Environmental Social Impact Assessment Study of

Soybean Oil Project

Submitted to

Sama Al-Manar for General Trading Co

SAMA ALMANAR
For General Trading Co.,Ltd.

PROPRIETARY NOTICE

Data contained in this proposal has been submitted in confidence and contains privileged or confidential commercial or financial information and such data will be used or disclosed only for evaluation purposes.

10 December 2023 - HIJRI - 28/05/1445

Prepared by

Enviro Solutions and Technologies Co

التكنولوجيا للحلول البيئية المتكاملة محدودة المسؤولية
ENVIRO SOLUTIONS & TECHNOLOGIES LLC

Quality Information

Document	Environmental Social Impact Assessment Study of Soybean Oil Project
Date	February 2023
Prepared by	Enviro Solutions and Technologies Co

Revision History

Version	Version Date	Details	Contributor Name/Position
A	Feb 2023	Draft for internal and WB review	Dr. Jaafar Nashid Hameed/General Manager and Dr. David Aubrey/Environmental Consultant

أخلاء المسؤولية:

هذا التقرير "دراسة تقييم الأثر البيئي والمجتمعي" تم إعداده من قبل مكتب التكنولوجيا للحلول البيئية مع الاحتفاظ ومراعاة جميع الشروط والاحكام بين العميل (شركة ساما المنار للتجارة العامة) والمكتب مع الأخذ بعين الاعتبار بأن المكتب قد اتخذ كافة الإمكانيات البشرية والمادية المتوفرة لديه لاستكمال هذه الدراسة على الوجة المطلوب وأن جميع المعلومات الموجودة بالدراسة هي صحيحة ودقيقة حتى تاريخ طباعة هذا التقرير ويجب أن تعامل بسرية وعدم إفشائها لأي طرف أخر إلا بموافقة المكتب. تفسير المعلومات والتوصيات هي بناءاً على معرفتنا وخبرتنا في هذا المجال والقياسات الحقلية إن تمت وكذلك بناءا على المعلومات والوثائق المزوده لنا من قبل العميل. ومكتب شركة التكنولجيا للحلول البيئية لا يتحمل أي مسؤولية في حالة الاستخدام الخاطيء لنتائج هذه الدراسة أو استخدامها لأغراض غير المخصصة لذلك وبدون إذن مسبق من المكتب.

Disclaimer:

This document “Environmental Social Impact Assessment Study” has been prepared by Enviro Solutions & Technologies Office (EnviroSOLTECH), with all reasonable skills and care within the general terms and conditions of the contract signed with the client (Sama AlManar for General Trading Co) and taking into consideration all our resources devoted to carry out this work by agreement with the client. The information contained in this document is, to the best of our knowledge, correct and accurate at the time of printing and shall be treated as confidential. The interpretation of data and recommendation are based on our knowledge, experience and field measurements as well as based upon the information made available to us by the client. EnviroSOLTECH accepts no responsibility for any misuse or application of the material set out in this document for any purpose other than the purpose it is prepared for without prior consent from the client.

Enviro Solutions & Technologies LLC
AlAmeer District, near Ateia Jubori Mosque,
AlNajaf AlAshraf, Iraq
Phone: 078 1100 6216 | 077 3642 9559 | 077 0222 9846
Email: info@envirosoltech.com |
Web: www.envirosoltech.com

شركة التكنولوجيا للحلول البيئية المتكاملة
حي الأمير، بجوار جامع عطية جبوري،
النجف الأشرف، العراق
٠٧٨١١٠٠٦٢١٦ | ٠٧٧٣٦٤٢٩٥٥٩ | ٠٧٧٠٢٢٢٩٨٤٦

Table Of Content

List of Figures

List of Tables

ES - EXECUTIVE SUMMARY

ES.1. Introduction

SAMA AlManar Co for General Trading is planning to build a new soybean oil plant in Umm Qasr South Port Berth 4, Basra, Iraq. This Project is based on importing soybeans from abroad and process it inside the facility to produce high quality vegetable soybean oil, taking advantage of strategic site allocated for this project and existing infrastructure (see Figure ES-1). The Project also includes importation of corn, which will not be processed on site, but only stored and distributed.

Figure ES-1: Location of the Soybean Oil Project Site within Republic of Iraq area

The Project will be part funded by the International Finance Corporation and, therefore, the Environmental & Social Impact Assessments (ESIAs) have been developed with regard to international environmental standards, notably the World Bank Group, and specifically the International Finance Corporation's (IFC), Performance Standards on Environmental and Social Sustainability (2012) and the Equator Principles (as reviewed in 2012).

This ESIA report is divided into twenty main sections which include: legal and regulatory framework; project description; assessment criteria and methodology; air quality &

meteorology; terrestrial land environment; terrestrial biological resources; noise/vibration; waste management; water quality management; Marine Environment; socio-economic; Archaeology and cultural heritage; health and safety aspects; traffic and transportation infrastructure; sustainable development assessment; analysis of alternatives; risk assessment; equipment design and safety requirements; summary of impacts and mitigation; and finally environmental management and monitoring plan.

ES.2. Legal & Regulatory Framework

The Iraqi Ministry of Environment (IMOE) has been delegated responsibility for environmental issues within the boundaries of the Republic of Iraq. The Ministry is responsible for controlling pollution and environmental degradation associated with the development and operations of all projects in Iraq.

As the soybean oil project will be located within the boundaries of Umm Qasr Port in Basra, the Iraqi environmental regulations and standards apply to this project. Further, as the proponent is seeking funding from the World Bank/IFC for building this new project, the project shall comply with applicable IFC environmental, social and disclosure policies and apply the World Bank environmental, health and safety (WB EHS) guidelines. Accordingly, the project must specifically adhere to the environmental guidelines and standards set by the Republic of Iraq and the WB-IFC as per pertinent regulations. However, when Iraqi regulations differ from the levels and measures presented in the WB EHS Guidelines, the soybean oil project is expected to satisfy whichever standard is more stringent. Further, where there are no appropriate IFC policies or guidelines, the project shall apply other relevant internationally recognized standards.

The following national and international regulations and guidelines are applicable to this project:

- Iraqi Law No. 12 of 1981: Land Acquisition Law
- Iraqi Regulation No. 2 of 2001: Preservation of Water Resources
- Iraqi Law No. 55 of 2002: The Law of Antiquities and Heritage
- Iraqi Law No. 2 of 2009: Protection and improvement of the environment and natural resources
- Iraqi Law No. 27 of 2009: Protection and Improvement of Environment
- Iraqi Law No. 17 for the year 2010: Protection of Wild Animals and Birds
- Iraqi Law No. 41 of 2015: Noise Protection and Control.
- Iraqi Law No. 37 of 2015: Labor codes, general labor and employment acts

- Iraqi Ministerial Instruction No. 3 of 2012: Environmental determinants for the establishment of projects and monitoring of their safe implementation
- Iraqi Ministerial Instruction No.12 of 2016: Occupational Health and Safety Requirements Regulations
- The IFC General EHS Guidelines, dated April 30th, 2007
- The IFC EHS Guidelines for Vegetable Oil Production and Processing, February 12, 2015
- The IFC EHS Guidelines for Food and Beverage Processing, April 2007
- The IFC and EBRD Workers' Accommodation: processes and standards, dated September 2009.

ES.3. Project Description

The extraction of soybean oil can be accomplished using one of two major approaches: mechanical extraction through pressing (or mechanical expelling), or by chemical extraction using solvent. This project will apply the chemical (i.e., hexane) extraction approach for soybean oil process as it has more advantages compared to the other approach. Soybean Oil extraction process can be divided into three phases. The first involves the pre-cleanliness, drying, cooling and storage of product to be processed. The second phase concerns the preparation of the grains for the oil extraction, by facilitating the extraction processes, such as the loss of grain, conditioning or heating, lamination, and expansion. The final phase involves the extraction itself, which may occur by using solvent (hexane).

This project will include the following main processes: scale, cleaning, conditioning / softening, cracking, flaking, expansion, drying and cooling, hull collection / crushing / transport / storage /packaging and dosing, meal crushing/grading/grinding, and etc.

ES.3.1 Site Location

Umm Qasr Port (see Figure ES-2) is situated within Basra Province near the southern borders of the Republic of Iraq close to the border with Kuwait. The Soybean Oil project is located close to the border with Kuwait within the 2 km border security zone.

The closest sizable population centre is Umm Qasr residential area, which is located approximately 2-3 km to the northwest of the site, and has a population of 63,500.

Figure ES-2: Soybean Oil Project Site Location within Umm Qasr area, Iraq

ES.3.2 Construction

The construction phase of the project is divided into an Early Works Package, and main construction phase. The Early Works package allows the preparation of the site in advance of the main construction phase and will commence in 4th quarter of 2022. Works include grading and levelling of the project site area, temporary roads, laydown areas, waste areas and construction temporarily accommodation areas and others.

A separate Construction Environmental Management Plan (CEMP) has been developed for the Early Works, to allow commencement of construction.

ES.3.3 Main Construction

The process facilities will mainly be constructed using off site pre-fabrication, and modular construction. The infrastructure works will be constructed with local contractors, where available, undertaking specific aspects of the work. The construction works will be performed in many areas at the same time to meet the required schedule.

A temporary construction camp area has been identified inside the project area. The construction camp will include temporary site offices and associated facilities, accommodation area and communal facilities including recreational and sports facilities, kitchens and dining halls, laundry facilities, first air room, and a mosque.

The temporary facilities will include the storage of 5-6 days of water supply provided through delivery by tanker from Umm Qasr area or via a local groundwater well. This water will be used for washing, cleaning as well as for construction activities such as concrete mixing and dust suppression. Bottled water will be purchased from local markets for drinking purposes at the project site. Wastewater will be collected via septic tanks and emptied by tanker to the wastewater treatment facility located near Umm Qasr area. Power will be provided by power line at the site. However, if the power is not arranged by the port authority during construction phase, diesel generators will used until a sub-station connecting to the national grid is provided..

The construction schedule will generate vehicle movements to and from the site as well as within the construction site. Traffic movements are estimated to be:

- Maximum 3-4 small buses (20 seats) per day for transport of workforce per shift to the project site;
- 7 to 10 HGVs (Heavy goods vehicle) per day for raw materials, equipment supply to the site and removal of waste;
- 2 water tankers per day for water supply during the early works period (until the water treatment plant is functioning); and
- 8 small cars for transport of managers, supervisors and engineers to the site.

Particular attention will be paid to areas which may impact or be impacted by the simultaneous development of the Project essential infrastructure.

Anticipated solid wastes generated during the 18-month construction include concrete, pipework and steel off-cuts, electrical cable waste, municipal waste and solid sanitary waste.

ES.3.4 Commissioning

The main activities and sequence of operations during the pre-commissioning and commissioning phase can be summarised as follows:

- Hydrotesting of pipelines and tanks;
- Flushing & cleaning of pipelines;
- System dry-out;
- Systematic conformity check of equipment;
- Static, de-energized test of equipment;
- Preliminary and functional checks;
- Operational test; and

- Pre-Start up activities.

Hydrotesting of pipelines and tanks will be conducted using fresh water. The total quantity of fresh water will be minimised through hydrotest water reuse. Discharge of hydrotest wastewater will be routed to the wastewater tank for testing prior to its reuse or disposal to the Arabian Gulf.

ES.3.5 Operation Phase

To support the proposed operations the Project provided infrastructure will include groundwater wells supplying the Project's water demand, and associated water treatment, cooling water, wastewater treatment system and storage facilities, and drainage services.

The Project also involves the provision of administrative areas such as offices, a training centre, staff meeting rooms, workshops and laboratories, and the provision of housing and essential services for the Project staff who will operate the facility.

Raw water will be abstracted from the local aquifer at the project site to provide for the needs of the Project; following abstraction groundwater will be pumped to the water treatment plant which uses reverse osmosis for the supply of process water.

In recognition of the scarcity of water in this region, and the low recharge of the aquifer, wastewater volumes from all treatment process units have been minimised and re-used wherever possible. These approaches reduce the quantity of wastewater for disposal and minimise the demand for raw water.

The on-site Industrial Wastewater Treatment system will pre-condition any discharges arising before directing it to the water management system.

In addition to the processing plant, the Project includes a general administrative and maintenance area, which includes a number of support buildings as follows:

- Electrical and Mechanical Workshops and warehouses;
- Guest house;
- Locker room
- Administration building and First aid room;
- Quality Control and Development laboratory;
- Training room;
- Canteen lab office;
- Mosque; and

- Security and reception buildings.

The Project has the following process units and associated building:

- Flat storage area
- Fuel tanks
- Groundwater treatment system with storage tank
- Industrial wastewater treatment system with storage tanks
- Power station with five generators (4 in operation and 1 stand-by)
- Boiler house- provides the heat needed by the process by generating steam and distributes it to the facility
- Extraction Unit
- Preparation Unit
- Underground solvent (hexane) tank
- Three Silos with capacity of 10,000 ton of soybean seeds each
- Eight crude soybean oil tanks

Relatively small number of vehicles (small cars and buses for transporting the project staff) and tankers (for transporting crude soybean oil) will be used during the operation phase and these vehicles and tankers will utilize the main road (two lines for each direction) linking Umm Qasr with other towns and cities; the expected impact from traffic will low magnitude and low significance on the existing network.

ES.3.6 Closure/Decommissioning

Decommissioning is expected following cessation of operations; the operational life of the plant is assumed to be about 30 years. The objective will be to return the site to its pre-project condition, as far as possible as per the Land Lease Agreement conditions with the Umm Qasr Port Authority.

ES.3.7 Workforce

During the construction phase, the workforce is estimated to be 250 workers. The construction work week will be 8 hours / day for 6 days / week.

During the the operation phase, the Soybean Oil facility will operate 24 hours per day in 3 continuous shifts with each shift working 8 hours per day. Operations staffing is estimated to be 200 individuals on site for all three shifts. The operational workforce will be predominantly transported to the site by bus.

The number of daily visitors is estimated on average to be 4 persons per day.

ES.4. Assessment of Impacts

The Environmental and Social Impact Assessment (ESIA) for the Soybean Oil Project has been undertaken according to the Iraqi Ministry of Environment, and IFC guidance. It has considered all potential impacts of the construction, commissioning, operation and closure / decommissioning of the Project on the environment, employees, and local community.

The ESIA includes an Environmental Management and Monitoring Plan (consisting of a number of sub-plans), and outline of an Emergency Environmental Response Plan. In addition, the Project management will implement the Environmental Management System for the project in line with international best practice. These plans are considered as “Live” documents, which are updated with any further recommendations identified in future phases.

The results of the impact assessment are summarized below. Potential impacts predicted as being of medium to high significance were assessed against appropriate mitigation measures to predict the residual impact significance. Potential impacts of lower significance were also identified, and although specific mitigation measures are not required for these aspects, a series of recommendations which are considered as good management practices are identified.

ES.4.1 Air Quality & Meteorology

Impacts of the Project on air quality were assessed against current air quality conditions. The contributions from the Project were compared as additional contributions to the existing situation to determine the overall impact of the Project on air quality.

The IMOE has defined Air Quality Standards for a variety of potential pollutants from point sources, and ambient air quality. Point source emissions are compared to the more stringent of IMOE and IFC standards. IMOE standards are used to determine compliance with ambient air quality, since according to IFC local standards take precedence, and IFC are only used in the absence of local standards.

The potential impact of greenhouse gases has also been assessed as required by the IFC’s Performance Standard 3 and Equator Principles 2.

ES.4.1.1 Results

Construction phase:

The modelling results indicate that ground level concentration for both particle sizes (PM_{10} and $PM_{2.5}$) due to emissions from construction of Soybean project alone will exceed neither the Iraqi ambient standards nor the WB guidelines for short-term and long-term average during normal and abnormal operations. However, the accumulative impact will exceed the WB ambient guidelines because the natural background level of PM is already above the corresponding ambient standard.

Operation Phase:

For the operation phase, two scenarios were considered: normal scenario (two boilers as well as extraction vent are in operation) when electricity is supplied by Umm Qasr port authority and worst-case scenario or abormal scenario (assuming all five generators (four and one stand-by) and three boilers are in operation) when there is no power supply from Umm Qasr port power station and the electricity is supplied by four generators and one as stand-by generator. The worstcase scenario may not continue more than a few hours to a few days. The modelling results for each pollutant during operation phase (both scenarios-normal and abnormal) are discussed hereunder.

Nitrogen Dioxide

The modeling results for the normal operation scenario (two boilers as well as extraction vent are in operation) indicate that ground level NO_x concentration due to the Project alone will be much below the ambient Iraqi standard as well as below the WB guideline for 1-hour maximum and annual average. However, during abnormal scenario (three boilers and five generators), the predicted ground level concentrations of NO_x will exceed the Iraqi and WHO standards for 1-hour maximum standard of 188μg/m^3 and 200μg/m^3 respectively. However, the annual average of NOx is below the corresponding standards for Iraq and WB.

Sulphur Dioxide

During the normal scenario, the SO_2 predicted values were 509ug/m^3 for 1-hour maximum, 38.2ug/m3 for 24-hour average and 7.4ug/m^3 for annual average. The predicated 1-hour and 24-hour average values exceed the WB guideline of 20ug/m^3 while the annual average concentration is much lower than the Iraqi standard of 47ug/m^3. Further, the predicted 1-hour maximum ground level concentrations during abnormal scenario exceed the prescribed standard and it is much higher than both the Iraqi standard of 262ug/m^3 and the WB guideline of 500ug/m^3. The predicated 24-

hour average value (108ug/m^3) is exceeding the WB guideline of 20ug/m^3 while the annual average concentration (34ug/m^3) is lower than the Iraqi standard of 47ug/m^3.

Carbon Monoxide

The predicted values of CO are much lower than the Iraqi ambient standards and WB guideline for 1-hour maximum (40,000ug/m^3 for Iraqi standard and 28,500ug/m^3 for WB guideline) and 8-hour average (Iraqi standard of 11,400ug/m^3 and WB guideline of 10,000ug/m^3) during normal and abnormal operations.

Hexane

The modelling results for hexane were predicted for 1-hour maximum, 3-hour maximum, 8-hour maximum, 24-hour average and annual average. Neither the Iraq authority nor WB has adapted ambient standard for hexane and accordingly guidelines from Ontario in Canada were adapted. The predicted 1-hour and 24-hour ground level concentrations of hexane (0.05ug/m^3 and 0.004ug/m^3) are much lower than the Ontario standards of 21,000 and 2,500ug/m^3 respectively.

Particulate Matter

Under normal and abnormal scenarios, the modeling results indicate that ground level concentration of PM_{10} due to the Project emissions alone will not exceed the Iraqi ambient standards or WB guideline for daily average (150ug/m^3 for Iraqi standard and 50ug/m^3 for WB guideline) and annual average (Iraqi standard of 50ug/m^3 and WB guideline of 20ug/m^3). Furthermore, it is clear from the modeling results that the predicted concentrations of PM_{10} due to Soybean Oil Project emissions will contribute slightly to the existing baselines of both daily average (110ug/m3) and annual average (85ug/m3) which are already above the WB ambient guidelines by more than 220% and 425% respectively.

Odor Emission

When the the modeling results for 1-hour maximum of SO_2, and hexane with the corresponding odor thresholds limits and occupational exposure standards, it is evident that predicted short-term concentration of both pollutants are below the odor threshold limit during normal and abnormal operations. However, during abnormal scenarios (operation of three boiler and five generators) there could be slight odor during a short time (10minutes).

Greenhouse Gases (GHGs)

The total estimated emission of GHGs from soybean oil project during normal operation is about 40,072 MT/year during normal operations and about 60,181 MT/year during abnormal operations, assuming these sources will operate 300 days per year. According to the Equator Principles, Principle 2, if the Project is expected to emit more than 100,000 Metric tonnes of CO_2 equivalent annually, an alternative analysis to evaluate lower greenhouse gases (GHG) intensive alternatives is required. Therefore, emissions associated with the processed facility are not expected to significantly incrementally impact global greenhouse gas emissions.

There are no medium or high negative impacts identified by the Impact Assessment of air quality except for SO_2 emissions; however, a number of mitigations/recommended measures are made to address both medium and low significant impacts

ES.4.1.2 Recommendations

Recommendations for the construction phase are focused on the reduction of dust impacts. These include:

- The development and implementation of a Construction Environmental Management Plan.
- All dust generating materials being moved to be covered with a suitable weighted tarpaulin.
- The amount of materials stockpiled to be minimized as far as is practicable, with any required stockpiles aligned parallel to the prevailing wind direction.
- The speed limit for vehicles to be reduced to prevent the generation of dust clouds.
- Damping of road surfaces to be implemented.
- Uneven surfaces on construction traffic routes to be graded periodically.

Recommendations for the operational phase are focused on SO_2 emission and around the monitoring of emissions and include:

- Undertake performance test to ensure all air emissions within the acceptable limits
- Use low-Sulphur fuel (with less than 1% Sulphur content) or preferably ultra-low sulfur fuel (with 100ppm sulfur content) for operating boilers. If low-sulfur fuel or ultra-low sulfur fuel cannot be obtained, either the stack height should be increased or control devices should be installed to reduce the impact of SO_2 on ambient air.
- Undertake monitoring of emissions as required by the IMOE with reporting to the relevant authorities.
- Undertake appropriate and periodic maintenance of any mitigation equipment installed at the facility
- Competencies and training requirements of staff with environmental

responsibilities, and lines of communication in the event of an emergency (including accidental releases of hazardous substances).

- Minimizing use of back up boiler.

In addition, Soybean Oil project management will undertake regular audits of environmental management plans to confirm their on-going effectiveness.

Prior to the commencement of operations, ambient air quality data will be gathered, and such data sets built on during the course of operations as appropriate.

ES.4.2 Terrestrial Environment

The Project area is currently in a developed site. The baseline assessment involved the analysis of soil (Chloride and Sulphate Content, Organic Content, Carbonate Content and others) and groundwater samples taken at the site. These indicated that soils are generally unpolluted.

Groundwater resources are present at the site. The groundwater wells will be the dominant source of water for the project. Analysis of groundwater samples suggest the water has high values of certain parameters (such as TDS) and would require treatment prior to use for different purposes at the project site.

ES.4.2.1 Results

The impact assessment identified potential for low impacts on the soil resources, and some degradation of soil quality from accidental spills during all phases.

There could be also potential to impact the groundwater resources through depletion of the limited recharge aquifer impacting both on the long-term water resources in the area, but also creating drawdown of the aquifer affecting other users.

There is also potential for impacts during operation from leakage of chemicals from the plant facilities or from catastrophic failure of the plant. The likelihood of this occurring, however, is very low.

ES.4.2.2 Recommended Measures

The following recommended measures were identified to mitigate any potential impacts:

- All storage tanks (except hexane tank) shall be above ground and maintained in good condition and inspected regularly. A record must be kept of all liquids/tanks/containers delivered to the site.

- All vehicles used on site shall be serviced and maintained to the highest standard, with a record kept of maintenance undertaken.
- Designated refueling, maintenance and storage areas shall be constructed in line with pollution prevention guidelines. These areas shall be hard-surfaced and contained by walls or bunds, with drainage systems and collection arrangement for spills and stormwater management.
- Hydrotesting, flushing and disposal of wastewater will be undertaken in line with appropriate measures to control, collect and treat the produced water.
- Wastewater should be treated where required to comply with water quality standards applied to discharge to the Arabian Gulf.
- Any accidental spill/leak will be fully cleaned as soon as the incident occurs.
- Design shall be such that accidental release from bunded containment areas would still discharge to a site drainage system in preference to entering the ground.
- Groundwater level monitoring shall be undertaken during the Project life.
- Waste materials shall be removed from site where possible following decommissioning. Any materials or plant to remain on site must be checked and contained/treated as necessary prior to site closure to ensure no potential soil contamination source remains.

ES4.3 Terrestrial Biological Resources

The Project is located within Umm Qasr Port area. The area around the project site consists of a relatively flat area of sand sheet and gravel plains with no significant tree or vegetative cover.

A number of protected biological species are present in the project area. These include:

- Jackal *(Banat Awa)*;
- Grey wolf (*Thia'ib Ramadi*);
- Wild rabbit *(Arnab Bari)*;
- Jungle cat (*Kit Bari*);
- Wild boar (*Khanzeer Bari*);
- Fox (*Abo Alhsain*);
- Lesser Jerboa (*Aljarbou'a*);

- Schneider Skink (*Hayat Um Slaiman*);
- Schokari sand racer (*Thu'aban Alrimal*); and
- Scorpion (*Alakrab Alaswad*); and

ES4.3.1 Results

The loss of biological resources under IFC principle 6 requires consideration of appropriate measures to avoid or minimise impacts. Where this is not possible, restoration of the area is required, or a biodiversity offset area provided if restoration of the area cannot be undertaken effectively.

ES4.3.2 Recommended Measures

- Develop and implement a comprehensive ecological monitoring plan
- Develop and implement a Biodiversity Management Plan to set out the measures required to enhance the ecological integrity and functionality of the habitats based on the findings of the ecological monitoring. The Plan will be reviewed and adjusted in line with any findings to ensure successful delivery of the objectives for the compensatory area.
- All contractors / employees shall receive a Site Induction which includes the ecological value and sensitivity of the Project area.
- Restrict vehicle movements to defined haul / access routes to minimise risk of wildlife collisions with vehicles.
- All industrial waste water treatment facilities and water storage tanks shall be securely fenced to prevent the ingress of mammal and reptile species. Use bird deterrents (i.e. predator kites) to deter bird species utilising these areas.
- Light pollution will be minimised by restricting lighting to essential areas only, and by using directional lighting to reduce light spillage. Construction work at night will be minimised and earth moving equipment will be fitted with more efficient sound reduction equipment wherever possible.
- Native plant species of local provenance shall be used for planting wherever practicable to reduce the risk of transmitting biological pathogens and alien species. Implement a quarantine procedure for all plant specimens brought to the Project area.

ES4.4 Noise and Vibration

Potential impacts of the Project on noise and vibration were modeled and assessed. The contribution from the Project was compared to the Iraqi and IFC Noise Standards for both daytime and night-time.

ES4.4.1 Results

Baseline noise measurements taken at the Project site boundary are within the Iraqi and IFC standards. The Project has been designed to comply with the requirements laid down in the Iraqi general environmental regulations and include measures such as housing of potentially noisy units and equipment.

The modeling shows that potential negative impacts are likely to be of low significance during all phases.

ES4.4.2 Recommended Measures

There are no specific mitigation measures required as part of the Impact assessment, however, recommendation include:

- Sound-proof enclosures and anti-vibration measures should be employed for certain equipment (such as boilers, air compressors, pump, and generators) to reduce noise levels on site, in keeping with the results of the updated noise and vibration model.
- Undertake regular monitoring tests for noise levels at facility boundaries to ensure the levels are within the acceptable limits.
- A noise and vibration management plan should be developed detailing measures to monitor and control noise and vibration emissions during construction.
- Regular audits of the above monitoring and management plan should be undertaken and revised in line with results.

ES4.5 Waste Management

Municipal Waste from Soybean Oil project will be disposed of in a government municipal landfill, located within Basra Province. However, the hazardous and non-hazardous industrial wastes will be transported to approved waste management facilities for treatment and disposal off and these facilities are located within Basra Province.

ES4.5.1 Results

The impact assessment identifies low to medium significance impacts associated with the generation of wastes by the Soybean Oil project.

Waste types identified during this assessment include:

- Non-hazardous solid wastes: construction debris, wood (pallets), empty drums and containers (plastic and metal), packaging (paper, cardboard, plastics), and municipal wastes and sanitary waste sludges;
- Hazardous solid waste: batteries; filters; empty oil, chemical or paint containers; fabrics contaminated with oil; spent catalyst, spent activated carbon, spent electrical equipment, industrial wastewater treatment sludge, oily sludge and clinical waste; and
- Hazardous liquid waste: waste oils, lubricants and fuels and drainage waters contaminated with these, solvents; paint; thinners; hydraulic fluid; and cleaning chemicals; contaminated hydro-test water.

All hazardous and non-hazardous wastes are to be stored on site temporarily in suitable storage containers and then transported off site by government approved waste carriers to off-site licensed waste management facilities.

The assessment of impacts during construction and operation phases showed the following:

- Impact from Hazardous and Non-hazardous Wastes during storage and Transport is low magnitude and low significance
- Impact of degradation Due to Incorrect Storage / Spillage is low magnitude and low significance

ES4.5.2 Recommended Measures

The following recommended measures were identified to mitigate potential impacts of low-to-medium significance:

- EPC Contractor will develop a Construction Waste Management Plan, and SAMA AlManar to develop an Operational Waste Management Plan to identify in more detail anticipated wastes, and their quantities, and undertake waste planning for treatment and disposal.
- Design, construct, manage and maintain storage areas for non-hazardous and hazardous waste to prevent accidental and/or uncontrolled discharges of material.

- Develop procedures to be implemented following an accidental release of hazardous substances, including details of containment and recovery measures to be applied;
- Develop procedures for the ongoing management, maintenance and monitoring of the retained waste storage facilities, including monitoring location, and frequencies, and analysis of resultant data.
- Implement waste segregation, and where possible recycling programme.
- Utilise / ensure the use of covered vehicles for the transportation of waste;
- Provide training of all suppliers and sub-contractors in site waste management procedures
- SAMA AlManar shall develop further the outline closure plan to include maintenance programme, monitoring and reporting strategy and emergency action plan for the waste storage areas and shall resource and implement these plans.

ES.4.6 Water Quality Management

The Soybean Oil project will have two treatment systems. The first system will be built for treating ground water which will be used later for different purposes at the project. The second system is for treating the industrial wastewater generated by the extraction unit and degumming process before it is discharged to the Arabian Gulf. The later system will treat certain parameters especially COD, BOD, TSS, Oil and Grease and pH to make them in compliance with the Iraq standards and WB-IFC guidelines.

All wastewater generated from buildings occupied by personnel such as from showers, kitchen, laundry facilities, and toilets are considered sanitary wastewater. These wastewaters will be stored in septic tank and then transferred to the off-site Sanitary Wastewater Treatment system.

ES.4.6.1 Results

The expected wastewater generated during the construction phase of this project will be low and the potential impact due to accidental spillages of hydrocarbons or sanitary wastewater during the construction phase will be of low magnitude and low significance.

The wastewater generated during the operation phase will be industrial wastewater and sanitary wastewater. The potential impact due to release of industrial wastewater or sanitary will be low magnitude and low significance.

ES.4.6.2 Recommended Measures

There are no specific mitigation measures required as part of the Impact assessment, however, recommendations for the prevention and reduction of pollution from accidental spills, and protection of the surface water systems include:

- Provide training of staff in environmental awareness and pollution prevention, and lines of communication for accidental releases of hazardous substances;
- Construction of designated refueling, maintenance and storage areas in line with pollution prevention guidelines. These areas are to be hard-surfaced and contained by walls or bunds, with drainage systems and collection arrangement for spills and stormwater management;
- Ensuring the availability of pumps and spill mitigation materials such as absorbent granules to contain and recover hazardous substances following release;
- Implementation of procedures to be followed in the event of accidental release of hazardous substances;
- Ensuring vehicles used to empty septic tanks are fit for purpose and operated by trained members of staff to prevent spillage;
- Ensure washing-out of concrete delivery, mixing and pouring plant and equipment are undertaken in a designated area and all wash water shall be contained for subsequent treatment and re-use and / or discharge;
- Undertake a programme of surface water sampling to establish the current ambient water quality, and monitor throughout project. Monitoring should be continued following decommissioning;
- Condition report to be produced before decommissioning identifying key issues such as condition of lining and drainage system;
- Implementation of a management plan prior to decommissioning of the facility, to include maintenance, monitoring and reporting strategy and emergency plan; and
- Regular audits of the above monitoring and management plans to be undertaken and revised in line with results.

ES.4.7 Marine

Umm Qasr is the main seaport of Iraq and also the only deep-water port of the country. It handles the majority of the country's export trade. This port comprises three different port zones: Umm Qasr South Port, North Port and Umm Qasr Mid port. The proposed soybean processing facility is proposed in the South Port. The Port lies along the Shatt Al-Basrah canal, between the Khor Abdullah and Khor Al-Zubair.

Tides are generally semi-diurnal (twice a day) in Umm Qasr, with a large variety in range and tidal current duration. Sediment analysis for Umm Qasr Port at five selected stations show typically clayey silts, with a small coarse fraction, except at one station where gravel was found. Organic content was about 20% at all five stations. The analysis of water quality at five selected points within Umm Qasr port showed that compared with U.S. sediment quality standards, lead, chromium, and cadmium exceed the standards; oil is within sediment water quality standards.

Besides fish, phytoplankton, zooplankton, and birds, there are other elements of the Umm Qasr area that contribute to biodiversity. Riverine habitat, mudflat habitat, and other areas possess rich benthos and seagrass resources.

ES.4.7.1 Results

Direct impacts of the project on the marine environment are minimal. Potential receptors of project impacts in the areas of oceanography/marine biodiversity of the area might include:

- Birds: The birds from the Umm Qasr mudflats will not be significantly affected by the present project.
- Mudflats: No significant impact on mudflats will occur as no dredging or dredge spoil disposal will take place, and the mudflats are at some distance from the soybean site.
- Saline marsh habitat: As no significant alterations will be made to any marine habitats, the impact of the project on marsh habitat will be negligible.
- Fisheries: Because of the distance of the project facilities from the marine habitat, and the lack of direct connectivity to effluent from the project to the marine habitat, there should be no impacts of the project on fisheries.
- Other biodiversity elements (plankton, marine mammals, cetaceans, etc.): again, due to sparsity of project overlap with the marine environment, there will be no significant impacts to these alternative biodiversity components.

ES.4.7.2 Recommended Measures

Given the scarcity of direct impacts, there is no need for mitigation. However, ongoing marine monitoring of the marine water quality, air quality, and some limited marine species (birds, fisheries) would contribute to understanding of the marine environment around the project site.

ES.4.8 Socio-Economics

ES.4.8.1 Results

The Project will provide many benefits to the region and to Umm Qasr in particular. The new development will create greater opportunities for employment and for local and regional businesses.

Potential negative socio-economic impacts include increased strain on municipal and social services (such as traffic, housing and municipal services).

ES.4.8.1 Recommended Measures

Implementation of the following measures is recommended to manage the potential impacts identified and to maintain good management practices:

- SAMA AlManar to enter into an agreement with Umm Qasr Municipality regarding the capacity of municipal services to be supplied to the Project housing during the early stages of operation. Where capacity is not available, SAMA AlManar to establish alternative service provision.
- Employ local resources with skills to suit the required roles where available, and use local companies to supply goods and services wherever feasible;
- Implement a comprehensive training programme to ensure the appropriate skill sets are developed and transferred to new personnel;
- Induction training to be provided to all foreign and non-Muslim workers on the local culture and practices; and
- Seek to support employment in the region and within other SAMA AlManar projects following decommissioning of the Project facilities.

ES4.9 Archaeology and Cultural Heritage

The Republic of Iraq has many cultural heritage and archaeological sites. Six sites in Iraq are included World Heritage Sites. The significance of impacts of the proposed project on local archaeology and cultural heritage resources, if any, have been assessed and where necessary, mitigation measures have been identified. The project is located far from any cultural heritage and archaeological sites that can potentially be impacted and accordingly the impact will be low magnitude and low significant.

ES4.9.1 Results

Two potential impacts on the archaeological resources have been identified during any construction activities that derive from the accidental discovery of unidentified archaeological features or artefacts within the site during construction. Impacts are characterised by a potential low consequence and low probability, and, given that the area to be excavated is not known to be archaeologically significant, the impact is of low significance.

The assessment for construction phases showed the following:

- Impact on archaeological resources due to construction activities is expected low magnitude and low significance
- Impact on cultural heritage due to interaction between expatriate workers and local people during construction is expected low magnitude and low significance

The Project operation phase may pose low impacts on archaeological and cultural heritage aspects of Basra Province during the following occurrences:

- Vehicle movements on-site/off-site
- Tourist expeditions by expatriate workers.

ES4.9.2 Recommended measures

- The EPC Contractor shall develop and implement a procedure (such as Archaeological chance find) for the management of unexpected archaeological resources and shall report any finds to the Project management and in accordance with National requirements.
- Contractual provisions should clearly indicate the procedure in case of any findings related to archaeology
- Every worker has to be trained in procedures to be applied in case of finding archaeological artefacts during any construction activities.
- A training session for new workers will need to be conducted as soon as workers arrive at the site.

- Contractors should take into account the possibility of finding archaeological artefacts during any excavation and construction work.
- EPC Contractor shall provide the workforce with tool box talks on the subject to raise awareness of the importance of cultural and heritage resource finds.

ES.4.10 Health and Safety

Two general hospitals, Umm Qasr general hospital and AlZubair general hospital, are available to all construction workers as well as operational and long-term workers. There are also general public health centres, a dental clinic, and a diabetes clinic. In addition, there are private health centres.

The nearest large general hospital is located in Umm Qasr residential area approximately 4km to the north-west of the project site. The health and safety of both employees and the local community have been considered as an integral part of the project design. The design process has included HAZID workshops and a series of detailed HSE assessments has been made for specific parts of the facility as part of the Front End Engineering Design process. Eliminating or reducing the risk of many of the potential operational Health and Safety impacts has been a central theme in this phase.

ES.4.10.1 Results

Potential sources of impacts during the construction phase include exposure to environmental factors (Air Quality, Noise, Water & Contamination), increased vehicle movement, Occupational Health & Safety of Construction Workers (including accidents and injuries, and mental health); and exposure to communicable and non-communicable diseases.

The results of impact assessment during construction phase showed the following:

- Health Impacts from Air Quality and Noise are expected to be low magnitude and low significance
- Health Impacts Related to Waste (Liquid & Solid) are expected to be low magnitude and low significance
- Impacts on Community Safety due to increase in Construction Traffic-Related Vehicle Accidents are expected to be low magnitude and low significance

The implementation of safety in design principles reduced the potential impacts during operation considerably. Those identified included exposure of the workforce to airborne pollutants and dust, traffic and transport (including community effects); occupational health, accidents and incidents; and communicable and non-communicable diseases.

The impact assessment highlighted exposure of the workforce to workforce accidents, increase of communicable diseases amongst the workforce, and traffic impacts on the community as being of low significance. Traffic safety impacts on the community were identified to be of low significance.

ES.4.10.2 Recommended Measures:

- The Environmental Emergency Response Plan will detail the procedures and process to be followed to protect both the workforce and the local community from potential harm in the event of an incident. This would include liaison with the local authorities to ensure services are (a) available, and (b) able to cope.
- Implementation of a comprehensive health screening and monitoring programme is to be undertaken to ensure workforce health is maintained, and reduce the spread of any communicable diseases (e.g., COVID-19, chickenpox, TB, gastrointestinal infections etc.).
- A risk assessment will be undertaken which shall define the specific risks and mitigation, including working hours, exposure limits, and use of PPE as required.
- Early engagement with local service providers to assess the capacity of the region to absorb any potential issues should be undertaken, and this will inform the design and staffing of the facilities to ensure local services are not adversely affected.
- Training and awareness on issues such as defensive driving will be provided to the workforce and suppliers
- Decommissioning will be planned by developing procedures and any HSE requirements to ensure the project is decommissioned safely and effectively, using the correct PPE etc. in line with requirements and intended future use.
- Implementation of the closure plan and associated post closure monitoring and maintenance requirements.

ES.4.11 Traffic and Transport

The Project area is served by the longest freeway in Iraq extending from Umm Qasr Port in Basra (far south part of Iraq) to Ar Rutba in Anbar (west of Iraq) with a length of 1,200 km (750 mi). Basra and Umm Qasr have many roads that are in good condition especially the road linking Basra city to AlZubair and the Umm Qasr area.

The Basra International Airport is the closest airport to Umm Qasr (Soybean Oil Project site): the distance from Basra International Airport to Umm Qaşr is 38.7 miles / 62.2 kilometers. This airport can be used by the project workers during construction and operation phases.

The railway is currently not fully operational, and no passenger service is currently operating.

ES.4.11.1 Results:

There are no medium or high negative impacts identified by the Impact Assessment. The potential impacts on the existing transport infrastructure (airport, road and marine traffic) during all project phases are low magnitude and low significance.

ES.4.11.2 Recommended Measures

- A Traffic and Transport Plan should be developed as part of the Environmental Monitoring and Management Plan, prior to commencement of any activities on site. In accordance with the IFC Guidelines, Project vehicles will avoid accessing the public highway wherever possible.
- Co-ordination and liaison with the Airport authorities, operators, and Umm Qasr Municipality to address any potential impacts from influx of workers to the area.
- Co-ordination and liaison with the Ministry of Transport, and the local authorities during all phases to ensure coordination of programmes and minimise use of road transport wherever possible;
- Management of shift changes to reduce peak traffic flows;
- Undertake traffic risk assessments during all phases and implementation of any recommendations;
- Identification of access / traffic routes for vehicles both on and to/from the site (including transport for the workforce);
- Implementation of driver training and awareness for both SAMA AlManar personnel and contractors;
- Implementation of measures to protect the local community where appropriate;

- Provision of suitable wheel washing equipment to prevent materials being deposited on the public highway;
- Re-use of materials on site to reduce the requirement to import bulk materials from other locations.

ES.4.12 Sustainable Development

The sustainable development assessment identified a number of positive and negative impacts associated with the project. These indicate that the Project faces a common challenge in terms of sustainability.

Negative impacts are typically associated with environmental sustainability. The positive impacts, though fewer in number, are of greater magnitude, and are associated with socio-economic aspects.

The recommended areas of focus for the Project in terms of sustainability which are to be implemented in future phases include:

- Establishment of objectives, targets and key performance indicators to monitor achievement of the goals established for the Project and progress towards sustainable development; and
- Implementation of continuous improvements as identified by the Project's Environmental Management System and associated monitoring, measurement and auditing.

ES.4.13. Consideration of Alternatives

The proposed Soybean Oil Project has been developed following the consideration of a range of project and design alternatives including:

- Do nothing option (no project);
- Alternate Locations;
- Alternative Production Options and Plant Design;
- Pollution control alternatives;
- Wastewater pre-treatment alternatives; and
- Waste management alternatives.

Potential social and environment factors were included in the identification and selection of alternatives during the front end design phase.

In addition, as the Project progressed the proposed facilities were tested against Best Available Techniques (BAT), as required under the IMOE, and the International Finance Corporation (IFC) Performance Standards.

The IFC has defined, in Performance Standard 3, the following objectives for promoting efficient use of resources and pollution prevention:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities;
- To promote more sustainable use of resources, including energy and water; and
- To reduce project-related greenhouse gas emissions.

ES.5 Conclusions

The Soybean Oil project can be considered as a category B project according to the Iraqi Environmental law No. 27 of 2009 (chapter 3, article 21) and according to IFC's Policy on Environmental and Social Sustainability. Based on information reviewed by IFC, the proposed Project will have limited adverse E&S risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed thorough existing mitigation measures and good international industry practices (GIIP).

The predicted impacts of the proposed Soybean Oil project are within the standards as defined by the IMOE Regulations and standards. Most of the impacts are of low magnitude and low significance. For those impacts identified as Medium, mitigation measures have been developed to further reduce the potential significance to Low. All mitigation measures and recommendations have been detailed in the Environmental Monitoring and Management Plan for implementation during the next phases of the project.

The Soybean Oil project footprint is within the Umm Qasr Port boundaries operational since 1967, and no land acquisition has been undertaken for the Project; hence, there are no impacts identified to be managed in a manner consistent with PS5: Land Acquisition and Involuntary Resettlement. No impacts associated with PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources were identified. The project is located within the boundaries of the existing port. The environmental assessment identified that the project lies outside the Khor Al-Zubair Important Bird Area (IBA) and Key Biodiversity Area (KBA) with the closest point located 2.5 km from the northwest of the Project site and on the opposite bank of the access channel. The IBA/KBA was not affected by the Project construction and there are no dredging spoils. There are no indigenous people groups in the project area as defined by PS7: Indigenous Peoples. Given the location of the project, no impact was identified to be managed consistent with PS8: Cultural Heritage.

1. INTRODUCTION

1.1 Project Understanding & Overview

According to Iraq's Ministry of Planning, Iraq's population had reached 41 million by the end of 2021. Accordingly, demand on food products (including vegetable oils) will be increasing. Sama AlManar for General Trading Co (A Group company of TIRYAKI AGRO) is planning to build a new soybean oil factory in Umm Qasr South Port Berth 4, Basra, Iraq, in part, to meet this increasing demand. The production capacity of this new project will be 2400 tons/day soybean meal and 600 tons/day degumming soybean oil which requires a 3000 tons/day soybean Crushing Plant.

Soybean is the second most important oilseed crop of the world, after palm oil, according to Oilworld. The demand for vegetable oils is expected to grow, mainly by increased consumption per capita in emerging countries. The average annual consumption of edible oil of a citizen of a developed country is about 50 liters, whereas the world average is about 20 liters/head/year (Cheng, M.H., 2017). Another factor that will contribute to this increase is soybean's use as biofuel (biodiesel and H-Bio), the new facet for consumption of vegetable oil (Asadauskas, 2000).

The investor (Sama AlManar Co) is planning to apply for loan from the World Bank/IFC (International Finance Corporation) to build its new soybean project. Accordingly, an ESIA should be prepared in accordance with IFC requirements. The IFC, which is part of World Bank Group, has prepared a set of Guidance Notes, corresponding to the Performance Standards on Environmental and Social Sustainability. IFC expects that each client will employ methods best suited to its business to meet the requirements of the Performance Standards. IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced. The eight Performance Standards on environmental and social sustainability, that the client is to meet throughout the life of an investment by IFC, are given below:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labor and Working Conditions
- Performance Standard 3: Resource Efficiency and Pollution Prevention
- Performance Standard 4: Community Health, Safety, and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement

- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

The IFC classifies any proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

- Category A: Projects having potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- Category B: Projects having potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
- Category C: Projects having minimal or no adverse environmental or social risks and/or impacts.
- Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

Further, the Iraqi environmental regulations and standards should be met since this project will be built in Umm Qasr Port, Basra, Republic of Iraq. The Iraqi environmental regulations and standards will be applied in case these standards and regulations are more stringent than those of WB-IFC because, as per the EHS Guidelines of WB-IFC, "When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent".

1.2 ESIA Methodology

This ESIA Report will be prepared in accordance with international lender standards, specifically the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012) although the Iraqi EIA Regulations will also be met. The following steps were undertaken to complete this ESIA:

- Screening Phase;
- Scoping Phase;
- Baseline Data Collection;

    - Stakeholder Engagement;
    - Impact Identification/Prediction; and
    - Analysis of Alternatives

- Screening: This process was undertaken to determine the appropriate extent and type of ESIA. The type of ESIA and its categories will be determined based on the type, location, sensitivity, and scale of this project and the nature and magnitude of its potential environmental impacts.

- Scoping: The scoping phase involves several parts including identifying the project location and area of influence, sensitive environmental and pre-screening reviews as well as developing a Scoping document. Area of influence (AoI) is defined in IFC Performance Standard 1 as *the area likely to be affected by: (i) the project 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 (include power transmission corridors, pipelines, relocation and access roads, borrow and disposal areas, construction camps, and contaminated land); (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.*

In this study the AoI was determined based on two steps: (1) the first step is to classify this project which was categorized as type B project with limited impacts and (2) the second step is defining the spatial scope which is varying depending on the project phase (construction or operation) and on the potential impact being considered (air or noise or water, etc). Having considered these two steps, the AoI for this project was defined as 5000m for the operation phase and 500m for the construction phase. These values were reached based mainly on the results of air dispersion modelling and noise modelling whereas the spatial scope for other topics (Biodiversity, Surface Water, Groundwater, Waste, Cultural Heritage) were assumed to be within the physical footprint of construction and operation works for the project.

This study includes the existing status of the environment in areas around this project for various components, such as air, noise, water, land, and socio-economic conditions.

- Baseline Data Collection: The assessment is based on data obtained from project-related literature review, the published literature, and by conducting field visits to the project area. Surveys were carried out to determine the existing socio-economic and environmental conditions at the project site and the surrounding area likely to be affected by the proposed project development.

- Community and stakeholder engagement activities: Public consultation in the ESIA process was undertaken during Oct 19 to 24, 2022. Also, consultation with stakeholders through prepared questionnaires to gather information were subsequently incorporated into the ESIA study report. The purpose of public and stakeholder consultation was to obtain supplementary information on various social, socio-economic and socio-cultural conditions, and views on other aspects of the project. The consultation also obtained some background information related to potential project impacts and environmental management and to identify any areas of specific concern which needed to be highlighted.

- Impact Identification/Prediction: The impact assessment and development of mitigation measures during all project phases (construction, operation and decommissioning) was an ongoing process that began during the project planning stage and continued as the project progresses.

- The key objectives of the impact assessment process are to:

  - Analyze how the Project may interact with resources and receptors identified during baseline studies in order to define, predict, and evaluate the likely extent and significance of environmental and social impacts that may be caused by the Project.
  - Develop and describe effective, realistic, and practical mitigation measures that avoid, reduce, control, remedy, or compensate for negative impacts and enhance positive benefits.
  - Evaluate the predicted positive and negative residual impacts of the project.
  - Develop a system whereby mitigation measures are integrated into Project activities and become Project commitments. This is achieved through the development of an Environmental and Social Management Monitoring Plan (ESMMP).

- Analysis of Alternatives: comparative analysis of alternatives for the project is provided in terms of site location analysis, feasibility, and technology available including the no project scenario.

- Environmental and Social Management Monitoring Plan (ESMMP): The ESMMP incorporates measures and procedures for the short and long-term environmental and social management of the project during its various stages.

Soybean Oil Project Plot and project schedule

As stated earlier, the proposed project is for construction of a soybean oil plant with daily production rates of 600ton of soybean crude oil (without refining) and 2,400 ton of soybean meal. In this plant, the extraction of soybean oil will be accomplished by chemical extraction using solvent (hexane). In addition, the project will import unprocessed corn with quantities of 20,000-25,000 tons /month which will be stored at the project site before being distributed to clients inside Iraq without further processing at the site (more details on process description is given in section 2).

The location of the soybean oil project will be within Umm Qasr port as shown in the yellow box in Figure 1-1. The overall project schedule includes 23 months of Engineering Procurement & Construction (EPC). Construction is planned to start in early 2022 and commissioning is scheduled to complete early 2024 as shown in Figure 1-2. It is estimated that the peak direct labour force during construction will be approximately 250 while during operation it will be upto 214.

Decommissioning is expected following closure of operation; the operational life of the plant is assumed to be about 30 years. The objective will be to return the site to its pre-project condition, as far as possible as per the Land Lease Agreement conditions with Iraqi Umm Qasr Authority.

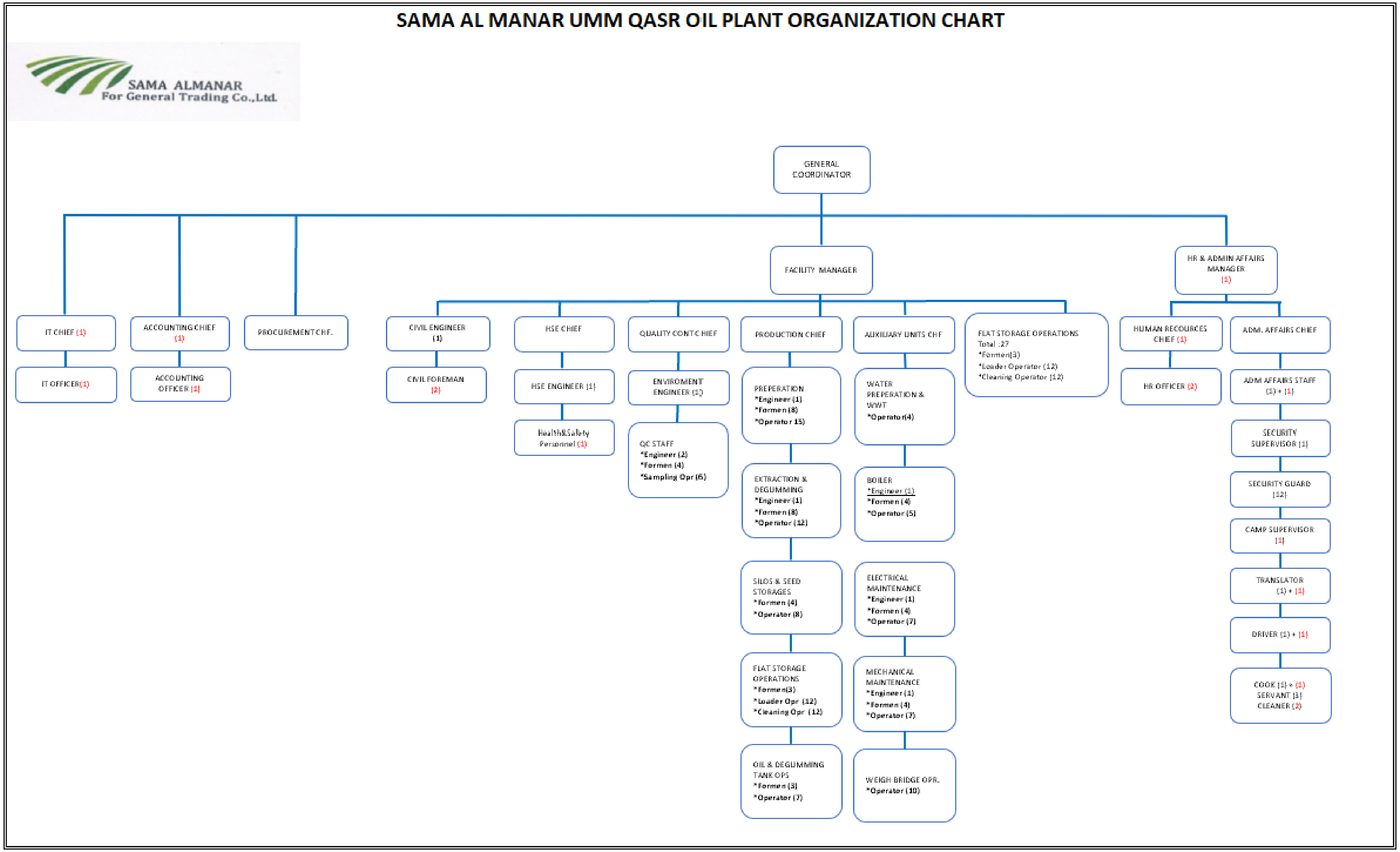


Figure 1-2: Personnel distribution for Soybean Processing Facility

Table 1-1: Soybean project schedule

	DESCRIPTION OF WORK
1	Excavation Works Flat Storages Zone
2	Dynamic Compaction
3	Geogrid Layin Works
4	Oil Plant 1 Extraction Unit Foundtion works
5	Oil Plant 1 Preparation Unit Foundtion works
6	Power Station 1 Building (Foundation)
7	Maintenance Workshop(Foundation)
8	Design Studies
9	Oil Plant 1 Hexane Tanks Foundation Works
10	Oil Tanks Foundations
11	Backfilling Works
12	Water Storage Tank 1 Construction
13	Weighbridge Supply & Installation
14	Boiler Room(foundation)
15	Power Station 2 Building (foundation)
16	Water Storage 2 Construction
17	Fuel Tanks Foundation
18	Hexane Tanks Material Production and Erection Works
19	Compressor Supply & Delivery
20	Power Station 1 Building (structure)
21	Gate House Construction
22	Silos Foundations
23	Oil Tanks Material Production
24	Flat Storage Superstructure Construction
25	Fuel Tanks Production & Delivery and Installation
26	Maintenance Workshop (structure) Construction
27	Boiler Room(structure) Construction
28	Power Station 2 Building (structure)
29	Steel Silos Material Production
30	Canopy Construction
31	Pipe Bridges Supply
32	Transformer Equipments Production and Erection Works
33	Steam Boiler Production & Delivery
34	R.O Water Treatment System Supply & Installation
35	Conveyor Systems Production
36	Extraction Equipment Installation
37	Preperation equipment Installation
38	Oil Plant Electrical, Piping, Insulation Steel Erection Works
39	Pipe Bridges Installation and isolation
40	Oil Plant 1 Husk Storage & Silobas Supply & Installation
41	Laboratuary Equipments Supply & Installation
42	Generator Supply & Installation
43	Canteen & Lab. Main Building (Structure Works)
44	Waste Water Unit(WWTP) Supply & Installation
45	Locker Room (Structure Works)
46	Steel Silos & Erection Works
47	Extraction Steel Erection Works
48	Preperation Room Steel Erection Works
49	Steam, pressure air, condense, waste water piping works
50	Conveyor Systems Installation
51	Oil Tanks Delivery & Erection works
52	Steam Boiler Installation
53	Fire Fighting System Supply & Installation
54	Steam Boiler Test and Isolation
55	Infrastructure Works
56	Electrical Infrasturcture Works
57	Oil Plant Test and commissioning and isolation works
58	Keystone Works
60	Landscaping Works

Timeline columns: 2021 (4.Qtr: 11, 12); 2022 (5.Qtr: 1, 2, 3; 6.Qtr: 4, 5, 6; 7.Qtr: 7, 8, 9; 8.Qtr: 10, 11, 12); 2023 (9.Qtr: 1, 2, 3; 10.Qtr: 4, 5, 6; 11.Qtr: 7, 8, 9; 12.Qtr: 10, 11, 12); 2024 (13.Qtr: 1, 2, 3; 14.Qtr: 4, 5, 6; 15.Qtr: 7, 8, 9; 16.Qtr: 10, 11, 12); 2025 (17.Qtr: 1, 2, 3; 18.Qtr: 4, 5, 6; 19.Qtr: 7, 8, 9; 20.Qtr: 10, 11, 12)

1.3 ESIA Overview and Objectives

An Environmental Social Impact Assessment (ESIA) is required for the soybean oil project in order to demonstrate that environmental control procedures are being applied to ensure adherence with the IFC requirements specifically meets the eight Performance Standards. This report presents the findings of the ESIA. ESIA for soybean oil project includes the following activities:

- Data collection and analysis requirements to complete ESIA as per local requirements and international standards of good practice;
- Conduct social survey and public/stakeholder consultation and meetings
- Determine what data are available;
- Advise on additional surveys if required;
- Conform with IFC as well as Iraqi Ministry of Environment requirements;
- Identify elements that may impact design at an early design stage;
- Prepare pre-construction environmental baseline for the soybean oil project site;
- Evaluate potential environmental impacts of the soybean oil project during construction, commissioning, operation, and decommissioning;
- Predict the cumulative impact for all aspects (air, water, noise, etc) due to this new Project;
- Identify mitigation measures to reduce impacts;
- Specify monitoring plan for implementation of proposed mitigation measures;
- Prepare technically sound, well documented, and defensible final report that may be used as a reliable reference at a later stage;
- Present key findings to the international (IFC) and local authorities.

