (PM)		Sulphur Dioxide (SO_2)		Nitrogen Oxides (NO_x)	Dry Gas, Excess O_2 Content (%)
	NDA*	DA*	NDA	DA	NDA/DA	
Natural Gas(all turbine types of Unit > 50MWth)	N/A	N/A	N/A	N/A	51 (25 ppm)	15%
Fuels other than Natural Gas (Unit >> 50MWth)	50	30	Use of 1% or less S fuel	Use of 0.5 % or less S fuel	152 (74 ppm)	15%

* NDA: Non- degraded Airshed, DA: Degraded Airshed

4.4.3 Water Quality

Iraqi national standards for water quality classifications for natural water bodies are provided below in Table 4-7.

Table 4-7 Iraqi National Water Quality Standards[7]

Parameter	Water Source Category			
	A-1 (Rivers, Streams and Lakes)	A-2 (Streams)	A-3 (Lakes)	A-4 (Springs)
Color	Normal	Normal	Normal	Normal
pH	6.5-8.5	6.5-8.5	6.5-8.5	-
Dissolved Oxygen (mg/l)	>5	>5	>5	-
BOD (mg/l)	<3	<3	<3	-
Cyanide CN^-(mg/l)	0.02	0.02	0.02	0.02
Fluoride F^-(mg/l)	0.2*	0.2*	0.2*	0.2*
Free Chlorine (mg/l)	Trace	Trace	Trace	Trace
Chloride Cl^-(mg/l)	200*	200*	200*	200*
Phenol (mg/l)	0.005	0.005	0.005	0.005
Sulphate SO_2^{-4} (mg/l)	200*	200*	200*	200*
Nitrate NO_3^-(mg/l)	15	15	15	15
Phosphate PO_4^{-3}(mg/l)	0.4	0.4	0.4	0.4

[7]The New Limits of the Regulation of the Protection of Rivers and Public Waters for a Year 1967, Ministry of Health, Directorate General of Human Environment (from EIA Report of KAZ Oil Terminal Project, December 2014)

Parameter	Water Source Category			
	A-1 (Rivers, Streams and Lakes)	A-2 (Streams)	A-3 (Lakes)	A-4 (Springs)
Ammonium NH_4^+(mg/l)	1	1	1	1
DDT (mg/l)	0	0	0	0
Lead (mg/l)	0.05	0.05	0.05	0.05
Arsenic (mg/l)	0.05	0.05	0.05	0.05
Copper (mg/l)	0.05	0.05	0.05	0.05
Nickel (mg/l)	0.1	0.1	0.1	0.1
Selenium (mg/l)	0.01	0.01	0.01	0.01
Mercury (mg/l)	0.001	0.001	0.001	0.001
Cadmium (mg/l)	0.005	0.005	0.005	0.005
Zinc (mg/l)	0.5	0.5	0.5	0.5
Chromium (mg/l)	0.05	0.05	0.05	0.05
Aluminium (mg/l)	0.1	0.1	0.1	-
Barium (mg/l)	1.0	1.0	1.0	1.0
Boron (mg/l)	1.0	1.0	1.0	1.0
Cobalt (mg/l)	0.05	0.05	0.05	0.05
Iron (mg/l)	0.3	0.3	0.3	0.5
Manganese (mg/l)	0.1	0.1	0.1	0.1
Silver (mg/l)	0.01	0.01	0.01	0.01

Water Source Category:
A-1 Rivers, Branches
A-2 Streams, aqua ducts, water courses and their original and secondary branches
A-3 Lakes, Basins and other water bodies
A-4 Springs, wells and underground water
* The quality standard is to be set as the listed value or more according to naturally existing amount in the source.

For drinking water quality; IFC General EHS Guidelines state that drinking water sources, whether public or private, should at all times be protected so that they meet or exceed applicable national acceptability standards or in their absence the current edition of World Health Organization (WHO) Guidelines for Drinking-Water Quality. Drinking water quality values of Iraqi national standards and the WHO guidelines are provided below in Table 4-8.

Table 4-8 WHO Guidelines for Drinking Water Quality

Parameter	Iraqi Drinking Water Standards	WHO Guideline Values
Acrylamide (mg/L)	0.0005	0.0005
Arsenic (mg/L)	0.01	0.01*
Barium (mg/L)	0.7	0.7
Cadmium (mg/L)	0.003	0.003
Chromium (mg/L)	0.05	0.05*
Copper (mg/L)	1.0	2.0

Parameter	Iraqi Drinking Water Standards	WHO Guideline Values
Cyanide (mg/L)	0.02	0.07
Fluoride (mg/L)	1.0	1.5
Lead (mg/L)	0.01	0.01
Mercury (mg/L)	0.001	0.001
Nitrate (as $NO3^-$) (mg/L)	50	50
Nitrite (as $NO2^-$) (mg/L)	3.0	3.0 0.2 **
Selenium (mg/L)	0.01	0.01
Ecoli (Number per 100 mL)	-	Zero
Color (TCU)	10	15
Turbidity (NTU)	5	< 5 acceptable to consumers < 0.1 for effective disinfection
Aluminum(mg/L)	0.2	0.1-0.2**
Chloride(mg/L)	250	250**
Copper(mg/L)	1	2 mg/L (of health significance)
Hardness(mg/L)	500	100–300**
Iron(mg/L)	0.3	0.3
Manganese(mg/L)	0.1	0.4 mg/L (of health significance)
pH		6.5-8.5**
Sodium (mg/L)	200	200**
Sulfate(mg/L)	250	500**
TDS(mg/L)	1000	600**
Zinc(mg/L)	3.0	3**
Calcium(mg/L)	50	-
Magnesium (mg/L)	50	-

* Provisional guideline value, as there is evidence of a hazard, but the available information on health effects is limited.
**No health-based guideline value has been proposed, however may affect acceptability of drinking-water

Source: A Compendium of Drinking Water Quality Standards in the Eastern Mediterranean Region, WHO Regional Office for the Eastern Mediterranean Regional Centre for EnvironmentalHhealth Activities (CEHA), 2006

4.4.4 Wastewater Standards

Iraqi national standards for wastewater discharge are presented below in Table 4-9.

Table 4-9 Iraqi National Wastewater Discharge Limits[8]

Parameter	Wastewater Discharge Limits	
	To Any Water Source	To Public sewers
Color	-	-
Temperature (°C)	< 35	45
Suspended Solids (mg/l)	50	750
pH	6-9.5	6-9.5
Dissolved Oxygen (mg/l)	-	-
BOD (mg/l)	<40	1,000
COD (Cr_2O_7 method) (mg/l)	<100	-
Cyanide (CN^-) (mg/l)	0.05	0.5
Fluoride (F^-) (mg/l)	5	10
Free Chlorine (Cl_2) (mg/l)	Trace	100
Chloride (Cl^-) (mg/l)	A. If the ratio of the amount of water discharged to the amount of source water is 1000:1 or less, the chloride concentration of the discharge is permitted at 1% of the concentration of the natural source before discharge. B. If the ratio of the amount of water discharged to the amount of source water is more than 1000:1 the wastewater discharge must not exceed a chloride concentration of greater than 600mg/litre. C. If the concentration of chloride in the source water is less than 200 mg/l then the permitted discharge limit must be established on a case by case basis.	600
Phenol (mg/l)	0.01-0.05	5-10
Sulphate (SO_2^{-4})(mg/l)	A - if the ratio of the amount of water discharged to the amount of source water is 1000:1 or less, the sulphate concentration of the discharge is permitted at 1% of the concentration of the natural source before discharge. B - If the percentage of the amount of wastewater discharged to the amount of source water is more than 1000:1, the wastewater discharge must not exceed a sulphate concentration of greater than 400mg/l.	300

[8]The New Limits of the Regulation of the Protection of Rivers and Public Waters for a Year 1967, Ministry of Health, Directorate General of Human Environment (from EIA Report of from EIA Report of KAZ Oil Terminal Project, December 2014)

Parameter	Wastewater Discharge Limits	
	To Any Water Source	To Public sewers
	C if the concentration of sulphate in the source water is less than 200mg/l then the permitted discharge limit must be established on a case by case basis.	
Nitrate (NO_3^-) (mg/l)	50	-
Phosphate (PO_4^{-3}) (mg/l)	3	-
Ammonium (NH_4^+) (mg/l)	-	-
DDT (mg/l)	0	-
Lead (mg/l)	0.1	0.1
Arsenic (mg/l)	0.05	0.05
Copper (mg/l)	0.2	-
Nickel (mg/l)	0.2	0.1
Selenium (mg/l)	0.05	-
Mercury (mg/l)	0.005	0.001
Cadmium (mg/l)	0.01	0.1
Zinc (mg/l)	2.0	0.1
Chromium (mg/l)	0.1	0.1
Aluminium (mg/l)	5.0	20
Barium (mg/l)	4.0	0.1
Boron (mg/l)	1.0	1.0
Cobalt (mg/l)	0.5	0.5
Iron (mg/l)	2.0	15.0
Manganese (mg/l)	0.5	-
Silver (mg/l)	0.05	0.1
Total Hydrocarbons and its Compounds (mg/l)	Discharge of total hydrocarbons to water sources according to the concentrations and limitations below are allowed; the concentration of hydrocarbons must be measured discharging to the water source. For a river in continuous flow 10 mg/l according to the ratio of the amount of wastewater discharged to the amount of the water source should not be less than 1000:1. For a river in continuous flow 5 mg/l and in accordance the ratio of the amount of wastewater discharged to the amount of the water source should be 500:1 or less. For a river in a continuous flow 3 mg/l and in accordance with the ratio of the amount of wastewater discharged to the amount of the water source should be 300:1 or less	-
Sulfide S^{-2} (mg/l)	0	3.0
Ammonia (mg/l)	0	10.0
Ammonia gas (mg/l)	0	6.0

Parameter	Wastewater Discharge Limits	
	To Any Water Source	To Public sewers
Sulphur Dioxide (mg/l)	0	7.0
Petroleum Alcohol (mg/l)	0	Not permissible
Calcium Carbonate (mg/l)	0	Not permissible
Organic Solvent (mg/l)	0	Not permissible
Benzene (mg/l)	0	0.5
Chlorobenzene (mg/l)	0	0.1
TNT (mg/l)	0	0.5
Bromine (Br_2) (mg/l)	0	1-3

In addition to national limits related to the quality of industrial wastewater, effluent standards of IFC EHS Guidelines for Thermal Power Plants are presented below in Table 4-10.

Table 4-10 Effluent Guidelines of IFC EHS Guidelines for Thermal Power Plants

Parameter	Maximum Value Allowed
pH	6-9
TSS (mg/L)	50
Oil and Grease (mg/L)	10
Total Residual Chlorine (mg/L)	0.2
Chromium – Total (Cr) (mg/L)	0.5
Copper (Cu) (mg/L)	0.5
Iron (Fe) (mg/L)	1.0
Zinc (Zn) (mg/L)	1.0
Lead (Pb) (mg/L)	0.5
Cadmium (Cd) (mg/L)	0.1
Mercury (Hg) (mg/L)	0.005
Arsenic (As) (mg/L)	0.5
Temperature increase by thermal discharge from cooling system	• Site specific requirement to be established by the EA. • Elevated temperature areas due to discharge of once-through cooling water (e.g., 1 Celsius above, 2 Celsius above, 3 Celsius above ambient water temperature) should be minimized by adjusting intake and outfall design through the project specific EA depending on the sensitive aquatic ecosystems around the discharge point.

Limits presented in IFC EHS Guidelines-General EHS Guidelines: Environment for treated sanitary sewage discharges are given in Table 4-11 below:

Table 4-11 Indicative Values for Treated Sanitary Sewage Discharges[a]

Parameter	Value
pH	6-9
BOD (mg/L)	30
COD (mg/L)	125
Total nitrogen (mg/L)	10
Total phosphorous (mg/L)	2
Oil and Grease (mg/L)	10
Total Suspended Solids (mg/L)	50
Total Coliform Bacteria MPN[b]/100 ml	400[a]

Notes:
a Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation.
b MPN = Most Probable Number

In terms of wastewater discharge standards, WHO requires compliance to local legislation.

4.4.5 Soil Quality

There are no applicable national standards regarding the soil quality. Therefore, for the assessment of the soil quality for the Project; the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health and the Dutch soil remediation intervention values for earth/sediment were considered for baseline soil quality assessment.

Table 4-12 The Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health and the Dutch Soil Remediation Intervention Values for Earth/Sediment

Parameter	Limit for transportation to groundwater used for drinking purposes (mg/kg)	Dutch Soil Remediation Intervention Values for Earth/Sediment (expressed as the concentration in a standard soil, 10% organic matter and 25% clay) (mg/kg dry matter)*
Antimony	20	15
Arsenic	12	55
Copper	63	190
Barium	750	625
Mercury	2	10
Zinc	6.6	720
Cadmium	200	12
Chromium	1.4	380
Lead	64	530
Molybdenum	70	200

Selenium	1	0.7**
Uranium	23	N/A

* Source: (Esdat Environmental Data Management Software, 2000)
** target value

As for the international project standards related to soil quality, the IFC's management approaches for land contamination due to anthropogenic releases of hazardous materials, wastes, or oil, including naturally occurring substances will be adopted (see Table 4-13). As in water discharge standards, WHO requires compliance to the local legislation.

Table 4-13 Project Standards Regarding Soil Quality

	Status	Approach
Is the Soil Contaminated?	Yes	Identify the source of uncontrolled pollution and control it to avoid further adverse impacts.
		Manage the risk to human health's ecological receptors.
		Decontaminate the land at the site while preventing human exposure to contamination.
	No	Hazardous materials wastes or oil should be managed correctly to prevent contamination.

Source: IFC, 2007.

4.4.6 Noise

There are no national noise limits for environmental noise.

IFC EHS General Guidelines limits regarding noise levels are provided below in Table 4-14.

Table 4-14 IFC EHS Guidelines-Noise Level Guidelines

Receptor	One Hour LAeq (dB) Limits	
	Daytime (07:00 – 22:00)	Night time (22:00 – 07:00)
Residential, institutional; educational	55	45
Industrial; commercial	70	70

According to IFC noise level guidelines, noise impacts should not exceed above levels or result in a maximum increase in background levels of 3 dB at the nearest receptor off-site. The nearest sensitive receptor in the vicinity of the Project is the dwelling at a distance of 270 m located in the Al Sadah Village.

5 ENVIRONMENTAL AND SOCIAL BASELINE

5.1 Baseline Studies

This section of the Report summarizes the results of the environmental and social baseline assessment related to the Project. The baseline assessment will be used to establish an environmental and social baseline against which impacts from the Project can be measured. The baseline takes into account the current conditions as well as the changing conditions (i.e. trends) apparent in the baseline. It also takes into consideration other developments in the area, which are underway or certain to be initiated in the near future.

The main objectives of the baseline description are the followings to:

- focus on the receptors that were identified during the scoping phase as having the potential to be significantly affected by the Project;
- describe and, where possible, to quantify the baseline characteristics of the physical, biological and social environments (nature, condition, quality, extent, etc.);
- provide data to facilitate the identification and evaluation of the possible impacts; and
- inform the assessors about the sensitivity, vulnerability and/or importance of resources/receptors.

In the context of the baseline studies, below listed environmental baseline measurements and social surveys were also conducted for the Project:

- Soil sampling at 7 locations;
- Groundwater sampling at the existing two wells;
- Surface water sampling from upstream and downstream Euphrates River;
- Passive sampling for NO2, SO2 and BTEX at 10 points for two months;
- Day-time and night-time noise measurements at 6 points both on work days and weekends;
- PM_{10} sampling at 4 points both during day-time and night-time;
- Ecological Surveys (Spring, Summer and Autumn Season Flora and Fauna Surveys);
- Cultural Heritage Site Surveys;
- Household and community level assessments and interviews with representative members of local communities, including inhabitants of nearby villages.

The physical, biological, social, cultural resources and environmental baseline characteristics of the Project Site and AoI are provided in the following sections. The environmental baseline analysis reports are presented in Appendix-E.

5.2 Physical Baseline

5.2.1 Air Quality

In order to assess the impacts of the proposed Project, ambient air quality in the area of influence (AoI) was measured at a number of specified locations within the AoI. The results of the air quality baseline assessment are used to assess the ambient air quality in the AoI and to classify the air shed within the AoI as either degraded or non-degraded. Since the IFIs define different stack gas emission limits for degraded and non-degraded air sheds, the emission limits applicable to the Project will be based on this determination.

The impacts of the Project on the baseline air quality should not exceed the local ambient air quality and related IFI standards. As a general approach, the IFC's General EHS Guidelines suggest that the individual effects of a project on air quality can make up 25% of the applicable air quality limit values to sustainably allow for additional future developments in the same airshed.

The Project Site is located in Nasiriyah City in Dhi-Qar Governorate, 200 km northwest of Basra. Primary Road No.7 passes to the north and the Baghdad-Basra railway passes to the north of the Project area. Nasiriyah Thermal Power Plant is located less than 1 km to the south and the Dhi-Qar Oil Refinery is located approximately 4.7 km to the south-east of the Project site.

The main sources of air pollution in the vicinity of the Project site are emissions from the Nasiriyah Thermal Power Plant and the Dhi-Qar Refinery along with the exhaust gas emissions from the traffic on Baghdad-Basra railway. The closest settlements to the Project area are Auejah Village on the south (0.5 km), Al-Mahmud Village on the north-east (1.5 km), Al-Agir Village on the west (2 km) and Al-Sadah Village on the west (2.5 km). Other emissions are from the stacks of the settlements where mainly oil and electricity are used for heating purposes.

PM_{10} measurements and passive sampling for NO_2 and SO_2 have been conducted for the Project in order to determine the physical baseline conditions in terms of air quality. For PM_{10}, spot measurements were conducted on weekdays and weekends at Al Auejah Village as well as at the Project site. $PM_{2.5}$ sampling wasn't carried out since the Project will not produce considerable amount of $PM_{2.5}$ emissions during both the construction and operational phases. The heavy construction activities, which generate dust emissions most, are estimated to last about 18 months, which is a relatively short period of time compared to the length of the operational phase. Furthermore, the results of the air quality modelling studies performed to estimate the ground level concentrations (GLCs) of PM_{10} indicate that the annual and daily GLCs during the construction phase are below the WHO ambient air quality guideline values provided in IFC's General EHS Guidelines on Environmental Air Emissions and Ambient Air Quality. The GLCs of PM_{10} have been estimated for the worst-

case conditions, therefore, the PM_{10} GLC values are expected to be even lower than the estimated values under the controlled conditions such as water spraying for dust suppression, covering material storage piles and pavement of roads. In this regard, the $PM_{2.5}$ emissions will even be in negligible amounts under the controlled conditions. During the operational phase, as the Power Plant will be equipped with combustion turbines, there will not be considerable amount of $PM_{2.5}$ emissions, principal sources of which are boilers. Moreover, there aren't any measurement companies in Iraq, which are technically capable of $PM_{2.5}$ sampling.

The coordinates of the PM_{10} measurement locations, dates of these measurements and the PM_{10} measurement results along with the Iraqi national ambient air quality standard and WHO ambient air quality guideline value for PM_{10} are provided below in Table 5-1. The PM_{10} measurement locations are shown on the map given in Figure 5-1.

Table 5-1 Coordinates of the PM_{10} Measurement Locations (UTM Zone: 38 R), Dates of these Measurements and the PM_{10} Measurement Results

Measurement Locations	Coordinates	Dates	Averaging Period	Measurement Results ($\mu g/m^3$)	Iraqi National Ambient Air Quality Standard for PM_{10} ($\mu g/m^3$)	WHO Ambient Air Quality Guideline Value for PM_{10} ($\mu g/m^3$)
Auejah Village	E: 613394; N: 3433020	11.09.2017	24-hour	28	150	50
		15.09.2017		25		
Project Site	E: 613260; N: 3433531	11.09.2017		35		
		15.09.2017		32		

The measurement results are below the Iraqi national ambient air quality standard and WHO ambient air quality guideline value of 150 $\mu g/m^3$ and 50 $\mu g/m^3$ for PM_{10}, respectively. Nevertheless, it should be taken into account that the region is frequently affected by dust storms and the locals often suffer from high dust concentrations[9].

[9] Dust storms could be defined as large air masses blown with 25 km/h or 7 m/s with high dust intensity, where the visibility is reduced to less than 1,000 m. Sometimes thick dust storms arrive in the form of a big wall of dust and debris (Al-Marsoumi & Al-Asadi, 2010).
Dust storms are considered to be one of the most important environmental hazards in Iraq. In the summer, Iraq is affected by low pressure centred in the areas of the Arabian Sea and the Indian Ocean, and the high pressure regions in the plateau of Anatolia, resulting in the Shamal winds in the north and northwest. From mid-June to mid-September, this is accompanied by intensive heating of the land surface, causing dust storms to rise to heights of one kilometer. In recent years, the frequency of dust storms has increased in Iraq and the surrounding areas due to drought, causing reduced vegetation cover and deterioration of soil quality. The average annual number of days with dust storms across Iraq for the period 1981 to 2011 indicated that Nasiriyah was the governorate with the highest frequency of dust storms, reaching 20 days/year (UNEP, WMO and UNCCD, 2016).
The major source area of dust is situated north of Nasiriyah and Samawa, it is an area characterized by major dune fields. In general, the rate of dust deposition increases from Baghdad to Nasiriyah where it reaches maximum value, then decreases toward Safwan. It is believed that dust storms covering the southern area of Iraq and the coastal area of Kuwait are originated from the southern Mesopotamia Desert in Iraq, and covered a part of Saudi Arabia too (Al-Marsoumi & Al-Asadi, 2010).

Passive sampling was performed for two consecutive months at ten (10) different locations within and around the proposed Project site, of which the coordinates are provided below in Table 5-2. The diffusion tubes remained on the field from 23.05.2017 until 01.07.2017 for the first month of the sampling period and from 30.06.2017 until 30.07.2017 for the second month of the sampling period. The prevailing wind direction, proximity to and population of the residential areas together with the presence of any sensitive ecosystems in the area were the factors considered in selection of the sampling stations. The passive sampling locations are demonstrated on the map provided below in Figure 5-1.

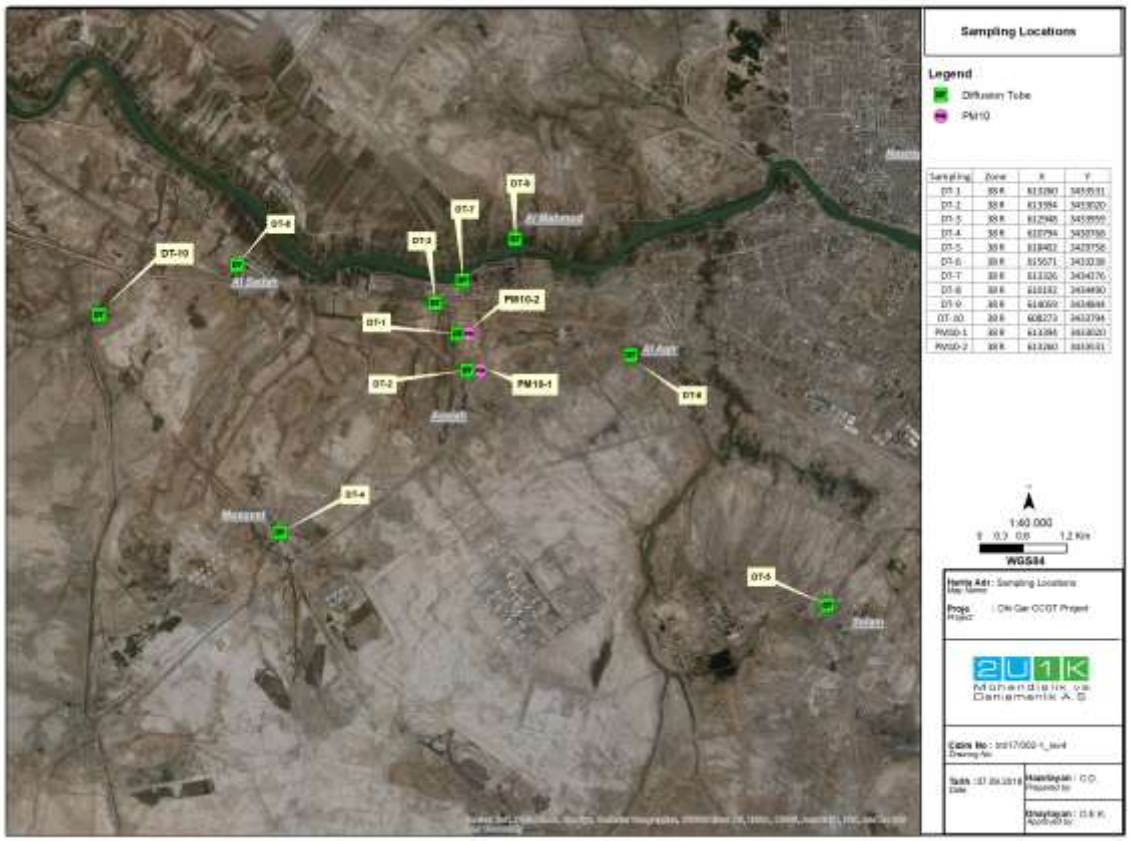


Figure 5-1 PM_{10} Measurements Locations and Passive Sampling Stations

At the end of the first sampling period, 4 of the 10 passive sampling tubes were missing, therefore the results of the 6 sampling tubes along with the blank sample are provided below in Table 5-2 for the first sampling period. At the end of the second sampling period, on the other hand, 1 of the 10 passive sampling tubes was missing and the results of the remaining 9 sampling tubes are provided below in Table 5-2.

Table 5-2 Coordinates of the Passive Sampling Stations and Analysis Results

No	Sample Codes	Sampling Locations	Coordinates (UTM Zone 38R)	1st Period Analysis Results (µg/m³)		2nd Period Analysis Results (µg/m³)	
				NO_2	SO_2	NO_2	SO_2
1	DT-1	Power Plant	E: 613260; N: 3433531	0.29	19.92	11.01	19.19
2	DT-2	Auejah Village	E: 613394; N: 3433020	0.21	12.30	8.21	19.18
3	DT-3	Al Sadah Village	E: 612948; N: 3433959	0.39	6.37	16.08	18.28
4	DT-4	Musuvet Village	E: 610794; N: 3430768	-*	-*	6.87	15.43
5	DT-5	Selam Village	E: 618402; N: 3429758	0.34	11.83	10.84	20.16
6	DT-6	Al-Agır (Nasiriye) Village	E: 615671; N: 3433238	-*	-*	14.97	35.95
7	DT-7	Water Intake Location	E: 613326; N: 3434276	-*	-*	8.00	15.80
8	DT-8	Al-Sadah Village	E: 610192; N: 3434490	0.20	4.40	11.21	17.52
9	DT-9	Al-Mahmud Village	E: 614059; N: 3434844	0.26	5.87	9.75	13.76
10	DT-10	Muhammadden Mersion	E: 608273; N: 3433794	-*	-*	-	-
11	Blank	ART.PS.17.07.01231	-	<0.01	12.04	-	-
Iraqi National Ambient Air Quality Standards (µg/m³)				75.3 (for an averaging period of 1-year)	104.7 (for an averaging period of 24-hour)	75.3 (for an averaging period of 1-year)	104.7 (for an averaging period of 24-hour)
WHO Ambient Air Quality Guideline Values (µg/m³)				40 – guideline (for an averaging period of 1-year)	125 - Interim target 1; 50 - Interim target 2; 20 – guideline (for an averaging period of 24-hour)	40 – guideline (for an averaging period of 1-year)	125 - Interim target 1; 50 - Interim target 2; 20 – guideline (for an averaging period of 24-hour)

*Sampling tubes missing

According to the analysis report, the results are below both the Iraqi limits and IFC guideline limits for ambient air quality. However, since the analysis results of SO_2 are relatively close to 25 % of the interim target 1 value, which is 31.25 µg/m³, the Project area can be considered as having a degraded air shed.

5.2.2 Hydrology and Water Quality

Groundwater and surface water represent essential sources of drinking and irrigation water in developing countries, particularly in rural areas where piped water supply may be limited or unavailable and where available resources are collected by the consumer with little or no treatment. Project activities involving wastewater discharges, water extraction, diversion or impoundment should prevent adverse impacts to the quality and availability of groundwater and surface water resources.

A hydrological analysis study has been conducted for the Project in order to provide groundwater and weather conditions data and evaluate the flood risk of the Euphrates River. The study was conducted by the Consulting Engineering Bureau of the College of Engineering, University of Baghdad in May, 2017.

The site of the Power Plant lies within the southern part of Mesopotamia Zone of hydrogeological zones classification of Iraq.

The closest water source to the Power Plant is the Euphrates River at a distance of about 1 km. Process water for plant operations and potable water will be supplied from the river and wastewater generated at the plant will be discharged to the river after treatment.

The Euphrates River is one of largest rivers in the Middle East and Southwest Asia which rises at the mountains of Turkey on the Armenian plateau. It is formed by the confluence of the Karasu and the Murat rivers and flows southeast across Syria and through western, central, and south parts of Iraq to Al Qurnah City where it joints Tigris River to form Shatt Al Arab River. The main tributaries of the Euphrates River are Sajur, Balikh and Khabur.These tributaries have their sources in Turkey and join the Euphrates River in Syria. Total length of the river is 2,940 km. 40% of the river is in Turkey, 20.5% in Syria and 39.5% in Iraq.

The groundwater at the site is less than 10 m depth below ground surface the movement is to the marshes at the south of the Mesopotamia Zone. Groundwater depth in hydrogeological zones of Iraq is provided below in Figure 5-2.

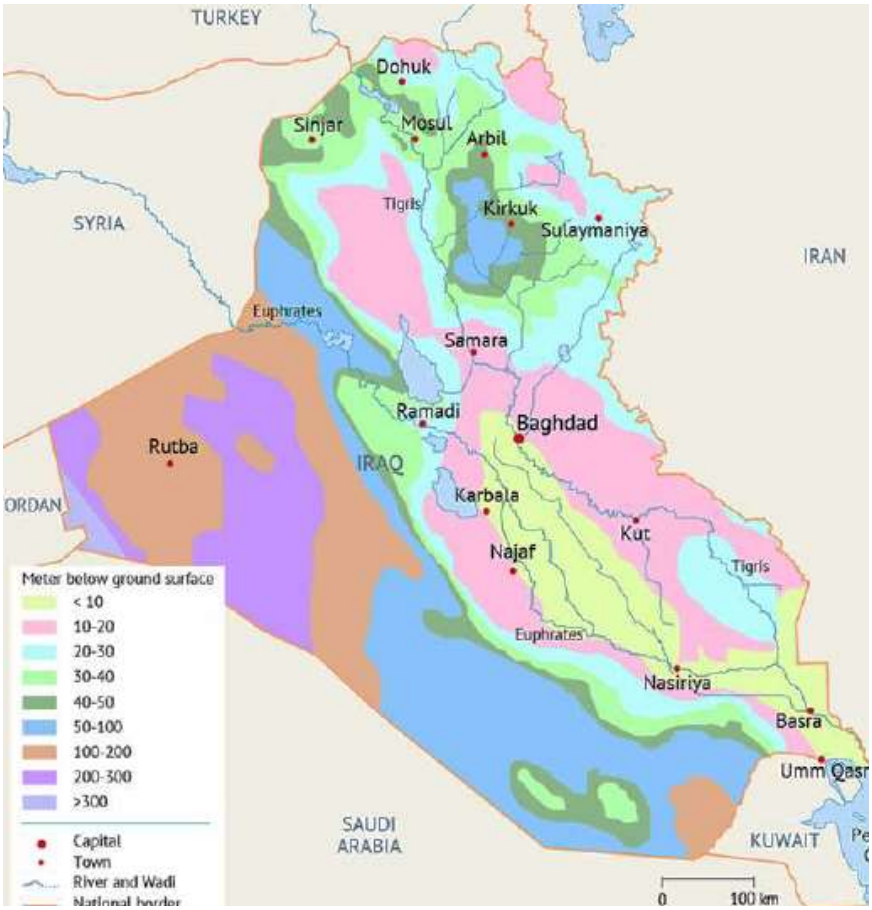


Figure 5-2 Groundwater Depth in Iraq (Source: Hydrological Study for Dhi-Qar CCGT, 2017)

Surface water and sediment sampling has been conducted from the Euphrates River in order to determine the baseline conditions.

Surface water sampling was conducted on 29.07.2017 from upstream and downstream of the Euphrates River. The analysis results are provided below in Table 5-3 along with the Iraqi national water quality standards for rivers, streams and lakes.

Table 5-3 Surface Water Analysis Results

Parameter	Unit	Analysis Results		Iraqi National Water Quality Standards
		Sample 1 (Upstream)	Sample 2 (Downstream)	Water Source Category of A-1 (Rivers, Streams and Lakes)
		E: 613108, N: 3434383	E:615289, N:3434377	
Ammonium (mg NH_4^+-N/L)	mg/L	0.05	0.068	1
Biological Oxygen Demand (BOD)	mg/L	**12**	**11**	<3
Dissolved Oxygen	mg/L	6.92	6.29	>5
Fluoride F^-	mg/L	**0.31**	**0.48**	0.2*
Phosphate PO_4^{-3}	mg/L	0.053	0.039	0.4
Electrical Conductivity	µS/cm	3920	3420	N/A
Chemical Oxygen Demand COD	mg/L	35	34	N/A
Manganese	mg/L	0.062	0.064	0.1
Nitrate	mg/L	1.02	1.08	15
pH	-	8.05	8.05	6.5-8.5
Colour (436 nm)	RES	<0.5	<0.5	N/A
Colour (525 nm)	RES	<0.5	<0.5	N/A
Colour (620 nm)	RES	<0.5	<0.5	N/A
Selenium	mg/L	<0.005	<0.005	0.01
Sulfur	mg/L	<0.002	<0.002	N/A
Total nitrogen	mg/L	1.76	1.79	N/A
Total phosphorous	mg/L	0.14	0.107	N/A
Total Kjehldahl Nitrogen	mg/L	0.72	0.69	N/A
Oil and Grease	mg/L	<10	<10	N/A
Temperature	ºC	30.2	30	N/A

*: The quality standard is to be set as the listed value or more according to naturally existing amount in the source.

The analysis results have been compared with the Iraqi national water quality standards for rivers, streams and lakes as there aren't any international water quality standards for natural water bodies, but there are international standards for drinking water quality. According to the analysis results, ammonium, dissolved oxygen, phosphate, manganese, nitrate, pH and selenium values comply with the Iraqi national water quality standards for rivers, streams and lakes (water source category of A-1). It was observed that the BOD values were above the related national water quality standard. Considering the settlements and agricultural lands at two sides of the river, runoff carried from the settlements can be considered to be the result of the high value of BOD.

The concentrations of fluoride in the samples are a little above the related Iraqi national water quality standard for rivers, streams and lakes, although they are below the related Iraqi and WHO drinking water quality standards, 1 mg/l and 1.5 mg/l, respectively. Fluoride can occur naturally in surface waters from the deposition of particles in the atmosphere and weathering of fluoride containing rocks and soils. Fluoride can also be introduced in water by various human activities such as chemical manufacturing plants and production of fluoridated chemicals (U.S. Environmental Protection Agency (EPA), 2010).

Water sampling from the Euphrates River will be conducted before starting water intake and discharge operations for the Project purposes in order to determine the heavy metal concentrations. The sampling points are provided below in Figure 5-3.

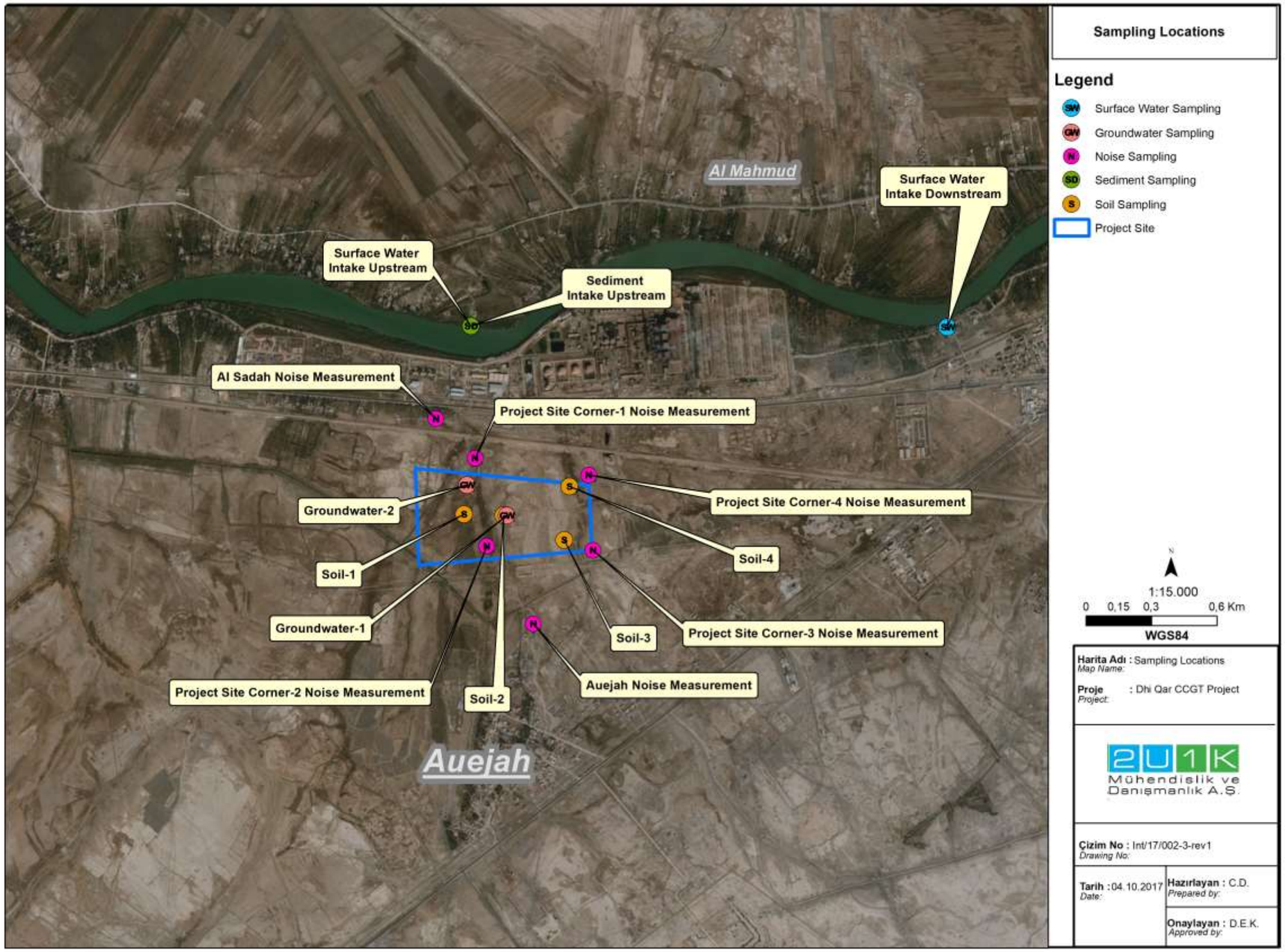


Figure 5-3 Baseline Measurement and Sampling Locations

Sediment sampling from upstream of the Euphrates River was also conducted. Analysis results are provided below in Table 5-4 along with the Project standards, which are the Canadian soil quality guideline values for the Protection of Environmental and Human Health. Since there are no applicable Iraqi national soil quality standards, the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health have been considered for baseline soil quality assessment.

Table 5-4 Sediment Analysis Results

Parameter	Unit	Analysis Results (UTM Zone 38R; Coordinates: E: 613108, N:3434383)	Project Standards (Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health)
			Limit for Transportation to Groundwater used for Drinking Purposes
TOC	mg/kg	26.22	N/A
Antimony	mg/kg	<1.25	20
Arsenic	mg/kg	6.69	12
Copper	mg/kg	38.94	63
Barium	mg/kg	98.18	750
Boron	mg/kg	32.49	N/A
Mercury	mg/kg	<0.25	2
Zinc	mg/kg	**48.73**	6.6
Cadmium	mg/kg	<0.25	200
Chromium	mg/kg	**116.34**	1.4
Lead	mg/kg	8.36	64
Molybdenum	mg/kg	<2.5	70
Selenium	mg/kg	**<1.25**	1
TPH	mg/kg	36.2	N/A

The sediment analysis results show that the concentrations of chromium and zinc are highly above the related guideline values and the concentration of selenium is slightly above the guideline value.

Heavy metals are introduced into the Euphrates River water either naturally or through anthropogenic sources. Metals that are naturally introduced into the river come primarily from the sources such as rock weathering, soil erosion, and the dissolution of water-soluble salts. Naturally occurring metals (especially the heavy metals) move through aquatic environments independent of human activities and usually without any detrimental effects. Anthropogenic pollutants are discharged from industrial, domestic and agricultural wastewater into the river water system. Sediment served as sinks for most of the metals in aqueous phase. The concentrations of heavy metals in soils are varied according to the rate of particle sedimentation, the rate of heavy metals deposition, the particle size and the presence or absence of organic matter in the soils (Murtadha & Qanbar, 2016).

In the article titled “Assessment of Heavy Metal Contamination in Euphrates River Sediments from Al-Hindiya Barrage to Al-Nasiria City, South Iraq” published in Iraqi Journal of Science in 2016, anthropogenic impacts on the sediments of the Euphrates River were assessed using enrichment factors, contamination factors, pollution load index and geo-accumulation index for the metals, including Chromium (Cr), Selenium (Se) and Zinc (Zn). Enrichment factor (EF) is widely used as an approach to characterize the degree of anthropogenic pollution to establish the enrichment ratios, while pollution load index (PLI) represents the number of times by which the heavy metal concentrations in the sediment exceed the background concentrations, and give a summative indication of the overall level of heavy metal toxicity in a particular sample. The enrichment factor ratios for the sediments of the Euphrates River showed that a number of elements including Zinc were deficiently to minimally enriched, while the elements including Chromium (Cr) and Selenium (Se) were moderately enriched, and significant enriched for several elements. The geo-accumulation index showed that the sediments of the Euphrates River are unpolluted by a number of elements including Selenium (Se) and Zinc (Zn), unpolluted to moderately polluted by the elements including Chromium (Cr), while the sediments are moderately polluted by several elements. The measure of the degree of overall contamination (PLI) at the stations including the Nasiriyah Station indicated strong signs of pollution by the measured metals (Murtadha & Qanbar, 2016).

Groundwater sampling was conducted at two wells within the plant area on 29.07.2017 for which the analysis results are provided below in Table 5-5 as compared with the Iraqi national water quality standards for springs. Groundwater sampling locations are provided in Figure 5-3.

Table 5-5 Groundwater Analysis Results

Parameter	Unit	Analysis Results		Iraqi National Water Quality Standards
		Well 1	Well 2	
		E: 613091; N: 3433655	E: 613272; N: 3433515	Water Source Category of A-4 (Springs)
Ammonium	mg/L	<0.01	<0.01	1
Arsenic	mg/L	0.02	0.0073	0.05
Mercury	mg/L	<0.0005	<0.0005	0.001
Electrical conductivity	µS/cm	30,800	10,430	N/A
Cadmium	mg/L	<0.001	<0.001	0.005
Chloride	mg/L	**11,850**	**5,750**	200*
Lead	mg/L	**0.194**	0.041	0.05
Nitrite	mg/L	0.158	<0.0066	N/A
Sulfate	mg/L	**6,174**	**4,086**	200*
Tetrachloroethane	µg/L	<0.07	<0.07	N/A
Total phosphorous	mg/L	0.028	0.116	N/A
Trichloroethane	µg/L	<0.09	<0.09	N/A

* : The quality standard is to be set as the listed value or more according to naturally existing amount in the source.

According to the groundwater analysis results, the concentrations of chloride and sulfate are considerably higher than the related national water quality standards. The lead measurement result of Well no 1 also exceeds the related standard.

Chloride occurs in all natural waters in widely varying concentrations. Chloride content normally increases as mineral content increases. Upland and mountain supplies usually are quite low in chloride, whereas rivers and groundwaters usually have considerable amounts. Chloride salts gain access to natural waters in many ways. The solvent power of water, dissolves chloride from topsoil and deeper at ions. Chloride in groundwater results from both natural and anthropogenic sources, such as run-off containing road deicing salts, the use of inorganic fertilizers, landfill leachates, septic tank effluents, animal feeds, industrial effluents, irrigation drainage, and seawater intrusion in coastal areas. Chlorides are important in detecting the contamination of groundwater by wastewater. Wastewater effluents add considerable amounts of chloride to receiving streams. Many industrial wastes contain appreciable amounts of chloride, discharge of industrial effluents into pits near factories or through unlined channels, without proper treatment, moves to low lying depressions on land resulting in groundwater pollution (Sameer V, Hampannavar, & Purandara, 2011).

Sulfate occurs extensively in groundwater, with both natural and anthropogenic sources. Primary natural sources of sulfate include atmospheric deposition, sulfate mineral dissolution, and sulfide mineral oxidation. Anthropogenic sources include coal mines, power plants, phosphate refineries, and metallurgical refineries (Miao, Brusseau, Carroll, Carreón-Diazconti, & Johnson, 2012).

Lead may enter the environment from human activities including the use of fossil fuels including past use of leaded gasoline, some types of industrial facilities, and past use of lead-based paint in homes. It can also be emitted into the environment from contaminated sites, such as former lead smelters. While natural levels of lead in soil range between 50 and 400 parts per million, mining, smelting, and refining activities have resulted in substantial increases in lead levels in the environment, especially near mining and smelting sites. When lead is released to the air from industrial sources or vehicles, it may travel long distances before settling to the ground, where it usually sticks to soil particles. Lead may move from soil into ground water depending on the type of lead compound and the characteristics of the soil (United States Environmental Protection Agency (EPA), 2017).

The results are the presentation of the baseline conditions of the Project area. A representative baseline assessment of ambient water quality is required for use with established scientific methods and mathematical models to estimate potential impacts to the Euphrates River and groundwater resulting from any effluent sources of the Project. The results of the baseline assessments will be referred to in the future in case of any suspicion on pollution due to the Project activities.

5.2.3 Soil Quality

The Power Plant will be established on a land of 294,281 m^2 area which had been expropriated in 1958 and has not been used for any purposes since then. Before expropriation, the land had been used for agricultural purposes.

In order to determine the baseline soil quality in the area, soil sampling was conducted in July 2017 within the scope of the ESIA studies.

Soil sampling was conducted at 4 locations within the Power Plant area for which the coordinates are provided below in Table 5-6. The locations of the sampling points are provided in Figure 5-3.

Table 5-6 Coordinates of the Soil Sampling Locations

No	Sample Code	Coordinates	
		N	E
1	N-29962/17	613077	3433522
2	N-29963/17	613257	3433517
3	N-29964/17	613535	3433403
4	N-29965/17	613559	3433649

The analysis of the soil samples was conducted according to the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health-for agricultural land use. The results of the analysis are provided in Table 5-7 along with the Canadian and the Dutch soil remediation intervention values for earth/sediment.

Table 5-7 Analysis Results of Soil Samples

Parameter	Soil sample-1 (mg/kg)	Soil sample-2 (mg/kg)	Soil sample-3 (mg/kg)	Soil sample-4 (mg/kg)	Canadian Limits for Transportation to Groundwater used for Drinking Purposes (mg/kg)	Dutch Soil Remediation Intervention Values for Earth/Sediment (expressed as the concentration in a standard soil, 10% organic matter and 25% clay) (mg/kg dry matter)*
Antimony	<1.25	<1.25	<1.25	<1.25	20	15
Arsenic	8.23	9.53	6.76	6.06	12	55
Copper	33.9	48.36	34.07	41.51	63	190
Barium	75.3	101.12	78.16	82.09	750	625
Boron	36.32	50.32	42.84	38.25	N/A	N/A
Mercury	<0.25	<0.25	<0.25	<0.25	2	10
Zinc	**40.44**	**68.39**	**43.34**	**52.01**	6.6	720
Cadmium	<0.25	<0.25	<0.25	<0.25	200	12
Chromium	**101.94**	**139.96**	**102.45**	**113.57**	1.4	380
Lead	6.3	9.28	6.51	7	64	530
Molybdenum	<2.5	<2.5	<2.5	<2.5	70	200
Selenium	**<1.25**	**<1.25**	**<1.25**	**<1.25**	1	N/A
TPH	11.9	30,4	29,6	31	N/A	N/A
TOX	<20	<20	<20	35.64	N/A	N/A
Uranium	<2.5	<2.5	<2.5	<2.5	23	N A

* Source: (Esdat Environmental Data Management Software, 2000)

According to the analysis results; chromium[10] and zinc concentrations exceed the Canadian the Dutch soil remediation intervention values for earth/sediment.

[10] The most common forms of chromium in the environment are trivalent, hexavalent, and the metal (zero valent) form. Trivalent chromium (as oxide) is the most stable form of chromium in solids, occurs naturally in many vegetables, fruits, meats, grains, and yeast, and is considered an essential nutrient. Hexavalent chromium and chromium in the metal form are generally produced by industrial processes. Hexavalent chromium also occurs naturally. Trivalent chromium can be oxidized to hexavalent chromium during water disinfection. Hexavalent chromium compounds are more water soluble than trivalent chromium compounds (American Water Works Association, 2013).

Hexavalent chromium (Chromium VI) is recognized as a human carcinogen via inhalation. Inhalation of hexavalent chromium compounds increases the risk of lung cancer. Exposure to hexavalent chromium from breathing dust or fumes is considered to have a much higher risk than exposure from drinking water (American Water Works Association, 2013).

Hexavalent chromium exposure can occur through people breathing it, ingesting it in food or water, or through direct contact with the skin. Occupational exposure can occur when people work in industries that process or use chromium, chromium compounds, or chromium processes (American Water Works Association, 2013).

Concerning the relatively high baseline chromium concentrations in soil, appropriate mitigation measures, which are elaborated in Section 6.5.7.1, will be taken in order to prevent the exposure of the workers.

The analysis results present the existing conditions before the Project is realized. These results will be referred to in the future in case of any suspicion on soil pollution due to the Project activities.

5.2.4 Noise

Background noise measurements were performed for Dhi-Qar CCGT at six points, four of which were at corners of the Plant area and two were at the closest settlements. Noise measurements were conducted for 24 hours both on work day and weekend. The distance of the nearest receptor at Al Sadah and Auejah Villages was 270 m and 310 m respectively to the Power Plant.

The coordinates of the measurement stations are provided below in Table 5-8. The locations are provided in Figure 5-3.

Table 5-8 Coordinates of the Measurement Locations

No	Measurement Location	Coordinates	
		E	N
1	Al Sadah Village	612948	3433959
2	Auejah Village	613394	3433020
3	Corner 1	613127	3433778
4	Corner 2	613181	3433375
5	Corner 3	613667	3433357
6	Corner 4	613648	3433700

Noise measurement results are provided below in Table 5-9 and Table 5-10 along with the IFC noise level guidelines for residential, institutional and educational receptors.