Figure 1-1: Map Showing soybean oil project site location within Umm Qasr Port, Basra, Iraq

This ESIA was undertaken to understand the environmental and social sensitivities associated with the construction and operation of this project and to identify mitigation measures in order to avoid any adverse impacts during every project's lifecycle. The achievement of this project may have certain Environmental and Social impacts which may be negative or positive. The negative environmental and social impacts need to be avoided as far as possible. The impacts which cannot be avoided need to be mitigated or managed.

The key objective of this ESIA will be as follows :

- Conducting ESIA study to take environmental and social impacts into account in the selection of preferred project options and to determine appropriate measures for mitigating/compensating anticipated environmental and social impacts at different stage of the project (mainly construction and operation).
- Determining the background level of existing pollution based on measurements, literature review and previous studies and reports, and then adding the expected pollution caused by this new project to the background. Compare new pollution levels with national and international standards (the World Bank guidelines).
- Use internationally recognised models and undertake quantitative studies to identify the environmental and social impacts of activities throughout the project life cycle.
- Identify and assess any potential impacts from all types of sources (stationary and mobile sources) during construction and operation on the environment and principally to the residents of the surrounding areas.

- Propose mitigation measures to reduce or remove the environmental and social impacts and, where possible, propose measures to enhance the baseline environment.
- Propose an environmental monitoring programme both for the construction and operation periods of the project.
- Ensure that the project is in compliance with the environmental and social standards of the IFC and any relevant national legislation.

1.4 Structure of the ESIA Report

The main sections in this ESIA are:

- Executive Summary;
- Section 1: Introduction;
- Section 2: Policy, Legal and Administrative Framework;
- Section 3: Project Description;
- Section 4: Impact Assessment Criteria and Methodology;
- Section 5: Air Quality and Meteorology;
- Section 6: Terrestrial Land Environment;
- Section 7: Terrestrial Biological Resources
- Section 8: Noise and Vibration;
- Section 9: Waste Management;
- Section 10: Water Quality Management;
- Section 11: Marine Environment;
- Section 12: Socio-Economics Aspects;
- Section 13: Archaeology and Cultural Heritage;
- Section 14: Health and Safety Aspects;
- Section 15: Traffic and Transportation Infrastructure
- Section 16: Sustainable Development Assessment;
- Section 17: Analysis of alternatives;
- Section 18: Risk Assessment;
- Section 19: Equipment Design Safety Requirements;
- Section 20: Summary of Impacts and Mitigations;
- Section 21: Environmental Management & Monitoring Plan;
- Section 22: Acronyms.

- Section 23: Appendices.

Following this introductory section, the EIA report is structured as follows:

2. Policy, Legal and Administrative Framework:

WB-IFC and national environmental guidelines and standards relevant to this project have been the basis for evaluating impacts.

Other relevant local, regional laws and international agreements are presented in this chapter, since the Republic of Iraq is subject to international protocols and agreements adopted by the Republic of Iraq and international organizations.

3. Project Description:

In this section is an outline of operations at soybean oil project site including a process description, preliminary plans and all phases of project (construction, commissioning, operation and decommissioning) with proposed schedules.

4. Impact Assessment Criteria and Methodology:

Criteria used for evaluating potential effects and definitions of magnitude and significance as they apply to potential impacts from the project on the ambient environment (air quality, water resources, biological and physical environments, socio-economic, archaeological/ cultural, noise and waste) will be discussed in this section.

5. Air Quality and Meteorology:

In order to comply with the environmental requirements of WB-IFC, a comprehensive environmental social impact assessment (ESIA) for this new project (soybean oil project) was prepared to demonstrate that the impact of the air emission on ambient air quality in the vicinity of this project as well as surrounding areas. This section provides all the necessary components of the ESIA for compliance with the regulations including status of the surrounding environment, an assessment of the key potential environmental impacts due to air pollution emissions including SO2, NOx, particulate matter, hexane and other pollutants.

After reviewing the relevant details of the project, the impact of this new facility during normal operation and construction phases was evaluated. Emissions to the surrounding air from the loading/unloading operation and vehicle movements on unpaved road during construction phase and from stacks and other sources during operation scenario specifically SO2, hexane, NOx, CO and PM10 were investigated to determine their impacts on the ambient air and compliance with the national and international standards.

This section addresses the results and conclusions of the assessment of ambient air quality as well as odour emission from various sources in the vicinity of the soybean oil project in order to establish baseline conditions, and thereby enable the prediction of impacts resulting from air emissions during construction and operation phases.

The AERMOD model was used for predicting the short-term and long-term concentration of SO2, NO2, PM and hexane. Further, this section highlights the greenhouse gas emissions from all sources at this new project.

6. Terrestrial Land Environment:

Overview of environment baseline survey, its evaluation and likely impacts of soybean project including regional and local geological and hydrogeological conditions, soil characterization and groundwater quality at the facility site to determine impacts on sensitive receptors are highlighted in this section.

7. Terrestrial Biological Resources:

Ecology on-site is presented here in relation to potential construction and operational impacts associated with the development of the project at the Umm Qasr site, based primarily on surveys of the terrestrial flora and fauna communities, focusing on native species. Areas of consideration include:

• Baseline field survey of habitats and key floral and faunal groups present on immediate project site, which could be potential receptors in the impact assessment process. These elements include:

- o Perennial vegetation;
- o Mammals;
- o Breeding and migratory birds; and
- o Reptiles (diurnal species).

• Information obtained from available literature review, local contacts or other sources. This information was used in evaluating the rarity and status of habitat or species in the vicinity of the project site, the Republic of Iraq or over wider geographical areas.

In this section the following topics were covered: field survey and literature review, baseline assessment and evaluation of potential environmental impacts to terrestrial ecology throughout lifetime of soybean oil project.

8. Noise and Vibration:

New potential sources of noise associated with different phases of this project (e.g., construction and operation) were identified and assessed. This section presents the noise baseline survey, its evaluation in light of applicable criteria and modelling-based predictions of the environmental impacts on receptors resulting from noise during the lifetime of the proposed Project located in the Umm Qasr area.

In this section noise from operational activities, which may pose some impacts on the nearest sensitive receptors to the project site, were addressed. Further, noise modelling during normal operation was conducted using a model (CUSTIC 3.0) to determine the impact on some sensitive receptors considering the baseline condition during day-time and night-time. Based on the baseline and modelling results, noise levels within the plant area were identified that must be mitigated by an effective noise control program and that will be followed for the future operations.

9. Waste Management:

In this section, a baseline survey of existing/future waste management facilities that are available for the soybean oil facility in Basra and recommendations for waste disposal as per national and international regulations, in addition to evaluation of potential environmental impacts resulting from waste management during the lifetime of the soybean oil project, were highlighted.

10. Water Quality Management:

Two main categories of water will be addressed:

(1) Storm water which is accumulated in the storm water trench inside the soybean oil project premises;

(2) Industrial waste water (process water) which includes used water in the

process unit.

Because the discharge of process water requires a permit and possibly treatment prior to discharge, recycling process water can be both environmentally and economically advantageous. The project management will ensure that discharge is completely controlled and meets the corresponding rules and regulations, and considers other mitigation measures that minimize the quantities of discharge according to Best Available Techniques (BAT). Moreover, other possible sources of pollution to the surface or ground water which arise from accidental spill from Fuel Tanks and other tanks from daily activities have been reviewed and mitigation measures have been proposed that will be implemented according to national and international regulations. Also, routine samples of water discharged from water treatment unit will be analysed to assure that the discharge complies with national and international rules and regulations.

11. Marine Environment:

Overview of project impacts to marine environment resulting from the construction, commissioning, operation and decommissioning of Soybean oil plant are discussed in this section. Receptors include marine species including infauna, flora, marine mammals, fish, avian fauna, and others. National protected species and areas have been noted.

12. Socio-Economic Aspects:

General description/evaluation at a national/regional level of socio-economic aspects have been identified, related to: demography, economic activity, infrastructure, and education including impacts on socio-economic/cultural aspects for each phase of the soybean oil project.

13. Archaeology/Cultural Heritage:

General description of archaeological and cultural characteristics on a national and regional level and impacts on archaeological and cultural aspects have been evaluated for each phase of the soybean project.

14. Health and Safety Aspects

Brief description of potential health and safety issues associated with the soybean project and available healthcare facilities.

15. Traffic and Transportation Infrastructure

This section describes the impact of this project during the construction, operation and decommissioning/closure on existing transport and traffic infrastructure of the Umm Qasr area and Basra province

16. Sustainable Development Assessment:

Analysis of sustainable development elements and their integration into both the soybean oil project ESIA and the project itself. The methodology employed for the sustainable development assessment of this project considers the impacts identified within the ESIA of the Soybean Oil Project using the criteria of timescale and extent. The principles of intra-generational equity and inter-generational equity will be used to take into account the duration associated with each significant impact identified during all project phases. Together these factors provide a means to evaluate the sustainability of the project. Project life cycle phases have been considered into each analysis that also include energy efficiency requirements.

17. Analysis of Alternatives:

Comparison of other possible feasible alternatives to the proposed location, preferred technology and others of the soybean project.

18. Risk Assessment:

Based on a review of the inventory of hazardous materials (including hexane) and the possible accidents associated with the project, the RA study focuses on the potential on-site and off-site impacts due to contamination by fire or spill events originating from large flammable inventory storage associated with the project have been discussed in this chapter.

19. Equipment Design and safety requirements:

This section focuses on some major equipment design elements related to equipment safety requirements rather than the operations guidance/management issues (e.g., dust control, signage, awareness, etc.). The section summarizes previous sections on technology to be used and likely impacts.

20. Summary of Impacts and Mitigation Measures:

Summary list of potential environmental impacts for construction, commissioning, operation and decommissioning phases of soybean oil project using criteria set out in Section 4 with magnitude and significance for each impact. Further, detailed list of potential mitigation measures/options identified in view of applicability and cost effectiveness including interactive impacts.

21. Environmental Management & Monitoring Plan:

Plan to monitor implementation of proposed mitigation measures / options during project lifetime.

22. Acronyms & Abbreviations:

List of abbreviations/acronym within ESIA report text.

23. Appendices:

APPENDIX (A)

Applicability and compliance of the Project with the IFC PS requirements

APPENDIX (B)

Air Dispersion Modeling

APPENDIX (C)

Stakeholder Identification, Public Disclosure and Consultation

APPENDIX (D)

Main Archaeology and Cultural Sites in Iraq

APPENDIX (E)

Social Management Plan

APPENDIX (F)

Occupational Health and Safety Plan

2. POLICY, LEGAL AND ADMINITRATIVE FRAMEWORK

2.1 Introduction

Within Republic of Iraq the National entity responsible for establishing environmental legislation and standards is the Ministry of Environment (MoE). As the soybean oil project will be located within the boundaries of Umm Qasr Port in Basra, the Iraqi environmental regulations and standards apply to this project. Further, as the proponent is seeking funding from the World Bank/IFC for building this new project, the project shall comply with applicable IFC environmental, social and disclosure policies and apply the World Bank environmental, health and safety (WB EHS) guidelines. However, when Iraqi regulations differ from the levels and measures presented in the WB EHS Guidelines, the soybean oil project is expected to satisfy whichever standard is more stringent. Further, where there are no appropriate IFC policies or guidelines, the project shall apply other relevant internationally recognized standards.

The guidelines and standards relevant to the Project are used as a basis for evaluating the project's impacts and are summarised in the subsequent sections of this document. As the guidelines and standards are presented as a summary, the full and most recent legislation will be consulted prior to implementation of any mitigation or monitoring actions.

All relevant standards, guidelines and performance thresholds which are introduced in the following sections are referenced as relevant within the individual technical assessment Sections of this ESIA: Sections 5 – 16.

In this section, the related national and WB-IFC regulations, standards and guidelines are highlighted. However, other relevant local, regional laws and international agreements are presented in Appendix A, since the Republic of Iraq is subject to international protocols and agreements adopted by the Republic of Iraq and, in addition to the environmental guidelines and standards by WB/IFC.

2.2 National Environmental Requirements

The Ministry of Environment has been delegated responsibility for environmental issues within the boundaries of the Republic of Iraq. The Ministry is responsible for controlling environmental degradation associated with the development and operations of all projects in Iraq.

National legislation and guidelines in Iraq generally address the potential environmental and social issues associated with the envisaged sub-projects. Iraq has also acceded to a large number of international environmental conventions and agreements and is committing new resources to assessments and plans to ensure their full implementation. With new laws requiring appropriate compliance with such international laws, a new approach to future environmental legislation is starting to emerge. However, although Iraq is a party to the treaties, environmental regulations, Iraq has traditionally lagged behind international standards.

The project is subject to the following Iraqi laws and regulations:

- Law No. 12 of 1981: Land Acquisition Law
- Regulation No. 2 of 2001: Preservation of Water Resources
- Law No. 55 of 2002: The Law of Antiquities and Heritage
- Law No. 2 of 2009: Protection and improvement of the environment and natural resources
- Law No. 27 of 2009: Protection and Improvement of Environment
- Law No. 17 for the year 2010: Protection of Wild Animals and Birds
- Law No. 41 of 2015: Noise Protection and Control.
- Law No. 37 of 2015: Labor codes, general labor and employment acts
- Ministerial Instruction No. 3 of 2012: Environmental determinants for the establishment of projects and monitoring of their safe implementation
- Ministerial Instruction No.12 of 2016: Occupational Health and Safety Requirements Regulations
- The National Environmental Strategy and Action Plan 2013-1017: Its main objective is to improve the quality of life and livelihood of the population through the protection of natural resources and support to sustainable practices; assessment of issues relevant to the environment situation and suggestion of environmentally-sound solutions; reduction of the potential impact causing environment deterioration, building an institutional and educational awareness to preserve the environment; a clear roadmap to implement the principles of proper environmental management; development of short- and long-term strategic solutions for global environmental variables.

General Environmental Legislation: Law No. 2 of 2009 aims to protect and improve the environment and natural resources, by preserving public health, biodiversity and cultural and natural heritage, and by encouraging sustainable development and international and regional cooperation. The Law establishes a Council for the Protection and Improvement of the Environment reporting to the Ministry of Environment and cooperating with other Ministries. The law defines the Council's duties and responsibilities. Smaller provincial Councils have been established in the different provinces of the country. This Law sets forth provisions for the regulation of air pollution and noise reduction;; biodiversity protection; management of hazardous waste; protection of the environment from pollution resulting from exploration and extraction of oil wealth and natural gas; establishment of an environmental protection fund; rewards; compensation for damages; and penal provisions.

Environmental Impact Assessment for projects:

As per the Iraqi Ministry of Environment (IMOE) of the federal government of Iraq, any project or activity prior to its establishment has to prepare environmental impact assessment study and obtain Environmental compliance certificate. The MoE classifies projects into 3 categories; category "A" with high environmental impact, category "B" with moderate impact and category "C" with low to no impact on environment. Examples of "A" category activities include: dams and reservoirs, forestry production projects, industrial plants, river basin development, thermal power and hydro-power development, manufacture, transportation and use of pesticides or other hazardous materials, hazardous waste management and disposal, etc. Examples of "B" category activities include: agro-industries, electrical transmission, renewable energy, rehabilitation or maintenance of highway or rural roads, rehabilitation or modification of existing industrial facilities, etc. preparation of EIA is usually exempt for category "C" project, and examples of "C" category activities are: small fish breeding pond, institutional development, most human resource projects, etc.

Law no. 27 of 2009 on the Protection and Improvement of the Environment describes an Environmental Impact Assessment (EIA) as: "a study and analysis of the environmental feasibility of proposed projects that may affect the creation or the exercise of their activities on human health and environmental safety of present and future with a view to protecting them." The new law also includes several criteria required in an EIA. According to Article 10, an EIA must include:

- Determination of positive and negative impacts of the project on the environment and the impact of the environment surrounding it;
- Contingencies for pollution emergencies and potential precautions;
- Possible alternative technology that is less harmful to the environment and the rational use of resources;
- Provisions to reduce waste, such as the inclusion of recycled or reused materials when possible; and

- An assessment of the environmental feasibility of the project and an estimate of the cost of pollution relative to production.

The procedure for submitting an EIA is set out in Article 11. Before any work is to commence, the EIA must be submitted to the federal Ministry of Environment. Work may not commence until approval from the ministry has been received. However, an EIA may not be compulsory by Iraqi Environmental authority for facilities that are located inside Umm Qasr Authority. In fact, the Iraqi Environmental authority would not be able to enforce any facility to conduct an EIA without approaching it through Port Authority. In this regard, a letter issued by Port authority confirming this exclusion will be submitted to the IFC once it is issued.

Although Law No. 27 includes an EIA requirement, several gaps have been identified, mainly in the procedural and compliance side:

There is no screening procedure to determine applicability and level of detail of an EIA; and no requirement for scoping during which issues that should be taken into consideration are identified

- The law does not include a social assessment and there is no requirement for stakeholder consultation, public participation and disclosure
- ESMPs are not usually implemented and if implemented, they are not sufficiently monitored and followed up, in particular during the construction phase.

In the majority of the projects, contractors are not aware of their basic environmental and social roles and responsibilities (occupational health & safety, community safety, impacts due to temporary labor influx, etc.) and tender documents do not usually contain such clauses (i.e. Environmental and Social Management Monitoring Plan (ESMMP)).

2.3 International Guidelines and Policies

2.3.1 The World Bank Group

The World Bank Group is a family of five international organisations that makes leveraged loans:

- International Bank for Reconstruction and Development (IBRD);
- International Development Association (IDA);
- International Finance Corporation (IFC);
- Multilateral Investment Guarantee Agency (MIGA); and
- International Centre for Settlement of Investment Disputes (ICSID). Of most relevance to the Project is the IFC.

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 have developed their Performance Standards on Social and Environmental Sustainability (revised 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. The IFC Performance Standards (2012) are:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labour and Working Conditions
- Performance Standard 3: Resource Efficiency and Pollution Prevention
- Performance Standard 4: Community Health, Safety, and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

The IFC developed the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) to provide technical reference documents with general and industry-specific examples of Good International Industry Practice as defined in IFC's Performance Standard 3: Resource Efficiency and Pollution Prevention. The IFC uses these Guidelines as a technical source of information during project appraisal activities. The following international regulations and guidelines are applicable to this project:

- The IFC General EHS Guidelines, dated April 30th, 2007
- The IFC EHS Guidelines for Vegetable Oil Production and Processing, February 12, 2015
- The IFC EHS Guidelines for Food and Beverage Processing, April 2007
- The IFC and EBRD Workers' Accommodation: processes and standards, dated September 2009.

On applying these Guidelines, the IFC expect that when host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance level protects human health and the environment.

2.3.2 Equator Principles

The Equator Principles, established in June 2003, and subsequently reviewed in 2006 and 2013 is a risk framework for identifying, assessing and managing environmental and social risks in project finance transactions. This framework is based on the IFC Performance Standards and the World Bank Group EHS Guidelines. Equator Principles Financial Institutions (EPFIs) have adopted the Equator Principles in order to ensure that the Projects financed are developed in a manner that is socially responsible and reflects sound environmental management practises. 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 Categorisation;
- 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.

2.3.3 ESIA Requirement

When a Project is proposed for financing, the EPFI is required to categorise the Project based on the magnitude of its potential risks and impacts. This screening is undertaken using the following categorisation scheme of the IFC:

- Category A: Projects with potential significant adverse environmental social risks and/or impacts that are diverse, irreversible or unprecedented;
- Category B: Projects with potential limited adverse environmental social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and
- Category C: Project with minimal or no adverse environmental and social risks and/or impacts

The Soybean Oil Project is considered to be a Category B project due to its limited spatial scale and limited potential environmental impacts. This Project will have limited adverse E&S risks and/or impacts that are few in number, generally site specific, largely reversible, and readily addressed through mitigation measures and good international industry practices (GIIP).

2.3.4 Applicability of the project to IFC Performance Standards

The IFC Performance Standards that the Soybean Oil Project is to meet through the life of project is shown in below table.

Table 2-1: Applicability of the project to IFC Performance Standards

IFC Performance Standard	Applicability to this Project
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	**Applicable** (More details are given in Appendix A)
Performance Standard 2: Labor and Working Conditions	**Applicable** (More details are given in Appendix A)
Performance Standard 3: Resource Efficiency and Pollution Prevention	**Applicable** (More details are given in Appendix A)
Performance Standard 4: Community Health, Safety, and Security	**Applicable** (More details are given in Appendix A)
Performance Standard 5: Land Acquisition and Involuntary Resettlement	**Not Applicable** The land allocated from this project is government property and has been leased from Umm Qasr Port Authority. Furthermore, the project has not led to resettlement, physical dsiplcement and economic displacement. Therefore, PS5 is not applicable to this project.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	**Applicable** (More details are given in Appendix A)
Performance Standard 7: Indigenous Peoples	**Not Applicable** No indigenous people at the project site

Performance Standard 8: Cultural Heritage	**Not Applicable** During EnviroSOLTECH team site visit, it is noted that the project site is not located in or adjacent to cultural heritage, therefore PS 8 is not applicable.

2.3.5 Project Commitments

This ESIA study has been conducted in accordance with the requirements of the Iraqi Ministry of Environment regulations as well as the IFC Performance Standards and the Equator Principles (EPIII) as far as practicable (See Table 2-2 and Table 2-3 respectively).

Those Performance Standards highlighted in italics have been identified as having limited or no relevance to the Project.

Table 2-2: Sama AlManar company's commitment to the IFC Performance Standards for the Soybean Oil Project		
IFC Performance Standards		Comment
Performance Standard 1	**Assessment and Management of Social and Environmental Risks and Impacts.** Requirements: Environmental and Social Management System (ESMS): a methodological approach to managing environmental and social risk and impacts in a structure way on an ongoing basis. The ESMS will incorporate: (i) policy; (ii) identification of risks and impacts; (iii) management programmes; (iv) organisational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review. Objectives: • To identify and evaluate environmental and social risks and impacts of the project. • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. • To promote improved environmental and social performance of clients through the effective use of management systems. • To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. • To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.	The following documents demonstrate adherence to this Performance Standard during FEED Stage: • Environmental and Social Impact Assessment (ESIA); • Environmental Monitoring Management Plan (EMMP); • Environmental Emergency Response Plan (EERP); and • Stakeholder Engagement Plan (SEP) and ESIA Socio- economic Chapter. Project management will establish an ESMS relevant to the Project and support any ongoing management and reporting as required. Project management will use the ESMS to manage the implementation of the actions necessary to meet the applicable requirements of all Performance Standard. Project management will establish a construction E&S management plan in line with the relevant Good Practice Note of IFC.
Performance Standard 2	**Labour and Working Conditions** Requirements are outlined for: Working Conditions and Management of Worker Relationship; Protecting the Work Force; Occupational Health and Safety; Workers Engaged by Third Parties; Supply Chain.	Section 14 of the ESIA identify and assesses potential impacts that the proposed project could pose on workers' health and conditions as well as proposing measures to manage and monitor them. Also, these should be integrated in the EMMP and EERP as appropriate.

	Objectives: • To promote the fair treatment, non-discrimination, and equal opportunity of workers. • To establish, maintain, and improve the worker-management • To promote compliance with national employment and labour laws. • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. • To promote safe and healthy working conditions, and the health of workers. • To avoid the use of forced labour.	
Performance Standard 3	**Resource Efficiency and Pollution Prevention** Requirements are outlined for: Resource Efficiency (Greenhouse Gases and Water Consumption); and Pollution Prevention (General, Hazardous Materials Management and Pesticide Use and Management) Objectives: • To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project-related GHG emissions.	The ESIA documents how potential impacts on human health and the environment were identified and assessed. Section 17 of the ESIA specifically identifies and describes the assessment of the key strategic and technological alternatives that have been considered for the Project, and the integration of best available techniques (BAT) principles within the facility design in order to minimize significant impacts. The Project will emit more than 25,000 tonnes of CO2 equivalent annually; therefore GHG emissions have been estimated and are reported within Section 5. Since the anticipated GHG emissions are below 100,000MT this project is not required to quantify GHG emissions annually.
Performance Standard 4	**Community Health, Safety and Security** Objectives: • To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. • To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.	Section 14 identify and assesses potential impacts that the proposed Project could pose on workers and community's health as well as proposing measures to manage and monitor them. These have been integrated to the EMMP and EERP as appropriate.
Performance Standard 5	***Land Acquisition and Involuntary Resettlement***	*This standard is not applicable to this prjecty since the*

		government (Umm Qasr Port authority – Primary owner) has allocated this land for this Project. Due to the nature of the Project site location and land ownership, no assessment of resettlement is required as part of the ESIA.
Performance Standard 6	**Biodiversity Conservation and Sustainable Management of Living Natural Resources** Objectives: • To protect and conserve biodiversity. • To maintain the benefits from ecosystem services. • To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.	The ESIA documents how potential impacts biodiversity and living natural resources were identified and assessed. Biodiversity Section of this ESIA specifically identifies the existing ecological status of the site and describes the assessment of potential impacts to the biodiversity, habitats, assessment of supply chain biodiversity risks, and ecosystem services as a result of the Project as well as proposing mitigation measures to manage and monitor them. Also, these have been integrated into the EMMP as appropriate.
Performance Standard 7	***Indigenous Peoples***	*The baseline assessment identifies no indigenous peoples occupying the land.*
Performance Standard 8	***Cultural Heritage*** Objectives: • To protect cultural heritage from the adverse impacts of project activities and support its preservation. • To promote the equitable sharing of benefits from the use of cultural heritage.	Section 13 of the ESIA describes the assessment of potential impacts that the proposed Project could pose to cultural or archaeological heritage as a result of the Project.

Table 2-3: Sama AlManar company's commitment to the Equator Principles (EPIII) for the Soybean Oil Project		
Equator Principles		**Comment**
Principle 1	**Review and Categorization** Categorization of the project based on the magnitude of its potential risks and impacts in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC).	Classification of the project under section 3 of the Iraqi environmental regulation, this project is considered to be a type B Category. Further, it is anticipated that the Equator Principle Financial Institutions (EPFIs) will categorize this project as a Category B project.
Principle 2	**Environmental and Social Assessment** Assessment process to address to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project. The Assessment Documentation should also propose measures to minimise, mitigate and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project. For Category A projects the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA).	The **ESIA Scoping Report** identified the relevant environmental and social risks and impacts of the proposed Project. Informed by the ESIA Scoping Report, the **ESIA** was completed to assess all aspects of the project. The Project is not expected to emit more than 100,000 tonnes of CO_2 equivalent annually; therefore an alternative analysis to evaluate less greenhouse gases (GHG) intensive alternatives was not required.
Principle 3	**Applicable Environmental and Social Standards** Compliance with host country legislation / permits is required to be addressed in the first instance, For Projects located in Non Designated Countries, the assessment is required to evaluate compliance with the respective IFC Performance Standards and World Bank Group EHS Guidelines. For Projects located in Designated Countries, the relevant host country laws, regulations and permits apply.	Republic of Iraq is a Non Designated Country; therefore the assessment process outlined in this ESIA evaluates compliance with the IFC Performance Standards and EHS Guidelines. Where Iraqi environmental Regulations are more stringent however, these have been applied. Early consideration of the applicable standards was communicated to engineering and design teams via an Environmental Basis of Design.
Principle 4	**Environmental and Social Management System and Action Plan** An ESMS to be developed and maintained by the Client for all Category A and B Projects. An Environmental and Social Management Plan is also required to address issues raised in the Assessment and incorporate actions required to comply with the applicable standards.	The Project management will establish and maintain an ESMS. Section 21 of this ESIA report includes an **Environmental Management & Monitoring Plan (EMMP)** developed to address and manage the environmental aspects and impacts related to the construction, commissioning and operation of the Project. The EMMP is considered appropriate as an ESMP. It is anticipated that all applicable standards will have been met to the satisfaction of the EPFI. However, if it is deemed necessary by the EPFI to prepare an Action Plan (AP) to address any gaps identified, Sama AlManar Co will work with the EPFI to resolve this

Principle 5	**Stakeholder and Engagement** For all Category A and Category B Projects, effective stakeholder engagement must be demonstrated as an on-going process in a structured and culturally appropriate manner with affected communities and where appropriate other stakeholders. For projects with environmental or social risks and adverse impacts, disclosure should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis.	The **Socio-Economic Section** of the ESIA (Section 12) and the **Stakeholder Engagement Plan (SEP)** to be prepared both address stakeholder engagement appropriate to this Project. The **SEP** outlines the approach to be taken in supporting the communications and engagement objectives, processes and deliverables required to support successful delivery of the Project. It also identifies the range of people and organisations that may be regarded as stakeholders in the Project, and describes the strategy to be used for engaging with these stakeholders in a culturally appropriate manner. The SEP will continue to be developed by Sama AlManar for the life of the Project.
Principle 6	**Grievance Mechanism** For all Category A and, as appropriate, Category B Projects, the client will, as part of the ESMS, establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.	The **SEP** (to be prepared) provides an Action Plan which initiates a grievance mechanism for use during the life of the Project. This will be developed further and maintained by the project management during all phases of the Project.
Principle 7	**Independent Review** For all Category A and, as appropriate, Category B Projects, an independent Environmental and Social Consultant not directly associated with the client will carry out an Independent Review of the Assessment Documentation including the ESMP, ESMS and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.	A technical Advisor has been appointed to the Project for any possible improvement in the process and environmental matters. The EPFI to advise if further Independent Reviewers are appropriate for the Project.
Principle 8	**Covenants** The client will covenant in the financing documentation: to comply with all relevant host country environmental and social laws; regulations and permits to comply with the ESMP and AP (where applicable), to provide periodic reports to the EPFI demonstrating compliance, and to decommission facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.	The **ESIA** will provide the initial documentation to demonstrate compliance with the appropriate regulations as well as commitments related to the outline plans developed for environmental management and decommissioning/closure. Sama AlManar will establish and maintain an ESMS relevant to the Project and support any on-going management and reporting as required by the EPFI.
Principle 9	**Independent Monitoring and Reporting** To assess Project compliance with the Equator Principles and ensure ongoing monitoring and reporting after Financial Close and over the life of the loan, the EPFIs will for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFIs.	The EPFI to determine the appropriate requirements for independent monitoring and reporting for this Project. .
Principle 10	**Reporting and Transparency**	

	For all Category A and, as appropriate, Category B Projects; • The client will ensure that, at a minimum, as summary of the ESIA is accessible and available online • The client will publicly report GHG emission levels during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually. *EP III Annex A Notes:* *Clients encouraged to report publicly on Projects emitting over 25,000 tonnes. In some instances, public disclosure of the full alternatives analysis or project- level emissions may not be appropriate.*	Sama AlManar will liaise with the EPFI to confirm requirements for disclosing the Assessment Documentation (e.g. Executive Summary of the ESIA) online for this Category B Project. The Project is not expected to emit more than 100,000 tonnes of CO_2 equivalent annually; therefore annually reporting of such emissions will not be required.

2.3.6 Relevant Environmental Standards and Guidelines:

In addition to the IFC requirements, the Project must specifically adhere to the environmental guidelines and standards set by the Iraqi Ministry of Environment as appropriate.

Also, the project shall use for reference other recognized regulations as a basis for technical justification:

- The U.S. Environmental Protection Agency (US EPA);
- U.S. State environmental rules and guidelines;
- European Union (EU) members environmental rules and guidelines; and
- Other internationally recognised and accepted regulatory bodies.

The IFC requires that when host country regulations differ from the levels and measures presented in the IFC Environmental, Health, and Safety Guidelines, projects are expected to achieve whichever is more stringent.

2.4 National and International Environmental Standards

As indicated earlier, where numerical standards have not been developed by the IFC or the Iraqi ministry of environment, the regulatory assessment criteria for the ESIA will be derived from other international standards or guidelines, including US and EU regulations. Reference will also be made to best international practice as documented in the following guidance:

- General Environmental, Health, and Safety (EHS) Guidelines, April 30, 2007;
- The IFC EHS Guidelines for Vegetable Oil Production and Processing, February 12, 2015
- The IFC EHS Guidelines for Food and Beverage Processing, April 2007
- World Health Organisation (WHO) guidelines for ambient air quality and irrigation water quality; and
- Legislation of the EU and the U.S. Environmental Protection Agency (US EPA).

The following sections provide a summary of the environmental guidelines relevant to the Project, which are elaborated more fully within the Project Environmental Design Basis. The most stringent of these will be used as a basis for evaluating project impacts or as described in the impact sections or as otherwise described in the impact sections.

2.4.1 Air Quality

Ambient Air Quality

The IFC General EHS Guidelines (2007) require that project air 'emissions do not result in pollutant concentrations that reach or exceed ambient quality guidelines and standards'. Standards are those established through national legislative and regulatory processes, and guidelines refer to levels 'primarily developed through clinical, toxicological, and epidemiological evidence'.

IFC guidelines for ambient air quality standards are provided in IFC General EHS Guidelines on Air emissions and Ambient Air Quality (April 30, 2007).

A compilation of national and WB-IFC ambient air quality standards and guidelines for selected parameters are presented as Table 2-4.

Table 2-4: Ambient Air Quality Standards for Iraq compared with WB guidelines

Pollutant	Averaging Time	Iraqi Standards	WB Guidelines [1]
Carbon Monoxide (CO)	1 hours	35 ppm	NA
	8 hours	10 ppm	NA
Sulphur Dioxide (SO_2)	1 hour	0.1 ppm (262µg/m^3)	500 µg/m^3
	24 hours	0.04 ppm (104 µg/m^3)	20 µg/m^3
	1 year	0.018 ppm (47 µg/m^3)	N/A
Nitrogen oxides as NO_2	1 Hour	NA	200 µg/m^3
	24 hours	0.05 ppm (94 µg/m^3)	NA
	1 year	0.04 ppm (75 µg/m^3)	40 µg/m^3
Photochemical Oxidants as Ozone (O_3)	8 hour	0.06 ppm (118 µg/m^3)	100 µg/m^3
Inhalable Particulates (PM_{10})	24 hours	150 µg/m^3	50 µg/m^3
	Annual	NA	20 µg/m^3
Inhalable Particulates ($PM_{2.5}$)	24 hours	65 µg/m^3	25 µg/m^3
	1 year	15 µg/m^3	10 µg/m^3
Total Suspended Particles	24 hours	350 µg/m^3	N/A
	1 year	150 µg/m^3	N/A
Non-Methane Hydrocarbons (NMHC)	3 hours	0.24 ppm (160 µg/m^3)	N/A
Pb	24 hours	2 µg/m^3	N/A
	3 months	1.5 µg/m^3	N/A
	1 year	1 µg/m^3	N/A
Benzene	1 year	3 µg/m^3	N/A
Dioxin	1 year	0.6 pico g/m3	N/A

Note: (1) World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile

Source Emissions

In addition to the ambient air quality standards, both the national and WB-IFC have a number of source standards that apply to individual facilities (including soybean oil manufacturing) or point sources, as well as general standards that apply to any type of source and facility. Table 2-5 shows the air emission guidelines for vegetable oil processing while table 2-5 shows the air emission standards of PM, NOx and SO2 for small combustion units (engine and boiler).

Table 2-5: Air Emissions Guidelines for Vegetable Oil Processing

POLLUTANTS	UNITS	GUIDELINE VALUE
Dust[1]	mg/Nm3	10 (dry dust) 40 (wet dust)
Hexane[2]	mg/Nm3	100
VOCs[3]	kg solvent loss/t feedstock	Animal fat: 1.5 Castor: 3 Rape seed: 1 Sunflower seed:1 Soya beans (normal crush): 0.8 Soya beans (white flakes):1.2 Other seeds and other vegetable matter: 1.5 (fractionation excluding degumming) 4 (degumming)

Note:

(1) Dust level of 10 mg/Nm3 for dry dust can be achieved by applying cyclones and bag filters on selected vents, e.g. from meal dryers, coolers, and grinders. A dust level of 40 mg/Nm3 for wet dust can be achieved by applying cyclones and/or multicyclones.

(2) Applies to the solvent plant and can be achieved by application of cyclones

(3) Refers to total solvent loss, European Solvent Directive 1999 (Council Directive 1999/13/EC of 11 March 1999. on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations).

Source: WB-IFC Environmental, Health, And Safety Guidelines Vegetable Oil Production And Processing February 12, 2015

Table 2-6: Small Combustion Facilities Emissions Guidelines (3MWth – 50MWth) – (in mg/Nm3 or as indicated)				
Combustion Technology /Fuel	**Particulate Matter (PM)**	**Sulfur Dioxide (SO2)**	**Nitrogen Oxides (NOx)**	**Dry Gas, Excess O2 Content (%)**
Engine				
Gas	NA	NA	200 (Spark Ignition) 400 (Dual Fuel) 1,600 (Compression Ignition)	15
Liquid	50 or up to 100 if justified by project specific considerations (e.g. Economic feasibility of using lower ash content fuel, or adding secondary treatment to meet 50, and available environmental capacity of the site)	1.5 percent Sulfur or up to 3.0 percent Sulfur if justified by project specific considerations (e.g. Economic feasibility of using lower S content fuel, or adding secondary treatment to meet levels of using 1.5 percent Sulfur, and available environmental capacity of the site)	If bore size diameter [mm] < 400: 1460 (or up to 1,600 if justified to maintain high energy efficiency.) If bore size diameter [mm] > or = 400: 1,850	15
Boiler				
Gas	NA	NA	320	3
Liquid	50 or up to 150 if justified by environmental assessment	2000	460	3

Solid	50 or up to 150 if justified by environmental assessment	2000	650	6
Notes: -N/A/ - no emissions guideline; Higher performance levels than these in the Table should be applicable to facilities located in urban / industrial areas with degraded airsheds or close to ecologically sensitive areas where more stringent emissions controls may be needed.; MWth is heat input on HHV basis; Solid fuels include biomass; Nm3 is at one atmosphere pressure, 0°C.; MWth category is to apply to the entire facility consisting of multiple units that are reasonably considered to be emitted from a common stack except for NOx and PM limits for turbines and boilers. Guidelines values apply to facilities operating more than 500 hours per year with an annual capacity utilization factor of more than 30 percent. Source: Environmental, Health, and Safety Guidelines General EHS Guidelines, 2007				

2.4.2 Waste Water Quality

As per Iraqi environmental regulation and standards, Article 3 of Regulation No.2 of 2001 prohibits the discharge or casting of waste water into public water irrespective of the entity (public and private). Entities are prohibited from discharging wastes, unless they obtain an approval to discharge wastes as per the criteria and specifications set out by the Environment Protection and Improvement Directorate (EPID). Article 4 prohibits discharging any pollutant into public waters, while article 5 authorizes the EPID to issue environmental restrictions pertaining to the quality of public water as well as the quality of water discharged into public water, sewage systems, or rainwater.

The WB-IFC Environmental, Health, and Safety (EHS) Guidelines, Wastewater and Ambient Water Quality are applicable to this project which covers the following parts: General Liquid Effluent Quality, Wastewater Management and Monitoring.

WB-IFC Effluent guidelines and Iraqi limits for direct discharges of treated effluents to surface waters applicable to this project are shown in table 2-7.

Table 2-7: Effluent Parameters for direct discharges to surface waters

Variable	Units	Iraqi Limits	WB Guidelines[3]
Colour	NA	NA	NA
Temperature	C	<35°C	<3[2]
Suspended Solids	mg/l	60	
pH	pH units	6 -9.5	6 – 9
BOD	mg/l	<40	50
COD	mg/l	<100	250

Table 2-7: Effluent Parameters for direct discharges to surface waters

Variable	Units	Iraqi Limits	WB Guidelines[3]
Nitrate	mg/l	50	NA
Phosphate	mg/l	3	NA
Free Chlorine	mg/l	Trace	NA
Lead	mg/l	0.1	NA
Copper	mg/l	0.2	NA
Mercury	mg/l	0.005	NA
Sulphate	mg/l	if the ratio of the discharge is to the amount of source water is 1:1000 or less, the sulphate concentration should not exceed 400 mg/L	NA
Total hydrocarbons & derivatives	mg/l	For the river with continuous flow, 5mg/L provided the ratio of discharge to source water is 1:500	NA
Total nitrogen	mg/l	NA	10
Total phosphorus	mg/l	NA	2
Oil and grease	mg/l	NA	10
Total suspended solids	mg/l	NA	50
Total coliform bacteria	MPN[1] / 100 ml	NA	400
Active Ingredients / Antibiotics	NA	NA	To be determined on a case specific basis

Notes:

(1) MPN = Most Probable Number

(2) Temperature increase, At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity

(3) Source: WB-IFC Environmental, Health, and Safety Guidelines for Food and Beverage Processing

2.4.3 Noise Limits

2.4.3.1 Operational Noise Limits

As per Iraqi Law No. 41 of 2015 on Noise Protection and Control amends previous legislation, regulates methodological issues in noise control, sets limits for exposure times to continuous noise between 80 and 115 dBA, and determines daytime and night-time standards for outdoor noise exposure. Law 41/2015 includes standards for ambient and occupational noise with correspondent exposure periods. The main gaps identified are:

- Ambient noise monitoring is not consistently conducted, and monitoring data is not available to the public.
- There is no tracking of compliance with occupational noise exposure during the majority of construction activities.
- Selected Noise limits are different from WBG limits. A brief comparison is presented in the table below.

The applicable environmental noise standards/guidelines that apply to soybean project as per national and WB Guidelines are shown in tables 2-8, and special noise criteria values have been pre-set by WB in order to protect the workers from physiological impairment that may result from excessive noise levels as shown in table 2-9.

Table 2-8: Maximum Allowable Noise Limits (dBA)

Iraqi Law No. 41 Requirements			WB Guidelines		
	Permissible noise intensity decibel		Receptor	One-hour LAeq (dBA) (LAeq is equivalent continuous level)	
TYPE OF AREA	DAY 7:00 – 19:00	NIGHT 19:00-07:00		DAY 07:00–22:00	NIGHT 22:00 - 07:00
Sensitive areas (Hospitals, clinics, convalescent and residential care homes)	50	40	Residential; Institutional; educational	55	45
Urban residential areas	60	50	Industrial; commercial	70	70
Suburban residential areas	55	45	Increase above background	+ 3	+ 3

Hotels and hostels	55	40	
Educational institutions (schools, universities, kindergartens etc.)	55	45	
Industrial areas and public institutions	70	60	
Commercial and administrative areas and institutions	65	60	
Private areas (Airport, railway stations, harbors)	70	60	
Cultural institutions and protected areas	60	50	
Recreational areas	60	50	
Residential areas in industrial zones	60	40	

Table 2-9: Limit values for noise regarding workers as per IFC/WB requirements
IFC/WB General EHS Guidelines: No employee should be exposed to a noise level greater than 85 dB (A) for a duration of more than 8 hours per day without hearing protection'.
legislation: Construction workers will wear ear protection devices as part of their Personal Protective Equipment (PPE), if they are exposed to noise levels higher than 80 Db (A).

2.4.3.2 Construction & "Non-Normal" Noise Limits

For non-normal; start-up/shut-down/emergencies for relatively short periods, a certain increase in noise limits may be expected and is acceptable :

- Daytime increase of 5 - 10 dB(A)

- Night-time increase of 5 dB(A)

2.4.4 Hazardous Materials Management

The soybean project may involve the transport, storage, and use of bulk quantities of hazardous materials (such as acids, alkalis, solvents, and hydrogen) during extraction. Their transport, storage, and handling provide opportunities for spills or other types of releases with potentially negative impacts on soil and water resources. Their flammability and other potentially hazardous characteristics also present a risk of fire and explosions. Hazardous materials should be managed according to the guidance presented in the WB-IFC General EHS Guidelines for Vegetable Oil Production and Processing (2015) and in WB-IFC Environmental, Health, and Safety (EHS) Guidelines (2007).

As per Iraq Law No. 27/2009 provides provisions for the handling of hazardous substances and wastes, and stipulates that they should conform with international standards and best practices for the protection of the environment. Instruction No. 3/2015 consists of 5 Articles and aims at organizing the management of hazardous wastes, either by those who produce them, transport or treat them. The producers should determine the types of waste, collect and storage them to be processed, obtain the environmental approval, keep both paper and electronic records on the quantities and types of waste and have transport documents if needed.

2.4.4.1 Hazardous Materials Storage and Handling Regulations

The national environmental authority lists criteria relevant to hazardous material and states that "Any hazardous material shall be managed in such a manner as to minimize to the fullest extent possible the potential for harm to human health or the environment". In light of this requirement soybean oil project will develop a series of preventive control measures for containers, storage areas, spill prevention, inspections, and monitoring.

2.4.4.2 Hazardous Material Transportation Regulations

Hazardous material transporters are responsible for the safety of the shipment during transit; emergency response plans for collisions/accidental spills/releases. Soybean project management is required to ensure that the transporters use a specially equipped hazard classification vehicle in accordance with the UN chemical hazard classification system for the transport of dangerous goods. In emergency cases and road accidents, soybean project management is required to immediately inform local Industrial Safety & Security Department (ISD).

2.4.5 Waste Management

WB EHS Guidelines (2007) defines the waste as any solid, liquid, or contained gaseous material that is being discarded by disposal, recycling, burning or incineration. It can be byproduct of a manufacturing process or an obsolete commercial product that can no longer be used for intended purpose and requires disposal.

Soybean project management will follow waste management guidance presented in the General EHS Guidelines (2007) which include the following: Waste Management Planning (Waste Prevention, Recycling and Reuse, Treatment and Disposal) and Hazardous Waste Management (Waste Storage and Transportation).

2.4.5.1 Wastes Treatment and Disposal

As per WB-IFC EHS guideline (2017) for treatment and disposal applicable to general wastes, if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed of and all measures should be taken to avoid potential impacts to human health and the environment.

Selected management approaches should be consistent with the characteristics of the waste and local regulations, and may include one or more of the following:

- On-site or off-site biological, chemical, or physical treatment of the waste material to render it nonhazardous prior to final disposal

- Treatment or disposal at permitted facilities specially designed to receive the waste. Examples include: composting operations for organic non-hazardous wastes; properly designed, permitted and operated landfills or incinerators designed for the respective type of waste; or other methods known to be effective in the safe, final disposal of waste materials such as bioremediation.

However, as for hazardous wastes disposal and treatment, in the absence of qualified commercial or government-owned waste vendors (taking into consideration proximity and transportation requirements), facilities generating waste should consider using:

- Have the technical capability to manage the waste in a manner that reduces immediate and future impact to the environment

- Have all required permits, certifications, and approvals, of applicable government authorities

- Have been secured through the use of formal procurement agreements

In the absence of qualified commercial or government-owned waste disposal operators (taking into consideration proximity and transportation requirements), project sponsors should consider using:

- Installing on-site waste treatment or recycling processes

- As a final option, constructing facilities that will provide for the environmental sound long-term storage of wastes on-site (as described elsewhere in the General EHS Guidelines) or at an alternative appropriate location up until external commercial options become available

All industrial/hazardous wastes generated in Iraqi cities shall be treated or disposed of in a government approved waste treatment and disposal facility within agreed time limit from date of generation of the waste.

Industrial and hazardous wastes will be disposed of in a special Class 1 double lined landfill.

As per the international regulations, the following hazardous waste must be disposed of by incineration:

- Waste containing organic solvents in excess of five wt. percentage;
- Wastes containing in excess of 50ppm of PCB or 1000mg/kg of Halogenated Organic Compounds (HOC).

Any facility generating industrial and hazardous wastes shall deliver to the local authority a waste audit form including name of the facility, description of wastes generated and quantities, waste classification, dates of disposal and other information as required.

2.4.5.2 Non-Hazardous Industrial and Municipal Wastes

As per WB-IFC EHS guideline (2017), Non-hazardous solid waste generated at construction and decommissioning sites includes excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills. Other non-hazardous solid wastes include office, kitchen, and dormitory wastes when these types of operations are part of construction project activities.

Non-hazardous industrial waste and municipal wastes shall be disposed of in goverment approved waste disposal facilities. Non-hazardous industrial and municipal wastes shall be disposed of in a Class II landfill single lined.

2.4.5.3 Wastes Transportation Regulations

Waste Manifest Regulations

As per national and international requirements; before transportation of hazardous and non-hazardous industrial wastes either for recycle, reuse, treatment, storage or disposal, a waste manifest certifying that the wastes are properly classified, described, packaged, marked and labelled shall be completed and signed. The manifest needs to contain the following information:

- A unique, sequential number;

- Details of the generator, the transporter and the disposer;
- For non-hazardous waste, a description of the waste including compositional data;
- For hazardous waste, a detailed chemical and physical analysis, safety and hazardous material handling precautions, and hazard class materials;
- Proposed recycle, reuse, treatment or disposal method;
- The total quantity of waste being transported, and the number and type of containers being transported to the designated disposal facility.

It is also necessary to obtain the environmental local's approval for transporting waste to the designated waste management/disposal facility, and the transporter's signature on the manifest.

Hazardous Waste Transportation

As per WB-IFC EHS Guidelines (2007), on-site and Off-site transportation of waste should be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public. All waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e., manifest) that describes the load and its associated hazards, consistent with the guidance provided in Section 3.4 on the Transport of Hazardous Materials.

2.5 Other Legislation

2.5.1 Occupational Health and Safety

WB-IFC requirements: The management of this plant shall apply all applicable WB Occupational Health and Safety to this project including the following:

- General Facility Design and Operation
- Communication and Training
- Physical Hazards
- Chemical Hazards
- Biological Hazards
- Radiological Hazards

- Personal Protective Equipment (PPE)
- Special Hazard Environments
- Monitoring

National requirements including Labor Law No.37 of 2015 and Ministerial Instruction No.12 of 2016 (Occupational Health and Safety Requirements Regulations) represent the primary legislation for health and safety issues. Law No.37/2015 differentiates between jobs depending on the circumstances and duties that the employees are conducting, bearing in mind that the new Labor Law includes more than 170 Articles, which include a number of new terms and additions. The Law organizes aspects of the relationship between the employer and employees, with the aim of protecting their rights and realizing sustainable improvement which is based on social justice, equality and providing suitable work for everybody without discrimination. The Law prohibits all types of compulsory labor and child labor, specifies a minimum working age (15 years), and prevents any discrimination or harassment, whether direct or indirect.

The Law regulates the work of female employees by granting additional rights beyond those existing in the old law. Furthermore, it addresses the work of subcontractors regarding the employees' rights, responding to the expansion of such work in Iraq without previous regulation. The law also regulates health of employees and stipulates that the National Centre of Occupational Health and Safety is to be in charge of planning and inspecting the implementation of health affairs in a manner that guarantees the safety of employees at work sites from occupational diseases and injuries, and sets out extensive requirements in this regard in order to achieve a healthy work environment.

The main gaps identified are (mainly during implementation):

- Lack of awareness to adhere to safe working measures among employers and workers.

- Contractors do not implement proper and complete occupational health and safety measures in order to reduce construction costs.

- There is limited capacity to monitor health and safety issues in some industrial sites

- Construction activities are usually not inspected for health and safety issues.

2.5.2 Human rights and Social Laws

The 2005 Constitution of Iraq guarantees fundamental rights to Iraqi citizens, men and women, including equality before the law, equal treatment before the law (Article 14); treatment with justice in judicial proceedings (Article 19(6)); participation in public affairs (Article 20); right to work (Article 22); and the preservation of the family, the protection of motherhood, childhood and old age, and the prohibition of child labor and violence in the family (Article 29). The Constitution also guarantees to all Iraqis, "especially women and children," "social and health security," "basic requirements for living a free and decent life," and income and housing (Article 30), as well as health care (Article 31), care for the persons with disabilities (Article 32), and education (Article 34).

Article 2 of the Iraqi Constitution declares Islam as the official religion of the state and as a foundation source of legislation, as is the case in most Arab countries. At the same time the Iraqi constitution reflects the religious and ethnic diversity of Iraq and stresses the protection of the rights of groups (Article 2 (4) 2, Article 3, Article 4, Article 7, Article 8 (8), Article 14, Article 41, Article 42, Article 43 of the Iraqi Constitution).The Iraqi Constitution stipulates that no law may be enacted that contradicts established provisions of Islam and, while also stipulating that no law may be enacted that contradicts the principles of democracy (Article 2 (1)).

Iraq is a party to eight of the nine core international human rights instruments, including: the International Covenant on Civil and Political Rights (ICCPR), the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW), the Convention on the rights of the Child (CRC) and its Optional Protocol on the involvement of children in armed conflict; the International Convention for the Protection of All Persons from Enforced Disappearance (ICPPED), and the Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (CAT). Iraq is not a party to the Rome Statute of the International Criminal Court (ICC), and the international crimes defined in the Rome Statute are not criminalized under its domestic law. Iraq has not accepted the ICC jurisdiction over the current situation under article 12(3) of the Rome Statute.

2.5.3 Rights of Children

The 1987 Labor Law, as amended by the Coalition Provisional Authority Order Number 89, of 2004 sets the minimum age for employment at 15 and the minimum age for hazardous work at 18. Article 9 (2) of the Coalition Provisional Authority Order Number 89 outlines categories of work considered hazardous, including work underground, underwater, in an unhealthy environment or where a child is unreasonably confined to the premises, and where children are required to use dangerous machinery or handle heavy loads. Instruction No. 19 of 1987 includes additional prohibitions on hazardous labor for children, barring children from working with lead or toxic substances, in construction, and at tanneries or in any other place of employment that is hazardous to the health or morals of the child.

Order No. 89 sets employment conditions for children age 15 and older, including work hours, medical examinations and annual leave policies; it also provides for the creation of a register of employed young persons. Children employed in family enterprises are exempt from the Order's requirements, which may put these children at greater risk for involvement in the worst forms of child labor. Article 34 of the Constitution guarantees Iraqis the right to free education at all levels. Children in Iraq are required to attend school until age 12.

Order No. 89 prohibits slavery and similar practices, including forced labor, child trafficking, and illicit activities such as drug trafficking. The Constitution prohibits trafficking of women and children, as well as the sex trade. The Penal Code prohibits the enticement of children under 18 years into prostitution and provides for up to 10 years of imprisonment for violations. Order No. 89 outlaw's child prostitution and child pornography; violations are punishable by imprisonment. In 2012, the Government passed the 2012 anti-trafficking law, which proscribes penalties for both sex and labor trafficking and replaces portions of the labor and penal codes.

2.5.4 Cultural Heritage

Law No. 55/2002 defines all movable and immovable antiquities, archaeological properties and artefacts in Iraq. It regulates communication channels between the public and the relevant authorities for each contact between the public and the revealed and non-revealed archaeological sites. Provisions governing contact with archaeological sites extend also to encompass developmental activities like road construction and rehabilitation wherever these developmental activities lie within an archaeological vicinity.

2.5.5 Climate Change and Ozone Depleting Substances (ODS)

Iraq acceded to the Framework Convention on Climate Change (FCCC), the Montreal Protocol, the Kyoto Protocol and the Paris Agreement. Iraq submitted its first Nationally Determined Contributions Document (NDC) on 15th October 2021 .