Table 5-9 Noise Measurement Results-At Nearest Settlements

Date	Measurement Period	Measurement Results Leq (dBA)		IFC Noise Level Guidelines for Residential, Institutional and Educational Receptors (One Hour L_{Aeq}(dBA))
		Al Sadah Village	Auejah Village	
23-24.07.2017 (Weekday)	07:00-22:00 (Daytime)	**59.5**	**57.1**	55
	22:00-07:00 (Nighttime)	**57.3**	**50.7**	45
28-29.07.2017 (Weekend)	07:00-22:00 (Daytime)	**58.2**	54.5	55
	22:00-07:00 (Nighttime)	**60.1**	**54.6**	45

Table 5-10 Noise Measurement Results-At Project Site Corners

Date	Measurement Period	Measurement Results Leq (dBA)				IFC Noise Level Guidelines for Residential, Institutional and Educational Receptors (One Hour L_{Aeq}(dBA))
		Corner 1	Corner 2	Corner 3	Corner 4	
23.05.2017 (Weekday)	07:00-22:00 (Daytime)	**68.3**	**62.1**	**59.2**	**65.4**	55
24.05.2017 (Weekday)	22:00-07:00 (Nighttime)	**60.0**	**58.6**	**57.4**	**63.6**	45
28.07.2017 (Weekend)	07:00-22:00 (Daytime)	53.6	50.5	54.3	**57.1**	55
29.07.2017 (Weekend)	22:00-07:00 (Nighttime)	**53.5**	**55.5**	**57.2**	**58.1**	45

IFC noise level guidelines of 45 dBA and 55 dBA for nighttime and daytime respectively are exceeded at the nearest sensitive receptors both on weekday and weekend. The noise limit level exceedances are potentially resulting from the Primary Road No. 7 and the Baghdad -

Basra Railway to the north of the Project site, as well as the Nasiriyah Thermal Power Plant, which is located less than 1 km to the north of the Project site.

According to the guidelines, noise impacts should not exceed the levels, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. The noise impact of the Project will be assessed with respect to the increase in background levels of 3 dBA.

5.2.5 Climate

The Project will be established in southeast of Iraq, west of Nasiriyah City of the Governorate of Dhi-Qar. Nasiriyah has a dry desert climate where summer seasons are hot and dry, while the winters are mild to cold. The annual average temperature varies from 6 to 45 °C. The temperature rises up to 50°C in summer and drops below 0°C during winter. The most common form of precipitation in the region is the form of rain. The region experiences rising of dust and dust storm frequently around the year. Rainfall is limited to November to April. Predominant wind direction is north and west. The region is affected by dust storms. The average number of days with rising dust and dust storms vary between 100 to 120 days with 14 to 20 days consecutively.

Meteorological data recorded in Nasiriyah City between 1971 and 2016 are given below in Table 5-11.

Table 5-11 Meteorological Data from Nasiriyah City (1971-2016)

Parameter	Range
Air temperature	6 to 48°C
Average annual rainfall	100 to 150mm
Average annual relative humidity	40 to 44%
Total annual evaporation.	3300 to 3600mm
Average annual wind speed.	3.5 to 4m/s
Annual number of days with rising dust.	100 to 120 days
Number of days with dust storms.	14 to 20 days
Atmospheric pressure.	10.10 to 10.11bar

According to the data obtained from Iraqi General Authority for Meteorological and Seismic Monitoring and the National Center for Environmental Prediction, total number of rainy days for the period between 1971 and 2016 is 1261. The average of rainy days is 27.4. The maximum number of recorded rainy days is 49 in 1982 and minimum number of recorded rainy days is 12 in 1973 and 2016.

Rainy days recorded between 1976 and 2016 are provided below in Figure 5-4.

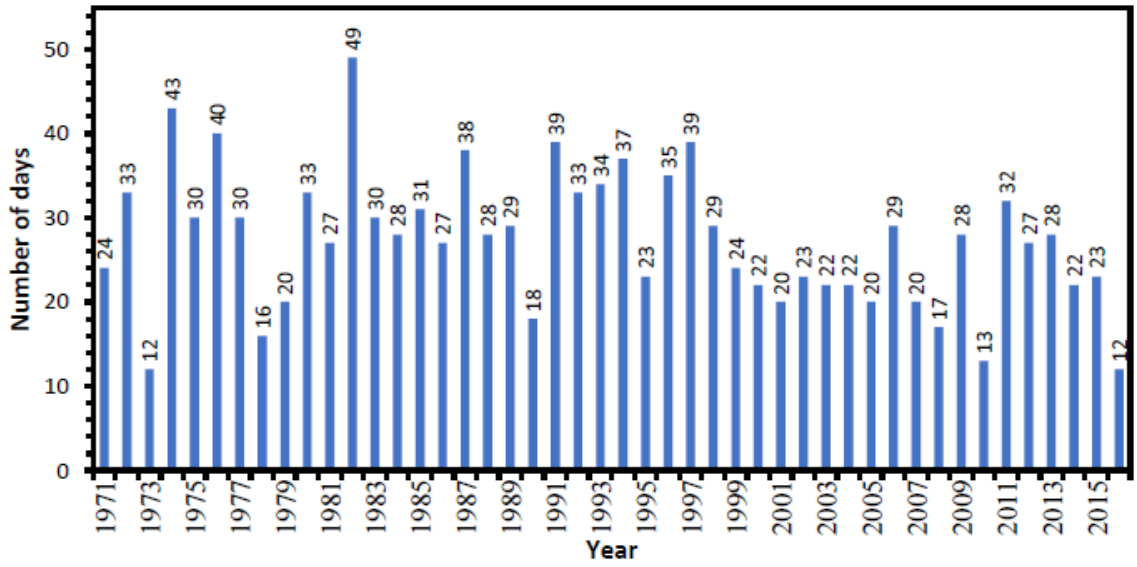


Figure 5-4 Recorded Rainy Days (1971-2016)

The average rainfall amount is 3.6 mm and maximum amount was recorded as 37.3 mm on 17 January, 1975. The average and maximum precipitation values are presented below in Table 5-12.

Table 5-12 Minimum and Maximum Rainfall Values (1971-2016)

Month			Year with maximum rainfall
	Minimum	Maximum	
January	19.4	78	1975
February	15.8	54	1991
March	16.3	82	1994
April	9.5	89	2004
May	3.8	26.2	1975
October	4.9	29.5	1977
November	13.3	79.9	1984
December	16.3	45	1975

Annual rainfall between 1971 and 2016 is provided below in Figure 5-5.

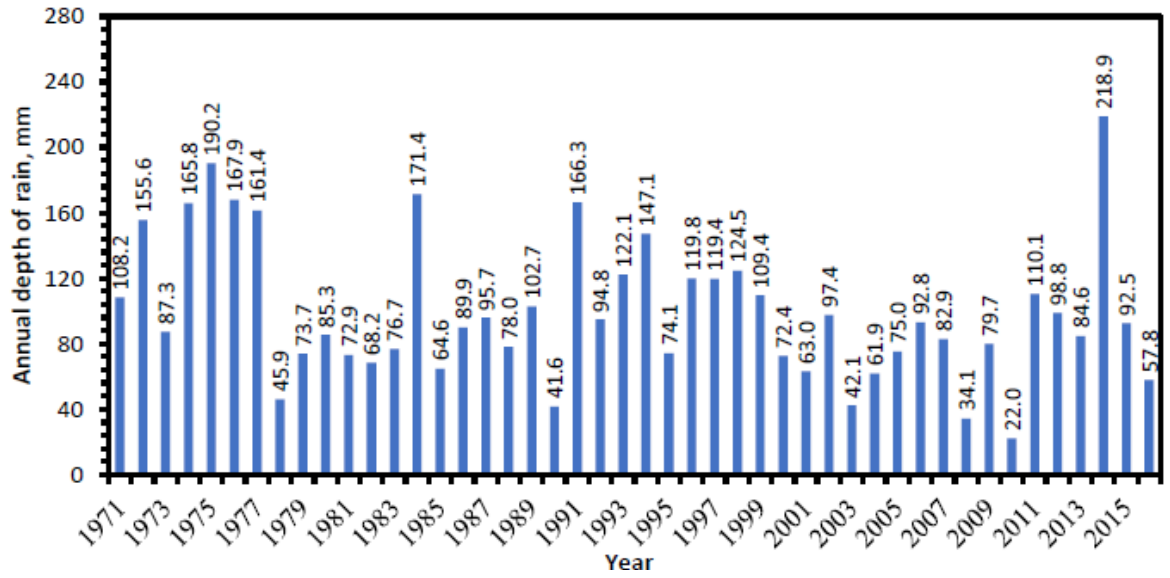


Figure 5-5 Annual Rainfall Amount (1971-2016)

5.2.6 Geology and Seismicity

A Geotechnical Investigation Report (Appendix-F) was prepared for the Project in May 2017. The study included fieldwork and laboratory testing. Within the scope of the fieldwork, soil exploration, groundwater observation, test pits excavation; static cone penetration test, seismic survey by cross-hole test and soil electrical resistivity test were conducted. The seismic survey was performed at five locations to a depth of 30 m from natural ground level, to measure compression and shear wave velocities for the computation of the elasto-dynamic soil parameters.

According to the study, it was observed that the site subsoil mainly consists deposits of silty clay strata intervened by layers of silty sand. Black spots of organic matter and white spots/traces of soluble salts were observed in certain samples, white tiny marine shell pieces, white shiny sheets of silica minerals together with (reddish) rusty traces of iron oxide compounds are frequently distributed in the strata in different amounts.

The water table was encountered between 1.5 - 2.5 m depth below the natural ground level (NGL), which is considered shallow. The fluctuation of the water table with the seasons could be observed (rising during spring). Accordingly, the zone immediately above the water table may be affected as far as strength and compressibility are concerned. As the moisture increases, the strength decreases and the compressibility increases.

The presence of soluble salts including gypsiferrous materials in appreciable amounts (up to 12% in top layers) associated with the presence of the water table in the encountered strata at the site in question, will increase the problems of leaching and enhance the collapse tendency. Soluble salts / gypsiferrous materials are water soluble and it may dissolve when the water table fluctuates or when water infiltrates into soil stratification causing loss of cementation. The loss of the soluble salts including gypsiferrous materials by dissolution

leads not only to decrease in the strength and bearing capacity of the soil, but also may increase the collapse potential. However, since the area is clayey and gypsum is within the impervious matrix, the fluctuating water impact will not be effective for leaching of gypsum.

The swelling characteristics of the soil indicate that the topsoil has slight to moderate tendency for swelling in the range of 10 – 40 kPa. In general, to avoid the problems associated with the foundation works on such a soil, two provisions are usually considered:

- Making the structure resistant to damage from soil movement by strengthening the structure to withstand movement, or;
- Compacting the topsoil layer and/or the zone beneath the base of footing after the excavation works to make even and adjust any irregularity occurred during the excavation works.

Taking into consideration the site conditions, the soil properties, the type of the structures and the loading distribution, the following precautions mentioned in the Recommendations section of the Geotechnical Investigation Report should be taken into consideration:

- Deep foundations (pile) are possible scenarios for the structures and facilities of the Power Plant as the stress from the super structures/machinery to the supporting subsoil is expected to exceed the safe allowable bearing capacity.
- Shallow foundation (spread, strip, continuous or raft foundation) could be used for the ancillary structures only provided that the applied load stress does not exceed the allowable bearing capacity and the conditions set in the item below, are to be implemented with care not to exceed the permissible limits before construction of the structures. However, due to the interaction in design between the geotechnical and structural aspects, the final decision in type and depth of the foundation is the designer's choice.
- As mentioned in the item above, for shallow foundations, a layer of compacted sub-base according to the specification with thickness of at least (0.5) m should be placed beneath the base of the shallow foundations in accordance with a number of requirements listed in the Recommendations section of the Geotechnical Investigation Report.
- It is recommended to fill the zone around the foundation with a well-compacted clayey layer of low permeability to meet the required relative compaction ratio of 95% of MDD. The material shall meet a number of specifications listed in the Recommendations section of the Geotechnical Investigation Report after (SORB/R5 - 2003).
- As per the Iraqi seismic requirements, the Project site is located in Seismic Zone 1 (low seismicity zone), which corresponds to a zoning coefficient of 0.05, and means that the area is not subject to any large earthquakes or under any other unstable seismic activities. Even though, this is the case, the Geotechnical Investigation

Report suggests to use Z = 0.15 for design of the structures. As the contract requirements are more stringent than the values suggested by the Geotechnical Investigation Report and Iraqi seismic requirements, the contract requirements are satisfied as shown below:

Design Code/Standard Reference : Uniform Building Code (97)

Seismic Zone : 2B (Z=0.2)[11]

Importance Factor : 1,00

Soil Profile : S_D as the N-value is greater than 15, and q_u is greater than 50 kPa and the average wave velocity is greater than 180 m/s for top 100 ft of the soil.

- The ground must be sloped away from the structures as much as possible and this slope must be maintained so that the runoff water will be carried away from adjacent to stand near the foundations, but must be drained into the lined ditches.
- The areas that do not support roadways, paved areas, or under structures, should be compacted to not less than 95% of the maximum dry density in accordance with (ASTM D1557).
- The water, sewer and gas lines must be installed in such a way that doesn't make weakness in foundation and should be designed to absorb movement without breaking.
- The sidewalks surrounding the structures should be constructed immediately after erection of the buildings.
- All concrete works in contact with the soil should be coated with bituminous material.
- A sub-grade layer for the road foundation can be formed using the site soil after compaction according to (ASTM D1557), and a relative compaction of 95% should be achieved.
- The foundations for the structures imposing dynamic loads should be checked against vibration forces using dynamic parameters.
- Type V sulphate resisting cement must be used in all concrete works that will be in contact with the soil. The minimum cement content should be 380 kg/m^3 for the foundations works. The maximum free water to cement ratio of 0.45 by weight should be used. Vibrators must be used in order to densify the fresh concrete.
- The site is mostly clay area. The sands are mostly clayey sands, which constitute lenses rather than layers. The fine content (FC) is mostly greater than 20% with a

[11] More stringent than suggested by the Geotechnical Report and Iraq Seismic Requirements

plasticity index (PI) of mostly larger than 10. Thus, these types of soils do not present liquefaction risk.

- All major equipment and buildings will bear on the bored pile foundations. Miscellaneous buildings non-sensitive to settlement will be laid on shallow/raft foundations.

In summary, as the structures will be designed as per the contract requirements, which are stringent than the values suggested by the Geotechnical Investigation Report and Iraqi seismic requirements, there will be no risk due to the seismic activities.

5.3 Biological Baseline Conditions

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

The Dhi-Qar CCGT Power Plant area is located in the Lower Mesopotamia Region. This region is the flat flood plain of the Tigris and Euphrates Rivers. In the triangle between Amara, Nasiriyah and Basra, there are extensive areas of permanent or seasonal shallow lakes, including the Central Marsh and Al Hawizeh Marsh.

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 are among the most important wintering areas for migratory birds in Eurasia.

Ecological site surveys have been conducted in order to determine the baseline conditions of the Project area and its vicinity in the scope of ESIA studies.

Seasonal Ecological Site Surveys were carried out between 22-28 May 2017, 27 July-1 August 2017 and 13-16 September 2017 at the proposed Project Site. Also secondary information from published scientific publications, flora-fauna field guides was collated for the biodiversity assessment.

Photos of terrestrial and aquatic sampling studies are given below.

Figure 5-6 Sampling Terrestrial Flora Components in Dhi-Qar CCGT Power Plant Project Site

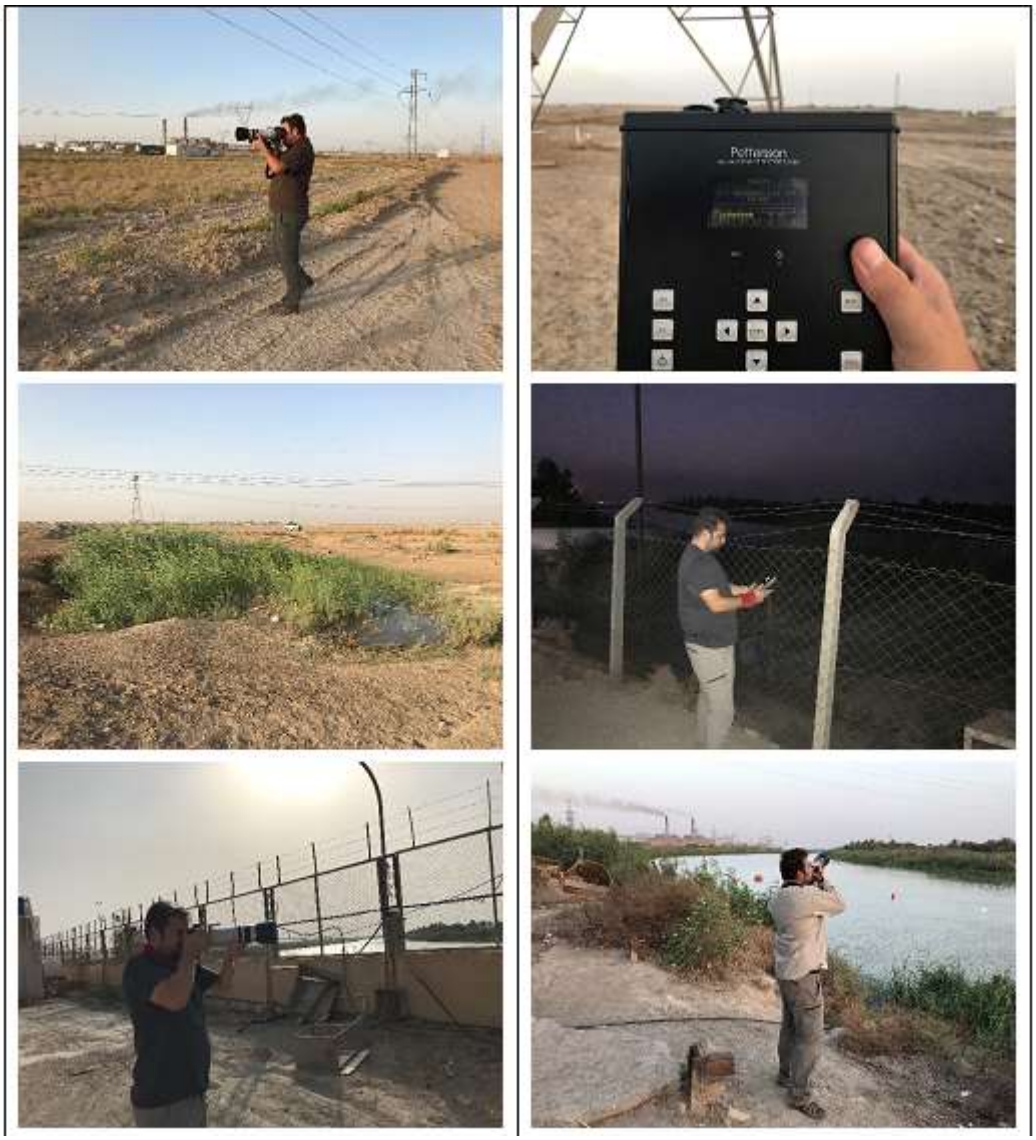


Figure 5-7 Sampling Terrestrial Fauna Components in Dhi-Qar CCGT Power Plant Project Site

Figure 5-8 Sampling of Aquatic Organisms

The objectives of the assessment were the following:

1. To describe the habitat on the proposed Project Site;
2. To determine the flora and fauna composition at the Project site and AoI;
3. To identify threatened flora and fauna species;
4. To identify the potential impact of the Project on wildlife and their habitat and;
5. To provide recommendation to mitigate the potential impacts of the Project.

A combination of quadrate sampling, transect counts and general observation were employed to determine the biological status of habitat types located at the Project site and in the AoI.

The plant specimen were pressed and dried according to the regular herbarium techniques and then the plant specimen was identified. The guidebook “FLORA of IRAQ (Royal Botanic Gardens, Kew)” was used to identify plants in the Project area. A sample for each plant species was collected for the identification procedure. The locations of plant species were recorded and photographs were taken.

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.

Direct observations, observations of non-living materials in nature (especially dead reptile individuals and/or skin, shield pieces, feces, nest-youngster-footprint etc.), site specific literature, information provided by local people1/25,000 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 until sunset.

No hunting-killing was performed during the identification of species for 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.

Terrestrial sampling locations are provided in Figure 5-9 below:

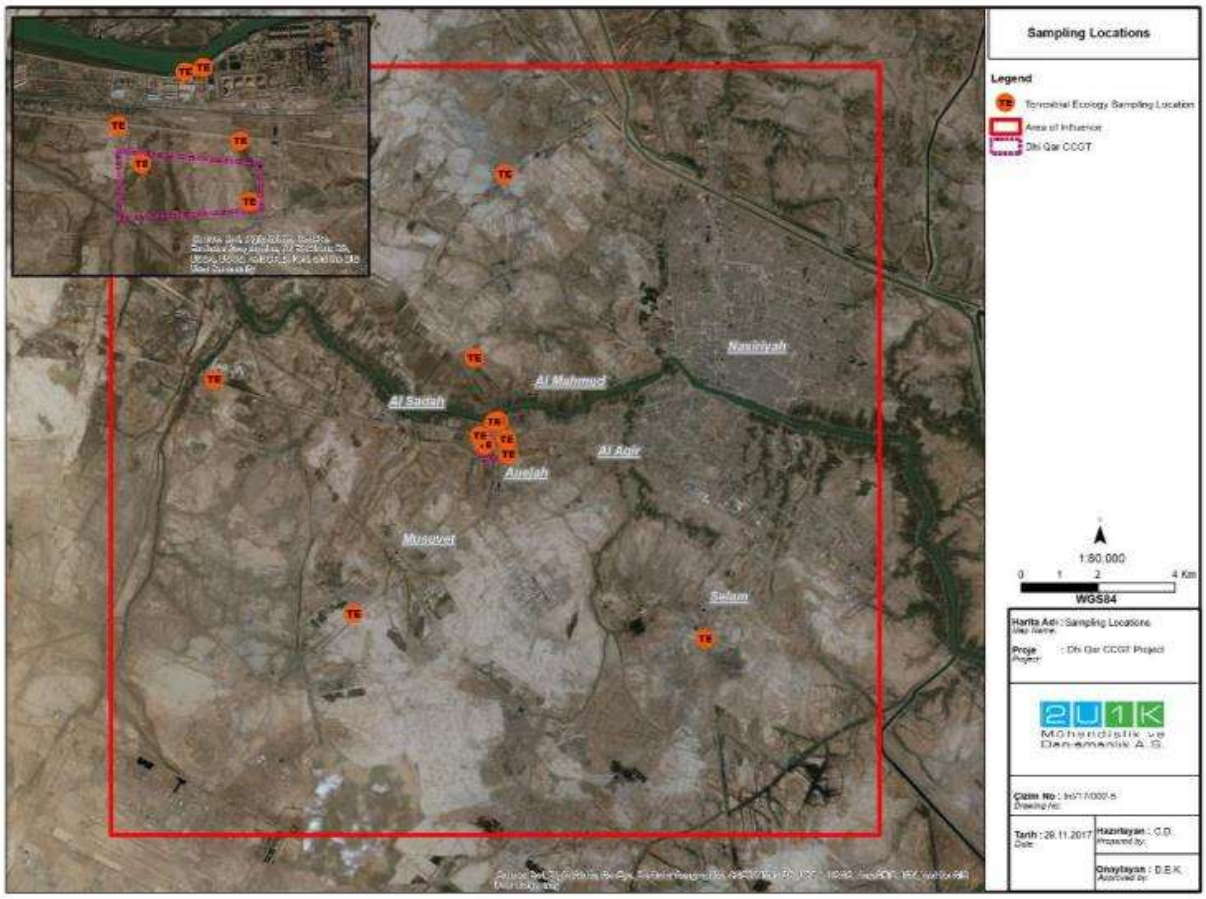


Figure 5-9 Terrestrial Sampling Locations

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.

When considered in 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 were collected from the sand and gravel slime areas, muddy areas, pebbles and rocky areas under the stones, and were identified at the family and / or genus level in the field and laboratory.

Fish specimen, an important indicator of aquatic vertebrate animals, has been obtained by professional fishermen. Nets were used to collect fish specimens. The fish samples were identified in the field and then released back into the river system.

Both terrestrial and aquatic studies were carried out within the plant area and AoI.

Details of the field studies are provided in Appendix-G.

5.3.1 Terrestrial Flora

The vegetation of the Project area is basically composed of seasonal marches and salt marshes. The species recorded in these areas belong mostly to the *Chenopodiaceae* family. However, species of the *Frankeniaceae, Tamaricaceae, Caryophyllaceae, Fabaceae, Poaceae* and *Capparaceae* families were also recorded.

Within the project area, small *Phragmites australis* (Cav.) Trin. ex Steud. assemblages were found in the ponds where ground water level is elevated.

Some parts of Dhi-Qar CCGT Power Plant Project area were previously used for agricultural purposes. However, currently, there is no evidence of agricultural activity in the Project area, because of the high concentration of salt found in the nearby marshes, which eventually contributed to low crop yields.

The survey together with the review of literature revealed that there are at least 14 species of plants, which represents 7 families. All of the species are located throughout Iraq and none of them is under threat. None of the species is endemic to Iraq.

The plant species identified by the field studies within the project area are presented in Appendix-G “Ecological Survey Report”.

5.3.2 Terrestrial Fauna

The wetlands of Mesopotamia are sufficiently large and have been isolated from other comparable wetland areas for a sufficient length of time to allow for the evolution of several forms of animals, which are unique to these wetlands. These include two species of mammals (*Erythronesokia bunnii* and *Gerbillus mesopotamiae*), one subspecies of mammal (*Lutra perspicillata maxwelli*), two species of birds (*Turdoides altirostris* and *Acrocephalus griseldis*), and two subspecies of birds (*Tachybaptus ruficollis iraquensis* and *Anhinga rufa chantrei*).

The wetlands are not conducive for mammalian habitats. They are rarely used by rodents and large-sized mammal species. Some abandoned slot holes were observed in the area for *Allactaga eupratica*. This probably indicates that the area is partly used for some species in the winter months.

A small number of feces belonging to Desert Hedgehog (*Paraechinus aethiopicus*) have been observed, indicating that this species uses the area for nutrition purposes. No critical mammalian species have been found in the area.

There are no core breeding, stopover, or breeding areas in the Project site or AoI for migrating birds. Therefore, there is not any migration activity on the area. An individual belonging to raptor species was not found in the project. Information about closest migratory bird flyway was given in Section 5.3.1.

This indicates that the faunal structure of the project area is poor. Terrestrial fauna lists of the project area are given in Appendix-G “Ecological Survey Report”.

According to site visit there are three amphibian species, eight reptile species, 48 bird species and 17 mammal species was identified.

Fauna species identified during the site surveys are presented separately for each fauna group in the subsequent sections.

Amphibians

Three amphibian species was identified during the site surveys. There are no permanent rivers or puddles suitable for amphibians to lay eggs inside the Project area. But the intake survey area has suitable areas for breeding and sheltering for the amphibian species dependant on surface water locations.

Potential breeding area for amphibian in the Project AoI is presented below in Figure 5-10.

Figure 5-10 Potential Amphibian Breeding Area in the Project Site

There are no endemic species among the amphibians recorded in at the survey area.

According to the European Red List of IUCN, only *Bufotes variabilis* is evaluated as "DD: Data Deficient" category and all remaining species are in LC (Least Concern) category.

Reptiles

Eight reptile species were identified during the site surveys. Among these species, none of them is under protection category as per IUCN. All reptile species are under protection in compliance to the provisions of Bern Convention. One reptile species is in Appendix-II-IV of Habitat Directive and one reptile species is in Appendix-IV of Habitat Directive. There are no endemic species among the reptile species recorded at the project site and its vicinity.

Birds

A total of 48 bird species were identified from the site survey, literature data and habitat suitability study. According to the European Red List of IUCN, all of the species are in LC (Least Concern) category. Except four species, all of the birds that ihve been dentified are under protection of Bern Convention. The list of the species is provided in Appendix-G "*Ecological Survey Report*".

There are no endemic species for Iraq.

Examples of the bird species observed in survey studies are given below in Figure 5-11, Figure 5-12.

Figure 5-11 *Acrocephalus scirpaceus*

Figure 5-12 *Streptopelia decaocto*

Figure 5-13 *Ceryle rudis*

Figure 5-14 *Merops persicus*

Mammals

17 mammalian species were identified during the site survey, literatures and habitat suitability.

All of the 17 identified mammalian species are listed as common species and none of them is threatened, or classified as rare or protected. *Myotis capaccinii* listed as VU (Vulnerable) in IUCN criteria. *Allactaga euphratica* and *Lutra tutra* are listed as NT (Near threatened) in IUCN criteria. The other 14 mammalian species recorded in the Project site and intake area are listed as LC (Least Concern).

Burrows of the mammal species observed in survey studies are given below.

Figure 5-15 Rodent *burrow*

Figure 5-16 Red Fox Burrow

5.3.3 Aquatic Flora and Fauna

This region of the Euphrates River contains brackish water. For this reason, marine and brackish water benthic species were found in the field. *Balanus* sp. from Arthropoda phylum, *Bela* sp. from Mollusca phylum and Diptera larvae were identified in the field study.

None of the benthic species identified in the Project area are listed as endangered or in need of protection.

Fishes 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. Some species are both ecologically and economically important.

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, *Alburnus mossulensis, Carassius aurata* and *Liza abu* were identified from Dhi-Qar Project site. In addition, juvenile fish have been observed in coastal areas of the river in the Project site.

Figure 5-17 *Oreochromis* sp. *Carassius aurata*, *Carasobarbus luteus*

Figure 5-18 *Luciobarbus esocinus*

Figure 5-19 Juvenile Fish Specimens in the Project Site

Endemism and conservation status of species identified and likely to be found in the river system are given in Appendix-G. *Carassius aurata*, *Oreochromis sp.*and *Ctenopharyngodon idella* are classified as exotic species. Additionally, *Capoeta barroisi* and *Carasobarbus kosswigi* are classified as protected species according to the IUCN Red list and are also categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.

5.3.4 Protected and Key Biodiversity Areas

Protected Areas

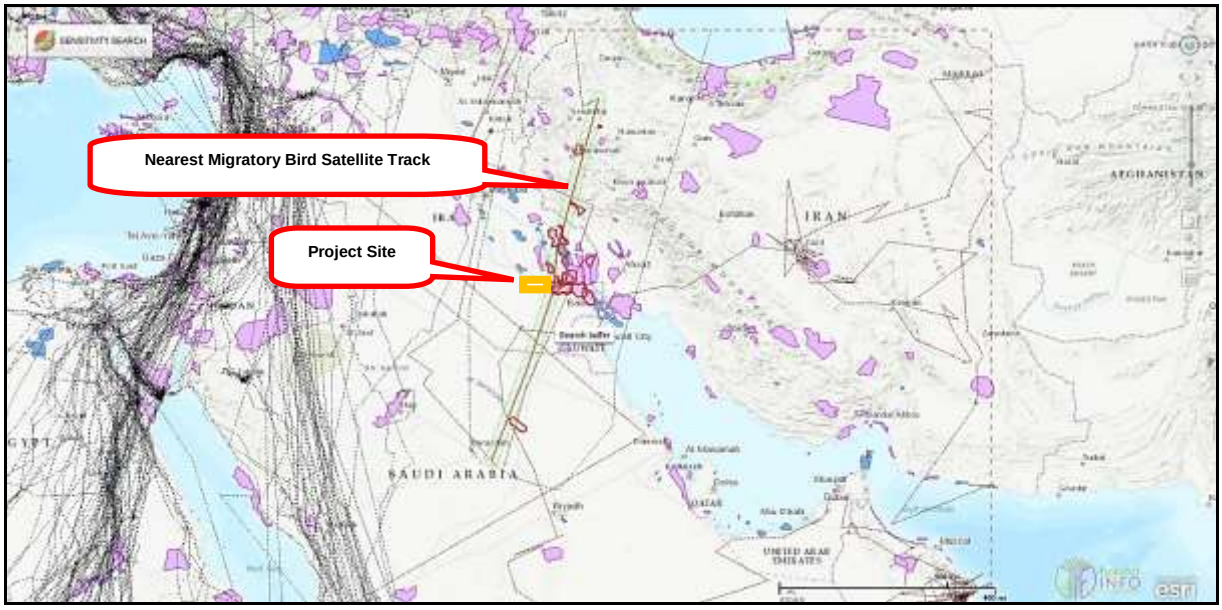
There are two main protected areas in southern Iraq:

- Mesopotamia Marshlands National Park and,
- Hawizeh Ramsar Wetland.

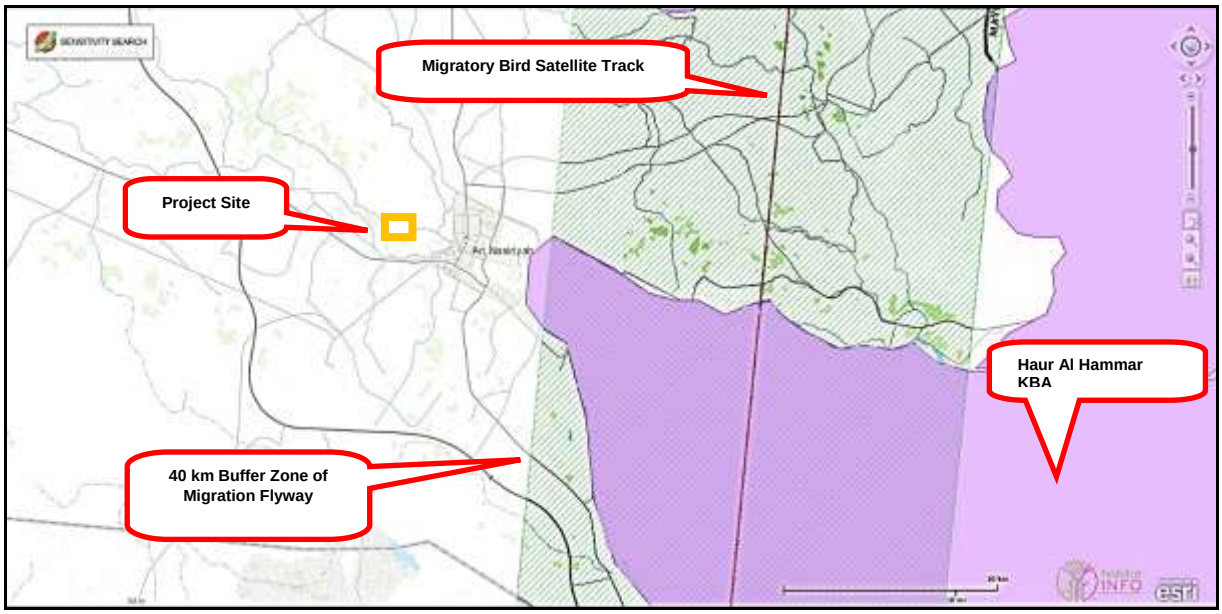
The proposed Mesopotamia Marshlands National Park is located downstream of Euphrates River. The boundary of the above-mentioned proposed national park has not been drawn but the distance from the Project site is approximately 50 km.

Twelve of the wetlands of lower Mesopotamia were listed as wetlands of international importance by Carp (1980). There are 19 wetlands, which were 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 Basra Reed Warbler (*Acrocephalus griseldis*) and Iraq Babbler (*Turdoides altirostris*).

According to the Birdlife International, nearest migratory bird satellite track to the Project area is located at a distance of 36 km. Migratory soaring bird sensitivity map tool of Birdlife was used to generate a corridor of 40 km on the right and left side of the migratory bird satellite track considering bird behaviors which is provided below in Figure 5-20. The Project is located at approximately 12 km distance from bird migration flyway.



.



Source: https://maps.birdlife.org/MSBtool/

Figure 5-20 Dhi-Qar CCGT and Closest Migratory Bird Flyway

Key Biodiversity Areas

The Haur Al Hammar, its surrounding marshes and neighboring haurs and areas of temporary inundation comprise some 3,500 km^2 of almost contiguous wetland habitat. The haur itself is the largest lake in the lower Euphrates, approximately 120 km long by up to 25 km wide. It is bordered in the north by the River Euphrates, in the west by the Southern Desert and in the east by the Shatt Al Arab. Map presenting the Project area and Haur Al Hammar KBA is provided below in Figure 5-21. The Project site is located at a distance of 12 km from Haur al Hammar wetland.

The marshes are rich in fish, and an estimate of the annual catch, published in 1966, was 30,000 tons, of which 70% were Cyprinidae. The local people, the Ma'dan (Marsh Arabs), are ethnologically and culturally distinct, and have lived in the area for at least 5,000 years. Fishing and wildfowl hunting are a major part of the local economy, and there is considerable dependence on reeds for forage for domestic buffalo, for house building and for the construction of floating islands for villages.

Haur Al Hammar and its associated marshes comprise one of the most important areas for waterfowl in the Middle East, both in terms of numbers of birds and diversity of species. The vast reed beds provide breeding habitat for a wide variety of resident species, while in winter the haur attracts huge numbers of migratory waterfowl. Koning and Dijksen (1973) visited the wetland at various points in December 1972 -- near the villages of Hammar and Fuhud and at three localities east of Nasiriyah -- and confirmed that this was the most important wintering area for waterfowl in Iraq. Carp visited the east end of the haur and Haur Aluwez in January 1972, while Carp and Scott visited the east end, the south-western shore, Haur Aluwez, the west end near Nasiriyah and the Fuhud and Hammar areas in January 1979. P. Ctyroký made some waterfowl counts in the area in 1979. Carp (1980) as a wetland of international importance listed the entire area.

The broad, muddy shoreline along the southern edge of the main Haur Al Hammar provides excellent habitat for shorebirds, while sedge marshes and marsh-edge habitat to the east and west of the main haur are particularly suitable for herons, egrets, *Platalea leucorodia, Plegadis falcinellus*, dabbling ducks and some shorebirds. Moist arable land, irrigation ponds and rain-water pools on the surrounding plains provide excellent feeding areas for geese, dabbling ducks, *Grus grus* and many shorebirds. The site supports large numbers of wintering birds of prey, including *Circus aeruginosus* and *Aquila clanga*. Passerines wintering in large numbers include Ant*hus spinoletta, Luscinia svecica, Lanius isabellinus* and *Passer hispaniolensis*.

Figure 5-21 Dhi-Qar CCGT Power Plant Area and Haur Al Hammar KBA

5.4 Socio-Economic Baseline

This section presents the results of the socio-economic baseline analysis against which the impacts of the Projects can be assessed. This baseline assessment takes into account present conditions, as well changing conditions (i.e. population, education) apparent in the baseline.

The aim of the socio-economic baseline study is to describe the socio-economic conditions and trends in the areas potentially affected by the Project to understand potential effects of the Project and to develop appropriate mitigation measures to prevent and/or mitigate any such effects. The socio-economic baseline defines the socio-economic issues of importance at the provincial and local community level and establishes a baseline of socio-economic data that can be used for monitoring changes in the affected communities after the Project commences operation.

The following variables were considered in connection with the socio-economic baseline assessment:

- Demography;
- Economy and Employment;
- Education;
- Health;
- Security;
- Infrastructure and Services ; and
- Vulnerable Groups.

5.4.1 Data Collection Techniques

Quantitative and qualitative data collection techniques were used in connection with the socio-economic baseline assessment.

Secondary Data Collection

Secondary data was collected and prepared through regional and national statistics, academic journals and project specific documents. Secondary data holds an important role in helping to identify key stakeholders and project affected people.

The resources that are used for the social baseline studies can be found below:

- Resources of the local authorities,
- Evaluation reports of Non-Governmental Organizations and International Finance Institutions; and,
- Project Information provided by Project parties.

Primary Data Collection Techniques

Primary data collection includes household and community level assessments and key informant interviews. Similar to secondary data collection techniques, primary data collection uses quantitative and qualitative data collection.

With the Community Level and Household Surveys, the primary data collection has been obtained to focus on the community level assessment in terms of describing environmental and social aspects of the Project.

The social field team undertook a combination of household surveys, key informant interviews and secondary data collection which covered four villages within the AoI. The community level questionnaires were conducted with Mukhtars[12] and Sheikhs[13] of the affected villages between 28 and 30 July, 2017. Household surveys and key informant interviews were conducted between 12 and 15 September, 2017.

It is important to note that, there are Mukhtars in every village within the Region, who are mainly responsible for official purposes. However, affected communities are often represented by Sheikhs with respect to informal purposes, such as providing information on socio-economic characteristic of local communities.

Interviews with the local community members were conducted in Arabic, the official language of Iraq in order to avoid any regional sensitivity that might arise from conducting interviews in one regional dialect or another.

The main tool for household surveys was a multi-subject questionnaire in Arabic which inquired about household demography, socio economy, land assets, local problems, control over resources and health. The household survey also included questions regarding community perception of impacts, such as impacts on local economy, local employment, environment (water, land, air), community's security, community's health, village's social structure and sense of community (e.g. through migrant workers), and local community infrastructure. In line with the sampling methodology, the total of 356 household questionnaires was conducted in affected village and Table **5-13** provides a detailed breakdown of these by village.

Table 5-13 Number of Household Surveys

Villages	Number of Household Surveys
Al-Sadah	29
Al-Agir	50
Al-Mahmud	136
Aujeah	141
Total	**356**

The social team also conducted a meeting with the Governor of Dhi-Qar on September 11, 2017 and received information regarding the AoI, possible impacts of the Project and suggestions that may be beneficial for the phases of the Project. Figure 5-22 presents a photo that was taken during the meeting with the Governorate of Dhi-Qar at the MoE office.

[12] Mukhtar is the head of a village or neighborhood in many Arab countries. Mukhtars are usually selected by some consensual or participatory method, often involving an election.

[13]Sheikh commonly designates the ruler of a tribe or community who, usually, inherited the title from his father. Sheikhs are also known as religious leader of their community.

Figure 5-22 Meeting with the Governorate of Dhi-Qar at the MoE office

5.4.1.1 Study Limitations

The social team was gathered for the purposes of both conducting household surveys and Public Participation Meetings (PPM) combined with female staff from the locals of the Dhi-Qar Region. When the possibility of 'female only' participation meeting was seeked from the head of villages, it was objected. This is highly related to the religious and cultural conservatism of the region, approaching local women is a quite sensitive matter in the region; therefore, no female participants attended in the PPM or were interviewed one-on-one with the female field staff for the sake of household surveys.

Especially, the field team attempted to include female locals for the baseline studies through seeking permission from the head of villages or directly seeking permission from the women in the village, however, as stated due to the nature of the cultural conservatism of the region, it was observed to be inappropriate to insist any further, as the women themselves in the villages rejected to be involved when asked by the female field staff directly during the household survey studies.

This attitude was not result of locals being opposed to the Project in general, in fact, according to the head of villages and observations through the PPM show that the locals do not have any objections against the Project, the locals were simply opposed to the idea of the field team interacting with the local women, as it seemed to not fit the social cohesion of the region. It is important to note that, the locals in general expected their cultural norms and religious codes to be respected by the field team.

The second limitation is on the Nasiriyah Central Prison. Nasiriyah Central Prison is located within the borders of AoI. Although the main intension of the social experts was to include detailed information of the Prison in the ESIA Report, especially in terms of capacity, type of inmates and any recent incidents (if any). However, almost no information has been obtained about the Prison throughout the field study from the locals as well as the local authorities.

During the field study, the social team asked further information on the Prison to the Governor of Dhi-Qar and the head of villages as well. Security in general is quite sensitive subject of the region and further information on State prisons such as capacity, recent incidents (i.e. escapes) or type of prisoners were not provided to the social team when asked. Only statement was that there had been no recent incidents within the Prison borders and further information was not allowed to be provided due to national security purposes. However, both from the desktop study and field observations, no recent incidents within or around the Prison has been recorded.

In terms of providing national statistics or figures for the education section below, some of the indicators are dated on 2013. This is due to lack of official figures publicized within the recent years by the Government of Iraq as well as NGOs.

Last, throughout the social field study, it was observed that there was a lack of national or local Project related NGOs in the region; as a result the social team did not obtain NGO's opinion regarding the Project and its activities.

5.4.2 Demography and Population

The estimated population of Iraq is 38,146,025. Approximately 75% of Iraqis are Arab. The areas south of and including Mosul are predominantly Arabs. Kurds live in the northeast and make up 20% of Iraq's population. Other ethnic groups, including Turkmen and Assyrian, constitute 5% of the population and live in small communities across the country, particularly in the north**.** Arabic and Kurdish are official languages nationally and Turkmen and Assyrian are official languages in the areas where they constitute a majority of the population.

The majority of the population of Iraq is geographically concentrated in the north, center, and eastern parts of the country, with the largest concentrations along the Tigris and Euphrates Rivers. The western and southern areas of the country are either lightly populated or uninhabited (Central Intelligence Agency).

As mentioned in previous sections, the Project Site is located in Dhi-Qar governorate, which is dived into five districts: Al-Chibaysih, Nasiriyah (the capital of the Governorate), Al-Rifa'i, Al-Shatra and Suq Al-Shuyukh. Dhi-Qar covers an area of 13,552 km^2 and is located in Southern Iraq to the North of Basra Governorate and shares internal boundaries with the Provinces of Missan, Muthanna, Qadissiya and Wassit (Mahmood Jamal AbdulHasan, 2017).

The majority of Dhi-Qar's inhabitants are Shia Arabs. A Sunni minority and smaller communities of Assyrian and Chaldean Christians, and Mandeans live in the Governorate. The population of the Dhi-Qar governorate is 1,742,852 (2015). Furthermore, 62.9% of the population reside in urban areas whereas, 31.7 % resides in rural areas of the governorate (NGO Coordination Committee for Iraq, 2015).

According to information gathered from the Community Level Surveys, there are 3,000 inhabitants in village of Al-Mahmud, 600 in the village of Al-Sadah; 4,200 in the village of Aujeah and 1,500 in the village of Al-Agir.

Table 5-14 below presents further demographic information gathered from head of villages, respectively.

Table 5-14 Demographic Information of the AoI

	Aejuyah	Al-Mahmud	Al-Sadah	Al-Agir
Total population	4,200	3,000	300	1,500
Number of households	600	500	270	500
Any change in population figures	Increased	Increased	Same	Increased

Source: Social Baseline Survey, 2017

In terms of age distribution, the majority of inhabitants in these villages are below the age of 35. Table 5-15 below presents further information on age group distribution of those living in villages in the AoI.

Table 5-15 Age Distribution of the AoI

Age	Percentage (%)
0-11	21.1
12-17	18.4
18-24	17.9
25-34	20.1
35-44	10.4
45-54	7.1
55-64	3.3
65 and over	1.4
Total	**99.7**

Source: Social Baseline Survey

Based on the community level interviews, the population of the villages in the AoI has increased over the last five years parallel to increase in birth rates. All of the inhabitants in the villages are Shia Muslims. 96.6% of the locals stated that they are living in their villages since birth, whereas, 2.1% have been living in their village between 2 to 5 years, 1.3% have been living between 6 to 10 years and the remaining 1.3% stated to be living in their village for over 10 years. When asked why they have moved to the villages, a majority of the interviewees stated that they moved as a result of marriage.

It is important to note that there are no refugees or internationally displaced people resided within the borders of the AoI.

5.4.3 Economy and Livelihood

Iraq is the second-largest crude oil producer in the Organization of the Petroleum Exporting Countries (OPEC) after Saudi Arabia, and it holds the world's fifth-largest proved crude oil reserves after Venezuela, Saudi Arabia, Canada, and Iran. Therefore, Iraq's economy is heavily dependent on oil revenues. In 2014, crude oil export revenue accounted for 93% of Iraq's total government revenues, according to the International Monetary Fund (IMF). In 2015, Iraq (excluding KRG) earned slightly more than $49 billion dollars in crude oil export revenue, $35 billion less than in 2014, despite a substantial increase in export volumes (U.S. Energy Information Administration, 2016) .

Although agriculture commands only 4 % of Iraq's GDP, it represents the principal economic activity. Prior to the 2014 insurgency, agriculture contributed more than 70 % of the income of farm households (Relief International, 2016).

Iraq has a short coastline of 58 km. However, there are six ports, all in Basra province, which is the Country's main trading link with the rest of the world. Most of Iraq's oil is exported through these ports. Basra is also the center of Iraq's oil industry as many of the largest oil fields are located near the city. Most of the other provinces also have large oil fields (Republic of Iraq National Investment Commision).

The governorate of Dhi-Qar is one of the most underdeveloped governorates of Iraq. The economy has remained relatively rural compared to other regions in Iraq. The agricultural sector however fails to provide jobs and income for the governorate's population. The sector has suffered from adverse side effects of the Public Food Distribution program, which was set in place after the 1990 invasion of Kuwait to provide Iraq's population with subsidized food rations. The program pushed down the prices of staple crops like wheat and rice, making them unprofitable for farmers. The draining of the marshes also devastated traditional fishing and farming methods of the Ma'dan. The Governorate also hosts a number of oil refineries, and a university located in the governorate's capital of Al-Nasiriyah (NGO Coordination Committee for Iraq, 2015). As shown by Table 5-16, unemployment and poverty rates in Dhi-Qar province are significantly higher than the national average.

Table 5-16 Economic Indicators of Iraq and Governorate of Dhi-Qar

Economic indicator	Dhi-Qar	Iraq
Population under the poverty line	37.8%	11.5%
Unemployment	19.4%	11.3%

Source: (NGO Coordination Committee for Iraq, 2015)

5.4.3.1 Economic Indicators of the AoI

As part of the community level survey, the social team conducted an assessment of the general economic conditions of each village in the AoI, which is summarized below.

According to Mukhtar of the Al-Sadah village, the average income of the village has increased over the last 5 years, this increase has been stated to be caused by improve in education levels of the locals. The majority of the working individuals are salaried employees.

- According to Sheikh of the Al-Mahmud village, majority of the locals are employed as construction workers and less than half of the village inhabitants are unemployed.
- In Al-Agir village, the Mukhtar stated that the general income of the locals has been decreasing over the past five years. The main employment opportunities in this village are limited to agriculture, technician jobs and construction work.
- In Aujeah village; according to Mukhtar interview, the average income of inhabitants in this village has decreased over the past five years. Income in this village is derived primarily from pensions, construction work and agriculture.

According to response to questionnaires submitted to village representatives in the AoI, 13.4% of the household members are unemployed, 44.5 % are either students or under the age of 18, 27.5% are housewives and 13.4 % are stated as employed. Table 5-17 below presents respective employment status of those who were interviewed by the Social Team.

Table 5-17 Employment Statuses of AoI

Employment Type	Aujeah	Al-Agir	Al-Mahmud	Al-Sadah
Salaried Employee	24.01%	29.7%	35.9%	6.4%
Daily Wage Worker	41%	56.7%	43.6%	45.2%
Unpaid Family Worker	0.93%	13.6%	16.7%	48.4%
Employer	34.6%	-	3.8%	-
Total	%100	100%	100%	100%

Source: Social Baseline Survey, 2017

When the social team asked to head of villages on how they perceived their economic status as compared to others within the region. 47.7% of the interviewees stated their income is below average, 49.7% stated that it was average and 52.5% stated that it was above average. Table 5-18 below presents this information in more detail below.

Table 5-18 Economic Evaluations of the Locals within the AoI

Employment Type	Aujeah	Al-Agir	Al-Mahmud	Al-Sadah
Above the region	7.1%	-	-	-
Average	78.5%	37.2%	44.1%	7.4%

Employment Type	Aujeah	Al-Agir	Al-Mahmud	Al-Sadah
Below the region	14.4%	62.8%	55.9%	92.6%
Total	**%100**	**100%**	**100%**	**100%**

Source: Social Baseline Survey, 2017

Majority of those who own land within the AoI also own their own homes. . 77.5% of the land owners lease their lands, whereas, 18.8% of them use it for greenhouse actives. Only 3.8% of the land owners stated to use their land for agriculture purposes. Among 3.8% small percentage of the land owners, 58.1% stated that their land is being cultivated. The main agricultural product in the region is wheat. According to locals, the agriculture production has decrease significantly in the region, as a result of lack of means and technology.

Furthermore, among the interviewed households, only 2% of the households deal with animal husbandry, in which, 65% are cattle and 35% are sheep or goat.

Table 5-19 below presents available skills of the interviewed households, respectively.

Table 5-19 Available Skills of the Interviewed Households in the AoI

Type of skills	Percentage
Engineer	0.5%
Driver	20%
Machine operator	4.6%
Construction worker	3%
Road construction and repair	5.4%
Electrical technician	5.4%
Machine technician	2.7%
Cleaner	4.3%
Security officer	22.7%
Health Specialist	2.7%
Office staff	21.9%
Cook	6.8%
Total	**100%**

Source: Social Baseline Survey, 2017

5.4.4 Education

The national literacy rate nation-wide for both sexes is 79% (as of 2013), with an illiteracy rate among women reaching almost 30% (2011 estimates). Only 53% of both sexes are enrolled in secondary schools and 16% in tertiary education. The ratio of female to male enrollment shows that women have much lower access to both secondary (74.8%) and tertiary (59.8 %) education than do men as of 2013. Such uneven access to education is also reflected in the relatively low percentage of the female labor force, which reached 17.6% in 2013 (Bertelsmann Stiftung's Transformation Index, 2016).Table 5-20 presents further details in terms of education indicators of Iraq below.

Table 5-20 Education Indicators of Iraq

Education Level	Female	Male
Primary	26%	29%
Intermediate	10%	13%
Secondary or equivalent	7%	9%
Technical Diploma	3%	4%
Bachelor's Degree	6%	6%

Source: (Relief International, 2016)

There are limited amount of information in terms of education indicators of the Dhi-Qar Governorate. According to latest report provided by the NGO Coordination Committee for Iraq, the governorate scores below the national average. Literacy and the enrolment rate in both primary and secondary education are lower than the Iraqi average (NGO Coordination Committee for Iraq, 2015).

5.4.4.1 Education Indicators of the AoI

According to Community Level Surveys with all the village heads, the education level for both genders in the AoI is perceived to be equal. Almost all children in both genders attend primary and secondary schools. For high school, the locals use city centers, except Al-Mahmud village, the village consists all education levels in one building. There are also considerable amount of individuals who graduated universities in all villages. Table 5-21 below presents the general overview on education levels of each village obtained through household surveys.

Table 5-21 Education Levels of the AoI

Type of Education	Aujeah	Al-Agir	Al-Mahmud	Al- sadah
Not in the school age	8.7%	29.5%	7.9%%	18.4%
Never attended	25.9%	7.9%	22.6%	4%

Type of Education	Aujeah	Al-Agir	Al-Mahmud	Al- sadah
Primary school student	20.8%	7.9%	22.1%	17.6%
Primary school dropout	14.3%	18.3%	16.2%	6.4%
Primary school graduate	7.1%	21.6%	15.2%	25.6%
Elementary school student	4.1%	4.1%	2.7%	4%
Elementary school dropout	5.7%	0.8%	4.1%	3.2%
Elementary school graduate	1.8%	2.5%	1.1%	11.2%
High school student	3.1%	1.7%	0.7%	0%
High school dropout	1.3%	0.8%	1.1%	1.6%
High school graduate	2.2%	2.9%	2.1%	2.4%
University student	0.9%	0.8%	0.6%	0%
University dropout	0.4%	0%	0%	0%
University graduate	3.6%	1.2%	3.6%	5.6%
Total	**100%**	**100%**	**100%**	**100%**

Source: Social Baseline Survey, 2017

Because a majority of village population is under 18 and substantially all of this age group attends primary school, the education level in the villages is expected to increase over time.

5.4.5 Health

In Iraq, investment in health yielded a short-term improvement in the life expectancy rate, from 68 years in 2007 to 69 years in 2011. The infant mortality rate is stated as 32 per 1,000 live births for the year of 2015 according to World Bank data. Better maternity care is associated with lower maternal mortality rates, declining from 295 per 100,000 women in the embargo decade of the 1990's to 84 in 2006 and 35 in 2013. Child delivery with assistance of health care specialists increased from 62 % in 2000 to 78 % in 2006 and 91% in 2013 (UNDP, 2014).

According to latest report provided by the NGO Coordination Committee for Iraq, the access to services like water and electricity in Dhi-Qar is below the national average. Only 78.9% of local inhabitants have sustainable access to an improved source of clean potable water, which is lower than the national average of 86.8%. The Governorate also has one of the lowest rates of individual access to public water supply. Only one fifth of the Governorate's population relies on the public sewage system as the primary way of disposing of waste water, with others using septic tanks or covered canals outside their house (NGO Coordination Committee for Iraq, 2015).

5.4.5.1 Health of the AoI

According to information gathered through Community Level Questionnaires, there are no health centers located in any of the villages, and there is no ambulance service that can be accessed by villagers. Instead, villagers must rely on taxis or mini-buses to take them to the nearest health centers or hospitals.

Table below presents the distance of the closest local health centers to the each affected villages, respectively.

Table 5-22 Distance of the Closest Health Center to the Affected Settlements

Name of the villages	Distance to the closest health local center
Aujeah	5 km
Al-Agir	3 km
Al-Mahmud	10 km
Al-Sadah	15 km

Source: Social Baseline Survey, 2017

The closest hospital is named as Private Emel Hospital that is located 8.5 km from the Project Site.

Villagers usually need to take a minibus or taxi to go to a health center. In Al-Mahmud and Al-Agir villages, the locals stated that there are noticeable amount of individuals who suffer from respiratory illness related to dust. Furthermore, the locals in Al-Agir village stated that there is high number of cancer patients in their village, however, no specific figure has been provided when asked.

Moreover, the majority of villagers in the AoI do not have health insurance. The ones that have insurance stated to have either general health insurance (also known as public health care) or state retirement insurance.

5.4.5.2 Depleted Uranium

Since the outbreak of the Gulf Wat in 1991, depleted uranium (DU) has been found in Iraq. While DU can cause birth defects and give rise to increased cancer risk, soil sampling taken at the Project Site failed to show elevated level of DU in the soil or in surface water.

According to research conducted by the International Atomic Energy Agency (2010), DU residues were detected in soil at the study area located in Nasiriyah. However, the DU concentrations in soil are low. Detailed information on the outcomes of the survey conducted by the Agency is presented in the given bullets below. Furthermore, the coordinates of the each survey location conducted by the Agency is presented, including with the distance of the each survey area to the Project Site, in the Table below as well.

Table 5-23 DU Surveys Conducted by the International Atomic Agency

No.	East	North	Size of the Study Area	Distance to the Project Site
1	621900	3412500	1.8 km x 2.4 km	5.9 km
2	614175	3413800	1.8 km x 2.4 km	19.4 km
3	613900	3427500	1.8 km x 2.4 km	5.7 km
4	611500	3427500	1.8 km x 2.4 km	5.7 km

No.	East	North	Size of the Study Area	Distance to the Project Site
5	610400	3430000	1.8 km x 2.4 km	4.1 km
6	600250	3429100	1.8 km x 2.4 km	13.3 km
7	600700	3434150	1.8 km x 2.4 km	12.3 km
8	604700	3438800	1.8 km x 2.4 km	9.5 km
9	619700	3439700	1.8 km x 2.4 km	9.3 km
10	619400	3435450	1.8 km x 2.1 km	6 km
11	620850	3430900	1.8 km x 2.4 km	7.4 km
12	622500	3439300	1.8 km × 1.8 km	10.2 km

Source: (International Atomic Energy Agency , 2010)

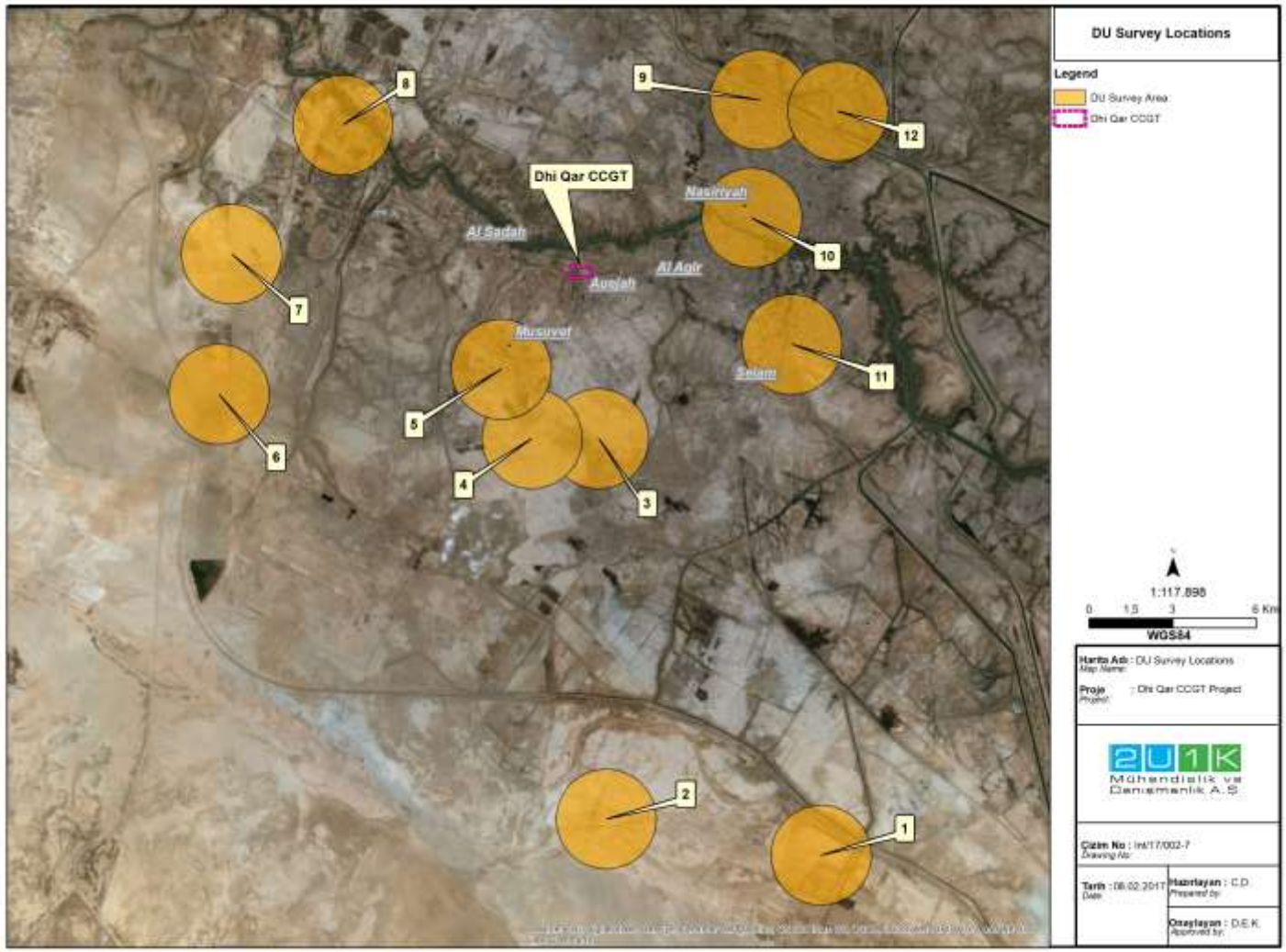


Figure 5-23 Location of the DU surveys conducted by the International Atomic Agency

Evaluation of the DU contamination on the surveyed areas by the Agency is can be found below.

Doses due to the inhalation of soil re-suspended by wind or human activities: The estimated annual inhalation dose due to DU in the studied area to both adults and children is about 1 µSv. This is a small radiation dose, about 0.6% of the world average annual dose due to natural radiation (~2.4 mSv/a).

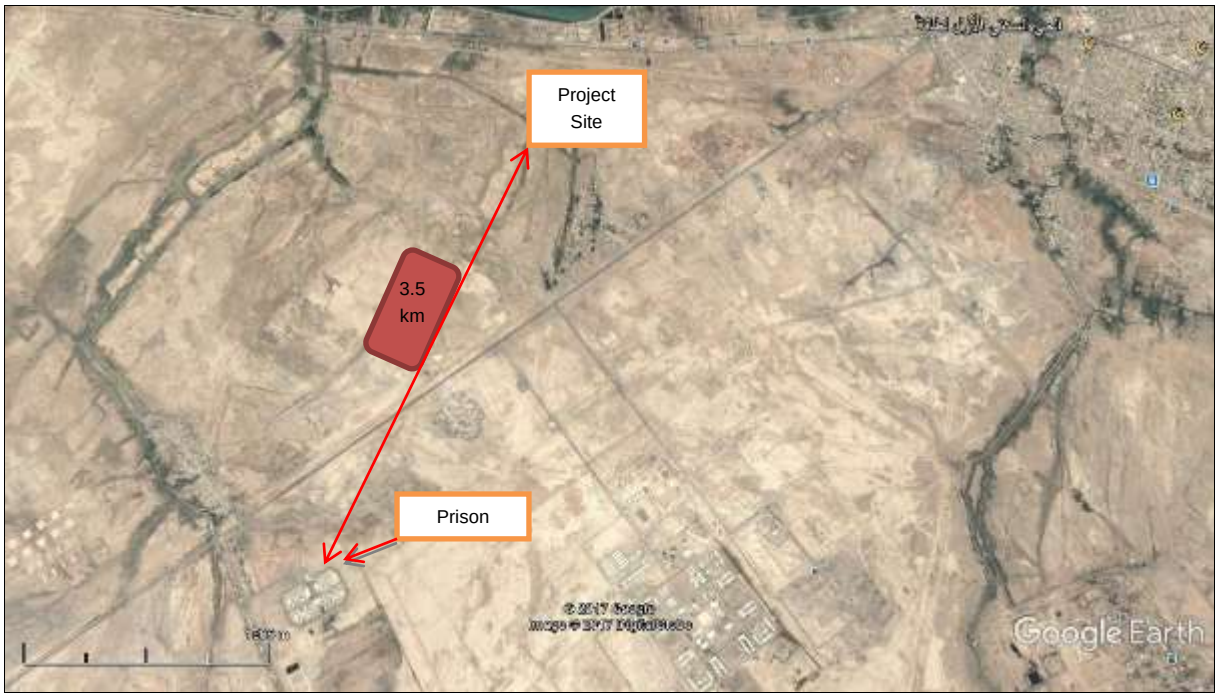
Soil: DU residues were detected in soil at the studied areas. However, the DU concentrations in soil are low. Upper estimates of the annual doses to adults and children due to the possible inhalation of DU present in the soil are about 1 µSv; doses via ingestion pathways are of the same order.

Water: The concentrations of DU detected in water supplies are low. In fact, the total uranium concentration in the water sample is about five times lower than the WHO guideline value for drinking water of 15 µg/L (International Atomic Energy Agency, 2010).

5.4.6 Security

Nasiriyah Central Prison

Nasiriyah Central Prison in Dhi-Qar governorate is located approximately 3.5 km from the Project Site. Based on publicly available information, Iraqi prisons, in general, are experiencing overcrowding as a result in the increased number of arrests of known or suspected Islamic State of Iraq and Syria (ISIS) militants. According to Human Rights Watch, over the past two years, more than 9,000 ISIS suspects have been sent to jail on ISIS-related charges (Forreign Affairs, 2016). See Figure 5-24 for satellite image of the Prison below.



Source: Google Earth

Figure 5-24 Satellite Image of Nasiriyah Central Prison

During the field study, the social study team could not get specific details regarding the number of jailed persons in the prison from locals or authorities, other than a general statement that there have been no escapes from the prison. The only thing that was informed regarding the prison is that, the prison constitutes all type of criminal inmates and there were no recent incident occurred within the borders of the prison. The locals of the AoI did not state any type of concern regarding the Prison as well.

Islamic State of Iraq and Syria (ISIS)

On September 14, 2017, ISIS militants organized triple terrorist attack in the Nasiriyah city approximately 30 km from the Project Site. According to news reports, the attacks were against Dhi-Qar civilians and Iraqi security forces. Other major attacks in the south of the country, include two suicide vehicle attacks in Basra province on May 19, 2017 and suicide bomb attacks in Karbala and Babel on June 9, 2017.

Security

The latest Threat Matrix, dated on January 2018, established by the international sources in Iraq can be found in the Matrix below.

Region	Political	Terrorism	Militancy	Crime	Kidnap and Ransom
KRG[14]	Moderate	Low	Moderate	Low	Low
North[15]	Moderate	High-Extreme	High	High	High
Baghdad	Moderate	Moderate	Moderate	Moderate	Moderate
Anbar	Moderate	High	High	High	High
South[16]	Moderate	Low	Moderate	Moderate	Moderate
Threat Scale	Minimal	Low	Moderate	High	Extreme

Source: (Risk Analysis Team, Iraq, 2018)

Figure 5-25 Threat Matrix of Iraq

The Threat Matrix provides general risk analysis of Iraq based on regions and subjects, respectively. The Project is located within the South Region of Iraq and in terms of terrorism, according to resources derived from Garda World (known to be one of the leading security services in Iraq), such activities (specifically from ISIS) stated as low, especially compared to other regions of Iraq.

5.4.7 Housing Conditions, Infrastructure and Services

According to the household surveys conducted by the social team, 72 % of the villagers in the AoI stated that their housing conditions are average, whereas, 26.8% stated to have worst conditions compared to other houses in the AoI. Table 5-24 below presents approximate surface area of the houses located in AoI, respectively.

Table 5-24 Surface Area of the Houses Located in AoI

Surface Area	Percentage
25 – 50 m^2	36.1%
50 - 200 m^2	36.5%
200 m^2 and up	27.4%

[14]KRG – Dohuk, Erbil & Sulaymaniyah

[15] North – Nineveh, Salah ad – Din

[16]South – Babil, Wasit, Karbala, Najaf, Qadisiyah, Dhi-Qar, Muthanna, Maysan & Basra

Surface Area	Percentage
Total	**100**

Source: Social Baseline Survey, 2017

As stated during the interviews, approximately 46% of the locals are living in their houses for more than 20 years. On the other hand, 44% of the interviewees rent their houses, 30.1% own their houses and 25% of them are living as an occupier.

77.6% of the homes in the AoI have indoor toilets. 43.5% of the toilets (both indoor and outdoor) are connected to septic systems, while the rest are connected to municipal sewer systems. 65.5% of the homes are heated by natural gas, 23.4% of the homes use electricity and the remaining of homes in the AoI are heated by coal, wood or solar, or some combination of the three.

The social team also gathered information regarding consumer products owned by villagers in the AoI, which is shown in Table 5-25.

Table 5-25 Household Belongings of the AoI

Type of belongings	Yes	No	Total
Refrigerator	94%	6%	100%
Washing Machine	49%	51%	100%
Dish Washer	25%	75%	100%
TV	48%	52%	100%
Satellite	33%	67%	100%
Cell phone	70%	30%	100%
Computer	23%	87%	100%
Internet	19%	81%	100%
Air Conditioning	49%	61%	100%
Car	34%	66%	100%
Tractor	17%	83%	100%
Agricultural Machinery	5%	95%	100%

Source: Social Baseline Survey, 2017

Water Resources

According to the information gathered from the household surveys from each village, the majority of households use open source water for drinking water purposes. Open source water can be defined as a non-protected, non-proprietary source of water available to the public. For further indicators, Table 5-26 below presents the types of water sources used in the AoI.

Table 5-26 Drinking Water Sources of AoI

Drinking Water Source	Percentage
Protected source water	29%
Well water	7%
Water tank	9%

Drinking Water Source	Percentage
Tap water	10%
Open source Water	43%
River	2%
Total	**100%**

Source: Social Baseline Survey, 2017

The majority of persons interviewed also indicated that they use open source water for irrigation purposes as well. The different types of water sources are presented in Table 5-27.

Table 5-27 Irrigation Water Sources of AoI

Irrigation Water Source	Percentage
Protected source water	8%
Open source water	50%
Water tank	11%
Tap water	6%
River	20%
Well Water	5%
Total	**100%**

Source: Social Baseline Survey, 2017

Lastly, the majority of the persons interviewed said that they use water tanks for potable water (domestic water) purposes. See Table 5-28 for further information.

Table 5-28 Potable Water (Domestic Water) Sources of AoI

Domestic Water Source	Percentage
Protected source water	3%
Open source water	24%
Well water	9%
Water tank	13%
Tap water	34%
River	17%
Total	**100%**

Source: Social Baseline Survey, 2017

Electricity

According to household surveys conducted in the AoI, almost all villages have access to electricity. However, the majority of the locals stated that electricity cut off occurs any time during the day without any advance warning.

Waste

Waste generated by the villages is disposed of in landfills or through incineration.

Village Problems

According to head of the villages, the main problem of the villages is unemployment. Due to the high unemployment rate within the AoI, there is a high concentration of families that live below or near the poverty line. Also given the absence of health care facilities in the AoI, many of the villagers have difficulty accessing transportation to health centers and can present a significant problem in the case of emergencies.

Table 5-29 below presents the topics that villagers in the AoI identified as household problems:

Table 5-29 Household Problems of AoI

Problems	Very Significant	Significant	Not Significant	Total
Unemployment	63%	33%	4%	100%
Low income	56%	43%	1%	100%
Cost of living	34%	62%	4%	100%
Security	23%	48%	29%	100%
Transportation	43%	50%	7%	100%
Lack of education services	20%	73%	7%	100%
Water	39%	52%	9%	100%
Electricity	40%	50%	10%	100%
Housing conditions	18%	77%	5%	100%
Waste disposal	58%	33%	9%	100%
Telecommunication	44%	43%	13%	100%

Source: Social Baseline Survey, 2017

5.4.8 Vulnerable Groups

The majority of the vulnerable groups in the AoI comprise low income groups, daily workers and people who have physical and mental disabilities. Table 5-30 below presents detailed information on vulnerable groups living in the villages of the AoI.

Table 5-30 Vulnerable Groups in the AoI

Vulnerable Groups	Number of People	Comments of Mukhtar
Low income groups	2,250	More than half of the population in Al-Agir and Aujeah village is stated to be low income.
Child as household head	5	Aujeah village is the only settlement that consists child household heads, according to head of the village.
Daily / temporary worker	Not exact figure	Almost all working young locals are occupied as temporary or daily workers.
Mental disability	25	-
Physical disability	60	In Aujeah village some of the disabilities have resulted due to past wars. Whereas, in Al-Mahmud village physical disability was mainly result of genetics.
Number of Female Headed Households	%8	According to household surveys, 8% of the population is estimated as Female Headed Households.

Source: Social Baseline Survey, 2017

5.4.9 Project Awareness

Majority of the locals from the AoI have heard about the Project through MoE, television and Nasiriyah Thermal Power Plant. Almost all attendees majority of the interviewees and attendees of the PPM were eager to learn further about the Project's employment opportunities. According to interviews conducted in the Aujeah village, a number of villagers are already employed by the Project for excavation works. The locals stated their interest to provide goods and services during both of the PPMs, especially in terms of security services, construction vehicles and machinery. It has been observed that, there is a lack of capacity of goods and services within the borders of the AoI, therefore, the locals are willing to deal these services from the city centers and profit from the commissions

Persons interviewed in Al-Sadah village indicated that they had prior experience as construction workers on the Nasiriyah Thermal Power Plant and expressed ttheir interest in having similar roles in connection with the Project.

None of the villagers who were interviewed by the social team expressed any concerns about the potential environmental impacts (other than increased traffic) caused by the Project.

The villagers recommended that additional police and security officers may be needed once construction of the Project moves forward.

5.4.10 Cultural Heritage

Site surveys were conducted on May 25-27, 2017 in order to determine the potential archaeological and immovable cultural assets within the Project Site and identify possible impacts of project activities on these sites. A "Terrestrial Archaeology Report" was prepared and is attached (Appendix-H). Archaeological publications on the Project site and its close vicinity were also collected and reviewed. The Project Site identified during the desktop research was transferred to GIS environment by using ArcGIS Map software for analyzing their relationship with the Site. The sources of information used during literature review are as follows:

- Academic publications,
- Historic maps,
- Reports on the previous Cultural Heritage Studies and Results of Field Excursion.

Site survey, using "field walking technique" was performed in order to identify, record and evaluate any visible archaeological traces (ceramic shards, architectural remains and/or trails, graves and/or traces of graves, mounds etc.) on the surface of the Project site. Also a desktop review of secondary and primary sources was performed to determine if there are any archeologically sensitive areas in the Project area. Based on this review, archaeological and immovable cultural assets identified within the administrative boundaries of Dhi-Qar,

Nasiriyah and Al Muthanna Protectorates and their relationships with the project construction areas were investigated.

The region, where the Project Site is located, is named as “Lower Mesopotamia”. The place names in the Mesopotamian geography have continuously changed throughout the history. The most important reason for this is the continuous invasions of the fertile Mesopotamian territories by different cultures. According to the literature review, the archaeological potential of the Mesopotamian geography is quite high. A lot of archaeological sites were discovered during the scientific investigations conducted within the boundaries of the Middle and Eastern Mesopotamia region.

According to the literature review archaeological Sites are located around the Project area, and their distance from the Project area are provided below in Table 5-31.

Table 5-31 Archaeological Sites Around the Project Site

Original (Ancient) Name of the Site	Modern Name	UTM	X	Y	Distance to the Project Site (km)
Lagash	Tell al-Hiba	38	633331	3475060	46.4
Unknown	Tell Shmid	38	579585	3511855	78
Zabala, Zabalam	Tell Ibzaykh	38	582534	3511559	80
Bad Tibira	Madain	38	595087	3472148	42
Tell Abu Shahrain	Eridu	38	595275	3409616	31
Unknown	Tell al-Ubeyd	38	599968	3425152	15
Kisiga	Tell al-Lahm	38	627482	3411887	25.5
Unknown	Tell Awayli, Oueilli	38	584498	3456767	36.5
Ur	Tell Maqayyar	38	605343	3425978	10.5
Larsa	Tell Senkereh	38	581248	3461594	42
Kutalla	Tell Sifr	38	591941	3462435	35.5
Unknown	Tell Umm al- Aqarib	38	588818	3497660	68
Girsu	Telloh	38	611039	3492259	58.5

No archaeological or immovable cultural assets were encountered within the borders of the Project site. In addition, no archaeological sites are located within the borders of the area where the project activities are to be conducted.

6 IMPACT ASSESSMENT

6.1 Environmental and Social Impact Assessment

ESIA is a systematic process to identify, predict and evaluate the environmental and social effects of proposed projects. ESIA best practice promotes environmentally sound and sustainable development through the identification of appropriate enhancement and mitigation measures. The primary aim and objective of the EIA process is to:

- Modify and improve environmental design;
- Ensure efficient and appropriate resource use;
- Identify key impacts and appropriate mitigation measures;
- Avoid irreversible environmental damage;
- Enhance social aspects of development; and
- Protect human health and safety.

An ESIA aims to ensure that all potential environmental and social impacts associated with a project's design, construction, operation and decommissioning are identified and assessed, and then appropriate mitigation measures are implemented to reduce or eliminate any potential residual impacts identified.

The ESIA process is iterative and contains a number of feedback loops which promote refinement of project development proposals.

6.1.1 Purpose of the ESIA

The purpose of this ESIA is to report the findings and conclusions of the ESIA process that has been undertaken for the Project. The ESIA provides a systematic analysis of the Project in relation to the existing environmental and social baseline. This ESIA is a public document and provides information to local stakeholders to help them understand the development of the Project and its potential environmental and social impacts.

The EU directive requires a discussion of the potential for direct, indirect, secondary, cumulative, short, medium and long-term, permanent, temporary, positive and negative effects to be addressed. All of these aspects have been included in this ESIA, although the level of detail in which they are considered differs depending on their likelihood and significance. Measures to mitigate potentially adverse impacts are discussed and any residual impacts identified.

6.2 Methodology

This section of the report presents the methodology used to assess the environmental and social impacts of the Project. It consists of a multi-stage iterative approach in order to predict and evaluate the potential effects the Project could have on the physical, biological, social and cultural environment. Measures are then identified for the Project to take to avoid, minimize, mitigate or compensate for any adverse impacts; and to enhance positive impacts where possible.

Results continue to be re-evaluated and modified as the assessment progresses and the Project impacts are monitored.

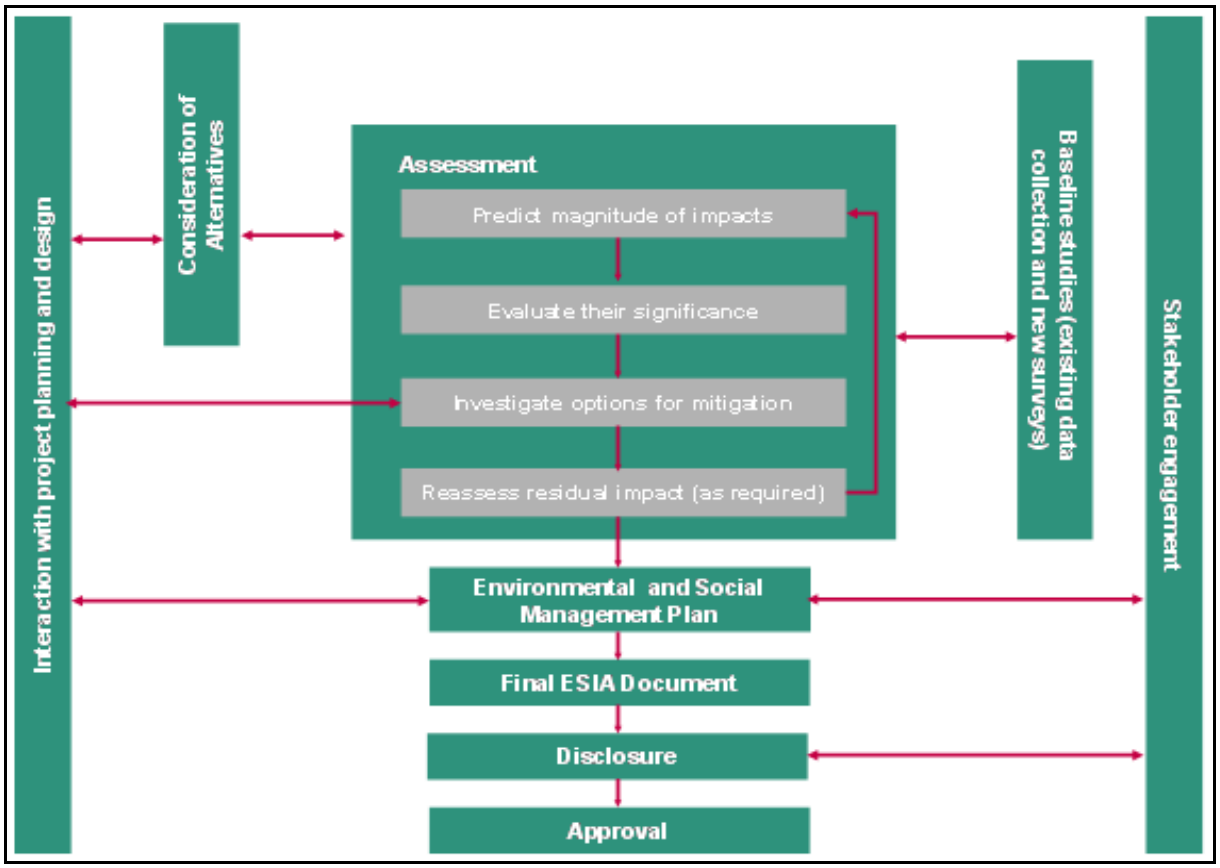


Figure 6-1 Environmental and Social Impact Assessment Methodology

6.2.1 Screening

The screening stage of the impact assessment process looks at the type of project and the applicable framework of legislation and standards to determine what type of impact assessment requirements apply to the Project.

Screening for this Project was undertaken through a review of applicable national legislation and international financing requirements. The outcome of the screening process established

the requirement for an ESIA that meets EIA requirements of Iraq and international financing institutions.

6.2.2 Scoping

Scoping is a vital early step in the preparation of the ESIA. The scoping assessment identifies issues that are likely to be important during the process and eliminates those that are not. Effective scoping will ensure that the ESIA focuses resources on those areas where significant impacts are likely. It also ensures that cumulative impacts are identified at an early stage and addressed so far as is practicable in the early stages of Project development. Good design practice dictates that alternatives are considered and the advantages and disadvantages of all options are evaluated.

The approach to the scoping is based on EPs and IFC's PSs on Environmental and Social Sustainability. Key process elements of the ESIA process generally consist of the following:

i. project definition;
ii. (initial) screening of the project and the scoping of the ESIA process;
iii. stakeholder identification and gathering of social and environmental baseline data, where relevant;
iv. impact identification and analysis; and;
v. generation of mitigation or management measures and actions.

The PSs of the IFC were utilized to define the scope of the Project ESIA. Given the tight project timetable, the initial scoping was based on the professional experience and expertise of the ESIA Team formed for the Project, discussions with the wider project team, reviews of the existing project documents including initial Project design, and assessment of the current environmental and social conditions of the Project Site and potential impacts of the Project. Scoping was undertaken for the Project to identify the AoI for the Project, to identify interactions between the Project and resources/receptors and impacts that could result from these interactions. A number of decisions regarding the location, scale, layout and design of the development were made during the proposal identification process. The Project as a large-scale energy project and operation of the facility are taken into account to identify key environmental and social issues to be assessed. The key environmental issues that were recognized during scoping have been taken into account in the ESIA study, and they have been discussed in detail in the respective sub-sections in Section 6.3.

The initial scoping has been accompanied with stakeholder consultation about the Project's benefits and impacts..

The "Scoping Phase Meeting" was conducted on 11/09/2017. There were two PPMs for Dhi-Qar Project; one in Aujeah village, the other one in Al-Sayad village. This was requested by the regional Sheiks of the region. An announcement for the Public Participation Meeting

(PPM) was through local television on September 9, 2017 to inform the public about the date, time, place, and subject of the meeting. As mentioned previously, due to cultural / religious codes of the region, no female participants attended the meetings. Also, the head of the villages did not allow the social team to conduct separate 'female-only' participation meeting.

There were total of 50 attendees in the PPM; 10 in Aujeah village and 40 in Al-Sadah village. The Social team, with the support of local translators, made a presentation summarizing the Project and its key environmental and social impacts identified through the scoping exercise. Comments and recommendations of the attendees about the project were taken into consideration.

The main concerns about the Project, which were raised by attendees of the PPMs are listed below:

Aujeah village:

- Although there is no legal proof, according to locals' statements, the land of the Project Site was previously used for agricultural purposes.
- The locals are satisfied in terms of reaching out to the MoE for Project matters. However, the locals also expressed their desire to have a direct line of communication with ENKA as well.
- As of now, there are 5 locals who are employed by the Project. The villagers expressed their expectation that the Project will hire additional workers from the villages.
- The locals are willing to work as a security or construction personnel. Also, they are willing to provide service and materials (e.g. food supply and cleaning materials) for the Project.

Al-Sadah village:

- The village currently suffers from high unemployment rates. This is especially the case with those under 30. Therefore, the majority of the attendees were young male who were eager to learn further about job opportunities.
- The locals requested that ENKA provide construction related skill development training to inhabitants of the village, especially younger villagers, so that they can use this training to find jobs once construction of the Project is completed.
- The locals raised their claims on how they used the Project Site for agricultural purposes[17].

[17] Ecological site surveys have been conducted in order to determine the baseline conditions of the Project area and its vicinity in the scope of ESIA studies. Seasonal Ecological Site Surveys were carried out between 22-28 May 2017, 27 July-1 August 2017 and 13-16 September 2017 at the proposed Project Site. Also secondary information from published scientific

Baseline Studies

This stage comprises the collection of baseline data representative of the Area of Influence n order to provide a baseline against which the impacts of the Project can be assessed. The baseline takes into account current conditions, as well as hanging conditions (i.e. trends) apparent in the baseline. It takes into consideration other developments in the area which are underway or certain to be initiated in the near future.

The collection of baseline data servers the following objectives:

- to focus on receptors that were identified during scoping as having the potential to be significantly affected by the Project;
- to describe and where possible quantify their characteristics (nature, condition, quality, extent, etc.);
- to provide data to aid the prediction and evaluation of possible impacts; and
- to inform judgments about the sensitivity, vulnerability and/or importance of resources/receptors.

See Section 5.1 for a description of the methodologies, limitations and results of the data collection, as well as a summary of the baseline conditions.

6.2.3 Stakeholder Engagement

Stakeholder engagement is a critical requirement underpinning the impact assessment process, which requires engagement with relevant stakeholders throughout key stages of the Project. This assists in informing stakeholders about the Project as well as understanding stakeholder views about the Project, which should be taken into account when identifying possible impacts from the Project. Stakeholder engagement activities are planned and recorded in a stakeholder engagement plan (SEP). A description of stakeholder engagement activities are presented in Section 7 and the SEP can be found in Appendix-I.

6.2.4 Assessment of Impacts

6.2.4.1 Introduction

Impact identification and assessment commences with scoping and continues through the remainder of the impact assessment process. This is largely an objective exercise to determine what could potentially happen to the environment as a consequence of the Project

publications, flora-fauna field guides were collated for the biodiversity assessment. Currently, there is no evidence of agricultural activity in the Project area, because of the high concentration of salt found in the nearby marshed, which eventually contributed to low crop yields.

and associated activities. As during scoping, potential interactions between the Project and baseline environment are identified. The potential impacts resulting from any potential interactions are then explained. As the range of potential impacts is diverse, a wide range of prediction methods are used including quantitative and qualitative methods.

The principal steps include:

- Impact prediction: to determine what could potentially happen to resources / receptors as a consequence of the Project and its associated activities.
- Impact evaluation: to evaluate the significance of predicted impacts by considering their magnitude and the sensitivity or importance to the affected resource / receptor.
- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Impact evaluation: to evaluate the significance of residual impacts assuming effective implementation of mitigation and enhancement measures.

6.2.4.2 Impact Types and Definitions

Impacts may occur as positive, negative, direct, indirect and cumulative. Determination of the type of impact is the important step of the assessment process. The determination of the impact type is based on geographical size, sensitivity of receptor, duration, significance and likelihood of the impact. Impact types are provided below in Figure 6-2.

Impact Type	Definition
Positive	Impacts that make positive changes over the current conditions.
Negative	Impacts that lead to new and undesirable changes over the current conditions.
Direct	Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component.
Indirect	Impacts which are not a direct result of the project, often produced away from or as a result of a complex impact pathway.
Cumulative	Impacts that consist of an impact that is created as a result of the combination of the project evaluated in the current project together with other projects causing related impacts.

Figure 6-2 Impact Types and Definitions

6.2.4.3 Impact Magnitude

Significance level for potential negative or positive impacts is determined by considering the impact magnitude and the likelihood of the impact. Impact magnitude is considered to be a function of impact extent, duration and sensitivity of receptor. The criteria used to determine impact magnitude are summarized below in Figure 6-3.

Impact Extent	***Project Area:*** potential impacts that only cover the borders within the Project site**.** ***Local:*** potential impacts area that covers the vicinity of the Project area. ***Regional:*** potential impacts that cover throughout the district. ***National:*** potential impacts that expected to create changes at national level.
Impact Duration	***Temporary:*** extend of the impacts expected to be less than 6 months. ***Short-term:*** impacts that are expected to only occur during the construction phase of the project. ***Long-term:*** impacts that are expected to occur throughout the operation phase of the project. ***Permanent:*** impacts that are expected to be permanent to the Project affected people.
Sensitivity of Receptor	***Very High:*** The environmental receptor has a high quality and/or is highly rare at international or national levels and has no low or no potential for substitution. ***High:*** The receptor has a high quality and/or is rare at local level and has no low or no potential for substitution; or has medium quality and rarity at national level, with limited potential for substitution. ***Medium:*** The receptor has medium quality and rarity at local level, with limited potential for substitution; or has low quality and rarity at national level. ***Low:*** The receptor has low quality and rarity at local level, with potential for substitution locally.
Impact Magnitude	***Negligible:*** There is no perceptible change to people's lives and ecosystems ***Low****:* Communities/ecological components are able to adapt with relative ease ***Medium****:* Communities ecological components are able to adapt with some difficulty ***High:*** Affected people/communities ecological components will not be able to adapt *to changes*

Figure 6-3 Impact Magnitude Criteria

6.2.4.4 Significance of Impacts

Once the nature of impact is identified, significance is determined for potential negative or positive impacts. For this assessment impact significance is determined by considering both the *impact magnitude* and the *likelihood* of the impact occurring. Likelihood is rated as follows:

Negligible: Impact will not occur.

Not-likely: Impacts are not expected. Impacts may possibly occur but infrequently.

Likely: Impacts that are expected to occur in most circumstances.

Certain: Impact will certainly occur.

By making use of significance rating, magnitude and likelihood of impact is considered simultaneously. For the estimation of impact significance, the following matrix is used:

Significance of Impact					
Likelihood		**Negligible**	**Not likely**	**Likely**	**Certain**
Impact Magnitude	**Negligible**	Insignificant	Insignificant	Insignificant	Insignificant
	Low	Insignificant	Insignificant	Low	Low
	Medium	Insignificant	Low	Medium	Medium
	High	Low	Medium	High	High

Figure 6-4 Impact Significance Rating

Significance rating is performed for each individual environmental and social issue, based on expert's experience and, project standards. For some topics such as air pollutants and noise and vibration, results of modelling are used to assess the significance of impacts against WB Group General EHS Guidelines (which are also known as IFC General EHS Guidelines) as well as other sector specific guidelines (i.e. EHS Guidelines for Thermal Power Plants) or national environmental standards that take into account receptor sensitivity and/or the source of impact. Impacts are quantified where possible and the method of qualification is clearly explained if significance cannot be quantified.

Significance ratings can be defined as follows:

Insignificant impact: Insignificant impact is identified when a resource or receptor, including communities, will not be impacted in any way by the project, or the predicted impact is considered to be negligible or not noticeable or cannot be distinguished from natural background variations.

Low significance: An impact of low significance is identified when an impact will be experienced, but the impact magnitude is small (with and without mitigation) and, within accepted standards, and/or the receptor is of low sensitivity or value.

Medium significance: An impact of medium significance is identified when the results are within accepted limits and standards. It means that the negative impact has been reduced to a level that is low, or positive impact enhanced as far as reasonably practicable.

High significance: An impact of high significance is identified when an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/ sensitive resource/ receptors. The overall goal of the ESIA is to achieve that the Project does not have any major residual negative impacts and major positive impacts are enhanced as far as achievable.

6.2.4.5 Overall Impact Assessment

Impact reversibility is used in order to finalize the overall impact assessment. Reversibility is related with the ability of an ecosystem or receptor to reverse into a pre-impact state by using its own resilience mechanisms, or maintain its former state despite a given impact.

Reversibility can be applied with the use of the matrix below:

Reversibility of receptor for each impact issue will be based on professional judgment, and will require input from relevant experts, including ecologists, biologists, sociologists and economists.

High reversibility: For impacts on ecosystems, the receptor will recover into its former state easily and spontaneously by natural processes, after mitigation measures. For social impacts, communities will return to their former lifestyles on themselves, in a short time.

Medium reversibility: For impacts on ecosystems, the receptor will recover to its former state after effective mitigation with some efforts (i.e. low-cost treatment methods, restoration, and rehabilitation). For social impacts, communities will turn back to their former lifestyles with support, compensation, etc.

Low reversibility: For impacts on ecosystems, the receptor will require great efforts (high-costs and long time) in order to recover to its former state.

Irreversible: The impact will be permanent; recovery is not possible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it.

Overall Impact Assessment					
Impact Reversibility		High Reversibility	Medium Reversibility	Low Reversibility	Irreversible
Impact Significance	Insignificant	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major
	High	Minor	Moderate	Major	Critical

Figure 6-5 Overall Impact Assessment

As seen in the matrix above, if reversibility is high, then the overall impact can be assessed as minor even if major in its significance. If, on the other hand, reversibility is low, then the impact can be significant in cases where no reversibility is possible.

Final impact categorizations can be defined as follows:

Negligible impact: Magnitude of change is comparable to natural variation.

Minor impact: Impact will be detectable but not-significant.

Moderate impact: Impact will be significant, amenable to mitigation; should be mitigated where practicable

Major impact: Impact will be significant, and must be mitigated.

Critical impact: Intolerable, corresponds to a major impact but not amenable to mitigation; alternatives must be identified.

6.2.4.6 Mitigation Measures

Once the significance of a given impact has been characterized, appropriate mitigation or enhancement measures are identified. In the case of mitigation, the priority is to first apply mitigation measures to the source of the impact (i.e., to avoid, or reduce the magnitude of, the impact from the associated Project activity), and then to address the resultant effect to the receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

6.2.4.7 Residual Impacts

Once mitigation and enhancement measures are identified, the significance of residual impacts is determined. Positive impacts are not assigned a degree of significance, but simply stated as being positive.

6.2.5 Dealing with Uncertainty

Even with a firm Project design and a stable environment, predictions are by definition uncertain. Potential impacts have been characterized through quantitative and/or qualitative assessment and expert judgment. Where assumptions have been made, the nature of any resulting uncertainties is presented. Uncertainty can also arise as a result of the stage of project planning at the time of report preparation. Where this results in uncertainty material to the findings of the ESIA, it is clearly stated. The general approach has been to take a conservative view of likely residual impacts, to identify standards of performance that the project will meet, and to propose suitable monitoring and additional contingency measures.

6.2.6 Management and Monitoring

The final stage of the impact assessment process is to define the required management and monitoring measures to ensure that impacts or associated Project components remain in conformance with applicable standards and that mitigation measures are effectively addressing impacts.

6.2.7 Study Limitations

Every effort has been made to obtain data concerning the existing environment and to accurately predict the impacts of the Project. The Project-specific aspects of this ESIA have drawn upon the existing literature, Project-specific documentation, personal communication with local experts and site-specific surveys and studies. References are provided to enable additional reading on specific aspects of interest.

This ESIA has been based on the best available information at the time of its publication. However, the ESIA of the Project will continue throughout the detailed design phase and will

take account of forthcoming research results as and when they become available. Baseline data discussions are divided into two main groups;

i. environmental baseline; and
ii. social baseline data gathering.

No significant limitations regarding the environmental baseline data gathering through literature search and field surveys (measurements and analysis) are noted.

Regarding the Project description data availability, limitations were related to the associated facilities, such as the energy transmission line and natural gas and crude oil transmission lines as well as the access road for which the final design details have not been defined by the MoE, yet. The lengths and routes of the energy transmission line and natural gas and crude oil transmission lines as well as the length of the access road have been provided for the Project therefore impact assessment for the energy transmission line and natural gas and crude oil transmission lines as well as the access road is limited within this report.

The environmental impact assessment of the energy transmission line is presented as a separate section where main concerns related to the OHTL in terms of impact assessment are provided. The establishment of the OHTL is the responsibility of the MoE and EPC commitment starts after the connection of the transmission line to the Power Plant. Once the details of the energy transmission lines are finalized, a separate ESIA will be conducted by the MoE.

In order to overcome the above limitations, some assumptions have been made based on the professional judgment of 2U1K's experience evaluating similar projects. It should also be noted that some of the gaps were highlighted in the ESMP.

Assumptions used when evaluating impacts are discussed in the relevant sections of this report. However, these assumptions are often implicit, relying on expert judgment. In the absence of technical information, or it has been necessary to make assumptions, these are documented. The ESIA has been undertaken during the initial design phase of the Project and therefore some of the technical aspects of the construction have yet to be determined. Where an alternative option could incur additional impacts, these are discussed within the relevant sections.

6.3 Impacts on Physical Environment

6.3.1 Air Quality

6.3.1.1 Construction Phase

The major sources of potential impacts on air quality during the construction phase of the Project are a result of dust generated from earthworks and vehicle movement on unpaved surfaces and various emissions from vehicles and equipment used in the construction process. These impacts will be temporary and limited to the construction phase and can be mitigated by particular measures.

Dust emissions

Excavation and construction activities, including removal of topsoil and development of access roads will cause dust emissions during the construction phase. The total amount of excavation material generated during construction of the Project is expected to be about 200,000 m^3. The material will be used for backfilling and landscaping in the Project area later. Excavated material will be temporarily stored at the Power Plant area.

Construction phase dust emissions have been estimated using AERMOD air quality dispersion software.

For the modelling study, construction area was considered to be 293,000 m^2 (29.3 ha) while construction period was estimated to last about 18 months. Using the approximate dust emission factor of 2.69 mega grams (Mg)/hectare/month of activity defined by the U.S. EPA for heavy construction operations, the total amount of the dust emissions is calculated as follows:

Dust Emissions = 2.69 Mg/ha/month of activity x 29.3 ha / 18 months = 4.38 Mg/month = 6.08 kg/h = 1.69 g/s

The emissions per unit area are calculated as $5.767*10^{-6}$ g/s*m^2.

Maximum Ground Level Concentrations (GLCs) of PM_{10} at Al Auejah Village which is at a distance of 0.5 km from the Project are presented in Table 6-1.

Table 6-1 Maximum GLCs of PM_{10} estimated by Air Dispersion Modelling

Parameter	Averaging Period	GLC (µg/m³)	WHO Ambient Air Quality Guideline Values (µg/m³)	IFC General EHS Guidelines Ambient Air Quality Guideline Values (µg/m³)	Iraq National Ambient Air Quality Standards (µg/m³)
PM_{10}	1-year	1.09	20	5 (25% of the guideline value)*	-
	24-hour	6.98	50	12.5 (25% of the guideline value)*	150

*: As a general rule, the IFC General EHS Guidelines on Environmental Air Emissions and Ambient Air Quality suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed. (US EPA Prevention of Significant Deterioration Increments Limits applicable to non-degraded airsheds.)

Figure 6-6 and Figure 6-7 show the annual and daily PM_{10} GLCs during construction phase of the Project respectively.

Figure 6-6 Annual PM_{10} GLCs for the Construction Phase

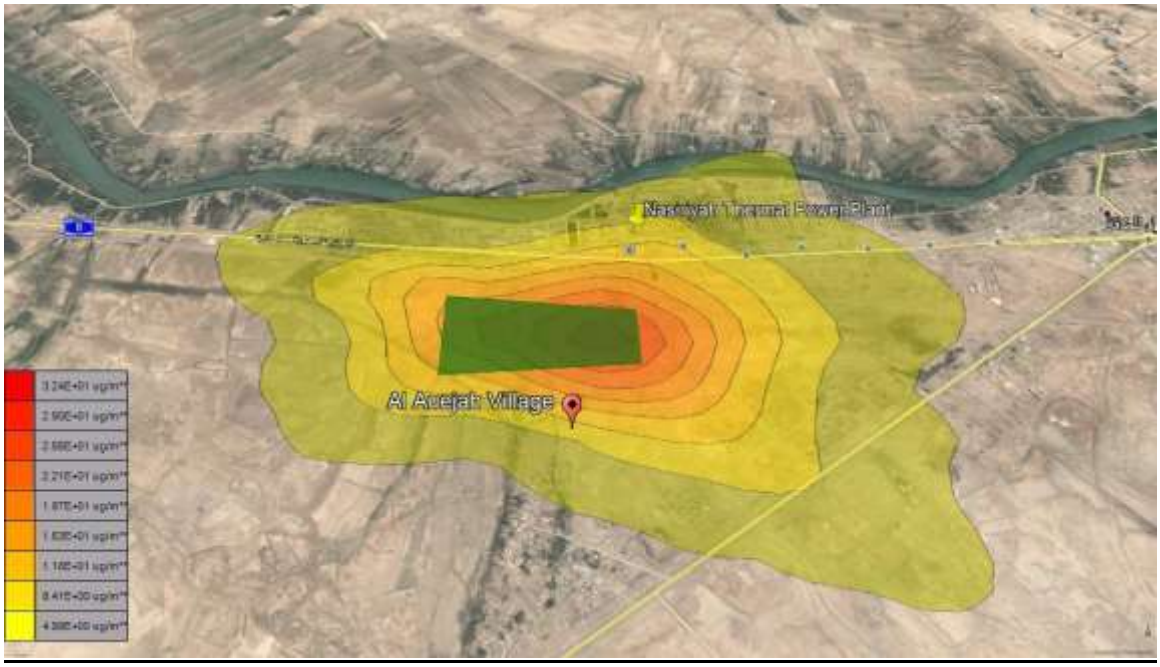


Figure 6-7 Daily PM_{10} GLCs for the Construction Phase

According to the model outputs; GLC for both 1-year and 24-hour period is below IFC General EHS Guideline values. It is estimated that the GLCs will comply with the limits during construction phase of the Project.

The GLCs have been estimated for the worst-case conditions, therefore, the PM_{10} GLC values are expected to be even lower than the estimated values under controlled conditions such as water spraying for dust suppression, covering material storage piles and pavement of roads.