National legislation/policy/administration related to this performance standard

As per national and international requirements all industries shall phase out chlorofluorocarbons (CFC) and halons or any other substances defined in the Montreal Protocol which are capable of depleting stratospheric ozone. The total phase out of ozone depleting substances shall be completed in accordance with the schedule and deadline stated within the protocol. Venting of CFC's and other ozone depleting substances to the atmosphere is prohibited except in the case of firefighting". Montreal Protocol establishes different total phase out dates for each of the ozone depleting substances included in Annexes A, B, C and E of the Protocol.

The Republic of Iraq ratified Montreal Protocol and its London and Copenhagen Amendments on 1 March 1993, as a Party operating under paragraph 1 of Article 5 of the Protocol, which relates to developing countries whose annual calculated consumption of controlled substances (as defined by Annex A of the Montreal Protocol) is less than 0.3 kg per capita (ca) on the date of entry into force of the protocol.

Within the framework of a national strategy, industrial facilities/plants are gradually stopping the use of certain ozone depleting chemicals such as the chlorofluorocarbons (CFCs), and are shifting to the use of substitute materials in application of the frame of action of the Montreal Protocol. Agenda 21

The Iraqi Government adopted the plan of action and principles outlined in Agenda 21 of the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, 3 to 14 June 1992. Commitment to these principles was re-affirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa from 26 August to 4 September 2002.

Agenda 21 establishes a framework for member states to operate in an environmentally compatible manner with a focus on sustainable development. These principles need to be upheld by new developments.

The UN Convention to Combat Desertification (CCD) was the first legally-binding agreement negotiated in direct response to Agenda 21. The Convention was adopted in 1994 and became legally binding to all Parties of the Convention on 26 December 1996. The strategy to combat desertification in countries suffering from bad drought or desertification, such as in the Republic of Iraq includes the following key steps:

- Taking precautionary measures for non deteriorated or partially deteriorated land.
- Promoting and facilitating access to information and appropriate technology.
- Strengthening climate forecasting facilities.
- Making provision for drought.
- Developing sustainable irrigation programmes using non-conventional waters.
- Establishing warehouse and marketing facilities for food in rural areas.
- Providing appropriate technology and training in agricultural and pastoral activities.

Future and long-term plans include legislation to restrict overgrazing and prevent desertification of natural pastures.

2.5.6 Best Available Techniques

The application of Best Available Techniques (BAT) in the Middle East is primarily based on the Integrated Pollution Prevention and Control (IPPC) Directive promulgated by the European Union. The focus of the directive is to minimize pollution from various industrial sources throughout the European Union (EU). The definition of BAT is provided in the European guidance documents as follows:

- *Best Available Techniques* is defined as “the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole”;
- *Techniques* are defined as to “include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned”;

- *Available* techniques are those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages…";
- *Best* is defined as the "most effective in achieving a high general level of protection of the environment as a whole".

In essence BAT balances the costs to the operator against benefits to the environment.

U.S. Best Available Control Technology (BACT)

As a supplement to EU guidance and because it is considered as an appropriate indicator of best practice, current U.S. Best Available Control Technology (BACT) standards and guidance will also be presented in this analysis for reference. BACT is an emission limitation that considers the cost of energy, environment, and economics in developing a degree of emission reduction that is achievable through application of good production processes, control systems, and techniques.

Furthermore, in no event can BACT allow emissions of a pollutant in excess of New Source Performance Standards (NSPS) or National Emission Standards for Hazardous Air Pollutants (NESHAPS) in the U.S. Therefore, this document will reference and discuss those federal regulations. The aforementioned federal Environmental Protection Agency (EPA) emission standards apply to certain air pollutants that are emitted from new, modified, or reconstructed stationary emissions sources and reflect the use of best available control technology.

BACT guidance is provided by the U.S. federal agency, EPA, and state agencies, such as the Texas Commission of Environmental Quality (TCEQ), and California's South Coast Air Quality Management District (SCAQMD) and Bay Area Quality Management District (BAQMD).

3. PROJECT DESCRIPTION

3.1 Introduction

The extraction of soybean oil can be accomplished using two major approaches: mechanical extraction through pressing (or mechanical expelling), or by chemical extraction using solvent. In the mechanical pressing process, heat and pressure are the two main principles for extracting oil and there is no chemical addition (reducing chemical waste). In hexane extraction, the process includes crop cleaning, cracking, dehulling, conditioning, flaking, extracting, solvent recovery, and desolvenization. The main issues for these two processes are the low efficiency and hazardous chemical problems, respectively. In extraction by pressing, the residual oil content of the raw material is around 10%, whereas in solvent extraction residual oil content can be reduced to less than 1% (Oetterer, M. et al., 2006 and Anderson, 2011). Further, the mechanical expelling method has other disadvantages (relatively higher energy consumption and facility maintenance requirements), whereas hexane extraction has disadvantages of safety and environmental issues (Li et al., 2004, Oliveira et al., 2013). Therefore, due to its relatively higher oil recovery and energy efficiency, the development and application of solvent extraction has expanded since the 1940s along with the early expansion of U.S. soybean production (Woerfel, 1995).

Generally speaking, the oil extraction process can be divided into three phases. The first involves the pre-cleaning, drying and storage of product to be processed. The second phase concerns the preparation of the grains for the oil extraction, by facilitating the extraction processes, such as the loss of grain, conditioning or heating, lamination, and expansion. The final phase involves the extraction itself, which may occur by mechanical pressing or using solvent (SoyStatsb, 2015). The owner of this project will utilize the solvent extraction approach for soybean oil processing and accordingly in this study the solvent extraction process will be discussed in detailed.

3.2 Process Description

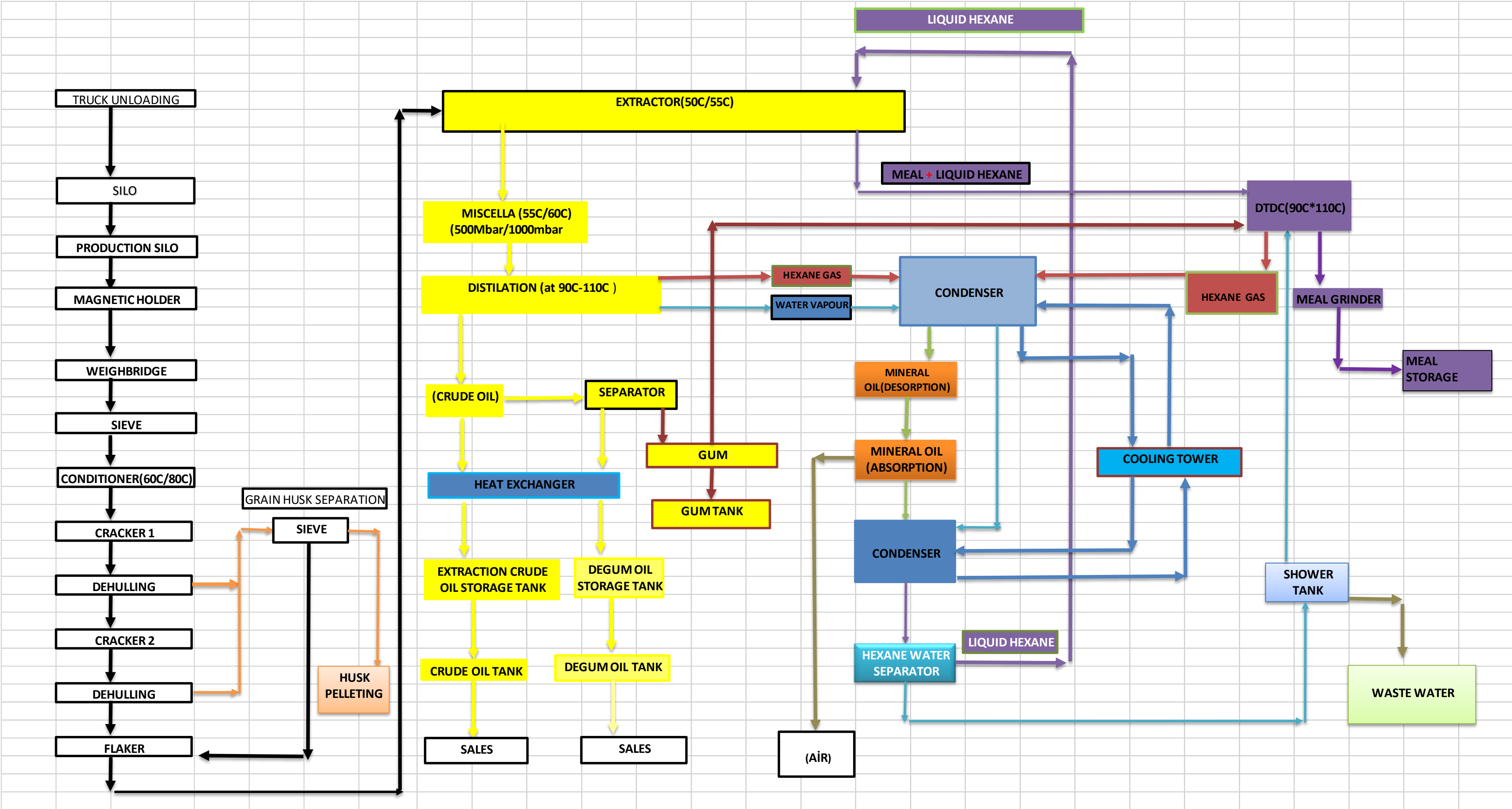
3.2.1 Preparation Plant Process Description

Soybean preparation plant includes:

- scale,
- cleaning,
- conditioning / softening,
- cracking,
- flaking,
- hull collection / crushing / transport / storage /packaging and dosing,
- meal crushing/grading/grinding, etc.

In order to recover the soybean hulls, the ground soya meal could be mixed together with grinding hulls, and then bagged and stored in a warehouse. The hulls also can be bagged and pelleted, then stored in a warehouse.

3.2.2 Process Flow



3.2.3 Scale and Cleaning

Oilseed is delivered to the preparation plant from silos (daily silo) by conveying equipment, and passes through a magnetic separator to remove the any metal, then weighed after cleaning to remove the impurities and use of a de-stoner to remove the light impurities and stones. The cleaning process will ensure the raw material enters the conditioning tower or other following process at high quality. After this, the soybean will enter the conditioning tower through an elevator. All this scaling and cleaning equipment (include conveying equipment) is designed with an aspiration (vacuum) system to keep the workshop environment clean and safe.

3.2.4 Soybean Conditioning

Soybean conditioning & softening occurs in the conditioning tower, which can soften and de-water simultaneously; the maximum de-water capacity can be designed based on the user's requirements. In the conditioning tower, soybean can be heated to the appropriate temperature and moisture which are suitable for dehulling and flaking. The heating section of the conditioning tower consists of a stainless steel oval tube, and soy is indirectly heated by low pressure steam. Air is heated by the air heater before entering the tower, and then the hot air passes through the material layer in full contact with the surface of soy, resulting in effectively removing bean surface moisture. The humid air is sucked out by the conditioning suction fan, which is separated by cyclone to collect the entrained impurities of air before entering into atmosphere. Soy remains in the tower for about 20-30 minutes, bringing soya moisture down to about 10.5 percent. The temperature is raised to 60-75 °C after conditioning. The heating section (oval tube with jacket) and the drying section (hot air heated by air heater) are alternately arranged, result in the optimal softening & drying effect, which is beneficial to the subsequent cracking, dehulling, and flaking (if too dry, the fines content will rise, if too wet, the hulls will stick on the kernel. The conditioner also can be designed to use flash steam from condensate or condensate directly (from condensate collection and recovery system) in the first heating tray, which can reduce steam consumption and energy costs.

3.2.5 Soybean Cracking, Dehulling and Kernel Fines Recovery

Soybean is delivered to the cracker after conditioning, fed into the first cracker to split into 2~4 pieces, with hulls sucked out by the first aspirator; after this, the primary cracked soya is processed by the secondary cracker, where the soybean is broken into 4~8 pieces, and finally hulls are removed by the secondary aspirator. The system is flexible, where users can choose two times dehulling, single dehulling or no dehulling (only pass one cracker, and bypass the second cracker and two aspirators), in response to the market demand and planned use for the soybean meal (based on the meal protein content). The hulls collected from two-times aspiration contains parts of crushed kernels, which need to be recovered in order to lower the loss of oil. The hulls leaving the aspirator are collected by cyclone and conveyed to the hull purification system, which first enter the rotating vibrating screen. The screen underflow has direct access to the flaker distribution scraper conveyor, whereas the aspirated screenings will go to the hull grinding section. The retained product on the screens will need to be separated again by aspirator, the heavy fines flow into the flaker, and the light phase transited to the hull grinding section after being collected by the dust collector.

3.2.6 Flaking

All the crushed soy kernels will be conveyed into the flaker (a double hydraulic roller), in which the kernel is pressed into slices with thickness about 0.25 to 0.35 mm. In the process of flaking, the kernel cytoderm is broken by the pressing and rubbing action to release the oil wrapped in the cell. In addition, flaking greatly reduces the distance that oil flows out, making it easier to extract oil. But it is not good to flake as thin as possible. If flakes are too thin, the fines content will increase, and the flaking machine power consumption also increases, so a reasonable thickness is preferred. In the actual operation, several sets of flaking machines can be used in a flexible arrangement, according to the working condition of equipment.

3.2.7 Soybean Hull Grinding, Addition or Pelleting, Conveying, Storage, and Bagging.

The collected hulls can be ground by Hammer mill, then collected in storage bins. It can be partially added into the soybean meal (by conveyor) quantitatively to control the meal protein content or conveyed by screw conveyor for bagging. Some of the ground hulls can be taken from the storage bins by screw conveyor, and dosed to the meal. The excess can be stored in a warehouse, and bagged in a warehouse. The soybean hulls also can be pelletized in the warehouse.

3.2.8 Meal Crushing, Metering, and Mixing

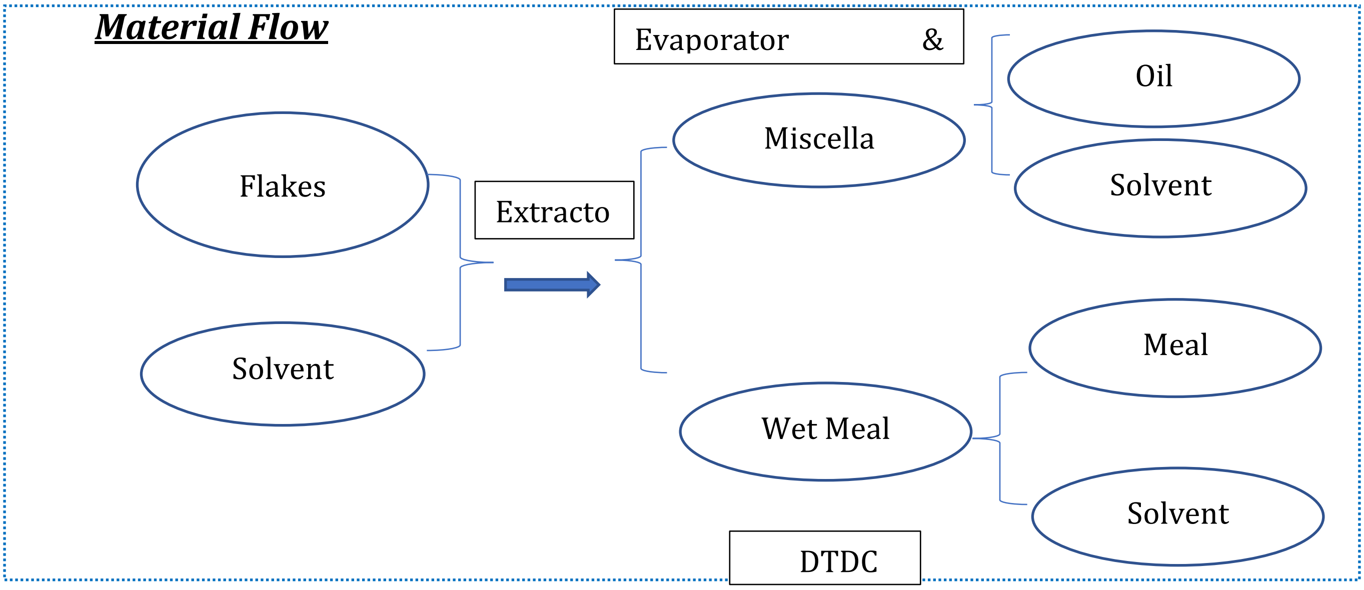
The meal from the solvent extraction plant may contain some big size pieces, which are first processed by a meal crusher, then separated by sieve according to the particle size to meet the requirements of the meal user. The excess meal will be ground by the meal grinder. Then, the hulls can be added in to adjust the protein content. Finally, the product meal is conveyed to the meal warehouse for bagging.

3.2.9 Condensate Water Recovery

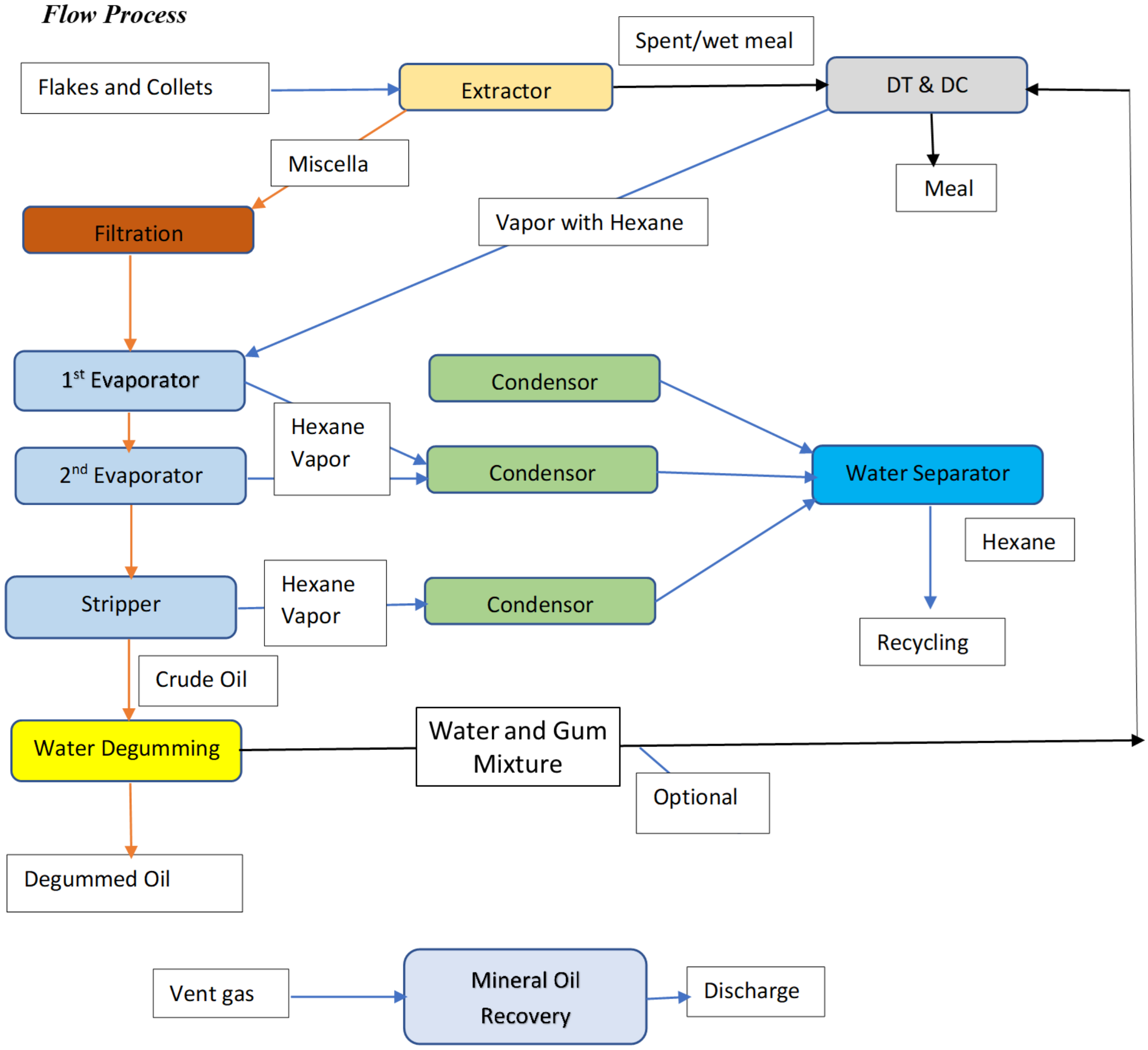
Condensate from each heating device is collected in the condensate flash tank. Here, secondary steam can be generated and sent to the conditioning tower, which can save 7 to 10 percent of the steam consumption. Hot water is pumped to the drying cooler using the hot water pump to heat the air in the cooler, which can save 40 to 70 percent of the cooler steam consumption.

3.3 Solvent Extraction Plant Process Description

The solvent extraction plant consists of the extractor system, the desolventizer – toaster – dryer – cooler (DTDC) system, the miscella evaporation system, the solvent condensation system, a vent gas recovery system, and other auxiliary systems such as zero effluent system, processing water, power, steam, compressed air. In addition, the water degumming system and lecithin drying also reside in this area of the plant.



Flow Process



3.3.1 Extractor System

Using a belt or shallow bed extractor or flakes are sent into the 104eding hopper of the extractor by the feeding conveyor from the preparation plant. This soy or flakes pass through a pneumatic slide gate and a feeding sealed screw conveyor. A material level sensor is installed on the top of hopper to control the spindle speed automatically, thus ensuring a stable material level in the hopper. The flakes in the extractor are moved by the drag chain, and flip and drop to the lower grid tray on the upper end, and continue to run to the discharge port. Fresh solvent is added in the vicinity of the discharge end, to minimize the residual oil content of solvent in wet meal to the greatest extent. The meal is sprayed and soaked by miscella with diminishing concentration between the feeding end and the discharge end of extractor, which form a counterflow operation. The extracting liquid collection hopper from the draining section has a special design to create a differential pressure between the lower and upper grid plate and strengthen the draining efficiency. This design enables improved efficiency of draining without side effects. The wet meal after draining discharges from the bottom of extractor, and is conveyed into the DTDC by the wet meal conveyor. The concentrated miscella is pumped from the miscella collecting hopper near the upper of the feed hopper into the full miscella buffer tank using the full miscella pump. After cleaning by the miscella hydrocyclone and the self-cleaning filter to control sedimentation, the miscella is temporarily stored, ensuring the flow of micella into the evaporator system is relatively stable.

3.3.2 DTDC System

Wet meal coming from the extractor is sent to the desolventizer – toaster – dryer - cooler (DTDC) by the wet meal conveyor and rotary valve. The DTDC is composed of a pre-desolvent tray, a desolvent tray, a stripping tray, an integration tray, and a drying & cooling tray. The pre-desolvent tray uses indirect steam for a heating source to remove parts of solvent on the surface of the wet meal. The rest of the solvent in the meal can be removed in the desolvent tray by the stripping effect of direct steam, which counterflows the meal flow and contacts the wet meal. The integration tray is designed to utilize the secondary steam generated from hot meal after compression by a hot steam pump, which can replace a part of the fresh steam, resulting in energy-savin. In this way, the process can also improve the taste of meal and make it easier to add waste water and gums to the meal.

The desolventized meal falls into a drying tray through the middle-feeding rotary valve, where it can be dried by hot air blowing into the meal from the dryer tray jacket and heated by the air heater. In the cooling tray, meal is cooled by the ambient air. Drying and cooling regulate the temperature and moisture of meal, thus making the moisture and temperature suitable for storage. Waste air produced by drying and cooling is discharged after separating the meal powder, which is collected into the conveyor by the cyclone. The finished meal is sent to the meal warehouse a conveyor. The specially designed DTDC can produce meal having better colour and higher protein solubility than other designs. The mixed gas from DTDC is used as a heating source for the first stage evaporator; to avoid damaging the heat exchangers, impurities in the gas are removed by the cyclone or the hot water scrubber. The hot water produced by the waste water digestion tank is pumped to the wet scrubber, then returns to the digestion tank with the captured meal powder, and that cycle repeats. Another pipe transports the waste water to the DTDC from the hot water pump, and the flow rate of the water is controlled by a flowmeter, thus making it possible to regulate the meal moisture, while at the same time, meal powder is sent back to DTDC.

3.3.3 Miscella Evaporation System

Miscella evaporation is operated under negative pressure, thus substantially reducing the boiling point of the miscella, which improves the quantity of heat and the quality of miscella such as color and moisture, etc. Miscella is futher buffered and sedimentated in the miscella buffer tank; whence the dregs are discharged to the upper meal bed of the extractor. After purification, the miscella is pumped to the first stage evaporator, and the mixed gas from the DTDC is used to heat the first stage evaporator. Solvent gas evaporated from the first stage evaporator is pulled into the evaporator condenser; the vacuum of the evaporator condenser is controlled by the steam ejector. Miscella is discharged from the bottom of the first stage evaporator, having an oil concentration of 75% or more. It can be forced to the second stage evaporator or by gravity itself (through a heat-exchange with the oil coming from the stripper). Oil from the first stage evaporator will be sent to the second evaporator after preheating by the heat-exchanger. The second stage evaporator is heated by indirect steam, and the evaporated solvent gas is sent to the same condenser. The second evaporator allows the oil concentration to reach around 95%; the evaporation temperature is automatically controlled by a loop incorporating a temperature sensor, etc. The miscella is then sent to the top of the oil stripper. Into the bottom of the stripper bubbles direct stream, taking off the residue solvent. The mixed gas enters the stripper condenser whose vacuum is maintained by another steam ejector. The stripped crude oil is pulled out by the pump. The bottom of the stripper is equipped with liquid level instrumentation, to ensure a stable level of stripper. The crude oil is sent to the oil dryer whose vacuum is maintained by another steam ejector. The gas is introduced to the stripper, creating higher vacuum in the dryer and reducing the steam dosage of the stripping tower at the same time. After drying, the seed oil is also pulled out by the pump; the bottom of the dryer is also equipped with liquid level controls. Finally, if the crude seed oil not need to be dried, it will be pumped to the exchanger and cooler directly. The crude oil dryer can also be used to dry the degummed oil. The crude oil heat-exchanger is an unconventional tube and shell heat-exchanger, to overcome the low transfer efficiency and unstable cooling effect of a normal exchanger. Use of this heat-exchanger design avoids the common tube blockage problem and high maintenance cost of a plate heat exchanger, thus guaranteeing the better quality of crude seed oil and the continuity of production.

3.3.4 Solvent Condensation and Water Separation System

The non-condensable free gases sucked from the stripping condenser, evaporator condenser, and vacuum condenser all discharge into the first evaporator shell by steam jet pump, in which it is partially condensed together with the mixed gas from the DTDC. It is then condensed by the heat exchanger and adding fresh solvent in the economizer. After this, it is condensed in the shell side of the DT condenser by cooling water, and finally flows into the vent gas condenser. Free gas out from extractor is washed by condensed solvent, then the solvent is sent to the evaporator condenser and stripping condenser. The solvent vapor generated from the waste water digestion tank and the free gas from other storage tanks enter the vent gas condenser directly.

All condensate water flows into the water-separation tank by gravity automatically; the tank is divided into a water-separation chamber and a solvent chamber. A circulating pump installed on the bottom of the solvent chamber returns solvent to the water diversion chamber in order to recover solvent without water.

After de-watering, the solvent is conveyed to the economizer by the fresh solvent pump for preheating, and then pumped into the extractor for reuse after heating by solvent heater. The separated waste water overflows into the water-sealing tank after removing the residual solvent by boiling in the waste water digestion tank.

3.3.5 Vent Gas Absorbtion System

The non-condensable gas from the vent gas condenser enters the bottom of the absorbtion column, the lean oil is sprayed from the upper portion of tower and passes through the packing layer, which counter flows through the vent gas for solvent absorption. The absorbed vent gas is discharged into the atmosphere by vent gas fan via a back-fire relief valve. The oil-rich with transits to the lean/rich oil heat exchanger by the rich oil pump, and then through the rich oil heat exchanger to the desorption column top. Meanwhile, the steam enters the tower bottom directly for desorption, and finally the released gas enters the evaporative condenser. The lean oil enters absorbtion for reuse after being processed through cooling-heating-cooling.

3.3.6 Water Degumming System

The purpose of water degumming is to remove the gums (lecithin and other phospholipids) from crude seed oil in a continuous manner. Most crude oil phospholipids can be hydrated, combining with water to be separated by centrifuge. A suitable acid (phosphoric acid or citric acid) will convert the non-hydrated phospholipids into the hydrated type. By selecting appropriate conditions (such as different acids, mixed mode and variable residence time), the hydration and separation in the degumming process can be optimized. To remove traces of water from degummed oil vacuum drying is used. The extracted oil is pumped into the plate heat exchanger through a duplex filter by screw pump from the middle storage tank, with a filter installed in the feed pump suction port to remove solid impurities in the oil. The plate heat exchanger has dual function: it is also used to regulate the temperature of hydration. Crude oil flow rate is controlled by a loop system consisting of a flow sensor and feed pump frequency converters. Water is added to the oil in the middle pipeline before arrival into the hydration tank, and thoroughly mixed together in a high shear mixer, and then remains for about 30 minutes or more in the hydration tank; the water line also equipped with a flow rate sensor. Hydrated oil is pumped into a self-cleaning centrifuge, which passes through a ring pipe and sight glasses for separation. Sight glasses will be part of process equipment to check if the process is going smoothly without any problem.Based on the specific gravity difference of oil and gum, gum is collected into the oil residue tank from the heavy phase outlet of centrifuge, whereas degummed oil is conveyed to the dryer in lighter phase outlet. A plate heat exchanger and a heater installed in the middle of pipeline before the dryer make sure the degummed oil is heated to the drying temperature. The cool side of the heat exchanger contains degummed oil, and the hot side of the heat exchanger is saturated steam, the oil temperature being controlled automatically by a closed-loop system composed of sensors. The vacuum of the dryer is provided by steam jet pumps, and the gas discharge from jet pump outlet is discharged into the solvent extraction stripper to be reused, but also to supply the desired vacuum for dryer. Gums containing water coming from the centrifuge are collected into the oil foot tank (oil foot means residual oil or oil trace), and are pumped into the DTDC system by screw-type oil pump mixed with soya meal.

Table 3-1: Names and quantites of inputs and outputs materials (in ton/year)

PRODUCTS TO BE PRODUCED (Average)	AMOUNT
Crude or Degummed Soybean Oil	180,000 ton/year
Soybean Meal	675,000 ton/year
Soybean Hull	27,000 ton/year
PRODUCT TO BE CONSUMED	**AMOUNT**
Soybean Seed	900,000 ton/year
Hexane	6,500 ton/year
Diesel	20,000 ton/year

The accounts stated in table 3-1 are calculated from a work program of 300 days a year.

- The capacity of the facility is 3,000 tons/day and it has the capacity of crushing 90,000 tons of soybean per month.

  3,000 ton x 300 days = 900,000 tons raw material

- Assuming an average of 20% oil in soybeans:

  900,000 x (20%) = 180,000 ton/year Crude soybean oil

- In order to increase the protein in the pulp, we assume an average husking content of 3%.

  900,000 x (3%) = 27,000 ton/year soybean bark

- Assuming 75% of the remaining pulp after removing the shell from the soybean seed;

  900,000 x (75%) = 675,000 ton/year soybean meal

Table 3-2: Power consumption by each machine unit

Machine Type	Total Units	Power (KW)
Extraction Plant	1	2000
Seed Preparation	1	2400
Steam Boiler with Diesel Fuel	3	800
Cooling Tower , R.O, Waste water etc	5	1000
Crude Oil Stock Tank 3.000 ton/pcs.	14	600

Administrative and Living Areas	3	300
Screw Compressor	2	200
Weighbridge, Security, Lighting	2	100
Steel Silo Storage, Transport, Ventilation	14	2000

- The total installed power of the soybean processing plant is planned as 9,600 kW.
- A generator corresponding to this installed power will be available at the facility.
- 3,600 tons of water per hour will be converted as absorption water in the closed cycle at the facility.
- Approximately 600 tons of water is needed in 24 hours for the extraction unit as well as for other purposes although the excat total daily water requirement should be taken from the mass balance values. This need will be met by treating the ground water taken from the wells to be drilled in the facility site.
- The compressed dry air requirement of the facility is approximately 630 Nm3/hr at 8 bar; this need will be met by screw compressors.

3.4 Unprocessed Corn

Corn demand is expected to grow as the livestock sector expands to meet consumer demand for poultry in Iraq. Accordingly, Sama AlManar intends to import corn from Brasil and/or Argentina with a quantity of about 20,000-25,000 tons per month, although this amount may vary depending on several factors such as market prices, customer changes, competition, etc. The unprocessed corn will be sold in the Iraqi Market as it is without processing.

The corn will be imported by vessels and discharged with the company's own stevedoring teams directly to trucks via bunkers. Discharged corn will be transported from the berth to flat storage inside the facility. One section of flat storage will be dedicated to bulk corn storage. Corn will be offloaded from trucks by dumping. The unprocessed corn will be moved from the flat storage area by trucks to customers inside Iraq in order to be used as animal food. If corn needs to be packed, packing machines and manual conveyors will be used before it is distributed inside Iraq.

3.5 Buildings, Silos and Storage tanks at the Project site

The locations and dimensions and more details on buildings, silos and storage tanks inside the project site are listed in the below table and shown in figure 3-2.

Table 3-3: Names and dimensions of buildings at the Project			
Building Name	X (Length m.)	Y (Length m.)	Z (Height m.)
Flat storage Area (capacity of 130.000 tons)	121.6	139.6	16.5
Water Storage Building No.1	40.0	25.1	5.2
Water Storage Building No.2	29.5	25.6	5.8
Maintanence Building	15.4	11.1	7.9
Guest House	17.6	40.4	9.0
Locker Room	11.4	29.6	5.0
Preparation Unit Building	59.2	20.4	35.5
Admin Building	30.5	28.1	9.0
Transformer Room 1	26.4	8.4	9.0
Transformer Room 2	22.4	16.7	9.0
Boiler House Building(1)	30.4	19.4	12.0
Extraction Unit Building	57.0	27.0	24.0
3 Silos(2)	94.5	27.9	30
Waste water Treatment Building	14.0	10.7	8
Storage Room	17.8	12.8	7.9
Fuel Tank building(3)	9.0	26.0	-
Solvent Tank(4)	31.4	10.1	-
Crude Soybean Oil Tanks(5)	73.9	37.4	18
Hazardous Waste Site	14.0	8.4	8.0

Notes:

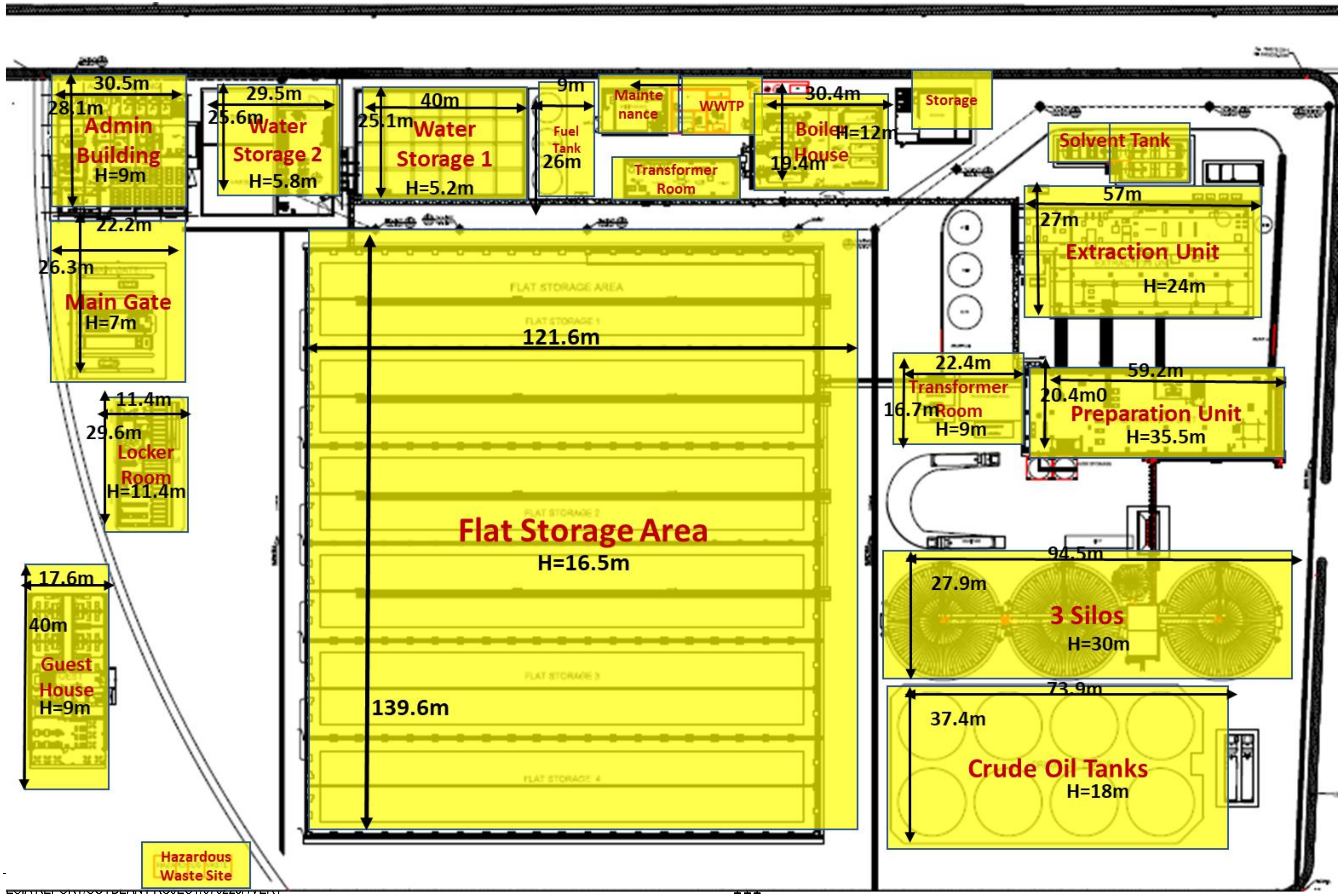
(1) Two Light Fuel Oil tanks will be built for operating boilers. Each tank will have a diameter of 7m and height of 10m.

(2) Three flat concrete bottom silos with capacity of 10,000 tons each will be built at the project site. Wall materials of silos will be made of galvanized s350 steel. Each silo will have 1 sweep auger and 2 sets of chain conveyors with 2 bucket elevators. Soybean seed density is 0,9 kg/lt.

(3) Three fuel diesel tanks (vertical shape) with capacity of 380 tons of each will be built at the project site. The height and diameter of each tank will be 10 and 7 meter respectively. These tanks will be used to operate the power generators.

(4) Three underground tanks for storage of hexane with capacity of 120 m^3 each will be built. The width and length of each tank will be 3.4m and 13.8m, respectively.

(5) Eight Crude Soybean Oil & Degum Soybean Oil Tanks with diameter of 16 m and height of 16 m each will be built.


30.5m
28.1m
Admin Building
H=9m
29.5m
25.6m
Water Storage 2
H=5.8m
40m
25.1m
Water Storage 1
H=5.2m
9m
Fuel Tank
26m
Mainte nance
WWTP
Transformer Room
30.4m
Boiler House
H=12m
19.4m
Storage
Solvent Tank
57m
27m
Extraction Unit
H=24m
22.2m
26.3m
Main Gate
H=7m
121.6m
139.6m
Flat Storage Area
H=16.5m
11.4m
29.6m
Locker Room
H=11.4m
22.4m
16.7m
Transformer Room
H=9m
59.2m
20.4m0
Preparation Unit
H=35.5m
17.6m
40m
Guest House
H=9m
94.5m
27.9m
3 Silos
H=30m
73.9m
37.4m
Crude Oil Tanks
H=18m
Hazardous Waste Site

3.6 Associated Facilities

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 (IFC, 2012). The only component that can be considered as an associated facility for this project is the road that links the project to the main port entreance gate. There are are no other associated facilities (such as high voltage transmission lines).

3.7 Utilities for the project

The power for this project will be supplied by the Umm Qasr port power station which has a load capacity of 33MW. The Soybean Oil Project will be responsible to extend an electrical cable with length of 1500m from the project site to the Port station to withdraw the required electricity line although gererators will be utilized during emergency scenario (power shutdown/ power outage).

Treated groundwater from wells will be utilised for various purposes (washing, cooling, process, etc.) at the project site. The bottled water will be used for drinking.

Diesel and light fuel oil will be bought from the nearest local source in Iraq to operate boilers and generators.

4. IMPACT ASSESSMENT CRITERIA AND METHODOLOGY

4.1 Introduction

This Section, Impact assessment criteria and methodology, presents an overview of the general impact assessment criteria and methodology applied to the assessment of potential impacts arising from the project elements so that this is not repeated across all section of this study.

The impact assessment criteria, outlined in the following section, have been applied to assessment of each of the proposed project elements during construction, operation and decommissioning phases and documented within each section. Where specific methods of assessment have been applied for an environmental aspect, these are presented in the relevant section.

In accordance with IFC Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts, the methodology for this Environmental and Social Impact Assessment (ESIA) has been developed in accordance with good international industry practice and potential impacts have been identified in the context of the Project's area of influence.

4.2 Project Site Location

The project site, illustrated in figure 4-1, is situated within Umm Qasr port at the Southern Borders Province of Republic of Iraq close to the border with Kuwait. This project (Soybean oil project) covers an area of approximately 171,000m2. The closest sizable population is Umm Qasr residential area, which is approximately about 2km to the north-west of the site.

Figure 4-1: Location of Soybean Oil Project within Umm Qasr port

4.3 Establishment of Baseline Conditions

Baseline information for this study has been collected from literature review, sites visits and monitoring and consultation. These can be summarised as below

- Literature review: details of literature review provided in section 21-Reference List;
- Site Visits and Consultation:
  - o October 19 2022: Preliminary site visit to review exiting land use and identify receptors
  - o October 19-23, 2022: Ecological Baseline Survey, part 1
  - o October 20, 2022: Environmental Scoping meeting with the directorate of Environment in Basra
  - o October 19-23, 2022: Air monitoring and ecological baseline survey, part 2;
  - o October 19-23, 2022: Air and noise monitoring, water sampling and consultation with Soybean staff, government officials and local community;
  - o October 22 and 23, 2022: Air monitoring and traffic counts

4.4 Impact Assessment Criteria

4.4.1 General

Impact weight is measured by linking assessment vs. suitable set of criteria which shows impact scores; beneficial, moderately adverse, strongly adverse, insignificant, etc.

Prediction and evaluation of environmental and social impacts within Sections 5-17 of this ESIA are considered against the baseline (including its value / sensitivity). In addition to the Key Principles provided by the national authority (Ministry of Environment), and as a basis for assessing environmental impacts, the methodology applied to this ESIA has been developed using a combination of the criteria, methodology and guidance provided by international requirements/best practice.

The main international sources considered are as follows:

- IFC (2012) Performance Standard 1 IFC Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts;
- The IFC General EHS Guidelines, dated April 30th, 2007
- The IFC EHS Guidelines for Vegetable Oil Production and Processing, February 12, 2015
- Directive 2011/92/EU on the assessment of the effects of certain public and private projects (codified version of the initial Directive of 1985 and its three amendments 97/11/EC, 2003/35/EC and 2009/31/EC)5; and
- Impact Assessment Guidelines and the ES Review Criteria from the Institute of Environmental Management and Assessment (IEMA).

The criteria presented in Table 4-1 will consider the following aspects:

The following factors are considered in classifying each potential impact generated by the Project, as presented in Table 4-1:

- Frequency: Occurrence of activity producing the impact, e.g. continuous, intermittent or a single event / less than once per year;
- Likelihood: Probability of impact occurrence (e.g., 100%, 50%, 0%);
- Extent: Spatial extent of the impact (e.g. within 2km of site boundary, outside the Project site but within 20km, within 200km, within Republic of Iraq, outside Republic of Iraq);
- Duration: Extent in time of the impact. Short term impact (less than the life of the project), medium term impacts (equal to the lifetime of the Project) and long term impacts (greater than the lifetime of the Project);
- Magnitude: Impact magnitude defined in relation to the limit criterion specified by the PME or international standards where available.
- Type of impact: Positive or negative effect; direct or indirect action.
- Potential significance: A combination of all the factors described in the preceding bullet points is used to determine the type and significance of a potential impact prior to mitigation. This is defined as low, medium or high.

Table 4-1 presents the terminology used throughout Sections 5 to 15 to describe and rank environmental and social impacts according to the categories defined above. Figure 4-2 presents how these criteria are combined in order to assess the significance of the potential environmental and social impacts identified.

Table 0-1: Terminology to Describe Environmental/Social Impacts

CATEGORY	TERMINOLOGY	DEFINITION
Scope of Impact(1)		
Frequency	Continuous Frequent Infrequent Rare	Uninterrupted or on a daily basis Once or more per day Less than once per day Single event / less than once per year
Likelihood	Certain Likely Unlikely No impact	Impact possibility estimated to be 100% Impact possibility estimated as > 50% but < 99% Impact possibility estimated as > 0% but < 50% Zero estimated possibility of impact
Extent	Local Provincial Regional National International	Within 2 km of the project site Outside the project site but <20 km away Outside the project site but <200 km away Within the Republic of Iraq Outside the Republic of Iraq
Duration	Short Medium Long	Less than one year More than one year, but less than or equal to life of project greater than life of project
Magnitude(2)	Very low Low Medium High Very high	Defined in relation to the limit criterion where available, e.g.: Very Low: Parameter < 10% limit criterion or standard Low: Parameter 10 to 50% limit criterion or standard Medium: Parameter 50 – 100% limit criterion or standard High: Parameter 100 – 200% limit criterion or standard Very High: Parameter > 200% limit criterion or standard Or, for qualitative assessment: -Very low: No degradation/adverse alteration to resource/receptor - Low: Minor degradation/adverse alteration to resource/receptor -Medium: Moderate degradation/adverse alteration to resource/receptor - High: Significant degradation/adverse alteration to resource/receptor -Very High: Permanent degradation/detrimental alternation to resource/receptor
		Type of Impact
Effect	Positive Negative	Beneficial impact Detrimental impact
Action	Direct Indirect	Impact caused solely by activities within scope of project Impact caused by activities partly outside scope of project
		Potential Significance
Significance	Low Medium High	Any low or medium magnitude impact that is unlikely to occur or is of short duration. Any medium magnitude impact that is certain or likely to occur and of medium or long duration. Also, any high magnitude impact that is unlikely to occur, of short duration, or local in extent. Any high magnitude impact that is certain or likely to occur, of medium or long duration, and regional in extent.

(1) *All terms are characteristics of the impact(s). For example, duration refers to duration of impact, not the activity causing it.*

(2) *Definition given is for resources in which numerical criteria are used to evaluate impacts.*

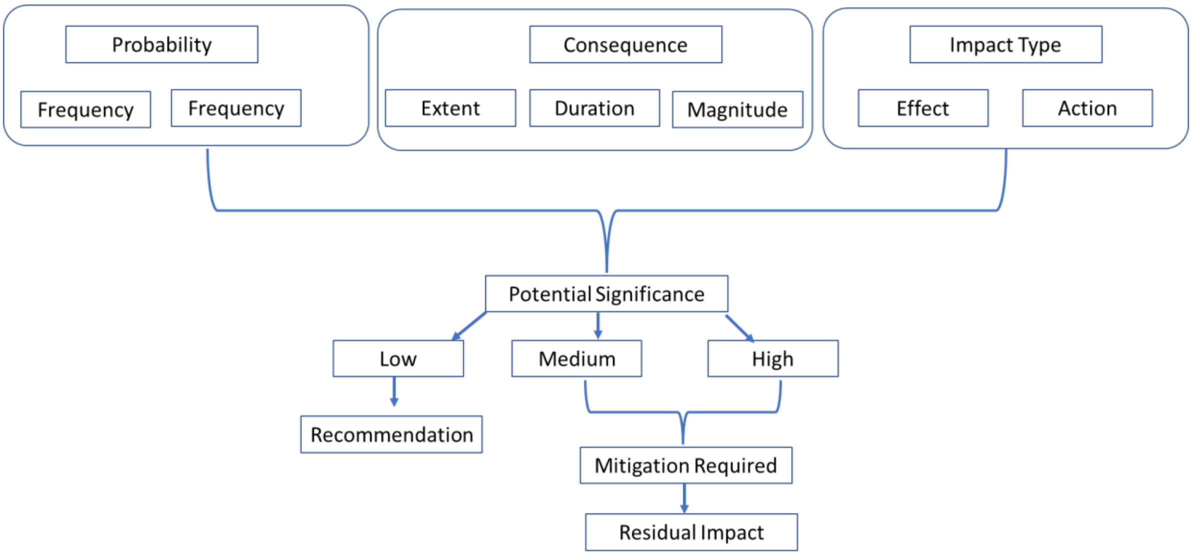


Figure 4-2: Combination of ESIA Criteria used to assess the potential Environmental and social Impacts Identified

4.4.2 Ambient Environment

The magnitude definitions for onshore physical environmental impacts are shown in Table 0-2.

Table 0-2: Magnitude Definitions for Ambient Environment Impacts

Component	Definition of Impact Magnitude		
	Low	**Medium**	**High**
Topography and drainage characteristics	Compaction of surface soils / emplacement of hardstanding over < 25% of site area.	Emplacement of hardstanding and/or managed drainage system over 50% of site area	Alteration of hydrological response of catchment.
Subsurface lithology	Addition of foundation materials / reworking / removal of soils altering the shallow geological succession. (Low to Medium)		Significant exploitation of certain formations, e.g., quarrying activities.
Nutrient content of soils	Minor changes to nutrient levels changing total soil nutrients	Alteration resulting in need for soil additives to sustain agricultural viability of soils.	Irreversible decimation of soil value for agricultural purposes.
Hydrogeology	Minor alteration to groundwater table not resulting in changes to groundwater flow direction.	Local diversion of groundwater and minor changes to hydrogeological properties only, e.g., due to subsurface structures.	Alteration of groundwater beneath site, e.g., change in direction of groundwater flow, introduction / removal of major flow pathways.
Soil / water chemistry	Minor alteration of chemical make-up, slight increase in total contaminative potential.	Significant increase in concentration of toxic metals/hydrocarbons presenting minor risk to water resources, marine organisms or site users.	Major degradation of soil / water quality providing on-going contamination source and /unacceptable risk to water resources (including marine organisms)/human health.

4.4.3 Biological Resources

Net effects on ecological receptor integrity (species, population, community, habitat). Table 0-3 shows criteria used to define type and magnitude of impacts on ecological receptors.

There are three categories for negative (adverse) impacts and two for positive (beneficial) impacts.

Table 0-3: Ecological Impact Assessment Criteria for Magnitude & Type of Impact

Magnitude/type	Criteria
High Negative	Likely to cause permanent adverse effect on integrity of ecological receptor.
Medium Negative	Adversely affects valued ecological receptor, no permanent effect on integrity.
Low Negative	Minimal/no effect.
Medium Positive	Likely to benefit receptor in terms of conservation status, not achieving favourable conservation status.
High Positive	Likely to restore an ecological receptor to favourable conservation status(1), or to create a feature of recognisable value.

These are based on currently accepted guidelines produced in the UK IEEM.

(1)The term"favourable conservation status" used in the definition of positive impacts is derived from the European Community Habitats Directive but the concept can be usefully applied to ecological impact assessment.

A habitat can be said to have achieved favourable conservation status when:

- Its natural range and the area it covers within that range are stable or increasing;
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue for the foreseeable future.

For a species, the conservation status is favourable when:

- The population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced in the foreseeable future;
- There is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

Criteria for determination of impact significance are set out in Table 0-4 and follow the usual approach of using geographical scope in order to assign levels of significance of effects. It should be noted that geographical terms used are similar to those used in the grading of impact extent (see Table 0-1), but the definitions are different and the two sets of terms should not be confused. “Regional” significance is defined here to relate to the wider Republic of Iraq region and surrounding countries; (such as Kuwait, northern and eastern Saudi Arabia). It is important to consider Republic of Iraq in this wider context, particularly with respect to its characteristic types of vegetation and its bird population.

In addition to "low", "medium" and "high" categories used elsewhere in this EIA, a "very high" level of significance is also used, e.g., in the case of impacts having a significance outside national boundaries.

Table 0-4: Ecological Impact Assessment Criteria for Impact Significance

Magnitude	Ecological Significance				
	International	Regional (Iraq and surrounding countries)	National (Republic of Iraq)	Provincial (within 50 km radius)	Local (within Umm Qasr)
High Negative	Very High	Very High	Very High to Medium	High to Medium	Medium to Low
Medium Negative	High to Low	High to Low	High to Low	Medium to Low	Low
Low Negative	Low (no impact)	Low (no impact)	Low (no impact)	Low (no impact)	Low (no impact)
Medium Positive	High to Low	High to Low	High to Low	Medium to Low	Low
High Positive	Very High	Very High	Very High to Medium	High to Medium	Medium to Low

4.4.4 Noise & Vibration

Table 0-5 and Table 0-6 present the definition of magnitude criteria for environmental noise impacts and the significance of noise impact assessment.

Table 0-5: Definition of Magnitude Criteria for Environmental Noise Impacts

Noise Level at Location of Receptor	Magnitude of Impact
Below or up to applicable noise limits	Low
1 to 5 dBA above applicable noise limits	Medium
6-10 dBA above the applicable noise limits	High
>10 dBA above the applicable noise limits	Very High

Table 0-6: Significance of Noise Impact Assessment

Frequency	Magnitude			
	Low	Medium	High	Very High
Continuous	Low	Medium	High	Very High
Frequent	Low	Low	High	Very High
Infrequent	Low	Low	Low	Medium
Once	Low	Low	Low	Medium

Table 0-77 presents applicable environmental noise limits for Republic of Iraq and WB-IFC.

Table 0-7 Maximum Allowable Noise Limits (dBA)			
Zone	**Iraq [1]**	**World Bank-IFC Guidelines[2]**	
		Day[5]	**Night[6]**
Residential and Institutional[3]	50	55	45
Industrial Area[4]	75	70	70
Increase above background	--	+ 3	+ 3

Notes:
(1) Maximum Noise Measured at Property Line - Not to be exceeded >10% of Measured Time (dBA)
(2) Guidelines for petrochemical plants. Measurements are to be taken at noise receptors located outside the project property boundary. Maximum allowable log equivalent (hourly).
(4) An industrial zone is an area where more than 50% of the properties are for manufacturing facilities
(5)Day-time hours 07:00 to 22:00.
(6) Night-time hours 22:00 to 07:00.
Sources:
Iraqi Regulations And Standards.
World Bank "Environmental, Health, and Safety General Guidelines, 2007"

4.4.5 Waste Management

Table 0-8 presents the criteria used for defining magnitude of impact from hazardous wastes and Table 0-9 presents the criteria used for defining significance of waste impact.

Table 0-8: Criteria Used for Defining Magnitude of Waste Impact

CRITERIA	SCORE	DEFINITION
Quantity	1	<10 tonne/day (solid) or <100 m³/d (liquid)
	2	10 to 100 tonne/day (solid) or 100 to 500 m³/d (liquid)
	3	>100 tonne/day (solid) or >500 m³/d (liquid)
Mobility	1	Immobile or possible to clean up quickly
	2	Can migrate if not cleaned up
	3	Very mobile
Persistence	1	Short term effect (if cleaned up)
	2	Medium term effect or long term intermittent
	3	Long term / continuous effect
Hazard	1	Non-hazardous material
	2	Hazardous material and contact is limited
	3	Hazardous material and contact is possible
Location	1	On site
	2	On site and environs
	3	Off site
Ranking *(based on sum total of score)*	11- 15	High
	8 – 11	Medium
	5 – 8	Low

Table 0-9: Criteria Used for Defining Significance of Waste Impact

CRITERIA	SCORE	DEFINITION
Likely contact with receptor	1	Little chance
	2	Indirect contact possible
	3	Direct introduction
Hazard	1	Unlikely to cause an impact
	2	Could cause an impact
	3	Likely to cause an impact
Liability	1	No liability to clean up
	2	Limited clean up /liability
	3	Receptor or source will need clean up
Ranking *(based on sum total of score)*	7 – 9	High
	5 – 7	Medium
	3 - 5	Low

4.4.6 Water Quality

The magnitude definitions for water quality impacts are presented in Table 0-10 and the significance criteria for water quality impacts is presented in Table 0-1.

Table 0-10: Magnitude Definitions for Water Quality Impacts

Component	Definition of Impact Magnitude		
	Low	Medium	High
Water quality	Minor alterations in one or more water quality parameters. No increase in concentrations of metals, hydrocarbons, or other toxic substances.	Major alterations in one or more water quality parameters. Concentrations of metals, hydrocarbons, or other toxic substances may be elevated, but are not likely to affect marine organisms. Temporary loss of amenity	Major alterations in water quality parameters. Elevated concentrations of metals, hydrocarbons, or other toxic substances are likely to affect marine organisms. Longer term loss of amenity

4.4.7 Marine Environment

The magnitude definitions for marine sediment and water quality impacts are presented in Table 0-11 and the significance criteria for marine sediment and water quality impacts is presented in Table 0-1. Background information is provided in Section 10.