Exhaust gas emissions

Due to the use of diesel fuel for the heavy construction vehicles, carbon monoxide (CO), sulfur oxides (SO_2), hydrocarbons (HC), nitrogen oxides (NOx) and particulate matter (PM_{10}) emissions will be generated during construction phase of the Project.

Emissions from construction equipment are calculated using Exhaust Emission Factors for Nonroad Engine Modeling - Compression-Ignition (Report No. NR-009A) of EPA.

Engine power of machines to be used in construction of the Power Plant, and corresponding exhaust emission coefficients are given below in Table 6-2.

Table 6-2 Engine Power and Emission Coefficients of Construction Equipment

Equipment	Number of Equipment	Engine Power (Hp)	Emission Factors (g/Hp-hr)			
			HC	CO	NO_x	PM
Jeep 4x4	2	253	0.2	1.0	2.8	0.4
Truck Mixer	6	320	0.2	1.0	2.8	0.4

Equipment	Number of Equipment	Engine Power (Hp)	Emission Factors (g/Hp-hr)			
			HC	CO	NO_x	PM
Concrete Pump Truck Mounted	2	400	0.2	1.0	2.8	0.4
Concrete Mixing Plant	1	148	0.2	1.0	2.8	0.4
Crawler Excavator	2	271	0.2	1.0	2.8	0.4
Wheeled Excavator	1	154	0.2	1.0	2.8	0.4
Wheel Loader	2	180	0.2	1.0	2.8	0.4
Skid Steer Loader	2	61	0.2	1.0	3.3	0.72
Backhoe Loader	2	49	0.6	2.5	5.0	0.6
Boom Truck	5	320	0.3	1.0	4.5	0.4
Dump Truck	3	306	0.2	1.0	2.8	0.4
Fire Fighting Truck	1	360	0.2	1.0	2.8	0.4
Sewage Vacuum Truck	1	228	0.4	1.0	4.5	0.4
Garbage Truck	1	228	0.4	1.0	4.5	0.4
Truck Tractor	3	414	0.2	1.0	2.8	0.4
Water Truck	2	280	0.4	1.0	6.9	0.4
Agricultural Tractor	3	72.7	0.7	1.0	6.9	0.72
Compactor	5	2.55	0.6	5.6	5.0	0.75
Forklift	1	82	0.2	1.0	3.3	0.72
Generator	12	162	0.2	1.0	2.8	0.4
Vibration Roller	2	35	0.6	2.5	5.0	0.6
Air Compressor	7	65.3	0.2	1.0	3.3	0.72
Rough Terrain Crane	6	229	0.2	1.0	2.8	0.4
All Terrain Crane	8	298	0.2	1.0	2.8	0.4
Crawler Crane	4	227.5	0.2	1.0	2.8	0.4
Telehandler	2	84.5	0.2	1.0	3.3	0.72
Manlift – 20 mt	2	42.5	1.8	5.0	6.9	0.8
Manlift – 26 mt	6	70	0.99	3.49	8.30	0.72
Manlift – 33 mt	5	75	0.2	1.0	3.3	0.72
Manlift – 43 mt	5	74	0.2	1.0	3.3	0.72
Manlift Scissors – 12 mt	2	4	0.6	5.6	5.0	0.75
Steel Bar Bending Machine	3	7.4	0.6	5.6	5.0	0.75

Equipment	Number of Equipment	Engine Power (Hp)	Emission Factors (g/Hp-hr)			
			HC	CO	NO_x	PM
Steel Bar Cutting Machine	3	5.4	0.6	5.6	5.0	0.75
Drilling Rig	3	241	0.2	1.0	2.8	0.4
Vibratory Hammer with Powerpack	3	395	0.2	1.0	2.8	0.4
Piling Rig	1	375	0.2	1.0	2.8	0.4
Light Tower	4	13.4	0.6	2.0	5.0	0.6

Exhaust Emission Factors for Nonroad Engine Modeling - Compression-Ignition, EPA

According to the above list, the exhaust emissions are calculated as follows:

Table 6-3 Exhaust Emissions of the Construction Equipment

Equipment	Emissions(kg/hour)			
	HC	CO	NOx	PM
Jeep 4x4	0.10	0.51	1.42	0.20
Truck Mixer	0.38	1.92	5.38	0.77
Concrete Pump Truck Mounted	0.16	0.80	2.24	0.32
Concrete Mixing Plant	0.03	0.15	0.41	0.06
Crawler Excavator	0.11	0.54	1.52	0.22
Wheeled Excavator	0.03	0.15	0.43	0.06
Wheel Loader	0.07	0.36	1.01	0.14
Skid Steer Loader	0.02	0.12	0.40	0.09
Backhoe Loader	0.06	0.25	0.49	0.06
Boom Truck	0.48	1.60	7.20	0.64
Dump Truck	0.18	0.92	2.57	0.37
Fire Fighting Truck	0.07	0.36	1.01	0.14
Sewage Vacuum Truck	0.09	0.23	1.03	0.09
Garbage Truck	0.09	0.23	1.03	0.09
Truck Tractor	0.25	1.24	3.48	0.50
Water Truck	0.22	0.56	3.86	0.22
Agricultural Tractor	0.15	0.22	1.50	0.16
Compactor	0.01	0.07	0.06	0.01
Forklift	0.02	0.08	0.27	0.06
Generator	0.39	1.94	5.44	0.78
Vibration Roller	0.04	0.18	0.35	0.04
Air Compressor	0.09	0.46	1.51	0.33
Rough Terrain Crane	0.27	1.37	3.85	0.55
All Terrain Crane	0.48	2.38	6.68	0.95
Crawler Crane	0.18	0.91	2.55	0.36

Equipment	Emissions(kg/hour)			
	HC	CO	NOx	PM
Telehandler	0.03	0.17	0.56	0.12
Manlift – 20 mt	0.15	0.43	0.59	0.07
Manlift – 26 mt	0.42	1.47	3.49	0.30
Manlift – 33 mt	0.08	0.38	1.24	0.27
Manlift – 43 mt	0.07	0.37	1.22	0.27
Manlift Scissors – 12 mt	0.00	0.04	0.04	0.01
Steel Bar Bending Machine	0.01	0.12	0.11	0.02
Steel Bar Cutting Machine	0.01	0.09	0.08	0.01
Drilling Rig	0.14	0.72	2.02	0.29
Vibratory Hammer with Powerpack	0.24	1.19	3.32	0.47
Piling Rig	0.08	0.38	1.05	0.15
Light Tower	0.03	0.11	0.27	0.03
Total	**5.26**	**23.00**	**69.66**	**9.22**

The total exhaust emission amount from the construction equipment has been estimated for the worst-case conditions, under the assumption that all the machinery is working at the same point and at the same time. Therefore, the total exhaust emission amount is expected to be much lower than the estimated value under the controlled conditions.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact - Dust and exhaust gas emissions from the construction vehicles. Dust emissions from the earthworks, movement of vehicles.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	There are 4 settlements within a 5 km radius of the Project site, which are namely Auejah (0.5 km), Al-Mahmud (1.5 km), Al-Agir (2 km), and Al Sadah (2.5 km). It is likely that the inhabitants are exposed to air emissions due to operations of Nasiriyah Thermal Power Plant which is at a distance of approximately 1 km to the Project site.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During the construction activities.				
Impact Extent	Project Area	**Local**	Regional	National	
	Dust and exhaust emissions will have impact locally.				
Magnitude	Negligible	Low	**Medium**	High	
	The impact magnitude will be medium, since dust and exhaust emissions will be generated during a limited time and locally.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	The impact of dust and exhaust emissions on the locals is likely to occur. PM_{10} level is expected to be below the limits at the closest receptor. Nevertheless, it should be taken into account that the region is frequently affected by dust storms and the locals often suffer from high dust concentrations[18].				
Impact Significance	Insignificant	Low	**Medium**	High	
	The impact significance is medium since the impact magnitude is medium.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	The receptors may not recover to their former states efficiently if no mitigation measure is taken.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

[18] Dust storms could be defined as large air masses blown with 25 km/h or 7 m/s with high dust intensity, where the visibility is reduced to less than 1,000 m. Sometimes thick dust storms arrive in the form of a big wall of dust and debris (Al-Marsoumi & Al-Asadi, 2010).
Dust storms are considered to be one of the most important environmental hazards in Iraq. In the summer, Iraq is affected by low pressure centred in the areas of the Arabian Sea and the Indian Ocean, and the high pressure regions in the plateau of Anatolia, resulting in the Shamal winds in the north and northwest. From mid-June to mid-September, this is accompanied by intensive heating of the land surface, causing dust storms to rise to heights of one kilometre. In recent years, the frequency of dust storms has increased in Iraq and the surrounding areas due to drought, causing reduced vegetation cover and deterioration of soil quality. The average annual number of days with dust storms across Iraq for the period 1981 to 2011 indicated that Nasiriyah was the governorate with the highest frequency of dust storms, reaching 20 days/year (UNEP, WMO and UNCCD, 2016).
The major source area of dust is situated north of Nasiriyah and Samawa, it is an area characterized by major dune fields. In general, the rate of dust deposition increases from Baghdad to Nasiriyah where it reaches maximum value, then decreases toward Safwan. It is believed that dust storms covering the southern area of Iraq and the coastal area of Kuwait are originated from the southern Mesopotamia Desert in Iraq, and covered a part of Saudi Arabia too (Al-Marsoumi & Al-Asadi, 2010).

Mitigation Measures

The impact on air quality during the construction phase is expected to be minor. In order to prevent dust generation, roads will be sprinkled with water regularly, especially during dry and windy weather conditions. Loading and unloading of construction materials will be performed in a proper way to prevent dust generation. Vehicles loaded with dust generating materials will be covered during transportation. Speed limits of 30 km/h will be applied for the drivers. Materials stored within the Project area will be monitored for dust emissions and covered or damped if required. Maintenance of the heavy machinery will be conducted periodically in order to control the exhaust emissions. Equipment/vehicles will be turned off when not in use.

If any complaints related to dust emissions are received from the local communities, the EPC Contractor will conduct PM_{10} measurements at the closest settlement (Al Sadah Village) in order to determine the levels of PM_{10} emissions generated during the construction activities and will take the required measures to minimize the emission levels.

Impact assessment table after mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact - Dust and exhaust gas emissions from the construction vehicles. Dust emissions from the earthworks, movement of vehicles.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	There are 4 settlements within a 5 km radius of the Project site, which are namely Auejah (0.5 km), Al-Mahmud (1.5 km), Al-Agir (2 km), and Al Sadah (2.5 km).				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During the construction activities.				
Impact Extent	Project Area	**Local**	Regional	National	
	Dust and exhaust emissions will have impact locally.				
Magnitude	Negligible	**Low**	Medium	High	
	The impact magnitude will be low with the given mitigation measures.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	The impact of dust and exhaust emissions on the locals are not likely to occur with the given mitigation measures.				
Impact Significance	**Insignificant**	Low	Medium	High	
	The impact significance is insignificant.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	The receptors will recover to their former states after effective mitigation with some efforts.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

6.3.1.2 Operation Phase

As mentioned in the above sections of the Report, Phase 1 of the Project will involve the operation the Project as a simple-cycle power plant with 4 gas turbines and will have a nameplate capacity of 432.8 MW. During Phase 2, the Project will be converted into a combined cycle power plant with 4 heat recovery steam generators (HRSGs) and a steam turbine, which will produce an additional 236.5 MW. Since the total rated heat input capacity of the proposed Power Plant is above 50 Megawatt thermal in-put (MWth), the Power Plant is covered under the IFC EHS Guidelines for Thermal Power Plants.

The gas turbines of the Power Plant will fire natural gas as the primary fuel and light distillate oil (LDO) and crude oil (CO) as the secondary fuel. Crude oil (CO) will be utilized in emergency situations when none of the fuels are available.

NO_X, SO_2, CO and PM emissions will be generated from the stacks of the Power Plant during operations. The air emissions and stack properties of the gas turbines, estimated ground level concentrations of the pollutants and their potential impacts as well as the suitable mitigation measures are provided in the following sub-sections.

Air quality dispersion modeling studies have been conducted in order to estimate the ground level concentrations of the pollutants in the ambient air generated by the proposed Power Plant both for the combustion of natural gas with no Sulphur content and liquid fuel with less than 0.5% S content in cases of continuous simple cycle and combined cycle operations. In case of use of fuel oil with less than 0.5% Sulphur content during emergency situations, operation period should be limited to 500 hour/year.

The design data used in the modeling studies for utilization of natural gas and liquid fuel in both cases of simple cycle and combined cycle operations is presented below in Table 6-4 and Table 6-5, respectively. The AERMOD input files including stack and topography data, emission rates and other control parameters i.e. building downwash, are also provided in Appendix-J.

Table 6-4 Air Emissions and Stack Properties of Natural Gas-Fired Gas Turbines in both cases of Simple Cycle and Combined Cycle Operations

Parameter	Value* (when natural gas is utilized)		IFC Guideline Value
	Simple Cycle Operation	Combined Cycle Operation	
NO_x Emission Concentration (ppm)	25 (51 mg/Nm^3)		25 (51 mg/Nm^3)
NO_x Emission Rate (g/s)	16.9	17.4	-
O_2 Content (Actual)	13.2 - 13.7%		-
H_2O Content (Actual)	8%		-
Stack Gas Flow Rate (dry with 15% O_2) (Nm^3/s)	332.2	341.5	-
Stack Gas Outlet Temperature (°C)	513.9	163.1	-

Stack Gas Exit Velocity (m/s)	38.3	24.5	-
Stack Inner Diameter (m)	5.7	5.3	-
Stack Height (m)	30	53	-

** There will be four gas turbines in the scope of the Project. These values are for one stack. In the modeling study, stacks of four gas turbines are included.*

Table 6-5 Air Emissions and Stack Properties of Liquid Fuel-Fired Gas Turbines in both cases of Simple Cycle and Combined Cycle Operations

Parameter	**Value* (when liquid fuel is utilized)**		**IFC Guideline Value**
	Simple Cycle Operation	**Combined Cycle Operation**	
SO_x Emission Rate (g/s)	93 (%0.5 S)		For non-degraded airsheds; use of 1% or less S fuel For degraded airsheds; use of 0.5% or less S fuel
NO_x Emission Concentration (ppm)	74 (152 mg/Nm^3)		74 (152 mg/Nm^3)
NO_x Emission Rate (g/s)	50.5	51.9	-
PM_{10} Emission Concentration (mg/Nm^3)	30		
PM_{10} Emission Rate (g/s)	9.966	10.245	
O_2 Content (Actual)	13.2 - 13.7%		-
H_2O Content (Actual)	8%		-
Stack Gas Flow Rate (dry with 15% O_2) (Nm^3/s)	332.2	341.5	-
Stack Gas Outlet Temperature (°C)	513.9	163.1	-
Stack Gas Exit Velocity (m/s)	38.3	24.5	-
Stack Inner Diameter (m)	5.7	5.3	-
Stack Height (m)	30	53	-

** There will be four gas turbines in the scope of the Project. These values are for one stack. In the modeling study, stacks of four gas turbines are included.*

As presented in the tables above, emissions from the Project out of the stacks will comply with emission guideline values, when taking into consideration the relevant emission guideline values and emissions data.

In addition to the emission limits at the stack, there are also standards for ground level concentrations stipulated in the IFC General EHS Guidelines for Environmental Air Emissions and Ambient Air Quality.

Air Quality Modeling Details

AERMOD model developed by the USEPA was used to estimate hourly, daily and yearly GLCs on the basis of the real time values. The model comprises the calculations of different

dispersion models for different sources (point, volume, line) from isolated stacks to fugitive pollutants. Additionally, it considers conditions like aerodynamic waves and turbulence.

AERMOD is working in a network system defined by the user and the calculations are made for corner points of each receiving environment segments forming the network. The network system used by the AERMOD model can be defined as polar or Cartesian. Additionally, the detailed calculations can be made at the discrete receptor points, which can be determined out of the network system.

AERMOD uses four different data given below:

- Wind direction, wind speed, temperature, mixing height, (depends on user's choice) hourly meteorological data set including wind profile exponential and potential vertical temperature difference.
- Coordinates and heights of each element in the network system defined as receiving environment.
- Data sets including source coordinates based on a starting point determined by the user, source height, diameter, emission rate, temperature and flow rate.

The results of the model are used to develop dispersion maps including whole dispersion area. Therefore, the assessment of the regional air quality under different scenarios (e.g. different treatment conditions, various pollution sources or varying seasonal conditions) is possible.

AERMOD model was employed in the air quality modeling study. The meteorological data, topographical data and the pollutant source data used in this study are described as follows:

Meteorological Data: Meteorological data needed for the modeling studies is obtained from the regional meteorological stations. The Nasiriyah Meteorological Station is the nearest meteorological station having relatively good quality data. From the meteorological data of the last 5 years (2012 - 2016), the hourly meteorological data of 2014, through use of which the worst-case results were produced in the air quality modelling study, were considered favorable to be used.

The wind maps of the Project site for the period 2012-2016 and for the year of 2014 as well as for every season of 2014 are provided below from 6-8 through Figure 6-13.

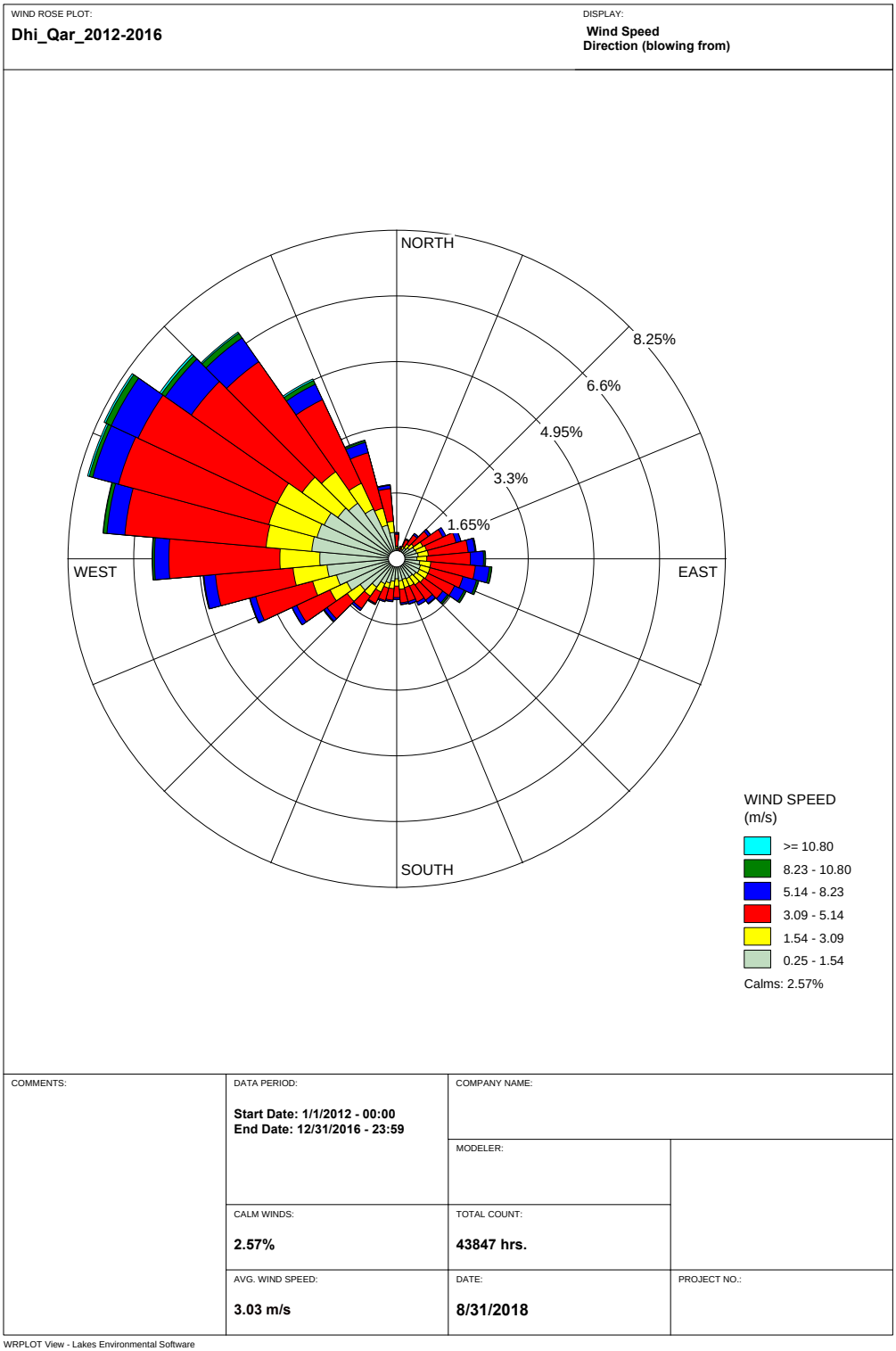


Figure 6-8 Wind Map of the Project Site for the Period 2012 - 2016

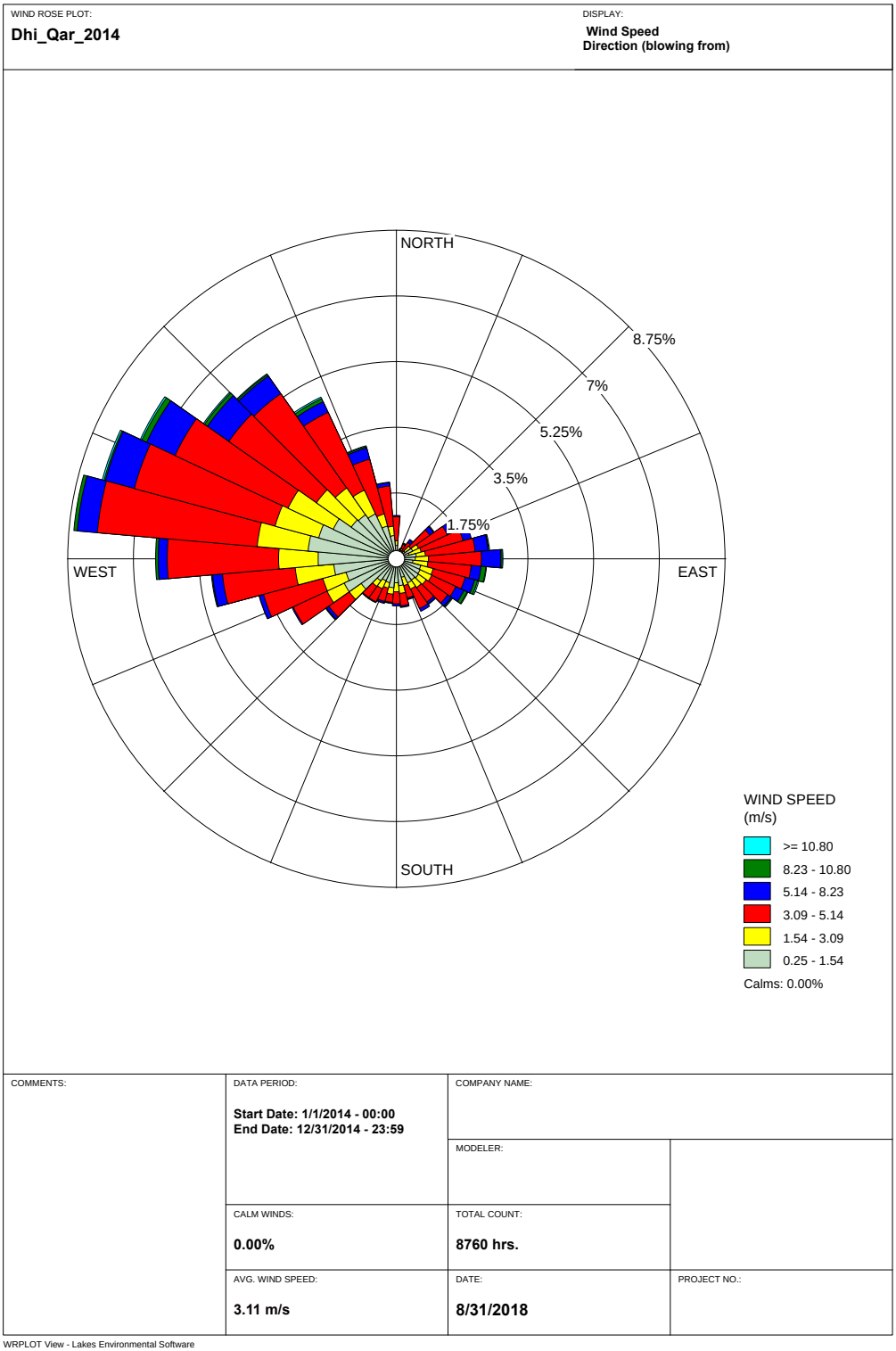


Figure 6-9 Wind Map of the Project Site for the Year of 2014

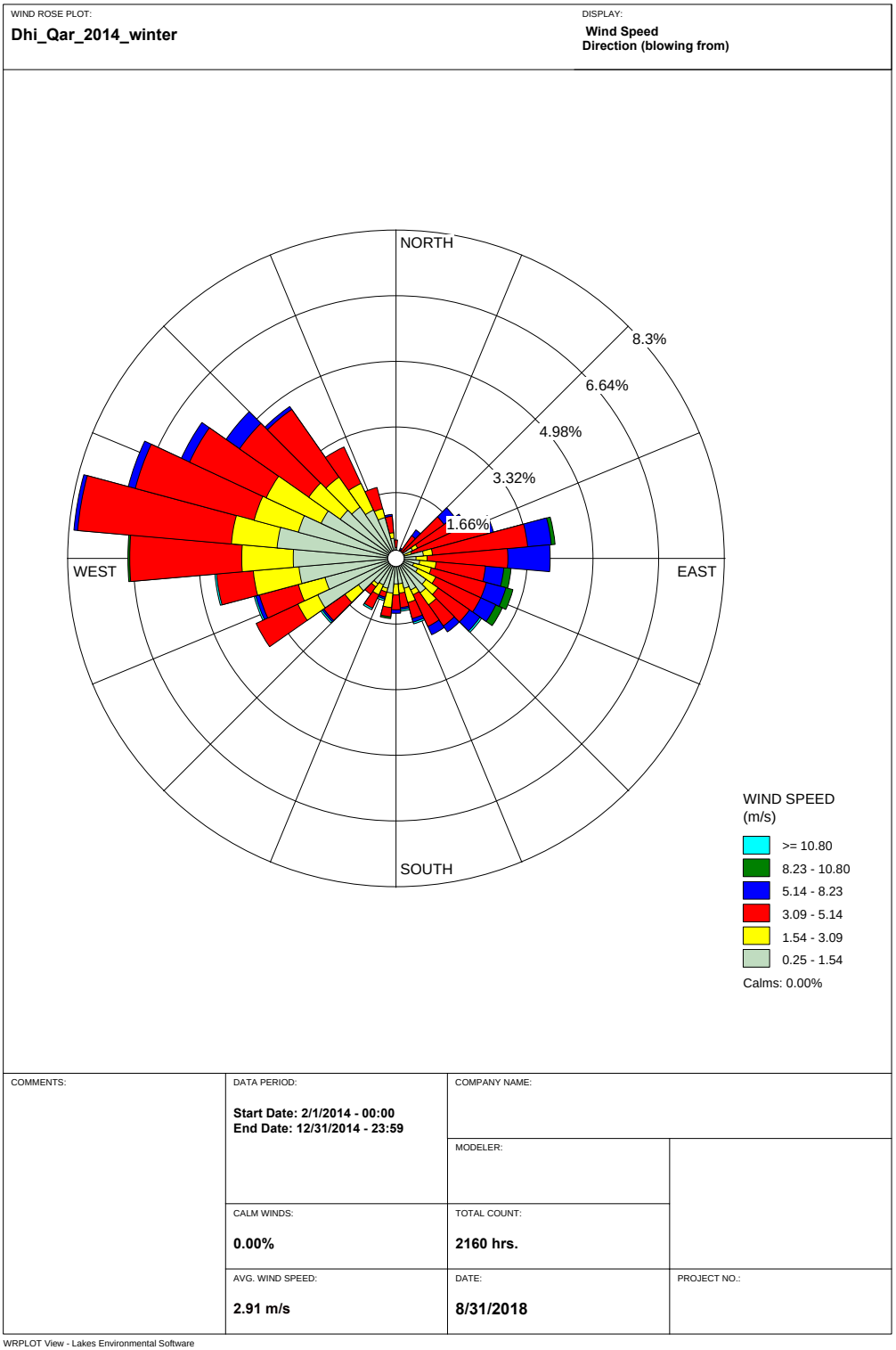


Figure 6-10 Wind Map of the Project Site for the Winter of 2014

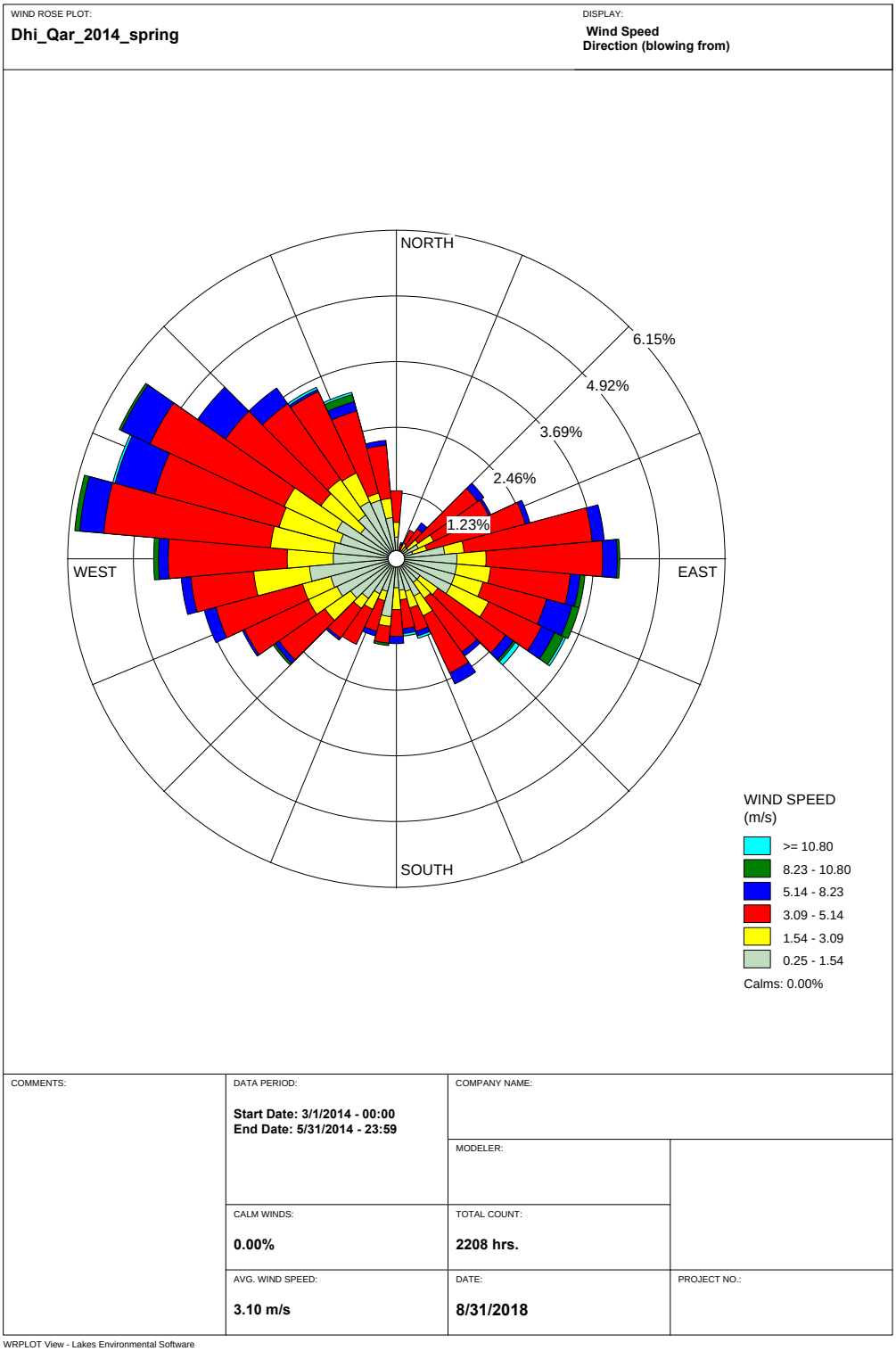


Figure 6-11 Wind Map of the Project Site for the Spring of 2014

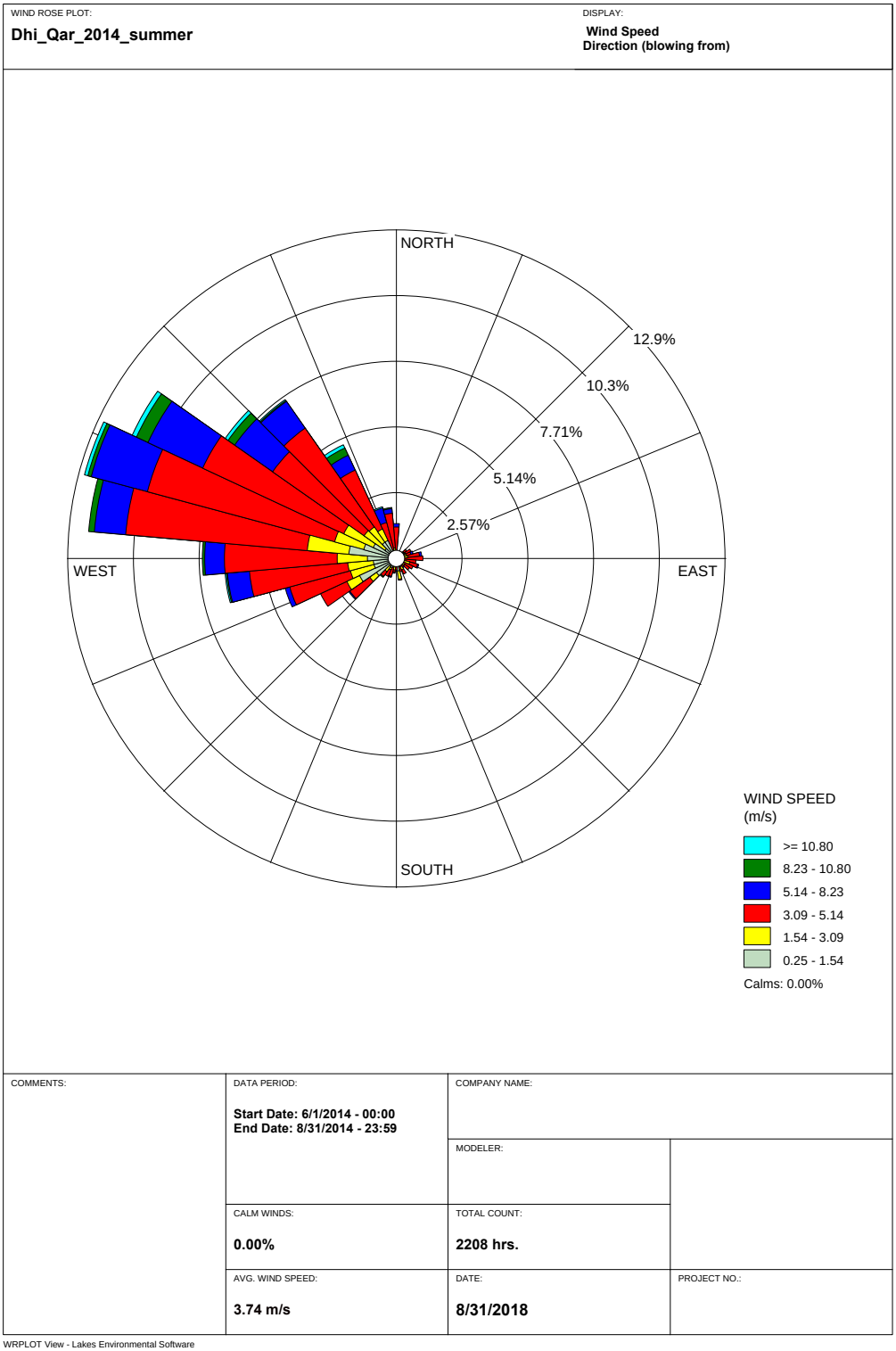


Figure 6-12 Wind Map of the Project Site for the Summer of 2014

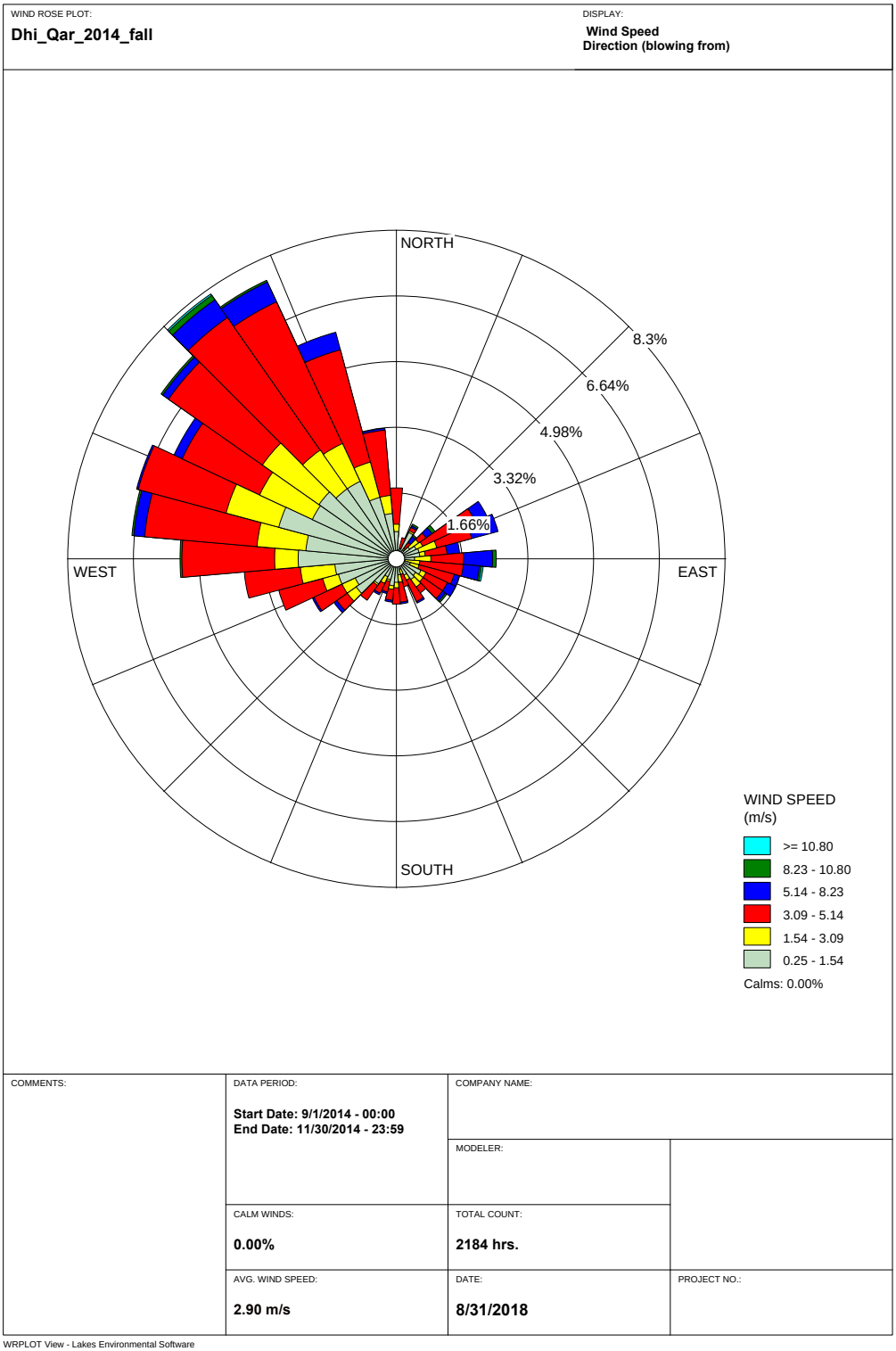


Figure 6-13 Wind Map of the Project Site for the Autumn of 2014

Topographical Data: As mentioned above, determining a study area and dividing it up into receiving environment segments are necessary for AERMOD. A rectangular area defined as a study area is selected by considering the proposed plant to be located at the center and is defined in accordance with the stack height of the proposed plant. The network system is within the 12 km × 12 km area in east-west and north-south directions and it includes nodes with 250 m intervals. The latitudes, longitudes and elevations of nodes are obtained from the ASTER GDEM database and are put into the model.

Pollutant Source Data: As defined above, the pollutant sources in the operational phase of the Project are four stacks of the four gas turbines. The properties of the stacks and air emissions from the stacks obtained from the Main Subcontractor, ENKA UK are presented in **Error! Reference source not found.** and**Error! Reference source not found.**,

The data given in the mentioned tables were utilized in the AERMOD model.

The emissions from other equipment, i.e. emergency generator sets, other machinery have not been modelled, since such emission sources are running less than 500 hours and hence cannot be considered in the modeling studies.

Air Quality Modeling Results

The IFC's General EHS Guidelines on Environmental Air Emissions and Ambient Air Quality suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed. In other words, it is recommended that the GLCs of pollutants generated by a Project do not exceed 25 percent of the applicable air quality standards.

Table 6-6 provides the hourly 98 percentile, hourly maximum and annual GLCs of NO_2 calculated by the modeling studies in both cases of simple cycle (Scenario 1) and combined cycle (Scenario 2) operations for utilization of the primary fuel, which is natural gas. The hourly 98 percentile GLC of NO_2 complies with the recommended value of the IFC for hourly NO_2 concentration in ambient air for sustainable airshed, corresponding to 25 percent of the IFC's ambient air quality guideline value (200 $\mu g/m^3$) which is 50 $\mu g/m^3$. The annual GLC of NO_2 also complies with the IFC limit value. The hourly maximum GLCs of NO_2 for both scenarios are in line with the IFC guideline value, although they exceed the recommended value of the IFC. Figure 6-14 and Figure 6-15 present the NO_2 dispersion maps for Scenario 1 and Figure 6-16 and Figure 6-17 for Scenario 2.

Table 6-6 Hourly 98 Percentile, Hourly Maximum and Annual GLCs of NO_2 calculated by the Modeling Studies in both cases of Simple Cycle and Combined Cycle Operations for Utilization of the Primary Fuel (Natural Gas)

Fuel Type	Scenarios	Emissions	Stack Height	Parameter	Period	Ground Level Concentration (µg/m³)	Limit Value (IFC EHS Guideline) (µg/m³)
Natural Gas	**Scenario 1 (Simple Cycle)**	16.9 g/s	30 m	NO2	Hourly	Max.: 60.36 (x: 613808; y: 3433780) (98 percentile is 12.25)	200 (50 is 25% IFC recommendation for sustainable air shed)
					Annual	1.24 (x: 613558; y: 3433280)	40
	Scenario 2 (Combined Cycle)	17.4 g/s	53 m	NO_2	Hourly	Max.: 57.91 (x: 613808; y: 3433780) (98 percentile is 27.83)	200 (50 is 25% IFC recommendation for sustainable air shed)
					Annual	3.23 (x: 613558; y:3433280)	40

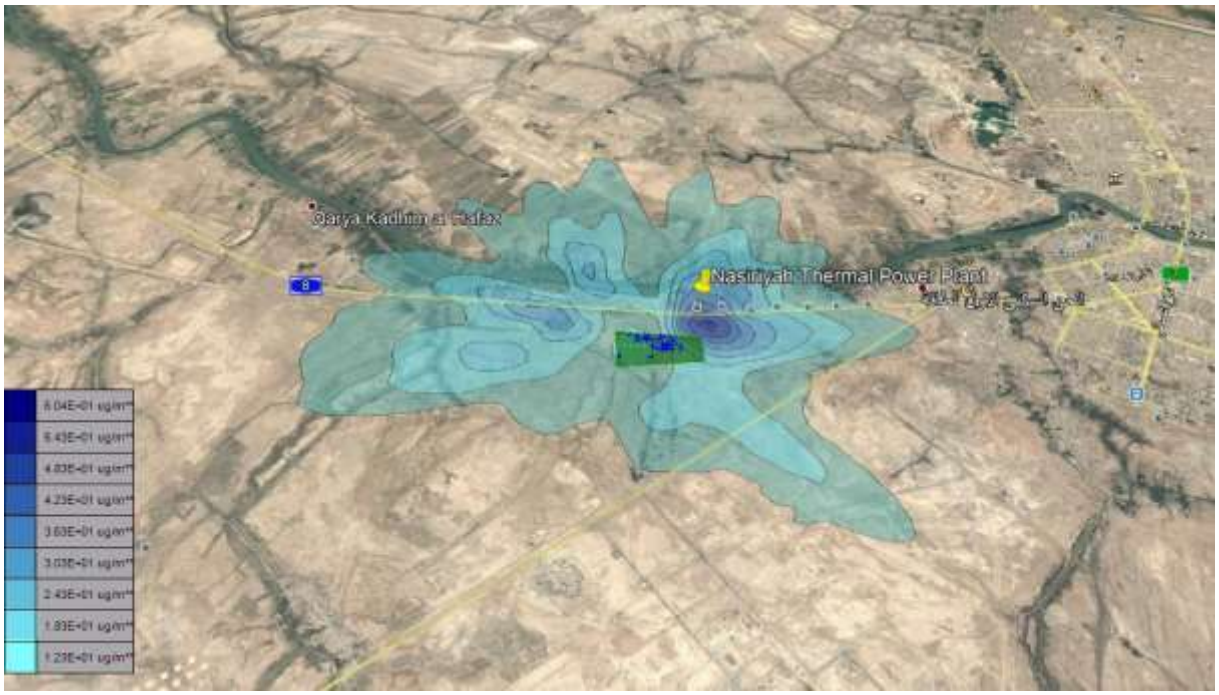


Figure 6-14 Dispersion Map of Hourly NO_2 GLCs in case of Simple Cycle Operation for Utilization of Natural Gas (Scenario 1)

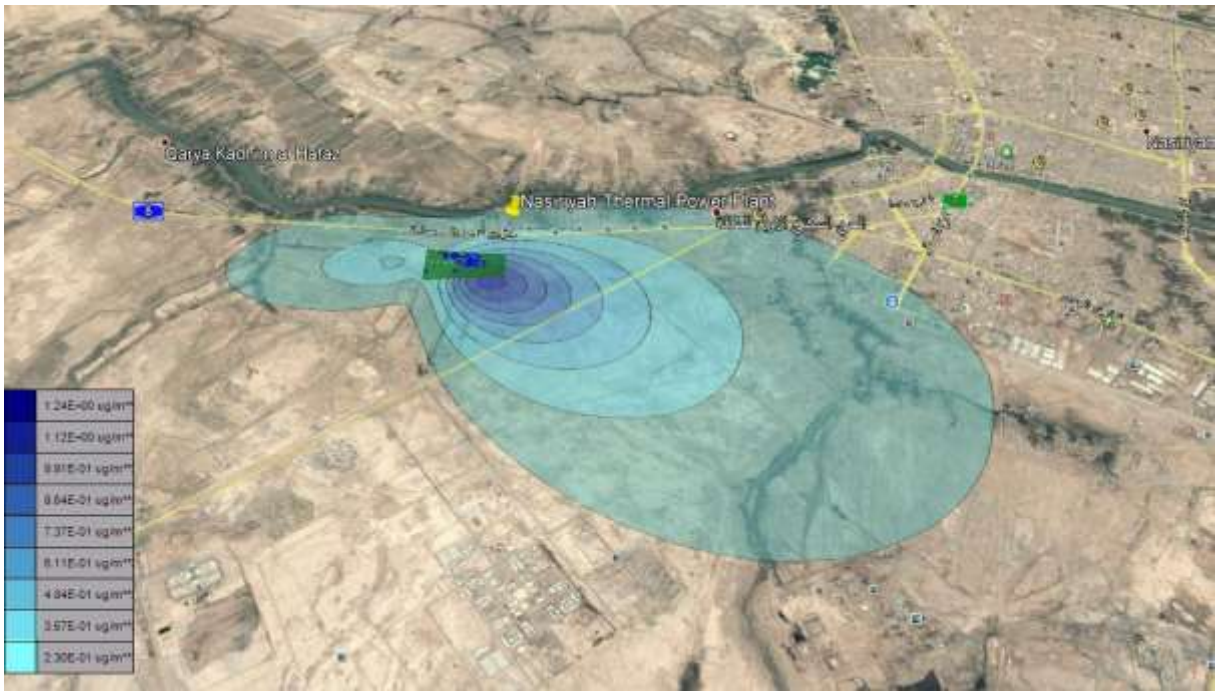


Figure 6-15 Dispersion Map of Annual NO_2 GLCs in case of Simple Cycle Operation for Utilization of Natural Gas (Scenario 1)

Figure 6-16 Dispersion Map of Hourly NO_2 GLCs in case of Combined Cycle Operation for Utilization of Natural Gas (Scenario 2)

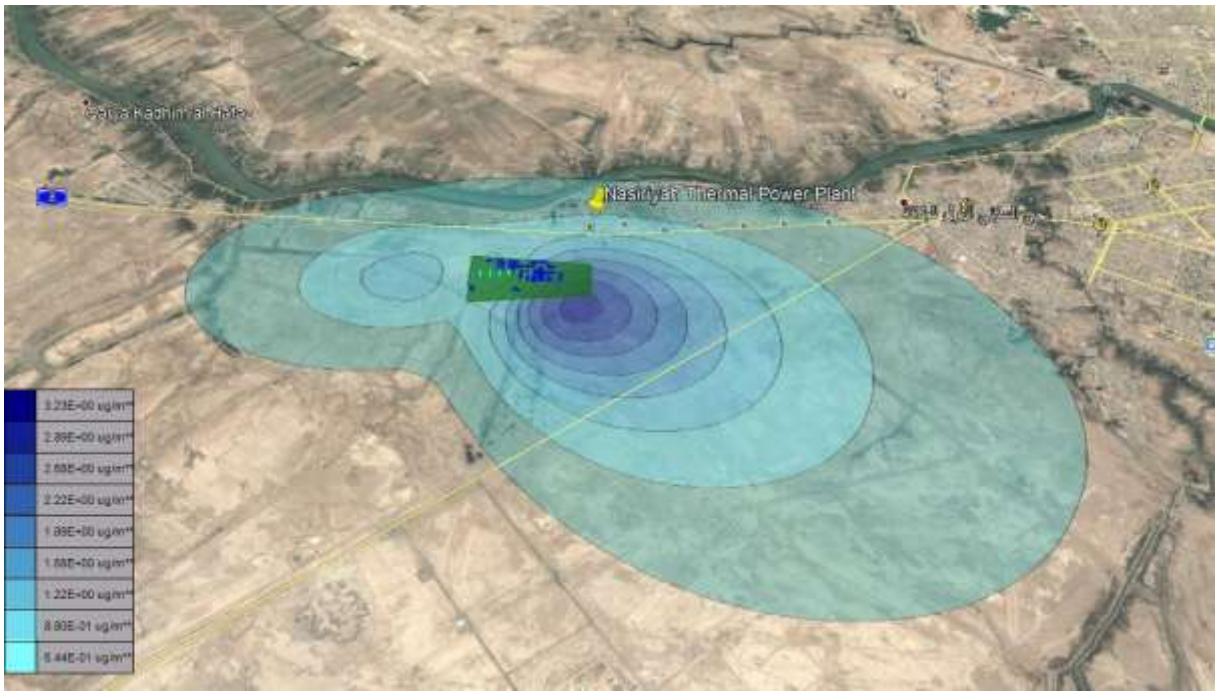


Figure 6-17 Dispersion Map of Annual NO_2 GLCs in case of Combined Cycle Operation for Utilization of Natural Gas (Scenario 2)

Table 6-7 provides the hourly 98 percentile, hourly maximum and annual GLCs of NO_2, daily maximum GLCs of SO_2 and daily maximum and annual GLCs of PM_{10} calculated by the modeling studies in both cases of simple cycle (Scenario 3) and combined cycle (Scenario 4) operations for utilization of the liquid fuel. For simple cycle operation (Scenario 3), the hourly maximum and annual GLCs of NO_2, the daily maximum GLC of SO_2 as well as the daily maximum and annual GLCs of PM_{10} comply with the guideline values set by the IFC EHS Guidelines, although the hourly maximum GLC of NO_2 and daily maximum GLC of SO_2 exceed the recommended value of the IFC (the 25 percent of the air quality guideline value). Nevertheless, the hourly 98 percentile GLC of NO_2 complies with the recommended value of the IFC EHS Guidelines. For combined cycle operation (Scenario 4), the hourly maximum GLC of NO_2 complies with the IFC standards while the hourly 98 percentile GLC of NO_2 is above the recommended value. The annual GLC of NO_2 as well as the daily maximum and annual GLCs of PM_{10} for Scenario 4 also complies with the IFC EHS Guidelines. In terms of the SO_2 emissions, the daily maximum GLC of SO_2 for Scenario 4 is in line with the limit value of the IFC EHS Guidelines, while it exceeds the recommended value of the IFC. Figure 6-18 through Figure 6-22 present the dispersion maps for Scenario 3 and Figure 6-23 through Figure 6-27 provide the dispersion maps for Scenario 4.

Table 6-7 Hourly 98 Percentile, Hourly Maximum and Annual GLCs of NO_2, Daily Maximum GLCs of SO_2 and Daily Maximum and Annual GLCs of PM_{10} calculated by the Modeling Studies in both cases of Simple Cycle and Combined Cycle Operations for Utilization of the Back-up Fuel (Liquid Fuel)

Fuel Type	Scenarios	Emissions	Stack Height	Parameter	Period	Ground Level Concentration (µg/m³)	Limit Value (IFC EHS Guideline) (µg/m³)
LIQUID FUEL	Scenario 3 (Simple Cycle)	50.2 g/s	30 m	NO_2	Hourly	Max.: 179.21 (x: 613808; y: 3433780) (98 percentile is 36.3)	200 (50 is 25% IFC recommendation for sustainable air shed)
					Annual	3.69 (x: 613558; y: 3433280)	40
		93 g/s	30 m	SO_2	Daily	Max.: 39.46 (x: 612058; y: 3434030)	125 (31 is 25% IFC recommendation for sustainable air shed)
		9.966 g/s	30 m	PM_{10}	Daily	Max.: 4.23 (x: 612058; y: 3434030)	50
					Annual	0.73 (x: 613558; y: 3433280)	20
	Scenario 4 (Combined Cycle)	51.6 g/s	53 m	NO_2	Hourly	Max.: 171.75 (x: 613808; y: 3433780) (98 percentile is 82.52)	200 (50 is 25% IFC recommendation for sustainable air shed)
					Annual	9.57 (x: 613558; y: 3433280)	40
		93 g/s	53 m	SO_2	Daily	Max.: 74.65 (x: 612058; y: 3433530)	125 (31 is 25% IFC recommendation for sustainable air shed)
		10.245 g/s	53 m	PM_{10}	Daily	Max.: 8.22 (x: 612058; y: 3433530)	50
					Annual	1.90 (x: 613558; y: 3433280)	20

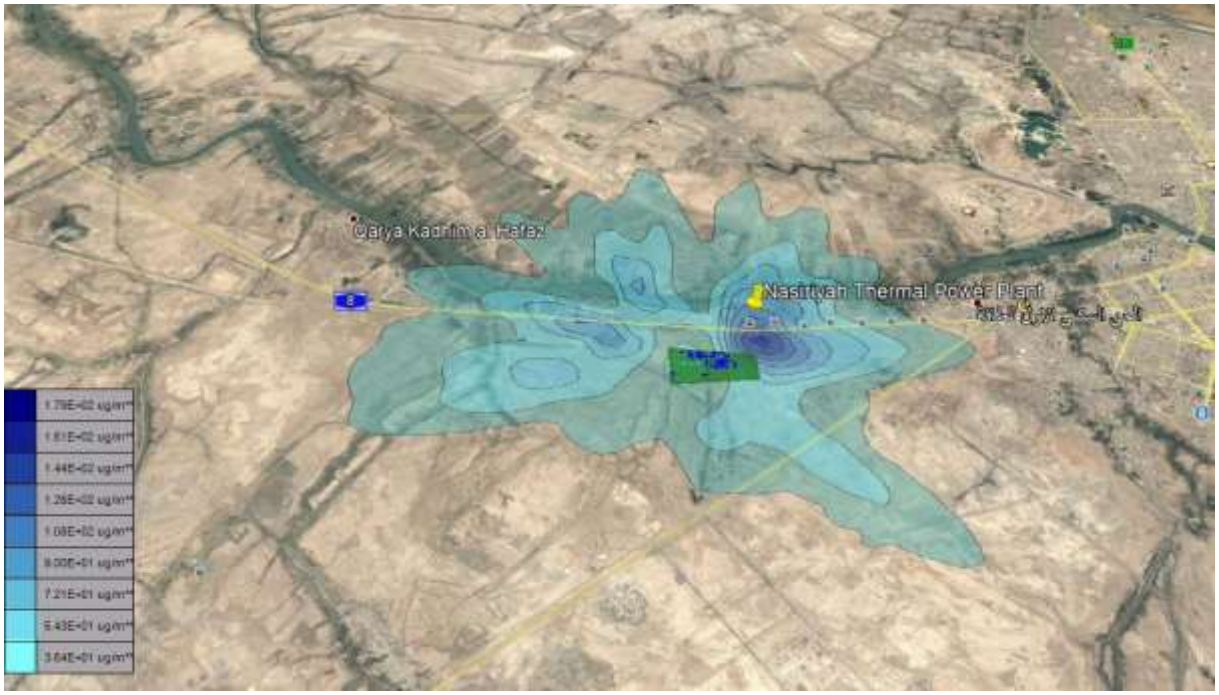


Figure 6-18 Dispersion Map of Hourly NO_2 GLCs in case of Simple Cycle Operation for Utilization of Liquid Fuel (Scenario 3)

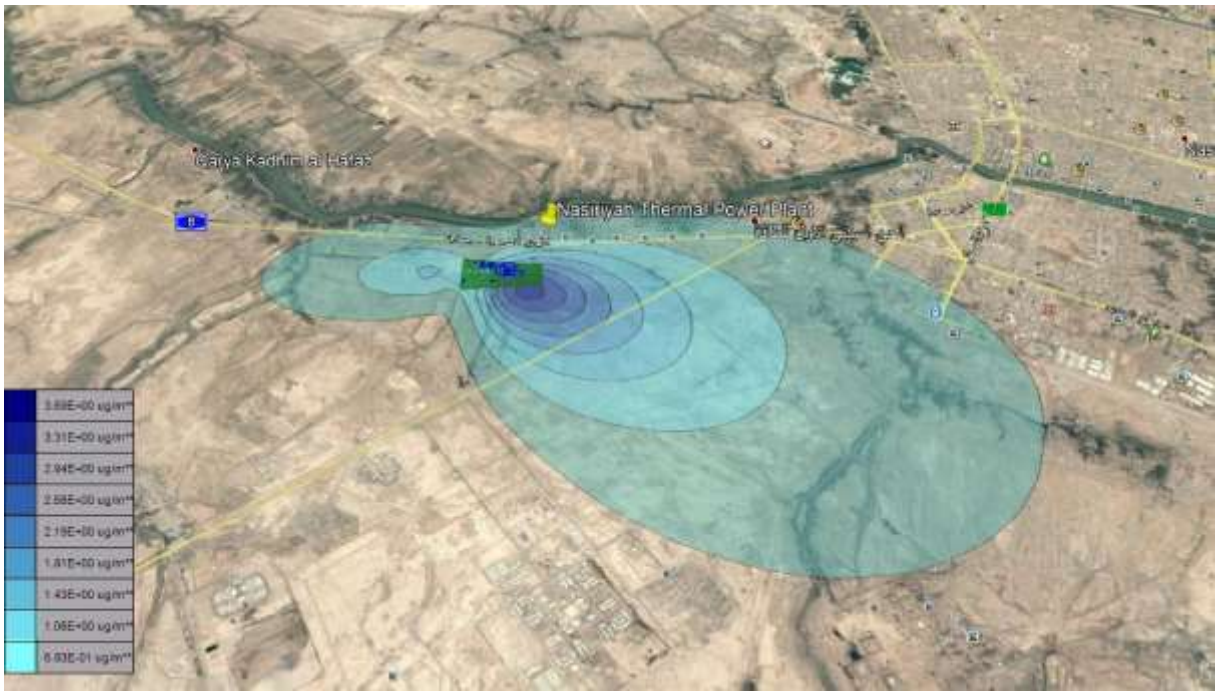


Figure 6-19 Dispersion Map of Annual NO_2 GLCs in case of Simple Cycle Operation for Utilization of Liquid Fuel (Scenario 3)

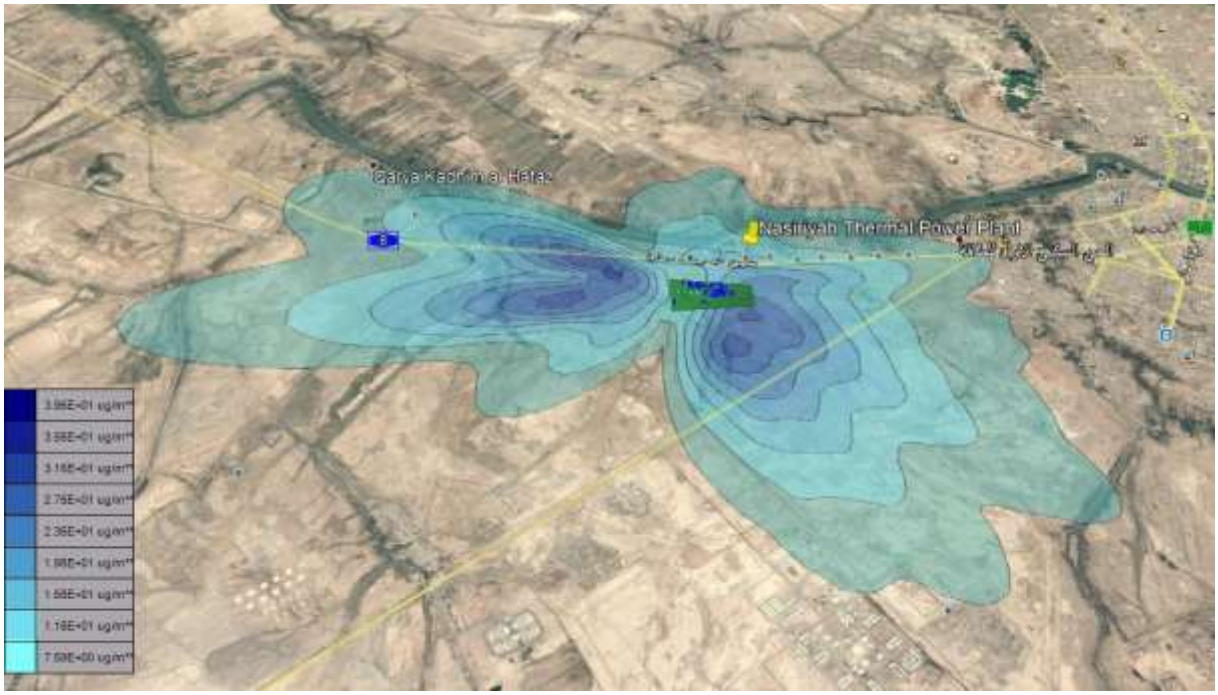


Figure 6-20 Dispersion Map of Daily SO_2 GLCs in case of Simple Cycle Operation for Utilization of Liquid Fuel (Scenario 3)

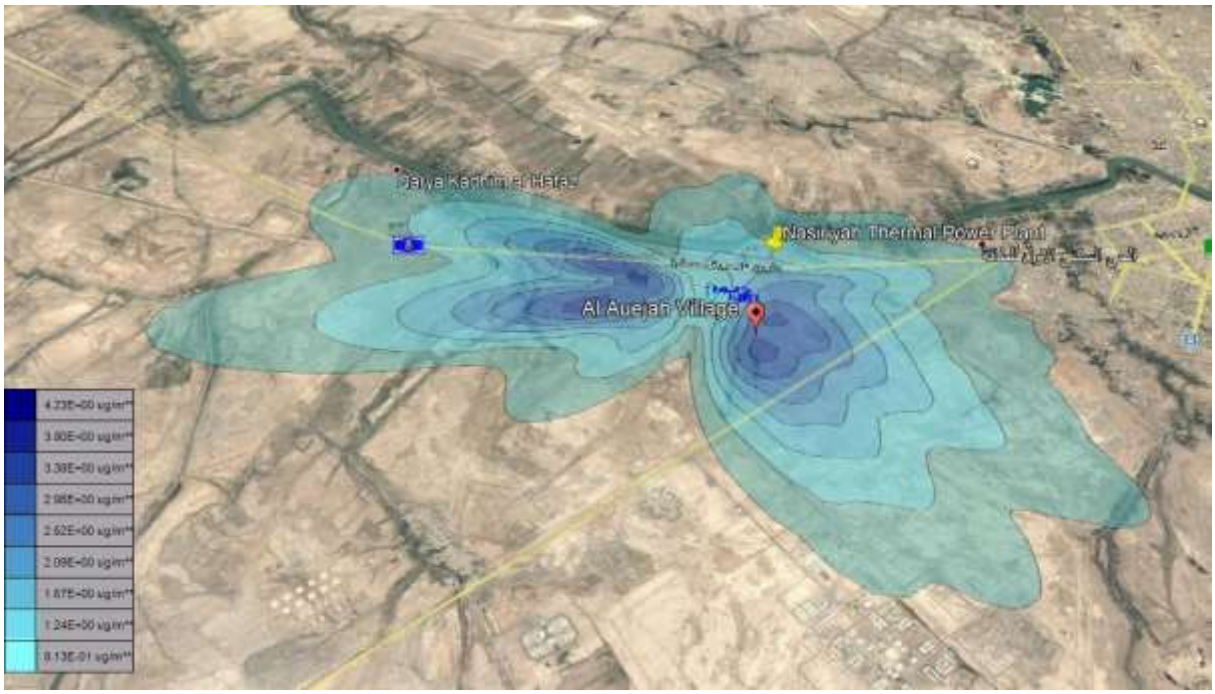


Figure 6-21 Dispersion Map of Daily PM_{10} GLCs in case of Simple Cycle Operation for Utilization of Liquid Fuel (Scenario 3)

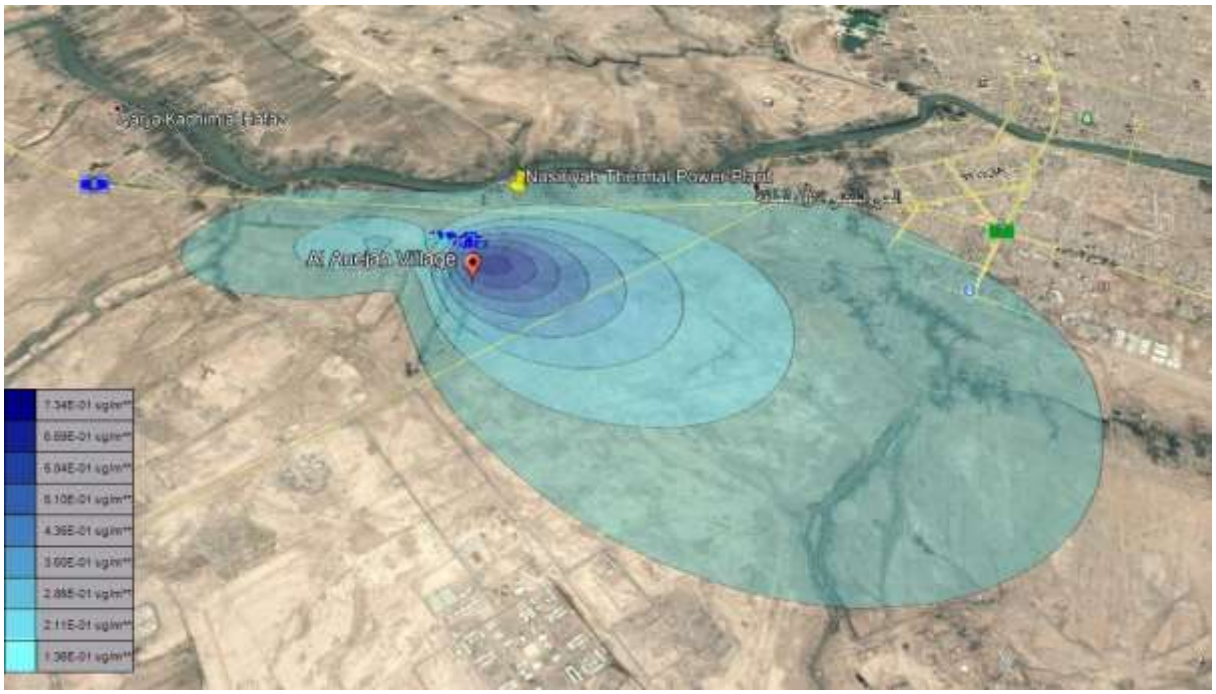


Figure 6-22 Dispersion Map of Annual PM_{10} GLCs in case of Simple Cycle Operation for Utilization of Liquid Fuel (Scenario 3)

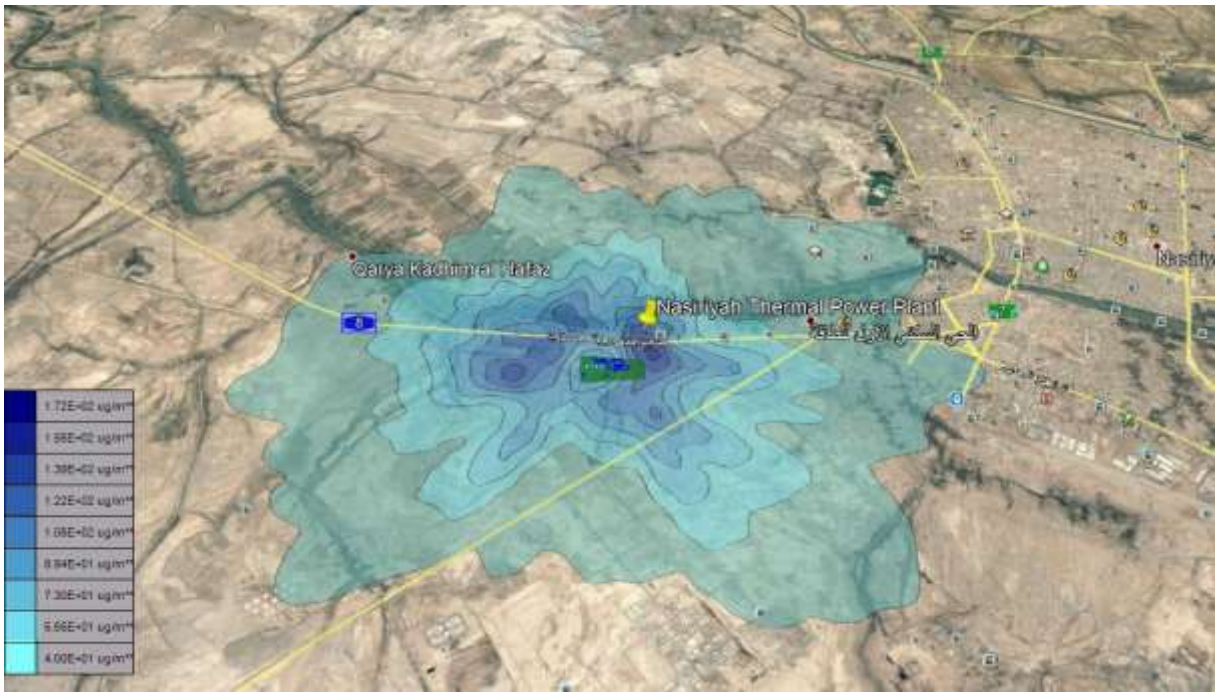


Figure 6-23 Dispersion Map of Hourly NO_2 GLCs in case of Combined Cycle Operation for Utilization of Liquid Fuel (Scenario 4)

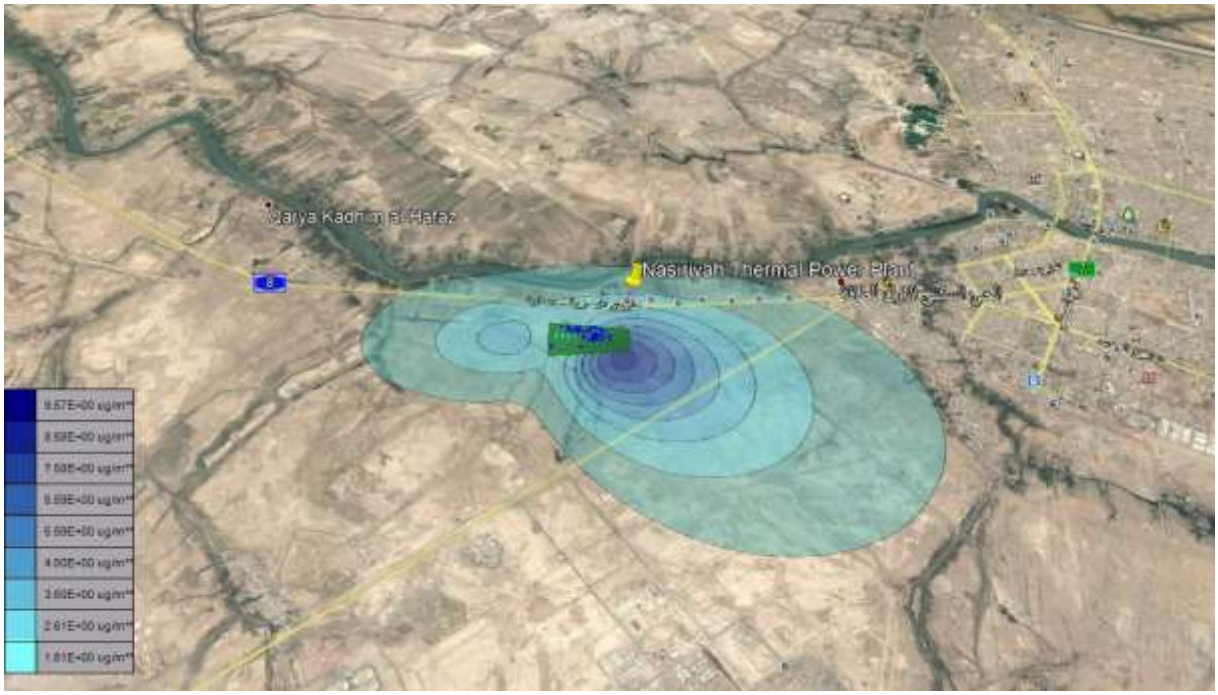


Figure 6-24 Dispersion Map of Annual NO_2 GLCs in case of Combined Cycle Operation for Utilization of Liquid Fuel (Scenario 4)

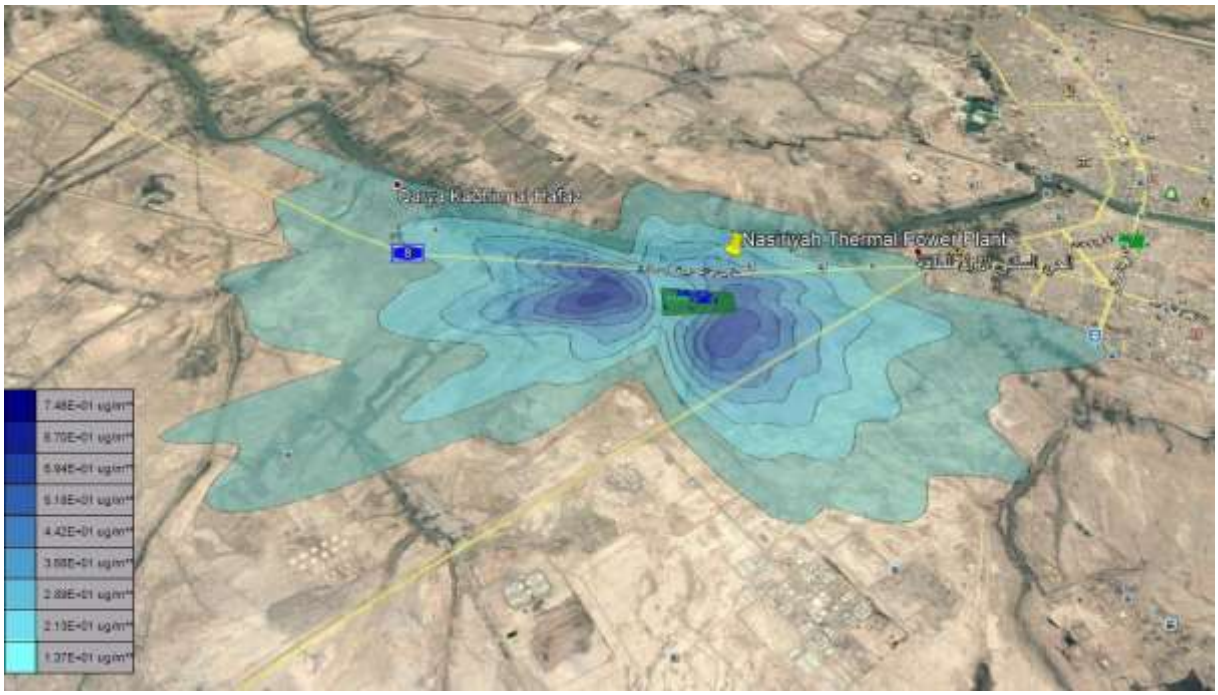


Figure 6-25 Dispersion Map of Daily SO_2 GLCs in case of Combined Cycle Operation for Utilization of Liquid Fuel (Scenario 4)

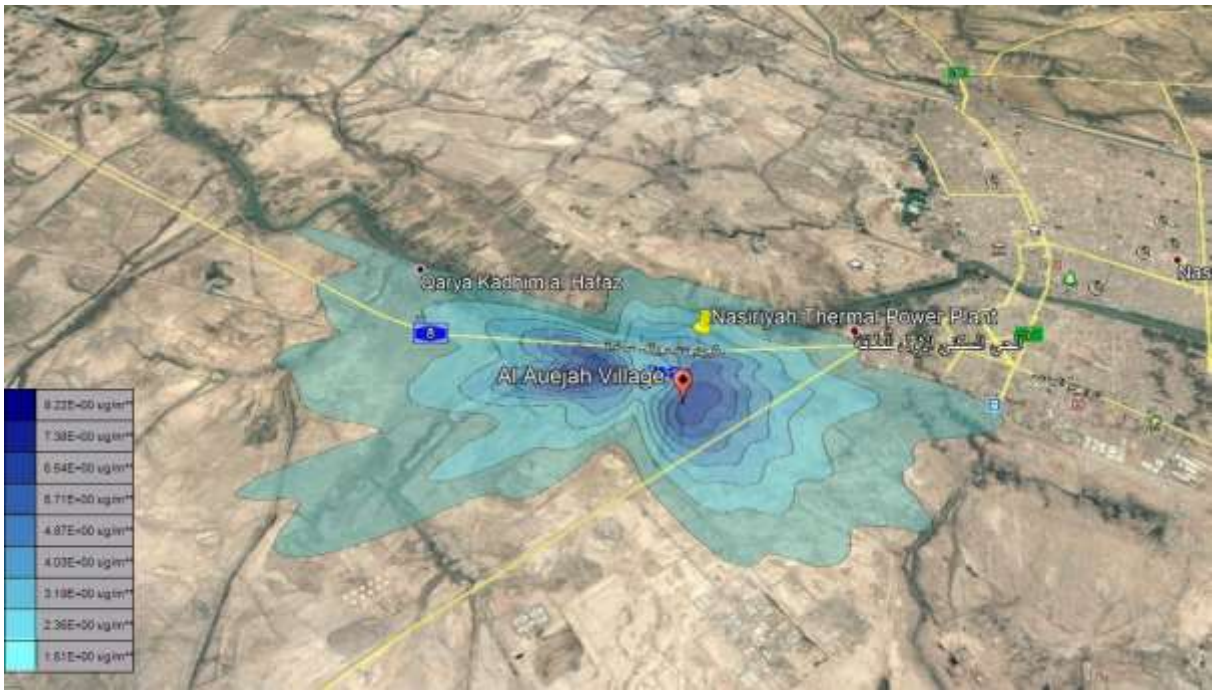


Figure 6-26 Dispersion Map of Daily PM_{10} GLCs in case of Combined Cycle Operation for Utilization of Liquid Fuel (Scenario 4)

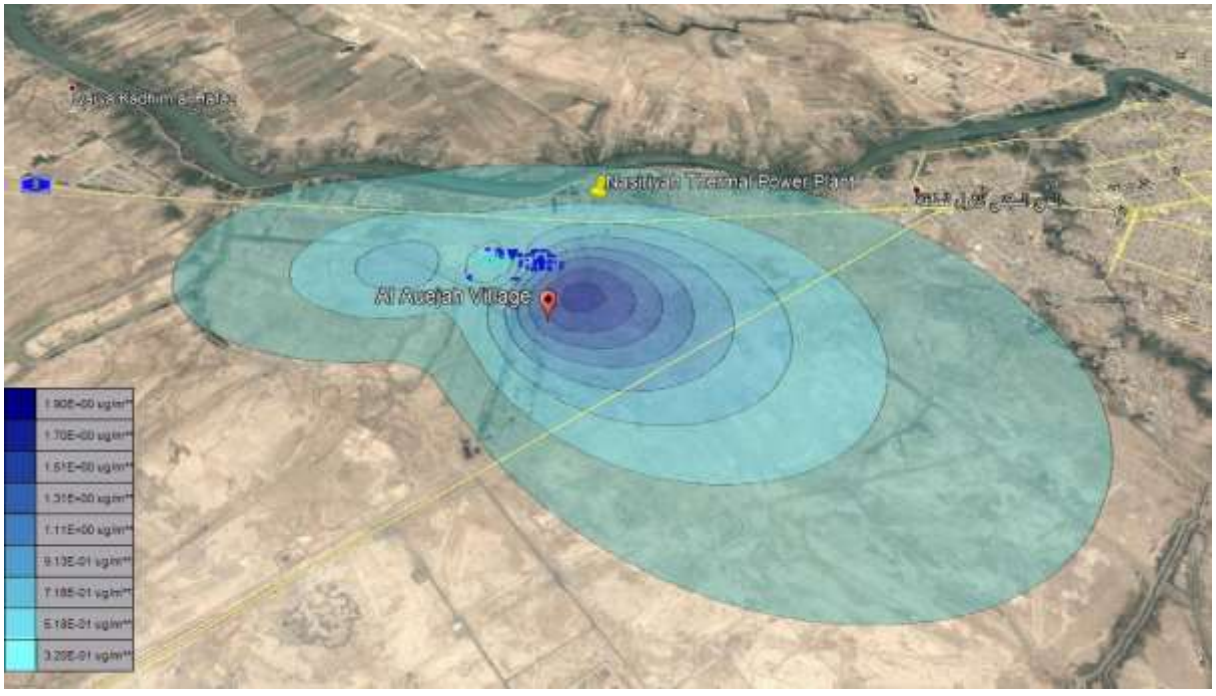


Figure 6-27 Dispersion Map of Annual PM_{10} GLCs in case of Combined Cycle Operation for Utilization of Liquid Fuel (Scenario 4)

According to the modelling results, NO_2 98 percentile GLCs for the utilization of natural gas are estimated to be in compliance with IFC requirements. Although natural gas will be the primary fuel, liquid fuel can be used until natural gas is provided for the Power Plant.

According to the modeling outputs although IFC limit values are complied with for both NO_2 and SO_2 for the utilization of liquid fuel; recommended values for sustainable air shed corresponding to 25% of the IFC limit values are exceeded. However the Project has secured an official letter from the MoE on November 23, 2017 confirming that natural gas would be the primary fuel and the back-up fuel will be CO and LDO for Dhi-Qar CCGT Power Plant, upon the meeting with the GPPP. Besides, the plant will be equipped with low-NO_x combustion technology to minimize NO_x emissions in order to comply with the required emission standards.

The GLCs of NO_2, SO_2 and PM_{10} calculated by the modelling studies at each passive sampling location are also provided below in Table 6-8.

Table 6-8 GLCs of NO_2, SO_2 and PM_{10} calculated by the Modelling Studies at Each Passive Sampling Location in the cases of Simple Cycle and Combined Cycle Operations for Utilization of the Primary Fuel (Natural Gas) and Back-up Fuel (Liquid Fuel)

No	Passive Sample Codes	Passive Sampling Locations	Coordinates (UTM Zone 38R)	Ground Level Concentrations (µg/m³)																
				Simple Cycle Mode with Natural Gas Scenario-1		Combined Cycle Mode with Natural Gas Scenario-2		Simple Cycle Mode with Liquid Fuel Scenario-3							Combined Cycle Mode with Liquid Fuel Scenario-4						
											PM10 Emission Conc. of 7 mg/Nm³ (2.3254 g/s)*		PM10 Emission of 30 mg/Nm³ (9.966 g/s)					PM10 Emission Conc. of 7 mg/Nm³ (2.3905 g/s)		PM10 Emission Conc. of 30 mg/Nm³ (10.245 g/s)	
				1-hour NO2 (µg/m³)	1-year NO2 (µg/m³)	1-hour NO2 (µg/m³)	1-year NO2 (µg/m³)	1-hour NO2 (µg/m³)	1-year NO2 (µg/m³)	24-hour SO2 (µg/m³)	24-hour PM10 (µg/m³)	1-year PM10 (µg/m³)	24-hour PM10 (µg/m³)	1-year PM10 (µg/m³)	1-hour NO2 (µg/m³)	1-year NO2 (µg/m³)	24-hour SO2 (µg/m³)	24-hour PM10 (µg/m³)	1-year PM10 (µg/m³)	24-hour PM10 (µg/m³)	1-year PM10 (µg/m³)
1	DT-1	Power Plant	E: 613260; N: 3433531	13.15	0.81	25.15	1.49	38.98	2.40	18.47	0.42	0.11	1.79	0.48	74.59	4.43	33.73	0.75	0.21	3.22	0.88
2	DT-2	Auejah Village	E: 613394; N: 3433020	20.75	0.95	41.35	2.58	61.55	2.82	31.86	0.61	0.13	2.60	0.56	122.63	7.66	65.21	1.40	0.35	6.03	1.52
3	DT-3	Al-Sadah Village	E: 612948; N: 3433959	14.95	0.30	32.39	0.96	44.32	0.88	16.01	0.17	0.04	0.73	0.18	96.06	2.85	39.41	0.55	0.13	2.38	0.57
4	DT-4	Musuvet Village	E: 610794; N: 3430768	8.93	0.09	15.06	0.15	26.46	0.27	5.14	0.08	0.01	0.32	0.05	44.67	0.44	9.49	0.11	0.02	0.47	0.09
5	DT-5	Selam Village	E: 618402; N: 3429758	6.48	0.20	10.02	0.30	19.24	0.59	4.87	0.10	0.03	0.43	0.12	29.72	0.90	8.13	0.15	0.04	0.66	0.18
6	DT-6	Al-Agır (Nasiriye) Village	E: 615671; N: 3433238	8.60	0.37	21.61	0.71	25.50	1.08	8.35	0.17	0.05	0.75	0.22	64.09	2.10	24.07	0.32	0.10	1.37	0.42
7	DT-7	Water Intake Location	E: 613326; N: 3434276	20.18	0.23	33.06	0.75	59.76	0.69	14.94	0.18	0.03	0.78	0.14	98.05	2.22	35.72	0.56	0.10	2.40	0.44
8	DT-8	Al-Sadah Village	E: 610192; N: 3434490	10.46	0.16	18.39	0.31	31.06	0.47	13.35	0.12	0.02	0.52	0.09	54.53	0.92	24.56	0.24	0.04	1.04	0.18
9	DT-9	Al-Mahmud Village	E: 614059; N: 3434844	22.65	0.18	25.47	0.43	67.24	0.54	7.59	0.13	0.02	0.56	0.11	75.53	1.27	17.15	0.31	0.06	1.32	0.25
10	DT-10	Muhammaddeen Mersion	E: 608273; N: 3433794	7.46	0.13	11.35	0.22	22.14	0.38	7.15	0.11	0.02	0.50	0.08	33.66	0.64	14.78	0.22	0.03	0.96	0.13
Limit Value (IFC EHS Guideline) (µg/m³)				200 (50 is 25% IFC recommendation for sustainable air shed)	40	200 (50 is 25% IFC recommendation for sustainable air shed)	40	200 (50 is 25% IFC recommendation for sustainable air shed)	40	125 (31 is 25% IFC recommendation for sustainable air shed)	50	20	50	20	200 (50 is 25% IFC recommendation for sustainable air shed)	40	125 (31 is 25% IFC recommendation for sustainable air shed)	50	20	50	20

*: The maximum value in the range of dust emissions to air from gas-oil-fired gas turbines with water or steam addition, as defined in the Best Available Techniques (BAT) Reference Document for Large Combustion Plants (June 2016)

Greenhouse Emissions

The GHG emissions to be originated from the proposed Power Plant are calculated by using the equations and emission factors defined by the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. The following equation is defined for the calculation of the GHG emissions from stationary combustion (i.e. gas turbines).

$Emissions_{GHG, fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG, fuel}$

$Emissions_{GHG, fuel}$: Emissions of a given GHG by type of fuel (kg GHG)
$Fuel\ Consumption_{fuel}$: Amount of fuel combusted (TJ)
$Emission\ Factor_{GHG, fuel}$: Default emission factor of a given GHG by type of fuel (kg GHG/TJ). For CO_2, it includes the carbon oxidation factor, assumed to be 1.

The primary fuel for the Project will be natural gas. The required natural gas flow will be about 145 tons/hour. Hereby, the total annual natural gas consumption of the proposed Power Plant is estimated as 1.270.200 tons/year.

The default emission factors for stationary combustion of natural gas in the energy industries are defined in Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories on a net calorific basis as provided in below.

Table 6-9 Default Emission Factors for Stationary Combustion of Natural Gas in the Energy Industries

Fuel	Default Emission Factors for Stationary Combustion in the Energy Industries (kg of greenhouse gases per TJ on a net calorific basis)		
	CO_2	CH_4	N_2O
Natural Gas	56.100	1	0.1

Provided that the estimated total annual natural gas consumption of the proposed Power Plant is 1.270.200 tons/year, the calculated density of natural gas is 0.0505 lbs/scu.ft and the calculated net calorific value of natural gas is 9.325.47 kcal/m^3, the net annual heat input will be about:

1.270.200 tons/year * 9.325.47 kcal/m^3 * 1/0.0505 scu.ft/lbs * 2.204.6226lbs/ton * 0.028316847 m^3/cu.ft * 4.186.8 joules/kcal * 10^{-12} TJ/joule = 61.307.39 TJ/year

Accordingly. the amounts of the GHG emissions will be calculated as follows:

Amount of the CO_2 Emissions = 56.100 kg CO_2/TJ * 61.307.39 TJ/year

= 3.439.344.579 kg CO_2/year

Amount of the CH_4 Emissions = 1 kg CH_4/TJ * 61.307.39 TJ/year

= 61.307.39 kg CH_4/year

Amount of the N_2O Emissions = 0.1 kg N_2O/TJ * 61.307.39 TJ/year

= 6.130.739 kg N_2O/year

In order to calculate the amount of the total GHG emissions, the CH_4 and N_2O emissions have to be converted to the CO_2 equivalent units. 1 kg CH_4 is equivalent to 21 kg CO_2 while 1 kg N_2O is equivalent to 310 kg CO_2. Considering this information, the amount of the total GHG emissions are calculated as follows:

Amount of the total GHG emissions = CO_2 eq. of CO_2 emissions + CO_2 eq. of CH_4 emissions + CO_2 eq. of N_2O emissions

Amount of the total GHG emissions = 3.439.344.579 kg CO_2 eq./year + (61.307.39 * 21) kg CO_2 eq./year + (6.130.739 x 310) kg CO_2 eq./year

= 3.442.532.563 kg CO_2 eq./year

The amount of the total GHG emissions to be originated from the stacks of the Power Plant is estimated at approximately 3.44 megatons CO_2 eq. per year in case of utilization of natural gas.

As mentioned above, light distillate oil (LDO) will be utilized as a secondary fuel. The amount of the total GHG emissions to be originated from the stacks of the Power Plant in the case of utilization of LDO is estimated as follows.

The daily LDO consumption will be around 25.000 oil barrels (3.974.682 liters). Hereby the total annual LDO consumption of the proposed Power Plant is estimated as 82.805.875 liters. Given that LDO will be utilized for 500 hours per year at most, to be excluded from the limits of the IFC EHS Guidelines for Thermal Power Plants.

The default emission factors for stationary combustion of motor gasoline in the energy industries which are defined in Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories on a net calorific basis are taken for light distillate oil as motor gasoline is one of the light distillates.

Table 6-10 Default Emission Factors for Stationary Combustion of Motor Gasoline in the Energy Industries

Fuel	Default Emission Factors for Stationary Combustion in the Energy Industries (kg of greenhouse gases per TJ on a net calorific basis)		
	CO_2	CH_4	N_2O
Motor Gasoline	69.300	3	0.6

Provided that the estimated total annual LDO consumption of the proposed Power Plant is 82.805.875 liters the density of LDO is 0.83077 kg/l and the gross calorific value of LDO is

10.800 kcal/kg, net annual heat input will be about:

82.805.875 l/year * 0.83077 kg/l * 10.800 kcal/kg *4.186.8 joules/kcal * 10^{-12} TJ/joule = 3.110.6 TJ/year

Accordingly the amount of the GHG emissions will be calculated as follows:

Amount of the CO_2 Emissions = 69.300 kg CO_2/TJ * 3.110.6 TJ/year

= 215.564.580 kg CO_2/year

Amount of the CH_4 Emissions = 3 kg CH_4/TJ * 3.110.6 TJ/year

= 9.331.8 kg CH_4/year

Amount of the N_2O Emissions = 0.6 kg N_2O/TJ * 3.110.6 TJ/year

= 1.866.4 kg N_2O/year

In order to calculate the amount of the total GHG emissions the CH_4 and N_2O emissions have to be converted to the CO_2 equivalent units. 1 kg CH_4 is equivalent to 21 kg CO_2 while 1 kg N_2O is equivalent to 310 kg CO_2. Considering this information the amount of the total GHG emissions are calculated as follows:

Amount of the total GHG emissions = CO_2 eq. of CO_2 emissions + CO_2 eq. of CH_4 emissions + CO_2 eq. of N_2O emissions

Amount of the total GHG emissions = 215.564.580 kg CO_2/year + (9.331.8 * 21) kg CO_2 eq./year + (1.866.36 x 310) kg CO_2 eq./year

= 216.339.119 kg CO_2 eq./year

The amount of the total GHG emissions to be originated from the stacks of the Power Plant is estimated as approximately 0.216 megatons CO_2 eq. per year in case of utilization of light distillate oil.

The amount of the total GHG emissions to be originated from the stacks of the Power Plant is further estimated for utilization of crude oil (CO), which will also be a secondary fuel. The daily CO consumption will be around 25.500 barrels (4.054.176 liters). Hereby the total annual CO consumption of the proposed Power Plant is estimated as 84.462.000 liters. Given that CO will be utilized for 500 hours per year at most, to be excluded from the limits of the IFC EHS Guidelines for Thermal Power Plants.

The default emission factors for stationary combustion of crude oil in the energy industries, which are defined in Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories on a net calorific basis, are provided below.

Table 6-11 Default Emission Factors for Stationary Combustion of Crude Oil in the Energy Industries

Fuel	Default Emission Factors for Stationary Combustion in the Energy Industries (kg of greenhouse gases per TJ on a net calorific basis)		
	CO_2	CH_4	N_2O
Crude Oil	73.300	3	0.6

Provided that the estimated total annual CO consumption of the proposed Power Plant is 84.462.000 liters the density of CO is 0.8875 kg/l and the gross heat of combustion of CO is 43.713 MJ/kg the net annual heat input will be about:

84.462.000 l/year * 0.8875 kg/l * 43.713 MJ/kg * 10^{-6} TJ/MJ = 3.276.7 TJ/year

Amount of the CO_2 Emissions = 73.300 kg CO_2/TJ * 3.276.7 TJ/year

= 240.182.110 kg CO_2/year

Amount of the CH_4 Emissions = 3 kg CH_4/TJ * 3.276.7 TJ/year

= 9.830.1 kg CH_4/year

Amount of the N_2O Emissions = 0.6 kg N_2O/TJ * 3.276.7 TJ/year

= 1.966 kg N_2O/year

In order to calculate the amount of the total GHG emissions the CH_4 and N_2O emissions have to be converted to the CO_2 equivalent units. 1 kg CH_4 is equivalent to 21 kg CO_2 while 1 kg N_2O is equivalent to 310 kg CO_2. Considering this information the amount of the total GHG emissions are calculated as follows:

Amount of the total GHG emissions = CO_2 eq. of CO_2 emissions + CO_2 eq. of CH_4 emissions + CO_2 eq. of N_2O emissions

Amount of the total GHG emissions = 240.182.110 kg CO_2/year + (9.830.1 * 21) kg CO_2 eq./year + (1.966 x 310) kg CO_2 eq./year

= 240.998.002 kg CO_2 eq./year

The amount of the total GHG emissions to be originated from the stacks of the Power Plant is estimated at approximately 0.241 megatons CO_2 eq. per year in case of utilization of crude oil.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact from air emissions from the stacks of the Power Plant.				
Receptor Sensitivity	Very Low	**High**	Medium	Low	
	There are 4 settlements within a 5 km radius of the Project site, which are namely Auejah (0.5 km), Al-Mahmud (1.5 km), Al-Agir (2 km), and Al-Sadah (2.5 km).				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase of the Project.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected at the Project site and environs.				
Magnitude	Negligible	Low	Medium	**High**	
	Magnitude is expected to be high since impact extent is local and impact will be during the entire operation phase. IFC limits are complied with during natural gas utilization but exceedance occurs during utilization of liquid fuel.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	Impact is certain if no mitigation measure is taken.				
Impact Significance	Insignificant	Low	Medium	**High**	
	Impact is expected to be medium				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact reversibility is medium.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Mitigation Measures

Natural gas will be utilized as primary fuel for power generation. Water injection will be applied for the Low-NOx combustion technology to minimize NOx emissions in order to comply with the required emission standards. The water with 127 m^3/hour flow rate for water injection of the system will be supplied from Euphrates River.

Continuous emission monitoring system for NO_2, SO_2 and CO as well as O_2 as reference variable will be installed in order to measure the pollutant levels from the stacks. Ambient air monitoring will also be conducted periodically in order to ensure the limits are complied with.

Additional emission abatement methods such as load reduction by shutting down one or more GTs during seasons which can lead to high emission concentrations based on monitoring data (from in-stack measurements and ambient air quality monitoring within the AoI); will be evaluated during liquid fuel combustion for the operation of the plant.

GHG emissions inventory will be prepared annually to monitor GHG emissions from the Project. Preventive maintenance will be implemented for power generators to ensure combustion efficiency.

Impact assessment table after mitigation is provided below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact from air emissions from the stacks of the Power Plant.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	There are 4 settlements within a 5 km radius of the Project site, which are namely Auejah (0.5 km), Al-Mahmud (1.5 km), Al-Agir (2 km), and Al-Sadah (2.5 km).				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase of the Project.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected at the Project site and environs.				
Magnitude	Negligible	Low	**Medium**	High	
	Magnitude is expected to be medium since IFC limits are complied with during natural gas utilization.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Impact is not likely to occur with the given mitigation measures.				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact is expected to be low				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact reversibility is medium.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

6.3.2 Noise

6.3.2.1 Construction Phase

Noise will be generated inevitably during the construction phase mainly due to transportation of construction material and operation of construction equipment. Noise level at a receptor depends on number and type of equipment used distance between noise source and receptor and level of attenuation likely due to ground absorption air absorption and barrier effects.

Construction noise generated from the Power Plant has been calculated regarding the sound levels of construction equipment which are provided below in

Table **6-12**.

Table 6-12 Construction Equipment Sound Power Level

Equipment Type	Number of Equipment	Sound Power Level (dBA)*
Jeep 4x4 (Pickup Truck)	2	75
Truck Mixer	6	79
Concrete Pump Truck Mounted	2	81
Concrete Mixing Plant** (Concrete Batch Plant)	1	83
Crawler Excavator	2	81
Wheeled Excavator	1	81
Wheel Loader	2	79
Skid Steer Loader	2	79
Backhoe Loader	2	79
Boom Truck	5	76
Dump Truck	3	76
Fire Fighting Truck	1	76
Sewage Vacuum Truck	1	76
Garbage Truck	1	76
Truck Tractor**	3	84
Water Truck	2	76
Agricultural Tractor**	3	84
Compactor	5	83
Fork Lift	1	75
Generator	12	81
Vibration Roller	2	80
Air Compressor	7	78
Rough Terrain Crane	6	81
All Terrain Crane	8	81
Crawler Crane	4	81
Telehandler	2	79
Man Lift – 20 mt	2	75
Man Lift – 26 mt	6	75
Man Lift – 33 mt	5	75
Man Lift – 43 mt	5	75
Man Lift Scissors – 12 mt	2	75
Steel Bar Bending Machine**	3	80
Steel Bar Cutting Machine	3	80
Drilling Rig	3	84
Vibratory Hammer with Powerpack (Vibratory Pile Driver)	3	101
Piling Rig	1	101

Equipment Type	Number of Equipment	Sound Power Level (dBA)*
(Impact Pile Driver)		
Light Tower (Torch)	4	74

** Actual measured L_{max} (dBA) at 50 feet (~15.24 m) from source. Data from the Construction Noise Handbook prepared for the U.S. Department of Transportation. Federal Highway Administration (https://www.fhwa.dot.gov/ENVIRonment/noise/construction_noise/handbook/handbook09.cfm).*

*** Spec. 721.560 Lmax at 50 feet (~15.24 m) from source*

Total sound power level generated from multiple machinery is calculated using the below formula (1):

$$10 \text{ Log } \sum_{i=1}^{n} 10^{Lpi/10} \quad (1)$$

According to the calculation the total sound power level of the construction machinery and equipment is calculated as 107.89 dBA at the Plant.

Sound power level at different distances from the source is also calculated according to the formula (2) below:

$$L_{eq} = L_{Wt} + 10\log\frac{Q}{4\pi r^2} \quad (2)$$

where

- Leq: Equivalent sound level;
- Lwt: Sound power level;
- Q: Directional Coefficient (taken as 2);
- r: Distance from source.

Here atmospheric absorbance and geographical and artificial barriers (buildings etc.) are omitted to consider the worst-case. Also it is assumed that all the machinery is working at the same point and at the same time. Equivalent sound level resulting from the Power Plant site with respect to distance is presented in Table 6-13 and Figure 6-28.