Table 0-11 Magnitude Definitions for Marine Sediment and Water Quality Impacts

Component	Definition of Impact Magnitude		
	Low	**Medium**	**High**
Sediments/ geology	Minor alterations in bottom topography, grain size distribution, mineralogy, and/or total organic carbon. No increase in metals or hydrocarbons.	Major alterations in bottom topography, grain size distribution, mineralogy, total organic carbon, metals and/or hydrocarbons. Metal and hydrocarbon concentrations may be elevated, but are not likely to affect marine organisms.	Major alterations in bottom topography, grain size distribution, mineralogy, total organic carbon, metals, and/or hydrocarbons. Elevated metal and hydrocarbon concentrations are likely to affect marine organisms.
Water quality	Minor alterations in one or more water quality parameters. No increase in concentrations of metals, hydrocarbons, or other toxic substances.	Major alterations in one or more water quality parameters. Concentrations of metals, hydrocarbons, or other toxic substances may be elevated, but are not likely to affect marine organisms. Temporary loss of amenity	Major alterations in water quality parameters. Elevated concentrations of metals, hydrocarbons, or other toxic substances are likely to affect marine organisms. Longer term loss of amenity

4.4.8 Socio-Economic Aspects

The magnitude definitions for socio-economic and cultural aspects are outlined in Table 0-12.

Table 0-12: Definitions of Impact Magnitude for Socio-Economic Factors

Category		Definition
Negative	High	• Major impact on human health and wellbeing (e.g., serious injury, fatality, etc.) • Major impact on livelihood of individuals (loss of livelihood resources) • Considerable impact on access to community facilities/utilities (resettlement of households) • Considerable consequence on the economy (no employment opportunities or use of local supplies/services. Local or regional economic recession)
Negative	Medium	• Medium impact on human health & well being (injury to individual, noise, odour, dust) • Moderate impacts on livelihood (restriction of access to livelihood resources) • Medium impact on access to community facilities & utilities (restricted access) • Moderate impact on the economy (moderate use of local supplies/services)
Negative	Low	• Limited impact on human health & wellbeing (occasional dust, noise/vibration disturbance) • Some impact on livelihood (some tension between local & non-local workforce, limited restriction to livelihood resources) • Some impact on access to community facilities & utilities (restricted access for a limited duration) • Some impact on the economy
Negative	Very Low	• Very limited impact to human health & wellbeing (possible nuisance due to occasional odours) • Very limited disruption caused to livelihood (no noticeable impact on access to livelihood resources) • Limited impact in accessing community facilities & utilities (possible inconvenience, electricity supply disruption) • Negligible impact on wider economy at a local, regional and national level
Positive	Low	• Some improvement to human health & wellbeing • Benefit to livelihood (some employment opportunities) • Limited improvements to infrastructure, access to community facilities & utilities • Some impact to the economy (limited use of local supplies & services)

Table 0-12: Definitions of Impact Magnitude for Socio-Economic Factors

Category		Definition
	Medium	• Moderate Improvement to human health & wellbeing • Medium benefit to livelihood (moderate employment opportunities) • Improvements to infrastructure, access to community facilities & utilities • Medium impact to the economy (some use of local supplies & services)
	High	• Major improvement to human health & wellbeing • Major benefit to livelihood (large scale employment opportunities) • Large scale improvements to infrastructure, access to community facilities & utilities • Major impact to the economy (extensive use of local supplies & services)

4.4.9 Archaeological and Cultural Heritage Aspects

The magnitude definitions for archaeological and cultural aspects are outlined in Table 0-13.

Table 0-13 Definitions of Impact Magnitude for Archaeological and Cultural Factors

Category	Definition
High	• Loss or degradation of any archaeological wealth existing on site (ground clearance damaging any existing subsurface artefacts) • Erosion of tradition & cultural values, severe restriction in access of cultural/historical sites
Medium	• Some degradation of any archaeological wealth existing on site • Moderate impact on tradition & cultural values (restriction in access to sites of cultural/historical significance)
Low	• Limited impact on any archaeological wealth existing on site • Some impact on tradition & cultural values (access of cultural/historical sites restricted to limited extent).
Positive	• Intact artefacts exhumed during site development, documented and preserved • Improvements & protection of cultural sites and access to same

4.4.10 Human Health

Table 0-14 details the criteria used to rank the magnitude of impacts regarding human health.

Table 0-14: Magnitude Definitions for Human Health Impacts

Magnitude Level	Examples of Impacts for Each Magnitude
High	• Diseases with potential to cause multiple fatalities; highly infectious diseases like HIV/AIDS, exposure of large populations to toxins at acute levels or known human carcinogens. • Permanent total disability or isolated fatalities resulting from diseases capable of irreversible damage with serious disability, road traffic accidents, and severe psychological stress leading to suicide.
Medium	• Diseases capable of irreversible health damage, partial disability without loss of life. • Adverse health effects that need prolonged continuous or intermittent medical attention.
Low	• Short-term nuisances. • Minor illness with full recovery in a few days that do not lead to chronic diseases.

4.5 Impact Assessment Reporting

The finding of the assessment process for each environmental aspect are presented in sections 5 to 15 with significance of any predicted environmental impacts being defined as Low, Medium or High and documented in ***bold italics***.

Impacts predicted as being of medium to high significance are then assessed against appropriate mitigation measures to predict the residual impact significance. An example of how every section report the mitigation identified for impact of medium to high significance is presented by table 4-15. The identification (ID) Codes assigned to each impact are used to reference the impacts and association mitigation measures through other sections of the ESIA (Summary of Impacts and summary of Mitigations).

Table 4-15: Example of impact and mitigation summaries

ID Code	Impact	Potential Significance	Mitigation Measure	Significance after Mitigation
T1	Increase in Vehicle movement will result in potential road traffic accidents during construction	High	A structured approach to traffic management and vehicle standards should be specified and safety measure should be implemented. Ensure the transport plan for the project is developed and implemented during the lifetime of the project. Establish pedestrian routes within the construction area to be used by workers	Medium

Mitigation Measures and Reporting

Two types of mitigation measures are identified through this ESIA study in order to manage the potential impacts identified:

-Type 1: Measures to be taken to manage potential impacts considered to be of medium or high significance. Following application of these measures, residual impacts are expected to be lower.

- Type 2: Recommended measures that could be taken to manage impacts classified as low/insignificant. These measures can be considered as good management practices.

5. AIR QUALITY & METEOROLOGY

5.1 Introduction

This section presents a summary of the existing ambient air quality in the vicinity of the soybean oil project site (referred to herein as the project) and the prediction of potential air quality impacts due to air pollution emissions of SO_2, NO_x, particulate matter and hexane during the various stages of the project (construction, operation and decommissioning).

The following scenarios will be presented in this section: (1) Normal operating condition of the project; (2) Normal operating condition during construction of the project (all emission sources with control devices); (3) Abnormal operating condition of entire project; (4) Abnormal operating condition during construction of the project (sources without effective control device). Further, the odor assessment and GHGS (Green House Gases) emissions will be discussed. Detailed project emissions inputs and modelling results are presented in Appendix B.

5.2 Baseline Conditions/Existing Environment

5.2.1 Introduction

This subsection presents a description of the baseline air quality and meteorological conditions at the project site, based on literature review and data collection by EnviroSOLTECH consultant. Site visits were conducted during October 2022.

5.2.2 Meteorology

Iraq has a hot, dry climate characterized by long, hot, dry summers and short, cool winters. The climate is influenced by Iraq's location between the subtropical aridity of the Arabian desert areas and the subtropical humidity of the Arabian Gulf. January is the coldest month, with temperatures from 5°C to 10°C. In most of the areas, summers are warm to hot with mostly sunshine, but high humidity in the southern part of Iraq, where the project is located, near the coast of Arabian Gulf. Daily Temperatures can be very hot; on some days temperatures can easily reach higher than 49°C. Hot, dry desert winds can be strong sometimes and can cause violent sandstorms. About 70% of the average rainfall in the country falls between November and March. Precipitation is sometimes concentrated, causing local flooding, especially in the winter months.

5.2.2.1 Air Temperature & Humidity

The ambient temperature data show that the hottest months were June, July and August while the coldest months were January, February and December. The highest ambient temperature during summer months could reach as high as 50.0⁰C and usually recorded in June and July while the lowest temperature could reach as low as 0.0⁰C and usually recorded in January. The mean monthly minimum temperature in mid-winter (December to February) is 0 to 5 degrees. The mean monthly temperature from May to September is 30 to 40 degrees while the temperature is 10 to 20 degrees in other months. Mean monthly maximum and minimum temperatures are shown in Figure 5-1. The estimated average annual temperature of Basra area is about 26.3 °C, for the period (1979 – 2014) as indicated in a study by Al-Zubaidi (2022).

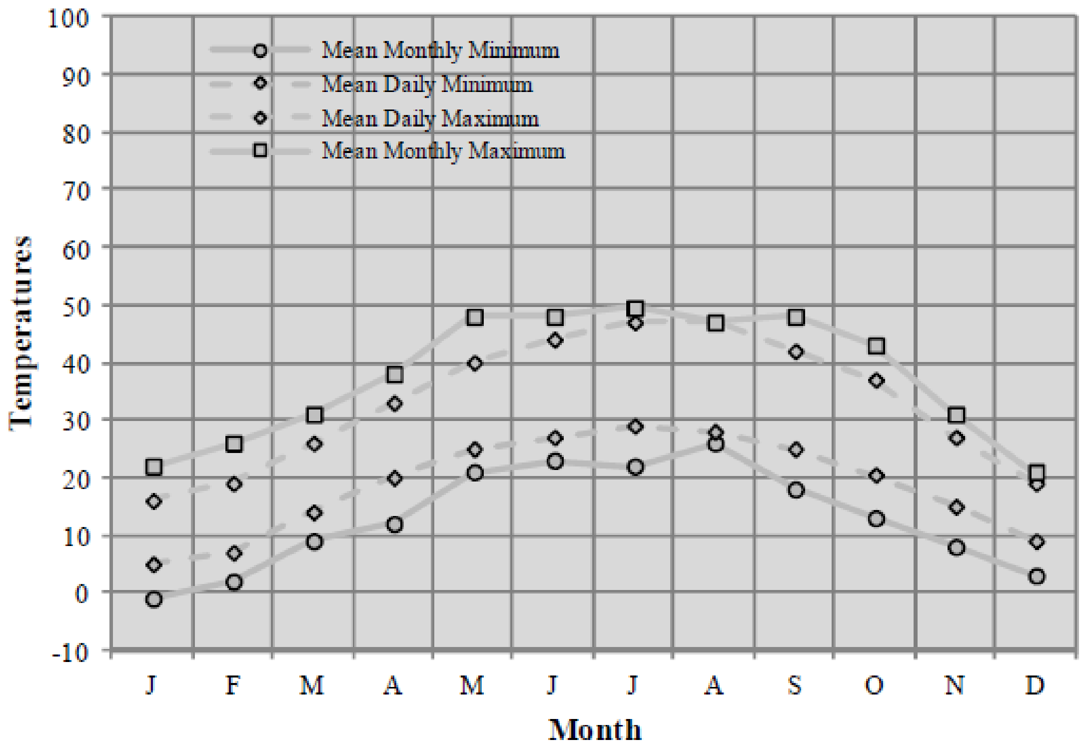


Figure 5-1: Mean Monthly and Daily Maximum and Minimum Temperature in Basra, Iraq. (Source: Admiralty Sailing Directions - Persian Gulf Pilot –NP 63 / United Kingdom Hydrographic Office)

5.2.2.2 Relative Humidity:

The most humid months were spring and summer months where the humidity could reach above 80%. The minimum humidity values are below 25% and average humidity during all month is about 50%. Basra city is a humid since it is located at the coast of the Arabian Gulf and affected by humid condition.

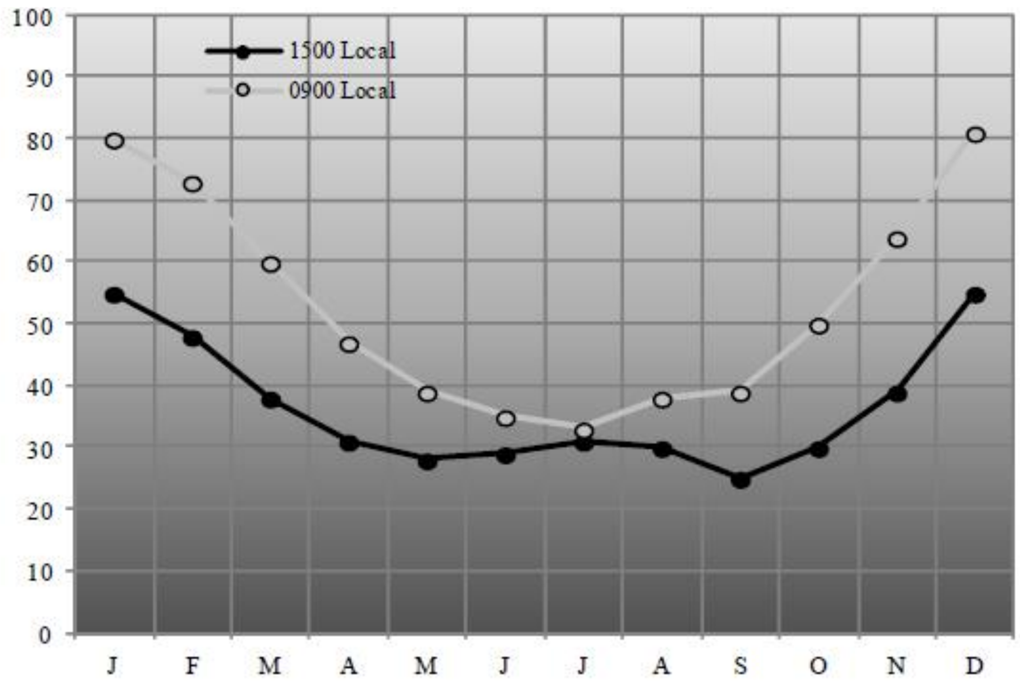


Figure 5-2: Mean monthly Relative Humidity in Basra, Iraq

Source: Admiralty Sailing Directions - Persian Gulf Pilot –NP 63 / United Kingdom Hydrographic Office

During our visit to the project site in Umm Qasr port (Oct 18 to 23, 2022), the lowest relative humidity (37%) was noted during noon time (1200 hour) local time while the maximum relative humidity (95%) recorded several times during early morning local time.

5.2.2.3 Winds

The wind data showed that the maximum monthly average winds are noted during June and July, where the average wind is about 5.5m/s, whilst the least windy months were October and December, where the monthly average wind speed was about 3.1 m/s.

During our visit to the project site in Umm Qasr port (Oct 18 to 23, 2022), the lowest wind speed (0.3m/s) was recorded several times during morning hours (between 07:00 and 09:00 hour local time) while the maximum wind speed (8m/s) was recorded during several time in afternoon hours (14:00 to 16:00 hour local time).

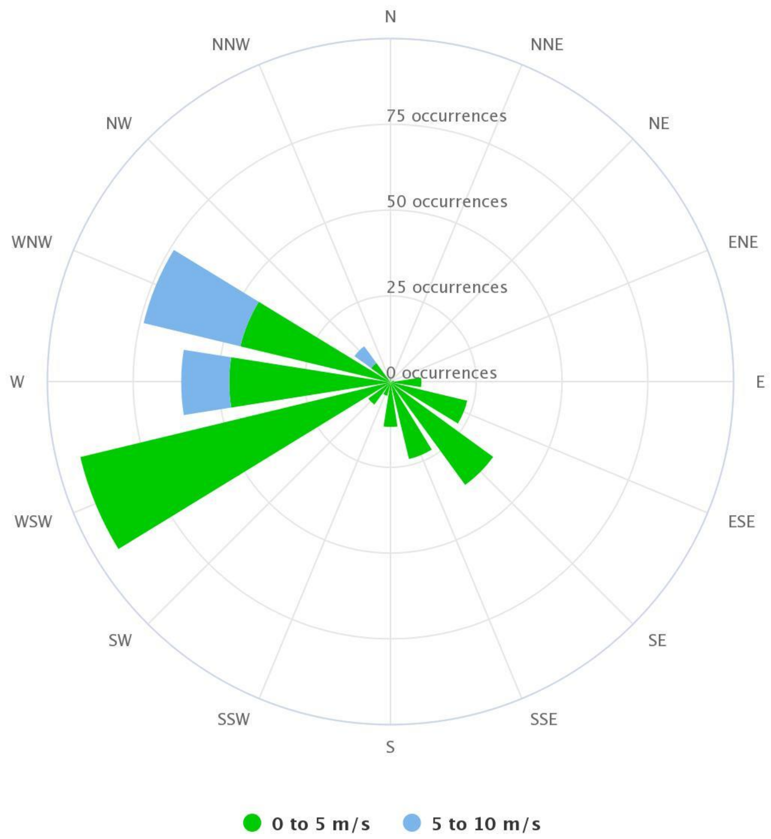


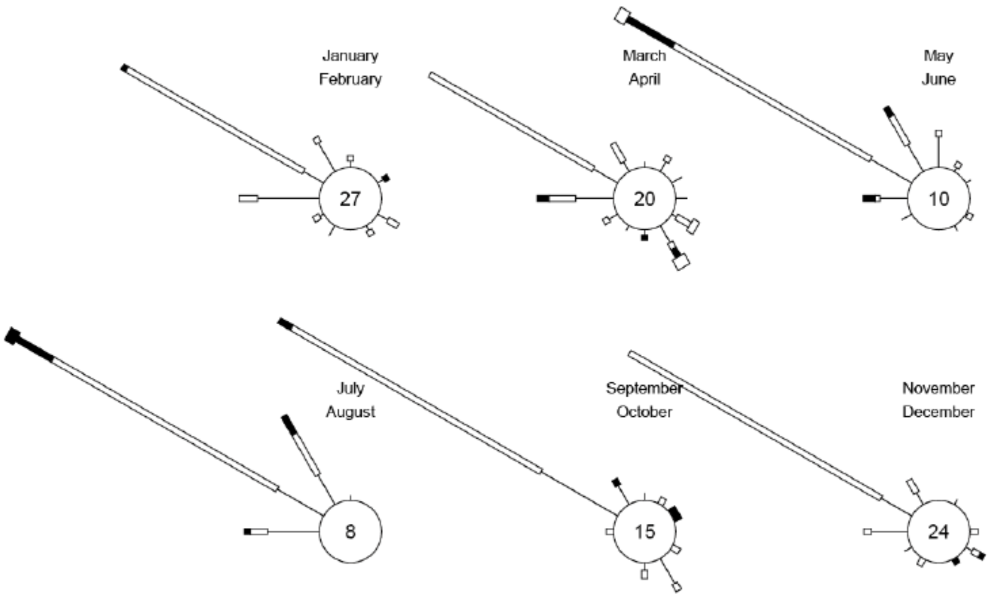
Figure 5-3: Wind rose at Umm Qasr, Basra, Iraq during Sept 28 to Oct 12, 2022.

The wind direction at Umm Qasr (shown in figure 5-3) during Sept 28 to Oct 12, 2022 indicates that the predominant wind direction is from west-north-west to west-south-west although there are some winds in the direction of South-east.

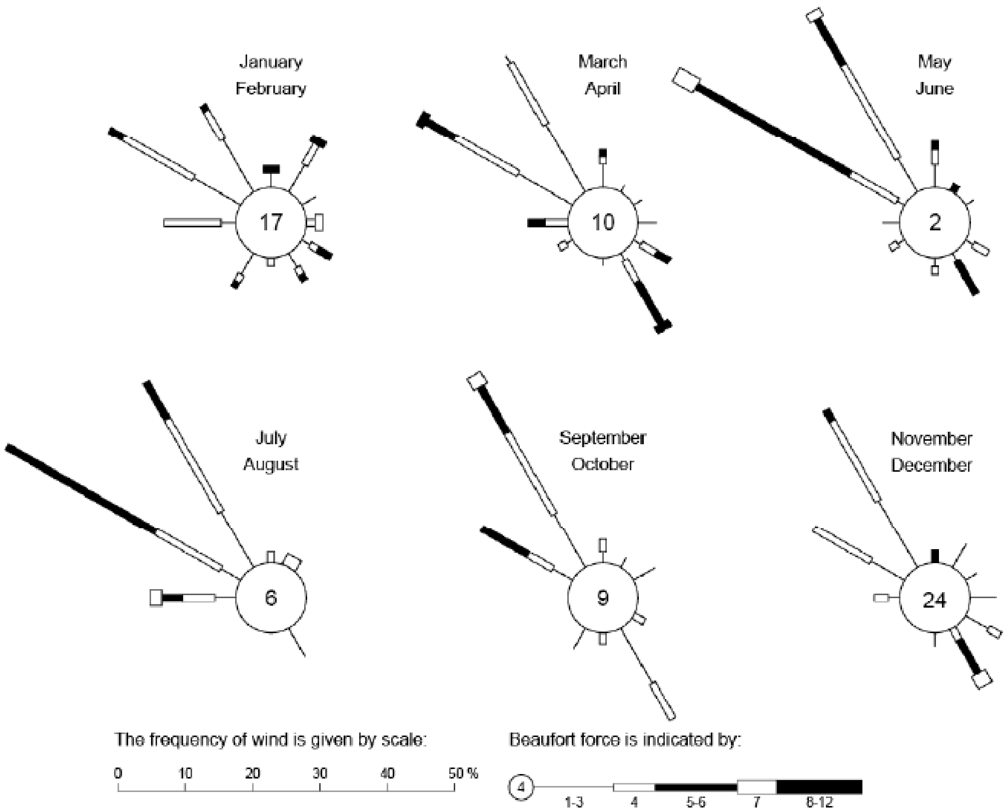
The wind rose results at Al Basra station are shown in Figure 5-4. Characteristics of wind condition in the Port Area are summarized below.

- Throughout the year, winds are predominantly from northwest.
- Winds of the Port Area are limited to from southeast and northwest directions.
- The dominant winds from northwest are known as “Shamal”. Winds from southeast are known as “Kaus”.
- Shamal occurs more frequently in winter than in summer season.
- On average, wind force at Al Basra station is about 4m/sec. It can be converted into 10 minutes average wind speed of 5.5 - 7.9 m/s. Wind becomes strong in the afternoon ranging on average between 8.8m/s and 13.9 m/s.
- The winds of more than 17.5m/s to 20.6 m/s) are also observed.

Wind distribution during 0900 Local Time



Wind distribution during 1500 Local Time



Note: Wind flow is towards the circle. The figure in the circle gives the precentage of calms.

Figure 5-4: Wind Rose in Basra, Iraq

Source: Admiralty Sailing Directions - Persian Gulf Pilot –NP 63 / United Kingdom Hydrographic Office

5.2.2.4 Precipitation

The amount of rainfall in Iraq is significantly different depending on the geographic location and topographic elevations, where it varies from (1,000 mm/year) in the far north-eastern part to less than (100 mm/year) in the southwestern parts ((Iraqi Organization for Meteorological Information (2015)). The estimated average annual rainfall and potential evaporation of the Basra area is about (99.5 mm/yr) and (4,000 mm/yr) respectively, for the period (1979 – 2014) as indicated in a study by Al-Zubaidi (2022).

The monthly average rainfall during the period of 1970 to 2019 is shown in figure 5-5. It is clear from this figure that the highest rainfall usually occurs in winter and spring months (November, December, January, February and March) and the lowest amount usually noted in summer months (June, July and August). The highest monthly average rainfall during the mentioned period (years of 1970 to 2019) was 42.5mm.

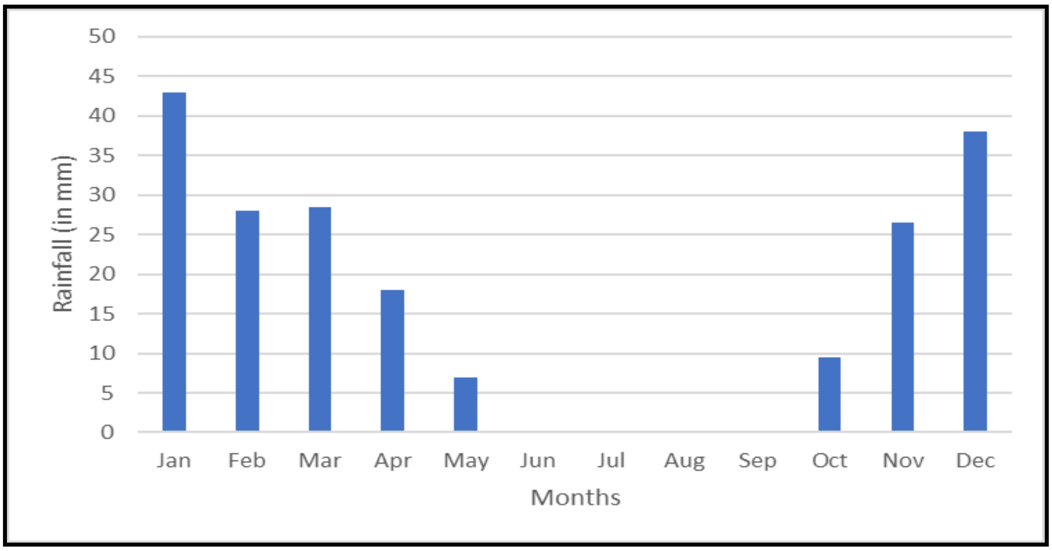


Figure 5-5: Monthly average for rainfall in Basra for the period 1970/1971 to 2018/2019 (Source A.A Al-Muhyi et al., 2022)

Comparison of total annual rainfall amount recorded during the period of 1970 to 2019 is shown in figure 5-6. The highest rainfall amount was 296mm recorded in 1986 while the lowest amount (31.9mm) noted in 2010 as shown in figure 5-6.

During our visit to the project site (Oct 19 to 23, 2022) there was no rainfall recorded.

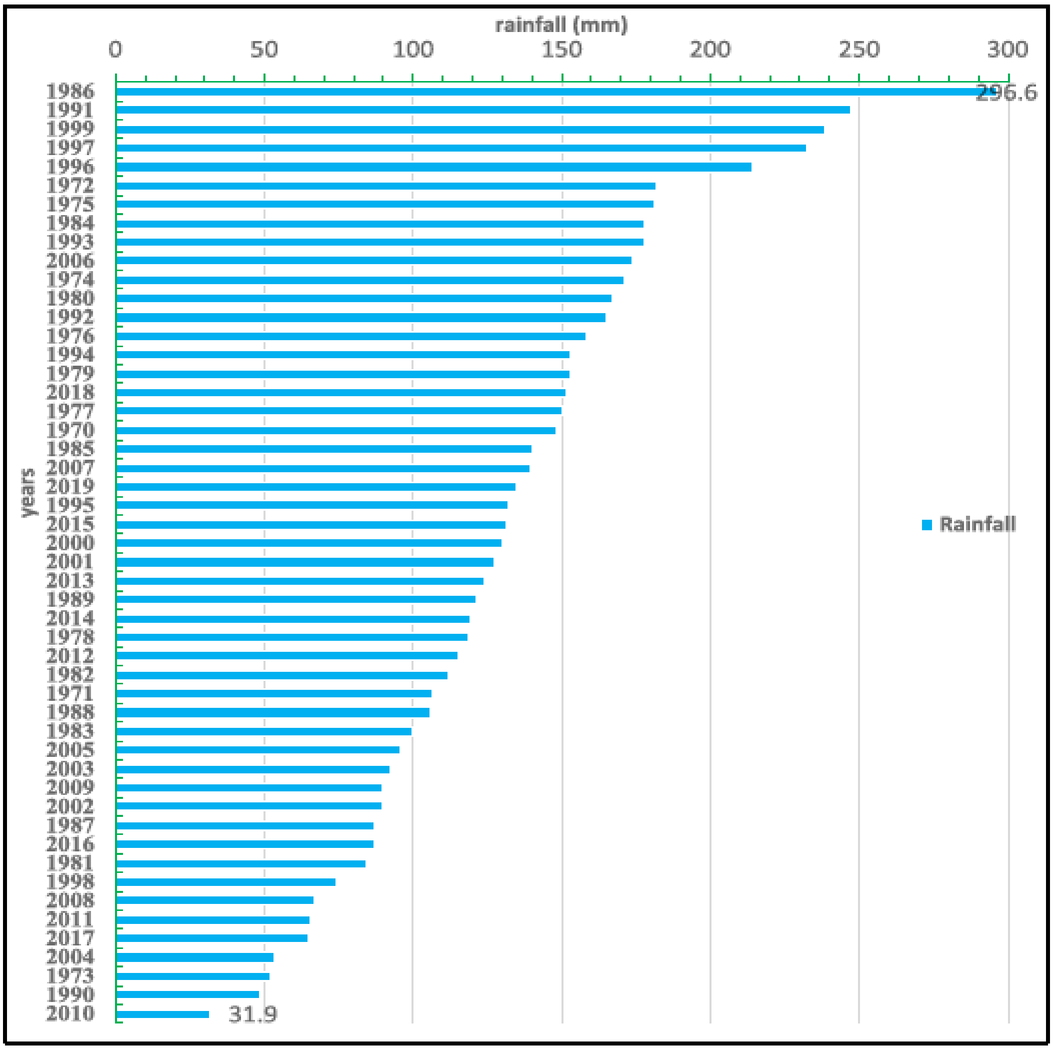


Figure 5-6: Annual rainfall as a descending order for the period of 1970 to 2019 (source: A.A Al-Muhyi et al., 2022)

5.2.3 Ambient Air Quality:

5.2.3.1 Introduction:

The soybean project will be located inside Umm Qasr port with the nearest residential receptors (community area and general Umm Qasr Hospital) being located approximately 2km to the northwest of the project site.

Main existing sources of air pollutants (in addition to the natural dust particulate emission from the desert and air pollution from traffic), within the industrial zone predominantly adjusted to the project site include the following:

- Basra Cement Plant (about 1.5km north of the project site)
- Umm Qasr Power plant (about 5.5km north of the project site)
- Fertilizer Plant (about 47.5km north-east of the project site)

There are other types of sources (Type II facilities) having less air pollution emission which are not listed above.

The closest sensitive receptors (National AlTour School and Gneral Umm Qasr Hospital) in the area are located within 3 km from the project site. Further, the project site is located close to an international buffer zone, less than 1 km adjacent to the border of Kuwait.

5.2.3.2 Ambient air quality background and monitoring data

The purpose of background data in a modelling context is to derive justifiable additions to the project contributions (PC) to allow a good indication of the overall predicted environmental concentration in a region for comparison to ambient air quality standards (AAQS). Modelling tools used can actually combine the contemporaneous hourly or daily air concentration derived from a process with the background concentration measured during that period. This gives the best indication of predicted environmental concentration (PEC) since the overall results undergo the averaging process within the modelling approach. However, this approach requires a continuous and extensive data set, which is not available here.

To have a general picture about the air quality background values within Basra province, the values from a study conducted by Shehabalden, A. et al. (2017) were taken at the following four locations within Basra city: Ashar, Tannuma, Abu-Khaseb and Zubair. The distances from each location to the project site are shown in below table. The measurements were taken during the period of January to December 2015. Air pollutants were monitored by a handheld gas analyzer (Instruments E- 4400) for NO_X, SO_2, CO_2 and CO, while a PDR -1200 (Personal Data Ram) device was used to measure total suspended particles (TSP). The results of this study for SO_2, NO_x , CO and CO_2 and TSP measurements are shown in table 5-1.

Table 5-1: Air quality data recorded at four locations located relatively close to the project site (Shehabalden, A. et al. 2017)

Station	season	Ashar 30°31'01.6"N 47°50'12.2"E	Tannuma 30°31'47.4"N 47°51'15.1"E	Abu-Khaseb 30°27'10.2"N 47°59'04.8"E	Zubair 30°23'26.0"N 47°41'49.4"E
Distance to the project site (km)		55km	58km	50km	48km
Description of each site		Heavy traffic, maximum commercial activities	Residential area with moderate traffic	Moderate scale industries functioning, Moderate traffic	Extension area with less traffic, thin population
TSP (mg/m^3)	Winter	222	215	180	249
	Spring	370	297	219	437
	Summer	262	219	208	305
	Autumn	228	186	132	232

	Annual average	271	229	185	306
SO2 (ppb)	Winter	162	121	16	126
	Spring	227	206	81	266
	Summer	336	338	155	334
	Autumn	169	165	28	138
	Annual average	223	207	70	216
CO (ppm)	Winter	9.57	8.3	4.4	8.1
	Spring	4.2	3.9	2.6	3.9
	Summer	4.9	3.9	2.3	3.9
	Autumn	8.1	4.2	3.8	5.3
	Annual average	6.7	5.1	3.3	5.3
CO2 (ppm)	Winter	300	294	207	270
	Spring	238	242	166	221
	Summer	258	254	203	250
	Autumn	270	234	203	239
	Annual average	266	256	195	245
NOx (ppb)	Winter	169	167	39	168
	Spring	105	102	52	101
	Summer	506	270	100	538
	Autumn	55	76	55	104
	Annual average	209	154	61	228

5.2.4 Assessment of Ambient Air Monitoring Data

The hourly air quality data (nitrogen dioxide, sulphur dioxide, carbon monoxide and particulate matter-PM_{10} (particles of less than 10 microns in diameter) and $PM_{2.5}$ (particles of less than 2.5 microns in diameter)) were collected at 6 locations as shown in Figure 5-7. Four locations are at the project site and two locations are in the residential area of Umm Qasr as clear from the figure. These hourly data were measured using a Graywolf handheld device while the daily and annual average were taken from the nearest air quality station in Al Zubair which is about 45km from the project site. These data are compared with the local and World Bank/international guidelines and are discussed in the context of the natural background concentrations for each pollutant as documented in the literature. All gaseous parameters are reported in μg/m^3 as well as in ppb for ease of comparison with standards except CO in ppm (i.e. μg/m^3) compared with standards and guidelines.

Figure 5-7: Locations of collected air quality data (St. x)at the project site and residential area during Oct, 2022.

Table 0-2: Ambient Air Baseline Summary for Umm Qasr area(1)								
Ambient Concentration in ppb (concentration in bracket in mg/m³)								
Criteria	**St#1**	**St#2**	**St#3**	**St#4**	**St#5**	**St#6**	**Iraqi Std**	**WB and Int. Std**
Nitrogen Dioxide								
Maximum 1 hour Average (µg/m³)	120 (225)	110 (207)	110 (207)	100 (188)	110 (207)	120 (225)	**100 (188)**	**WB: (200) USEPA: 100 (188) WHO 106 (200)**
Annual Average (µg/m³)	37.5 (70.5)						**40 (75)**	**WB: (40) USEPA: 50 (100) WHO: 21 (40)**
Magnitude	**High**	**High**	**High**	**Medium**	**High**	**High**		
Ozone								
Maximum 1 hour Average (µg/m³)	57.1 (112)	58.6 (115)	54.0 (106)	55.6 (109)	51.0 (100)	51.5 (101)	--	--
Maximum 8 hour Average (µg/m³)	40.0 (78)	36.5 (71)	35.4 (69)	36.8 (72)	34.7 (68)	34.4 (67)	**60.0 (118)**	**WB: (100) USEPA: 120 (235)**
Annual Average	30						--	--

Table 0-2: Ambient Air Baseline Summary for Umm Qasr area[1]								
	Ambient Concentration in ppb (concentration in bracket in mg/m^3)							
Criteria	**St#1**	**St#2**	**St#3**	**St#4**	**St#5**	**St#6**	**Iraqi Std**	**WB and Int. Std**
(µg/m^3)	(59)							
Magnitude	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**		
PM-10[2]								
Maximum 24 hour Average (µg/m^3)	78	101	110	80	79	109	**150**	**WB: 50 USEPA: 150 WHO: 50**
Annual Average (µg/m^3)	85						**--**	**WB: 20 WHO: 20**
Magnitude	**High**	**V. High**	**V. High**	**High**	**High**	**V. High**		
PM-2.5								
Maximum 24 hour Average (µg/m^3)	48	46	50	44	37	42	**65**	**WB: 25 USEPA: 35 WHO 25**
Annual Average (µg/m^3)	34[6]						**15**	**WB: 10 USEPA: 12 WHO: 10**
Magnitude	**High**	**High**	**High**	**High**	**High**	**High**		
Hydrogen Sulphide								
2nd Highest Value 1 hour Average (µg/m^3)	80 (115)	140 (201)	110 (158)	100 (144)	<LDL 1 (1.4)	<LDL 1 (1.4)	**140[1] (200)**	**USEPA: 140[1] (200)**
Maximum 24 hour Average (µg/m^3)	30.6 (44)						**--**	**WHO: 105 (150)**
Annual Average (µg/m^3)	10.2 (14.7)						**--**	**--**
Magnitude	**Medium**	**High**	**Medium**	**Medium**	**V. Low**	**V. Low**		
Sulphur Dioxide								
Maximum 1 hour Average (µg/m^3)	<LDL of 10 (26.2)	<LDL of 10 (26.2	50 (131)	<LDL of 10 (26.2)	<LDL of 10 (26.2)	<LDL of 10 (26.2)	**100 (262)**	**WB: 500 USEPA: 75 (200) WHO: 75 (200)**
Maximum 24 hour Average (µg/m^3)	8 (21)						**40 (104)**	**WB: 8 (20) WHO: 8 (20)**
Annual Average (µg/m^3)	5.2 (13.6)						**18 (47)**	**--**
Magnitude	**V. Low**	**V. Low**	**Low**	**V. Low**	**V. Low**	**V. Low**		
Carbon Monoxide								
Maximum 1 hour Average (µg/m^3)	2 (2,284)	7 (7,994)	2 (2,284)	3 (3,426)	2 (2,284)	5 (5,710)	**35[1] (40,000)**	**USEPA: 35[3] (40,000) WHO: 25 (28,500)**
Maximum 8 hour Average (µg/m^3)	1.025 (1,173)						**10[1] (11,400)**	**USEPA: 9[3] (10,000) WHO: 9 (10,000)**
Annual Average (µg/m^3)	0.27 (310)						**--**	**--**
Magnitude	**V. Low**	**V. Low**	**V. Low**	**V. Low**	**V. Low**	**V. Low**		
Hexane[7]								
Maximum 1 hour Average (µg/m^3)	**1.9 (6.7)**						**--**	Ontario: 5,970 (21,000)[8]

Table 0-2: Ambient Air Baseline Summary for Umm Qasr area[1]								
Ambient Concentration in ppb (concentration in bracket in mg/m^3)								
Criteria	**St#1**	**St#2**	**St#3**	**St#4**	**St#5**	**St#6**	**Iraqi Std**	**WB and Int. Std**
Maximum 24 hour Average ($\mu g/m^3$)	**0.15 (0.53)**						--	Ontario: 711 (2,500)[8]

Note:

(1)All hourly data were measured by handheld device but the daily and annual data were collected from air quality station in Zubair/Basra about 45km Northwest of project site
(2)Not to be exceeded more than twice per month
(3) Not to be exceeded more than once per year
(4) PM_{10} = suspended particulate matter below 10 microns in size
(5) Sites# 1, 2, 3 and 4 at the project site whereas sites 5 and 6 at Umm Qasr residential area
(6) Since there is no long-term $PM_{2.5}$ data, the $PM_{2.5}$ level was calculated based on assumption that $PM_{2.5}$ is about 40% of PM10 level.

(7) Measurements of hexane were taken from a previous study was conducted by us for a site in UAE which has a similar environment to Umm Qasr area. The measurements were conducted by our team in UAE during Dec 2019 to Jan 2020 using Chromatotec AirmoVOC C2-C6 and C6-C12.

(8) Ontario Ambient Air Quality Criteria

Abbreviations:
LDL = Lowest Detection Level
NA = Not Applicable
ppb = Part Per Billion
NM = Not monitored
-- =Criteria not established
$\mu g/m^3$ = microgram per cubic metre
NMHC = Non-methane hydrocarbons
WB =World Bank Guideline
WHO =World Health Organization
USEPA = United States Environmental Protection Agency

5.2.4.1 Nitrogen Oxides (NOx)

Nitrogen dioxide (NO_2) is a reddish-brown gas at high concentration. Upon dilution it becomes yellow or invisible, has a pungent odor at high concentration, and has an odor similar to bleach at lower levels (Fang, M.L et al., 2019).

Nitrogen oxides consist of a group of gases produced as the result of high-temperature combustion processes, such as those occur in automobiles and power plants. Direct emissions are mainly in the form of nitric oxide (NO) with smaller amounts of nitrogen dioxide (NO_2) and nitrous oxide (N_2O). Nitric oxide and nitrogen dioxide are called as "NOx". The main two sources of NOx are traffic and industries. It is anticipated that at Umm Qasr and surrounding area the main contributor for NO_x is point sources (cement plant and power plant), with the exception of roadside locations. The combustion sources as well as traffic mainly emit nitric oxide (NO) which spontaneously oxidizes to nitrogen dioxide (NO_2) in ambient air. NO_2 is a toxic gas and often correlated with other air toxic pollutants (such as nano particle) because both pollutants are emitted from same source.

In the general urban environment, the principal sources of nitrogen dioxide are traffic and to a lesser extent industry, shipping and households. Nitrogen dioxide is generally found in the atmosphere in close association with other primary pollutants, including ultra fine particles. It is also a precursor of ozone and therefore co-exists in photochemically generated oxidant pollution. Nitrogen dioxide is itself toxic, and its concentrations are often strongly correlated with those of other toxic pollutants. (WHO, 2005)

Urban levels have been found to vary with time of day, season and meteorological factors. Typically, urban areas (such as Umm Qasr area) are affected by traffic-related peaks, which correspond to the rush-hour emissions of nitric oxide which are oxidised in the atmosphere to nitrogen dioxide (WHO, 2000). Maximum 30 minute and maximum 24-hour concentrations of nitrogen dioxide have been reported elsewhere at concentrations of up to 940 μg/m^3 and 400 μg/m^3, respectively. Annual average nitrogen dioxide concentrations in Asian cities typically lie in the range 23–74 μg/m^3. Typical concentrations measured in New Delhi in February 2005 were 31–83 μg/m^3. The annual average concentrations recorded at Zubair/Basra close to Umm Qasr (70 mg/m^3) are therefore within the range recorded in the urban environment. They currently meet the Iraqi air quality requirements.

The hourly NOx concentration recorded at the project site (4 sites) and residential area (2 sites), ranging between 100-120 mg/m^3, exceed the 1-hour maximum concentration standards (except site 4) established by the Iraq (100 mg/m^3), USEPA (188 mg/m^3) and World Health Organization (200 mg/m^3).

When evaluating the magnitude of each result compared with the standard/guideline, the results place hourly ambient air quality for all sites (except site 4) in high band while the annual average results for all site in the medium band.

In Umm Qasr, the data recorded during the monitoring period (Oct 19-23, 2022) showed that the NO_x short-term concentrations ranged between 100 and 120 mg/m^{3}as hourly maximum, which exceeded the WHO 1hr standard, and they exceed the Iraqi and WB limit. Nevertheless, it is possible that such high values were affected by local traffic in the area (Foster Wheeler Energy Limited, 2005).

5.2.4.2 Ozone (O3)

Ozone is a colorless, odorless gas at ambient concentration, and is a major component of smog. Ozone is considered as a secondary pollutant because it is formed in the atmosphere through some complex reactions between oxygen, hydrocarbons and nitrogen oxides in the presence of sunlight and high ambient temperature. Ozone is effectively generated at a regional scale from emissions from both industrial and urban areas, and a proportion of the observed ozone at any one location may result from advection within the recirculating air masses.

The maximum 8-hour concentrations at all sites do not exceed the 8-hour average standard of Iraq (118µg/m^3), USEPA (140µg/m^3) and the WB/WHO 8-hour average Guideline (100µg/m^3).

Elevated concentrations of ozone have been measured elsewhere even in rural areas where local sources of ozone precursors are insignificant. Long-range transport of ozone and/or its precursors from upwind sources or tropospheric infolds have been cited as being responsible. Some of the Mediterranean cities recorded 1-hour average ozone concentrations above 300 µg/m^3. Measurement in India reported significant diurnal cycles in the average ozone concentration, with an average maximum of 117 µg/m^3 in the peak at noon and typical minimum of 23 µg/m^3 at sunrise. High concentrations of surface ozone have been observed as a result of regionally produced secondary pollutants in the Cairo region. Also, background tropospheric ozone at Ras Mohamed, at the southern tip of the Sinai Peninsula, shows high concentrations (especially in the summer) frequently exceeding 150 µg/m^3. In the urban area of Cairo, 120 µg/m^3 (8-hour average) was exceeded for more than 10% of the time during the year, and at Ras Mohammed for more than 15% of the time (WHO, 2005).

At the project site, the data recorded during the period (Oct 19 to 23, 2022), showed that the highest hourly value (115µg/m^3) and the highest 8-hour maximum (78µg/m3) of ozone recorded at site #2 and site#1 respectively.

When evaluating the magnitude of each result compared with the standard/guideline, the results place hourly and 8-hour ambient air quality for all sites in the medium band.

5.2.4.3 Suspended Particulate Matter (PM10)

Particulate matter is the tiny particulate of solid or semi-solid material found in the atmosphere. The main source of dust in the atmosphere is fugitive dust from the earth's surface during high surface winds and dust storms. Airborne particulate matter is a complex mixture of organic and inorganic constituents. The smaller particles represent the greatest risk since they are able to enter the lower respiratory tract (Khalil et al. 2016; Kim et al. 2015). PM_{10} (particulate matter < 10 µm in size) is regarded by the USEPA as an indicator of health-related particles. The natural background level as an annual arithmetic mean, in rural areas in Europe is generally between 50 and 150 µg/m^3 (measured gravimetrically). The annual arithmetic mean values are within the observed range for European population centres. In Asia the annual average concentrations are between 35 and 220 µg/m^3 (WHO, 2005). However, in relation to national and international standards, measurements at all sites are within the national daily average standard of 150 mg/m^3 but they exceed the WB guideline of daily limit (50 mg/m^3) and annual average guideline (20 mg/m^3).

When evaluating the magnitude of each result compared with the standard/guideline, the results place daily and annual average measurements of PM_{10} for all sites in the high to very high band.

In Umm Qasr area, the data indicated that PM_{10} particulate concentrations were above the long- and short-term guidelines of WB, although the exceedance was mainly attributed to natural sandstorm dust in this desert environment.

5.2.4.4 Suspended Particulate Matter (PM2.5)

$PM_{2.5}$ is an important indicator of risk to health from particulate pollution and might also be a better indicator than PM_{10} for anthropogenic suspended particles in many areas. Natural PM sources can contribute significantly to $PM_{2.5}$ although less than they contribute to PM_{10}. Fine particles are responsible for most visibility problems in Asia. Measurements in the centre of Beijing show $PM_{2.5}$ concentrations averaging just over 100µg/m^3. The monthly average concentrations varied between 61µg/m^3 and 139 µg/m^3. During air pollution episodes, daily mean $PM_{2.5}$ values can reach 300µg/m^3 (WHO, 2005).

At the project site and surrounding area, the maximum daily and annual average of $PM_{2.5}$ concentration (85 mg/m^3 and 34u mg/m^{3}respectively) are exceeding the WB 24-hour and annual average guidelines (25 mg/m^3 and 10 mg/m^3 respectively) although the daily average was below the national standard of 65 mg/m^3.

When evaluating the magnitude of each result compared with the WB standard/guideline, the results place daily and annual average measurements of $PM_{2.5}$ for all sites in the high band.

5.2.4.5 Hydrogen Sulphide (H2S)

Hydrogen Sulfide (H_2S) is a colorless gas, soluble in various liquids including water and alcohol. It has a rotten egg odor and can be smelled at very low concentration. Hydrogen sulphide causes odor nuisance at concentrations far below those associated with it being a hazard to human health. Odor threshold varies considerably in the literature but half-hour arithmetic mean concentrations exceeding 7µg/m^3 have been implicated in producing substantial complaints from the exposed public while the lowest-adverse-effect level is reported as 15,000µg/m^3, when eye irritation has been observed (WHO, 2000).

At Umm Qasr and surrounding area, the hourly measurements at all sites (except site 2) are within the national and USEPA standard of 200 mg/m^3. However, hourly measurements at site 2 exceed the standard. It is anticipated that nearby sources, such as refinery and petrochemical plants at Kuwait side, may contribute to high concentration of hydrogen sulphide concentrations. For example, during our measurements at the project site the wind was south-easterly blowing from Kuwaiti industries toward the Soybean Oil site.

Furthermore, the monitoring data showed that the 24-hr average value WHO standard (150 mg/m^3) was not exceeded at all sites.

5.2.4.6 Sulphur Dioxide (SO2)

Sulphur dioxide is a colorless, non-flammable gas that smells like burnt matches. Odor thresholds for SO_2 range between 0.4ppm and 8.0ppm, but most people can detect its taste at a level of about 0.3 to 1.0 ppm. This pollutant is emitted into the atmosphere either directly (e.g. fuel combustion, petroleum refining and smelting operations), or through oxidation of hydrogen sulphide obtained from the decomposition of organic matter.

The sulphur dioxide can be considered as indicative of an industrial area. Data on concentrations of sulphur dioxide elsewhere are based either on national monitoring networks, which tend to be concentrated in urban areas, or on cooperative programmes for the study of long-range transport of pollutants. In some of the megacities in developing countries the highest sulphur dioxide concentrations are being recorded during the period 2000-2005, although some large urban areas have fairly low concentrations. In February 2005, New Delhi reported weekly average concentrations of 5–10 µg/m^3, while Djakarta reported between 4 µg/m^3 and 24 µg/m^3 While typical annual average concentrations of sulphur dioxide in urban areas in developing countries are 40–80 µg/m^3, those in North America and Europe are 10–30 µg/m^3, and in cities in the EU 6–35 µg/m^3. (WHO, 2005).

In Umm Qasr and surrounding area, the SO_2 data, showed that the annual average concentration was 13.6 mg/m^3 while daily maximum concentration was 21µg/m^3. The hourly average concentration was ranging between 26µg/m^3 (10ppb), which is the low detection limit of the instrument, and 131 mg/m^3 recorded at site#3.

In relation to Iraqi and WB criteria, sulphur dioxide concentrations at all sites were below the national maximum hourly standard (262 mg/m^3 and WB guideline of 500 mg/m^3 and below the daily average standard of both national standard of 104 mg/m^3 and WB guideline of 20 mg/m^3 . Further, the annual average of SO2 was 13. mg/m^3 was below the national standard of 47 mg/m^3 .

When evaluating the magnitude of each result compared with the Iraqi standard and WB guideline, the results showed that ambient air quality of SO_2 at all sites are in the very low-to-low band.

5.2.4.7 Carbon Monoxide (CO)

Carbon monoxide is an odorless, tasteless, colorless and poisonous gas that is created from incomplete combustion of carbon-containing fuels and waste (Surender and Pankila Khanna, 2018). The major source of carbon monoxide in the environment is the incomplete combustion of carbonaceous fuels (such as Road transport), oxidation of methane and formaldehyde derived from biological activity and also from certain industrial processes.

In relation to national and international criteria, none of the measurements approached or exceeded the 1-hour and 8-hour average criteria.

Natural background levels of carbon monoxide range between 60 and 140 mg/m^3. Concentrations in urban areas typically depend mainly on source emission (traffic density). They also vary greatly over time and with distance from source. The 8-hour mean concentrations are generally <20,000 mg/m^3. However, maximum 8-hour mean values of up to 60,000 mg/m^3 have been occasionally observed (WHO, 2000).

In Umm Qasr and surrounding area, the CO data, showed that the highest hourly average concentration (7994 mg/m^3) recorded at site #2 and the highest 8-hour average (1173 mg/m^3), were lower than the Iraq corresponding standards (40,000 and 11,000 mg/m^3, respectively).

5.2.4.8 Hexane

Hexane is part of volatile organic compounds (VOC_s), which are the main group of hydrocarbons in the atmosphere, and play an important role in the formation of ozone and other photochemical oxidants in the troposphere (Fatin Abdul Aziz et al. 2019). Hexane is a colourless, clear, highly volatile and flammable liquid under standard conditions. Commercial and laboratory grades of hexane are widely used as solvent and extractant in numerous industrial and commercial applications. The estimated half-life for this atmospheric reaction is 2.9 days.

The principle industrial sectors that release n-hexane to air are food manufacturing (vegetable oil-based). Symptoms of acute human inhalation exposure to n-hexane include: dizziness, light-headedness, drowsiness, nausea, headache, eye and throat irritation. In general, n-hexane appears to be of relatively low acute toxicity to human unless high concentration occurs.

In this project, the main sources of hexane emission into the atmosphere are the extraction plant and the hexane storage tank. The total emission rate of hexane from this project (1mg/Nm3) will be low compared to the WB guideline of 100mg/Nm3.

Since there are no hexane measurements available at the site and surrounding area, data of this parameter were taken from another study which was conducted by EST consultancy during Dec 2019 to Jan 2020 at a site that has a similar urban environmental in UAE. The 1-hour measurement (6.7 mg/m^3) and daily average of 0.53 mg/m^3 are much lower than the Ontario guideline of 21,000 mg/m^3 and 2,500 mg/m^3 respectively.

In conclusion, we can summarize the above results as follows:

- SO_2 concentrations for all averaging periods (1-hour maximum, 24-hour average and annual average) are much lower than the Iraqi standards as well as below the WB guidelines.
- The 1-hour maximum of NO_2 concentration at all sites (except site# 4) are above the WB guideline of 200 mg/m^3 . Further, the annual average concentrations exceeded the WB guideline of 40 mg/m^3 .
- CO measurements are far below the 1-hour and 8-hour standards for Iraqi standards as well as below the WB guidelines.
- The PM_{10} and $PM_{2.5}$ measurements exceeded the daily and annual WB guidelines due to mainly natural sources impacts (sand storm).

5.3 Impact Assessment

The potential significance of these impacts upon air quality and meteorology at the site is assessed with reference to the assessment criteria presented in section 4 with the sensitivity of the impact resources/receptor also considered.

Based on available data, the contribution from the project was compared with the existing air quality conditions and with the ambient air quality standards to determine the overall impact of the project on air quality. The IFC require that the emissions from this project should not result in pollutant concentrations that reach or exceed relevant ambient air quality guidelines and standards by applying national legislated standards or in their absence, the current WHO Air Quality Guideline or other internationally recognized sources (e.g., WB/IFC). This analysis relies on WB-IFC and Iraqi standards for determining project impacts. Also, project analysis has been conducted in accordance with the IFC's Performance Standards and Equator Principles related to GHG emissions requirements. Project consistency with Equator Principle 2 and IFC Performance Standard 3 are included in this analysis.

Ground level concentrations of various air pollutants have been predicted over a 20km domain based on anticipated emissions from the soybean oil project by means of air dispersion modelling applying the AERMOD Model. AERMOD is an accepted air quality model used the world over. The predicted results estimate the maximum ground level concentrations, averaged over time periods specified by the user. Receptor grids plus discrete receptors at the nearest residential areas and the locations of some sensitive receptors were modelled to determine the ground level air concentrations resulting from the project. Details of the dispersion modelling methodology adopted, and results obtained are included hereunder. Further details on dispersion modelling results obtained are presented in Appendix B.

The methodology for assessment of magnitude and significance of impacts is presented in this subsection. The assessment of impacts is summarised and tabulated, the magnitude and significance of each impact are also summarised below at the end of each subsection (***in bold italic***).

The general approach adopted in this modelling part is to predict ground level concentrations using internationally approved air dispersion model. Where possible, actual historic meteorological data applicable to the area has been used as input for the modelling. Where this is not possible, or appropriate, combinations of worst-case meteorological conditions for dispersion have generally been used for modelling as recommended by the U.S. EPA. While these combinations of meteorological conditions may not occur for significant periods of time, they are representative of potential worst-case conditions for dispersion and hence highest ground level concentrations over short time periods.

5.3.1 Results and discussions

5.3.1.1 Modelling Results for Construction Phase

Generally speaking, heavy construction could be a source of dust emissions that may have substantial temporary impact on local air quality. The construction of the Soybean Oil project will involve the movement of relatively large amounts of raw materials (i.e., sediments) and soil material and these activities may inevitably generate some dust, particularly in a dry, windy environment such as that of Iraq. In this subsection the modelling results for the construction phase will be discussed and added to the baseline condition for particulate and gases. Measurements collected at the project site and data from Zubair/Basra air quality monitoring station, indicate that NOx and PM_{10} concentrations exceeded the Iraqi standards and WB guidelines at some sites. The high concentrations of NO_2 was due to mainly emissions from traffic road. Moreover, the particulate concentrations are generally influenced very much by natural windblown dust.