Table 6-13 Sound Level with Respect to Distance during Construction

Distance (m)	Equivalent Sound Level (Leq)
0	107.89
50	65.93
100	59.91
200	53.89
300	50.37
400	47.87
500	45.93

Distance (m)	Equivalent Sound Level (Leq)
550	45.10
600	44.35
700	43.01
800	41.85
900	40.82
1000	39.91
1250	37.97
1500	36.39
1750	35.05
2000	33.89

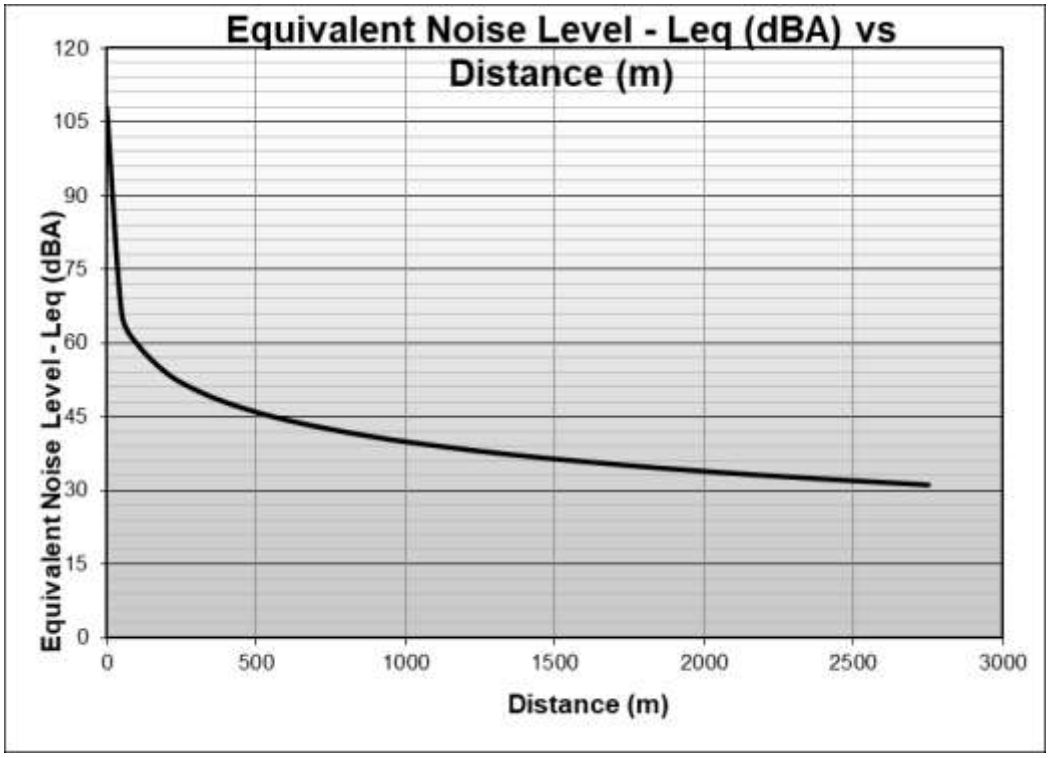


Figure 6-28 Equivalent Sound Level with Respect to Distance during Construction

IFC noise level standard at night time is 45 dBA. As seen in the calculations sound level decreases to 45.93 dBA after 500 m from the Power Plant and slightly above the nighttime limit value. As mentioned before noise levels are calculated for the worst case scenario assuming that all the machinery is working at the same point and at the same time. Therefore during construction noise levels are expected to be lower and adverse impact is not expected at Auejah Village at a distance of 500 m which is the closest settlement to the Project site.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-Noise generated by construction activities.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	Residents of Aujeah (as being the closest settlement to the Project Site) have medium sensitivity.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	Project Area	**Local**	Regional	National	
	Noise level is 45.93 dBA at the closest receptor where the night time IFC standard is 45 dBA for worst case conditions.				
Magnitude	Negligible	**Low**	Medium	High	
	Noise level is below 45 dBA which is the night time IFC standard after 600 m from the Project site for worst case conditions.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	The impact is likely to occur if no mitigation measure is taken.				
Impact Significance	Insignificant	**Low**	Medium	High	
	The significance of the impact is expected to be low.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	The impact is expected to have medium reversibility.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Mitigation Measures

Although noise impact is expected to be negligible at the closest settlement good site working practices will be implemented during construction activities and noise control measures will be adopted where necessary i.e. maintenance of construction equipment will be conducted regularly number of equipment operating simultaneously will be minimized as practical exhaust mufflers will be applied to the equipment in order to minimize noise emissions and also speed limit of 30 km/h will be implemented for the vehicles at the construction site and access road. Noise generating activities will not be conducted during night-time in order to prevent disturbance to the local communities. If any compliance is received, noise measurements will be conducted at the closest sensitive receptor.

Noise mitigation measures will also include wearing of the proper personal protective equipment (PPE) by workers. Personal protective equipment (PPE), such as earplugs and earmuffs, will be used as a last resort after all efforts to eliminate or reduce the source of the noise have been exhausted. Issues to take into account when using PPE include:

- making sure the PPE chosen is appropriate for the type and duration of the noise — it should also be compatible with other protective equipment;
- workers should have a choice of suitable hearing protection so they can select the most comfortable solution;

- many workers, such as drivers, need communication earmuffs or headsets, often with active noise cancellation (ANC) to ensure clear communication and minimise accident risks;
- the PPE should be correctly stored and maintained; and
- training should be given on why the PPE is necessary, how it should be used, and how to store and maintain it (European Agency for Safety and Health at Work, 2005).

An effective hearing conservation program should be implemented in the construction site when exposures exceed 90 dBA for an 8 hour exposure. This program strives to prevent initial occupational hearing loss, preserve and protect remaining hearing, and equip workers with the knowledge and hearing protection devices necessary to protect them (Occupational Safety and Health Administration, U.S. Department of Labor).

Residual Impacts

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

6.3.2.2 Operation Phase

There will be noise generated during the operation phase of the Power Plant mainly due to ACC, HRSG, turbines, generators and cooler fans.

In order to assess the noise impacts for operation phase noise modelling has been conducted using the IMMI v2011-2 software. Ground topography and building information as well as meteorological data were considered in order to develop noise level mapping.

Operation noise generated from the Power Plant has been calculated regarding the sound levels of operation equipment which are provided below in Table 6-14.

Table 6-14 Operation Equipment Sound Power Level

Source	A-Weighted Sound Power Level Lw(dBA)	
	Inside Buildings	Transmission Loss
STG Building	110	20
Connection between HRSG and STG	85	-
Outside Buildings		
HRSG	55	
HRSG Stacks	53.5	
HRSG Stacks Top	69.3	
Main Transformer	64.5	
ACC	85	
Fin Fan Coolers	93.8	
Condensate Pump	76.9	

Some of the noise sources such as steam turbine, steam turbine generator and air compressors are located inside the buildings. Gas turbines and gas turbine generators have enclosures. The ACC is expected to be the major noise source of the Power Plant.

According to the calculation equivalent sound level resulting from operation of the Power Plant is provided below in Table 6-15 and Figure 6-29 and Figure 6-30.

Table 6-15 Sound Level with Respect to Distance during Operation

Noise Reeptor Locations	Distance (m)	Ldaytime (LdBA)	Lnighttime (LdBA)
Qarya Kadhim El Hafa	2400	39.78	39.27
Nasiriyah	2100	37.22	37.24
Euphrates River	1278	44.63	45.84
Auejah	445	52.73	52.58
Al Sadah	245	59.57	59.56
Corner 1	0	63.53	63.38
Corner 2	0	53.76	53.67
Corner 3	0	65.93	61.09
Corner 4	0	52.87	52.45

Noise levels for daytime and nighttime are provided below in Figure 6-29 and Figure 6-30 respectively.

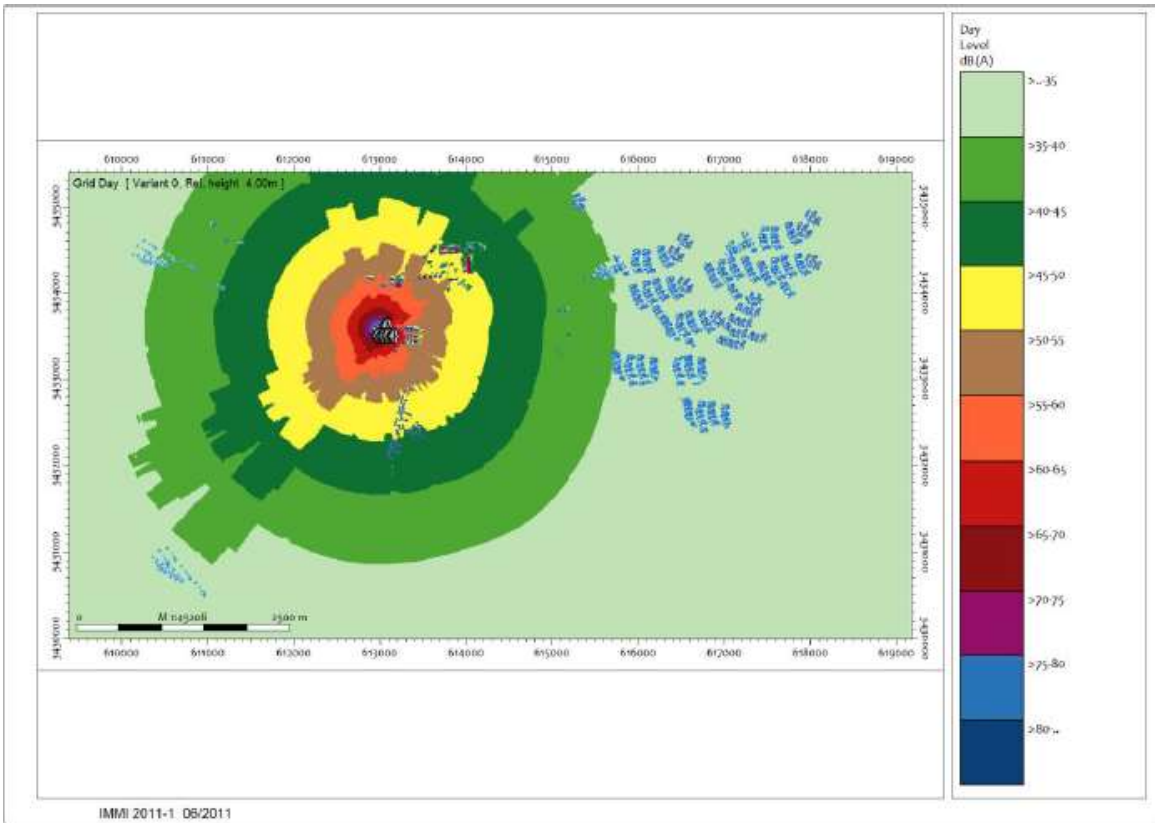


Figure 6-29 Noise Map for Daytime

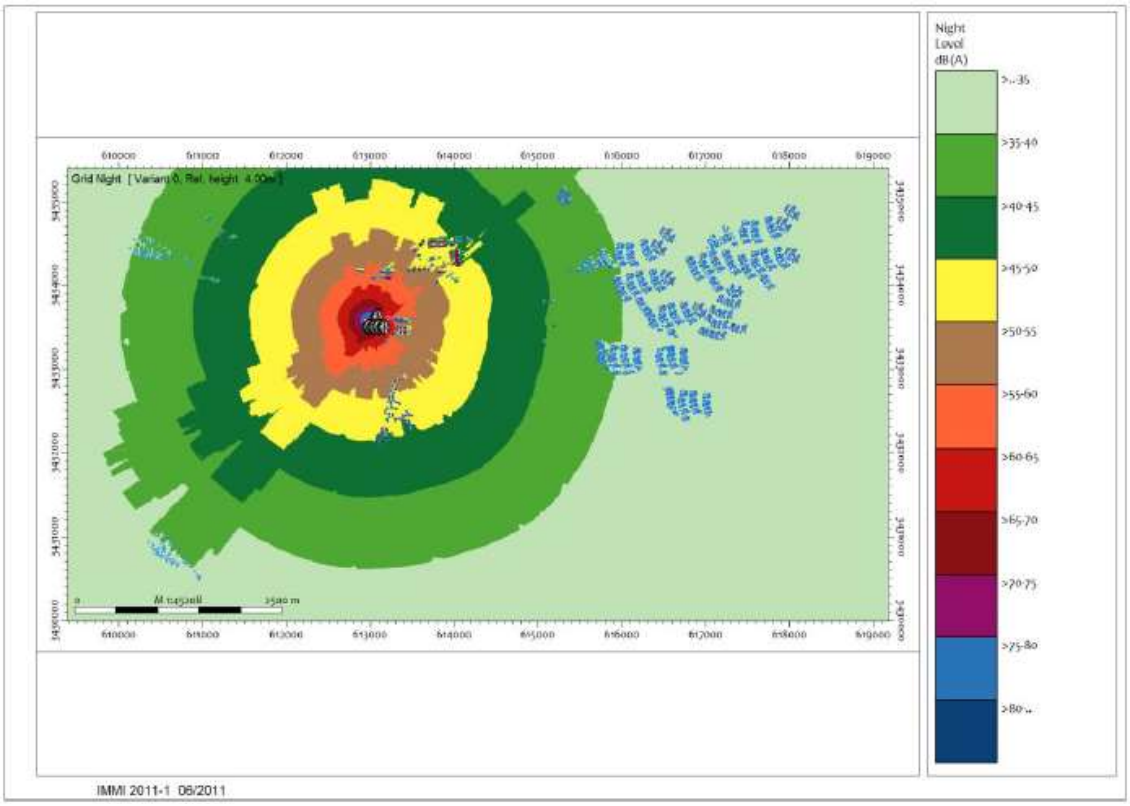


Figure 6-30 Noise Map for Nighttime

IFC guidelines suggest that the 45 dBA and 55 dBA for nighttime and daytime respectively should not be exceeded or noise levels should result in a maximum increase of 3 dBA in background levels at the nearest receptor location off-site. As can be seen in Table below the increase in background noise levels is below 3 dBA at Auejah but 3.10 dBA and 3.34 dBA for daytime and nighttime at Al Sadah village.

Table 6-16 Baseline Noise Measurement and Noise Modelling Results

Noise Receptor Locations	Average Measurement Results (dBA)		Predicted Project Noise Only (dBA)		IFC Limits (increase of 3 dBA in background levels) (dBA)		Cumulative Noise (dBA)	
	Lday	Lnight	Lday	Lnight	Lday	Lnight	Lday	Lnight
Al Sadah	58.90	58.92	59.07	59.56	61.90	61.92	62.00	62.26
Auejah	55.99	53.07	51.57	52.58	58.99	56.07	57.33	55.84
Corner 1	65.43	57.87	63.26	63.38	70	70	67.49	64.46
Corner 2	59.38	57.32	60.98	61.09	70	70	63.26	62.61
Corner 3	57.41	57.3	51.48	52.45	70	70	58.40	58.53
Corner 4	62.99	61.67	52.69	53.67	70	70	63.38	62.31

It was observed that ACC is the major noise source for the predicted noise levels at Al Sadah village.

Noise impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-Noise generated by the operation of gas turbines. HRSG, the steam turbine and generators.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	Residents of Al Sadah and Auejah Villages may experience slight noise impacts during the operation phase of the Project, without any mitigation measure is taken.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Operation phase.				
Impact Extent	Project Area	**Local**	Regional	National	
	Noise impact is local.				
Magnitude	Negligible	Low	**Medium**	High	
	Increase in background noise levels is slightly above 3 dBA at the nearest settlement.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	Impact is certain				
Impact Significance	Insignificant	Low	**Medium**	High	
	Noise impact is medium				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact on the receptors will not alter the existing life quality.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

Maintenance of noise generating equipment will be conducted regularly in order to prevent increased noise levels from equipment.

Silencers, mufflers or acoustic enclosures will be installed to reduce sound power level of noisy equipment.

Noise measurement will be conducted at the start of the operation in order to monitor noise levels at Al Sadah village. If exceedance from the limit values occurs acoustic barriers close to the source or to the receptor to minimize the transmission of sound will be installed.

Noise impact assessment table after mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-Noise generated by the operation of gas turbines. HRSG, the steam turbine and generators.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	Residents of Al Sadah and Auejah Villages are sensitive towards noise impacts.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Operation phase.				
Impact Extent	Project Area	**Local**	Regional	National	
	Noise impact is local.				

Magnitude	Negligible	**Low**	Medium	High	
	The magnitude is expected to be low as if exceedance from the limit values occurs acoustic barriers close to the source or to the receptor to minimize the transmission of sound will be installed.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Impact is not likely to occur				
Impact Significance	**Insignificant**	Low	Medium	High	
	Noise impact is insignificant				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact on the receptors will not alter the existing life quality.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

6.3.3 Water, Soil and Groundwater

6.3.3.1 Construction Phase

During construction phase of the Project, water will be mainly used for concrete curing. dust suppression landscaping purposes and for the use of domestic purposes by the construction personnel. Water required during construction phase will be obtained from the Euphrates River which is located approximately 1 km from the Project site. Water will be treated at the Water Treatment Plant which will be established within the Power Plant area before use for domestic purpose, WHO drinking water quality standards will be applied for drinking and potable water usage.

The water table level with respect to the Project Reference Level (RL = 0.00m) is at RL = 1.90 m for the Dhi-Qar Project. Therefore, dewatering will not be needed before construction of most shallow foundations. However, it will be temporarily (for a very short duration) needed during construction of the particular foundations that are below the water table level which are exceptional in the scope of the Project. The Project site is located in a remote area, therefore, there are not any non-project structures present that will be affected during construction. In case of the Project structures, it is evident that where necessary the sequence of construction will be scheduled for structures from deeper to shallower foundations in order to eliminate the potential impacts.

The number of construction personnel will vary during construction activities with the peak number of 1773. Water consumption of 1773 personnel during construction works will be as follows:

Water required: 220 l/person/day = 0.22 m^3/person/day

Total water requirement: 0.22 m^3/person/day x 1773 persons = 3090 m^3/day.

About 50 m^3/day of water is also estimated to be used for dust suppression.

Wastewater discharge and runoff may lead to contamination of surface water, soil and groundwater unless managed appropriately. Wastewater generated during construction activities will be due to domestic use of the personnel. Water consumption of the personnel is estimated be the amount of wastewater for construction phase. Wastewater generated from the construction activities will be discharged to Euphrates River after treatment at the Domestic Sewage Treatment Plant which will be established for the Project. Treated wastewater will comply with both Iraqi wastewater discharge limits and IFC EHS Guideline standards in order to prevent any contamination to Euphrates River.

During the construction phase maintenance of construction equipment or fuel refilling will occur at the plant area. Fuel and oil will also be stored within the Power Plant area. Fuel or oil spills during maintenance and any leak from fuel/oil storage tanks can cause contamination of soil and groundwater.

Impact assessment table before mitigation is provided below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact on Euphrates River, direct impact to soil and groundwater in case of oil spill.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Euphrates River has high sensitivity for water intake and discharge for Project purposes.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	Project Area	Local	**Regional**	National	
	Euphrates River is used by communities along the downstream part of the river				
Magnitude	Negligible	Low	Medium	**High**	
	Impact magnitude is high considering high sensitivity of Euphrates River.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Water intake and discharge are likely to have impact on Euphrates River				
Impact Significance	Insignificant	Low	Medium	**High**	
	Significance is high.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Reversibility of the impact is expected to be medium.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Mitigation Measures

Untreated wastewater discharge to the environment will be prohibited. Domestic wastewater will be discharged to Euphrates River after being treated at the Domestic Sewage Treatment Plant. The effluent quality will be monitored for compliance with both Iraqi wastewater discharge limits and IFC EHS Guideline standards in order to prevent any contamination to Euphrates River.

Drip pans will be used during maintenance activities and fuel refilling; also spill kits will be available at site in order to response immediately in case of emergency. Spill Response and Prevention Procedure which has been established will be implemented throughout the lifetime of the Project.

Fuel/oil storage tanks will be located on impermeable ground with secondary containment such as concrete berms with capacity larger than 110 percent of the largest tank in order to prevent any contamination to soil or groundwater in case of any spill or leakage.

Fuel storage tanks and chemical storage areas will be prevented from unauthorized access.

Oil/water separators will be installed to treat surface run-off from bunded areas before discharge to storm water system.

Impact assessment table after mitigation measures is provided below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact on Euphrates River, direct impact to soil and groundwater in case of oil spill.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Euphrates River has high sensitivity for water intake and discharge for Project purposes.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	Project Area	Local	**Regional**	National	
	Euphrates River is used by communities along the downstream part of the river				
Magnitude	Negligible	Low	Medium	**High**	
	Impact magnitude is high considering high sensitivity of Euphrates River.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Water intake and discharge will have impact on Euphrates River				
Impact Significance	Insignificant	Low	**Medium**	High	
	Significance is medium since discharge limits will be complied with.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Reversibility of the impact is expected to be medium.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Residual Impacts

The overall residual impact will be reduced minor to negligible with monitoring the measures and related management plans and practices put in place.

6.3.3.2 Operation Phase

Water will be required for domestic purposes of the personnel, as service water and as demineralized water for the boilers. HRGS and cooling system during the operation phase. Water balance diagram of the Project is provided in Appendix-K.

Water required during operation phase of the Project will also be supplied from the Euphrates River, WHO Drinking water quality standards will be complied with for drinking and potable water uses.

Water treatment plant will be established for the Project both for potable water and demineralized water for the process. There will be a storage tank of 120 m^3 for potable water within the plant site.

Demineralized water will be stored in water storage tank with a capacity of 11.520 m^3 within the Project site. There will also be a fire water storage tank with a capacity of 5.050 m^3 and raw water storage tank with a capacity of 7.200 m^3.

There will be three types of wastewater during operation phase of the Project: storm water process effluent and domestic sewage systems. Drainage systems for storm water sewage water chemical and oily water will be established within the plant area.

Domestic wastewater generated from the Project will be treated through Domestic Sewage Treatment Plant and collected in the plant storm/process water collection basin.

Storm water will be collected in plant storm/process water collection basin through drainage channels.

Oily Water Treatment Plant (OWTP) will be established for the Project for oil-contaminated wastewater generated during operations. The treatment plant will include an API Oil/Water Separation System and if required, also DAF type Oil/Water Separation and a Filtration Unit.

Oil-contaminated wastewater will mainly be generated during the maintenance of equipment and at tank storage areas. Oily water will be separated through the separator and effluent water will be transferred to storm/process water collection basin. The oil will be handled according to the hazardous waste management plan.

Clean fuel drains from skids will be collected in isolated pits and slop tanks. and will be trucked away by licensed companies. Clean fuel drains will not be mixed with oily water network or any other plant network.

Wastewater generated from the gas turbine operations, process water treatment plant and combined cycle plant equipment will be neutralized first and transferred to plant storm/process water collection basin.

Neutralized WTP discharge, storm water, treated domestic wastewater, separated water phase of oily water and HRSG blowdown will be mixed in plant storm/process water collection basin where temperature will be regulated with quench water from the river. Quench water will be used from the river where there is back ground Ammonia present. Therefore, there will be some Ammonia in the plant discharge water, however, it will not exceed the baseline value.

Discharge water will be monitored for flowrate, temperature, pH and provision for manual sampling will be provided.

According to the water balance diagram maximum flow rate of the plant effluent water discharge to the river is 1.130.18 m^3/hr. Discharge of treated wastewater from the collection basin will be at one location and from the surface to the Euphrates River.

It is stated in the Hydrological Study Report prepared for the Project that the average flow rate of the Euphrates River recorded between 2011 and 2017 in Nasiriyah city is 722.988 m^3/h, Compared with the average flow rate of the Euphrates River recorded between 2011 and 2017 in Nasiriyah city, the average flow rate of the raw water withdrawn from the Euphrates River as per the Water Balance Stream Flow Rate Table, which is 305.35 m^3/h as well as the maximum effluent flow rate of 1.130.18 m^3/h remains negligible. As the average flow rate of the Euphrates River is on the order of 1.000 times the plant effluent discharge to the River, no computational fluid dynamics modeling was conducted. The plant effluent is designed to be cooled down to 35°C and below before its discharge to the River as per the

related Iraqi legislation, therefore temperature rise around the discharge point would be negligible, certainly less than 3°C. It is also worth to mention that the maximum effluent flow rate of 1.130.18 m^3/h will only occur under storm conditions, whereas the normal discharge flow rate will be 135 to 230 m^3/h.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact on Euphrates River, direct impact to soil and groundwater in case of accidental spill or leaks.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Euphrates River has high sensitivity for water intake and discharge for Project purposes.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase				
Impact Extent	Project Area	Local	**Regional**	National	
	Euphrates River is used by communities along the downstream part of the river, although potential impact of accidental spill or leak is limited to the Project site footprint and gas pipeline.				
Magnitude	Negligible	Low	Medium	**High**	
	Impact magnitude is high considering the sensitivity of Euphrates River.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Water intake and discharge will have impact on Euphrates River				
Impact Significance	Insignificant	Low	Medium	**High**	
	Significance is high.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Reversibility of the impact is expected to be medium				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Mitigation Measures

Untreated wastewater discharge to the environment will be prohibited.

Drainage systems for storm water, sewage water, chemical and oily water will be established within the plant area in order to collect wastewater separately.

Domestic wastewater and industrial wastewater will be discharged to the Euphrates River after treatment at the Domestic Sewage Treatment Plant and Oily Water Treatment Plant.

The effluent quality will be monitored for compliance with both Iraqi wastewater discharge limits and IFC EHS Guideline standards in order to prevent any contamination to the Euphrates River.

Drip pans will be used during maintenance activities and fuel refilling; also spill kits will be available at site in order to respond immediately to spill events. Spill Response and Prevention Procedure will be implemented throughout the lifetime of the Project.

Emergency Response Plan will be developed for soil and groundwater clean-up and contamination.

Fuel/oil storage tanks will be located on impermeable ground with secondary containment in order to prevent any contamination to soil or groundwater in case of any spill or leakage. Secondary containment for the storage tanks will contain berms or dikes with capacity larger than 110 percent of the largest tank. Secondary containment will be impervious and chemically resistant.

Fuel storage tanks and chemical storage areas will be prevented from unauthorized access.

Oil/water separators will be installed to treat surface run-off from bunded areas before discharge to storm water system.

Impact assessment table after mitigation is provided below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact on Euphrates River, direct impact to soil and groundwater in case of oil spill.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Euphrates River has high sensitivity for water intake and discharge for Project purposes.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase				
Impact Extent	Project Area	Local	**Regional**	National	
	Euphrates River is used by communities along the downstream part of the river				
Magnitude	Negligible	Low	Medium	**High**	
	Impact magnitude is high considering the sensitivity of Euphrates River.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Impact is not likely.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Significance is medium since discharge limits will be complied with.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Reversibility of the impact is expected to be medium				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Residual Impacts

The overall residual impact will be reduced minor to negligible with monitoring the measures and related management plans and practices put in place.

6.3.4 Waste

6.3.4.1 Solid Wastes

6.3.4.1.1 Construction Phase

During the construction phase, non-hazardous waste such as domestic waste from the personnel, construction waste, packaging waste and excavated material is expected to be generated. Construction wastes are expected to be cables, scrap metal, empty containers, wooden materials, cement bags etc.

The peak number of workers will be about 1773 during the construction phase. Domestic waste generated by the personnel is estimated to be 450 to 750 kg/day during the peak construction time mainly generated at the camp site.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Soil and groundwater contamination is direct negative impact unless wastes are disposed properly.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The sensitivity of receptor is medium.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	**Project Area**	Local	Regional	National	
	Construction site				
Magnitude	Negligible	Low	**Medium**	High	
	Magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Occurrence of impact is likely if no mitigation measure taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	The impact significance is medium.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact of solid wastes is highly reversible.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

Wastes will be collected and stored separately according to their types. Training of the workers will be provided to reduce and reuse wastes generated. Domestic solid waste will be stored in closed leak proof containers in order to prevent any leakage to soil and also to prevent odor generation. Improper dumping of solid waste to the environment which can cause soil and groundwater contamination will be prevented. The Project will enter into a waste disposal services contract with the district authority for the arrangement of waste disposal from the Project.

A research has been done on the current situation of the waste management programs and disposal facilities in the southern region of Iraq. Nonetheless, the information available is not sufficient to provide information on the nature of the disposal facilities and opinion on their ability to meet the international standards. Information that has been found only covers the years between 2004 and 2011. With those results, a theoretical guess can be made about the current situation (Alnajjar. 2016). Between June 2007 and September 2007 United Nations Environment Program conducted a fieldwork in the southern region of Iraq including the Dhi-Qar Governorate about the solid waste practices and solid waste characteristics which found out that limited facilities were available for solid waste collection and transport. Furthermore, the results of the field survey showed that the outskirt areas did not have such

services and tended to dump their waste on the nearest available land. In addition, legal measures were found to be not enough for the management and handling of hazardous waste (Aoki,2009). On the other hand, a study carried out in 2016 states that solid waste programme for Dhi-Qar Governorate was being conducted by UNICEF and EU for Iraq's Sustainable Development Goals. However, these efforts still do not compensate the solid waste problem in Iraq in fact they only provide information and help people to understand the size of the problem (Alnajjar, 2016).

Vegetative topsoil stripped during site preparation will be stored separately to be used for landscaping purposes. Excavated material will also be stored at the site and will be used for backfilling during construction activities. Stored material will be covered or will be dampened to prevent dust generation. Topsoil will be covered to prevent erosion during temporary storage.

A Waste Management Plan as part of HSE Management has been developed for the Project. The plan will be implemented for the collection, storage and disposal of wastes.

Impact assessment table after mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Soil and groundwater contamination is direct negative impact unless wastes are disposed properly.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The sensitivity of receptor is medium.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	**Project Area**	Local	Regional	National	
	Construction site				
Magnitude	Negligible	**Low**	Medium	High	
	Magnitude is low with the given mitigation measures.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Occurrence of impact is not likely with the given mitigation measures.				
Impact Significance	**Insignificant**	Low	Medium	High	
	The impact significance is insignificant.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact of solid wastes is highly reversible.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will continue to be negligible with monitoring the measures and related management plans and practices put in place.

6.3.4.1.2 Operation Phase

Solid waste generated during the operation phase will be domestic wastes and packaging wastes similar to the construction waste. 500 personnel are expected to be employed during operation phase, therefore waste generation of about 250 kg/day is expected during the operation phase. Improper storage of solid waste which can cause soil and groundwater contamination will be prevented.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Soil and groundwater contamination is direct negative impact unless wastes are disposed properly.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The sensitivity of soil is medium.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase				
Impact Extent	**Project Area**	Local	Regional	National	
	Power plant area				
Magnitude	Negligible	Low	**Medium**	High	
	Magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Occurrence of impact is likely if no mitigation measure is taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	The significance of the impact is medium.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact of solid wastes is highly reversible.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

Similar to the construction phase, wastes will be collected and stored separately according to their types. Training of the workers will be provided to reduce and reuse wastes generated. Domestic solid waste will be stored in closed leak proof containers in order to prevent any leakage to soil and also to prevent odor generation. Improper dumping of solid waste to the environment which can cause soil and groundwater contamination will be prevented. The Project will enter into a waste disposal services contract with the district authority for the arrangement of waste disposal from the Project.

A Waste Management Plan as part of HSE Management has been developed for the Project. The plan will be implemented for the collection, storage and disposal of wastes.

Impact assessment table after mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Soil and groundwater contamination is direct negative impact unless wastes are disposed properly.				

Receptor Sensitivity	Very High	High	**Medium**	Low	
	The sensitivity of soil is medium.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase				
Impact Extent	**Project Area**	Local	Regional	National	
	Power plant area				
Magnitude	Negligible	**Low**	Medium	High	
	Magnitude is low.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Occurrence of impact is not likely with the given measures.				
Impact Significance	**Insignificant**	Low	Medium	High	
	The significance of the impact is insignificant.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact of solid wastes is highly reversible.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will continue to be negligible with monitoring the measures and related management plans and practices put in place.

6.3.4.2 Hazardous Wastes

6.3.4.2.1 Construction Phase

During the construction period, waste oil, oily rags, waste air and oil filters will be generated due to the maintenance of the construction vehicles and equipment. Waste paint and lubricants, batteries and contaminated drums and containers waste, vegetable oil due to catering for the workers and medical waste at the infirmary will also be generated at the campsite. There will also be sludge generation at the domestic wastewater treatment plant. Spill or leaks of hazardous waste can cause contamination of soil and groundwater if not handled and stored properly.

In accordance with the MoE's Letter dated 04.09.2018 no. 2885, chemical waste will have to be stored as hazardous material in compliant storage and safe environment in accordance with the approved environmental procedures. Treating and destroying this waste is done by the Directorate for Treating and Destroying the Dangerous Chemical, Biological, and War Waste of the Ministry of Science and Technology as the only authorized entity responsible for destroying such material. These materials and research ways should be reviewed to recycle and reuse them by industrial or research institutions or universities.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact on soil and groundwater quality				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	The sensitivity of receptor is high to hazardous waste.				

Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	**Project Area**	Local	Regional	National	
	Construction site				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Occurrence of impact is likely if no mitigation measure is taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium				
Impact Reversibility	High Reversibility	Medium Reversibility	**Low Reversibility**	Irreversible	
	Impact of hazardous wastes has low reversibility without mitigation measures.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Mitigation Measures

Hazardous wastes will be collected and stored separately in leak proof containers. Secondary containment will be provided for the storage containers and hazardous waste storage areas will have concrete floor to prevent any leakage to soil. Disposal of hazardous waste will be undertaken by an authorized party. Spill kits will be available at the site for immediate response to spill. Waste Management Plan and Spill Response and Prevention Procedure have been developed for the Project. The plan will be implemented for the collection, storage and disposal of hazardous wastes.

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact on soil and groundwater quality				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	The sensitivity of receptor is high to hazardous waste.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	**Project Area**	Local	Regional	National	
	Construction site				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Occurrence of impact is not likely regarding the mitigation measures				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact significance is low				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact of hazardous wastes has medium reversibility, considering the worst case scenarios even with mitigation measures.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will continue to be negligible with monitoring the measures and related management plans and practices put in place.

6.3.4.2.2 Operation Phase

Hazardous waste generated during the operation phase of the Project will be waste oil from maintenance of equipment chemicals used for demineralizing of the water contaminated tins and drums, oily rags, batteries, and vegetable oil due to catering for the workers.

There will also be the generation of sludge cake from the water treatment plant, sludge and oil slurry from the oil contaminated waste treatment, sludge from the domestic wastewater treatment plant, wash off from gas turbines and sludge from heavy fuel oil, crude oil treatment plant. Washing water effluents will be collected in washing water recovery pit (prior to off-site disposal via trucks) which has a capacity of 20 m^3. Sludge will be collected in storage tank of 36 m^3 prior to off-site disposal via trucks. Disposal of hazardous waste will be undertaken by an authorized party. Spill or leaks of hazardous waste can cause contamination of soil and groundwater if not handled and stored properly.

Impact assessment table before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct impact on soil and groundwater quality				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	The sensitivity of receptor is high to hazardous waste.				
Impact Duration	Temporary	– Short-term	**Long-term**	Permanent	
	During operation phase.				
Impact Extent	**Project Area**	Local	Regional	National	
	Power plant area				
Magnitude	Negligible	Low	**Medium**	High	
	Magnitude is medium				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Impact occurrence is likely if no mitigation measure is taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	**Low Reversibility**	Irreversible	
	Impact of hazardous wastes has low reversibility without mitigation measures.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Mitigation Measures

Hazardous wastes will be collected and stored separately in leak proof containers. Secondary containment will also be provided for the storage containers and hazardous waste storage areas will have concrete floor to prevent any leakage to soil. Disposal of the sludge will be undertaken by an authorized party. Spill kits will also be available at the site for

immediate response. Waste Management Plan and Spill Response and Prevention Procedure have been developed for the Project. The plan will be implemented for the collection, storage and disposal of hazardous wastes.

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact on soil and groundwater quality				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	The sensitivity of receptor is high to hazardous waste.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	**Project Area**	Local	Regional	National	
	Construction site				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Occurrence of impact is not likely regarding the mitigation measures				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact significance is low				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact of hazardous wastes has medium reversibility, considering the worst case scenarios even with mitigation measures.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will continue to be negligible with monitoring the measures and related management plans and practices put in place.

6.4 Impacts on Biological Environment

6.4.1 Flora and Fauna

6.4.1.1.1 Construction Phase

The impacts of construction activities on flora and fauna of the Project region can be:

- Habitat loss due to the permanent land clearance;
- Noise disturbance to fauna;
- Increased exposure to atmospheric pollutants;
- Possible release or introduction of alien or invasive species during the landscape works;
- Wastewater discharge to aquatic habitats;

- Potential for impingement/entrainment of two sensitive fish species, which are namely Capoeta barroisi and Carasobarbus kosswigi due to the water intake structure

However due to the low biodiversity of the project area, limited impacts on both flora and fauna of the region during construction phases is expected.

Noise has the greatest effect on wildlife that relies heavily on auditory signals for survival and in particular on birds. The effects of vibration on wildlife is poorly studied, however avoidance behavior around the source of vibration is likely in particular for reptiles and amphibians.

In particular, dust emissions could impact vegetation directly by covering leaf surface and indirectly through impacts on soil composition and structure. Dust can block stomata on the leaf surface, affect photosynthesis, respiration, transpiration, and may cause leaf injury symptoms. As a result, the productivity of plants can decline. With the consequent reduction in vegetation growth, abundance and species loss, fauna species that depend on them for food and shelter can be indirectly affected.

Removal of natural vegetation cover and soil disturbance could facilitate the spreading of invasive alien (non-native) species accidentally introduced. These species tend to have an advantage in disturbed ecosystems, and if they penetrate into a habitat they can potentially change its functionality and species composition, including priority biodiversity species. Local fauna that depend on those ecosystems could also be indirectly affected.

The study area consists of 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 Intake area according to the IUCN's Red List. The intake area is on the edge of the Euphrates River, considering the size of the river, it has a sustainable ecosystem structure.

According to the site surveys, it was observed that fauna species rarely visit the Project site due to currently degraded habitat quality. Therefore noise impact is not expected to cause disturbance on the inhabiting faunal community around the region.

Habitat loss impact assessment due to the construction activities before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact- Habitat loss due to the permanent land clearance				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	There is no protected species, Diversity of the flora of the area is very low				
Impact Duration	Temporary	Short-term	Long-term	**Permanent**	
	Impact is permanent				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact is expected at the Project footprint and associated facilities				
Magnitude	Negligible	Low	**Medium**	High	
	Magnitude is expected to be medium				

Likelihood	Negligible	Not Likely	Likely	**Certain**	
	Impact is expected as certain				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact is expected to be medium.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact will not occur after construction				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

- Fencing or restraining construction areas to reduce the risk of footprint creep.
- Vehicles will drive on designated routes unless otherwise authorized
- Existing roads will be used as much as possible in construction activities

Residual Impacts

The residual impact will be reduced to negligible after the mitigation measures are applied.

Noise impact assessment for fauna before mitigation is as follows:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-Noise generated by construction activities.				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	There is no protected species, Diversity of the fauna of the area is very low				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction activities.				
Impact Extent	Project Area	**Local**	Regional	National	
	Noise will have impact locally.				
Magnitude	Negligible	**Low**	Medium	High	
	Magnitude will be low since receptor sensitivity is low and impact duration is short-term.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	Impact is expected as certain				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact is expected to be low.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact will not occur after construction				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Mitigation Measures

Noise impact is expected to be negligible at the close vicinity, good site working practices will be implemented during the construction activities and noise control measures will be adopted where necessary i.e. maintenance of construction equipment will be conducted regularly exhaust mufflers will be applied to the equipment in order to minimize noise emissions and also speed limits will be implemented for the vehicles.

Residual Impacts

The residual impact will remain negligible after the mitigation measures are applied.

Impact assessment for increased exposure to atmospheric pollutants before mitigation is as follows:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact- Increased exposure to atmospheric pollutants				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	There is no protected species, Diversity of the flora and fauna of the area is very low				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected to be local				
Magnitude	Negligible	**Low**	Medium	High	
	Magnitude is expected to be low				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Impact is likely to occur				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact is expected to be low.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact will not occur after construction				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Mitigation Measures

In order to prevent dust generation, roads will be sprinkled with water regularly, especially during dry and windy weather conditions. Loading and unloading of construction materials will be performed in a proper way to prevent dust generation. Vehicles loaded with dust generating materials will be covered during transportation. Speed limits of 30 km/h will be applied for the drivers. Materials stored within the project area will be monitored for dust emissions and covered or damped if required. Maintenance of the heavy machinery will be conducted periodically in order to control the exhaust emissions. Equipment/vehicles will be turned off when not in use.

Residual Impacts

The residual impact will remain negligible after the mitigation measures are applied.

Impact assessment for the introduction of alien or invasive species before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	There is no protected species, Diversity of the flora and fauna of the area is very low				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected at the Project Area				
Magnitude	Negligible	**Low**	Medium	High	
	Magnitude is expected to be low				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Impact is not likely to occur				
Impact Significance	**Insignificant**	Low	Medium	High	
	Impact is expected to be insignificant.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Impact will not occur after construction				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Mitigation Measures

If spreading of invasive species is observed, an appropriate eradication program will be developed and implemented.

Residual Impacts

The residual impact will remain negligible after the mitigation measures are applied.

Wastewater discharge impact assessment before mitigation is as follows:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-				
Receptor Sensitivity	Very High	**High**	Medium	– Low	
	Capoeta barroisi and *Carasobarbus kosswigi* are classified as under protected species according to the IUCN Red list and are also categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During construction.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected to be local				
Magnitude	Negligible	Low	Medium	**High**	
	Magnitude is expected to be high				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	Impact is certain				
Impact Significance	Insignificant	Low	Medium	**High**	
	Impact is expected to be High.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact will occur after construction				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Mitigation Measures

Untreated wastewater discharge to the environment will be prohibited. Domestic wastewater will be discharged to Euphrates River after being treated at the Domestic Sewage Treatment Plant. The effluent quality will be monitored for compliance with both Iraqi wastewater discharge limits and IFC EHS Guideline standards in order to prevent any contamination to Euphrates River.

Wastewater discharge impact assessment after mitigation is as follows:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Capoeta barroisi and *Carasobarbus kosswigi* are classified as under protected species according to the IUCN Red list and are also categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.				
Impact Duration	Temporary	**Short-term**	**Long-term**	Permanent	
	During construction.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected to be local				
Magnitude	Negligible	Low	Medium	**High**	
	Magnitude is expected to be high				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Impact is not likely to occur				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact is expected to be medium.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact will occur after construction				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Residual Impacts

The residual impact will be reduced to minor after the mitigation measures are taken during the construction activities. *Capoeta barroisi* and *Carasobarbus kosswigi* will be monitored every spring season during construction activities in terms of population. If decrease in the population is observed additional measures will be evaluated.

Impact assessment for the potential impingement/entrainment of two sensitive fish species due to the water intake structure before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Capoeta barroisi and *Carasobarbus kosswigi* are classified as under protected species according to the IUCN Red list and are also categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	During the construction phase.				
Impact Extent	**Project Area**	Local	Regional	National	
	The impact is expected to occur within the Project area.				
Magnitude	Negligible	Low	Medium	**High**	
	The magnitude of the impact is expected to be high.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	The impact is likely.				
Impact Significance	Insignificant	Low	Medium	**High**	
	The significance of the impact is expected to be high.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	The impact is highly reversible.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

The maximum flow rate of the raw water supplied from the water intake will be approximately 344 m^3/h, which is considerably less as compared to the amounts of raw water required for operation of the power plants equipped with once-through cooling systems. Taking into consideration the much lower flow rate, corresponding to approximately 95 l/s, and the appropriate design of the water intake screen structures, the impingement/entrainment of the fishes will be prevented. As per the United States Environmental Protection Agency's Technical Development Document for the Final Section 316(b) Existing Facilities Rule (EPA-821-R-14-002) of May 2014, the relationship between intake velocity and impingement is well-established since EPA's Phase I rule (66 FR 65256). Impingement mortality can be greatly reduced by reducing the through-screen velocity in any screen. EPA compiled fish swimming speed data as it varies with the length of the tested fish and with water temperature. These data show that a 1.0 f/s corresponding to 0.3048 m/s velocity standard would protect 78 percent of the tested fish, and a 0.5 f/s corresponding to 0.1524 m/s velocity would protect 96 percent of these fish. Since screen fouling can increase the velocity in the screen areas that remain open, the EPA concluded that a through-screen velocity of 1.0 f/s may not be protective under the expected range of operating conditions and that a through-screen velocity of 0.5 f/s (0.1524 m/s) would provide a reasonable safety margin. As a result, many existing facilities have designed and operated their modified traveling screens or wedge wire screens so as not to exceed a through-screen velocity of 0.5 f/s (0.1524 m/s).

The passive intake screens as wedge wire screens with a patented internal dual flow modifier creating a nearly uniform low flow velocity through the entire screen surface will be used for water intake for the Dhi-Qar Combined Cycle Power Plant. They are designed to

meet the regulatory requirements mentioned above for a maximum through-screen velocity for both entrainment and impingement in lakes or oceans or locations where the currents are not counter and perpendicular to the wedge wire screens. The through-screen velocity will be 0.15 m/s as required which is the maximum velocity at which a juvenile fish can turn around swim away and not be impinged onto a passive screen.

For prevention of impingement/entrainment of the fishes, the construction workers will be trained on how to protect the fish species in accordance with the Information Sheet provided in Appendix-L. A biologist will also monitor the population of the fish species.

Residual Impacts

The residual impact will be reduced to negligible after the mitigation measures are applied.

6.4.1.1.2 Operation Phase

The impacts of operation activities on flora and fauna of the Project region can be:

- Noise disturbance to fauna;
- Electrocution and collision risks;
- Wastewater discharge to aquatic habitats;
- Potential for impingement/entrainment of two sensitive fish species, which are namely Capoeta barroisi and Carasobarbus kosswigi due to the water intake structure.

Noise has the greatest effect on wildlife that relies heavily on auditory signals for survival and in particular on birds. The effects of vibration on wildlife is poorly studied, however avoidance behavior around the source of vibration is likely in particular for reptiles and amphibians.

Energy transmission lines may cause fire if passes on tall trees, however energy transmission line authorities will take adequate maintenance measures to control growth of trees so that there will be no contact with the transmission lines.

Electrocution and collision risks on birds also can arise due to the ETL. Electrocution is the short-circuit incidence that occurs when it bridges the gap between two energized components or an energized and an earthed (also called ‘grounded’) component of the pole structure.

Domestic wastewater generated from the Project will be treated through Domestic Sewage Treatment Plant and collected in the plant storm/process water collection basin.

Treated wastewater will be discharged to Euphrates River in compliance with Iraqi national wastewater discharge standards and IFC EHS Guidelines-Indicative Values for Treated Sanitary Sewage Discharges.

Some critical species were identified in the Intake area according to the IUCN’s Red List. The intake area is on the edge of the Euphrates River, considering the size of the river, it has a sustainable ecosystem structure.

Impact assessment on noise disturbance to fauna before mitigation is as follows:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-Noise generated by operation activities.				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	There is no protected species, Diversity of the fauna of the area is very low				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase.				
Impact Extent	Project Area	**Local**	Regional	National	
	Noise will have impact locally.				
Magnitude	Negligible	**Low**	Medium	High	
	Magnitude is expected to be low.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	Impact is expected as certain				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact is expected to be low.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Reversibility of the impact is expected to be high				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Mitigation Measures

Noise impact is expected to be negligible at the closest settlement. good site working practices will be implemented during construction activities and noise control measures will be adopted where necessary i.e. maintenance of construction equipment will be conducted regularly, exhaust mufflers will be applied to the equipment in order to minimize noise emissions and also speed limits will be implemented for the vehicles.

Residual Impacts

The residual impact will remain negligible after the mitigation measures are applied.

Impact assessment in terms of electrocution and collision risks to bird species before mitigation is provided below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact.				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	There is no protected species, Diversity of the fauna of the area is very low				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact is long-term.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact is expected at the Overhead Transmission Line.				
Magnitude	Negligible	Low	**Medium**	High	
	Magnitude is expected to be medium				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Impact is likely to occur				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact is expected to be medium.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Reversibility of the impact is expected to be medium				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

Cross arms, insulators and other parts of the ETL will be constructed so that birds find no opportunity to perch near the energized power lines. Visibility enhancement objects such as marker balls, bird deterrents, or diverters should be employed to eliminate or minimize bird mortality.

Residual Impacts

The residual impact will be reduced to negligible after the mitigation measures are applied.

Wastewater discharge impact assessment before mitigation is as follows:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Capoeta barroisi and *Carasobarbus kosswigi* are classified as under protected species according to the IUCN Red list and are also categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected to be local				
Magnitude	Negligible	Low	Medium	**High**	
	Magnitude is expected to be high				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	Impact is certain				
Impact Significance	Insignificant	Low	Medium	**High**	
	Impact is expected to be high.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Reversibility of the impact is expected to be medium				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Mitigation Measures

Untreated wastewater discharge to the environment will be prohibited.

Drainage systems for storm water, sewage water, chemical and oily water will be established within the plant area in order to collect wastewater separately.

Domestic wastewater and industrial wastewater will be discharged to the Euphrates River after treatment at the Domestic Sewage Treatment Plant and Oily Water Treatment Plant. The effluent quality will be monitored for compliance with both Iraqi wastewater discharge limits and IFC EHS Guideline standards in order to prevent any contamination to the Euphrates River.

Impact assessment of wastewater discharge after mitigation is provided below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact-				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Capoeta barroisi and *Carasobarbus kosswigi* are classified as under protected species according to the IUCN Red list and are also categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During operation phase.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact is expected to be local				
Magnitude	Negligible	Low	Medium	**High**	
	Magnitude is expected to be high				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Impact is not likely to occur				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact is expected to be medium.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Impact will occur after construction.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Residual Impacts

The residual impact will be reduced to minor after the mitigation measures are taken during the operational phase. *Capoeta barroisi* and *Carasobarbus kosswigi* will be monitored every spring season for three years.

Impact assessment for the potential impingement/entrainment of two sensitive fish species due to the water intake structure before mitigation is presented below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Direct negative impact.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Capoeta barroisi and *Carasobarbus kosswigi* are classified as under protected species according to the IUCN Red list and are also categorized as 'Endangered-EN' and 'Vulnerable-VU' respectively.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	During the operation phase.				
Impact Extent	**Project Area**	Local	Regional	National	
	The impact is expected to occur within the Project area.				
Magnitude	Negligible	Low	Medium	**High**	
	The magnitude of the impact is expected to be high.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	The impact is likely.				
Impact Significance	Insignificant	Low	Medium	**High**	
	The significance of the impact is expected to be high.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	The impact is highly reversible.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

The maximum flow rate of the raw water supplied from the water intake will be approximately 344 m^3/h which is considerably less as compared to the amounts of raw water required for operation of the power plants equipped with once-through cooling systems. Taking into consideration the much lower flow rate, corresponding to approximately 95 l/s and the appropriate design of the water intake screen structures the impingement/entrainment of the fishes will be prevented. As per the United States Environmental Protection Agency's Technical Development Document for the Final Section 316(b) Existing Facilities Rule (EPA-821-R-14-002) of May 2014, the relationship between intake velocity and impingement is well-established since EPA's Phase I rule (66 FR 65256). Impingement mortality can be greatly reduced by reducing the through-screen velocity in any screen. EPA compiled fish swimming speed data as it varies with the length of the tested fish and with water temperature. These data show that a 1.0 f/s corresponding to 0.3048 m/s velocity standard would protect 78 percent of the tested fish, and a 0.5 f/s corresponding to 0.1524 m/s velocity would protect 96 percent of these fish. Since screen fouling can increase the velocity in the screen areas that remain open, the EPA concluded that a through-screen velocity of 1.0 f/s may not be protective under the expected range of operating conditions and that a through-screen velocity of 0.5 f/s (0.1524 m/s) would provide a reasonable safety margin. As a result, many existing facilities have designed and operated their modified traveling screens or wedge wire screens so as not to exceed a through-screen velocity of 0.5 f/s (0.1524 m/s).

The passive intake screens as wedge wire screens with a patented internal dual flow modifier creating a nearly uniform low flow velocity through the entire screen surface, will be used for water intake for the Dhi-Qar Combined Cycle Power Plant. They are designed to

meet the regulatory requirements mentioned above for a maximum through-screen velocity for both entrainment and impingement in lakes or oceans or locations where the currents are not counter and perpendicular to the wedge wire screens. The through-screen velocity will be 0.15 m/s as required which is the maximum velocity at which a juvenile fish can turn around swim away and not be impinged onto a passive screen.