During the construction phase of Soybean Oil project, there will be fugitive dust emissions from earth-moving, excavation, filling and grading of site area. Also, relatively small amounts of gas emissions from power generators (with less than 1 MW operation capacity for each) are expected during this phase. The maximum predicted ground level concentrations of particles (PM_{10} and $PM_{2.5}$) during construction activities are included in table 5-3.

Table 5-3: Predicted ground level concentration of particles (PM_{10} and $PM_{2.5}$) during normal and abnormal construction operations

		Normal Operation (µg/m³)	Abnormal Operation (µg/m³)	Baseline (µg/m³)	Iraqi standard	WB/WHO Guidelines
PM_{10}	**1-Hour(1)**	104	274	NA	**NA**	**NA**
	24-Hours	17	33	110	**150**	**50**
	Annual	4.2	6	85	**NA**	**20**
$PM_{2.5}$	**1-Hour(1)**	16.9	32	NA	**NA**	**NA**
	24-Hours	2.97	4.1	50	**65**	**25**
	Annual	0.7	0.9	34	**15**	**10**

Note: [1] The highest measurement recorded at the project site

The modelling results (shown in table 5-3 and figures 5-9 to 5-20 in Appendix B) indicate that ground level concentration for both particle sizes (PM_{10} and $PM_{2.5}$) due to emissions from construction of Soybean project alone will not exceed either the Iraqi ambient standards nor the WB guidelines for short-term and long-term average during normal and abnormal operations.

Also, most of these high values fall either inside the Project site boundary or close to it as clear from graph 5-9 to 5-20 during both scenarios. Furthermore, during thee construction phase it is expected that the dust emission may not cause visibility problems even when control measures are not used. It is clear from the above table that the predicted concentrations of PM_{10} will raise the baseline which is already above the corresponding ambient standard. When the modelled 24-hour value of PM_{10} was added to the baseline concentration during both scenarios, the results exceeded the WB 24-hour average guideline by more than 216% for both scenarios (normal and abnormal). Also, the annual average concentration of PM_{10} will exceed the WB standard by more than 446% after adding the background which is already high. Further, for the case of $PM_{2.5}$ when the modelled 24-hour value was added to the baseline concentration during both scenarios, the results are above the WB guideline of 24-hour average and annual average.

Moreover, it is obvious that there is no impact during construction on the community areas which are about 2km away and the impact on the neighbouring industries is negligible during the normal scenario and low during the abnormal scenario.

Although the predicted concentrations of PM_{10} and $PM_{2.5}$ from the Project construction alone are below the WB ambient air quality guidelines for daily and annual average, the accumulative impact will exceed the WB ambient guideline. Accordingly, **dust control measures may be needed during construction as a mitigation measure as it is recommended in the General EHS Guidelines (World Bank, 2007a).** These measures would include the use of covers, water suppression for control of loose material or unpaved road surfaces, or increased moisture content for open material storage piles. Additionally, Soybean Oil project construction site impacts are not expected to be unusual in comparison to other construction sites in Umm Qasr Port area. Construction sites that use good dust suppression techniques and well-maintained vehicles typically do not cause violations of air quality criteria off-site.

Specific potential impacts on the air quality environment due to construction are summarised in below table:

Table 5-4: Construction Phase Impacts Assessment

Factor	AQ1
Receptor Important/Sensitivity	Low
Frequency	Continuous
Likelihood	Likely
Extent	Local
Duration	Short
Magnitude	Low
Effect	Negative
Action	Direct
Significant	Low

Air Impact from Dust Emissions (AQ1)– Low Magnitude, Low Significance close to the Project site and construction would add little to existing dust levels inside Umm Qasr Port and negligible outside the Port.

5.3.1.2 Modelling Results for Operation Phase:

Maximum predicted offsite ground level concentration due to Soybean Oil Project emissions are presented in table 5-10 and in figures 5-21 through 5-33 for the normal operation scenario (see Appendix B). The normal operation scenario (two boilers as well as extraction vent are in operation) was run for the following pollutants: SO_2, NOx, CO, PM_{10} and Hexane.

The modelling results for each pollutant are discussed hereunder:

Nitrogen Dioxide

The modelling results for normal operation scenario indicate that ground level NO_x concentration due to the Project alone will be much below the ambient Iraqi standard as well as below the WB guideline for 1-hour maximum and annual average.

The contribution of normal operations emissions of the Project to ambient air quality levels is considered as low to moderate inside Umm Qasr Port and low to very low outside the port, although the modelling results of maximum 1-hour concentration (129 mg/m^3) is about 64 to 68% of the Iraqi ambient standard (188 mg/m^3) and WB guideline (200 mg/m^3) but the annual averages (5.7 mg/m^3) are much lower than the Iraqi and WB limits. Further, it can be inferred from the modelling results that the contribution of the predicted 1-hour value (129 mg/m^3) to the existing ambient baseline concentration (225 mg/m^3) during this scenario is possibly medium. Further, the contribution of predicted annual average concentration (5.7 mg/m^3) to the ambient baseline level (70.5 mg/m^3) is expected to be very low.

For mitigation measures, Soybean Oil Project management shall perform annual stack emission testing of the source emission in order to ensure the NOx source emission as per national and WB source standard of 460mg/Nm^3 . The adoption of additional NOx controls may not be required.

Specific potential impacts on the air quality environment due to emission of NOx are summarised in below table:

Table 5-5: Operation Phase- Impacts Assessment for NOx

Factor	AQ2
Receptor Important/Sensitivity	Low
Frequency	Continuous
Likelihood	Likely
Extent	Local
Duration	Medium
Magnitude	Low to Medium
Effect	Negative
Action	Direct

Significant	Low

Air Impact from NO_x Emissions (AQ2)– Low to Medium Magnitude; Low Significance.

Sulphur Dioxide

The predicted 1-hour maximum ground level concentrations (508 mg/m^3) outside Project boundary during normal scenario for SO_2 exceed the prescribed standard and are higher than the Iraqi standard of 262 mg/m^3 and slightly above the WB guideline of 500 mg/m^3 . The modelling results indicate that the impacts primarily close to the facility borders because the stack height for boilers is relatively low (30m). The highest one-hour concentration values of SO_2 are located very close to the facility boarder (<100m). The SO_2 predicted values (outside facility boundary) were 508 mg/m^3 for 1-hour maximum, 38.2 mg/m^3 for 24-hour average and 7.4 mg/m^3 for annual average. The predicated 24-hour average value is exceeding the WB guideline of 20 mg/m^3 while the annual average concentration is much lower than the Iraqi standard of 47 mg/m^3 . The results indicate that contribution of the Project to the ambient SO_2 concentrations for all averaging periods (1-hour, 24-hour and annual) ranges between medium and high.

For 24-hour average values, the WHO guidelines (WHO, 2005) suggest an interim Target 1 level of 125 µg/m^3 and an interim Target 2 level of 50 µg/m^3, in addition to a guideline of 20 µg/m^3. WHO interim Target 2 can be considered as an intermediate goal which would be reasonable and feasible to meet within a few years for some developing countries (including Iraq) and lead to significant health improvements (WHO, 2005). Accordingly, if the predicted 24-hour average of SO2 (38.2 mg/m^3) is compared with the WHO/WB interim Target 2 of 50 mg/m^3 , then the concentration will be within the acceptable range.

For mitigation measure, the Soybean Oil Project shall perform annual stack emission testing of the source emission in order to ensure the SO_2 emission as per source standard of 2000mg/Nm^3 . The adoption of any additional SO_2 controls may not be required.

Specific potential impacts on the air quality environment due to emission of SO_2 are summarised in below table:

Table 5-6: Operation Phase- Impacts Assessment for SO_2

Factor	AQ3
Receptor Important/Sensitivity	Low
Frequency	Continuous
Likelihood	Likely
Extent	Local
Duration	Medium
Magnitude	Medium
Effect	Negative
Action	Direct

Significant	Low

Air Impact from SO_2 Emissions (AQ3)– Medium Magnitude, low Significance.

Particulate Matter (PM_{10})

In this scenario, the modelling results (shown in table 5-10 and figures 5-26 to 5-28) indicate that ground level concentration of PM_{10} due to the Project emissions alone will not exceed the Iraqi ambient standards or WB guideline for short-term (150ug/m^3 for Iraqi standard and 50ug/m^3 for WB guideline) and long-term average (Iraqi standard of 50ug/m^3 and WB guideline of 20ug/m^3) during normal operations. The isopleth contours show that most of particle concentrations fall very close to the Project site boundary as clear from graphs 5-26 to 5-28 (see Appendix B).

Furthermore, the modelling results show that the predicted concentrations of PM_{10} due to Soybean Oil Project emissions will contribute slightly to the existing baselines of both daily average (110 mg/m^3) and annual average (85 mg/m^3) which are already above the WB ambient guidelines by more than 220% and 425% respectively. Based on these results, it can be concluded that the contribution of the Project to the exiting baseline for daily average and annual average is low. Accordingly, adoption of any additional PM controls may not be needed**.**

PM_{10} emissions during normal operation activities may not have negative impact on the Project site and surrounding area. Specific potential impacts on the air quality environment due to emission of PM_{10} are summarised in below table:

Table 5-7: Operation Phase- Impacts Assessment for PM_{10}

Factor	AQ4
Receptor Important/Sensitivity	Low
Frequency	Continuous
Likelihood	Unlikely
Extent	Local
Duration	Medium
Magnitude	Very Low
Effect	Negative
Action	Direct
Significant	Low

Air Impact from PM Emissions (AQ4)–Very Low Magnitude, Low Significance.

Carbon Monoxide (CO)

The predicted ground level concentration of CO due to the Project emissions alone are shown in table 5-10 and figures 5-26 to 5-28 (see Appendix B). The predicted values are much lower than the Iraqi ambient standards and WB guideline for 1-hour maximum (40,000 mg/m^3 for Iraqi standard and 28,500 mg/m^3 for WB guideline) and 8-hour average (Iraqi standard of 11,400 mg/m^3 and WB guideline of 10,000 mg/m^3) during normal operations. The isopleths contours show that most of CO concentrations fall close to the Project site boundary as clear from graphs 5-26 to 5-28.

Furthermore, the predicted concentrations of CO due to Soybean Oil Project emissions will contribute slightly to the existing baselines of 1-Hour average (7,994 mg/m^3), 8-Hour average (1,173 mg/m^3) and annual average (310 mg/m^3) which are less than 0.25% of the corresponding standards. Based on these results, it can be concluded that the contribution of the Project to the existing baseline for 1-hour and 8-hour average and annual average is very low. Accordingly, adoption of any additional CO controls may not be needed.

CO emissions during normal operation activities may not have any negative impact on the Project site and surrounding area. Specific potential impacts on the air quality environment due to CO emission are summarised in below table:

Table 5-8: Operation Phase- Impacts Assessment for CO

Factor	AQ5
Receptor Important/Sensitivity	Low
Frequency	Continuous
Likelihood	Unlikely
Extent	Local
Duration	Medium
Magnitude	Very Low
Effect	Negative
Action	Direct
Significant	Very Low

Air Impact from CO Emissions (AQ5)–Very Low Magnitude, Very Low Significance.

Hexane:

Hexane emissions are assessed because of two reasons: firstly, its contribution to ozone formation and health effects and secondly this pollutant may cause odor problem. The main sources of hexane emissions within the Project are the fugitive emission from storage tanks and from the extraction unit. The modelling results for hexane were predicted for 1-hour maximum, 3-hour maximum, 8-hour maximum, 24-hour average and annual average. Neither Iraq authority nor WB has adapted ambient standard for hexane and accordingly guideline from Ontario in Canada was adapted as shown in table 5-10. It is clear from this table that the predicted 1-hour and 24-hour ground level concentrations of hexane (0.05 mg/m^3 and 0.004 mg/m^3) are much lower than the Ontario standards of 21,000 and 2,500 mg/m^3 respectively.

The isopleths contours of hexane indicate that the impacts occur primarily close to the facility borders. Further, these concentrations are reduced relatively quickly when moving away from the site boundary.

Further, it can be inferred from the modelling results that the contribution of predicted concentrations to the existing ambient baseline concentrations during this scenario is very low.

Hexane emissions during normal operation activities may not have any negative impact on the Project site and surrounding area. Specific potential impacts on the air quality environment due to hexane emissions are summarised in below table:

Table 5-9: Operation Phase- Impacts Assessment for Hexane

Factor	AQ6
Receptor Important/Sensitivity	Low
Frequency	Continuous
Likelihood	Unlikely
Extent	Local
Duration	Medium
Magnitude	Very Low
Effect	Negative
Action	Direct
Significant	Low

Air Impact from hexane Emissions during normal operation (AQ6) – Very Low Magnitude, Low Significance.

Table 0-10 Maximum predicted concentration for normal scenarios compared with the ambient standards

Poll.	Average Time	Baseline[1]	Prediction (outside Project boundary)	Model (outside Project) as % Standard	Estimated magnitude contribution of model to baseline as %[3]	Ambient Air Quality Standards	
						IRQ	WB
NO_x (µg/m^3)	Highest 1-hour	225	129	68%	Medium	188	200[3]
	Annual	70.5	5.7	14.3%	Very Low	100	40
SO_2 (µg/m^3)	Highest 1-hour	131	508	194%	High	262	500
	24-hour	21	38.2	191%	High	104	20
	Annual	13.6	7.4	15.7%	Medium	47	--
CO	Highest 1-hour	7,994	51	0.13%	Very Low	40,000	28,500

(μg/m³)	8-hour	1,173	14	0.11%	Very Low	11,400	10,000
	Annual	310	2.0	--	Very Low	--	--
PM10 (μg/m³)	1-hour	>1000	47.4	--	Low	--	--
	24-hour	110	4.6	9.2%	Very Low	150	50
	Annual	85	0.7	3.5%	Very Low	50	20
Hexane (μg/m³)	1-hour	6.7[5]	0.050	0.000006%	Very Low	--	21,000[4]
	3-hour	NM	0.022	--	--	--	--
	8-hour	NM	0.010	--	--	--	--
	24-hour	0.53[5]	0.004	0.000002%	Very Low	--	2,500[4]
	Annual	NM	0.001	--	--	--	--

[1] The highest reading recorded in all 6 sites as shown in table 5-2
[3] 1-Hour Maximum
[3] Estimated magnitude: High: Greater than 75%; medium: 50-75%; low:25-50; very low: less than 25% of baseline
[4] Ontario Ambient Air Quality Criteria, 21,000ug/m3 equivalent to 5,970ppb and 2,500ug/m3 equivalent to 711ppb
[5] These measurements were taken from a site in UAE which has a similar urban environment to Umm Qasr area. The measurements were conducted by our team in UAE during Dec 2019 to Jan 2020 using Chromatotec AirmoVOC C2-C6 and C6-C12.

Abbreviations:
IRQ =Iraq
WB = World Bank
NM = Not Monitored
-- = Not determined
μg/m³ = Microgram per cubic metre

Abnormal Operation (Worst Case Scenario)

Worst case scenario has been modelled to identify the impact of this project on ambient air. During this scenario, it is assumed three boilers and five generators are in operation simultaneously. The modelling results for SO_2, NO_x, CO and PM_{10} during this scenario are discussed hereunder.

Nitrogen Oxides

Table 5-15 displays that the predicted ground level concentrations of NO_x during abnormal scenario will exceed the Iraqi and WHO standards for 1-hour maximum standard of 188µg/m³ and 200µg/m³ respectively. However, the annual average of NOx is below the corresponding standards for Iraq and WB. The isopleths contours of NO_x resulting from the Project emissions are shown in figures 5-40 and 5-41 in Appendix B. The modelling results indicate that the impacts are primarily close to the facility borders.

It is clear from the modelling results that the contribution of predicted 1-hour value (214 mg/m³) to the ambient baseline concentration (225 mg/m³) during this scenario is high and this value is higher than the Iraqi 1-hour maximum standard (188 mg/m³). However, the annual average concentration (3 mg/m³) will not exceed the Iraqi standard of 100 mg/m³ and will not exceed the WB guideline of 40 mg/m³ . The contribution to the ambient baseline level (70.5 mg/m³) is expected to be low.

NOx emissions during abnormal operation activities could negatively impact air quality on the Project site and surrounding area although the duration of such operation could be short. Specific potential impacts on the air quality environment due to emission of NOx are summarised in below table.

Table 5-11: Abnormal Operation Phase- Impacts Assessment for NOx

Factor	AQ7
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	Likely
Extent	Local
Duration	Short
Magnitude	Low to Medium
Effect	Negative
Action	Direct
Significant	Low

Air Impact from NO_x Emissions during abnormal operation (AQ7)– High Magnitude, Low Significance.

Sulphur Dioxide

The predicted 1-hour maximum ground level concentrations (760 mg/m^3) outside Project boundary during abnormal scenario for SO_2 exceed the prescribed standard and it is much higher than both the Iraqi standard of 262 mg/m^3 and the WB guideline of 500 mg/m^3 . The predicated 24-hour average value (108 mg/m^3) exceeds the WB guideline of 20 mg/m^3 while the annual average concentration (34 mg/m^3) is lower than the Iraqi standard of 47 mg/m^3 . The results indicate that contribution of the Project to the ambient SO_2 concentrations for all averaging periods (1-hour, 24-hour and annual) during abnormal scenario is considered as high.

For mitigation measure and in case this scenario takes place for any reason, the Soybean Oil Project shall operate all three boilers and five generators only during short periods of time and under certain circumstances. However, if the soybean is planning to operate all three boilers continuously and simultaneously, then the project management shall either install control devices (such dry flue gas desulfurization) or apply switching to a low sulfur fuel (such as light diesel). Further, the project management shall perform annual stack emission testing of the source emission in order to ensure the SO_2 emission as per WB source standard of 2000 mg/Nm^3 . The adoption of any additional SO_2 controls may not be required.

SO_2 emissions during abnormal operation activities could negatively impact air quality on the Project site and surrounding area although the duration of such operation could be short. Specific potential impacts on the air quality environment due to emission of SO2 are summarised in below table.

Table 5-12: Abnormal Operation Phase- Impacts Assessment for SO2

Factor	AQ8
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	Likely
Extent	Local
Duration	Short
Magnitude	Medium to High
Effect	Negative
Action	Direct
Significant	Medium

Air Impact from SO_2 Emissions (AQ8)– Medium to High Magnitude, Medium Significance.

Particulate Matter (PM_{10})

Under abnormal scenario, the modelling results (shown in table 5-15 and figures 5-45 to 5-47 in Appendix B) indicate that ground level concentration of PM_{10} due to the Project emissions alone will not exceed the Iraqi ambient standards or WB guideline for daily average (150 mg/m^3 for Iraqi standard and 50 mg/m^3 for WB guideline) and annual average (Iraqi standard of 50 mg/m^3 and WB guideline of 20 mg/m^3) during abnormal operations. The isopleths contours show that most of particle concentrations fall either inside the project site boundary or close to the Project site as clear from graphs 5-45 to 5-47 in Appendix B.

Furthermore, the modelling results predicted concentrations of PM_{10} due to Soybean Oil Project emissions will contribute slightly to the existing baselines of both daily average (110 mg/m^3) and annual average (85 mg/m^3) which are already above the WB ambient guidelines by more than 220% and 425% respectively. Based on these results, it can be concluded that the contribution of the Project to the existing baseline for daily average and annual average is very low. Accordingly, adoption of any additional PM controls may not be needed.

PM_{10} emissions during abnormal operation activities may not have negative impact on the Project site and surrounding area. Specific potential impacts on the air quality environment due to emission of PM_{10} are summarised in below table:

Table 5-13: Abnormal Operation Phase- Impacts Assessment for PM_{10}

Factor	AQ9
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	Unlikely
Extent	Local
Duration	Short
Magnitude	Very Low
Effect	Negative
Action	Direct
Significant	Very Low

Air Impact from PM Emissions (AQ9)–Very Low Magnitude, Very Low Significance.

Carbon Monoxide (CO)

The predicted ground level concentration of CO due to the Project emissions alone are shown in table 5-15 and figures 5-42 to 5-44 in Appendix B. The predicted values are much lower than the Iraqi ambient standards and WB guideline for 1-hour maximum (40,000 mg/m^3 and 28,500 mg/m^3 respectively) and 8-hour average (11,400 mg/m^3 and 10,000 mg/m^3 respectively) during abnormal operations.

Furthermore, it is clear from the modelling results that the predicted concentrations of CO due to Soybean Oil Project emissions will contribute slightly to the existing baselines of 1-Hour average (7,994 mg/m^3), 8-Hour average (1,173 mg/m^3) and annual average (310 mg/m^3 which are less than 1% of the corresponding standards. Based on these results, it can be concluded that the contribution of the Project to the existing baseline for 1-hour and 8-hour average and annual average is very low. Accordingly, adoption of any additional CO controls may not be needed.

CO emissions during abnormal operation activities may not have negative impact on the Project site and surrounding area. Specific potential impacts on the air quality environment due to emission of CO are summarised in below table:

Table 5-14: Abnormal Operation Phase- Impacts Assessment for CO

Factor	AQ10
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	Unlikely
Extent	Local
Duration	Short
Magnitude	Very Low
Effect	Negative
Action	Direct
Significant	Very Low

Air Impact from CO Emissions (AQ10)–Very Low Magnitude, Very Low Sig

Table 0-15: Maximum predicted concentration for abnormal scenarios (worst-case scenario) compared with the ambient standards

Poll.	Average Time	Baseline[1]	Prediction (outside Project boundary)	Model (outside Project) as % Standard	Estimated magnitude contribution of model to baseline as %[3]	Ambient Air Quality Standards	
						IRQ	WB
NO_x (µg/m³)	Highest 1-hour	225	214	114%	High	188	200[3]
	Annual	70.5	3.0	7.5%	Very Low	100	40
SO_2 (µg/m³)	Highest 1-hour	131	760	290%	High	262	500
	24-hour	21	108	540%	High	104	20
	Annual	13.6	34	72%	High	47	--
CO (µg/m³)	Highest 1-hour	7,994	57.8	0.2%	Very Low	40,000	28,500
	8-hour	1,173	16.4	0.16%	Very Low	11,400	10,000
	Annual	310	2.3	--	Very Low	--	--
PM10	1-hour	>1000	74.6	--	Very Low	--	--
	24-hour	110	10.8	21.6%	Very Low	150	50
	Annual	85	3.1	15.5%	Very Low	50	20

[1] The highest reading recorded in all 6 sites as shown in table 5-2
[2] 1-Hour Maximum
[3] Estimated magnitude: High: Greater than 75%; medium: 50-75%; low:25-50; very low: less than 25% of baseline

Abbreviations:
IRQ =Iraq
WB = World Bank
NM = Not Monitored
-- = Not determined
$\mu g/m^3$ = Microgram per cubic metre

5.4 Other Air Quality Issues

5.4.1 Odour Assessment

Health Effects of Odor on Human Health

Health effects of air pollution range from acute symptoms such as coughing and respiratory infections to development of chronic diseases and even mortality. However, the severity of effects depends on both pollutant type and actual exposure severity.

The main concern of odor is its ability to cause an effect that could be considered 'objectionable' or 'offensive', resulting in annoyance, nuisance or actual harm. An objectionable or offensive effect can occur either where an odorous compound is present in low concentrations (lower than the national/international standards) or when it occurs in high concentrations exceeding the standards. A wide range of symptoms were observed for people exposed to offensive odor including vomiting, respiratory problems, nausea, drowsiness, fatigue, eye, nose and throat irritation, headache, chest tightness, nasal congestion, shortness of breath and other symptoms. Some symptoms (such as headache and nausea) can have a significant adverse impact on human daily activities and the long-term effect of such symptoms may not be known.

Furthermore, elderly persons, people with respiratory illnesses (such as asthma or other) and even children, because of their small body weight and developing respiratory system, are classified as a susceptible sub-population. Prolonged exposure to an odor can result in people becoming desensitized so that they can no longer detect the odor although the odorous chemical may exist in the air. On the other hand, individuals may become sensitized to olfactory stimulants as a result of repeated exposure to nuisance levels of odors. In addition, odorous gases are not only responsible for unpleasant odors but also affect the comfort, health, and production efficiency of animals as well as the comfort and health of human workers (Tamminga, 1992). For example, hydrogen sulfide has been considered as the most dangerous gas from livestock production systems and it is responsible for deaths of animals and farm workers in animal facilities. Chronic exposure to H_2S can lead to respiratory diseases, eye diseases, and neurological diseases.

Nature of Odors:

To completely describe an odor, four different dimensions are often considered:

- Odor character is basically what the odor smells like. For example, benzene has a sweet smell.
- Odor intensity is the relative observed psychological strength of an odor above its threshold. It is determined by an odor panel and is described in categories which progress from "not perceptible", then "very weak", through to "extremely strong".
- Odor threshold is the lowest odorant concentration necessary for detection by a certain percentage of the population, normally 50%. The odor thresholds for a number of pure compounds have been successfully quantified using dynamic olfactometry in conjunction with gas chromatography – mass spectrometry (GC-MS). However, the characteristics of complex odors cannot be derived reliably from the individual characteristics and concentrations of each odorous compound present in a gas mixture.
- Hedonic tone is the degree to which an odor is perceived as pleasant or unpleasant.

Odor Impact Assessment:

Humans have a sensitive sense of smell and can detect odor even when chemicals are present in very low concentrations. The subject of odor is a highly complex one and the response of an individual to odor exposure is highly subjective: their reaction will depend on several aspects mainly: concentration (odor or chemical concentration level), duration of exposure to the odor, frequency of odor occurrence, intensity of perceived odor (a mixture of offensiveness, odor character and hedonic tone) and tolerance degree and expectation of the receptor (Jiang and Sands, 1998). The following characteristics can further complicate the assessment of odors:

- An odor can arise from a single substance or from a combination of substances.
- In combination with other substances, the characteristic odor of a single substance can be modified so as to be unrecognizable.
- Odor changes as the mixture becomes diluted. Individual components may fall below their odor threshold.
- Odors from a substance or mixture of substances can be pleasant when dilute but offensive when concentrated.
- Odors that are pleasant or acceptable to one person can be offensive and unacceptable to other individuals which can have different sensitivities to odor.

Although odor is not anticipated to be an issue at Soybean Oil project during normal and abnormal operations, potential odor impact associated with this facility operation has been assessed considering only SO_2 and hexane emissions from some sources (such as boiler, generators and extraction plant) during normal and abnormal scenarios. Sama

AlManar (operator of Soybean Oil project) has confirmed that there will be no sulphur compounds emission from wastewater open pond and accordingly the emission from this source was not considered in this study. The modelling results of SO_2 and hexane which discussed earlier, will be compared with the odor thresholds limit as shown in table 5-16.

Table 5-16: Odor threshold limits for SO_2 and Hexane compared with the modelling results

		1-HOUR MAXIMUM	OTL*	TWA**
SO2	Normal Scenario	508 µg/m³ (Estimated 10 minutes Concentration = 724 **µg/m³**)***	910 to 7040 µg/m³ (0.35 to 2.7ppm) Varies with individuals	5240 µg/m³ (2ppm)
	Abnormal Scenario	760 µg/m³ (Estimated 10 minutes Concentration = 1,087 **µg/m³**)***		
Hexane	Normal Scenario	0.05 µg/m³	106,000 to 873,000 µg/m³ (30 TO 248ppm)	176,000µg/m³ (50ppm)

** OTL is Odor Threshold Limit;*
***TWA is Time Weighted Average*
****10-minuts time average of SO_2 was calculated based on 1-hour time average and using the following power law equation: $C_{10\text{-}min}=C_{1\text{-}hr}\ (60min/10min)^{0.2}$*

As clear from table 5-16 that by comparing the modelling results for 1-hour maximum of SO_2, and hexane with the corresponding odor thresholds limits and occupational exposure standards, it is evident that predicted short-term concentration of both pollutants are below the odor threshold limit during normal and abnormal operations. However, during abnormal scenarios (operation of three boiler and five generators) there could be slight odor persisting a very short time (10 minutes).

Based on these results, SO_2 and hexane emissions from the Soybean Oil Project with the given inputs will not cause any odor problem outside Project boundary during normal scenario, but the project may generate odor outside the facility fence during abnormal operation scenario for a very short time (10 minutes).

SO_2 emissions during abnormal operation activities could negatively impact air quality on the Project site and surrounding area although the duration of such operation could be short. Specific potential impacts on the air quality environment due to emission of SO2 are summarised in below table.

Table 5-17: Normal and Abnormal Operation Phase- Impacts Assessment for Odor

Factor	AQ11 (Normal)	AQ12 (Abnormal)
Receptor Important/Sensitivity	Medium	Medium
Frequency	Continuous	Rare
Likelihood	Unlikely	Likely

Extent	Local	Local
Duration	Medium	Short
Magnitude	Very Low	Medium
Effect	Negative	Negative
Action	Direct	Direct
Significant	Low	Low

Air Impact from Odor (AQ11 & AQ12)–Very Low Magnitude, Very Low Significance.

5.4.2 Greenhouse Gases

Gases that trap heat in the atmosphere are often called greenhouse gases. There are six greenhouse gases emitted due to mainly combustion of fossil fuels. These gases include: CFC, CO_2, CH_4, N_2O, O_3, SF_6. These gases are usually expressed in terms of CO_2 equivalent (CO_2 Eq). The CO_2 emission factors are based on the heat content of the fuel used.

CO_2 emission associated with the Project could also result in negative impacts upon global greenhouse gases emissions. Specific potential impact on the air quality environment due to the greenhouse gas emission are summarised in table 5-18 and discussed in the following text.

Table 5-18: Greenhouse Gas Emissions Impacts Assessment

Factor	AQ13
Receptor Important/Sensitivity	Low
Frequency	Continuous
Likelihood	Likely
Extent	Intentional
Duration	Long
Magnitude	Low
Effect	Negative
Action	Direct
Significant	Low

GHG Impact Assessment:

As discussed in section 2- Policy, legal and administration framework, the proposed project is subject to the Equator Principles and the IFC Performance Standards. As such. Principle 2 and IFC Performance Standard 3 include requirements for resource efficiency and pollution prevention. This includes the requirement to minimize the Project impacts upon greenhouse gas emissions.

The International Energy Agency (IEA) has estimated the total CO_2 equivalents' emission in Iraq was 290.5 Million Metric tonnes in 2019 (IEA, 2020). This total CO_2 emission value is summation of emissions from two sectors: Fugitive emissions (151.1 million ton CO_2 Equivalent) and fuel combustion (139.4 million ton CO_2 Equivalent). The proposed project is anticipated to generate CO2 emissions through soybean oil processing and operation. Construction phase vehicles would also be a source of CO_2 emissions, however, these emissions would be temporary and are not included in the discussion below. Table 5-19 shows the total Project CO_2 emissions associated with Project operations primarily from two sources: Generators and Boilers.

Table 5-19: Greenhouse emission at Soybean oil facility		
Source name	**Normal Operation**	**Abnormal Operation**
	MT/Year	**MT/Year**
Emission from Generators	72	181
Emission from Boilers	40,000	60,000
Total Emission	40,072	60,181

The total estimated emission of GHGs from soybean oil project during normal operation is about 40,072MT/year during normal operation (assuming that boilers will operate 300 days per year and generators will operate 12 days per year) and is about 60,181MT/year during abnormal operation assuming boilers will operate 300 days per year and generators will operate 24 days/year. According to the Equator Principles, Principle 2, if the Project is expected to emit more than 100,000 Metric tonnes of CO_2 equivalent annually, an alternative analysis to evaluate less greenhouse gases (GHG) intensive alternatives is required. Therefore, emissions associated with the processed facility are not expected to significantly incrementally impact global greenhouse gas emissions.

Although the GHGs emission from this project is less than 100,000 Metric tonnes of CO_2 equivalent annually, it is recommended that all reasonable attempts to be made by soybean oil project to maximise energy efficiency and design facilities to minimise energy use. In addition to energy efficiency and associated emissions reductions, carbon capture and storage should be considered (World Bank, 2007a, 2007b).

GHGs Emission Impact (AQ13)- Low Magnitude and Low Significance

5.5 Mitigation

Introduction:

In accordance with the methodology established in section 4, mitigation measures are to be implemented to minimize potential negative impacts of the activities on the air quality, including construction dust and operational emissions. The impact assessment has identified no negative impacts of high significant during normal operation; however, recommendations can be made to apply good management practice and mitigate those negative impacts identified of low significant.

Construction Recommendations:

The site contractor of this project shall develop, implement and maintain a construction phase Environmental Emergency Response Plan (EERP) and a construction Environmental Management Plan (CEMP) as based on the Environmental Management and Monitoring Plan (as shown in Section 21 of this ESIA). These plans should detail responsibilities and procedures for environmental and emergency response management during construction, including the following:

- Cover of all dust generating materials being moved by trucks, etc., with a suitably weighted tarpaulin;

- Minimize the amount of materials stockpiled as far as is practicable, with any required stockpiles aligned parallel to the prevailing wind direction;

- Cover of exposed soils in heavily trafficked areas such as roads or car parks and dust generating stockpiles where feasible with gravel or crushed stone to reduce wind blown dust generation;

- A reduced site speed limit to prevent the generation of large dust clouds from vehicles;

- Subject to water availability and the time of the year, surface spraying of road surfaces with water and a soil binding agent;

- Periodic grading of any uneven surface that arise on construction traffic routes;

- Implementation of a monitoring programme to verify construction vehicle comply with regulations and standards.

Commissioning and Operations Recommendations:

The site operator of this project shall develop, implement and maintain an operational phase Environmental Emergency Response Plan (EERP) and Environmental Management and Monitoring Plan (EMMP) to further protect against impact of local air quality. These plans should detail responsibilities and procedures for environmental and emergency response management during operation, including the following:

- Conducting performance test to ensure the air pollutants emissions ($SO2$, NO_x and hexane) are in compliance with the WB acceptable limits

- Appropriate maintenance of any important mitigation equipment

- Competence and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental releases of hazardous substances).

- Monitoring and maintenance of any dust and gases control devices to ensure effectiveness; and

- Regular audits of the above management plans to confirm their ongoing effectiveness.

- Prior to commencement of operations, ambient air quality data should be again gathered and such data sets built on during the course of the operations.

Further, EHS Guidelines for Vegetable Oil Production and Processing (2015) recommends the following to prevent and control any odors and dust may be generated:

- Ensure proper maintenance of cleaning, screening, and crushing equipment—including in any ventilation and air handling systems—to reduce emissions of fugitive dust, and avoid the use of compressed air or steam for cleaning.

- Install cyclones and/or fabric filters or electrostatic precipitators on selected vents—including meal dryers, coolers, and grinders—to remove odor emissions.

- Reduce odor emissions (e.g., from soap splitting, cookers in the extraction process, vacuum systems, and pressurized systems) with a caustic, alkaline, or ozone scrubber system, or incinerate the gas in a boiler plant or in separate incinerator systems.

6 TERRESTRIAL ENVIRONMENT

6.1 Introduction

This section presents the findings of the terrestrial environment baseline review and the likely impacts on the terrestrial environment arising from various phases of the soybean project. The assessment addresses regional and local geological and hydrogeological conditions, characterises the soil and groundwater quality as well as groundwater resources issues, and assesses potential impacts on receptors. Baseline conditions and related impact assessment for surface water are provided in section 9 – water quality management. Surface water information is only presented in this chapter where it is related to the groundwater environment or local soils. Similarity, any impacts on the terrestrial environment related to dust are covered in section 5- Air Quality and Meteorology.

6.1.1 Baseline Conditions

The baseline conditions of the site were established based on investigation including borehole drilling and monitoring well installation; test-pits and cross-hole investigation; geotechnical analyses aimed at the evaluation of the properties of the foundation soils; well elevation and positioning survey; and groundwater level measurements.

- Groundwater level measurement;
- Sampling of three groundwater monitoring wells;
- Laboratory analysis; and
- Aquifer analysis using three of the monitoring wells to establish Site specific hydrogeological parameters.

The findings of the investigation are used here to develop an environmental baseline with which to compare results of future operations and to evaluate any existing and potential environmental impacts resulting from the project establishment.

6.1.2 Geology

6.1.2.1 Regional Geology

Iraq lies at the NE corner of the Arabian Peninsula. It is a land of contrasting geography with an arid desert in the west and rugged mountains of the Taurus and Zagros in the NE (Kurdistan region), separated by the central fertile depression of Mesopotamia: long known as the cradle of civilization. In geological terms Iraq lies at the transition between the Arabian Shelf in the west and the intensely deformed Taurus and Zagros Suture Zone in the N and NE. The evolution of the Arabian Shelf has been influenced by the mobility of the Precambrian basement and by tectonism along the Neo-Tethyan margin. The tectonic framework of Iraq has been affected by intracratonic transpressional and tran-extensional movements controlled by the interactions of stress along the plate margin with the Precambrian basement fabric and structural grain.

The geography of Iraq is diverse and falls into four main regions:

- The desert (west of the Euphrates);
- Upper Mesopotamia (between the upper Tigris and Euphrates rivers);
- Northern highlands of Iraqi Kurdistan;
- Lower Mesopotamia, the alluvial plain extending from around Tikrit to the Arabian Gulf.

The Mesopotamian foredeep basin covers an intermediate structural position between the Alpine geosyncline area of Zagros in N-NE Part of Iraq and the Pre-Cambrian African-Arabian Platform to the west. This zone is characterized by great subsidence since Mesozoic time until late Cenozoic with slight folding of sedimentary cover up to 9 km (Laske et al., 1997; Seber et al., 1997). The third zone is the northern part of African-Arabian Pre-Cambrian platform and is characterized by an unfolded stable zone, an almost horizontal dipping strata and smooth relief (Ditmar et al., 1971), consisting of:

- Quaternary deposits of the stable shelf
- The Mesopotamian flood plain sediments and the alluvial fans and aeolian sediments
- The Quaternary sediments of the Unstable Shelf which include the polygenetic fills and the fills in the wide synclines and depressions in the High Folded Zones

The Alluvial plain begins north of Baghdad and extends to the Arabian Gulf. Here the Tigris and Euphrates Rivers lie above the level of the plain in may places, and the whole area is a river delta interlaced by the channels of the two rivers and by irrigation canals. Intermittent lakes fed by the rivers in flood also characterize south-eastern Iraq.

Mesopotamia is a flat plain sloping gently from NW to SE covered with recent sediments of fluvial and Aeolian origin. In general, the Mesopotamian plain is considered as synclinorium with continuous depression to accommodate the huge amount of sediments contributed annually by the Tigris and Euphrates Rivers based on the fluvio-lacustrine and partly marine basinal sediments. The Quaternary of the Mesopotamia plain is built up by fluviatile gravels and large outwash fans, developed along the margins of the region.

The sequence of formation in the Quaternary era consists of Plio-Pliestocence deposits represented by the Mahmudiya Formations which have an average thickness of 20 m in the area near Mukdadiya

Geographically, Al-Ansari (2020) divided the topography of Iraq into the following four regions: Mountain Region, Plateau and Hills Region, The Mesopotamian plain, and Jazera and Western Plateau as shown in figure 6-1.

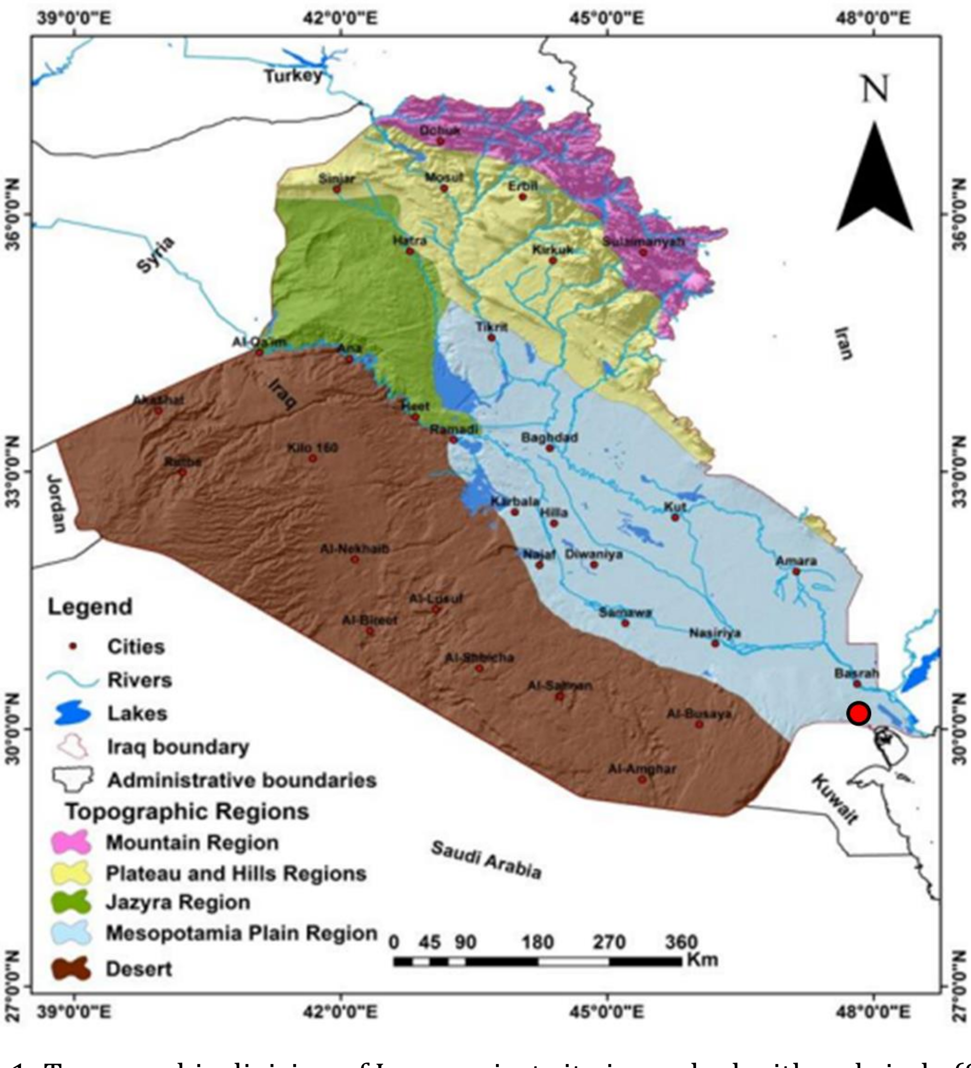


Figure 6-1: Topographic division of Iraq, project site is marked with red circle (Source of map: Al-Ansari, 2020)

Surface Geology of Iraq has been defined by Jassim and Goff (2006). The surface geology of Iraq roughly reflects its morphology as shown in figure 6-2. Generally, the youngest sediments (Quaternary and Neogene) lie within the central depression whereas the flanks expose older strata of Palaeogene to Paleozoic age.

The surface geological map (figure 6-2) shows that the Paleozoic succession appears in small areas north and west of Iraq. The Khabour Formation is the oldest exposed rock unit in Iraq in Cambro –Ordovician age (Baban and Lawa, 2016). In contrast, Ga'ara Formation (Permian) is exposed in Western Iraq, and it is considered the main aquifer in this area. The Triassic and Jurassic successions are also exposed in western Iraq's central part, represented by Mulosa, Zor Houran, Ubaid, Hussainite, and Amej formations.

The outcrops of the Cretaceous sediments are exposed mainly in three parts. The first part is located in north and northeastern Iraq. The second part represents a very small area and is located in northeastern Iraq near Sinjar Mountain. The third part is located in the western part of Iraq and extends to the Iraqi-Saudi border.

Tertiary successions cover all parts of the Iraq surface. They appear in the northeastern and northwestern parts and all the Western and Southwestern regions of Iraq, as they appear in very small areas in Eastern Iraq. Quaternary sediments of the Tigris and Euphrates Rivers with their tributaries and distributaries cover the area located in central and Eastern Iraq and some parts in North and West,

Along the Iranian border are thrust sheets of sedimentary and igneous rocks which formed in the Neo-Tethyan oceanic domain. The lowest of these comprise radiolarian chert and volcanics which were thrust over the shelf carbonates of the Arabian Plate during the Late Cretaceous. These thrust sheets were later peneplaned and covered by onlapping Upper Maastrichtian to Palaeogene clastics and carbonates. The structurally highest thrust sheets in Iraq are composed of metamorphic and igneous rocks and represent the extension of the Sanandaj Sirjan Zone of Iran to Iraq.

The topography of Iraq is shown in figure 6-3. As clear from the figure that Basra city is located at topography height range between 0-200m above mean sea level.

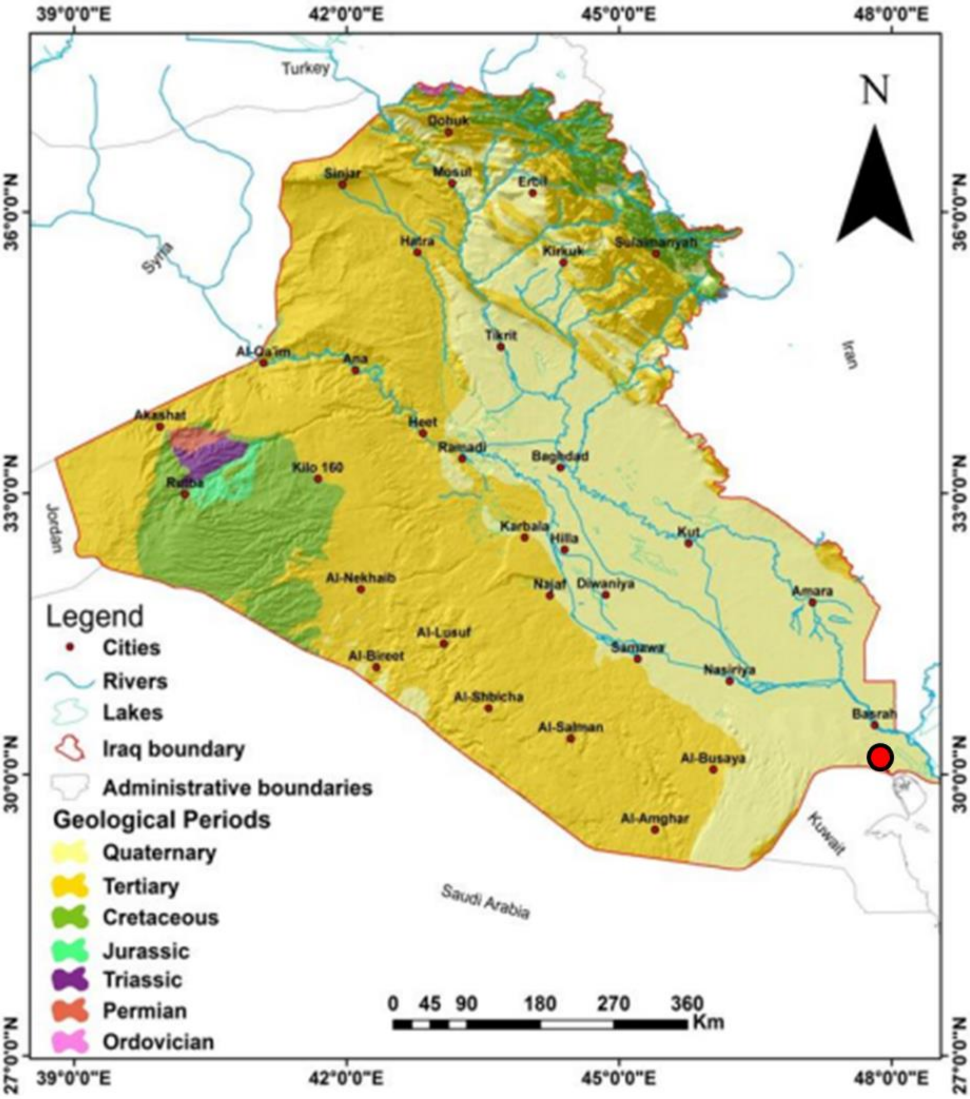


Figure 6-2: Surface geology map of Iraq, project site is marked with red circle (Source of map: Al-Zubedi A. S., 2022)

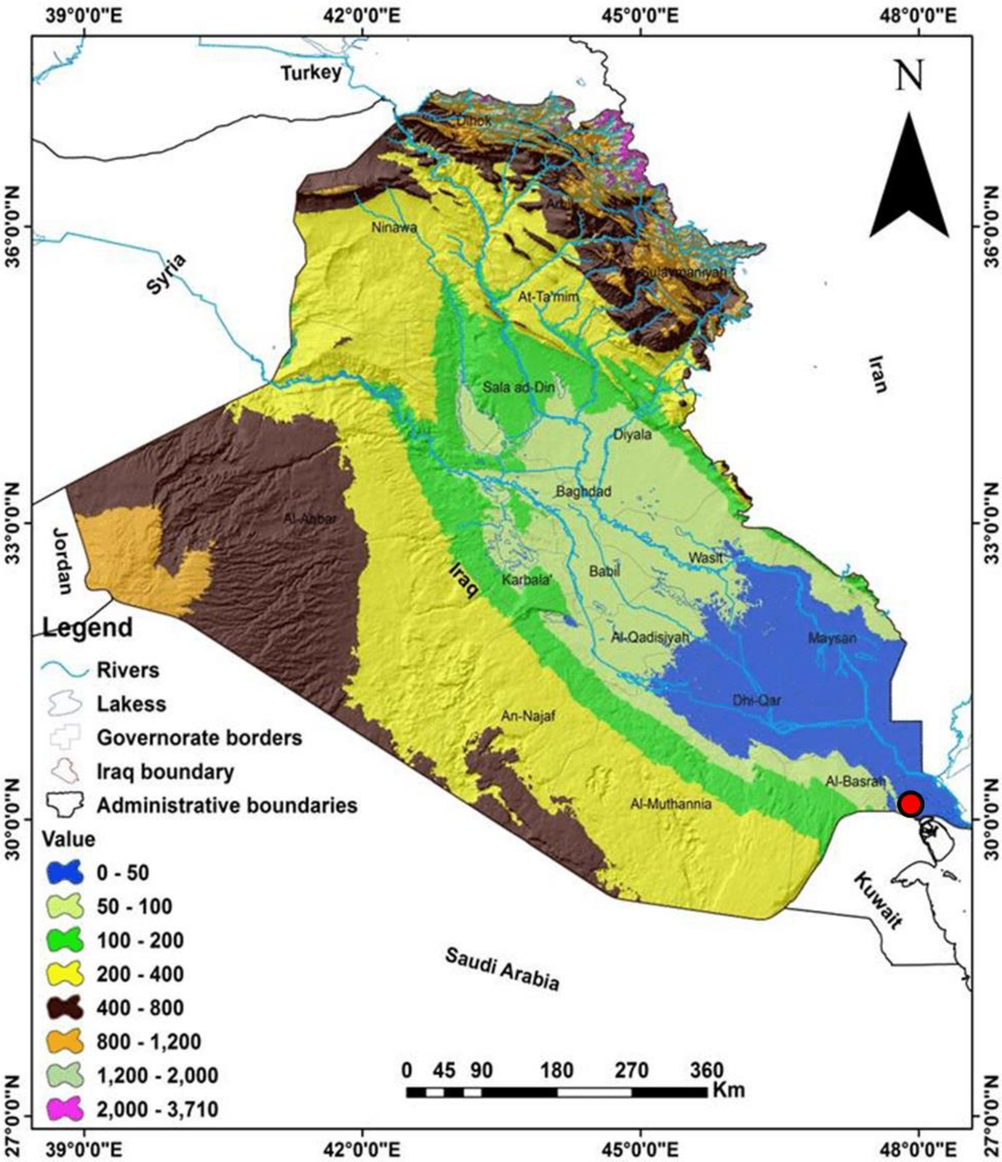


Figure 6-3: Topography of Iraq, project site is marked with red circle (Source of map: Al-Zubedi A. S., 2022)

6.1.2.2 Local Geology

Umm Qasr/Basra city is a part of the Mesopotamian plain, which forms a flat terrain with few hills of relatively slight height. The location of Basra city has played a major role in understanding the geology of the Mesopotamian plain. The geological studies showed that the city was formed because of sedimentation processes caused by the deposition of marshes, rivers and Gulf sediments during geological time. Its location as a lower deltaic area of Tigris, Euphrates, Karun and Shatt Al-Arab rivers had a great reflection on the formation of alluvial (marine Hammar formation) and fluvial sediments. These deposits can be considered as normally consolidated (Mahmood, and Albadran, 2002). In addition to these deposits, geologists have recognized surficial coarse-grained sediments as a result of Dibdiba deposits.

Fugro (2021) studied the local geology of the project site at Berth Area 4 of Umm Qasr Port in Basra, Iraq and found the following:

- The top layer generally consists of fill material made of medium dense, gravelly, slightly gypsiferous calcareous silica sand to approximately 1 to 4.5 m BGL (Below Ground Level).
- This layer is underlain by very soft to firm, brown, calcareous clay with low plasticity, to depths of about 4 to 10 m BGL.
- The third layer is encountered made of medium dense gypsiferous calcareous silica sand interbedded with hard, brown, calcareous clay with low to high plasticity, down to the bottom of boreholes. The water table depth was observed to be about 1.4 to 4.2 m BGL.

Seismicity

The seismicity of Iraq is of intermediate character and the focal depth is shallow. Tectonically, Iraq is located in a relatively active seismic zone at the tectonically active northern and eastern boundaries of the Arabian Plate (AlSinawi and Ghalib, 1995b). Earthquakes in this seismic zone can cause significant infrastructure damage, especially in the eastern part of NE Iraq (Kurdistan region) as shown in figure 6-4 which gives general picture on seismic distribution Map for Iraq. North-East of Iraq is directly influenced by the seismicity of the Alpine orogenic system (Zagros-Taurus range). This part of Iraq, characterized by high mountain ranges and shallow somewhat diffuse seismicity, is one of the most seismically active continental regions of the world with a long and well-documented history of earthquakes (Jassim S. Z. Goff J.C., 2006). It is therefore important to take into consideration seismic parameters in future design of large buildings in the mentioned part of Iraq. However, the soybean oil project is located far from this region and will be built in an area that has weak seismic activity.

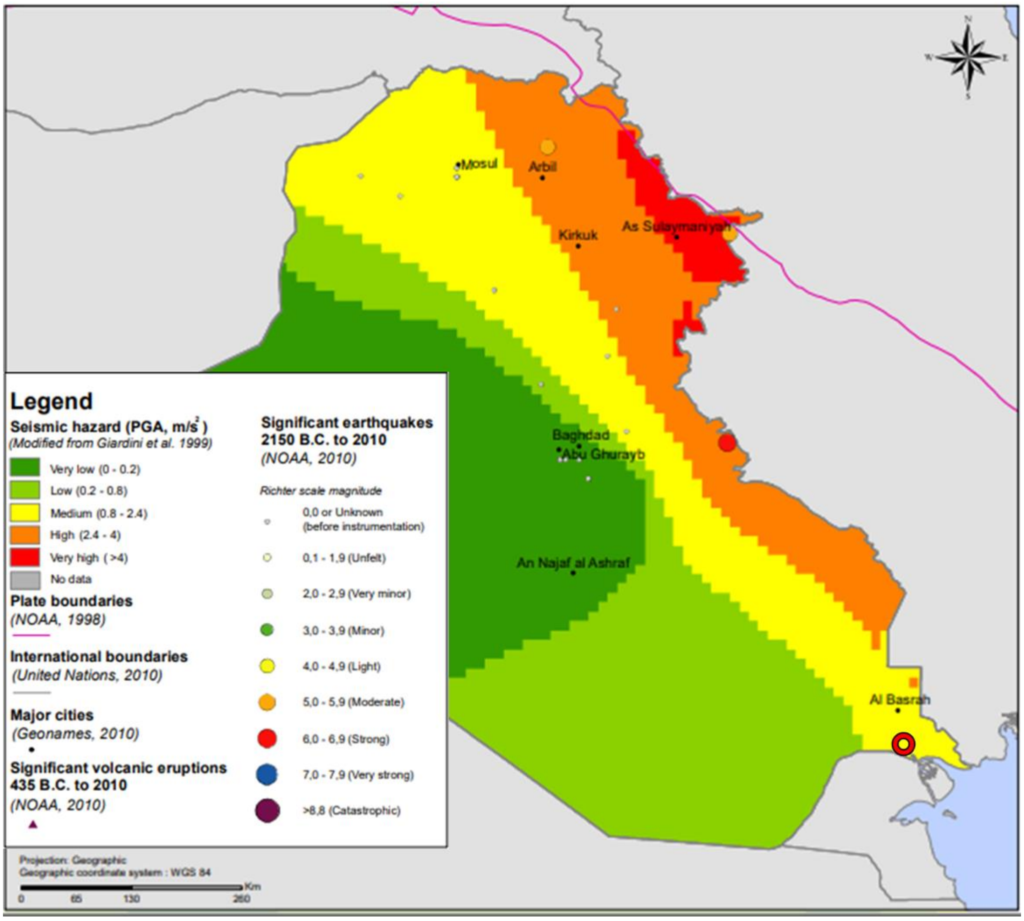


Figure 6-4: Seismic Hazard Distribution Iraq Map, project site is marked with red circle (Source of map: World Health Organization, 2010)

Probabilistic seismic hazard analysis for Iraq was conducted by Ameer et al. (2004) who showed the following statistical results:

- 90% of the seismic events in Iraq occur at intermediate-shallow focus levels.
- 54% of the events have “mb” magnitude of 4-5 with focal depths in the range of 30-40km.
- Less than 8% have magnitude greater than 5.5.