For prevention of impingement/entrainment of the fishes, the workers will be trained on how to protect the fish species in accordance with the Information Sheet provided in Appendix-L. A biologist will also monitor the population of the fish species.

Residual Impacts

The residual impact will be reduced to negligible after the mitigation measures are applied.

6.5 Impacts on Social Environment

Power plant projects have both negative and positive impacts from a socio-economic standpoint. Influx, noise and dust emissions generated by construction activities can be characterized as negative impacts; while short and long-term employment opportunities and economic benefits can be described as positive impacts[19]. Both positive and negative impacts are explained for construction and operation phase under this section.

This section of the Report assesses the direct and indirect potential socio-economic impacts of the Project. For this section, some of the impacts likely to have the same receptor and similar mitigation measures for both construction and operation phase are presented in the same section. Major social issues subject to assessment are:

- National Economy
- Land Acquisition
- Local Economy and Livelihood
- Labour Influx
- Transportation and Traffic
- Community Health and Safety
- Occupational Health and Safety
- Cultural Heritage

Both quantitative and qualitative data collection techniques were used during social impact assessment.

6.5.1 National Economy

Operation Phase

There are powerful connections between energy provision and socioeconomic development. Energy is an important factor of socioeconomic development. Iraq's energy demand has grown rapidly almost every year and it will continue to grow. One of the main consequences of the Project is the provision of energy. This will create beneficial effect on the wider community.

The AoI of the Project is highly in need of electricity. According to Coordination Committee for Iraq, less than 30% of the population within the Dhi-Qar governorate relies solely on the public electricity network, with the majority of Dhi-Qar's inhabitants using private or shared

[19] Taking consideration of the positive impacts in nature, reversibility section of the related assessment tables have not been evaluated..

generators to complement their electricity supply. 70% of the households who are connected to the electricity network report daily power cuts of more than 12 hours; which reveals the need of the Project (NGO Coordination Committee for Iraq. 2015). This information has been backed up during the social field study as well. According to household surveys, locals stated that electricity cut off occurs any time during the day without any advance warning.

The Project will address the energy needs of Dhi-Qar Governorate and Iraq, contribute to national development, and help improve efficiency and quality of infrastructure services.

Impact assessment table is provided as follows:

Impact Type	**Positive**	Negative	**Direct**	Indirect	Cumulative
	Energy provision is a direct positive impact. The Project is expected to address the electricity needs in the long run which the local inhabitants are suffering due to long daily cuts.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	As stated by the locals, electricity cut off occurs any time during the day without any advance warning. Therefore, the receptor sensitivity is high.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Operation phase of the project is planned for 25 years.				
Impact Extent	Project Area	Local	**Regional**	**National**	
	The Project is expected to address the electricity needs of people of Dhi-Qar Governorate and Iraq.				
Magnitude	Negligible	Low	Medium	**High**	
	Since the duration of the impact is wide spread and long lasting, the magnitude of the impact is high.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	It is a certain impact.				
Impact Significance	Insignificant	Low	Medium	**High**	
	Considering the energy needs of Iraq, energy provision is a high level impact.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	Irreversible	
	N/A				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

6.5.2 Land Use

6.5.2.1 Construction Phase

The Project will be established in Nasiriyah City of Dhi-Qar Governorate, covering an area of 294.281 m^2. The Project will be located on a rural area of 30 ha which is owned by the Governorate and has been transferred to MoE for Project purposes.

The allocation of the Project Site causes no land acquisition. Therefore there will be no need to take mitigation measures for economic or physical displacement for the allocated Site.

However, during the PPM, the locals raised their claims on how they used the Project Site for agricultural purposes. This matter was evaluated by the experts during the ecological site surveys to assess whether if there is a recent history of agricultural activities conducted by the locals. As a conclusion, there was no evidence found in terms of locals occupying the

Site for agricultural purposes. In other words, as stated in the Section 5.3.1 of the Report, there is no evidence of agricultural activity in the Project area, because of the high concentration of salt found in the nearby marshes, which eventually contributed to low crop yields

Also, according to information gathered from the social baseline assessment, majority of the households in the AoI do not have an income that is land based.

As for the associated facilities, there will be no private land allocation. According to official letter from the Moe on January 25, 2018, land ownership of the areas of OHTL, access roads and fuel pipelines belong to the Government of Iraq. Last, subject of land allocation was discussed during the PPMs; the locals stated that they will be willing to sell their land when needed to improve their household income.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Land acquisition is a direct negative impact.				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	The land for the Project Site, OHTL, access roads and energy transmission pipelines are owned by the Government of Iraq and allocated to MoE. Holeler. Project vehicle movements and other construction activities can accidentally damage crops near the Project site or along the transportation road.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact will be during construction				
Impact Extent	Project Area	**Local**	Regional	National	
	The extent of the impact is determined as local.				
Magnitude	Negligible	**Low**	Medium	High	
	Impact magnitude is considered as low.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Impact is not likely to occur.				
Impact Significance	**Insignificant**	Low	Medium	High	
	Impact is expected to be insignificant				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	The impact reversibility is medium.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Mitigation Measures

- In case of requirement of further land acquisition, priority will be given to the governmental land.
- In case of further land acquisition is required by the private land owners, the process will be realized in cooperation with the related governmental institutions and Project Affected People will be compensated on cash terms based on expropriation values. Compensation standards will be transparent and applied consistently to all communities and persons affected by the displacement.

- Land acquisition process should endure that disclosure of the information include a well-publicized grievance procedure consistent with the provisions of IFC PS 5.

- Any loss of or damage to crops or lands caused by Project activities will be compensated.
- The Project will minimize damage to crops by minimizing the area of disturbance caused by vehicle movement and other construction activities.
- Although the Subcontractor is not responsible for the land acquisition or compensation to any affected land owners. a grievance mechanism will be utilized to convey any concerns from affected local residents to local authorities.

Residual Impacts

- Residual impact will remain negligible after the mitigation measures are applied.

6.5.3 Employment Opportunities

6.5.3.1 Construction Phase

The Project intends to have positive impact on the local economy. Regarding social baseline data, technical and construction works are the primary income sources for the villagers in the AoI.

Table below presents the current employment figures of the pre-construction phase. As can be seen from the Table, there are 50 local workers employed for the excavation works which consist more than half of the total current labour force.

Work Force Category	Turkish	Iraqi (Locals)	Indian
Staff	19	6	1
Direct	10	21	5
Indirect	8	23	10
Total	**37**	**50**	**16**

Source: ENKA, 2018

According to the information gathered by the Project Subcontractor 349 blue collar and 3 white collar Iraqi nationals are expected to be hired throughout the construction phase.

All of the unskilled workers are expected to be hired from the AoI throughout the construction phase of the Project. The Project parties are willing to hire locals if qualified to extend as possible. Besides for the excavation activities and unskilled workforce, there are 14 additional Iraqi employees whom are currently working for the Project as well. Further details on the employment type of the national workers can be found in the Table below.

Number of Iraqi Staff	Department	Occupation
4	Food and & Nourishment	Kitchen Worker
1	Camp & House Keeping	Cleaner & Worker
1	Procurement	Local Procurement Speacialist
1	QA / QC	QA QC Engineer
1	Security	Translator
4	Security	Gate Escort

Source: ENKA, 2018

Employment opportunities for Iraqi nationals are structured to be advertised on the level of the community based committee and the local governmental unit in order to prevent explosion on the local labour market.

In other words, promotion of employment opportunities will be prioritized firstly for those who reside in the AoI and limited to Dhi-Qar region.

Although the Iraqi Labour Law[20] does not impose an obligation on employers to employ a certain percentage of Iraqi nationals, however, as stated, the Project Subcontractor will hire workers, especially within the borders of the AoI, to the extent possible.

It is important to note that these figures only represent direct employment opportunities of the Project, indirect opportunities are discussed in Section 6.5.4 (Local Procurement).

Assessment of the impacts for the local employment opportunities is summarized in the Table below.

[20] The Labour Law applies to all employees in Iraq (i.e. including Iraqis and foreigners) except the public sector employees who have been hired according to the Civil Service Law and all security forces. The Iraqi Labor Law does not impose an obligation on employers to employ a certain percentage of the Iraqi nationals. The Labour Law regulates the work of foreigners in the country and devotes a special section to the rights of foreign workers, the work permits and visas that should be obtained, and the requirements and conditions to obtain the same. In addition, the Labour Law gives the right to a foreign employee to submit his complaints directly to the Inspection Committees of the Ministry of Labour, in case of any violation. Last, the Labour Law emphasise the principal of equality among workers, to eliminate any direct or indirect discrimination in order to be compatible with the international standards.

Impact assessment table is provided below.

Impact Type	**Positive**	Negative	**Direct**	Indirect	Cumulative
	Increase in employment opportunities will result direct positive impact of the Project. As of now, more than half of the total labour force is derived from the locals.				
Receptor Sensitivity	**Very High**	High	Medium	Low	
	The locals in the AoI are quite eager to be part of the Project activities due to lack of employment opportunities in the AoI. According to household survey results, 63% of the locals stated that unemployment is a very significant issue.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Throughout the construction phase of the Project.				
Impact Extent	Project Area	**Local**	Regional	National	
	The impact is expected as local.				
Magnitude	Negligible	Low	**Medium**	High	
	Considering the short term duration and locals extend of the impact, the magnitude of the impact is medium.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	The impact is certain.				
Impact Significance	Insignificant	Low	**Medium**	High	
	The impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	Irreversible	
	N/A				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Impact Enhancement

- Contracts and policies should be all clear for all workers.
- Worker representatives will be given access to the Project management.
- Review opportunities to establish a skills training program with an aim of training interested authorities and local villagers.
- Transparent recruitment process will be established by the Project Subcontractor and employment opportunities will be announced to locals.
- The Project Subcontractor has corporate level Human Resources policy which observes wage standards, working hour regulation, freedom of association and staff encouragement. The policy will also eliminate child and forced labour, discrimination on the basis of religion, language, gender or social status, bullying and harassment. This policy will be implemented by all the contractors to cover local employment and training of local people.
- Throughout the hiring process, the Project will abide labour standards established by IFC (PS 2) and ILO conventions when gaps are identified between national legislation and international standards. The Project will monitor the implementation and compliance to these standards by contractors and sub-contractors across the supply chain. For example, although Iraq's Labour Law states minimum age of employment in Iraq is 15, according to IFC Performance Standard 2; where young people below

the age of 18 years are employed, it will be made clear that they will not be employed in hazardous work and their work will be subject to an appropriate risk assessment.

- If there are no eligible among the applicants, job announcements will be announced by banner, newspaper and radio, internet and Governorate office.

6.5.3.2 Operation Phase

According to information gathered by the Project Owner, 500 employees will be hired for the Operation Phase. Given that much of the local population do not have the necessary professional skills to be hired during the operation phase, this may limit the opportunity to employ local people. On the other hand, information gathered by the community surveys shows that, there are security officers, office staffs and technicians occupied within the borders of the AoI that may be considered for the employment opportunities for the operation phase. See Section 5.4.3.1 for further information on the available skills of the locals in the AoI.

Impact assessment table is provided below.

Impact Type	**Positive**	Negative	**Direct**	Indirect	Cumulative
	Employment impacts are considered as direct and positive.				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	Given that much of the local population may not have the necessary professional skills to be hired during the operation phase, this may limit the opportunity to employ local people.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Throughout the operation phase of the Project.				
Impact Extent	Project Area	Local	**Regional**	National	
	The impact Regional.				
Magnitude	Negligible	Low	**Medium**	High	
	The magnitude of economic impact is expected to be medium.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	The impact is certain.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	Irreversible	
	N/A				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Enhancement Measures

- Review opportunities to establish a skills training program with an aim of training interested locals to contribute to the operation phase of the Project.
- Throughout the hiring process, the Project will abide labour standards established by IFC (PS 2) and ILO conventions when gaps are identified between national legislation and international standards. The Project will monitor the implementation and compliance to these standards by contractors and sub-contractors across the supply

chain. For example, although Iraq's Labour Law states minimum age of employment in Iraq is 15, according to IFC Performance Standard 2; where young people below the age of 18 years are employed, it will be made clear that they will not be employed in hazardous work and their work will be subject to an appropriate risk assessment.

- Inform locals for employment opportunities in timely manner. If there are no eligible among the applicants, job announcements will be announced by banner, newspaper and radio, internet and Governorate office.
- Review opportunities to establish a skills training program with an aim of training interested local villagers to contribute to the construction phase of the Project.
- The Project Owner will establish Human Resources policy which observes wage standards, working hour regulation, freedom of association and staff encouragement. The policy will also eliminate child and forced labour, discrimination on the basis of religion, language, gender or social status, bullying and harassment.

6.5.4 Local Procurement

Since the procurement strategy of the MoE is not certain at this stage of the Project, this section will be focused mainly on construction local procurement. However, enhancement measures will be applicable for both phases of the Project.

The Project will require goods and services throughout the construction and operation phases in which local businesses may have the opportunity to provide these goods and services (e.g. construction equipment, food for the accommodation camp). This is referred to as indirect employment.

As of now, total of 35 vehicles and construction machineries were supplied by the local subcontractors. Furthermore, there are 109 local subcontractors assigned at the current stage of the Project.

Currently, there is an Iraqi Procurement Officer occupied for the scope of Project activities. According to ENKA Sustainability Report of 2017, the Project's current local procurement ratio is almost 35% and is expected to increase as the Project progresses.

The Table below presents the assessment of the procurement impacts for the construction phase below.

Impact assessment table is provided below.

Impact Type	**Positive**	Negative	**Direct**	Indirect	Cumulative
	Local procurement is direct positive impact resulted by goods and service need of the Project.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	The locals stated their interest to provide goods and services during both of the PPMs, especially in terms of security services, construction vehicles and machinery. It has been observed that, there is a lack of capacity of goods and services within the borders of the AoI, therefore, the locals are willing to deal these services from the city centers and profit from the commissions.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Throughout the construction phase of the Project.				
Impact Extent	Project Area	Local	**Regional**	National	
	As mentioned above, there is a lack of capacity for goods and services within the AoI, therefore, these services may be obtained from the Region.				
Magnitude	Negligible	Low	**Medium**	High	
	The magnitude of economic impact is expected to be medium.				
Likelihood	Negligible	Not Likely	Likely	**Certain**	
	The impact is certain.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	Irreversible	
	N/A				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Enhancement Measures

- A procurement plan will be developed and implemented alongside with a local recruitment plan. Development of these plans should involve consultation with relevant stakeholders, including government authorities and local villagers; as much as possible.

- Inform local businesses of contracting opportunities in a timely manner. Ensure that the process is culturally appropriate.
- The Sub-contractor and the Project Owner will prioritize procurement of goods and services from businesses in the Project Area where these they can ensure that prices are competitive, quality can be maintained, and periodicity of supply can be maintained.

6.5.5 Labour and Working Conditions

The impact assessment of this section is considered together for both the construction and operation phase, as similar consequences can arise as well as same mitigation measures will be applied for both phases of the Project.

The entire unskilled workforce is expected to be hired from the locals of AoI, on the other hand, majority of the skilled construction workers are expected to be recruited from India. Indian workers will be hired through recruitment offices from India as they will be informed, trained and introduced regarding the scope and measures of the Project as well as the cultural codes of the Region prior to arrival in Iraq. This recruitment process has been

applied by the Sub-contractor from previous projects in Iraq as well. Due to security purposes, the foreign construction workers will be accommodated and inhabited at the camp within the Project Site in which will be secured by the high security fences. As it will be stated in their contract, the workers will only reside in the Project Site for the security measures.

Since the migrant workers will only reside and accommodate within the borders of the Project Site, no interactions between the locals and the migrant workers is foreseen. In terms of interaction between international workers and Iraqi workers within the borders of the site, specific mitigation measures are designed to prevent any potential conflict among the workers (see mitigation measures below for further details).

For operation phase of the Project, 500 workers will be hired by the MoE. The majority of the workers during the operation phase is expected to be Iraqi nationals.

The Project Subcontractor will be responsible for human resources for the construction period. The Project will comply with national labor, social security and occupational health and safety laws as well as the principles and standards of ILO convention. The national principles embodied in the ILO convention are:

- The abolition of child labor
- The elimination of forced labor
- The elimination of discrimination
- Collective bargaining

Furthermore, in the scope of ENKA's Human Resources Policy specifically made for the Project will have provisions for:

- Age;
- Wages;
- Working hours;
- Disabled employees;
- Non-employee workers (i.e. sub-contractors);
- Health and safety; and
- Workers camps.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning Labour and Working Conditions can be direct and negative.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	Considering 1.743 workers will be hired during the construction phase and 500 for the operation phase, the receptor sensitivity is medium. As the workers will be trained prior to entering the Site and all the worker provisions will already be established.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact duration can be counted as long-term, taking into consideration of 36 months of construction and a total of 25 years operation.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the project area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Unwanted impacts may occur if no mitigation measure is taken throughout the Project life span.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact will have medium significance.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	The impact reversibility is high.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

- For construction phase, the workers will be trained in advance for their accommodation in Iraq within harmony. Camp Management Procedures will be strictly in place and Code of Conduct will be in use as well. Code of conduct will outline expected behavior with respect to their daily interactions with local residents, if any, and users of public amenities. This will be part of the labour force management plan to be developed for the Project. The labour force management plan will also include requirements for induction and training on expected behaviours and on disciplinary procedures (including dismissal procedures for unacceptable conduct).
- Due to security purposes, interactions of the workers, especially foreigner ones, to the surrounded community will be limited. Therefore, Project Site will provide all the necessary needs of workers, including daily needs, meals, accommodation areas and recreation areas. For the Indian workers, culturally appropriate food and religious areas will also be provided within the Site.

- Throughout the phases of the Project, the workers will have contracts which clearly state the terms and conditions of their employment and their legal rights. Information will include, but not be limited to, entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity / paternity or holiday). All workers will be able to join trade unions of their choice and have the right to collective bargaining. Contracts will be verbally

explained to all workers where this is necessary to ensure that workers understand their rights prior to any employment contract to be signed.

- Especially for the local employees, wages, benefits and conditions of work offered will be comparable to those offered by equivalent employers in Dhi-Qar Governorate.

- Provide cultural awareness training as an on-boarding requirement to all non-local workers, and in particularly foreign workers, in order to prevent cultural clashes with regards to dress codes, food consumption, etc.

- The Project will put in place a worker grievance mechanism. The grievance mechanism will be open to all the staff and their contractors. The grievance mechanism will be publicly advertised by the Project in the workforce. It will be easily accessible by workers, free of retribution and will allow anonymous complaints to be raised and addressed.

- A management plan will be put in place for the construction camp, outlining not only a code of conduct for construction workers but also measures for managing the camp to ensure adherence to international standard for providing a safe environment that is clean and with adequate sanitary and waste management and the provision of potable water. Provisions will also be made for outlining the minimum amount of space for each worker, laundry and cooking facilities (separate area for the foreign personnel, if necessary), the provision of first aid and medical facilities, heating and ventilation.

- The Project will comply with 'Workers' accommodation: processes and standards, a guidance note by IFC and the EBRD' (2009).

- A retrenchment plan will be put in place to mitigate adverse effects of job losses on the workers concerned. Retrenchment of workers is likely to be required across the lifespan of the Project, particularly during the transition from construction to operation. Retrenchment of workers will be undertaken in line with national law and international best practices, and will include providing skills to enable individuals to secure alternative employment.

- It is expected that a human resource labour policy shall be developed. Under the policy, the project proponent shall provide all employees with information regarding their rights under national labour law, including their rights related to wages and benefits. The policy will cover working conditions, right to organize, non-discrimination, grievance mechanisms, child labour, and forced labour. ENKA has a labour policy and a subcontractor agency, which can ease and accelerate these targets. ENKA's HSE procedure will include requirements for induction and training on expected behaviours and on disciplinary procedures (including dismissal procedures for unacceptable conduct).

- The Project Owner shall establish human resource labour policy for all operational employees with information regarding their rights under national labour law, including their rights related to wages and benefits. The policy will cover working conditions, right to organize, non-discrimination, grievance mechanisms, child labour, and forced labour.
- All Project parties will require all contractors to sign an anti-corruption and responsible procurement policy. Thus for all contractor contracts, the Project will make explicit reference to the need to abide by IFC standards and ILO conventions in relation to labor and welfare standards, freedom of association and reference must be made to child and forced labor. Emphasis will also be placed on anti-discrimination measures. Where young people below the age of 18 years are employed, it will be made clear that they will not be employed in hazardous work and their work will be subject to an appropriate risk assessment.

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning Labour and Working Conditions can be direct and negative.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	Considering 1.743 workers will be hired during the construction phase and 500 for the operation phase, the receptor sensitivity is medium.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact duration can be counted as long-term, taking into consideration of 36 months of construction and a total of 25 years operation.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the project area.				
Magnitude	Negligible	**Low**	Medium	High	
	Impact magnitude is low.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Unwanted impacts are not expected to occur with the given mitigation measures above.				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact will have low significance.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	The impact reversibility is high.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

If all workers related management plans and practices are put in place and international conventions are abided by and monitored, then the overall residual impact to working conditions will continue to be negligible with monitoring the measures on a secure and safe working environment.

6.5.6 Labour Influx Interaction with the Locals

6.5.6.1 Construction Phase

The Project will employ 1.743 workers during the construction phase of the Project. Table below presents the number of workers whom will be hired for the construction phase of the Project, including their nationality, respectively.

Nationality	Blue Collar	White Collar	Total
Turkish	338	143	481
Iraqi	349	3	352
Foreign (Indian)	880	30	910
Total	1.567	176	**1.743**

The social baseline shows that there are 4 villages in the AoI with total population of 9.000 inhabitants. Considering the number of Turkish and Indian workers as given in the Table above, approximately 15% increase in general population is expected during the construction phase of the Project. As obtained during the social field study, the villages in the AoI already experiencing electricity shortages in any time during the day, this increase in population weight may cause additional burden to current electricity shortage. The Project Site will access to electricity through MoE via11kV or 33kV with 3MVA capacity connections within 100m of site boundary with necessary permits.

The foreign workers will be trained regarding the security measures and limits prior to arrival and will be aware that they will be occupied within the Site borders only. The foreign workers will be assisted via security personnel to their transportation as soon as their arrival to the airport and this process will be applied for the time their departure as well. Therefore, no interaction with the foreigners will be experienced among the local community. Since foreign workers will only be accommodated at a camp which will have a range of on-site amenities. This will minimize the need for the workforce to utilize (or rely on) local infrastructure – i.e. minimizing the pressure that may be experienced by community infrastructure and services. (As to their agreement, at the conclusion of the construction phase, the workers brought in from outside the area will leave back to their country or residence). If the migrant worker is required to transfer to the Hospital, security forces will be assigned to security guard throughout the process.

Excavation and construction works may expected to cause dust and noise emission. However, according to environment impacts section of this Report, the potential impacts are assessed as negligible with the stated mitigation measures. Further information on dust and noise impacts can be found in sections 6.3.1 and 6.3.2 of this Report, respectively.

As stated earlier, in terms of national workers, there will be total 352 Iraqi workers employed throughout the construction phase of the Project. Employment opportunities for Iraqi nationals are structured to be advertised on the level of the community based committee and the local governmental unit in order to prevent explosion on the local labour market.

It is important to note that, due to Iraqi national security precautions; movement between the

regional borders within Iraq is quite limited and almost prohibited. An Iraqi cannot transport or move across regional borders without any reference or official permission, in which will be checked, and will be questioned by the security checkpoints or patrols. Therefore internal migration caused by the Project is not foreseen.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Approximately 15% increase in general population is expected during the construction phase of the Project. Therefore, influx is direct negative impact.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	The receptor sensitivity is high due to: • Additional population load may create pressure on local communities due to insufficient infrastructure. • Employment of foreign labour may disturb existent social cohesion.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact duration is short term.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impacts regarding the influx expected to be local.				
Magnitude	Negligible	Low	**Medium**	High	
	Considering the impact will be limited to local, the magnitude is expected as medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Influx related impacts may be likely to occur.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is evaluated as medium level.				
Impact Reversibility	High Reversibility	**Medium Reversibility**	Low Reversibility	Irreversible	
	Reversibility of the impact is medium, the locals are not adaptive to the multi-national environment. However, the main source of impact will be expected in peak season of the construction period, which is considered as short time.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

- In order to prevent dust generation, roads will be sprinkled with water regularly, especially during dry and windy weather conditions. Loading and unloading of construction materials will be performed in a proper way to prevent dust generation. Vehicles loaded with dust generating materials will be covered during transportation. Speed limits of 30 km/h will be applied for the drivers. Materials stored within the project area will be monitored for dust emissions and covered or damped if required.

- Noise impact is expected to be negligible at the closest settlement, good site working practices will be implemented during construction activities and noise control measures will be adopted where necessary i.e. maintenance of construction equipment will be conducted regularly, exhaust mufflers will be applied to the equipment in order to minimize noise emissions and also speed limits will be implemented for the vehicles.

- All Project workers will be trained in terms of electricity usage within the Site borders and eliminate unnecessary use of power.

- The Project Subcontractor sets targets for local hiring and seeks to use local businesses and services to the extent as possible.

- Grievance Mechanism will be established for the workers in order to receiving, handling and recording complaints.

- Provide accommodation to all foreign Project workers within the Project fences. Accommodation will meet IFC worker accommodation guidelines.

- The magnitude of influx, and the type and significance of indirect impacts from influx are difficult to forecast. It is therefore important that the throughout the Project phases, monitoring influx and any associated negative impacts closely should be implemented in order to take appropriate and immediate action where necessary. In order to monitor influx and its impacts, the Project will:

    - Implement and disseminate a community level grievance mechanism, through which local community members can submit concerns and complaints about influx and related negative impacts;

    - Engage regularly with head of villages and relevant governmental authorities to discuss and monitor influx and any associated impacts, especially monitor on changes in electricity cuts during the construction phase.

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Approximately 15% increase in general population is expected during the construction phase of the Project.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	The receptor sensitivity is high due to: Additional population load may create pressure on local communities due to insufficient infrastructure. Employment of foreign labour may disturb existent social cohesion.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact duration is short term.				
Impact Extent	**Project Area**	**Local**	Regional	National	
	Impacts regarding the influx expected to be local.				
Magnitude	Negligible	**Low**	Medium	High	
	Considering the mentioned points below, the magnitude will be low. - Interactions between locals and foreign workers will be minimized to the extent as possible with the security measures and all foreign workers will be trained regarding the nature of the AoI prior to arrival. - Electricity usage will be monitored and encourage energy saving behaviours to all workers. - Monitoring grievance mechanism and taking all the necessary steps to avoid further discomfort among the locals, when necessary.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	With the given mitigation measures, the impacts are expected to not likely occur.				
Impact Significance	**Insignificant**	Low	Medium	High	
	Impact significance is evaluated as insignificant level.				
Impact	High Reversibility	**Medium**	Low Reversibility	Irreversible	

Reversibility		**Reversibility**			
	Reversibility of the impact is medium; the locals are not adaptive to foreigners within the AoI. However, the main source of impact will be expected in peak season of the construction period, which is short time.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

6.5.6.2 Operation Phase

In terms of operation phase of the Project, the MoE plans to employ a number of 500 workers during the operation phase of the Project. The expected skill-set for the operational works may not be available within the AoI, therefore, migrant workers (i.e. skilled and highly skilled categories) are expected to be employed throughout the operation phase. It is assumed that some of these workers will come from outside the AoI (however, the breakdown in terms of the number of people from outside the local area is unknown). Given the duration of the Project, it is anticipated that these workers may bring their families with them. These workers may place some additional pressure on the local infrastructure. However, given the population of the AoI is 9.000, this additional pressure can be accommodated without any additional negative impact.

In addition, as stated in section 5.4.5.1 there are no health centers located AoI. For this reason, if health care is required, workers will likely need to utilize facilities outside the local area.

Last, there is potential to impact more widely on community services (e.g. schools, community centers). This assumes that workers will be brought in from other areas and bring with them their families as stated. For primary schools the migrant workers may enrol their children to schools in the AoI. For high school on the other hand, just like locals in the AoI, the migrant workers may use schools in the city centers as there are only one high school in the AoI (except one located in Al-Mahmud village). This impact is expected to result in only a handful of families moving into the area. As a result, the extent and scale of the impact is likely to be local with minimum impact.

In terms of interaction with the locals, almost all workers are expected to be Iraqi national, therefore, no negative impact on existed cultural cohesion of the AoI is anticipated.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impact caused by local influx on local infrastructure is a direct negative impact.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The receptor of the impact is the locals of the AoI, considering the population figures of the villages, the locals are not expected to have difficulty with minor change in the				

	population.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact duration is long term considering the operation phase of the Project.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impacts regarding the influx expected to be local.				
Magnitude	Negligible	Low	**Medium**	High	
	Considering the impact will be limited to local, the magnitude is expected as medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Influx related impacts may be likely to occur.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is evaluated as medium level.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	Reversibility of the impact is high.				
Overall Impact Assessment	Negligible	**Minor**	Moderate	Major	Critical

Mitigation Measures

- For the operation phase, noise impact is expected to be negligible at the nearest settlement (See Section 6.3.2.2) maintenance of noise generating equipment will be conducted regularly in order to prevent increased noise levels from equipment.
- Implement and disseminate a community level grievance mechanism, through which local community members can submit concerns and complaints about influx and related negative impacts.
- The Project Owner should consider social investment/ corporate social responsibility plan/ program. As part of the plan, AoI should explore opportunities to enhance community infrastructure and services.
- The Project Owner should ensure appropriate and adequate health care services are provided on site and at the accommodation camp to address/ manage worker illnesses and injuries.
- When needed, provide an introduction for workers moving into the area – so that workers understand local culture and customs.
- The local jobseekers will be given preference and only if the required skills and experience are not available locally. Iraqi workers will be imported from elsewhere in the country.

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impact caused by local influx on local infrastructure is a direct negative impact.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The receptor of the impact is the locals of the AoI, considering the population figures of the villages, the locals are not expected to have difficulty with minor change in the population.				

Impact Duration	Temporary	Short-term	**Long-term**	Permanent
	Impact duration is long term considering the operation phase of the Project.			
Impact Extent	Project Area	**Local**	Regional	National
	Impacts regarding the influx expected to be local.			
Magnitude	Negligible	**Low**	Medium	High
	Considering the given mitigation measures the magnitude of the impact is low.			
Likelihood	Negligible	**Not Likely**	Likely	Certain
	Influx related impacts expected to not likely occur.			
Impact Significance	**Insignificant**	Low	Medium	High
	Impact significance is evaluated as insignificant level.			
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible
	Reversibility of the impact is high.			
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	Critical

Residual Impacts

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

6.5.7 Occupational Health and Safety

6.5.7.1 Construction Phase

Occupational health and safety hazards can include construction machinery, handling of electricals, noise pollution and dust pollution. In the case of spills/leaks, there is a potential for fire hazards and some hazardous substances.

The Project site also needs to implement proper measures for fire safety, public accessibility, falling objects, structural safety and any emergency situations. The occupational health and safety concerns mentioned above would be consistent across the Project life cycle. While ENKA will implement procedures to manage health and safety risks, the contractors and those in the supply chain will also be required to operate in line with the safety procedures. Safety of the working conditions will be ensured by and will be the responsibility of ENKA; including OHS related issues, camp management and following related legislations and management plans.

As mentioned, the Project will employ range of people during construction phase. There is potential for the workforce to introduce and / or increase the rate of spread of communicable diseases in the Project Area. This includes of a new and/ or a more virulent strain of an existing disease.

The closest hospital is named as Private Emel Hospital that is located 8.5 km from the Project Site. This full-fledged hospital includes departments of neurology, cardiology,

orthopaedics and general surgery. The hospital also provides services of Tesla MRI Scan and Color Doppler. The experts of the Subcontractor paid a visit to the Hospital and made observations with the assistance of Dr. Priyamk, a doctor from the neurology deparment. According to the observations, the Hospital also includes Hindu hospital workers and doctors within their capacity. Furthermore, there will be a health clinic within the borders of the Project Site.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning occupational health and safety are negative and direct.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Receptor sensitivity is considered high since there will be total of 1.743 construction workers with three different national backgrounds.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact will occur during construction.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	OHS impacts are likely to occur considering the number of workers if no mitigation measure is taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Mitigation Measures

Sufficient working conditions in harmony with Iraqi legislation and international best practice - if possible- will be ensured (Ensured in General Camp Rules document provided by ENKA). It is important to note that all OHS related training and awareness meetings, policies, banners should be available in all languages of the Project workers to be aware of the precautions.

- Dhi-Qar CCPP Project HSE Plan of ENKA elaborates on OHS related issues which can be furtherly referred. To summarize, Iraqi legislation and ISO 22000 will consist the framework approach, which the latter regulates food safety, Camp Supervisor, Project HR and Administration Manager, Business Manager and Project Manager will be responsible concerning toilet-bin control-garbage, staff accommodation, recreation areas, storage, housekeeping, catering and general camp maintenance.

- Potential hazard risks related with construction activities will be defined and measures to minimize the occurrence of hazards. The measures will include (but not limited to) to prevent below hazards:
    - Slips and falls
    - Work in heights
    - Struck by objects
    - Moving machinery
    - Dust
    - Confined spaces and excavations
    - Contact with hazardous substances
    - Traffic operations
- The Project will develop an Occupational Health and Safety Management Plan which will be a subset of the overall ESMMP system, tailored to the needs of the Project and the construction and operation phases. This plan will set standards that will be met by the ENKA and sub-contractors. It will include the following:
    - Measures will be outlined to prevent accidents, injury and illness / disease;
    - Provision of personal protective equipment will be outlined along with its uses;
    - Provision of preventative and protective measures relating to the modification, substitution or elimination of hazardous conditions or substances; and
    - Documentation and reporting of occupational accidents, illness / disease and incidents, emergency prevention, preparedness and response arrangements. This process will also include a procedure for identification of near misses and incidents as well as root case analyses of near miss events and accidents.
- The Project will abide by IFC standards and ILO conventions when gaps are identified between national legislation and international standards. The Project will monitor the implementation and compliance to these standards by contractors and sub-contractors across the supply chain.
- Although the DU contamination surveys conducted by the Atomic Energy Agency stated the DU concentrations in soil are low (See 5.4.5.2 for further information) appropriate PPE will be provided for the workers to limit any possible exposure.
- Concerning the relatively high baseline chromium and zinc concentrations in soil, appropriate mitigation measures such as the proper use of the PPE and good site practices to prevent the generation of dust, will be taken in order to prevent the exposure of the workers. In this regard, the proper use of appropriate protective clothing and equipment will be ensured whenever a hazard evaluation of the workplace has identified that skin or eye contact with Cr(VI) presents or is likely to

present a hazard to the workers. Where such a hazard is identified, the clothing and equipment needed to protect the workers from Cr(VI) hazards must be selected. Some examples of protective clothing and equipment that may be necessary, include, but are not limited to gloves, aprons, coveralls, foot coverings and goggles. Normal street clothing and uniforms or other accessories that do not protect workers from Cr(VI) hazards are not considered protective clothing or equipment under the standard. The clothing and equipment will be provided and maintained at no cost to the workers (Occupational Safety and Health Administration of U.S. Department of Labor, 2011).

- Undertake pre-employment screening to all workers to ensure workforce fitness for work. However, it is important that the pre-screening process do not cause discrimination.
- As part of Project orientation training, include awareness rising of the prevention and treatment of communicable diseases.
- The Project Site will include a health clinic within its borders including a doctor and nurses. The health clinic should include electrocardiogram, defibrillator, main surgical intervention kits, etc. The health clinic will have an observation room with a capacity of at least 4 beds and quarantine room in case of quarantine incidents.
- There will be an ambulance assigned for the Project Site to transport the patient to the hospital or to transfer the patient to the clinic in terms of emergency. The ambulance should obtain all the necessary permission by the MoE to pass through the checkpoints in the Nasiriyah / Basra Region or to the Basra Airport in case of emergency. Security will be assigned to a migrant worker in case of Hospital transfer is required.
- Provision of onsite health care, to ensure that medical attention can be provided for a worker who present with symptoms of a communicable diseases. An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it.
- All workers (regular and contracted) should be provided with training on Health and Safety policies and toolbox training for specific tasks with appropriate refresher courses throughout the life cycle of the Project.
- Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits. This training should include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tag-out procedures, first aid including CPR, and proper rescue procedures.
- Permitting system should be implemented to ensure that lifting equipment is operated by trained and authorized persons only.

- Appropriate safety harnesses and lowering/raising tools should be used for working at heights.
- Safe drinking water supply should be provided for the workers.
- Excavated areas should be temporarily fenced to avoid access to outsiders and wildlife.
- Security should be deputed at potential accident sites to restrict entry and prevent near miss or fatal incidents.
- All equipment should be turned off and checked when not in use.
- Workers will stop working in extreme natural climatic conditions i.e. heat wave, heavy rain etc.
- Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning occupational health and safety are negative and direct.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Receptor sensitivity is high.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact duration can is short-term.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	The magnitude of the impact is medium.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	OHS impacts are not likely to occur considering the mitigation measures stated above.				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact significance is low.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Residual Impacts

Residual impact is determined as moderate considering the worst case scenario for reversibility. Therefore a strict monitoring of the implementation of mitigation measures and workers' awareness and trainings for the risks of Project activities will be continuously provided which will result minimizing even avoiding the likelihood of the impact.

6.5.7.2 Operation Phase

According to IFC's Environmental, Health, and Safety Guidelines for Thermal Power Plants document (I)Non-ionizing radiation, (ii)Heat, (iii)Noise, (iv)Confined spaces, (v) Electrical hazards, (vi)Fire and explosion hazards, (vii)Chemical hazards, (viii)Dust health and safety impacts are of particular concern during operation phase of the thermal projects.

Non-ionizing radiation may arise from working in proximity to electric power generators, equipment, and connecting high-voltage transmission lines may create electric and magnetic fields (EMF).

Heat is one of the important OHS impacts of the operation phase. This impact may occur during operation and maintenance of combustion units, and related hot equipment.

Noise sources in combustion facilities include the turbine generators and, compressors.

Electrical Hazard is mainly energized equipment and power lines.

Fire and Explosion Hazards may arise from transfer, and use large quantities of fuels.

The closest hospital is named as Private Emel Hospital that is located 8.5 km from the Project Site. This full-fledged hospital includes departments of neurology, cardiology, orthopaedics and general surgery. The hospital also provides services of Tesla MRI Scan and Color Doppler. The experts of the Subcontractor paid a visit to the Hospital and made observations with the assistance of Dr. Priyamk, a doctor from the neurology department. According to the observations, the Hospital also includes Hindu hospital workers and doctors within their capacity. Furthermore, there will be a health clinic within the borders of the Project Site.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning occupational health and safety are negative and direct.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Receptor sensitivity is high.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact duration is long-term.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	OHS impacts are likely to occur if no mitigation measures are taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Mitigation Measures

- The Project Owner will adapt, implement and monitor Occupational Health and Safety Management Plan which will be a subset of the overall ESMMP system,

tailored to the needs of the Project operation phase. This plan will set standards that will be met by the ENKA and sub-contractors. It will include the following:

  - Measures will be outlined to prevent accidents, injury and illness / disease;
  - Provision of personal protective equipment will be outlined along with its uses;
  - Provision of preventative and protective measures relating to the modification, substitution or elimination of hazardous conditions or substances; and
  - Documentation and reporting of occupational accidents, illness / disease and incidents, emergency prevention, preparedness and response arrangements. This process will also include a procedure for identification of near misses and incidents as well as root case analyses of near miss events and accidents.

- The Project will abide by IFC standards and ILO conventions when gaps are identified between national legislation and international standards. The Project will monitor the implementation and compliance to these standards by contractors and sub-contractors across the supply chain.
- An ambulance should be assigned for the Project Site to transport the patient to the hospital or to transfer the patient to the clinic in terms of emergency. The ambulance should obtain all the necessary permission by the MoE to pass through the checkpoints in the Nasiriyah / Basra Region or to the Basra Airport in case of emergency.
- Provision of onsite health care, to ensure that medical attention can be provided for a worker who present with symptoms of a communicable diseases. An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it.
- Undertake pre-employment screening to all workers to ensure workforce fitness for work. However, it is important that the pre-screening process do not cause discrimination.
- Occupational EMF exposure should be prevented or minimized through the preparation and implementation of an EMF safety program.
- Regular inspection and maintenance of pressure vessels.
- Provision of adequate ventilation in work areas to reduce heat and humidity.
- Reducing the time required for work in elevated temperature.
- Ensuring access to drinking water.
- Shielding surfaces where workers come in close contact with hot equipment. including generating equipment, pipes etc.

- Use of warning signs near high temperature surfaces and personal protective equipment (PPE) as appropriate, including insulated gloves and shoes.
- Provision of sound-insulated control rooms with noise levels below 60 dB(A); Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization.
- Use of voltage sensors prior to and during workers' entrance into enclosures containing electrical components.
- Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them.
- Security should be deputed at potential accident sites to restrict entry and prevent near miss or fatal incidents.
- All equipment should be turned off and checked when not in use.
- All workers (regular and contracted) should be provided with training on Health and Safety policies in place with appropriate refresher courses throughout the life cycle of the Project.

Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits, this training should include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tag-out procedures, first aid including CPR, and proper rescue procedures. Provisions should be made for periodic retraining as necessary. Although there is no legal requirement for designation of an extra safety exclusion zone and no extra safety exclusion zones have been defined, the fire and explosion risks have already been considered through preparation of the layouts for the plants. For instance, the fuel treatment units/fuel storage tanks within the plant sites are located at least 100 m distance from the plant site boundaries. Moreover, the closest settlements are far enough from the plant site.

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning occupational health and safety are negative and direct.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	Receptor sensitivity is high.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact duration is long-term.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact significance is medium.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	OHS impacts are not likely to occur with the given mitigation measures.				
Impact	Insignificant	**Low**	Medium	High	

Significance	Impact significance is assessed as low.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Residual Impacts

Residual impact is determined as moderate considering the worst case scenario for reversibility. Therefore, a strict monitoring of the implementation of mitigation measures and workers' awareness and trainings for the risks of Project activities will be continuously provided which will result minimizing even avoiding the likelihood of the impact.

6.5.8 Community Health and Safety

6.5.8.1 Construction Phase

During the construction phase, there will be traffic increase on the Primary Road No. 7 passing from the north of the Project site, which will be used for transportation of construction material to the Project site. Traffic will also increase on the route from the Umm-Qasr Port through Safwan-Zubair DGS-Tuba-Rumaila-Nasiriyah-Strategy Road-Al Kidhir-Batha to the Project site that will be used for transportation of heavy and oversized equipment. Increased number of vehicles may enhance the risk of traffic accidents and also heavy vehicles may damage the road. During the construction phase, dust and noise generation will occur, however impact on the closest settlements is not expected to be significant. As stated in Section 5.4.1.1 (Education) almost all children attend primary and secondary schools, since they usually walk to school, the children within the borders of AoI are quite sensitive towards the traffic impacts and can be affected negatively throughout the construction phase of the Project.

With the presence of new infrastructure in the rural area, there may be safety issue such as locals falling in unsecured zones or interacting with unsecured equipment in which may cause onsite accidents or injuries.

Also, majority of the locals use open source of water for domestic purposes, therefore it is particularly important to manage hazardous materials and waste onsite. Given the reliance of open water sources, it is unlikely that the locals would have the ability to adapt to any sort of contamination.

Based on official correspondence with Dhi-Qar Environment Directorate, received on February 23, 2017, it was revealed that there were no pollutants and unexploded ordnances in or around the Project site.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning community health and safety are direct and negative.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	AoI consists of a total of 9.000 inhabitants. If not properly managed, there is a risk of nuisance and health effects to the locals of AoI.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact duration is short-term.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact will be local.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Community health and safety impacts are likely to occur considering the number of locals resided in the AoI, if no mitigation measure are taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Mitigation Measures

- A Traffic Management Plan will be developed and implemented for the Project.
- A Community Health Safety Security Plan should be prepared. A Community Health Safety Security Plan should be prepared. Transportation movements during the beginning and the end of the school hours either will be managed through alternative pathways or will be limited.
- Each school within the AoI will be informed regarding the traffic hours and necessary mitigation measures will be organized for the children who walk to school / home.
- Load and speed limits will be applied during the transportation of heavy equipment. Safety and traffic signs will be properly placed near and around the project site on the road to the Project site.
- Also drivers will be trained for complying with traffic rules in order to minimize traffic accident risk.
- Bridge conditions will be checked for transportation of ultra-heavy equipment. It is not possible to find the design details of all of the bridges in Iraq. Therefore, the bridge

conditions will be evaluated based on the previous experiences, if there is no possibility for construction of a bypass road.

- On the transportation route from the Umm-Qasr Port to the Project site, equipment with a maximum length of 30 m can be transported with some minor civil works. Transport length can be increased by major civil works.
- The maximum width of equipment that can be transported on the transportation route from the Umm-Qasr Port to the Project site, is 7 m. Good traffic management will be done for wider equipment.
- The maximum height of equipment that can be transported on the transportation route from the Umm-Qasr Port to the Project site, is 6 m from the ground to avoid all obstacles. However, the low voltage powerlines must be lifted up by the isolator stick to prevent any contacts between equipment and distribution line. In case of transportation of taller equipment, the low voltage, medium voltage and high voltage powerlines on the specified route, will be shutdown, lift up or dismantled.
- Maintenance of the damaged roads due to project activities will be provided by the Project Subcontractor.
- Any activities outside the Project Site will be appropriately sign posted.
- Development of waste management plan. Temporary storage areas are in compliance with the IFC standards and final disposal sites will be developed with the cooperation with the local authorities.
- Engagement activities prior to construction will ensure that local stakeholders are informed of the risks and consequences of entering the site. The Project will implement an awareness raising campaign with local stakeholders regarding the risks related to the movement of heavy vehicles and increased traffic in the area. The main focus of this campaign will be during the construction phase and will focus on local residents, children (in schools) and the users of local amenities. It will be implemented in coordination with local community groups and the Mukhtars and/or Sheikhs.
- The Project Company will monitor emissions and noise and take immediate measures where necessary.
- An Emergency Response Plan will be developed for the Project in order to respond to accidental and emergency situations associated with the project to prevent and mitigate any harm to people and/or the environment.
- Fuel/oil storage tanks will be located on impermeable ground with secondary containment in order to prevent any contamination to soil or groundwater in case of any spill or leakage (See Section 6.3.3 for further information).

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning community health and safety are direct negative.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	AoI consists total of 9.000 inhabitants. If improperly managed, there is a risk of nuisance and health effects to the locals of AoI.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact duration is short-term.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact will be local.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Community health and safety impacts are not likely to occur with the given mitigation measures.				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact significance is low.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Residual Impacts

Residual impact is determined as moderate considering the worst case scenario for reversibility. Therefore a strict monitoring of the implementation of mitigation measures and employees' awareness and trainings for the risks of Project activities will be continuously provided which will result minimizing even avoiding the likelihood of the impact.

6.5.8.2 Operation Phase

According to IFC's Environmental, Health, and Safety Guidelines for Thermal Power Plants document; community health and safety impacts may be of particular concern for thermal power plant projects from water consumption and traffic safety.

Water required during operation phase of the Project will also be supplied from the Euphrates River which may create negative impact in case of oil spill. Water consumption and potential impacts of the Project was assessed in Section 6.3.3.2 of this Report. Also, during the operational phase, the contribution to the existing traffic load is expected to be minimum.

The Project will employ 500 people during operation phase, this is potential for the workforce to introduce and/or increase the rate of spread of communicable diseases in the Project Area. Considering there are no health facilities in the AoI, increase in the communicable diseases will leave the local villagers vulnerable.

Unauthorized visits to the Project Site by the locals may cause interaction with unsecured equipment. This can lead to accidents and injuries.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning community health and safety are direct negative.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The nuisance and health effects to the locals of AoI are assessed as medium.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact duration can is long-term.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Community health and safety impacts are likely to occur considering the number of locals resided in the AoI, if no mitigation measure are taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Mitigation Measures

- A traffic management plan will be developed and implemented for the Project.
- Load and speed limits will be applied during the transportation of heavy equipment. Safety and traffic signs will be properly placed near and around the project site on the road to the project site.
- In order to prevent unauthorized, the project should fenced with a high grade security fence with razor wire, security cameras, lookout points, and internal lighting.
- Drivers will be trained for complying with traffic rules in order to minimize traffic accident risk.
- A Community Health Safety Security Plan should be prepared.
- An Emergency Response Plan will be developed for the Project in order to respond to accidental and emergency situations associated with the project to prevent and mitigate any harm to people and/or the environment.
- Undertake pre-employment screening to ensure workforce fitness for work. However, it is important that the pre-screening process do not result in discrimination.
- Provision of onsite health care, to ensure that medical attention can be sought should a worker present with the symptoms of a communicable disease;

- Training for all workers on the transmission routes and common symptoms of communicable diseases. This can help reduce the potential for workers to unknowingly transmit communicable diseases. This will also help to increase knowledge within the local villages – e.g. through the training of workers that have been sourced from the local villages.
- Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning community health and safety are direct negative.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	AoI consists total of 9.000 inhabitants. If improperly managed, there is a risk of nuisance and health effects to the locals of AoI.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact will occur during operation.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact will be limited to the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Community health and safety impacts are not likely to occur with the given mitigation measures.				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact significance is low.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal accidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Residual Impacts

Residual impact is determined as moderate considering the worst-case scenario for reversibility. Therefore a strict monitoring of the implementation of mitigation measures and employees' awareness and trainings for the risks of Project activities will be continuously provided which will result minimizing even avoiding the likelihood of the impact.

6.5.9 Security

6.5.9.1 Construction Phase

As stated in the baseline section of the ESIA Report, South Region of Iraq is analysed as a low threat region in terms of terrorist activities, especially compared to other regions of Iraq.

During the household surveys, the locals suggested more police and security officers in the Region. This suggestion is to be considered in line with the Project requirements.

Nasiriyah Central Prison in Dhi-Qar governorate is approximately 3.5 km from the Project Site, in other words, within the borders of AoI. According to baseline studies, there have been no recorded escape or uprising has taken place at the Prison.

The Project is and will be promoted as “infrastructure project owned by the Government of Iraq”. In this respect, promoting the Project as a national investment, the reflection towards the Project’s area is not expected to be a target for terrorist activities. During the construction phase, the security from the borders of the Project Site is under the responsibility of MoE, in order words. Iraqi nationals employed under the Government of Iraq will be protecting the Project Site.

According to the Project’s Preliminary Security Plan, MoE will be responsible for guarding the Project Site fences and Gates. MoE will provide:

- An armed, uniformed guard force commanded by a Guard Commander or Supervisor who is to provide external security to the Project Site, first access control and protection of the Project’s asset’s for the duration of the project work. The services will be active 24 hours a day 365 days a year and;

- Continued occupation and security of the Project Site when not occupied by Sub-contractor or project schedule is halted.

According to agreement among the Project parties, the Sub-contractor and EPC will utilize the fence of the Plant and apply all necessary precautions to safeguard the health and safety of all employees, all material and equipment from all construction and construction related activities inside the fence.

Guards will be recruited from the local population and will be trained to the standards required to conduct armed guard force. All towers will be manned by guards to have lookout for approaching threats to the camp. These armed guards will also provide a perimeter protection. Local National guards will also be provided at all times to act as a low level patrol. National guards will conduct foot patrols at irregular times to deter and if necessary interdict any criminal activity. In terms of airport transfers of expats will be done by B6 protected armoured vehicles.

The strength of the security force is provided in the Table below.