Some examples of earthquake that is recorded during the recent history in Iraqi territory are given below:

- In July 1940 and January 1950, earthquakes hit Baghdad; the effects were felt within a circle with diameter of 150 Km; many houses collapsed (Al-Warid, 1989).
- On 17/ 10/ 1946, 1/ 1/ 1950 and March, 1956 strong earthquakes hit Baghdad causing large damage to properties (Al-Warid, 1989).
- In 1992, Kasimiyah village (50 Km east of Erbil) was hit by an earthquake; tens of houses were collapsed but no lives lost were recorded (Sissakian et al., 1992).

Fugro (2021) made downhole seismic survey at the project site and the results of these tests are shown in table 6-1. The downhole seismic unit was set up by the Furgo site geophysicist followed by setting the survey parameters and carrying out a noise test to QC the seismic signal. The measurements were taken at 1m depth increment. For each measurement three stacks were recorded to improve the signal to noise ratio. The methodology of downhole seismics can be obtained from Furgo (2021).

Table 6-1: Results of downhole seismic survey by Furgo on April 21, 2021

Depth (m)	Distance (m)	P-Wave Time (ms)	S-Wave Time (ms)	P -wave Velocity (km/s)	S-wave Velocity (km/s)	Vp/Vs	Density (Mg/m3)	Poisson's Ratio	Bulk Modulus (GPa)	Shear Modulus (GPa)	Young's Modulus (GPa)
0.30	4.01	10.66	17.48	0.41	0.219	1.87	2	0.30	0.21	0.10	0.25
1.30	4.21	8.54	15.17	0.634	0.339	1.87	2	0.30	0.50	0.23	0.60
2.30	4.61	7.14	14.72	0.925	0.448	2.06	2	0.35	1.18	0.40	1.08
3.30	5.19	7.57	15.61	1.388	0.403	3.44	2	0.45	3.42	0.32	0.94
4.30	5.87	8.12	18.20	1.499	0.41	3.66	2	0.46	4.05	0.34	0.98
5.30	6.64	8.40	23.59	1.424	0.433	3.29	2	0.45	3.56	0.37	1.09
6.30	7.46	8.78	25.16	1.363	0.627	2.17	2	0.37	2.67	0.79	2.15
7.30	8.32	9.50	25.99	1.462	0.746	1.96	2	0.32	2.79	1.11	2.95
8.30	9.21	10.61	26.93	1.843	0.79	2.33	2	0.39	5.13	1.25	3.46
9.30	10.12	10.84	27.37	1.748	0.918	1.90	2	0.31	3.86	1.69	4.41
10.30	11.05	10.76	27.96	2.005	0.99	2.03	2	0.34	5.43	1.96	5.25
11.30	11.99	10.76	28.16	2.215	1.064	2.08	2	0.35	6.79	2.26	6.11
12.30	12.93	10.82	28.75	2.322	1.241	1.87	2	0.30	6.68	3.08	8.01
13.30	13.89	11.42	29.24	2.322	1.229	1.89	2	0.31	6.76	3.02	7.89
14.30	14.85	12.20	30.03	2.151	1.15	1.87	2	0.30	5.73	2.65	6.88
15.30	15.81	12.42	30.79	2.189	1.17	1.87	2	0.30	5.93	2.74	7.12
16.30	16.78	12.52	31.21	2.186	1.15	1.90	2	0.31	6.03	2.65	6.92
17.30	17.76	13.18	31.90	2.056	1.099	1.87	2	0.30	5.23	2.42	6.28
18.30	18.73	14.06	32.50	2.035	1.088	1.87	2	0.30	5.13	2.37	6.15
19.30	19.71	15.00	33.85	2.204	1.175	1.88	2	0.30	6.03	2.76	7.19
20.30	20.69	16.22	34.82	2.095	1.12	1.87	2	0.30	5.43	2.51	6.52
21.30	21.67	16.75	35.55	2.254	1.205	1.87	2	0.30	6.29	2.90	7.55
22.30	22.66	16.88	36.24	2.19	1.168	1.88	2	0.30	5.95	2.73	7.10
23.30	23.64	16.92	37.13	2.212	1.11	1.99	2	0.33	6.50	2.46	6.56
24.30	24.63	17.14	37.82	2.29	1.224	1.87	2	0.30	6.49	3.00	7.79
25.30	25.61	17.86	38.64	2.323	1.181	1.97	2	0.33	7.07	2.79	7.40
26.30	26.60	17.93	39.61	2.394	1.274	1.88	2	0.30	7.13	3.25	8.46
27.30	27.59	18.64	40.52	2.417	1.17	2.07	2	0.35	8.03	2.74	7.38
28.30	28.58	18.96	41.06	2.434	1.234	1.97	2	0.33	7.79	3.05	8.08
29.30	29.57	19.46	41.76	2.411	1.291	1.87	2	0.30	7.18	3.33	8.66

6.1.3 Ground Conditions

The ground conditions encountered at the Site during the investigation, were sand dunes and desert which form the majority of this area. Al-Abboodi et al. (2020) studied soil strata for Umm Qasr and surrounding areas (called Al-Zubair district) and found the soil consisting of the following layers:

1. The first soil layer, which extends to a depth ranged between (19.5 - 24.0 m), contains medium to dense, brown, poorly graded sand with or without gravel and sometimes with fine materials.

2. The layer directly beneath the top layer extends to a depth ranged between (22.0 - 24.0 m) and consists of very dense, brown, poorly graded gravel with sand. This layer is sandwiched between two poorly graded sand layers.

3. The last layer, which extends to a depth of 30 m, consists of dense to very dense, brown, poorly graded sand with gravel.

Further, the study showed the typical soil profile of this area as shown in figure 6-5. The figure shows the variation of standard penetration test results (SPT-N) with depth.

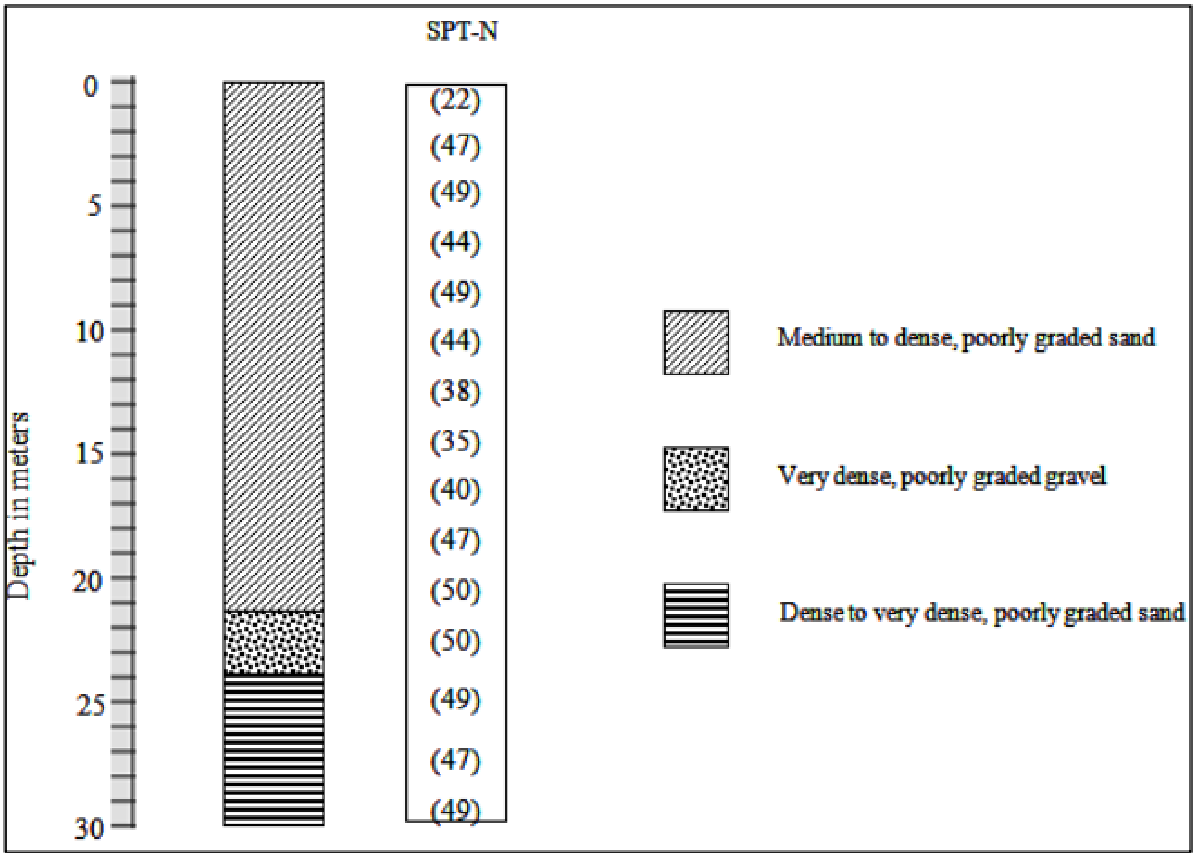


Figure 6-5: Typical soil profile and SPT-N values of Umm Qasr which is part of Al-Zubair district (source: Al-Abboodi et al., 2020)

6.1.4 Groundwater

Groundwater is one of the most important water resources in Iraq, especially in the areas distant from surface water resources like this project. Groundwater can be considered the second source of water resources in Iraq (Al-Zubaidi, 2022). It plays major role in the livelihood of people by supplying water for drinking, irrigation, industrial and other purposes, particularly in Western, Southern desert, and al Jazeera areas. In addition, large areas in the Kurdistan region, where the Tigris and Euphrates rivers and their tributaries are flow mainly in a narrow zone along the river valleys in Kurdistan region and the Mesopotamian plain in central and Southern Iraq, rely on groundwater usage.

In this project, Sama AlManar will utilize the water from wells for most needs (including cooling, washing, process, etc.) except consumption, and it is expected that water intake from these wells inside the Project site will not affect communities which are relatively far (about 5km) from the project site.

Borehole:

Sama AlManar's contractor (Fugro (2021)) drilled boreholes to a maximum depth of 40 m bgl at the project site. The boreholes were drilled allowing for continuous description of the soil profile and recovery of undisturbed samples (Class 1 and 2) and disturbed samples (Class 3). Borehole casing was used during drilling and testing. A guar gum and water mixture were used for drilling support and flushing, with the level in the borehole maintained above groundwater level at all times during drilling to ensure stability at the base of the hole.

The Fugro survey team obtained undisturbed samples in soft / firm cohesive strata whenever encountered. The samples were collected using a Shelby tube sampler and Piston sample (OD 75 mm, 1000 mm length) designated 'SH' and "P" respectively. The bottom of each sample was tested with a Torvane (TV). The undisturbed samples were sealed with wax inside plastic sampling tubes at the site.

Ground water depth was determined by Fugro (2021) to be about 4m. Groundwater levels were monitored with an autonomous data logger installed inside the piezometer.

6.1.4.1 Groundwater Quality – Chemical Analysis

Overview

Groundwater sampling was conducted on October 19, 2022 and on May 23 and 24, 2022 (before project initiation) through Sama AlManar Co's contractor (Basrat Al-Rafidain Laboratory); sampling and laboratory analysis were conducted for 3 groundwater wells across the Project site. A total of 6 samples was collected from the wells as per the specifications.

All wells were first developed (purged and monitored for water quality stabilisation) prior to sampling.

Field Parameters

Selected parameters were analysed in the field during well purging and sampling activities, including temperature, pH and conductivity. Temperature ranged from 33.4°C to 34°C. pH ranged from 7.8 up to 8.4. Conductivity ranged from 41 mS/cm up to 61 mS/cm.

Groundwater Results

The Soybean oil project plot plan and groundwater well locations map are shown in figure 6-6.

Figure 6-6: Groundwater well plot plan

Seven chemical parameters were analysed by Sama AlManar's contractor (Basrat Al-Rafidain Laboratory, Water test report, 2022) in all the 3 wells as shown in table 6-2.

The groundwater chemical results of analysis are shown in tables 6-2. As per World Bank IFC, water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards (WB-IFC EHS Guidelines, 2007). The laboratory results were compared with the WHO water quality standards. Based on this comparison, results of all GW wells (except pH) do not meet the WHO guidelines and therefore the groundwater in at project site should be treated prior to being used for drinking or other purpose of personal hygiene (such as washing or bathing).

Table 6-2: Analysis results for GWW number 1 to 3 (source: Basrat Al-Rafidain Laboratory, Water test report, 2022)

Well No	Date of test	pH	T.D.S ppm	E.C. ms	Cl^{-} ppm	$SO^{-2}3$ ppm	Hardness ppm	Alkalinity ppm
W1	23-5-2022	7.94	4,035	8.07	493.5	2,719.2	2,600	107
W2	19-4-2022	8.12	6,348	10.14	1,699.7	3,286.8	1,761	96
	23-5-2022	7.71	7,404	12.3	458.3	3,337.2	2,400	95
W3	19-4-2022	8.37	7,176	11.42	1,881.8	3,356.9	1,613	103

	23-5-2022	7.8	7,242	12.1	399.5	3,378.4	2,720	100
WHO Guidelines for Drinking-water Quality		6.5-8	600	-	250	250	200	-

Note: The test carried out by Basrat Al-Rafidain Lab in accordance to the following methods: ASTM D 512, 514, 1881, 1293

*E.C.: Electrical conductivity; $SO^{-2}3$: Sulfite ion

6.1.5 Surface Water

The project site is located on the coast of Arabian Gulf but not located close to the river or within a wadi system and so longer lasting surface flows will be limited to times of heavy rain. However, whilst heavy rainfall may cause local inundation of the site area, in particular where surfaces have been compacted, this will be temporary, and water will infiltrate into the ground or evaporate off. Surface waters are therefore not considered to be an issue for this Project.

6.1.6 Soil Quality – Physical and Chemical Analysis

6.1.6.1 Overview

Soil resources at the Soybean Oil Project site are typical of the area, with a relatively thin layer of sands which are dry and low in humid content and normal plant nutrients. Soils at the site are of low quality; in their current state they would not support agricultural production without considerable improvement and irrigation.

Past disturbance of the site during other project construction has already caused damage to the soils present, with compaction and loss of natural vegetation in evidence. The loss of vegetation further lowers the value of the soils remaining on the site. The existing soils are not considered to have an intrinsic value beyond local importance and so are not considered to be of importance for this topic.

6.1.6.2 Physical Properties of Soil

Physical tests (moisture content, unit weight, particle size distribution, Atterberg limits and particle density) for five layers were conducted by Fugro (2021) on soil samples recovered from the boreholes and trial pits.

The physical test results for the five layers showed the following findings:

- Moisture content ranged between 5% up-to 50% although layers 2 and 3 have higher moisture content.
- Fine content ranged between about 0.0% at layer 4 and up-to 98% at layers 3 and 5.

- Unit weight was ranging between about 16Kn/m3 at layer 2 and upto 24.5 Kn/m3 at layer 4.
- Sand content was found in all layers, although layers 4 and 5 have the highest values of about 90-95%
- Gravels content was mainly less than 20% at all layers and some layers (3, 4 and 5) have values near 0.0%.

Some results related to soil physical properties are plotted against depth shown in figures 6-7 and 6-8.

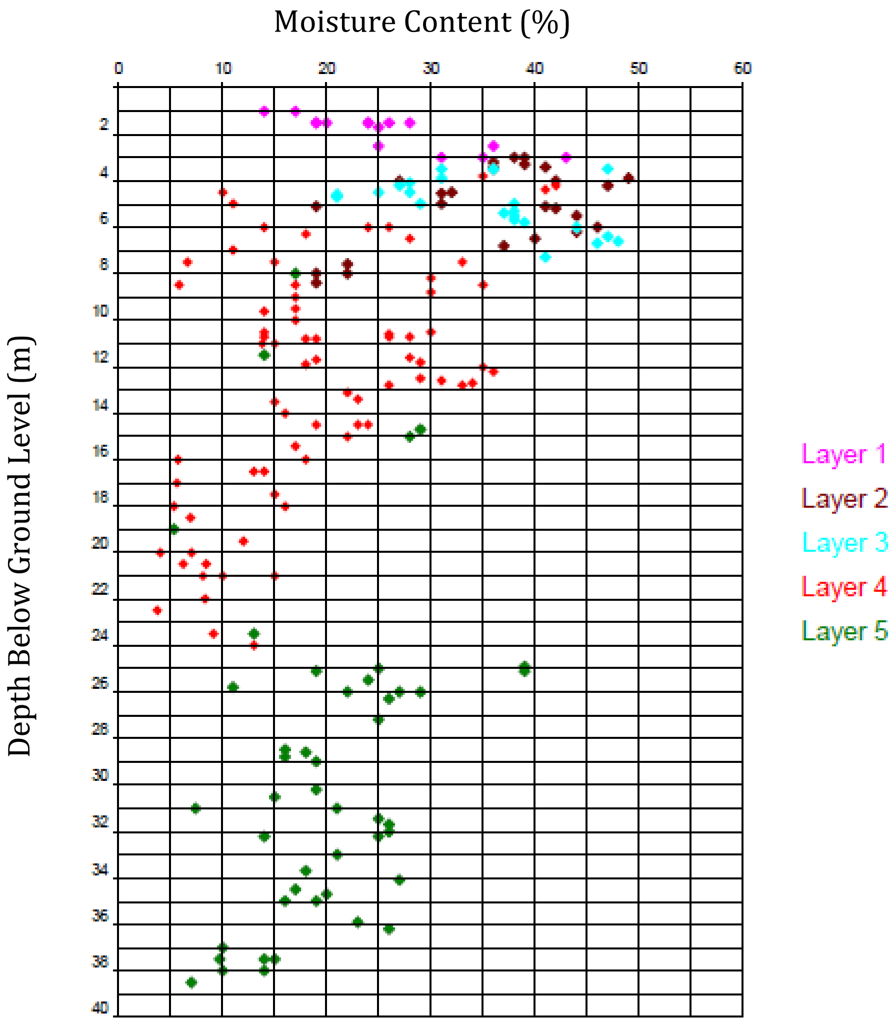


Figure 6-7: Moisture content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

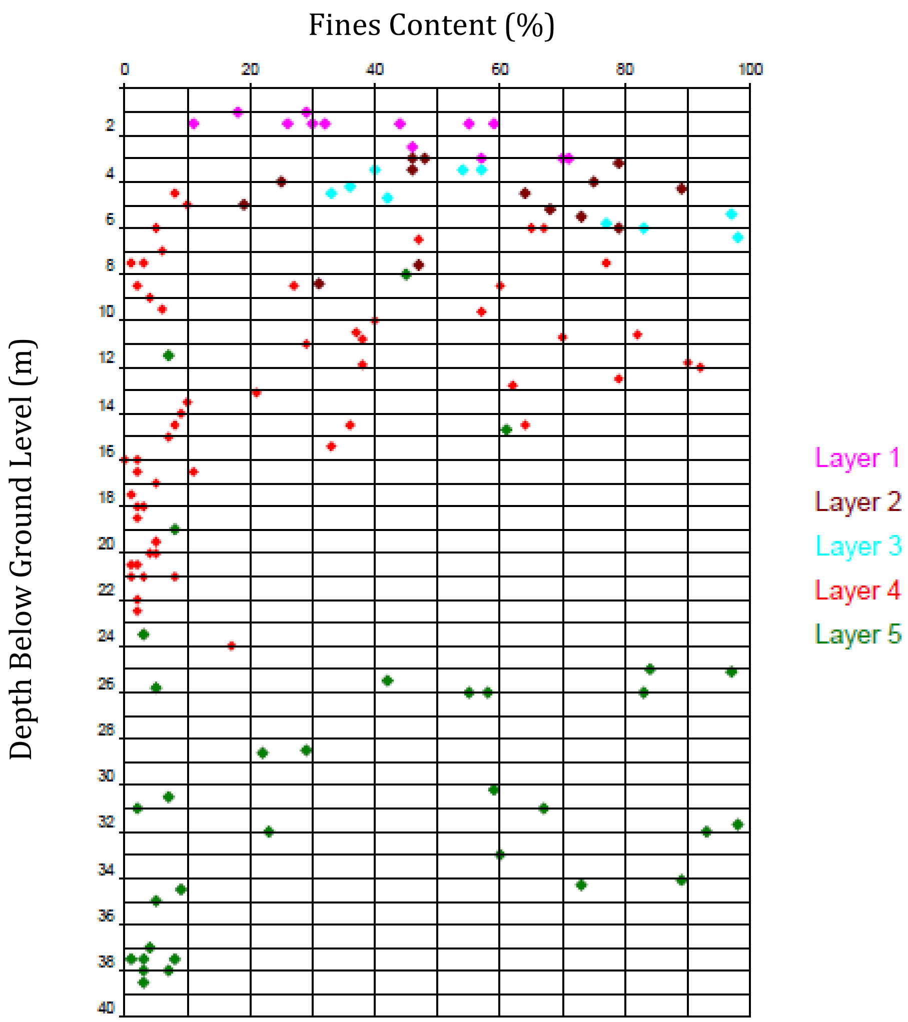


Figure 6-8: Fines content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

6.1.6.3 Chemical Properties of Soil

Fugro (2021) collected samples of soils from different depths for analysing chemical analysis. The results of this chemical analysis can be summarised as follows:

- Chloride and Sulphate Content: Soil sulphate and chloride content are up to 2.4 g/L (average 1.7 g/L) and 0.4% (average 0.1%) respectively.
- pH: The pH values of soil are between 8.1 and 8.. In accordance with the Soil Survey Manual (1993), the soils are classified as strongly alkaline.
- Organic Content: Organic content values are between 1.1% and 2.4% (more details are given in Appendix B), classifying the soils as inorganic to slightly organic.
- Carbonate Content: Carbonate content values are between 0.4% and 18%, classifying the soils as calcareous clay or calcareous silica sands in accordance with Clark & Walker (1977)
- Gypsum Content: Gypsum content values ranged from 0.9% to 41.6 % (average 21.6 %) with the highest value within the top 2 m bgl, classifying the soils as none to highly gypsiferous, in accordance with Barzanji (1973). It should be noted that the Barzanji classification was developed for agricultural purposes and does not reflect any foundation engineering judgement. It is used in this report as the only published reference classifying soils according to their gypsum content.

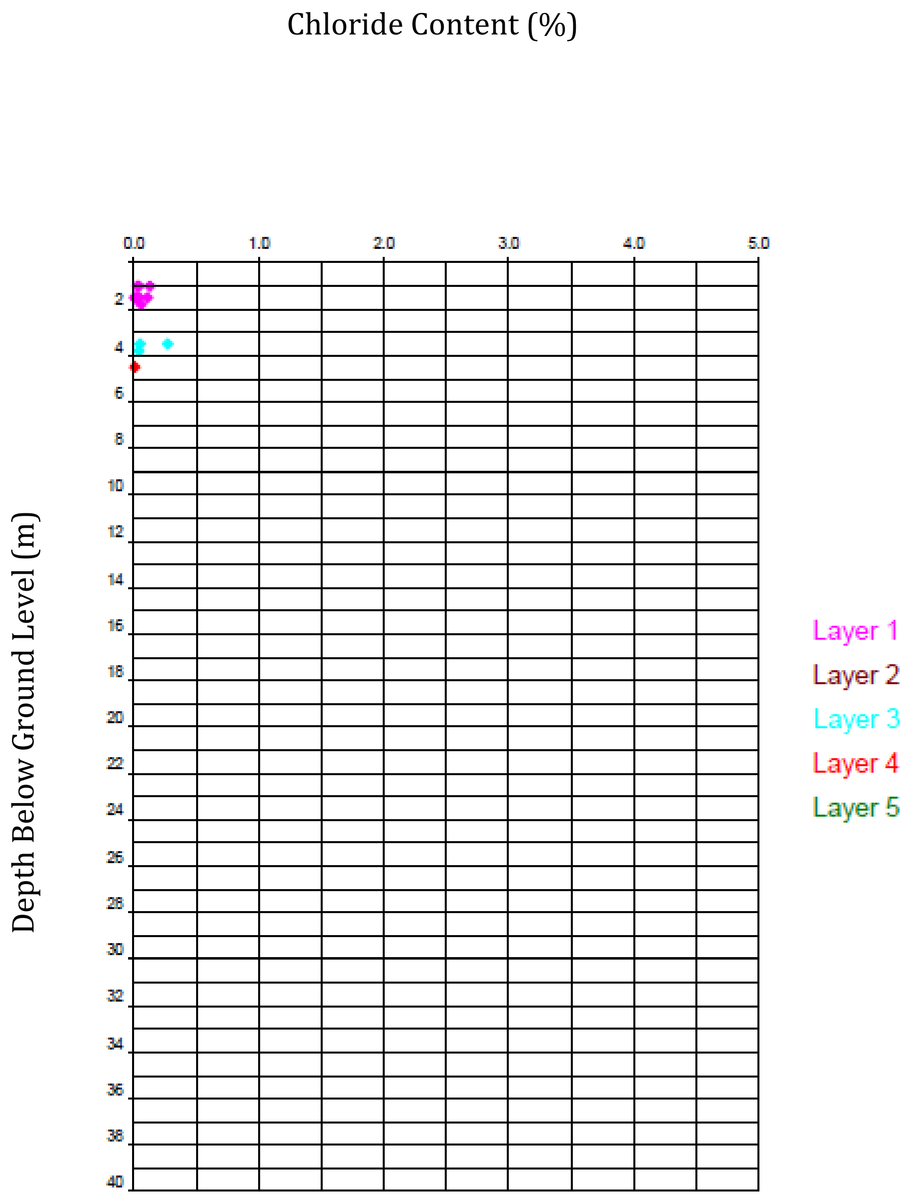


Figure 6-9: Chloride content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

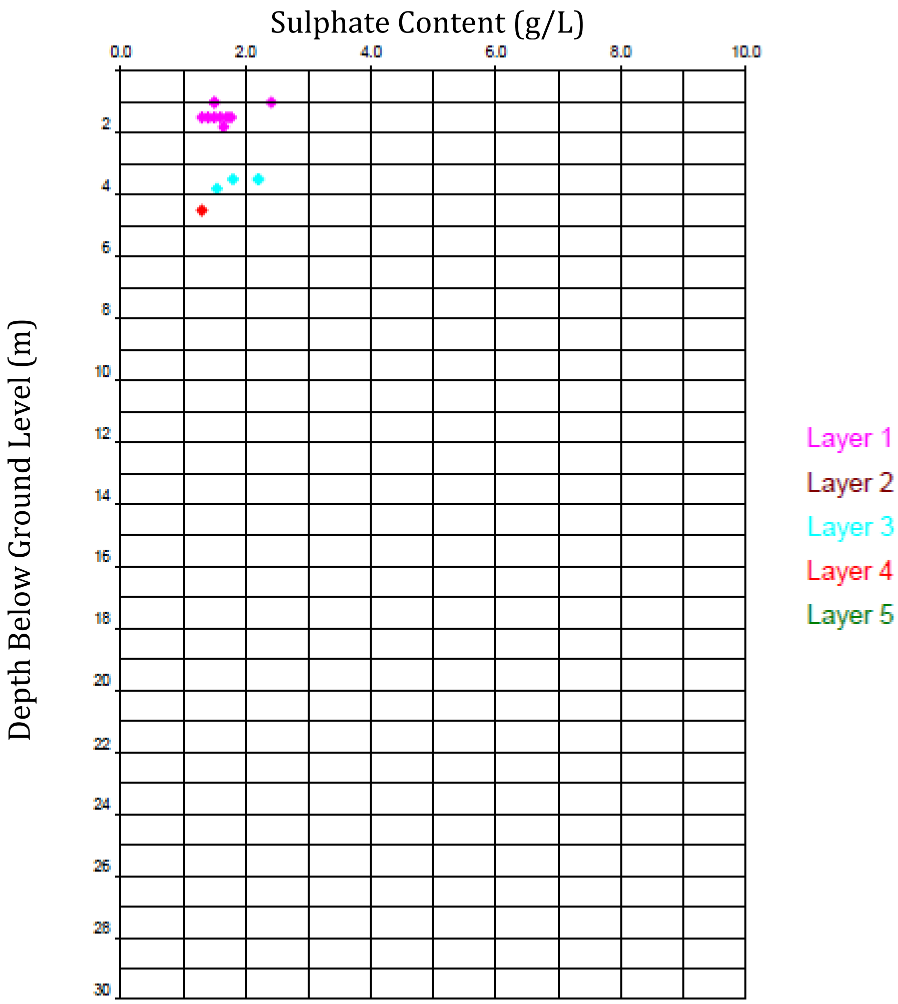


Figure 6-10: Sulphate content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

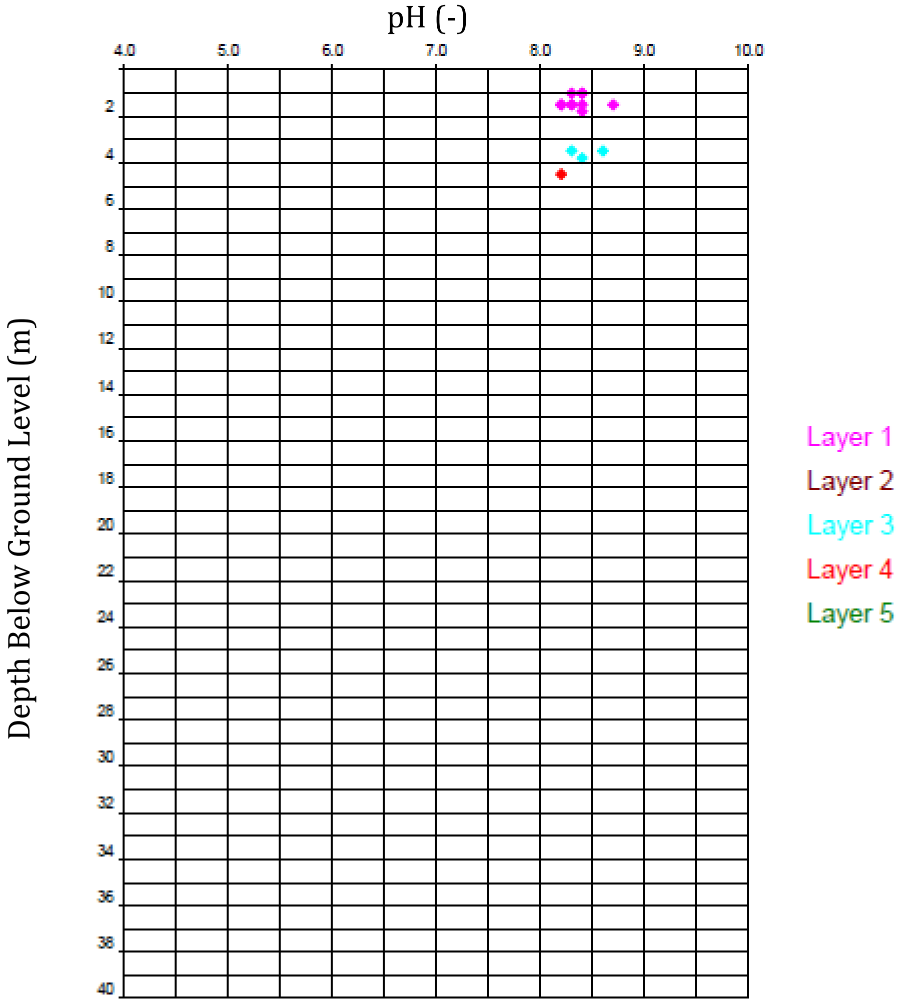


Figure 6-11: pH verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

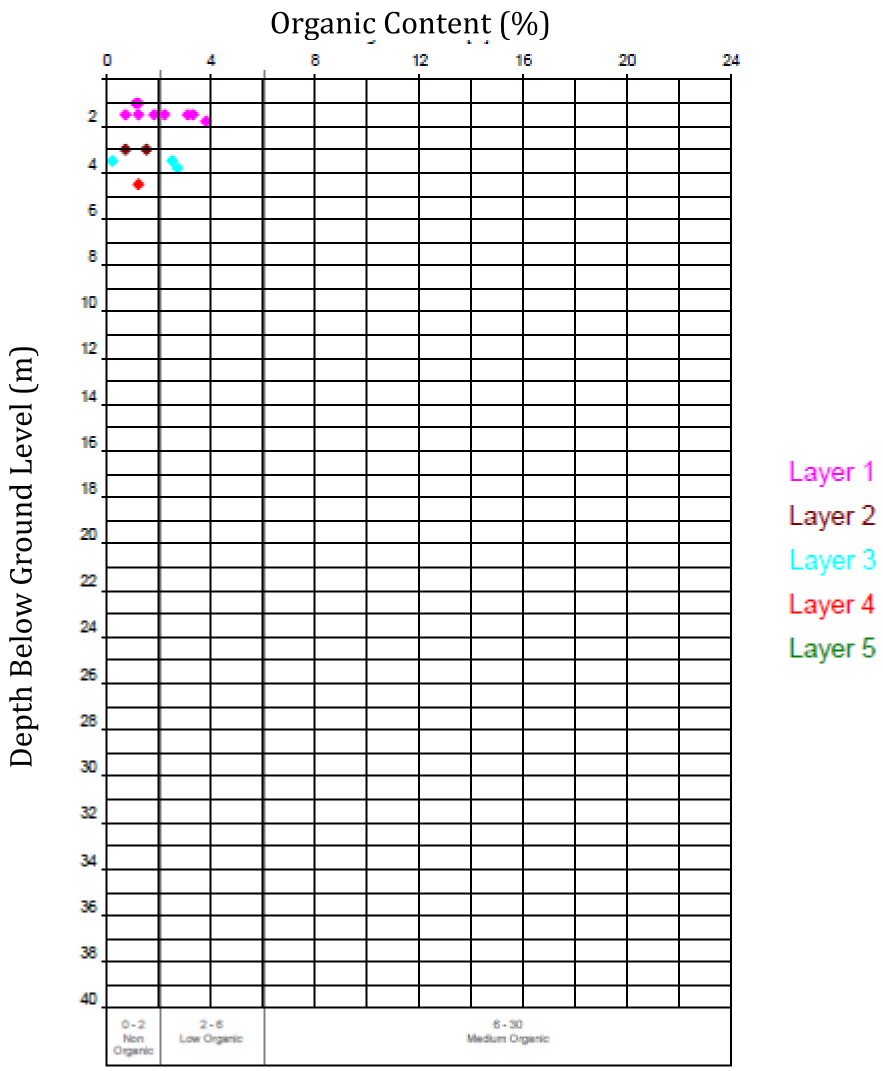


Figure 6-12: Organic content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

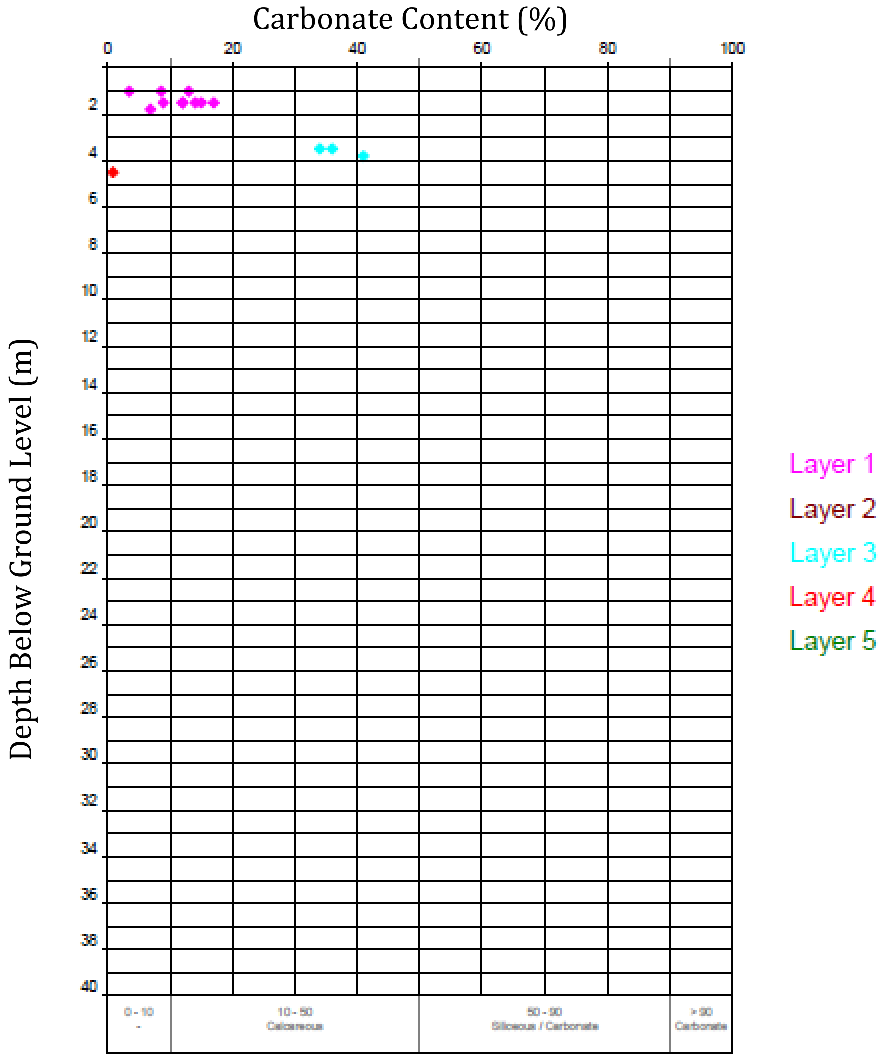


Figure 6-13: Carbonate content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

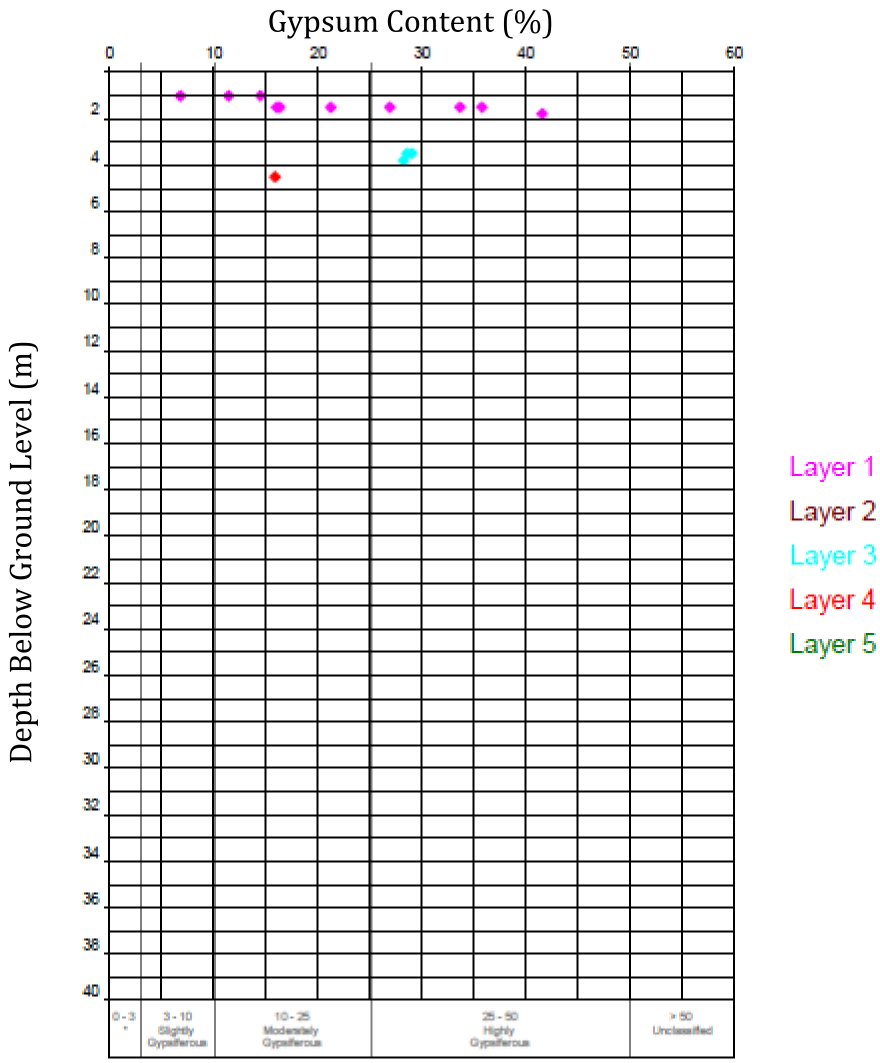


Figure 6-14: Gypsum content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

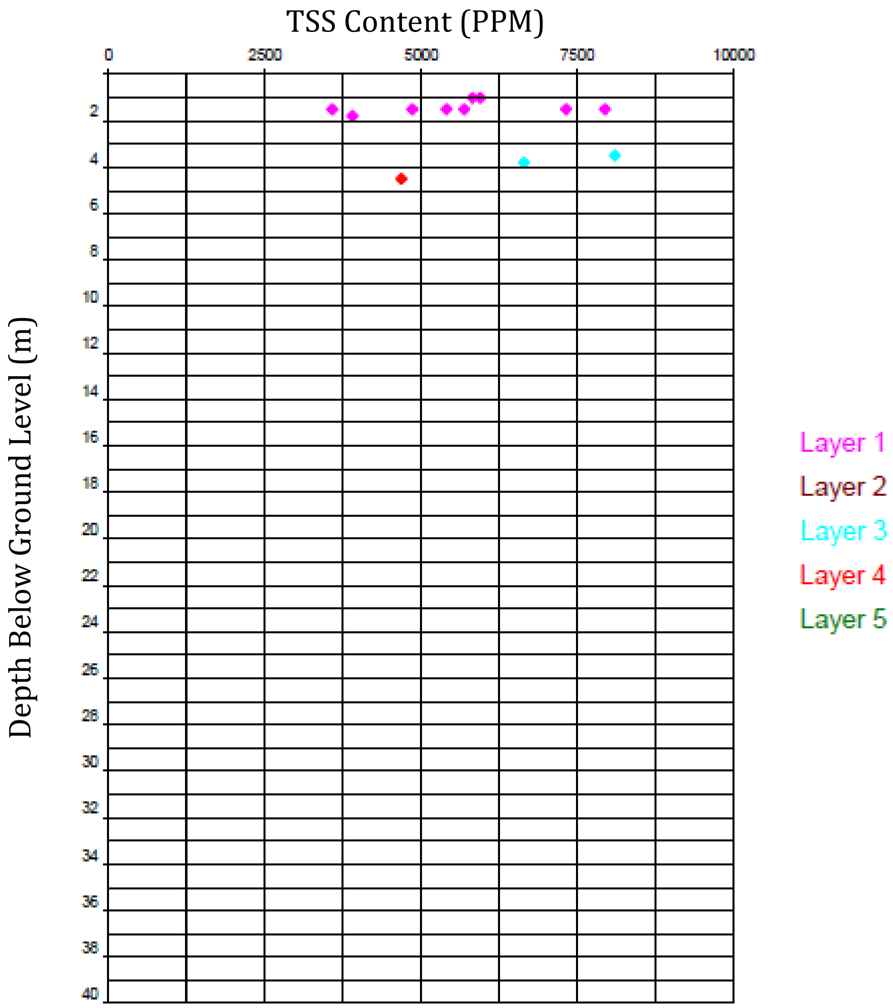


Figure 6-15: Total Soluble Salts (TSS) content verse depth at project site, Berth Area 4 at Umm Qasr Port (source: Fugro, 2021)

6.1.7 Soil & Groundwater Quality Summary

The analyses of soil and groundwater for suites of potential organic and non-organic contaminants support the conclusion that there will be minimal or negligible contaminant impact at the project Site (Fugro, 2021).

The Arabian Gulf and associated coastal and marine ecosystems are considered here to be the most sensitive receptor(s) to impact from soil or groundwater contamination. It is concluded that the risk to these receptors should be considered minimal. Quantitative risk assessment is a tool that could then be used to assess level of risk based on more detailed investigations after operation of Soybean oil project.

6.2 Impact Assessment

6.2.1 Overview

The development of the project may result in potential impacts to the terrestrial environment during the construction, commissioning, operation and decommissioning/closure phases. Accidental events may also result in potential impacts. An assessment of impacts on quality of soil and quality of groundwater has been undertaken.

The significant of potential impacts on soils, geological deposits and groundwater have been assessed and where appropriate, mitigation measures identified, and the resulting residual impacts evaluated. Potential groundwater impacts relate to water quality and also water resource potential and exiting abstractions, which may be impacted for example by groundwater abstraction for development.

The assessment of surface water impacts is provided in section 8- Water Quality Management. Any groundwater input to surface water flows during rainfall events, will be ephemeral and relate solely to the rainfall events. This eventually is therefore considered part of the surface water assessment and not discussed further in this section.

The storage and handling of non-hazardous and hazardous material and wastes generated during all phases of the project may lead to spillage and releases which could impact the terrestrial environment if not adequately managed. A detailed assessment of waste management will be addressed in Section 8.

The management and significant of impacts are assessed and defined according to the criteria presented in section 4- Assessment criteria. The assessment of impact is summarised and tabulated in other Section 18, the magnitude and significance of which for each impact are also stated below at the end of each subsection (in bold italic). Next to each magnitude/significance statement and for ease of reference, each issue is identified by a unique number which is repeated in Table 20-1 (summary of Impacts and Mitigations) and 21-1 (Monitoring Table), where applicable.

6.2.2 Construction

Construction is likely to give rise to environmental impacts to soils and groundwater. Activities such as levelling, earthworks, facility construction, trenching and backfilling for pipelines & cables, and vehicle movements are considered the activities with have the potential to cause some impacts on soil conditions. Additionally, the construction and operation of a worker's camp could involve some impacts of a similar nature.

Potential impacts on the terrestrial environment due to the above activities are summarized in table 6-3 and discussed hereunder.

Table 6-3: Construction phase potential impacts summary

Factor	*TE1* **Impact on Soil Resources**	*TE2* **Alteration of Topography**	*TE3* **Degradation of soil and groundwater quality**	*TE4* **Degradation of soil**	*TE5* **Degradation of soil and groundwater quality due to waste generation**	*TE6* **Subsurface contamination resulting from transfer of hazardous waste**
Receptor Importance/ Sensitivity	*Medium*	*Low*	*Low*	*Medium*	*Medium*	*Low*
Frequency	*Continuous*	*Continuous*	*Continuous*	*Frequent*	*Frequent*	*Frequent*
Likelihood	*Likely*	*Certain*	*Certain*	*Likely*	*Unlikely*	*likely*
Extent	*Local*	*Local*	*Local*	*Local*	*Local*	*Local*
Duration	*Medium/Low*	*Long*	*Medium*	*Short*	*Medium*	*Short*
Magnitude	*Low*	*Low*	*Low*	*Medium*	*Low*	*Low*
Effect	*Negative*	*Negative*	*Negative*	*Negative*	*Negative*	*Negative*
Action	*Direct*	*Direct*	*Direct*	*Direct*	*Direct*	*Direct*
Significance	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*

The following potential impacts on the soil and groundwater resources have been identified:

- **Impact on Soil Resources**

During the construction activities, such as earth works, vehicle movements and some other constructions works have the potential to cause soil erosion, including an increase in the effect of wind and storm water erosion. There is currently no agricultural land use in the project site, but the potential for future vegetation growth has been ruled out in the baseline, supported by irrigation and potential soil improvements. The soils are also linked to ecology, where other conditions are appropriate.

The utility of the soil present within the project areas will be largely lost due to the presence of built infostructure and associated services. The soils present at the project site are present across a much wider area and therefore the local soil resources are not rare or unique. However, if developed with irrigation the soils have localized ecology value, this indicates a degree of sensitivity to the potential impacts. It should be noted that the assessed potential impact significance is limited to soils within parts of the project area and that because these soil types extend across a much wider area the impact on regional soil resources will be low or negligible.

Environment Impact TE1 – Low Magnitude, Low Significance (locally only)

- **Alteration of Topography**

Earthworks required during construction of the project are limited to some cut and fill activities to achieve levelling and/or re-grading. The detailed description and layout of the proposed development document indicates that, based on cut and fill calculations undertaken for the early works, all material derived from this process will be reused on site as part of the cut and fill, and in the preparation of temporary roads.

Environment Impact TE2 – Low Magnitude, Low Significance

- **Degradation of soil and groundwater quality due to industrial operations, minor spillages, traffic and emplacement of fill material**

This impact refers to the degradation of the chemical quality of soil and groundwater chemistry from construction operations including traffic, industrial operations, and the emplacement of fill material. As the site geology is not of significant interest, the land is of low agricultural worth and nutrient value and the groundwater is not an important resource, the significance of this impact is deemed low.

Environment Impact TE3 – Low Magnitude, Low Significance

- **Degradation of soil quality due to maintenance activities**

Maintenance activities could include small repairs, routine lubricant and wash down of equipment. A large amount of equipment may be involved in the construction phase and the routine maintenance tasks may pose a significant contamination risk if not controlled. Released of larger quantities of washdown water, which may contain contamination, is identified as the most significant potential source of contaminants related to maintenance. A medium significant is assessed.

Construction activities will require a large number of vehicle movements and introduction of oils, fuels and chemical storage both for construction purposes but more significantly in preparation for the operation phase. Spillage or leakage from vehicles, tanks or pipelines represents a significant risk and for the worst-case scenario, if not controlled, the potential impact on local soils is considered to be high significance.

Environment Impact TE4 – Medium Magnitude, Low Significance

- **Degradation of soil and groundwater quality due to waste generation.**

During the construction phase, non-hazardous and inert waste storage are likely to result in a general degradation of the soil and groundwater quality at the Site.

According to Section 3 (Project Description) and section 8 (waste management), it is planned that if any solid and liquid waste, both hazardous and non-hazardous, are generated during construction, it will be treated in the government-approved waste management facility, in Basra City.

As all hazardous and non-hazardous waste storage areas shall be paved and curbed and waste will not be stored on-site over a long period, the magnitude and the significance of this impact is assessed as low.

Onshore Environment Impact TE5 – Low Magnitude, Low Significance

- **Subsurface contamination resulting from transfer of hazardous waste**

Transfer of hazardous waste generated during construction activities could result in a subsurface contamination. All hazardous waste storage areas shall be paved and curbed and all waste storage containers should be provided with secondary containment. The volume of waste to be generated during the construction phase will be relatively small, in terms of potential contamination affecting groundwater and subsequence dilution.

Considering this, the magnitude and the significance of this impact is assessed as low.

Onshore Environment Impact TE6 – Low Magnitude, Low Significance

6.2.3 Commissioning

In addition, the potential spillage and leakage risks described for the construction phase are present, albeit the scale of activity and therefore the risks are much lower for the commissioning phase and will be less significant than the potential impact specific to this phase.

Potential impacts on the terrestrial environment due to the above activities are summarised in table 6-4 and discussed here under.

Table 6-4: Commissioning phase potential impacts summary

Factor	TE7 **Degradation of Soil Quality**	TE8 **Degradation of Groundwater Quality**
Receptor Importance/Sensitivity	Medium	Medium
Frequency	Infrequent	Infrequent
Likelihood	Likely	Unlikely
Extent	Local	Local
Duration	Medium	Medium
Magnitude	Low	Very Low
Effect	Negative	Negative
Action	Direct	Direct
Significance	Low	Low

- **Degradation of Soil Quality**

Hydrostatic testing and flushing could be carried out on new tanks and pipelines. Desalinated fresh water will be used for these activities. During these activities the water used could pick up trace concentrations of contaminants, potentially including hydrocarbons and inorganic contaminants. Discharge of the wastewater produced may therefore negatively impact soils quality. However, the impact on soils is expected to be minimal, particularly in comparison to operational releases and is considered to be of low significant.

Small amounts of hazardous or contaminant materials may be used during the commissioning phase, such as for testing process plant or in minor repairs and modifications. The amounts of these materials expected to be used during commissioning are small, however if not controlled significant impact from spillage could occur. Therefore, any potential impacts to local soils are considered to be of medium significance.

Onshore Environment Impact TE7 – Low Magnitude, Low Significance

- **Degradation of Groundwater Quality**

The described activities specific to the commissioning phase have the potential to impact on the underlying groundwater quality, with any soils which become contaminated by the activities acting as a source and pathway. However, given the medium significance of potential impact on soils and the protection offered to groundwater by nature of its relatively depth and overlying aquitards, the significance is assessed as low.

Onshore Environment Impact TE8 – Very Low Magnitude, Low Significance

6.2.4 Operation

Potential impacts on the terrestrial environment due to the above activities are summarised and discussed hereunder.

Table 6-5: Operation phase potential impacts summary

Factor	TE9 **Degradation of soil quality due to waste generation**	TE10 **Degradation of soil quality due to Accidents and Spills**	TE11 **Degradation of soil and groundwater quality due to irrigation with treated wastewater**
Receptor Importance/Sensitivity	Medium	Medium	Medium
Frequency	Continuous	Rare	Continuous
Likelihood	Unlikely	Unlikely	Unlikely
Extent	Local	Local	Local
Duration	Medium	Medium	Medium

Magnitude	Low	High	Low
Effect	Negative	Negative	Negative
Action	Direct	Direct	Direct
Significance	Low	Low to Medium	Low

- **Degradation of soil quality due to waste generation**

The main administrative and maintenance includes various support buildings: workshops; warehouses; fire station; domestic and Administrative residential buildings (for approximately 211 employees). Operations will generate traffic movement, maintenance operations and solid and liquid waste. Impacts due to traffic movement should be less than during the construction phase. Impacts due to routine operations may pose a significant contamination risk if not controlled. Waste management facilities are provided, and waste will either be stored on-site or transported off-site to suitable disposal facilities. The significance of potential impact for these activities is medium.

Specific activities with related potential impacts on local soil quality include the following:

- Wastewater generation- resulting from activities such as equipment washdown, cleaning of raw material and other activities. Contaminants in wastewater streams may include: high COD, BOD, TSS, Oil and Grease, solvent and low Ph. General contaminants of concern include micropollutants such as PAH (e.g. from diesel oil, fossil fuel burning) and heavy metals (arsenic, cadmium, mercury, cobalt and copper). The wastewater will be treated at a treatment unit, which will remove dissolved and suspended solids, high chemicals and neutralise the effluent. The treated effluent water should meet applicable standards before discharge to prevent any impact on local soil quality.

- Stormwater discharge- run-off from the project site may be significant during short periods of heavy rainfall that can be experienced in the project area. Runoff from the project site will have the greater potential for contaminants but a stormwater drainage collection system would be recommended to be built to capture this run-off.

Although these specific activities as well as others have the potential to generate some levels of contaminants in the water, the control and treatment measures incorporated in the base design will prevent introduction of significant contaminants into local soils, or in the case of brine spraying the extent is limited, and therefore the assessed potential impact is low. Occurrence of accidents and spills is covered as separate impact factors below.

Impact TE 9- Low Magnitude and Low Significant

- **Degradation of soil quality due to Accidents and Spills**

Potential impacts to the quality of local soils may results from unplanned and accidental release, leaks and spills of some chemicals. Significant potential releases may result from presence of large volumes of chemicals during transport, handling and crushing, cleaning and other activities.

The main chemicals of concern in relation to accidental release from the storage facilities would be diesel/fuel oil and hexane, as they are relatively mobile when released, creating a significant impact on local soil quality.

Although the probability of a significant spillage/leakage incidence is unlikely, given the base design control measures, the potential magnitude is assessed as high and the potential impact is assessed as medium.

Leaks/spills from infrastructure and services:

Smaller volume leakage and spillage from pipes, storage tanks and domestic and support facilities may occur during the lifetime of the project. Substances released could include fuel oil, hexane, domestic sewage and wastewater.

Long duration impacts to soils and superficial geology may be generated, however the impact will be limited to the location of the release and the magnitude is considered to be low. Therefore, this aspect is considered to be of low significance.

Firewater Runoff during Emergency Event

In the event that firefighting is necessary, a large volume of firewater runoff could potentially be generated. This run-off could contain some chemicals, hydrocarbons and fire-fighting foam which may impact soil quality if the final discharge is not controlled. As this would be an emergency situation, complete containment and controlled discharge cannot be guaranteed.

Soil could be contaminated with a medium to high magnitude and medium to long duration. Therefore, this aspect is considered to be of medium significance.

In summary of various aspects relevant to accident and spills, it is considered that the potential impact significant is medium

Onshore Environment Impact TE10- High Magnitude and Low to Medium Significant

- **Degradation of soil and groundwater quality due to irrigation with treated wastewater**

According to Section 3 (Project Description), all water used for irrigation purposes shall meet the irrigation water quality standards and also following guidelines for the use of treated effluent for irrigation. Considering this, the magnitude and significance of this impact can be assessed as low.

Onshore Physical Environment Impact TE11 – Low Magnitude, Low Significance

6.2.5 Closure/Decommissioning

Potential impacts from closure/decommissioning phase are both short term, resulting from decommissioning activities, and long term legacy issues resulting from materials and conditions left in place.

Potential impacts on the terrestrial environment due to the related activities are summarised and discussed hereunder.

Table 6-6: Closure/Decommissioning phase potential impacts summary

Factor	TE12 **Degradation of general soil / groundwater quality**	TE13 **Other activities related to closure/decommissioning phase**
Receptor Importance/Sensitivity	Medium	Medium
Frequency	Frequent	Rare
Likelihood	likely	likely
Extent	Local	Local
Duration	Short	Medium
Magnitude	Medium	Low
Effect	Negative	Negative
Action	Direct	Direct
Significance	Low to Medium	Low

- **Degradation of general soil / groundwater quality**

Similar impacts from general decommissioning activities, including associated maintenance activities, are expected as from construction activities. Release of quantities of contaminated materials, including residual process materials and products and release of larger quantities of washdown water, are identified as the most significant risk. Potential impact to soils is considered to be of medium to high magnitude and of medium significance.

Maintenance activities could include small repairs, routine lubrication and wash down of equipment. A large amount of equipment may be involved in the decommissioning phase and routine maintenance tasks may pose a significant contamination risk if not controlled and have a medium significance.

Onshore Environment Impact TE12 – Medium Magnitude, Low to Medium Significance

- **Other activities related to closure/decommissioning phase.**

Other impact due to closure/decommissioning phase including the following:

- **Alteration of drainage characteristic and shallow soil composition.**

- **Degradation of soil and groundwater quality due to waste generation from the project deconstruction.**

- **Subsurface contamination resulting from transfer of hazardous waste.**

All of these impacts can be classified as of low magnitude, low significance for this phase, because it is understood that all the impervious materials would be removed, which would improve the drainage of the area.

Onshore Environment Impact ET13– Low Magnitude, Low Significance.

6.3 Mitigation

Impacts identified in this section that are predicted to be of medium or high significance are assessed against appropriate mitigation measures and the residual impact significance assessed. It should be noted that many of the potential impacts that have been assessed as being of low significance will still be mitigated by measures presented in the tables below. For example, although potential impacts on groundwater quality have been assessed as low due to possibly the relatively depth to groundwater, the measures adopted to protect soil quality will further protect groundwater quality as contaminated soils would be a source and pathway to contaminate underlying groundwater.

6.3.1 Construction phase recommendations:

The contractor shall develop, implement and maintain a construction phase Environmental Emergency Response Plan (EERP) and a construction environmental Management Plan (CEMP). These plans will detail responsibilities and procedures for environmental and emergency response management during construction, including the following:

- Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental releases of hazardous substances);

- Procedures to be implemented following an accidental release of hazardous substances, e.g. during refuelling, including details of containment and recovery measures to be applied; and

- Availability of pumps and spill mitigations materials such as absorbent granules to contain and recover hazardous substances release.

- All storage tanks (except hexane tank) shall be above ground and maintained in good condition and inspected regularly. A record must be kept of all liquids/tanks/containers delivered to the site.

- All vehicles used on site shall be serviced and maintained to the highest standard, with a record kept of maintenance undertaken.

- At each vehicle wash area, there shall be a regularly maintained wash-water collection and recycling system.

The contractor will undertake regular audits of the above management plans to confirm their ongoing effectiveness.

There are no specific recommendations required in relation to the low significance potential impacts associated with topography, recharge of groundwater. It should be noted however that the mitigation measures put in place for TE4 will also further protect groundwater quality.

6.3.2 Commissioning Phase Recommendations:

Additional corresponding documents should be compiled for this phase, if commissioning phase activities are not already included within the Construction Environmental Management Plan (CEMP) and Environmental Emergency Response Plan, discussed earlier.

There are no specific recommendations required in relation to the low significance potential impact associated with groundwater quality. It should be noted however that the mitigation put in place for TE7 will also further protect groundwater quality.

Operation Phase- Impacts and Mitigations:

ID Code	Impact	Potential Significance	Mitigation Measure	Significance after Mitigation
TE10	Degradation of soil quality due to accidents and spills	Medium	-Any accidental spill/leak will be fully cleaned as soon as the incident occurs, and if required polluted soil will be excavated and removed to a licenced waste disposal site. Any accidental spill/leak will be recorded. -Where possible the site design would be such that accidental release from bunded containment areas would still discharge to a site drainage system in preference to entering the ground.	Low

6.3.3 Operation phase Recommendations:

The site operator shall develop, implement and maintain an Environmental Management and Monitoring Plan (CEMP) and Environmental Emergency Response Plan for the operational phase, to further protect against impact of local soil and groundwater quality. These plans will detail responsibilities and procedures for environmental and emergency response management during operation, including the following:

-Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental release of hazardous materials)

-Procedures to be implemented following an accidental release of hazardous materials, e.g., during refuelling, including details of containment and recovery measures to be applied;

- Availability of pumps and spill mitigation such as absorbent granules to contain and recover hazardous substances releases; and

- Maintenance procedures of all equipment, pipelines and drainage systems in place.

The operator will undertake regular audits of the above management plans to confirm their ongoing effectiveness.

Prior to commencement of operations, chemical profiling will be undertaken to assess the requirement, if any, for treatment facilities assigned to the runoff/seepage from the various process units.

Closure/Decommissioning Phase- Mitigation:

ID Code	Impact	Potential Significance	Mitigation Measure	Significance after Mitigation
TE12	Degradation of soil quality due to decommissioning activities	Low to Medium	-Designated refuelling and maintenance areas and areas for delivery and storage (in tanks/containers) of potentially contaminative liquids will be constructed. These areas will be hard-surfaced and contained by walls or bunds, with drainage systems and collection arrangement for spills and stormwater management. All storage tanks shall be above ground and maintained in good condition and inspected regularly. A record must be kept of all	Low

			liquids/tanks/containers delivered to the site. -All vehicles used on site shall be serviced and maintained to the highest standard, with a record kept of maintenance undertaken. - At each vehicle wash area, there shall be a regularly maintained wash-water collection and recycling system.	

6.3.4 Closure/Decommissioning Phase Recommendations

Most of decommissioning activities will be similar to those undertaken during construction in relation to the potential for contamination of the terrestrial environment and therefore an Environmental Emergency Response Plan (EERP) and Environmental Management and Monitoring Plan (EMMP) which covers the decommissioning phase is required.

7 TERRESTRIAL BIOLOGICAL RESOURCES

7.1 Introduction

The potential construction and operational impacts associated with the development of Soybean Oil project on terrestrial ecology (land-based ecosystems) is presented here. The findings will be based primarily on survey of the terrestrial flora and fauna community, focusing on native species. Areas of consideration include:

- Baseline field survey of habitats and key floral and faunal groups close to the project site, which could be potential receptors in the impact assessment process. These were:
  - Perennial vegetation;
  - Mammals;
  - Breeding and migratory birds; and
  - Reptiles (diurnal species).
- Information obtained from available literature review and local sources. The obtained information was used in evaluating the rarity and status of habitat or species in the vicinity of the project site or over wider geographical areas.

These data were used to assess the impacts of the Soybean Oil project during construction, commissioning, operations, decommissioning.

7.2 Literature Review

An extensive information search was carried out to obtain required information for the terrestrial biological evaluation. Other information and documentation were obtained from existing studies and reports, relevant web sites, articles, and interviews.

7.2.1.1 Onsite Impacts - low magnitude, low significance.

7.2.1.2 Construction impact includes removal of low value poor condition vegetation, with potential displacement of associated fauna limited to hardy, migratory and breeding birds and mangrove forests. Off-site Impacts - low magnitude, low significance.

During the phase of construction works, site grading/excavation is a source of disturbance to wildlife in the area, and main concern here may be the prevailing migratory/local birds near the area. The coastal wetlands are located less than 200m from major process units at the project, while a dedicated storm water system on-site ensures proper drainage allowing water flow thru site and onward natural outwash to Arabian Gulf coastal waters.

Minimal flora on-site at the Project site, with only tracks of cats roaming in the area, implies that there are no species of high ecological value on-site. Off-site salt marshes are located at a distance (they are of high value by providing shelter to migratory and breeding birds), and they are a valuable resource and a sensitive receptor of high priority in the Government list of protected areas.

Hereunder two main impacts (disturbances and pollution) predicted during the construction and commissioning phases, are described.

Disturbances on-site and off-site during construction:

The construction phase will generate some noise disturbances and visual disturbance associated with the movement and operation of vehicles and machinery. These activities have the potential to result in the displacement of species from the Project area and the zone of influence to the detriment of these individuals through increased competition of resources and / or displacement into habitats which are of lower quality. This includes the avoidance of the area by migrant, wintering and breeding bird species. However, some species that have long associations with human habitation are likely to benefit from the additional human presence (e.g., house sparrow and the house bunting).

The behaviour of those species and individuals not displaced is likely to be modified to avoid disturbance (e.g., less time spent foraging) and this could impact the viability of these populations. Impacts on species of Least Concern and lower are predicted to be of low significance.

Impact TB1 – Low Magnitude and Low Significance

Pollution on-site and off-site during construction:

The construction phase of the Project will generate construction waste, including food waste and construction waste. The implementation of an effective waste management strategy will limit the potential for food waste to attract vermin, thereby avoiding any significant increase of predation on species. This strategy will also reduce the attractiveness of the construction camps to scavenging mammals thereby reducing potential human / animal conflict.

The clearance of areas in preparation for development and cut and fill operations has the potential to significantly increase soil erosion and sediment run-off during times of rainfall. Although the risk is intermittent, the erosion and deposition of sediments could potentially result in the loss and degradation of habitats.

Construction activities also have the potential to generate significant amounts of dust. However full dust suppression techniques will be implemented to reduce dust emissions and the possible smothering of adjacent habitats.

Impacts of pollution are therefore assessed as low significance.

Impact TB2 – Low Magnitude and Low Significance

7.3 Baseline

7.3.1 Overview

A preliminary terrestrial ecological study conducted for the project site consisted of a literature review and a site walkover undertaken by Enviro Solutions and Technologies (EnviroSOLTECH) team. The site walkover was made at selected locations within the project site and areas adjacent to the project site. Available literature was reviewed in order to gather information regarding typical national, regional and local flora and fauna.

The method of investigation is presented and provides information about the study area, along with general information on coastal ecosystems and interaction of various components and their contribution to on-site/immediately surrounding ecosystems.

Based on the literature review and the information gathered, the following important factors related to Basra province and Umm Qasr area are given below:

• The Iran/Iraq conflict heavily changed the area particularly along the border region with Iran and southern parts of Iraq;

• Agricultural runoff threatens water quality and results in increasing salinity in many areas of this ecoregion; and

• Uncontrolled hunting is a threat to many waterfowl and other fauna and fishing is also uncontrolled with the prevalent use of electro-fishing.

7.3.2 Methodology

A terrestrial ecology study was conducted in order to identify and review available information sources, such as historical and geological maps, aerial photographs, satellite imagery and environmental databases. Further, a site walkover survey was carried out to obtain information on presence/potential for terrestrial biological resources on-site and its vicinity.

A physical on-site survey was conducted at selected locations within the project site and surrounding areas, in order to give a general overview of species and habitats present, and identify the potential for/presence of documented regional or local species; all values are indicative.

Survey methodology included the following:

- Area ecology referring to background literature together with information from site walkover;
- Ecological components of special interest specific to the project site;

- Special focus on rare/endangered species;
- Noting species present, dominance, quality of habitats on project site and surrounding areas; and
- Identifying and photographing major species and habitats.

7.3.3 Description of Soybean Oil Project Site and its Surroundings

7.3.3.1 Location

The Soybean Oil project site is surrounded to the north and south by the CMA Terminal and Etihad Food Industries Co; the site is near a residential area to the west and the Arabian Gulf coast to the east (Figure 7-1).

Figure 7-1: Soybean Oil project and surrounding facilities

Based on our observations and field visits to the site on Oct 19 to 23, 2022, we noted the following: There is no river, channel or aqueduct inside or near the project site area. The nearest river to the site is Shatt AL-Arab River with its six branches. The distance between the project site and Shatt Al-Arab River is 48 km. On the other hand, the nearest man-made channel to the study area is Shatt Al-Basra Channel, which is the main drain channel in Iraq. It ends in Khor Al-Zubair channel. This channel is located at about 27 km distance northwest of the project site, Figure (7-2).

Furthermore, we noted there are no protected zones are present in Umm Qasr or in the surrounding area. However, across the Shatt Al-Basra channel from the site is the Khor Al-Zubair Important Bird Area (IBA) and Key Biodiversity Area (KBA), with the closest point located 2.5 km from the southwest of the Project site and on the opposite bank of the access channel. The Khor Al-Zubair IBA extends along the Khor southwards to a point on the river opposite Umm Qasr, but not including Umm Qasr.

Figure 7-2: Soybean Oil Project, Shatt Al Basra and Shatt Al Arab, Basra, Iraq

7.3.3.2 Climate

The Republic of Iraq is characterised by hot and dry conditions in the summers and cooler temperatures with some cloudiness and rain in the winters. The average temperature in Basra is 24 degrees Celsius ("°C") and having substantial seasonal and diurnal variability. Basra's climate receives an average of about 150 mm of rainfall per year and the average annual relative humidity is about 60 percent. However, the relative humidity in the winter months can be quite high, with a daily average of about 80% in January, with higher humidity overnight and early morning and lower humidity during the afternoon. Fog and stratus clouds occur mostly at night and towards sunrise and usually burn off before midday. The annual wind distribution indicates moderate to strong winds from the north-west and a secondary maximum of south-easterly winds, with winds from other directions very infrequent.

7.3.3.3 Wild Plants

Wild plants have adapted to survive in harsh conditions and extreme temperatures. The vegetation consists of shrubs and perennial herbs and annuals, which vary seasonally, depending on the amount of rainfall in winter. The vegetation in the area of Umm Qasr and Al-Zubair is an important element in the desert ecosystem. It protects the soil from erosion and provides important sources of feed for livestock species and wild animals; like other elements of biodiversity, vegetation has been subjected to degradation because of overgrazing and uprooting of trees. The following table shows the main plants which grow naturally in the area.

Table: 7-1: Wild plants in the areas of Umm Qasr and Al-Zubair

Family	Scientific Name	Local Name
Asteraceae	*Achillea santolina*	Qaisom
Cactus	*Cactus*	Subair
Tamaricaceae	*Tamarix articulata*	Athal
Leguminosa	*Alhagi camelorum*	Agoul
Cucurbitaceae	*Citrullus colocynthis*	Hnthal
Zygophylaceae	*Schanginia*	Tahma (Tarteer)
Juncaceae	*Juncus maritimus*	Asal
Leguminosae	*Prosopis farcta*	Shaouk
Fabaceae	*Melilotus indicus*	Alhandgoug
Cruciferae	*Lepidium aucheri Boiss*	Rishad Bari
Malvaceae	*Malva neglecta*	Khubaiza
Solanaceae	*Salix purpurea*	Sifsaf
Solanaceae	*Solanum nigrum*	Ainab Al-Thalab
Compositae	*Aster tripolium*	Barbeen Siwagi
Salicaceae	*Populus euphratica*	Algharb

.

7.3.3.4 Coastal Ecosystems

Coastal areas can be defined as the interface or transition area between land and sea and are often diverse and dynamic. They are important both ecologically and economically, providing a high aesthetic and recreational value, which can support tourism, as well as providing attractive sites for industrial development and human settlements. The Soybean Oil project site lays close to a coastal area of the Arabian Gulf.

Coastal areas frequently contain critical terrestrial and aquatic habitats. Such habitats together comprise unique coastal ecosystems, supporting a rich biological diversity and frequently contain a valuable assortment of natural resources. Examples of such habitats are estuarine areas, coral reefs, coastal mangrove forests and other wetlands, tidal flats and seagrass beds, which also provide essential nursery and feeding areas for many coastal and oceanic aquatic species. Coastal vegetation itself is affected by many biotic and abiotic factors and their balance determines the stability and continuity of the coastal ecosystem structure.

Most of the world's fish production (about 90%) relies on coastal area habitats that are home to migratory and non-migratory water/shorebirds, as well as some threatened and endangered species such as turtles and dugong which are part of the biological diversity of coastal environments, under the Convention on Biological Diversity, UN Conference on Environment and Sustainable Development, Rio de Janeiro, June 1992, entered into force on 29 December 1993.

More details on the marine environment are given in section 11.

7.3.3.5 Fauna

Wild Animals:
There are no wild animals present at the project site or in its surroundings because the region is dominated by commercial and industrial activities and populations. But, if we take the broader Al-Zubair area which is part of the desert region in south Iraq, we may find some mammals present in the region, particularly those that have the capacity to bear the thirst and that live on plants and desert wildlife such as camels, grey wolves and foxes. This diversity of mammals has declined in recent years, and they only exist now in remote areas which are far from industrial activities and residential areas. The following table shows some of the wild animals that may be found in the Umm Qasr and Al-Zubair area.

Table 7-2: Wild animals in Umm Qasr and Al-Zubair area

Scientific Name	Common Name	Local Name
Canis aureus	Jackal	Banat Awa
Canis lupus	Grey wolf	Thia'ib Ramadi
Capensis lepus	Wild rabbit	Arnab Bari
Felis chaus	Jungle cat	Kit Bari
Sus scrofa	Wild boar	Khanzeer Bari
Vulpes vulpes	Fox	Abo Alhsain
Meriones unguiculatus	Lesser Jerboa	Aljarbou'a
Eumeces schneiderii	Schneider Skink	Hayat Um Slaiman
Psammophis schokari	Schokari sand racer	Thu'aban Alrimal
Androctonus crassicauda	Scorpion	Alakrab Alaswad

The National Report on Biodiversity in Iraq (July 2010) (www.cbd.int/doc/world/iq/) speculated that several mammal species have been eradicated from the area such as Arabian Oryx (*Oryx leucoryx*) and Asiatic Cheetah (*Acinonyx jubatus*). Spiny-tailed lizards (*Uromastyx sp.*) as well as other unidentified reptile species have been recorded in the past. All species in this ecoregion require more study in order to establish clear population patterns and effects of environmental changes.

Birds

The desert nature of the region of Basra province and its dry, hot and semi-desert weather, particularly in the area of Umm Qasr and al-Zubair, impose special conditions of natural diversity of birds adapted according to the nature of the region. Many types of birds reside in this region such as; prey birds (Alsokoryat), Passerines (Al-Asforyat) and the endangered bird bustards. However, the presence of such a diversity of birds usually occurs in areas away from industrial activities and particularly in areas that are free from population. The following table shows a list of the most important bird species that exist in Umm Qasr and Al-Zubair areas.

Table 7-3: Birds of Umm Qasr and Al-Zubair areas

Scientific Name	Common Name	Local Name
Nycticorax nycticorax	Raven	Alghrab Alaswad
Bueto bueto	Common Buzzard	Alsaqr Alhawam
Francolinus francolinus	Black Francolinus	Alhijil
Pterocles senegallus	Spotted Saandgrouse	Alqita Almrakat
Pterocles orientalis	Black-bellied Sandigrouse	Kita Aswad Albatin
Columba oenas	Stock Dove	Alyamam
Streptopelia decaocto	Collared Dove	Yamam Mtaouak
Sturnus vulgaris	Starling	Alzaraour Alsha'ia
Pycnonotus leucogenys	White cheeked Bulbul	Albulbul
Aquila nipalensis	Steppe Eagle	Aiqab Albadia
Vanllus leucurus	White Tiel Plorer	Altatwa
Aquila clanga	Greater spotted Eagle	Aliqab Alasfa'a Alkabeer
Himantopus himantopus	Black-winged stilt	Algarsou's or Abo Almagazil
Galerida cristata	Crested Lark	Qambra Mitmawja
Alaemon alaudipes	Hoopoe Lark	Qambara alhududiya
Sylvia nana	Desert Warbler	Hazja (Dakhla) Alsahra
Chlomydotis undulate	Ltoubara Bustard	Alhabar
Lanius collurio	Red-backed Shrike	Sirid Daktash (Mihmar Aldhahr)
Oenanthe alboniger	Hume's Wheatear	Ablaq Hyoum
Oenanthe deserti	Desert Wheatear	Ablaq Albadiya wilsahra
Oenanthe xanthoprymna	Red-tailed Wheatear	Ablaq Ahmar Althail
Phoenicurus ochruros	Black Redstart	Humaira'a Sawda'a
Motacilla alba	White Wagtail	Thiara Baidha'a

Motacilla flava	Yellow Wagtail	Thiara Safra'a
Aquila pomarina	Lesser Spotted Eagle	Aliqab Alasfa'a Alsagir
Passer domesticus	House Sparrow	Asfour Douri
Falco peregrines	Peregrine falcon	Alshahin
Alectoris chukar	Chukar	Alhijl

Umm Qasr and surrounding areas are important for wintering migratory bird species from Eurasia. Data obtained from the Nature Iraq survey between 2005 and 2008, which included the marshlands of southern Iraq, recorded 159 species of birds of which 34 are considered to be of conservation concern (IUCN Red List), including eight that are globally threatened: Marbled Duck (*Marmaronetta angustirostris*), Ferruginous Duck (*Aythya nyroca*), White-headed Duck (*Oxyura leucocephala*), Basra Reed Warbler (*Acrocephalus griseldis*), Black-tailed Godwit (*Limosa limosa*), Asian Imperial Eagle (*Aquila heliaca*), Greater Spotted Eagle (*Aquila clanga*) and the Macqueen's Bustard mentioned above.

7.4 Impact Assessment

7.4.1 Overview

The construction, commissioning, operation and decommissioning of the Project have the potential to impact the ecological integrity and function of the Study Area, and to adversely affect individual species, populations and communities of plants and animals. To ensure that the impact assessment process is transparent and robust and permits the identification of targeted and specific mitigation measures, a systematic and rigorous approach to impact identification and characterisation has been adopted as outlined in Chapter 4: Impact Assessment Criteria and Methodology. This systematic approach facilitates the identification of potentially significant impacts on the identified biological resources and has been augmented further as described in the following sections.

Impact significance for biological resources has been determined by comparing magnitude against the geographic value/importance of such resources. Section 4 (Table 4-3) shows the criteria used to define the type and magnitude of impacts on biological receptors. These are based on currently accepted guidelines produced in the UK (IEEM, 2006).

The identification and management of impacts has also taken into account the advice for protecting, restoring and enhancing biodiversity and ecosystem services as set out in the International Finance Corporation's Performance Standards, in particular Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Resources (2012), and the Equator Principles (2006). Furthermore, due to the fragility of this ecosystem and the patchiness of habitats and biological resources, a precautionary approach has been taken when assessing significance.

The aim of an ecological impact assessment is to:

- Determine the significance of impacts on valued ecological receptors
- Significance of an impact depends on the value of the ecological receptor and the scale or magnitude of the impact.
- Demonstrate that proposed developments will meet the legal requirements relating to species, sites or habitats.

7.4.2 Construction

7.4.2.1 Onsite Impacts

Habitat disturbance, dust, noise, lighting, presence of structures, vehicle traffic, piling and worker activity within the Project site's boundary may not affect sensitive biological resources with a low degree of habitat fragmentation due to earthworks, road cutting and rough grading, due to the already minimal vegetation cover (of no significant value) at the project site. Higher than baseline noise levels may disturb local birds and other animals within project site, however noise is of relatively short time intervals and effects are insignificant due to absence of permanent sensitive receptors with some loss in halophytic vegetation cover, while it shall be noted that existing habitats are marginal with low value as a natural habitat for birds, mammals and reptiles and is in poor condition with no plans from the government side to improve vegetation cover on site.

Soybean Oil project as a whole may not add to the overall cumulative loss of natural habitats in Umm Qasr area, which is by itself a negligible net impact on the total ecosystem in the area because of very low eco-value of habitats that may be affected by the project facility.

For any export/import needs, the Soybean Oil project will use readily available marine terminals, thus eliminating needs to construct new marine terminals and avoiding further associated impacts to coastal line.

7.4.2.2 Off-site Impacts

Potential impacts of dust settlement, vibration, lighting and noise from any earth moving vehicles during the construction will be negligible on Flora/fauna adjacent to the Project site, provided desert plants are naturally equipped with certain defence tools and high tolerance to prevailing severe dust environments and naturally occurring sandstorms. High intensity lights and glow may disturb or displace nocturnal fauna on-site.

Specific potential impacts on biological resources due to the proposed construction and commissioning phases are summarised in Table 7-4.

Table 7-4: Construction Phase- Impacts Assessment due to Disturbance and pollution

Factor	TB1 (Disturbance)	TB2 (Pollution)
Receptor Important/Sensitivity	Local	International
Frequency	Continuous	Infrequent
Likelihood	Likely	Unlikely
Extent	Local	Local
Duration	Medium	Medium
Magnitude	Medium	Medium
Effect	Direct	Indirect
Action	Negative	Negative
Significance	Low	Low

7.4.3 Commissioning

Potential impact from commissioning is very short and is limited to the already low-value sensitive receptors on-site, and neighbouring facilities, commissioning phase impacts are of low magnitude/low significance.

Intense lighting and high pitch noise inside/outside fence line due to security requirements, has potential to disturb local birds and wildlife.

Potential effects of elevated air pollution (mainly some gases and particles) on vegetation from exiting sources within the Project during commissioning will be discussed in detail in operation phase. In view of the cumulative impacts, the effect of air pollution and noise on vegetation and birds will be similar to the construction phase and can be considered as a negative impact of low magnitude with a medium to low significance.

Overall Biological Resources Impact – Low Magnitude, Low Significance.

7.4.4 Operation

7.4.4.1 Onsite Impacts

Lighting impact:

Potential impacts of increased light are considered to be of negligible magnitude and significance. Best available lighting systems will be used to minimise glare.

Biological Resources Impact – Low Magnitude, Low Significance.

Disturbance

The Soybean Project will be operated 24hrs a day, 300 days a year. As a consequence, there will be almost continual sources of noise disturbance arising from some process units (such as preparation unit and boiler), generator and vehicle movements.

Many of the mammal species are crepuscular or nocturnal and operation activities during these periods have the potential to significantly disturb the natural behaviour of these species. However, some mammal species do have a capacity to become habituated to human disturbance.

The 24hr operation of the Project also has the potential to disturb resident, over-wintering and migratory species (i.e. noise and light pollution rendering the site less favourable). However, these species are mobile and would be likely to find alternative habitat to utilise.

Impacts of disturbance on species of Least Concern and below are predicted to be adverse low significant.

Impact TB3 – Low Magnitude and Low Significance

Air Pollution. The air quality modelling indicates that the contribution of the Project emissions to gases and particles levels outside the project fence during normal operation is very low although the existing baseline conditions of some pollutants indicates a potential problem (see Section 5 – Air Quality for details).

Sulphur dioxide, Nitrogen oxides, Particles may affect vegetation in a number of ways: degradation of chlorophyll, reduced photosynthesis, raised respiration rates, changes in protein metabolism, lipid and water balance and enzyme activity (WHO, 1987). High concentrations cause leaf necrosis, while longer term exposure of some gases will result in chronic injury. Apart from visible effects 'subtle injury' can also result including reduced plant growth and greater susceptibility to climatic extremes or pathogens (WHO, 1987).

Some gases (such as sulphur dioxide) are likely to form acids in the atmosphere and be deposited on surrounding vegetation as 'acid rain'. This is more likely to occur during periods of rainfall or heavy mists which occur during the period of November and March. In parts of Europe, acid deposition leading to acidification of soils and water bodies is a serious problem; however, it is unlikely to have any impact in areas such as Umm Qasr where the soils are predominantly formed of base-rich carbonates and would quickly neutralise the effects of any acid.

Effects of elevated particles or NOx, or SO_2 pollutants on vegetation could be significant and therefore monitoring of these air pollutants should be part of any routine ecological monitoring programme. In view of the cumulative impacts, air pollution effect on vegetation has been defined as a negative impact of medium magnitude with a medium to low significance.

Impact (TB4)– Low Magnitude, Low Significance.

7.4.4.2 Offsite Impacts

Various environmental aspects; site activities trucking movement, dust, noise and pollution associated with the Project may not have effects on areas around Project site, with no possibility of lighting/glare extending offsite.

Impact– Low Magnitude, Low Significance.

Specific potential impacts on biological resources due to the operation phase are summarised in Table 7-5.

Table 7-5: Operation Phase- Impacts Assessment due to Disturbance and pollution

Factor	TB3 (Disturbance)	TB4 (Pollution)
Receptor Important/Sensitivity	Local	International
Frequency	Frequent	Continuous
Likelihood	Likely	likely
Extent	Local	Local
Duration	Medium	Long
Magnitude	Medium	Medium
Effect	Direct	Indirect
Action	Negative	Negative
Significance	Low	Low

7.4.5 Closure/Decommissioning

Site construction and closure/de-commissioning share similar potential impacts, in terms of wildlife disturbance, since major demolition of structures will take place and dismantling of buildings and other installations. Its duration is short term and effects are of low magnitude and low significance.

The restoration of the project units will facilitate the rehabilitation of natural habitats. These restored habitats will not have the same ecological value or function as those lost due to the level of disturbance to the soil profile however they will contribute to minimising impacts of habitat loss / degradation and fragmentation. A comprehensive Restoration Plan will be prepared outlining the proposals to maximise the ecological value of the restored habitats. This will include proposals for landscape seeding and planting, using native species of local provenance only. Local seed collection should be undertaken from the surrounding habitats to avoid the risk of introducing non-native species.

Specific potential impacts on ecological receptors due to closure/decommissioning phase are summarised in Table 7-6.

Table 7-6: Decommissioning Phase- Impacts Assessment

Factor	TB5
Receptor Important/Sensitivity	International
Frequency	Continuous
Likelihood	Likely
Extent	Local
Duration	Long
Magnitude	Medium
Effect	Direct

Action	Positive
Significance	Low

Biological Resources Impact (TB5)- Low Magnitude, Low Significance.

7.4.6 Mitigations

Specific Mitigation Measures:

A hierarchical approach to mitigation development has been adopted to manage impacts identified for the construction, commissioning, operational and decommissioning phases of the Project. This approach consists of three distinct stages:

- Avoidance – avoid impacts wherever possible.
- Minimise – Reduce the effect of negative impacts that cannot be avoided.
- Compensate – Implement compensatory measures for remaining significant impacts.

The primary objective of the proposed mitigation measures is to protect and enhance the ***conservation status of habitats and species within and adjacent to the Project***

To evaluate the success of the proposed mitigation in achieving this primary objective, a robust and comprehensive ecological monitoring plan will be implemented prior to the commencement of construction activities. The scope of this monitoring plan will be developed in full consultation between Sama AlManar Co and the governing bodies within Basra Province. Under this plan, sensitive ecological receptors and indicator species will be monitored to ascertain whether impacts are manifesting themselves as predicted, to assess the effectiveness of the proposed mitigation measures in managing these impacts.

Should it be identified that mitigation measures are not achieving the primary objective, then further interventions will be taken to reverse adverse trends.

In addition to the specific mitigation measures described above, a suite of recommendations which primarily consist of good management practices to address impacts of low significance have been documented. It is the intention that with the implementation of these measures, impacts of low significance can be reduced to no impact.

Construction and Commissioning phase Recommendations:

The Construction Contractor shall develop, implement and maintain a construction and commissioning phase Environmental Emergency Response Plan (EERP) and Construction Environmental Management Plan (CEMP) as supporting documents to the Environmental Management and Monitoring Plan (EMMP). These plans will detail responsibilities and procedures for environmental management and emergency response during construction and commissioning, including the following specifically targeted to biological resources:

- Speed restrictions to reduce dust emissions from construction vehicles;

- On-site landscaping by implanting trees, bushes and shrubs of species that need less irrigation

- Site clearance procedures that allow species to move away before clearance, rather than being trapped within the construction area;
- A dust management strategy to reduce dust emissions from construction activities. This will include dust suppression of haul routes and covering loads on construction vehicles;
- A construction site waste management plan and erosion and pollution prevention measures to reduce the risk of contaminants entering the natural environment; and
- Identification and control of water discharges, to ensure the drainage capacity of the location, and to minimise erosion potential.
- Participating in green projects in Umm Qasr and surrounding areas

- Supporting local government in providing Environmental education programs

- Avoided working at night wherever possible.

- Fit earth moving equipment with more efficient sound reduction equipment.

- Use the following precautions when dealing with digging and earth moving equipment: low-noise engines, noise tempering covers and procedures to keep the engine cover closed.

Operation phase Recommendations:

Sama AlManar Co shall develop, implement, audit and maintain a Project Environmental Management and Monitoring Plan (EMMP) and an Environmental Emergency Response Plan (EERP). These plans will detail responsibilities and procedures for environmental management and environmental emergency response during operation of the facility. This shall include in specific relation to management of biological resources:

- Applying BAT Best Available Technology in process design, to reduce cumulative impacts effects.

- Ensure all designed controls are implemented to reduce air pollution and noise emissions.

- Minimizing any effects of elevated particles and gases (such as NO_x and SO_2) emissions on vegetation and should be monitored as part of a routine ecological monitoring programme established to preserve and protect the natural resources.

- Applying energy efficient lighting systems to minimise light disturbance to nocturnal animals

- Usage of the latest model vehicles for lower emissions
- On-site implantation of suitable plant species
- A waste management plan and erosion and pollution prevention measures to reduce the risk of contaminants entering the natural environment; and
- Provision of Site Induction to all personnel which includes the ecological value and sensitivity of the Project area, details on site access and exclusion zones, guidance on species identification and actions to take if encountered within Project areas.

Closure and Decommissioning phase recommendations:

Sama AlManar shall further develop the outline closure plan prepared for the ESIA over the Project life, to provide adequate detail for sound, and sustainable site decommissioning and closure. The closure plan should specifically detail the rehabilitation measures to be implemented as part of Project closure, and should consider provision of ecological monitoring to assess the success of habitat restoration / rehabilitation, and allow for corrective actions to be implemented as appropriate.

The project management shall develop and ensure that decommissioning activities are undertaken in accordance with a decommissioning plan which addresses though is not limited to:

- Applying the BAT to minimize the particles and gases (such as NO_x and SO_2) emissions during closure/decommissioning phase.
- Implementation of a site waste management plan and pollution prevention measures to reduce the risk of contaminants entering the natural environment.
- Implementation of speed restrictions to reduce dust emissions from operational vehicles and implementation of dust management strategy.
- Use the following precautions when dealing with equipment movement: low-noise engines, noise tempering covers and procedures to keep the engine cover closed.

8 NOISE AND VIBRATION

8.1 Introduction

Exposure to high levels of noise can affect the behaviour and health of human beings. Noise pollution can cause annoyance, interfere with work, cause sleep disturbances, hypertension, hearing loss and other health effects. Exposure to high noise over a long duration of time can cause noise-induced hearing loss. Accordingly, noise levels are regulated according to Iraqi authority and IFC requirement.

Potential sources of noise associated with different phases of this project (e.g., construction and operation) have been identified and assessed. Where detailed information on noise levels associated with specific equipment, has not been available during the Front-End Engineering Design (FEED) stage, a number of assumptions to estimate likely noise emissions associated with the proposed project have been made within the impact assessment.

This section presents the noise baseline survey, its evaluation in light of applicable criteria and modelling based predictions of the environmental impacts on receptors resulting from noise during the lifetime of the proposed Project located at Umm Qasr.

8.2 Baseline Environment

The proposed project is located inside Umm Qasr Port boundary and about 2km south-east of the residential area. A noise survey has been carried out by EnviroSOLTECH on Oct 21, 2022 at free field locations for a duration of 5 minutes at two noise sensitive receptor(s) off-site and at various locations on the boundary of the proposed project site, as shown in figure 8-1.

Noise level measurements were carried out using Cirrus Optimus Uni-T UT352 Sound Level Meter (figure 8-2). The noise meter was mounted on a tripod such that it was at least 3.5 meters from any reflecting structure (other than the ground) with the microphone position 1.2 to 1.5 meters above ground level. The meter was calibrated before the monitoring exercise using a Acoustic Calibrator and no significant drift in calibration was observed. If the drift was greater than ± 1 dB(A) re-calibration would be recommended.

Figure 8-1: Locations of noise measurements at four receptors within Project site's fence

(Soybean Oil Project shaded with light Orange colour)

Figure 8-2: Noise meter used for monitoring at 6 locations (4 locations at facility fence and 2 locations at offsite sensitive receptors) (Picture to the right is monitoring at project site and at the left is monitoring at sensitive receptor (Hospital))

Noise Monitoring Results

The following conclusions can be extracted from the baseline noise survey as shown in table 8-1:

- The maximum noise levels (measured as LA_{max}) at the fence ranged between 50 – 66 dB(A) while at sensitive receptors levels ranged between 63 and 67 dB(A).

- The equivalent continuous noise levels (measured as LA_{eq}) at the fence ranged between 43 – 66 dB(A).
- The equivalent continuous noise level (LA_{eq}) at receptor#4 (43 dBA) was the lowest whereas the noise level at receptor#3 (63 dBA) was the highest.
- Based upon the results of the noise monitoring survey, it can be concluded that the noise measured at the Project site is below the national and World Bank guideline (70 dB(A)) for industrial areas. However, the noise level at sensitive receptors (hospital and school) were above the national and World Bank guideline (55 dB(A)) for Hospitals and educational areas due to mainly traffic since both receptors are located near the main road.
- Meteorological conditions were monitored during the measurement period, and results indicated that the average wind speeds, temperature and relative humidity were 15-16 km/h, 31-35 °C and 37-56% respectively.

Table 8-1: Noise level data summary*

Location#	Location	Baseline Sound Level dB(A)		Remarks
		LA_{eq}	LA_{max}	
Receptor 1	30° 1'23.17"N 47°56'45.08"E	54	62	Northwest boundary of the proposed site adjacent to road. Observations: construction to south-east and passing trucks (occasional)
Receptor 2	30° 1'23.58"N 47°56'56.79"E	51	56	Northeast boundary of the proposed site adjacent to road (less traffic). Observations: construction to south and fewer trucks passing (occasional)
Receptor 3	30° 1'18.48"N 47°56'44.63"E	63	66	Southeast boundary of the proposed site adjacent to construction area. Observations: construction work is on-going.
Receptor 4	30° 1'18.42"N 47°56'57.46"E	43	50	Southwest boundary of the proposed site. Observations: no traffic and less affected by construction work compared to other sites.
Receptor 5	30° 2'10.12"N 47°55'2.65"E	59	63	Sensitive receptor: near Umm Qasr General Hospital Observation: the site is affected mainly by traffic
Receptor 6	30° 2'27.92"N 47°54'48.64"E	61	67	Sensitive receptor: near Al Suwais Primary School Observation: the site is affected mainly by traffic

*Note:

- *All noise data were recorded during day-time hours (02:00 to 5:00pm).*
- *LAeq : A weighted, time-continuous equivalent sound level. Notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the weighted fluctuating sound measured over that period A widely used noise parameter describing a sound level with the same energy content as the varying acoustic signal measured.*
- *LA_{max} : is the maximum weighted sound pressure level recorded over the period stated*

8.3 Noise Impact Assessment

8.3.1 Overview

Noise will be generated at the Project site during construction, commissioning and normal operations as well as during emergency operation of the proposed facility.

The criteria for the evaluation of impacts were identified in section 4: Impact Assessment Methodology. Table 4-5 and Table 4-6 in section 4 present the definition of magnitude criteria define specifically for environmental noise impacts and the significance of noise impact assessment.

In order to assess potential noise and vibration impact, consideration has been given to application standards and guidance. The applicable environmental noise limits for the Project are those of the Iraqi standards; the World Bank Group (IFC) guidelines are included for reference as international good practice. In addition, reference is also made to BS 5228: 2009- "Code of practice for noise and vibration control on construction and open sites" (Parts 1 and 2) to inform the assessment of the construction phase.

Potential noise impacts from activities during each project phases (construction, operation and decommissioning) are assessed in this section. The assessment of impact from noise is summarised and the magnitude and significance for each impact are also stated below at the end of each subsection (in bold italic).

8.3.2 Noise Modelling Details:

CUSTIC 3.2 modelling software was used for noise prediction during construction and operation phases of the proposed project. CUSTIC is capable of executing predicted noise contours showing sound pressure as it moves away from the point source. This software calculates the noise level in each point of the space considering each of the sources and the condition of the atmosphere.

Ground condition: no existing ground topographical data has been included within the model. As a worst-case scenario it has been assumed that the project area is flat. As a result, the noise prediction made at the nearby noise sensitive receptors will generate worst-case noise impact prediction when modelled. The project area has been assumed to be acoustically hard, and as such no acoustic ground absorption has been included within the model.

Meteorological Conditions (Temperature and Relative Humidity): an average annual temperature of 24 ^{0}C has been assumed and an average relative humidity of 55% has been assumed based on the historical meteorological data for the project site.

Noise Receptors: A total of more than 500 on-site and off-site receptors (including sensitive receptors) have been included within the model. These receptor points have been positioned at 50m intervals around the boundary of the project site and at a height of 1.5m above ground.

8.3.3 Construction Noise

8.3.3.1 Potential Sources of Impacts:

Project noise levels will vary during the construction period, depending upon the construction phase. Construction would include various activities such as grading and preparing the site, installing stone column piles, pouring concrete, erecting steel, installing the plant equipment and performing site clean-up. There is a fair amount of site preparation required to remove the overburden and grading prior to general civil and plant construction.

It is expected that the construction activities would involve the creation of the foundation and fabrication of the new project. Table 8-2 presents the typical equipment items expected to be used during any construction activities and their indicative sound power levels. The noise data for individual items of construction equipment (in terms of source Sound Power Level (PWL)) were taken from the Hong Kong Environmental Protection Department's Publication "Technical Memorandum on Noise from Construction Work other than Percussive Piling".

Table 8-2: Estimated Sound Pressure Levels for construction equipment

Construction Activity	Sound Power Level (dBA L_{eq})
Generator	108
Air Compressor	104
Fork Lift	104
Bulldozer	106
Plate Compactor	108
Roller Compactor	108
Excavator	112
Mobile Crane 50 Ton	112
Mobile Crane 30 Ton	112
Welding Machines	112
Grader	113

Source: Technical Memorandum on Noise from Construction Work other than Percussive Piling", Environmental Protection Department, Government of Hong Kong

8.3.3.2 Impact assessment during construction phase:

Noise prediction for construction activities in the proposed project was derived using CUSTIC 3.2 modelling software. The worst case scenario is described wherein all equipment (shown in table 8-2) having typical sound pressure level for each equipment are running at the same time. The total estimated sound power level from all mentioned equipment is 120.7 dB(A).

It is clear from (figure 8-3) that the construction activities will generate relatively low noise levels and should be able to continue around the clock without exceeding the maximum allowable limit (50dB(A)) at the nearest noise sensitive locations, which are approximately 2 km from the site. Further, these levels are lower than the World Bank limit (World Bank, 1998) for daytime (55dB(A)) and night-time (45dB(A)) for residential areas. Additionally, based on the noise prediction shown in figure 8-3, the noise due to construction activities alone (without adding background) is expected to be less than 50% of the national standard in the nearest community receptors. For example, the predicted level is about 29dB(A) at both Umm Qasr General Hospital area and the Primary school.

Further, the modelling results (figure 8-3) showed that the highest noise level due to construction activities is predicted to be about 50 dB(A) at the project boundary fence. As for the cumulative noise levels at Project boundary fence line as shown in (table 8-3), the results show that all levels at all four receptors are also below the national limit and WB/IFC guideline (70dB). The highest value of 68.5dB(A) is at receptors 2 and 3, which is slightly less than the national limit and World Bank limit of 70dB(A) for industrial zones.

Table 8-3: Cumulative noise level during construction of Soybean project boundary line

Receptor#	WB-IFC and Iraqi limit	Background Noise level	Project Contribution	Cumulative Noise Level (dB(A))	Above or Below limit
R1*	WB-IFC=70 Iraqi Limit=70	54.0	67.0	54.2	Below
R2*	WB-IFC=70 Iraqi Limit=70	51.0	**68.5**	**51.2**	**Below**
R3*	WB-IFC=70 Iraqi Limit=70	63.0	68.5	64.1	Below
R4*	WB-IFC=70 Iraqi Limit=70	43.0	67.0	43.2	Below
R5**	WB-IFC=55 Iraqi Limit=60	59.0	16.0	59.1	Above WB-IFC***
R6**	WB-IFC=55 Iraqi Limit=60	61.0	11.0	61.1	Above WB-IFC and National limit***

*Industrial area; ** Residential area; *** the values above the limits due to existing high background level. Conservative assumption of all equipment in use at one time likely causes the exceedences, and therefore is not realistic.

An increase in vehicles using the main roads leading to the site would likely occur during the construction period. However, there are no houses or noise sensitive areas in the immediate vicinity of those roads and thus there would be no significant vehicular noise impact to human receptors. Construction traffic should be routed around Umm Qasr residential area to the extent possible to minimize impacts. Construction traffic in or near the city during night-time hours should also be minimized.

Specific potential impact on the noise environment due to the construction activities are summarized in table 8-4 and discussed in the following text.

Table 8-4: Construction phase potential impacts summary

Factor	*NV1* **Impact From Increase of Noise at Receptors**	*NV2* **Impact From Increase of Vibration at Receptors**
Receptor Importance/Sensitivity	*Medium*	*Medium*
Frequency	*Frequent*	*Infrequent*
Likelihood	*Certain*	*Certain*
Extent	*Local*	*Local*
Duration	*Short*	*Short*
Magnitude	*Low*	*Low*
Effect	*Negative*	*Negative*
Action	*Direct*	*Direct*
Significance	*Low*	*Low*

- *Impact from Increase of Noise Levels at Receptors- Construction*

Noise levels will be variable during the construction phase as different stages of the work are undertaken. The construction phase will include the use of various equipment including a generator. However, it is unlikely that all equipment would be at use simultaneously, and thus the modelled values above are unreasonably high. The predicted noise levels are expected to be acceptable under the Iraqi standards and WB-IFC guidelines and it is considered unlikely that adverse noise impacts will arise at any nearby noise sensitive premises.

Impact NV 1- Low magnitude and Low Significance

- *Impact from Increase of Vibration Levels at Receptors- Construction*

It is expected that there will be variable levels of activity during the construction phase. The use of each moving equipment and compaction machines during the early work program will cause additional levels of vibration in the area. There will also be an increase in number of construction plant and heavy goods vehicles (HGV) in the project site, which will all have an impact on vibration level in the area. Vibration levels are expected to be acceptable and given the significant distance (> 2 Km) to sensitive receptors the overall impact is considered to be low.

Impact NV 2- Low magnitude and Low Significance

In conclusion, noise emission during construction is expected to be minimal at the nearest sensitive receptor and construction activities are not presumed to cause any significant impacts to the surrounding environment. Accordingly, no noise control is considered necessary.

However, although noise emission during construction is expected to be minimal and is not presumed to cause any significant impacts to the surrounding environment, it is expected that the selected contractors would be required to adhere to good working practices so as to minimise noise impacts on both the health and welfare of the onsite workers, and the general environment. The following general measures may be implemented to minimise effects of construction noise:

- Select inherently quiet equipment wherever possible.
- Ensure machinery is properly maintained, particularly engine exhaust silencers.
- Machinery should be turned off when not in use (not left idling).
- Where practicable, make use of screening afforded by spoil stockpiles for high noise activities.
- Scheduling certain high noise emitting works to more acceptable times of day.

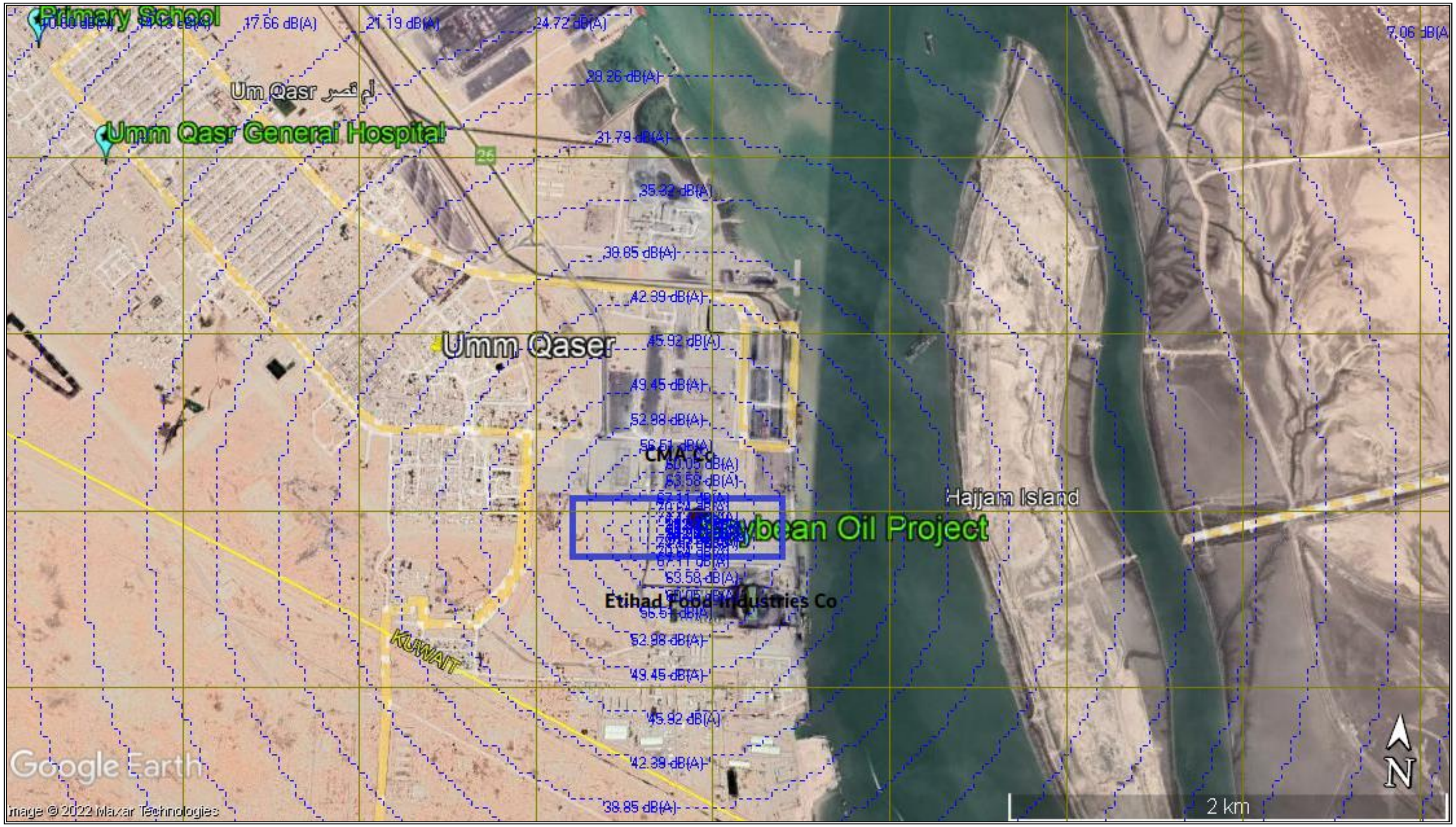


Figure 8-3: Predicted Noise Level Contours – Construction scenario at Soybean Oil project

8.3.4 Commissioning Noise

There will be few significant sources of noise during commissioning phase. The highest noise levels would be expected during the commissioning of any industrial new project, if high pressure steam pass through pipe is used, which is eventually discharged directly to the atmosphere. The estimated noise level at the nearest residential area would represent a significant increase in noise level over existing. However, it should also be expected that these events will be of short duration and would not occur under normal operation and are usually confined to daylight hours.

Table 8-5: Commissioning phase potential impacts summary

Factor	*NV3* **Impact From Increase of Noise at Receptors**
Receptor Importance/Sensitivity	*Medium*
Frequency	*Frequent*
Likelihood	*Certain*
Extent	*Local*
Duration	*Short*
Magnitude	*Medium*
Effect	*Negative*
Action	*Direct*
Significance	*Low*

Impact from Noise – Steam Blows and other commission works – Medium Magnitude, Low Significance

8.3.5 Operation

8.3.5.1 Potential Sources of Impacts:

Under the normal operations of Soybean project, noise will be emitted mainly from the following main noise sources in this project:

- Preparation Unit (screening, crushing, etc) with combined noise level of 70 dB(A) (with maximum level of 75 dB(A)),
- Boiler room with combined noise level of 80 dB(A),
- Air compressors with combined noise level of 65 dB(A) (with maximum level of 75 dB(A)),
- Generators with combined noise level with a maximum value of 75 dB(A)

The locations of the main noise sources are shown in (figure 8-4). Normally, the Soybean Oil facility will be in continuous operation and overall noise levels would be expected to be similar throughout the day and night. Potentially, the most critical period with respect to adverse public reaction would be at night, and this is reflected in the regulatory standards, which have lower limits for night-time in residential areas.

8.3.5.2 Impact assessment during operation phase:

CUSTIC 3.2 noise-prediction software was used for the prediction of noise due to operation of preparation unit, boilers, air compressors and generators at project site and its impacts of surrounding environment. The noise modelling software usually predicts the noise levels at receptors after considering various attenuation effects (e.g., distance, ground, atmospheric, etc) and screening effects due to buildings, tanks etc.

The noise emission contours from the project have been predicted and mapped over the project site and the surrounding areas as shown in (Figure 8-5). The noise levels represent the anticipated normal level from the main three sources within soybean oil project site.

The predicted noise level from the operation of the main noise sources (preparation unit, boiler room, air compressors and generators) at the facility fence line is between 6.3 to 28.75 dB(A) as maximum without adding the background, presented in (Figure 8-5). However, even after adding the existing noise background level at receptors the cumulative noise levels are below the national limit of 75 dB(A) for industrial areas as shown in (table 57) or slightly lower than the limit at point 2. However, Soybean Oil project may install control measure for some noise sources (such as acoustic insulation and 3m barrier) and accordingly the noise level at the fence will be further reduced.

The predicted noise level (without adding the background) at the nearest residential location is less than 3.5 dB(A) which would not be intrusive. The proposed project would therefore be in continual compliance and there would be little likelihood that the sensitive receptors in question will be affected by proposed project. Similarly, noise levels at the hospital would be even lower and therefore in compliance.

Typically, to protect employees' hearing, the plant will meet Occupational Health and Safety standards to confine noise levels on the site to 85 dB(A) at 1 meter from any item of equipment to which personnel would have access. Unless noise control measures are implemented, there might be some areas onsite (designated as "Restricted Areas") where noise levels could exceed 85 dB(A). In these specified work areas, the use of appropriate hearing protection is mandatory.