Position	Day	Night	Rest	Total
ENKA Security Manager	-	-	-	1
PSC Security Manager	-	-	-	1
Guard	3	3	3	9
Watch keeper	2	2	**2**	**6**

Source: Preliminary Security Plan

In terms of incident management, the Project will use an Iraq licensed Private Security Company to assist throughout the incident management process. The Private Security Company will have extensive expatriate management and resources based in Southern Iraq and have sufficient capabilities to deal with an incident.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning security are direct and negative.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	AoI consists of a total of 9.000 inhabitants and there will be a total of 1.743 workers resided in the Project Site during the peak period. If not properly managed, unavoidable circumstances may occur.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact duration is short-term.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact will be local.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Security related incidents are likely to occur considering the number of locals resided in the AoI and construction workers, if no mitigation measure are taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal incidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Mitigation Measures

- The plant will be surrounded with fence and unauthorized access to the Project area will be prevented. Unauthorized access to the Project area will be prevented establishing a security zone and put a security management system in place.
- According to IFC's Performance Standard 4: Community Health, Safety, and Security, requires companies to manage private security responsibly; engage with public security; and consider and investigate allegations of unlawful acts by security personnel. Therefore, for the scope of this Project, a Preliminary Security Plan has been established in order to describe how security will be managed and delivered and what resources will be required. The Security Management Plan is the Subcontractor's overarching guidance document for all other procedures and protocols related to security. It also considers risks and impacts to communities posed by a company's security arrangements and include provisions and mitigation measures to address these.
- The Security Management Plan links to the Security Risk Assessment and respond to identified risks, providing direction, organization, integration, and continuity to the company's security and asset-protection program. The level of effort in assessing and managing security risks should be commensurate with the level of security risk associated with the project and its operating context. (IFC, 2017).
- Conflict Management Training shall be given to all security personnel for region specific threats.

- All personnel travelling to the Project area will follow Meet and Greet procedure stated in the Security Plan of the Project.
- ENKA has its own camp management procedures and will be responsible for providing secure conditions. Armed security personnel will be in place in line with the previously aforementioned item. The security for the outside of the Project Site will be provided by the MoE.

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning community health and safety are direct negative.				
Receptor Sensitivity	Very High	**High**	Medium	Low	
	AoI consists of a total of 9.000 inhabitants and there will be a total of 1.743 workers resided in the Project Site during the peak period. If not properly managed, unavoidable circumstances may occur.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	Impact duration is short-term.				
Impact Extent	Project Area	**Local**	Regional	National	
	Impact will be local.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Security related incidents are not likely to occur with the given mitigation measures.				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact significance is low.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal incidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Residual Impacts

Residual impact is determined as moderate considering the worst case scenario for reversibility. Therefore a strict monitoring of the implementation of mitigation measures and employees' awareness and trainings for the risks of Project activities will be continuously provided which will result minimizing even avoiding the likelihood of the impact.

6.5.9.2 Operation Phase

As stated in the baseline section of the ESIA Report, South Region of Iraq is analysed as a low threat region in terms of terrorist activities, especially compared to other regions of Iraq.

Nasiriyah Central Prison in Dhi-Qar governorate is approximately 3.5 km from the Project Site, in other words, within the borders of AoI. According to baseline studies, there have been no recorded escape or uprising has taken place at the Prison.

The Project is and will be promoted as “infrastructure project owned by the Government of Iraq”. In this respect, promoting the Project as a national investment, the reflection towards the Project’s areas is not expected to be a target for terrorist activities.

During the operation phase of the Project, MoE will have full control of the security activities. In other words, armed and unarmed security within and outside of the Project site will be under the MoE responsibility.

Impact assessment table before mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning security are direct negative.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The potential security related incidents to the locals of AoI and 500 operation workers are assessed as medium.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact duration can is long-term.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact extent can be limited with the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	Not Likely	**Likely**	Certain	
	Security related impacts likely to, if no mitigation measure are taken.				
Impact Significance	Insignificant	Low	**Medium**	High	
	Impact significance is medium.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal incidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	Moderate	**Major**	Critical

Mitigation Measures

- MoE will establish A Security Management in order to describe how security will be managed and delivered and what resources will be required. The Security Management Plan is the Project Owner’s overarching guidance document for all other procedures and protocols related to security. It also should consider risks and impacts to communities posed by a company’s security arrangements and include provisions and mitigation measures to address these.
    - The Security Management Plan should link to the Security Risk Assessment and respond to identified risks, providing direction, organization, integration, and continuity to the company’s security and asset-protection program. The level of effort in assessing and managing security risks should be commensurate with the level of security risk associated with the project and its operating context. (IFC, 2017)
    - Conflict Management Training shall be given to all security personnel for region specific threats.

- Throughout the Project life span, the Project should comply its practices with the Voluntary Principles on Security and Human Rights[21].

Impact assessment table after mitigation is provided below.

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impacts concerning security are direct negative.				
Receptor Sensitivity	Very High	High	**Medium**	Low	
	The potential security related incidents to the locals of AoI and 500 operation workers are assessed as medium.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	Impact will occur during operation.				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact will be limited to the Project Area.				
Magnitude	Negligible	Low	**Medium**	High	
	Impact magnitude is medium.				
Likelihood	Negligible	**Not Likely**	Likely	Certain	
	Security related incidents are not likely to occur with the given mitigation measures.				
Impact Significance	Insignificant	**Low**	Medium	High	
	Impact significance is low.				
Impact Reversibility	High Reversibility	Medium Reversibility	Low Reversibility	**Irreversible**	
	Considering the worst case scenario (fatal incidents), the impact is expected to be irreversible.				
Overall Impact Assessment	Negligible	Minor	**Moderate**	Major	Critical

Residual Impacts

Residual impact is determined as moderate considering the worst-case scenario for reversibility. Therefore a strict monitoring of the implementation of mitigation measures and employees' awareness and trainings for the risks of Project activities will be continuously provided which will result minimizing even avoiding the likelihood of the impact.

6.5.10 Cultural Heritage

The potential impact of the Project on cultural heritage may occur due to site preparation activities including excavation. Field survey and literature search have been conducted for the Project and its vicinity during baseline studies in order to determine the potential

[21] The Voluntary Principles on Security and Human Rights were developed by the Governments of the USA and the UK, in collaboration with the extractive and energy sectors, and non-government organisations. The Voluntary Principles are designed to guide companies in maintaining the safety and security of their operations within an operating framework that encourages respect for human rights. They help companies to identify human rights risks and take meaningful steps to address those risks in a manner that helps ensure respect for human rights in their operations. The Voluntary Principles provide a framework for companies to manage risk effectively by:
Conducting a comprehensive assessment of human rights risks associated with security;
Engaging appropriately with public and private security service providers and surrounding communities in complex environments; Instituting human rights screenings of and trainings for public and private security forces;
Developing systems for reporting and investigating allegations of human rights abuses

archaeological and immovable cultural assets. No archaeological or immovable cultural assets were encountered during the study. The closest archaeological site is at a distance of 10.5 km. Therefore impact on cultural heritage due to Project activities is not expected.

Impact assessment on cultural heritage before mitigation is provided below:

Impact Type	Positive	**Negative**	**Direct**	Indirect	Cumulative
	Impact on cultural heritage is negative and direct.				
Receptor Sensitivity	Very High	High	Medium	**Low**	
	There are no archaeological sites encountered during baseline studies.				
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
	The potential impact is mainly during construction phase				
Impact Extent	**Project Area**	Local	Regional	National	
	Impact can occur within the Project area.				
Magnitude	**Negligible**	Low	Medium	High	
	The magnitude of impact is negligible.				
Likelihood	**Negligible**	Not Likely	Likely	Certain	
	Impact on cultural heritage is not expected.				
Impact Significance	**Insignificant**	Low	Medium	**High**	
	Impact is expected to be insignificant.				
Impact Reversibility	**High Reversibility**	Medium Reversibility	Low Reversibility	Irreversible	
	The impact carries a high reversibility, on project area and the vicinity.				
Overall Impact Assessment	**Negligible**	Minor	Moderate	Major	**Critical**

Mitigation Measures

Although it is not expected; in case any cultural asset is discovered during the interventions (digging, splitting, explosion, test excavation etc.) to the ground during construction activities within the borders of the Project site, compliance with the "Law No.55 of 2002. For the Antiquities & Heritage of Iraq" requirements will be provided. Also a Chance Find Procedure will be developed for the Project in order to manage any encounter with cultural assets during Project activities.

Residual Impacts

The overall residual impact will remain negligible with monitoring the measures and related management plans and practices put in place.

6.6 Impacts of Energy Transmission Line

The power generated by the Power Plant is planned to be connected to the national grid through a 1 km OHTL1 from Nasiriyah Thermal Power Plant. One other option for the connection to the national grid will be through 176 km length OHTL between the Project and the 400 kV substation at the north of Nasiriyah. The energy transmission lines are provided in Figure 2-8. It is planned to utilize both transmission lines for the Project in the future. Although the proposed routes are provided, design details have not been defined yet. The establishment of the OHTL is the responsibility of MoE and EPC commitment starts after the connection of the transmission line to the Power Plant. Once the details of the energy transmission lines are finalized a separate ESIA will be conducted by the MoE. Although it requires a specific impact assessment, main concerns related to OHTLs are addressed below:

The potential impacts of the OHTL during the construction phase are expected to be mainly on land use, air quality, noise, soil and groundwater, occupational health and safety and community health and safety.

The emissions during the construction phase will be associated with the dust and exhaust gas resulting from the operation of onsite diesel vehicles, skimming of topsoil layers, and excavation for the electricity transmission towers and transportation of the necessary material and equipment for the construction of the electricity transmission line and transmission towers. The existing access roads will be used if possible and unnecessary traffic will be restricted. Excavated material storage will be minimized and will be covered if required. The construction impacts will be limited in duration and extent, therefore are expected to be negligible.

Improper use or handling and spills of hazardous materials such as insulating oils, paints or fuel can lead to soil and groundwater contamination. In case of storage of hazardous material at the site, the materials will be kept in leak proof containments on designated areas with impermeable floor, spill kits will be available at the working site. Maintenance of the construction vehicles will not occur at the site. The impacts on soil and groundwater are expected to be negligible.

Noise generation due to the vehicle movement and construction equipment will occur during the construction activities however will be temporary and transient in the environment. Also, the working hours will be limited in order to prevent nuisance. Therefore, the noise impacts are expected to be negligible.

Regarding the community health and safety during construction phase, the local communities will be informed about the high voltage before switching on the transmission line. Signs and barriers will be placed in order to prevent contact of the community with high voltage electricity. Fences or similar conducting material installed near power lines will be grounded to prevent electrical shock.

Occupational health and safety hazards during the construction and operation activities are primarily due to the live power lines and working at height. Risk assessment of the laying of transmission lines will be conducted. According to the risk assessment, required prevention and control measures will be developed and implemented. The risk of hazard will be minimized through measures including;

- Employment of only trained and certified workers during maintenance or installation of electrical equipment.
- Deactivating and properly grounding live power distribution lines before starting work.
- Provision of fall protection systems along with required personal protective equipment (PPE).

During the operation phase, the potential impacts are expected to be mainly due to the electromagnetic field (EMF)

Although the site will be visited regularly by the MoE for maintenance, there will be no generation of domestic or hazardous wastes, air emissions or noise during operation. During the operation of the OHTL, plants and trees will be cleared to protect the electric wires if necessary.

The OHTLs are the source of the high electricity and magnetic fields because of the high voltage and currents. Although there is no proven adverse impact of electromagnetic field on human health, there are still some potential risks depending on the frequency and intensity of the fields. Therefore, some limits were developed for exposure to electrical and magnetic fields. “IFC EHS Guidelines for Electric Power Transmission and Distribution” presents exposure limits for general public exposure to 50/60 Hz electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) which are provided below Table 6-17.

Table 6-17 ICNIRP Exposure Limits for General Public Exposure to Electric and Magnetic Fields

Frequency	Electric Field (V/m)	Magnetic Field (µT)
50 Hz	5000	100
60 Hz	4150	83

The effect of the electromagnetic field decreases when the distance from the source increases therefore the line will be installed away from the settlements as far as possible. It is not expected that the potential exposure to the communities to be above ICNIRP recommended exposure limits, however if EMF levels are confirmed to be above the recommended levels, engineering techniques will be considered to reduce the EMF which include:

- Shielding with specific metal alloys.
- Increasing height of transmission towers.
- Modification to size, spacing and configuration of conductors.

6.7 Cumulative Impacts

IFC Performance Standard 1, Assessment and Management of Environmental and Social Risks and Impacts, recognizes that in some instances, private sector developers need to consider cumulative effects in their identification and management of environmental and social impacts and risks. Therefore, IFC believes that when a private sector project sponsor faces cumulative environmental and social impacts, it should have mechanisms for identifying the magnitude and significance of its contribution to those impacts and risks, and should include appropriate mitigation measures as an integral component of the project's environmental and social management system (ESMS).

Performance Standard 1, in paragraph 8, defines the area of in influence to encompass "cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned, or reasonably defined developments at the time the risks and impact identification process is conducted." Performance Standard 1, in footnote 16, limits the cumulative impacts to be addressed to "those impacts generally recognized as important on the basis of scientific concerns and/or concerns from "Affected Communities" and provides examples such as "incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways."

IFC defines cumulative impact assessment in its Good Practice Handbook as: the process of (a) analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen valued ecosystem components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible.

IFC further defines VECs as "environmental and social attributes that are considered to be important in assessing risks"; and that they may be:

- physical features, habitats, wildlife populations,
- ecosystem services,
- natural processes,
- social conditions, or
- cultural aspects.

While VECs may be directly or indirectly affected by a specific development, they are also often affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of ecological pathways.

The key task with the CIA is to describe how the potential impacts of a proposed development might combine, cumulatively, with the potential impacts of the other human activities.

6.7.1 Time Bound

Temporal scope of the assessment extends along the lifetime of the Project. Impacts are discussed for the construction, operation and closure phases of the Project.

6.7.2 Identification of Other Projects and Activities

In the context of the Project; associated facilities such as energy transmission line and natural gas and crude oil transmission lines are assessed within the ESIA. The existing projects considered for the Cumulative Impact Assessment are Nasiriyah Thermal Power Plant at a distance of less than 1 km on the south of the Project site and Dhi-Qar Refinery at a distance of approximately 4.7 km on the south east of the Project site. The refinery and the power plant have already been operating in the region with their contribution of environmental and social effects. With this intention, as it is described in Section 5 of this report baseline studies which have been conducted for the Project including air quality and noise measurements and surface water sampling as well as social studies reflects the impacts from the operating two other projects.

The projects planned to be developed by the Iraqi Government in the future are provided in Table 6-18 and shown in

Figure 6-31.

Table 6-18 Other Existing and Future Projects in the Region

No	Project	Distance to Project Site	Timeline
1	Turkish Hospital	8 km	Mid -2019
2	Dhi-Qar Airport	14 km	completed
3	Wastewater treatment plants	2 x (16 km)	End of 2019
6	Dhi-Qar industrial city	13 km	End of 2019

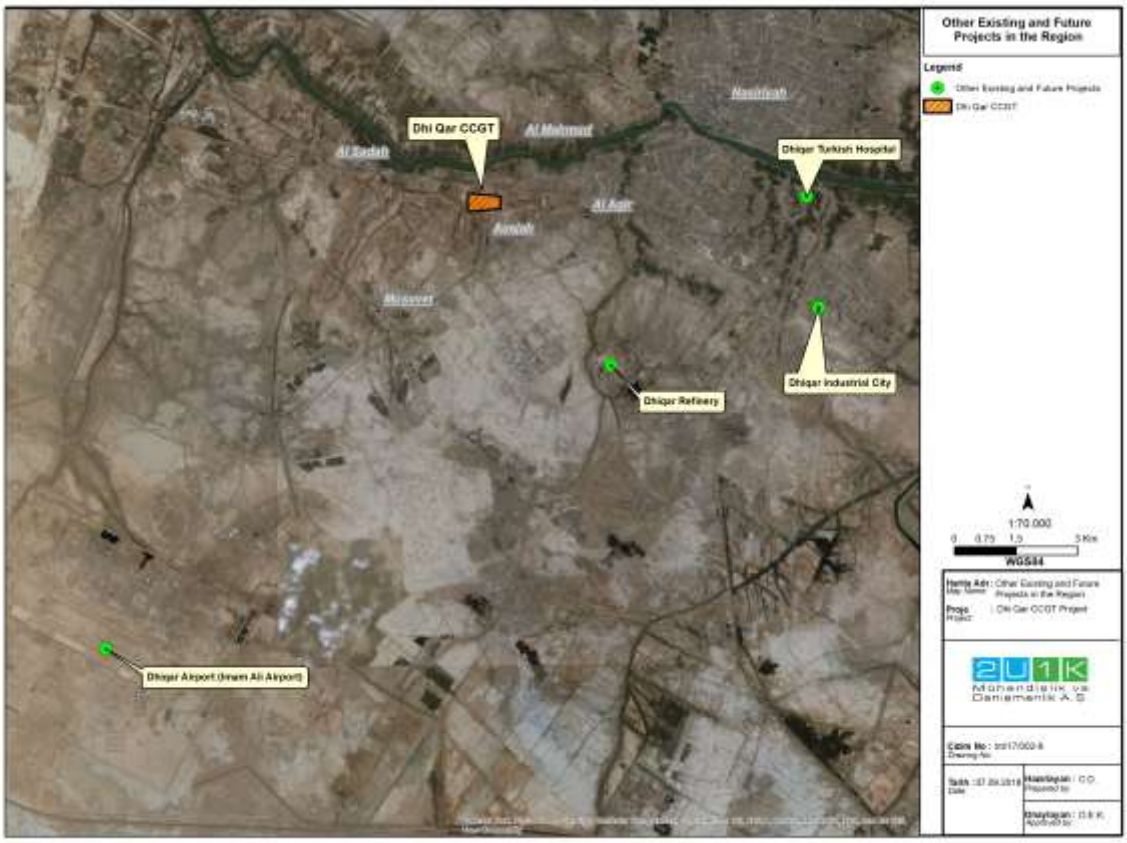


Figure 6-31 Distance of Other Existing and Future Projects to the Project Location (The larger size of the map can be found in Appendix-M)

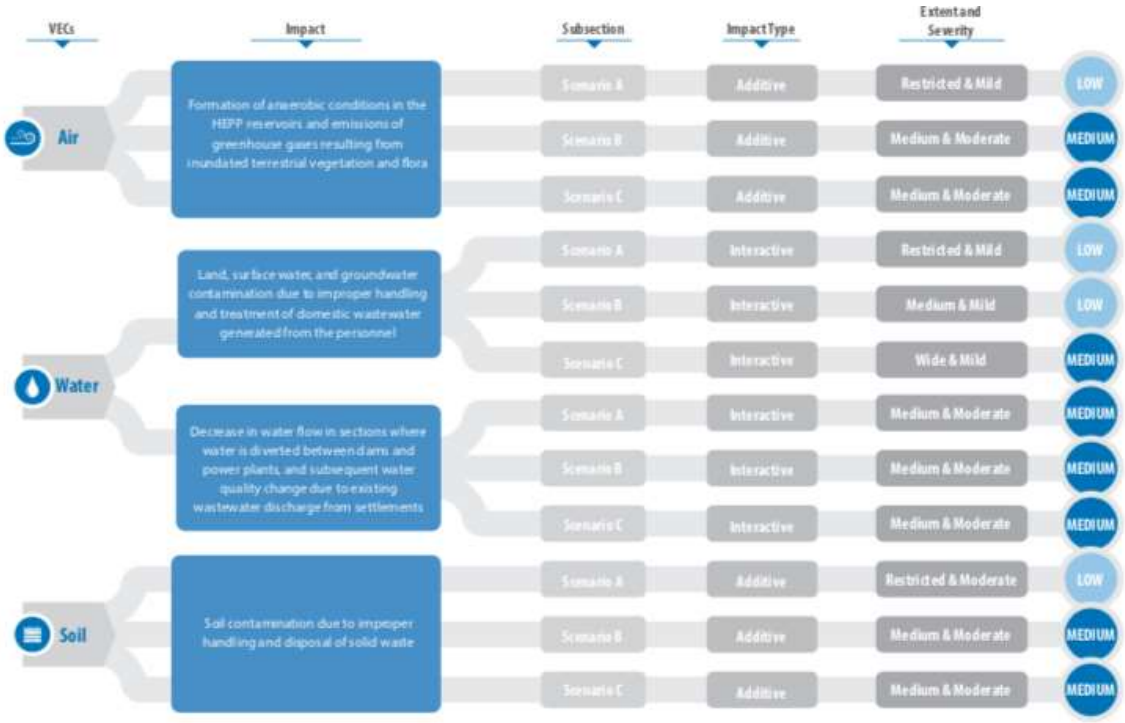
6.7.3 Study Limitations

The information provided by the Iraqi Government is the only source of information. The information on future project regards basic data including location of the project and timeline.

6.7.4 Cumulative Assessment Methodology

Assessment of cumulative impacts considers the effects of other past, present and planned projects with similar impacts on the project area of influence. The key point in determining the need for cumulative impact assessment is that one or more impact topics are impacted by different developments.

As it is described above in Section 6.5, environmental and social impacts are assessed considering the environmental components and subcomponents, if there are any, as well as impact parameters. The quantification or qualification of the impacts on the respective VEC is then presented. The diagram showing the flow of VEC identification process is given as follows:



Source: World Bank, 2012

Figure 6-32 Assessment of Impacts on VECs

A sample with air selected as the environmental component is presented as follows:

Source: World Bank, 2012

Figure 6-33 Sample VEC Table

Assessment of impacts in this study is performed by identifying the VECs in this manner. Environmental components such as air, water and soil have been presented, and impact parameters and VEC(s) are given to properly visualize what impact source will be affecting what resource in what pathway.

The CIA methodology follows the steps indicated below:

Significance of cumulative impacts in CIA is different than significance of impacts in ESIA. In the ESIA process, impact significance is important for deciding whether mitigation is necessary. On the other hand, significance of cumulative impacts is evaluated in terms of the

potential resulting impact to the vulnerability and/or risk to the sustainability of the VECs assessed. This calls for the use of thresholds, which is not easy and practicable for biological and social VECs. For environmental VECs, thresholds are more available as limits of acceptable change, such as maximum concentration of the pollutant in an airshed beyond which health of nearby communities could be adversely affected, or a maximum amount of linear infrastructure in a landscape before visual impacts become unacceptable. For biological and social VECs, the ESIA Report establishes level of significance on available scientific knowledge and experience and on in consultation with stakeholders, government agencies, and technical experts.

6.7.5 Identification of VECs and Associated AOIs

As given in related sections of ESIA Report, study areas are separately defined for individual impact issues, based on their impact sources and corresponding VECs. In this scope, the Project area is primarily defined as the footprint of the project components. Associated facilities, areas potentially impacted by the project and cumulative impacts from other current and planned activities are also included Project area definition.

Boundaries for the CIA encompass the geographic and temporal extent of impacts of the Project on the VEC conditions. With this intention, geographic boundaries are different for each VEC as defined by the area of influence. Future actions are excluded from CIA if they are outside the AoI of a VEC and the CIA mainly focuses on the operation stage of the Project and possible residual impacts from construction.

VECs known to be affected by the Project with related AoIs based on the ESIA, are listed below in

Table 6-19 Summary of Impacts and Area of Influence

VECs	Impacts from the Project	Area of Influence
Air quality	PM10, NO_2 and SO_2 emissions from power plant.	12 x 12 km ESIA AoI.
Biodiversity	Land take from forest areas, tree cutting, top soil removal, discharge, emissions, noise, etc.	Footprint of the Project and close environment, Euphrates River.
Soil	Top soil removal, storage of materials and wastes	Footprint of the Project.
Water	Contamination risks	Euphrates River
Noise and vibration	Transportation, engines of on-site equipment (i.e. ventilation fans)	Nasiriyah City
Landscape and Visual Impacts	Site layout of project units (shafts, CWPs, the wharf)	Near by settlements.

VECs	Impacts from the Project	Area of Influence
Employment	Positive Employment opportunities	Nasiriyah City
Land	Land take for the project	Project footprint.
Community safety	Truck traffic, chemical spills, etc.	Nasiriyah City
Waste	Waste generation from the project	Nasiriyah City
Cultural heritage	Cultural heritage features	Project footprint.

6.7.6 Cumulative Impacts and Mitigation Approach

At initial stage, considering the environmental and social impacts of the project and its components, the VECs are listed against the Project and other activities to check whether they are prone to cumulative impacts. By considering this list, the impacts evaluated with the terms “negligible” or “low” as the outcome of environmental and social impact assessment are scoped out from the CIA study. Furthermore, priority is given to those VECs that are likely to be at the greatest risk from the Project’s contribution to cumulative impacts. Table 6-20 screens out the VECs prone to negligible impacts and positive impacts.

As can be seen in Table 6-20, VECs regarding Air Quality, Seawater and Marine Ecosystem, Population, Employment and Land Use are considered as sensitive in terms of cumulative impacts.

Table 6-20 Screening of Cumulative Impacts

VECs	Impact Significance of Project Activities	Impact Significance of Planned Power Plant	Remarks
Air quality	Minor	Moderate	The assessment study regarding air quality modelling shows that potential impacts of the major project activities in are well below related national standards as well as complies with lenders requirements. Proposed projects regarding future developments in the region show that except Dhi-Qar Industrial City Project, there will be no major air pollution sources. And the distances between the future projects and proposed power plant, indicate the probability of cumulative impacts at low level. As given information by Iraq Government, the types of industries in the Dhi-Qar Industrial City Project are not defined yet. Thus, qualitative assessment is not possible. On the other hand, 25 percent of the applicable WHO ambient air quality standards have been considered for the Project to allow additional, future sustainable development in the same airshed, as suggested by IFC's General EHS Guidelines on Environmental Air Emissions and Ambient Air Quality. Therefore, the proposed Project development allows additional developments in the area in the future.
Biodiversity	Minor	Minor	Impacts caused by Project Activities and future projects on terrestrial biodiversity are limited with footprint of project units (land take) and close environment. Therefore, no overlapping impact is foreseen.
Soil	Negligible	Moderate	Impacts caused by Project Activities and future projects on soil are limited with footprint of project units and close environment. Therefore, no overlapping impact is foreseen.
Water	Minor	Moderate	Euphrates river is the major source of water. Euphrates river is also major receiving body of discharges. Despite the long distance between the project and future projects there might be overlapping impact. On the other hand, considering the water use and corresponding waste water discharge of the project with respect to huge water flow of Euphrates River and potential water demand of future projects such as Dhi-Qar Industrial City, the impact level of the proposed power plant still remain minor, and the significance will be negligible, when it is compared to other projects.
Noise and vibration	Negligible	Negligible	Noise Impacts caused by Project Activities and future projects are limited with their close environment. Therefore, no overlapping impact is foreseen.
Landscape and Visual Impacts	Negligible	Negligible	Visual impacts of Project Units are very limited and not overlapping in terms of sensitive receptors.
Community Health and Safety (traffic)	Minor	Minor	Project timeline shows that most of the projects are planned to be finalized at the end of 2019. In this respect, a traffic increase in the main transport routes during

VECs	Impact Significance of Project Activities	Impact Significance of Planned Power Plant	Remarks
			construction period can be expected. This impact will be temporary and limited with the construction period.
Waste	Minor	Minor	Municipal waste production capacities of the projects are limited.
Cultural heritage	Negligible	Negligible	Impacts caused by Project Activities and future projects on Cultural Heritage are limited with footprint of project units and close environment. Therefore, no overlapping impact is expected.

6.7.7 Mitigation Approach

Cumulative impacts are rather imposed on communities and can be managed with well-established coordination of mitigation and monitoring systems for the Project and the planned power plant. Mitigation approaches are given in table below.

Table 6-21 Mitigation Approaches for Cumulative Impacts

VECs	Impacts	Mitigation approach
Air Quality	Degradation of ambient air quality.	A coordinated monitoring system suggested for best practice. The system should be managed and operated by Iraq Government.
Water	Water quality monitoring for the Euphrates River.	A coordinated monitoring system should be established in order to identify source of contamination and required measures. The system should be managed and operated by Iraq Government
Community Health and Safety	Increased traffic on main transport roads.	Implementation of Traffic Management Plan and implementation of effective drive safety trainings. The plan and trainings should be updated in parallel to existing traffic data during construction period.
Waste	Hazardous and non-hazardous waste to be managed.	Coordination with Nasiriyah Municipality

7 STAKEHOLDER ENGAGEMENT

7.1 Objectives of Stakeholder Engagement

Stakeholder engagement is a two-way process of communication between the Project parties and its stakeholders. It is a key part of the ESIA process, allowing stakeholders to express their views about the Project. The SEP presented in Appendix-I has been developed with the aim of explaining how the Project will communicate with stakeholders that may be directly or indirectly affected by and / or interested in the Project. The SEP summarizes engagement activities undertaken to date and includes details of the approach and mechanisms proposed for future engagement with stakeholders. It also includes details of a grievance mechanism for stakeholders to raise any concerns related to the Project.

In accordance with international best practice, the purposes of the SEP are to:

- consult and participate with affected communities;
- inform indigenous and vulnerable people;
- ensure a technically and culturally appropriate approach to engagement with all key stakeholder;
- ensure the adequate and timely sharing of information with affected stakeholders and other interested parties;
- provide sufficient opportunity for stakeholders to express their opinions and concerns; and
- ensure that these concerns are incorporated into the project decision-making processes during all stages of the project lifecycle.

7.2 Stakeholder Engagement Approach

Stakeholder engagement has been divided into four stages, the first two of which have already been undertaken:

- Phase 1: Initial Engagement
- Phase 2: Impact Assessment
- Phase 3: Impact Assessment Disclosure
- Phase 4: Project Implementation

A range of tools has been used for stakeholder engagement as part of this project. The specific methods used have, and will vary across the different stakeholder groups and particular consideration has, and will be made towards vulnerable groups.

Specific tools for engagement will include:

- Project Brochures,
- Project Website,
- Grievance Mechanism,
- Public Relations Officer,
- Newspapers,
- Public Meetings, and
- Phone calls.

7.3 Roles and Responsibilities

The Project Subcontractor will make sure that all affected parties, particularly affected settlements and local authorities are informed about the Project and will be involved in the process of identifying the important issues of the Project. Roles and responsibilities have been defined in order to ensure effective stakeholder engagement during the life of the project.

Principal roles and responsibilities for the implementation of this plan during the construction phase are outlined in Table 7-1 below.

Table 7-1 Principal Roles and Responsibilities for the Implementation of the Stakeholder Engagement Plan during the Construction Phase

Roles	Responsibilities
Site Manager	Ensures that this SEP is implemented Provides necessary resources for effective implementation of this Plan Coordinates with parties for effective implementation of this Plan
HR & Administration Manager **Grievance Officer**	Implements and improves this SEP Determines necessary resources for effective implementation of this SEP and submits to his line managers Evaluates the compliance of Project activities with national and international legislation requirements. Searches the causes of the social incidents that cause; injuries, delays or stoppage in the work and disputes among Project and communities Monitors all grievances and ensure that all complaints are resolved and closed. Coordinates with parties for proper implementation of this SEP
Security Manager **Site EHS Manager** **HSE Manager** **Construction Manager**	Implements this Plan Organizes cooperation activities with employees Reports grievances, which are received or observed verbally, to Project Manager. Fills out a Complaint & Consultation Register Form Investigates and proposes appropriate methodology for resolving the grievance. Conducts follow ups for the results of complaints and reports on weekly, monthly and annual basis to the Management.

7.4 Stakeholder Identification

In order to develop an effective SEP, it has been necessary to determine exactly who the stakeholders are and understand their priorities and objectives in relation to the Project. By classifying stakeholders, it has been possible to develop a plan that is tailored to the needs of different stakeholder groups. Different issues are likely to concern different stakeholders and so different types of stakeholders have been grouped based upon their relations to the Project. Having an understanding of the relations of a stakeholder group to the Project helps identify the key objectives of any engagement.

Table 7-2 illustrates how each stakeholder is connected to the Project.

Table 7-2 Connection of Stakeholders to the Project

Stakeholder Groups	Stakeholder Type		Connections to the Project
	Affected Party	Other Interested Party	
Local Communities			
• Mukhtar[22] of Aujeah Village • Sheikh[23] of Aujeah Village • Residents of Aujeah Village • Mukhtar of Al-Sadah Village • Sheikh of Al-Sadah Village • Residents of Al-Sadah Village • Mukhtar of Al-Mahmud Village • Sheikh of Al-Mahmud Village • Residents of Al-Mahmud Village • Mukhtar of Al-Agir Village • Sheikh of Al-Agir Village • Residents of Al-Agir Village • Users of local public amenities • Employees of surrounding government institutions and public amenities	√		Households and communities that will receive impacts (positive or negative) as a result of the Project – e.g. positive employment opportunities, provision of infrastructure services or negative impacts associated with dust and noise.
Government			
• Ministry of Electricity • Ministry of Oil • Ministry of Environment	√		• Ministry of Electricity is the owner of the Project. Also, all permits and land allocation outside of Project Site is provided by the MoE.

[22] Mukhtar is the head of a village or neighborhood in many Arab countries. Mukhtars are usually selected by some consensual or participatory method, often involving an election.

[23]Sheikh commonly designates the ruler of a tribe or community who, usually, inherited the title from his father. Sheikhs are also known as religious leader of their community.

Stakeholder Groups	Stakeholder Type		Connections to the Project
• Ministry of Transportation			• The Ministry of Oil will provide fuel gas connection to the gas pipeline as well as crude pipeline to the Project Site. • The Ministry of Environment is the governmental institution concerned with implementing the state's Environment Protection and Improvement policy, and has assumed this task since its creation in 2003 as a natural development reflecting the deep understanding and attention of the Government of Iraq attaches to environment and responding to the urgent need to practice environmental work in order to face the grave environmental challenges and problems.
Local Administrations			
• Dhi-Qar Governorate		√	Local government of primary political importance to the Project with permitting requirements that must be met by the Project and responsibilities for waste management, infrastructure and traffic management. The Project Subcontractor will have to work in cooperation with the local administration bodies.
Employees			
• Construction Staff • MoE	√	√	The construction and operation of the Project will require substantial labor effort and employment. The peak number of workers employed during construction phase will be1773

7.5 Previous and Planned Stakeholder Engagement Activities

This section outlines the previous stakeholder engagement activities undertaken during scoping and the main impact assessment as well as planned ESIA disclosure activities and activities during project implementation.

Table 7-3 Stakeholder Engagement Activities

Engagement Activities Undertaken			
Stakeholder	**Engagement Methods**	**Main Objectives**	**Specific Discussion Areas**
Mukhtar / Sheikh	In-Depth Interviews	➢ Identify Stakeholders ➢ Identify directly and indirectly affected people	➢ The aim of the Project ➢ The scope of the Project
Local residents Mukhtar / Sheikhs Academics	➢ Community Level Survey ➢ Focus Group Discussions ➢ Scoping Phase Meeting ➢ Public Participation Meeting	➢ Identifying the negative impacts ➢ Identifying the positive impacts ➢ Identifying the impact indicators ➢ Providing recommendations on mitigation and enhancement measures to strengthen the positive effects and minimize the negative effects of the Project.	Impacts of the construction and operation phases.
Future Engagement: Impact Assessment Disclosure			
Stakeholder	**Engagement Methods**	**Main Objectives**	**Specific Discussion Areas**
Local residents Mukhtar Sheikh Businesses Academics Impacted Government Departments	➢ Newspaper ➢ Community Meetings ➢ Website ➢ Television Advertisements ➢ Provision of Draft ESIA document	➢ To make the final ESIA available to all interested and affected stakeholders. ➢ Inform Project design and management plans	➢ Content of ESIA ➢ Key positive and negative impacts ➢ Residual impacts and manners in which they can may be mitigated
Future Engagement: Implementation			
Stakeholder	**Engagement Methods**	**Main Objectives**	**Specific Discussion Areas**
Local Residents, Mukhtar / Sheiks/ Government Departments	➢ Media notifications of project progress ➢ Community consultation events ➢ Updating SEP and Sustainability reporting ➢ On-going Community liaison and grievance logging. resolution and reporting ➢ Phone line and postal and email address	➢ Identifying the negative impacts ➢ Identifying and advertising the positive impacts ➢ Identifying the impact indicators ➢ Providing recommendations on mitigation and enhancement measures to strengthen the positive effects and minimize the negative effects of the Project.	➢ Impacts of the construction phase –focusing on those raised at the ESIA stage, such as road safety, and any unforeseen impacts ➢ Impacts of the operation phase.

7.5.1 First Public Participation Meeting

The initial scoping has been accompanied with stakeholder consultation about the Project's benefits and impact. The "Scoping Phase Meeting" was conducted on 11/09/2017. There were two PPMs for Dhi-Qar Project; one in Aujeah village, the other one in Al – Sayeh village. This was requested by the regional Sheiks of the region. An announcement for the

PPM was through local television on September 9, 2017 to inform the public about the date, time, place, and subject of the meeting. As mentioned previously, due to cultural / religious codes of the region, no female participants attended in both meetings. Also, the head of villages did not allow 2U1K to conduct separate 'female-only' participation meeting.

There were total of 50 attendees in the PPM; 10 in Aujeah village and 40 in Al-Sadah village. 2U1K team, with a help of local translators, made a presentation to inform people about the investment and its key environmental and social impacts identified through scoping. Comments and recommendations of the attendees about the project were taken. List of attendees and photos of PPM can be found in Appendix-I (SEP) of the Report.

The main concerns about the Project, which were raised from the attendees during both of the PPMs, are listed below, respectively;

Aujeah village:

- The locals are satisfied in terms of reaching to MoE for Project matters. However, the locals are requesting to establish direct communication with ENKA as well.
- As of now there are 5 locals whom stated to work for the Project. The villagers are expecting higher local worker figures for the Project.
- The locals are willing to work as a security or construction personnel. Also, they are willing to do business for raw materials.

Al-Sadah village:

- The village currently suffers from high unemployment rates of the young generation. Therefore, the majority of the attendees were young male whom are eager to learn further about the job opportunities.
- The locals requested ENKA to provide skill development trainings to the affected villages, especially for young generation to learn more regarding the construction works, in return, they will be able to find further jobs after the end of construction phases of the Project.

Each questions, concerns and suggestion raised from the locals have been addressed either by the Project employees or 2U1K experts, respectively.

7.5.2 Future Stakeholder Engagement

Disclosure of the Draft ESIA Report will provide detailed information about the Project activities, assessment of the impacts and the planned mitigation measures as well as monitoring activities. After submitting the Draft ESIA Report to the lenders, it will be advertised and made available for public review.

Display venues would be expected to include:

- Dhi-Qar Governorship;
- MoE;
- Aujeah, Al-Agir, Al-Mahmud and Al-Sadah villages; and,
- The Project office.

A community meeting should be held to disclose the ESIA. Electronic copies of the Draft ESIA Report will be made available on CDs/memory sticks and the Draft ESIA Report with its appendices will be distributed to select stakeholders registered on the database. Copies of the Draft ESIA Report will also be made available for download from the Project website.

The Public Relations officer of the Project will be responsible for receiving and collecting all comments. All received comments will be fed into the ESIA finalization process and the Final Report will be posted on the Project website.

7.5.3 Grievance Mechanism

Grievances can be an indication of growing stakeholder concerns (real and perceived) and can escalate if not identified and resolved. Identifying and responding to grievances supports the development of positive relationships between projects, communities and other stakeholders.

A grievance management process will be established for the Project. This will provide a formal and on-going avenue for stakeholders to engage with the Project. This grievance mechanism will be accessible to all sections of the affected community, at no cost and will not impede access to other judicial or administrative remedies. Affected communities will be repeatedly informed about the grievance process over the course of community engagement activities.

Stakeholders will be able to share their opinions and grievances via a range of options such as web sites, letters and face-to-face meetings during all future phases of the Project. Feedback will also be provided to demonstrate how their comments and suggestions have been incorporated into the Project decision-making process in the second public participation meeting and this process will be continued in all phases of the Project. A separate grievance mechanism will be established for Project workers.

Grievance procedures will be coordinated through the nominated Grievance Officer who will feed the grievances through to the Project Subcontractor's PRO, who is the primary interface between the community and the Project Subcontractor. The Subcontractor and other project parties are aware of the sensitive role of women in local area; therefore, in order to involve implementation of grievance mechanism equally, it is advised that female PRO should also be hired in order to ensure the design of the mechanism is responsive to everybody resided in the AoI. Even though one on one engagement with the women in the AoI have not been

permitted, in order to promote this service, banners can be posted within the borders of the AoI and head of villages can be informed regarding the 'female only' communication resources for the grievance mechanism. Further information can be found in the SEP.

Confidentiality procedures will be put in place to protect the complainant, as appropriate. Complaints should be reviewed as soon as possible in order to be prioritized for resolution. Regardless of general response and resolution timeframes, some complaints may require immediate attention, for example, an urgent safety issue or where it concerns the livelihood of locals or workers.

The grievance mechanism will be advertised and announced to the affected stakeholders so that they are aware of the process, know they have the right to submit a grievance and understand how the mechanism will work and how their grievance will be addressed. In most cases, a grievance or complaint will be submitted by a stakeholder or local resident by phone, in writing or by speaking with one of the Subcontractor's PROs.

Channels of Communication

Numerous channels will be used for stakeholders to submit any complaints and requests:

- Telephone – All incoming calls will be registered and information summarized daily and sent to the relevant department for processing and action in accordance with the grievance procedure outlined above.
- Electronic channels – Stakeholders have the opportunity to send comments, remarks, requests and complaints via the official website of the Project Subcontractor.
- Post – Mail can be used by stakeholders for submission of their queries/requests/complaints/comments for consideration by the PRO. All incoming letters will be documented and stored as well as the responses sent to the originating party in accordance with the grievance procedure outlined above.
  - Name: Mr. Muwafaq Yousif Azeez
  - Tel: +964 782 786 5242
  - Mail: nasiriyah1@yahoo.com / nasiriah@gppproject.moelc.gov.iq
- Any queries/requests/complaints/comments can be brought to the attention of the Project Subcontractor verbally or written (e-mail) or by filling in a Grievance Form which will be available in the project site office (See Annex 3 of the SEP).

See Appendix-I for further information on grievance mechanism.

8 ENVIRONMENTAL & SOCIAL MANAGEMENT and MONITORING PLAN

An “Environmental and Social Management and Monitoring Plan (ESMMP)” has been prepared for construction and operational phases of the Project in order to present the organizational requirements, actions and monitoring programme that should be implemented by the EPC Contractor and the Project Owner in order to;

- Avoid negative impacts;
- Minimize residual impacts to levels which are acceptable in terms of environment, health, safety (EHS) and society, in case negative impacts are unavoidable, and;
- Operate in compliance with the national legislation as well as IFC/WB Group Performance Standards.
- ESMMP presents the measures for environmental and social impacts of the Project, which are developed based upon the information gathered regarding the baseline conditions of the Project site and the impact assessments that were described in the main text of the ESIA report. The Commitments Register, which includes the measures for environmental and social impacts of the Project, is given in Appendix-N. Additionally, discussions with stakeholders, EPC Contractor and the Project Owner were taken into consideration while defining these measures.

The ESMMP, which is presented in Appendix-O, covers the construction and operation phases of the Project which have positive or negative potential impacts on the environment and the communities.

9 ENVIRONMENTAL & SOCIAL MANAGEMENT SYSTEM

In line with IFC Performance Standard 1, an Environmental and Social Management System (ESMS) will be established by the Project Owner and the EPC Contractor. The Project Owner and the EPC Contractor is responsible for establishing an ESMS and implementing the ESMP and supporting sub-plans. 2U1K Muhendislik ve Danismanlik A.S., as the consultant of the Project Subcontractor will support the Project Subcontractor during the establishment of such ESMS for the realization of the Project.

During the construction phase of the Project, it is the EPC Contractor's responsibility to implement all mitigation and management measures. However the Project Owner will monitor EPC Contractor's activities to ensure the defined mitigation and management measures are effectively implemented.

During operation phase Project Owner will establish an Environmental and Social Management System in order to develop and implement the measures against potential impacts of the Project during operation.

The following management plans and procedures will be developed and implemented throughout the life of the Project:

- Health and Safety Plan
- Emergency Response Plan
- Traffic Management Plan
- Chance Find Procedure
- Waste Management Plan
- Hazardous Waste Management Plan
- Spill Response and Prevention Procedure
- Retrenchment Plan
- Local Procurement Plan
- Security Management Plan

Contractor Management

During the entire lifetime of the Project subcontractors will be engaged for various activities. The EPC Contractor and the Project Owner will be in full responsibility to ensure that the sub-contractors are aware and their activities are compliant with the requirements of the

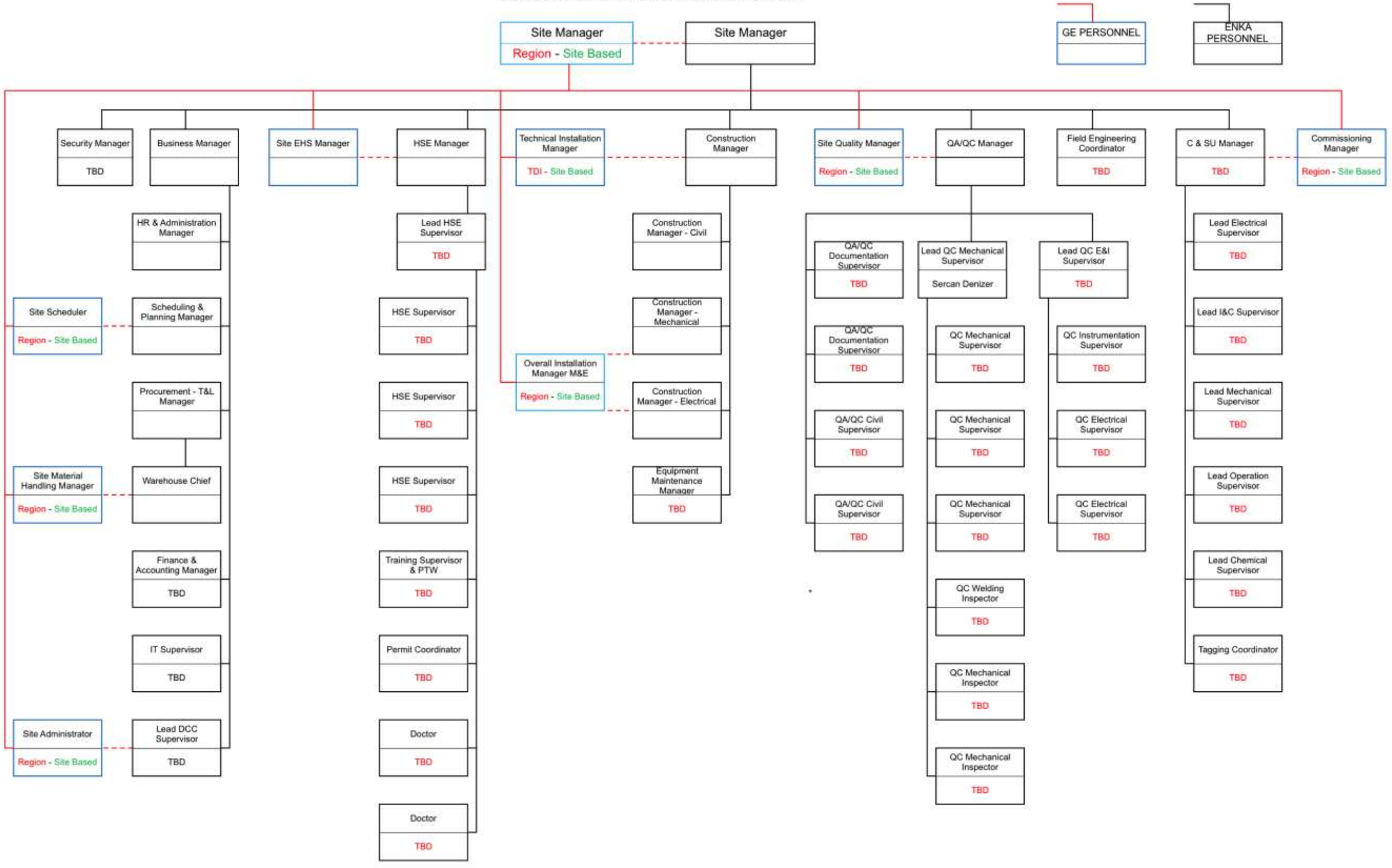
ESMP. A Contractor Management Plan will be developed for the successful implementation of the ESMP. The Contractor Management Plan will mainly include the following:

- Assignment and designation of those responsible for the implementation of the Contractor Management Plan from the senior managers of the Project Owner.
- Training sessions and awareness promotion activities for those in positions in the Project Owner's Contracting/Procurement Department, focusing on the requirements of the ESMP.
- The specific relevant ESMP provisions (including requirements regarding occupational health and safety) will be included in the tender documents as appropriate.
- The bidding contractors' ability to fulfill the ESMP requirements (i.e. sufficient skills and experience) will be examined as a main criterion and employed when awarding tenders.
- Each and every contract that is made will incorporate requirements regarding the relevant environmental and social risks and ESMMP requirements which are associated with the contract activities. Furthermore, they will incorporate non-compliance solutions and mitigation measures when deemed appropriate. Additionally, all contracts will stipulate that all sub-contractors will be held accountable to obligations which are similar to those of the main contractor.
- The contractor will be required to ensure that all staff members are trained and skilled in the appropriate EHS topics and that all activities are completed in accordance with both the Iraqi legislation and the international best practices (such as the IFC Performance Standard 2 on Labor and Working Conditions).
- The contractor will be required to demonstrate the skills, qualifications and/or working experience of his staff and subcontractors to the Supervisor (of the Project Owner). The construction workforce and sub-contractors will receive comprehensive H&S training at the beginning of their assignment, and then on a regular basis thereafter throughout the entire period of construction. Furthermore, special safety instruction will be given to those in the workforce who are temporary or young.
- In the event that international companies are contracted and significant numbers of foreign workers will be involved in the Project, special attention will be given to ensure that not only all Iraqi labor laws and regulations are followed, but international ones as well (e.g. the International Labor Organization (ILO) core labor standards such those regarding child labor, working hours, overtime compensation, etc.).
- It is the duty of the Project Owner to routinely monitor the performance of the contractors with respect to their fulfillment of the ESMP obligations.

Health, Safety and Environment Management of the EPC Contractor

A HSE Plan has been developed for the construction phase of the Project by the EPC Contractor and an Organizational Structure has been established for the implementation of the plan.

DHI QAR CCPP PROJECT
CONSORTIUM SITE ORGANIZATION CHART



The HSE Plan describes the following activities which are to be implemented and adhered to by all parties involved with the Project:

- Strategies to be used for implementation of health and safety systems;
- Compliance with the requirements of ISO 14001, OHSAS 18001;
- Compliance with requirements of national legislation;
- Management systems required to measure and audit safety performance and objectives;
- Accountabilities and responsibilities for each employment category to ensure effective safety management;
- Guidelines for the development of project safe working procedures and systems.

The following HSE policies and procedures have been prepared in conjunction with the Project's HSE Management system:

Table 9-1 Document List

Document Name
HSE Management, System Policies and Programs
HSE Responsibilities
Alcohol / Drug Policy
Hazard Management Procedure
Subcontractor Management Procedure
HSE Training
Safety Incentive Program
Disciplinary Action Program
HSE Leadership and Communication
Construction Procedures&Operations (Control of Work)
Confined Space Entry
Excavation & Trenching
Housekeeping
Lock Out Tag Out
Personal Protective Equipment
Permit to Work System
Floor & Wall Openings
Compressed Gas Cylinders
Hand and Power Tool Use
Rigging and Lifting Operations
Office Safety
Radiography

Document Name
Scaffolding
Journey Management Plan
Working At Height
Dust Control
Manual Handling
Machine Guarding
Temporary Electrical Works
Hot Work
Fire Protection
Occupational Health&Hygiene
Health Management Plan
Fitness to Work Process
Occupational Hygiene
Noise
First Aid
Environment
Construction Environmental Management Plan
Hazardous Material Management
Spill Response and Prevention Procedure
Waste Management Plan

The MoE will also develop and implement Health and Safety Management System throughout the operation phase.