Based on the preceding discussion, the impact from the operation of Soybean Oil project would be considered of

***Low magnitude and low significance*.**

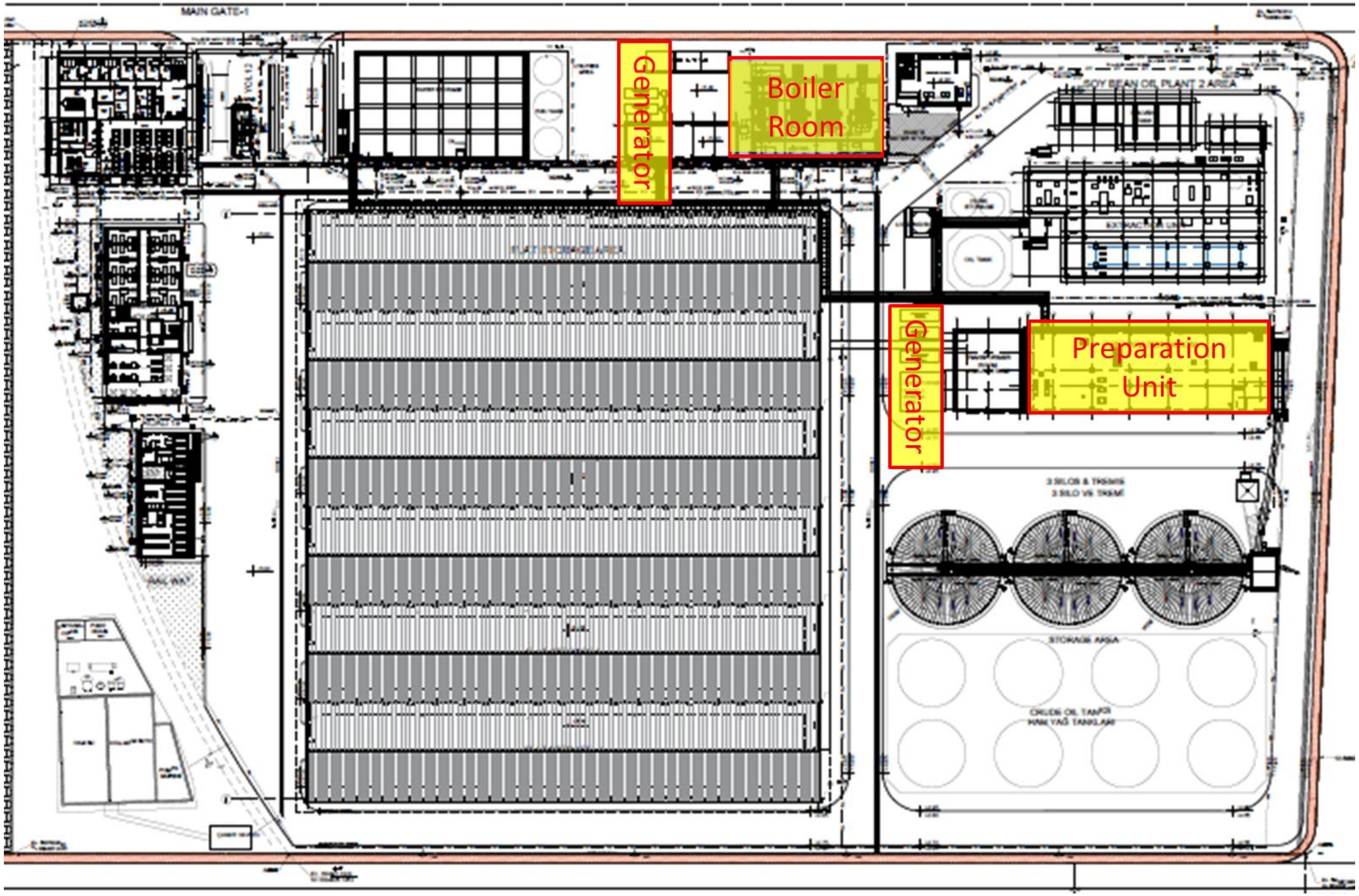


Figure 8-4: Locations of main operational noise sources at Soybean Oil project site

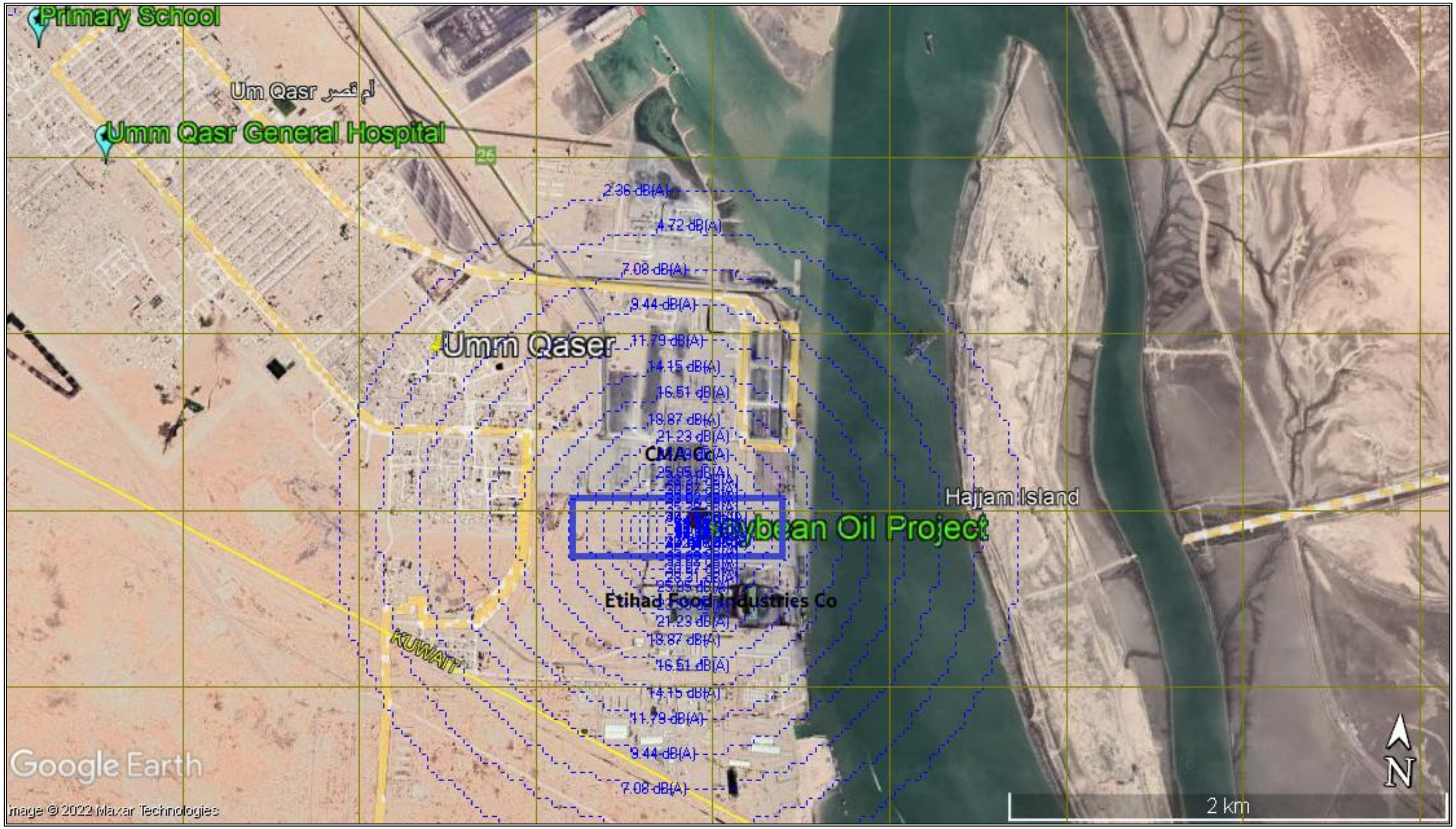


Figure 8-5: Predicted Noise Level Contours – Operation scenario at Soybean Oil project

Table 8-6: Cumulative noise level during operation of Soybean Oil Project at Project's boundary line					
Receptor#	WB-IFC and Iraqi limit	Background Noise level	Project Contribution	Cumulative Noise Level (dB(A))	Above or Blow limit
R1*	WB-IFC=70 Iraqi Limit=70	54.0	28.0	54.1	Blow
R2*	WB-IFC=70 Iraqi Limit=70	51.0	32.2	51.1	Blow
R3*	WB-IFC=70 Iraqi Limit=70	63.0	32.0	63.1	Blow
R4*	WB-IFC=70 Iraqi Limit=70	43.0	28.0	43.1	Blow
R5**	WB-IFC=55 Iraqi Limit=60	59.0	< 2.4	59.1	Above WB-IFC***
R6**	WB-IFC=55 Iraqi Limit=60	61.0	< 2.4	61.1	Above WB-IFC and National limit***

*Industrial area; ** Residential area; *** the values above the limits due to existing high background level

In conclusion, Soybean Oil project may need to install acoustic chambers and sound insulation for any equipment installed or to be installed in the future as part of the project process with a potential sound level in excess of 85dB in order to comply with the National and World Bank IFC noise requirements.

Table 8-7: Operation phase potential impacts summary	
Factor	*NV4* **Impact From Increase of Noise at Receptors**
Receptor Importance/Sensitivity	*Medium*
Frequency	*Frequent*
Likelihood	*Certain*
Extent	*Local*
Duration	*Continuous*
Magnitude	*Low*
Effect	*Negative*
Action	*Direct*
Significance	*Low*

Overall Impact from Noise–Low Magnitude, Low Significance

8.3.6 Emergency Plant Operations

Though not specifically stated, noise level limits are considered to apply to the normal operation of the project. For non-normal (e.g., start-up, shutdown) or emergency conditions which would only occur for relatively short periods during commissioning and operation, some increase in noise limits would normally be expected. In our opinion, a short-term increase of 5 to 10 dB(A) during the day and 5 dB(A) at night may be acceptable to inhabitants of nearest residential locations.

During emergency conditions, it is inevitable that there will be an increase in noise levels due to operation of some sources (such as steam venting). However, such events would be expected to be infrequent and high gas flow rates would reduce with time as the system is depressurised.

Impact from Noise during emergency– Medium Magnitude, Low Significance

8.3.7 Decommissioning

At the end of the functional life of the project, the facility would be decommissioned. The decommissioning phase activities are likely to increase noise and vibration levels in the immediate vicinity of the site with the associated various activities (e.g., excavation, tank removal, site clearing, grading and levelling). The noise and vibration associated with the decommissioning process will be largely similar to that experience during construction.

Overall Impact from Noise during decommissioning–Low Magnitude, Low Significance

8.4 Mitigation

8.4.1 Overview:

In accordance with the approach described in section 4- Impact Assessment Criteria and methodology, mitigation measures are identified where impacts are determined to be of medium or high significant. The project site is although generating noise and vibration as a result of activities, is a relatively significant distance from the nearest sensitive receptors. Thus, the impact assessment has identified no impacts of medium or high significance and no mitigation measures associated with these to be implemented. Nonetheless, the following recommendations are made to address low significance impacts identified.

8.4.2 construction phase:

The construction contractor should undertake a noise and vibration assessment and shall ensure compliance with applicable national and WB-IFC standards (whichever ones are stricter). This assessment should include work to establish and ensure acceptable vibration and air overpressure during all construction activities. The contractor should develop, implement and maintain a construction phase Environmental Emergency Response Plan (EERP) and a Construction environmental Management Plan (CEMP). These plans will detail responsibilities and procedures for environmental and emergency response management during construction, and include the following:

Noise Management Plan- detailing measures to control noise and vibration emissions during construction and should consider:

- Monitoring to verify construction plant comply with the national standards and regulations for noise
- Reduce noise level for nighttime construction
- Reduction of vehicle movements to minimize noise

All construction work should be undertaken using best practicable means following guidance such as BS 5228:2009- "Code of practice for noise and vibration control on construction and open sites", or other internationally recognized guidance for the control of noise and vibration.

Temporary sound-proof enclosures and anti-vibration measures should be employed to reduce noise levels on site, in keeping with the results of the updated noise and vibration model as necessary.

8.4.3 Commissioning:

During commissioning, the contractor should undertake a noise exercise to ensure compliance with required standards and guidance. The noise monitoring exercise will enable any necessary mitigation measures to be identified. Noise measurements would continue until it is established that there is full compliance with the required standards and limits.

8.4.4 Operation:

Soybean oil facility should establish a program of noise monitoring during the early months of operation. This will include monitoring of noise at the boundary of the project site to determine compliance with applicable standards and guidelines and assess the need for mitigation. As appropriate, noise mitigation measures such as the creation of screening mounds or installation of temporary noise barriers could be adopted.

Soybean oil facility shall develop, implement and maintain an Environmental Emergency Response Plan (EERP) and Environmental Management and Monitoring Plan (EMMP) for the operational phase, to further protect against impact from noise and vibration. These plans will detail responsibilities and procedures for environmental and emergency response management during operation, and shall include the following as a minimum:

- Noise monitoring program and procedures for the implementation of such to demonstrate compliance with ambient noise standards

- Monitoring of vibration levels and air over pressure levels to demonstrate these meet regulatory/good practice requirements;

- Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of complaint; and

- Maintenance procedures of all equipment in place to minimize noise from equipment

The operator should undertake regular audits on the above management plans to confirm their ongoing effectiveness.

8.4.5 Closure/Decommissioning

Prior to decommissioning/closure soybean oil facility should evaluate potential noise and vibration sources associated with planned decommissioning activities, and establish measures to ensure these activities comply with the necessary noise guidelines at the sensitive receptors.

9 WASTE & MANAGEMENT

9.1 Introduction

Waste management is an integral part of this ESIA , and it is important to evaluate waste impacts related to Soybean Oil project within Umm Qasr area resulting from waste generation, storage and management activities during the lifetime of the project. A review of existing waste facilities is part of the baseline survey to determine BEST waste disposal options for the Project as per information relating to the expected waste generation for Soybean Oil project during construction, commissioning, routine operation, and decommissioning. Sources inside the project facility with potential for release of contaminants were examined as well as cost-effective options to reduce, contain or mitigate adverse effects of waste streams.

9.2 Baseline

9.2.1 Overview

The Iraqi Ministry of Health and Environment has issued a number of laws related to waste management (Industrial – Municipal) including collection, removal and disposal of waste, and protecting land from pollution due to waste disposal especially hazardous waste and overuse of chemicals, fertilizers and pesticides. Industries exert efforts to reduce generation of such waste by adoption of clean, energy efficient industrial processes using lesser quantities of raw material and revert to recycling to the fullest, especially with rising cost of waste disposal in the country and limited treatment/disposal options and legal liabilities associated with long term effects of dumped wastes, and some environmentally oriented industries in the Republic of Iraq even consider waste as a resource and a revenue source.

As per EHS Guidelines for Vegetable Oil Production and Processing (2015), vegetable oil processing activities generate significant quantities of organic solid waste, residues and by-products. The amount of waste generated depends on the quality of the raw materials and on process efficiency. Wastes, residues, and by-products may be used for producing commercially viable by-products or for energy generation. Other solid wastes from the vegetable oil manufacturing process include soap stock and spent acids from chemical refining of crude oil; spent bleaching earth containing gums, metals, and pigments; deodorizer distillate from the steam distillation of refined edible oils; mucilage from degumming; and spent catalysts and filtering aid from the hardening process.

9.2.2 Local waste management facilities

Existing and future waste management facilities in Basra province were determined in order to assess capabilities of available waste treatment services within the boundaries of Umm Qasr area including operation, methods to minimise environmental impacts and conformance to national and international protocols, in order to determine the site's suitability for the disposal of wastes arising from the proposed project.

There are 18 companies that can manage and handle the waste management in Iraq and the address with more details on each company is listed in below table:

Table 9-1: List of waste management companies in Iraq

#	Company name and address	Permitted activities
1	Sama Karam Iraq Co. Basra, Iraq k.towaina@gmail.com Khalidtoowaina@yahoo.com Tel:077090690-07806311718-07833966888	Treatment and disposal of chemical and industrial wastes (solid and liquid wastes)
2	Zain AlShahad for General Trading Co, Misan, Iraq info@zainalshahad-gro.com zainalshahad.2005@gmail.com Tel:07801753824-07700039744	-Storage and handling used batteries, oil and tires -treatment of certain chemical wastes -used chemical containers
3	Directorate for treatment and disposal of hazardous chemical and biological wastes Basra, Iraq	- Two incinerators for the disposal of solid and liquid hazardous wastes. The rated capacity of each is 30 tons per day -A special system for washing contaminated containers -treatment of liquid wastes using different chemical methods - Drum storage area for liquid wastes
4	Arad AlHadarat Co, Basra, Iraq info@civi-land.com, info@civi-land-int.com Tel:07830506575-07830508577	-Construction of open pond built with polyethylene liner - Treatment for recovering oil and using oil water separator and -Building evaporation pond -Treatment of solid waste such as contaminated soil and used oil using some approved chemicals and biological method, other approved ones.
5	Treatment of laboratory wastes, Baghdad, Abu-Guraib, Iraq	Treatment of laboratory wastes using special advanced system
6	A station for treatment and disposal of hazardous chemical and biological wastes (Mr. Ibrahim Ali Hadi),	- Incinerator for the disposal of hazardous chemical and biological wastes. The rated capacity of the incinerator is 2 tons per day

	Dhi Qar, Iraq	- Incinerator for the disposal of organic and non-organic liquid wastes. The rated capacity of the incinerator is 2 tons per day - Treatment of contaminated soil using biological methods
7	Jawharat AlSalam Co for treating and disposal of chemical wastes, Baghdad, Iraq Tel: 07711134111	-Construction of treatment pond (with high density polyethylene liner) - Single-lined evaporation ponds for the disposal of non-hazardous liquid wastes -Treatment of chemical and biological solid wastes -Treatment of contaminated soil
8	Directorate for treatment and disposal of hazardous chemical and biological wastes, Baghdad, AlTawitha info@scbma-lab.gov.iq	-Incinerator for the disposal of medical wastes. The rated capacity of the incinerator is 500kg per day. - Incinerator for the disposal of solid and liquid hazardous wastes. The rated capacity of the incinerator is 30 tons per day. - A system for cleaning contaminated containers with operating capacity of 200 pieces/day - Neutralization capabilities for the treatment of acidic and alkaline liquid wastes - A unit for treating liquid waste - Has a permit for transporting wastes
9	RSK Co, Basra, Iraq Office@btg-btl.com Office@btgworld.com Tel:07812369044	The company has the following treatment methods: - Centrifugal decanter system for separation of pure oil, water and sediment phases from waste oil and hydrocarbon sludge -Biological methods -Thermal treatment method -Air sparge and Bio Sparge with SVE -Skimmer technique for contaminated sites - Removal and collection of asbestos
10	Sweden Seabsyan Co, Kirkuk, Iraq info@seabsyan.com	Treatment of pollution caused by oil spill using physical and biological methods
11	AlFaiha Co. for oil services and hazardous wastes disposal and radioactive materials, Basra, Iraq	The company has the following capacities: -Construction of landfills for disposal of solid hazardous wastes; built with HDPE double liner and leachate collection and detection system -Oil water separators

		- Evaporation pond for the disposal of non-hazardous liquid wastes -Treatment of solid wastes -
12	AlMoamar Co. for Oil services, Muthanna, Iraq	Biological treatment for oily wastes
13	Directorate for treating hazardous chemical and biological wastes, Baghdad, Iraq info@scbma-lab.gov.iq	- Physical wastewater treatment -Treatment of contaminated soil using either washing, incineration or biological/chemical methods. -Treatment of contaminated containers
14		
15	Directorate for treating hazardous chemical and biological wastes, Basra, Tuba, Iraq Basra, West Qurna 1 Basra, West Qurna 2 info@scbma-lab.gov.iq	-Biological treatment for hydrocarbons and heavy metals in contaminated soil -
16	AlGhalwa for general trading and engineering consultancy, Basra, Iraq info@Alghalwa.com Tel:07600284443	-Oil skimming method -additives for oil and water separation - Centrifugal decanter system -Washing and treating contaminated containers -biological treatment for contaminated soil - treatment of dry pollution gases -Treatment oil spills and leakage - incineration for waste treatment
17	AlBasra integrated gate for general transportation and environmental services, Basra, Iraq Info2bbcbasrah.com Tel: 07705600362	-Treatment and disposal of hazardous wastes - rinse out contaminated containers - Centrifuge method -Removal and collection of asbestos -Movable incinerator technique
18	Huqool AlTaqa Co for waste recycling and environmental and energy services, Basra, Iraq Husham.alnahi@huqoolaltaqa Tel: 07812999899	-Cleaning and treatment of contaminated containers -treatment of liquid wastes - solid and liquid separation method - Rotating furnace for treatment - Chemical naturalization Unit - Liquid incinerator Unit - treatment of contaminated water -Treatment of oil spill - Waste oil recovery -Oil recovery due to leakage

9.2.3 Industrial Waste Transportation

Hazardous waste transportation resources are available through a number of government-approved contractors, and involves safe transport of bulk loads of liquids, contaminated soils, totes, drums and specific containers for soil, liquids, and sludge.

Transport services are provided in accordance with the regulations of the Iraqi Ministry of Environment and Civil Defence.

9.3 Waste Generated during Project Lifetime

9.3.1 Definition of Waste

Environmental legislation relating to solid waste management is covered by the Iraqi Environmental Regulations and Rules that provides procedures to control the processes of production, transportation, storage, treatment and final disposal of hazardous wastes in the Republic of Iraq.

The Soybean oil Project management understands that the project should also follow Basel Convention rulings that define wastes as "substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law".

9.3.2 Classification of Wastes

According to the Basel Convention (outlined in Chapter 2 – Policy, Legal & Administrative Framework), wastes are classified into two categories, as summarised in (table 9-2).

Table 9-2: Classification of Waste as per Basel Convention

Waste Type	Definition
Non-Hazardous Wastes	*Any wastes that are not hazardous and can be classified as Municipal and Inert wastes.* • *Municipal wastes include garbage, refuse, office wastes and other materials resulting from operations of residential, commercial and municipal, institutional establishments and from community activities.* • *Inert wastes are neither biodegradable nor chemically active in the natural environment such as glass, concrete building materials, etc.*
Hazardous Wastes	*Those wastes which by virtue of their concentration of constituents and characteristics (e.g., ignitibility, corrosiveness, reactivity, toxicity, mutagenicity, radioactivity, etc.) pose a hazard to human or environmental*

Table 9-2: Classification of Waste as per Basel Convention	
Waste Type	**Definition**
	health and well-being if improperly managed. Any solid waste for which extract concentration exceeds the USEPA leachate (1) concentration limit for toxicity of a particular species will be considered toxic and therefore shall be classified as hazardous. In case of doubt, a leachate test is required to determine the hazardous nature of a particular waste. This will determine the appropriate waste disposal options available
Notes: *(1) Extraction by Toxicity Characteristics Leachate Procedure (TCLP) as detailed in USEPA 40CFR Part 261 subpart D, section 261.35, dated 16 August 1991.*	

Other definitions of hazardous, non-hazardous, municipal wastes and inert wastes are given in table below.

Table 9-3: Classification of Waste as per the Iraqi Authority and international organizations	
Waste Type	**Definition**
Hazardous Wastes	*any solid, semi-solid, liquid, or contained gaseous waste, or combination of such wastes, which may because of its quantity, concentration, physical or chemical characteristics pose a hazard or potential* *hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed. ~~These wastes shall also include:~~*
Non-Hazardous Industrial Wastes	*Any solid, liquid, semi-liquid or contained gaseous materials or wastes resulting from industrial, mining, and agricultural operations and sludge from industrial, agricultural or mining, water supply treatment, wastewater treatment or air pollution control facilities, provided that they are not hazardous, municipal or inert wastes as otherwise defined in these Regulations.*
Municipal Wastes	*They include garbage, refuse, food waste, office waste, waste vegetation and other decomposable material resulting from operation of residential, commercial, municipal, industrial or institutional establishments and from community activities.*
Inert Wastes	*Any wastes which are not biologically or chemically active in the natural environment, such as glass, concrete and brick materials, broken clay and manufactured rubber products.*

9.3.3 Construction and Commissioning Waste

The estimated solid/liquid wastes, that could be generated during the construction phase of the Soybean Oil project, are listed below (table 9-4) and quantities estimated based on similar projects and scaled according to the projected average construction workforce of about 250 and project material consumption. The following assumptions were made:

- An effective on-site plan for waste reduction will be implemented
- Material and chemical procurement will be minimized to avoid over-stockpiling
- No generation of radioactive wastes
- Broken tools and surplus materials will be part of the scrap waste stream;
- Uncontaminated soil and rock from earthworks on site will not be considered wastes;

- Aqueous liquids/sludge will not be classified as wastes if discharge is permitted by the local Environmental Authority
- All other non-permitted aqueous liquids/sludges will be considered as wastes.

Table 9-4: Solid/Liquid Wastes During Construction

Category/Waste type	Estimated Annual Waste Generated			
	≤1 tonne	≤10 tonnes	≤100 tonnes	≥100 tonnes
Non-Hazardous Combustible Solid Waste				
Paper and cardboard		✓		
Wood (pallets)			✓	
Non-Hazardous Non Combustible Solid Waste				
Sand/shot blast materials			✓	
Transformers		✓		
Empty drums and containers (metal and plastic)		✓		
Insulation		✓		
Plastics: bubble wrap, packaging & bottles		✓		
Domestic Waste				✓
Concrete / re-bar			✓	
Tyres		✓		
Glass	✓			
Caked Bio Sludge	✓			
Scrap Metal		✓		
Hazardous or Potentially Hazardous Solid Waste				
Empty drums (oil/chemical)		✓		
Batteries (Lead-acid)		✓		
Resins	✓			
Oily rags		✓		
Capacitors (containing oil)	✓			
Medical Waste	✓			
Chemical / Paint Containers		✓		
Filters	✓			
Hazardous Liquid Waste				
Waste Chemicals / lab waste	✓			
Cleaning chemicals	✓			
Greases		✓		
Hydraulic fluid		✓		
Oils		✓		
Lubricants		✓		
Diesel		✓		
Paints	✓			
Thinners	✓			
Coatings	✓			
Solvents	✓			
Acids	✓			
Alkalis	✓			
Firefighting agents		✓		

9.3.4 Operations Phase

During the operation phase, Soybean Oil project may generate different types of wastes: the organic and inorganic. The organic wastes can be classified as organic liquid waste or organic sludge waste. The inorganic waste can be classified into inorganic liquid or inorganic solid wastes.

Organic liquid wastes include waste oils, diesel oil, used lubricating oil, laboratory waste, spent solvents, paint wastes. Organic sludge wastes include fuel oil tank sludge, retention pond sludge, effluent basin sludge, spent greases, wastewater sludge, etc.

Inorganic liquid wastes include battery electrolytes and waste chemicals whereas inorganic sludge wastes include industrial wastewater treatment sludge.

Solids industrial wastes (with organic traces) are generated in this project including the following: used batteries (100kg/year), cartridges (10kg/year), oil filters (30 kg/year) and other small quantities of possible wastes.

An organic and inorganic waste inventory spreadsheet identifying type of waste, estimated quantities and suggested method during facility operation phase is provided in (table 9-5) , based on our experience and the information provided by the Project, considering an overview of type and quantity of waste expected during normal operations.

According to (table 9-5) anticipated maximum solid and liquid waste annual volume during the operations phase is distributed in the following manner:

- Non-Hazardous Solid and liquid Waste:
  - Less than 11,000 m^3 / year expected
- Hazardous or Potentially Hazardous Waste:
  - Hazardous waste: less than 10 m^3 / year expected

The operational life of the facility is currently unknown (but estimated to be about 30 years) and may vary depending upon technological and economic developments that cannot be reliably predicted this far in advance.

Table 9-5: Estimated Solid/liquid Waste Generation in Soybean Oil Project		
Main type of waste generated	**Excepted Quantities in tons/Year***	**Suggested treatment/disposal method**
Contaminated wastewater	Less than 160,000	Evaporation
Industrial Wastewater Sludge (dry sludge)	About 122	Landfill or could be used in cement manufacturing
Empty drums	Less than 50	Clean and reuse
Hydrocarbons	Less than 10	Blending, oil recovery for reuse
Oily Sludge	Less than 10	Oil recovery and bioremediation
Used batteries	Less than 1	Acid neutralization and metal recycle
Waste oil	Less than 10	Recycle/reuse
• ** Assuming an average waste density of 1 Ton/m³*		

(Table 9-5) highlights that the largest proportion of hazardous waste will originate from the Effluent Treatment System and is in the form of contaminated wastewater and sludge.

9.3.5 Closure / Decommissioning wastes

The progressive backfill of the site will result in a deficit of material at the end of the life of the project. Decommissioning of the facility can be expected to generate similar wastes to those identified for the construction phase, however it is reasonable to expect relatively higher quantities of contaminated wastes:

- Non-hazardous solid wastes: demolition wastes, scrap metals, packaging (paper, cardboard, plastics), municipal wastes and sanitary wastewater and evaporation pond sludges;

- Hazardous solid waste: demolition wastes; contaminated scrap metals and redundant plant filters, empty oil, grease and chemical containers, contaminated fabrics/ spill absorbents, spent catalyst, spent activated carbon, oily sludge and clinical waste, contaminated soils; and

- Hazardous liquid waste: waste oils, lubricants and fuels, solvents, hydraulic fluid and acids and other chemicals.

9.3.6 Waste Management

Soybean Oil facility will apply an on-site waste management system to take care of all waste needs in an effective and safe manner to avoid over-piling and potential risks if waste is stored for long time periods and main items to be addressed here are as follows:

- Construction/operational related solid and liquid wastes are planned to be disposed of in local waste management facilities in accordance with Iraqi and WB requirements.
- On-site management and storage of such wastes will be in accordance with Iraqi and WB-IFC regulations.
- Wastes will be stored in on-site waste storage facilities as per plot space allocated.
- No on-site waste treatment nor incinerator for the disposal of hazardous and non-wastewater wastes.
- Transport of wastes will be through government approved waste transporters only.

9.4 Impact Assessment

9.4.1 Overview

Evaluation of impacts related to waste generation is summarised hereunder, the magnitude and significance of which for each impact are also stated below. Potential environmental impacts that could result directly from waste management relate to releases of waste substances, the hazards presented by such releases and the effect that the releases may have on other processes. Main releases associated with waste management are emissions to air, liquid and solid discharges.

The releases may be controlled or uncontrolled. The latter can be split into "unavoidable" releases (such as small losses during storage or handling) or accidental releases (such as a pipe burst, drum spills, etc.). The type of release will depend upon the phase of site development and the location of the wastes. The control or management of risks will be more difficult on third party sites, e.g., landfill sites and private incinerators, though they have been permitted to operate such facilities.

A review of existing landfill sites in Basra City, indicates that most waste management facilities have basic controls in terms of fencing, landfill lining, or leachate collection systems for Class I and II landfills, with a written schedule for inspecting waste storage and treatment areas and associated monitoring, safety and emergency equipment.

Hazards that may occur as a result of a release include the contamination of natural receptors, e.g., the physical environment (i.e., soil and groundwater), the marine environment, the biological environment of the affected area and the atmosphere, and adverse impacts on human health and safety.

Waste management activities may also contribute to other environmental impacts, albeit indirectly. The storage of wastes on site (especially if prolonged) may impede operations on site and thereby increase the risk of other incidents. Transport of wastes offsite results in additional traffic (though minimal), the impact of which will be influenced by vehicle condition, transport routes and proper waste containment.

9.4.2 Construction

9.4.2.1 Overview

Construction wastes include debris, waste materials, broken tools, off-spec raw material, empty packaging, consumed cans/tins, pallets, general refuse and a range of hazardous solids/liquids, contaminated soil and rock, lubricants, materials contaminated with hydrocarbons, used and surplus grease, paints, solvents, diesel and adhesives, used batteries, etc.

Impacts: releases of material, contamination of roads from mud on transport vehicle tyres, odours from hazardous wastes, noise, dust and air emissions from trucks.

Range of impact: Low: if proper waste management procedures are applied for storage on site, collection, transportation and disposal to prevent releases.

Potentially affected resources: soil, groundwater and air quality, terrestrial biological and human resources

9.4.2.2 Generation of Non-Hazardous and Hazardous Wastes

Non-Hazardous wastes:

The estimated quantity of non-hazardous waste during construction phase will be relatively small (<70 tonnes). This quantity of waste will be transported offsite in government-approved facilities since the project has no onsite facilities for waste management during construction.

Risk: Transport impacts - air quality - noise - human health - soil and groundwater .

On-site storage/and off-site disposal:

Impacts: low, (if waste material is non-hazardous, short-term effect). On-site waste storage will be as per national and WB requirements. Off-site disposal increases likelihood of windblown and subsurface contamination (through rainwater leachate), which may result in future liabilities on the project management.

9.4.2.3 Hazardous Wastes:

Hazardous waste quantities during construction are relatively low in quantity (less than 50 ton) and are comprised of: empty chemical / paint containers, used fuel, waste fluids/lubricants/additives for machinery, diesel, greases, waste oils.

Impact: Storage of generated liquid and solid hazardous wastes may result in adverse effects on-site and contamination of land; sub-surface soil and groundwater.

Part of the construction hazardous waste types could be returned to supplier if possible, for recycling.

Other waste should be stored on-site in appropriately labelled containment facilities until disposal time.

Solid hazardous waste will be transported to local double-lined Class I landfills.

Storage of waste in government-approved facilities that have proper waste storage provisions for storage of liquid, drummed, ignitable or reactive wastes until time of disposal.

On-site storage:

Impact of on-site storage of hazardous waste on human health and the environment is expected to be low for hazardous waste, given the fact that Soybean oil project management will follow proper HSE procedures.

Waste materials stored on-site (hazardous, long-term effect, low quantity): the mobility of liquid waste may require special care.

On-site storage of such wastes will be undertaken in accordance with the national authority requirements.

Short term storage period for liquid hazardous wastes may not increase likelihood of subsurface contamination, with low risk in possible future liabilities. ***(low for solid wastes – Low for liquid wastes).***

Off-site disposal:

Off-site disposal is the only option for the project waste, and impacts related to off-site disposal of hazardous waste will be low, given the small quantities of materials involved (hazardous, short-term effect, low quantity). Since disposal management and proper control measures and monitoring wells, increase of likelihood of potential windblown litter and dust, however subsurface contamination is of low significance since all landfills operating in Basra city should be designed with high standards, so potential future liabilities are a limited.

Transport off-site:

Transfer of hazardous construction waste material implies the possibility of road accidents and road-blown litter and semi-solid waste contaminating main roads, with the potential for release during transit and potential subsurface soil, surface water and groundwater contamination. The magnitude of the impact related to transport of hazardous waste on human health and the environment is expected to be low, given the low quantities of materials involved (hazardous, short-term effect, low quantity). Likelihood of occurrence for such events is low; but duration of impact, potential pathway to receptors and potential liability associated with the clean-up of receptors the significance of this impact is medium. The significance of this impact will decrease once wastes are properly disposed off-site.

- ***Impact from Hazardous and Non-hazardous Construction Wastes during storage and Transport (WM1) – Low Magnitude, Low Negative Significance***.

9.4.2.4 Environmental Degradation Due to Incorrect Storage / Spillage

Incorrect storage of both hazardous and non-hazardous waste has the potential to contaminate soils, and surface water, generate litter and encourage vermin. It also presents a risk to wildlife. The EPC contractor is required to generate a Site Waste Management Plan (SWMP), and to store wastes generated during construction and commissioning in accordance with the requirements of Iraqi Environmental regulations that are related to waste control and waste storage and handling, therefore the potential impact is considered to be of low significance. Impact of spills on the soil, groundwater and surface water are addressed in Section 6 Terrestrial Environment and Section 10 Water Quality Management.

Impact of degradation Due to Incorrect Storage / Spillage during construction (WM2) - Low Magnitude, Low Negative Significance

Table 9-6: Construction Phase- Impacts Assessment due to Waste Storage, Transport and Spillage

Factor	WM1	WM2
Receptor Important/Sensitivity	Low	Medium
Frequency	Frequent	Frequent

Likelihood	Unlikely	Unlikely
Extent	Provincial	Local
Duration	Short	Short
Magnitude	Low	High
Effect	Negative	Negative
Action	Direct	Direct
Significance	Low	Low

9.4.3 Commissioning

9.4.3.1 Overview

Commissioning will involve initial start-up of plant operations and testing of all process equipment, including storage tanks and pipes. The environmental impacts of wastes generated during this phase are anticipated to be minimal given the nature and estimated quantity of materials involved.

9.4.3.2 Non-Hazardous Wastes

Commissioning phase will generate non-hazardous waste that requires disposal offsite at facilities that are government- approved, with small risk of transport related impacts; air quality, health, noise. Waste storage on site presents a low risk to soil and groundwater.

On-site storage/off-site disposal: estimated amounts of non-hazardous waste generated during this phase is expected to be much lower than the construction phase waste, since commissioning period will be significantly shorter than the construction period. The likelihood of the impact of non-hazardous waste disposal during the commissioning phase is lower than the construction phase (Low Magnitude/Low Significance).

9.4.3.3 Hazardous Wastes

Hazardous wastes may be generated from unexpected releases anytime at commissioning phase. Waste oil, lubricants, resins, batteries, paints, solvents and oily rags, and all wastes are to be sent to government-approved facilities for treatment/recycling/disposal.

On-site storage: Onsite storage impacts is low for hazardous waste, given the materials involved and the mobility of liquid waste, and on-site storage of such wastes will be undertaken in accordance with national and international requirements. The storage period expected for liquid hazardous wastes is relatively short so the likelihood of potential subsurface contamination is low keeping down any potential future risk. Significance of the impact is Low for solid wastes and Low for liquid wastes.

Off-site disposal: the magnitude of the impact related to off-site disposal of hazardous waste on human health and the environment is expected to be low, given the materials involved (hazardous, long term effect, low quantity). The uncertainties related to disposal management and environmental control (e.g., monitoring wells not operational) increase the likelihood of potential windblown and subsurface contamination, which could lead to potential future liabilities. This affects the significance of the impact, which is considered low.

Transport off-site: impact is low to medium, given materials involved (hazardous, long term effect, low quantity). Duration of the impact, potential pathway to receptors and potential liability associated with the clean-up of receptors the significance of this impact is medium. The significance of this impact will be lower after waste is transported off-site for safe treatment/recycling/disposal.

Impact from Hazardous and Non-hazardous Commissioning Wastes during storage, transport and disposal (WM3) – Low Magnitude, Low Negative Significance.

Table 9-7: Commissioning Phase- Impacts Assessment due to Waste Storage, Transport, and disposal

Factor	WM3
Receptor Important/Sensitivity	Medium
Frequency	Frequent
Likelihood	Unlikely
Extent	Local to Provincial
Duration	Short
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

9.4.4 Operation

9.4.4.1 Overview

Soybean Oil project will start operations phase and will begin producing commercially, with relatively small quantities of hazardous wastes generated, that is in addition to non-hazardous wastes and negligible quantity of hazardous waste from office/mess facilities.

Low environmental impact of wastes is assumed, though it may be lowered through proper mitigation measures on-site to ensure that waste is properly managed from source to end-point at governmental approved disposal facility. Trucks hauling wastes will also generate noise, dust and air emissions, potentially affecting terrestrial, biological and human health. Landfilled waste has potential to impact soil and groundwater, and impacts can be controlled by proper environmental controls: leachate systems – landfill liner design - groundwater sampling – adequate landfill operations.

9.4.4.2 Generation of Non-Hazardous and Hazardous Wastes

9.4.4.3 Non-Hazardous Wastes

There are two main types of non-hazardous wastes generated by this projet. First type is domestic wastes whereas the second type is wastewater treatment sludge. Both non-hazardous wastes types will be disposed of in government-approved facilities. The theoretical amount of domestic non-hazardous solid waste (packaging waste, paper waste, plastic waste, glass waste, etc.) generated during the operations phase will vary depending on the number of personnel and production to be employed in the enterprise is calculated below. Due to the workers who will work in the project site, there will be domestic solid waste generation. The amount of solid waste originating from the 217 personnel who will work in the enterprise; Solid Waste Generation Amount = 1.15 kg/day-person x 217 persons/day = 250 kg/day

Solid Waste Generation Amount = 250 kg/day x 25 days/month x 12 months/year = 75 tons/year

These wastes will be stored in garbage containers and disposed of as indicated by the port authority and relevant laws.

On the other hand, the wastewater sludge will be about 122ton/year and will be either disposed off in landfill or could be used in manufacturing cement or other construction material.

<u>On-site storage/off-site disposal:</u> Disposal of such wastes will take place at governmental approved site, and the only disposal option is landfilling implies that impact at operations phase is (low Significance).

Impact from On-Site Storage and Off-Site Disposal of Non-Hazardous Operations Wastes – Low Magnitude, Low Negative Significance

9.4.4.4 Hazardous Wastes:

The hazardous solid wastes to be generated at the facility during the operation phase will be relatively of low quantities (less than 50 ton per year) and comprise of: organic wastes, empty chemical / paint containers, consumed fuel, waste fluids/lubricants/additives for machinery, diesel, greases, waste oils.

Impact: Storage of generated liquid and solid hazardous wastes may result in adverse effects on-site and contamination of land; sub-surface soil and groundwater.

Part of the construction hazardous waste types could be returned to supplier if possible, for recycling.

Other waste should be stored on-site in appropriately labelled containment facilities until disposal time.

Solid hazardous waste will be transported to local double-lined Class I landfills

Storage of waste will be in government-approved facilities that have proper waste storage provisions for storage of liquid, drummed, ignitable or reactive wastes until time of disposal.

On-site storage/off-site disposal: Disposal of such wastes will take place at government-approved facility, and the only disposal option is landfilling implies that impact at operations phase is (medium Significance).

Impact from Hazardous and Non-hazardous Wastes during storage and Transport (WM4) – Low Magnitude, Low Negative Significance.

9.4.4.5 Environmental Degradation Due to Accidental Events

There is potential for accidental events during the operation of the Project which result in the release of hazardous substances. The uncontrolled release of hazardous waste from a storage area has the potential to have a negative impact on the environment through contamination of soil, surface water and groundwater, and wildlife.

Accidental release of wastes could be realised during the movement of materials on or off-site or through the use of inappropriate containers, overfilling, or container damage. The accidental release of wastes could contaminate the ambient air quality, contaminate water or soils.

Impact of degradation Due to Incorrect Storage / Spillage during Operation (WM5) - Low Magnitude, Low Negative Significance

Table 9-8: Operation Phase- Impacts Assessment due to Waste Storage, Transport and Spillage

Factor	WM4	WM5
Receptor Important/Sensitivity	Medium	Medium
Frequency	Frequent	Frequent
Likelihood	likely	likely
Extent	Provincial	Local
Duration	Medium	Medium
Magnitude	Low	High
Effect	Negative	Negative
Action	Direct	Direct
Significance	Low	Low

9.4.5 Decommissioning

9.4.5.1 Overview

Decommissioning will involve dismantling of installations, equipment, buildings as well as removal of excess raw materials and wastes and may also involve demolition of whole plant. Waste generated during the decommissioning phase may be similar to waste generated during the construction phase.

Non-Hazardous Wastes

Non-hazardous waste will be stored on site and disposed of at an authorised facility within Basra province.

<u>On-site storage and off-site disposal:</u> Impacts are low, given the low quantity, characteristics, hazardous constituents of wastes (non-hazardous, short term effect), though on-site storage of wastes will be temporary and significance of impacts is low.

Hazardous Wastes

Decommissioning works will include minimal hazardous waste generation including obsolete machinery, scrap piping, sludge, contaminated tools and expired equipment, used oils, surplus items, consumed lubricants and solvents. Hazardous waste is temporarily stored on-site and disposed of at a government-approved facility.

<u>On-site storage</u>: Impacts by onsite storage are medium for solid waste and high for liquid waste, and wastes will be managed as per national and WB requirement. Short term storage for liquid hazardous wastes may increase likelihood of potential subsurface contamination, which could lead to potential future risk, and impact is low for solid wastes and high for liquid wastes.

<u>Off-site disposal</u>: Off-site disposal of hazardous waste on human health and ambient environment is medium, (hazardous wastes, long term effect, low quantity). Waste disposal management and environmental control will be as per national and international requirements in governmental approved facility (e.g. monitoring wells, landfill design and operational procedures of waste facilities) may lower likelihood of potential windblown and subsurface contamination, reducing potential future risk and significance of the impact, which is considered low.

<u>Transport off-site</u>: The magnitude of the impact is expected to be low, given the materials involved (hazardous, long-term effect, low quantity). The duration of the impact, potential pathway to receptors and potential liability associated with the clean-up of receptors the significance of this impact is low to medium. The significance of this impact will decrease as soon as waste leaves the project site and reaches the approved waste management facility.

Impact from Hazardous and Non-hazardous Decommissioning Wastes during storage, Transport and Disposal (WM6) – Low Magnitude, Low Negative Significance.

Table 9-9: Decommissioning Phase- Impacts Assessment due to Waste Storage, Transport, and Disposal	
Factor	**WM6**
Receptor Important/Sensitivity	Medium
Frequency	Frequent
Likelihood	Unlikely
Extent	Local
Duration	Short
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

9.4.6 Emergency Incidents

9.4.6.1 Overview

Emergency incidents may cause serious environmental impacts related to wastes, and some may be local on-site, while other incidents may occur off-site during transit or at disposal facility, thus creating a medium impact, mainly from dust particulates causing a certain degree of air pollution, as well as possible impacts on groundwater due to uncontrolled leachate events. Some accidents may result in contamination that needs clean-up and rehab works of land or roads at all phases.

Incidents/Accidents include: start-ups, shutdowns and maintenance activities which may give rise to abnormal environmental emissions or discharges or exceedance of emission or discharge standards, and result in spills or releases of hazardous materials in quantities which may impact groundwater or the environment outside the plant boundaries.

Significant quantities of liquid wastes may be released onsite by pipe in the process plant or by errors or component failures during storage/loading/unloading/transport.

9.4.6.2 Hazardous Substances Releases

As a result of un-expected waste releases, several impacts may occur: health effects, soil pollution, equipment/building damage and contaminates clothing, as well as creating larger volumes of wastes in a "clean area". Accidental releases require rapid response and immediate clean and facility emergency response plan. Clean-up works involve special absorbent compounds, depending on MSDS of spilled material and further increasing waste volumes, while some waste streams consist of VOCs, creating vapours if released resulting in foul odours, which impacts land and air by ambient air pollution effects, ground and groundwater contamination and at times, affected areas may even be larger than the size of the spill itself, requiring more complex procedures for rehabilitation and clean-up.

Impacts may be minimised considering the fact that potential pollution sources in process units are designed to be spill-proof and are equipped with containment bunds, paving and diking.

In incidents involving the release of solid wastes, containment is easier if weather conditions are optimum, however in severe climate conditions; high wind and heavy rain increase potential for dust emissions and leachate infiltration to land.

However, drainage system on site is enclosed and directed to any on-site wastewater pre-treatment system, and even at storm events, the on-site storm water system is capable of handling storm events and thus minimizing any off-site flow of contaminated waters and preventing the creation of storm water run-off that may reach the marine environment.

Accidental releases during a fire tend to create extremely hazardous conditions and is a main concern in emergency situations and response planning at the facility.

Impact from Hazardous and Non-hazardous Wastes during emergency incident (WM7) – Low Magnitude, Medium Negative Significance.

Table 9-10: Decommissioning Phase- Impacts Assessment due to Waste Storage, Transport, and disposal

Factor	WM7
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	likely
Extent	Provincial
Duration	Short
Magnitude	Medium
Effect	Negative
Action	Direct
Significance	Low to Medium

9.5 Mitigation Measures:

Implementation of mitigation measures will be required during construction, commissioning, operation and decommissioning of the facility to minimise potential negative impacts of the activities on waste management systems. The mitigation measures comprise a combination of physical design features of the facility, management procedures and monitoring arrangements and are described in the following subsequent sections. The following text assesses the impacts predicted as being of medium to high significance against appropriate mitigation measures to predict the residual impact significance.

9.5.1 Construction and Commissioning phases:

The EPC Contractor shall develop, implement and maintain a Construction Waste management Plan (CWMP) based on good industry practise, an Environmental Emergency Response Plan (EERP) and a Construction Environmental Management Plan (CEMP) as supporting documents to the Environmental Management and Monitoring Plan (Section 20 of this ESIA). These plans will detail responsibilities and procedures for environmental management and emergency response during construction, including:

- Competencies and training requirements of staff managing waste storage areas and communication and procedures in the event of an emergency;
- Spill control procedures;
- Waste segregation, and storage procedures;
- Procedures to be implemented following an accidental release of hazardous substances, e.g. during refuelling, including details of measures to be adopted to stop, contain as far as practicable on site, and clean up spills, and to inform the relevant authorities in the event that a spill migrates (or occurs) off-site so that appropriate regional plans can be activated; and
- Availability of pumps and spill mitigation materials such as absorbent granules to contain and recover hazardous substances releases.

The contractor will undertake regular audits of the above management plans to confirm their ongoing effectiveness.

The Engineering Procurement and Construction Contractor (EPCC) shall:

- Design, construct and manage and maintain storage areas for non-hazardous and hazardous waste to prevent accidental and/or uncontrolled discharges of material.
- Implement waste segregation, and where possible recycling programme.
- Minimise the on-site storage times;
- Utilise / ensure the use of covered vehicles for the transportation of waste;

- Minimise the distance travelled;
- Provide training of all suppliers and sub-contractors in site waste management procedures
- Undertake an extensive audit of waste management facilities to confirm capacity to receive future quantities of waste, and operation in compliance with licence conditions and good industry practise

9.5.2 Operation Phase Recommendations

The Project management shall develop a Waste Management Strategy for the Project lifecycle, which shall apply the waste hierarchy and shall be commensurate with good practice within the waste management industry. The project management shall develop, implement, audit and maintain a Project Waste Management Plan in accordance with regulatory requirements and good industry practise, building on the Project EMMP and an EERP. This plan will detail responsibilities and procedures for waste management during operation of the facility. This shall include but, not be limited to:

- Waste and recycling objectives and targets;
- Waste segregation, storage and recycling / waste management procedures;
- Maximum storage times, and details of waste handling and labelling requirements;
- Selection, monitoring and auditing of waste contractors, and off site waste management facilities;
- Waste vehicle requirements;
- Competencies and training requirements of staff with responsibilities for managing waste storage areas, and procedures and lines of communication in the event of an emergency (including accidental releases of hazardous substances);
- Procedures to be implemented following an accidental release of hazardous substances, including details of containment and recovery measures to be applied; and
- Procedures for the monitoring of waste arisings and collection and reporting of data on these.

Further, recommended techniques for minimizing the volume of solid waste and by-products for disposal include the following:

- Reduce product losses through better production/storage control (e.g., monitor and adjust air humidity to prevent product losses caused by the formation of molds on edible materials).
- Collect residues from the raw material preparation phase for conditioning (drying) and reprocessing (grinding) to yield by-products (e.g., animal feed).
- Return waste and residues to fields to assist in soil nutrient management.

The facility management shall provide training for staff, sub-contractors and suppliers on the on-site waste management system (as appropriate), use of spill mitigation materials and equipment and procedures, in the event of an emergency (including accidental releases of hazardous substances).

The facility management shall undertake an extensive audit of waste management facilities in Basra city (shown in table 8-1) to confirm capacity to receive future quantities of waste, and operation in compliance with licence conditions and good industry practise

The facility management shall undertake regular audits of the above management plans to confirm their ongoing effectiveness.

9.5.3 Closure / Decommissioning Phase Recommendations

The facility management shall further develop the outline closure plan prepared for the ESIA over the Project life, to provide adequate detail for sound, and sustainable site decommissioning and closure. The closure plan should detail procedures for the safe and environmentally sound decommissioning of the project, and management of the retained waste storage facilities.

Furthermore, the plan should consider including:

- Procedures for removal and disposal of wastes during closure / decommissioning;
- Waste segregation, storage and recycling / waste management procedures;
- Waste handling and labelling requirements;
- Selection, monitoring and auditing of waste contractors, and off-site waste management facilities;
- Competencies and training requirements of staff with responsibilities for waste management in decommissioning, and lines of communication in the event of an emergency (including accidental releases of hazardous substances);
- Competencies and training requirements of staff with

responsibilities for ongoing management, maintenance and monitoring of the retained waste storage facilities and procedures and lines of communication in the event of an emergency (including accidental releases of hazardous substances);

- Procedures for the ongoing management, maintenance and monitoring of the retained waste storage facilities, including monitoring location, and frequencies, and analysis of resultant data.

The facility management shall update (or develop new), implement, maintain and audit the EERP and EMMP so the documents remain adequate and effective for the decommissioning / closure phase. This should be undertaken in the context of the detailed closure plan developed over the course of the Project life, and in advance of decommissioning / closure.

Following decommissioning and demolition of the facility, a survey of the surface water and soil quality at the site should be completed to confirm that the presence and operation of the facility has not led to an unacceptable deterioration in quality. Should contamination be identified that could have been caused by the facility, a specific remedial plan will be developed to define the extent of contamination and remedial measures to be implemented.

10 WATER QUALITY MANAGEMENT

10.1 Introduction

The purpose of this Section is to describe the existing water resources and associated water quality and assess the impact of the Project during all phases (construction, commissioning, operation and decommissioning) on any nearby surface water. The main source of water for the Project is groundwater wells and impacts on this resource are assessed in Section 6 Terrestrial Environment. Potential impact on habitat/ecology is assessed in Section 7 Terrestrial Biological Resources. This chapter assesses the impacts of changes to the surface water system and water quality.

10.2 Baseline:

10.2.1 Introduction:

The Republic of Iraq recognizes the following water resources: surface water (i.e. lakes, rivers and Arabian Gulf) and groundwater. As a result, all water usage comes from these two sources.

10.2.2 Surface Water Quality

The main source of surface water in Iraq is represented by the Euphates and Tigris Rivers and many tributaries of the Tigris River (figure 10-1). The Euphates and Tigris enter Iraq from Turkey. World Bank (2006) stated that 100% of the Euphrates water comes from outside the borders of Iraq while 67% of the Tigris water also comes from outside sources. During the flooding period of the Euphates and Tigris Rivers, the surplus water accumulates in many lakes (e.g., Al-Tharthar, Al-Habanih and Al-Razaza) and marshes (e.g., Abu-Dibs and Al-Hammar) in middle and southern Iraq. The two rivers join in the city of Al-Qurnah, north of Basrah. The Mesopotamian plain begins north of Baghdad and stretches down to the Gulf, where the rivers Euphates and Tigris create a delta together with irrigation canals. In the delta, many lakes form wetlands and marshlands characterizing southern Iraq. Both rivers are distinguished by a high concentration of salts. Generally speaking, the water quality of the Tigris and Euphates Rivers deteriorates downstream, as the salinity and ionic concentration increase but at a different rates (Chabuk et al., 2020).

The total water withdrawal in Iraq, depending largely on Tigris and Euphrates Rivers, was about 42.8 km^3 in 1990, which is used for agricultural (90%), domestic (4%) and industrial (6%) purposes (Al-Ansari, 1998 and 2013, Sadik and Barghouti, 1994, World Bank, 2006). According to the most recent estimates, 85% of the water withdrawal is used for agricultural purposes (Al-Ansari and Knutsson, 2011, Al-Ansari, 2013, 2016, Al-Ansari et al., 2012).

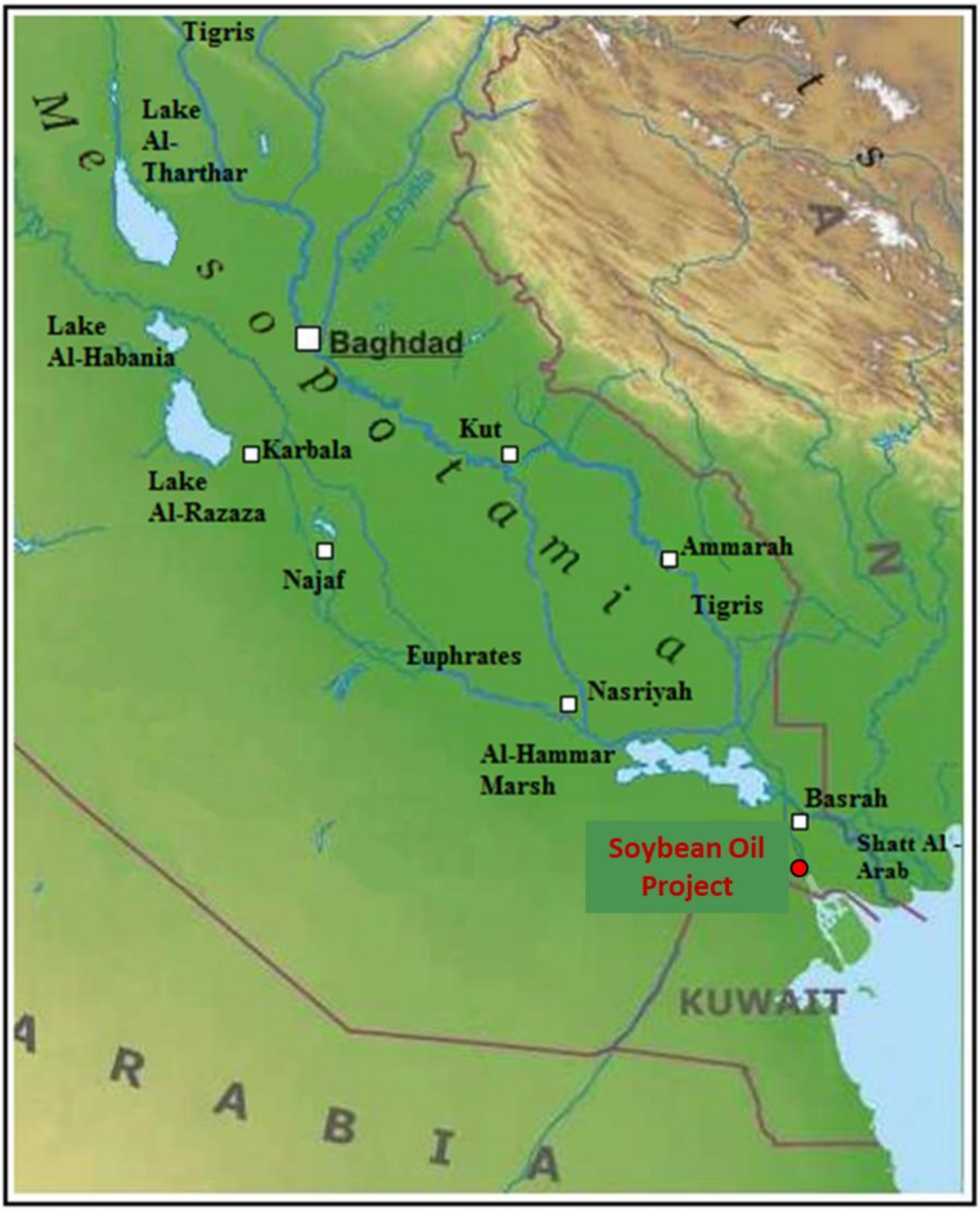


Figure 10-1: Surface water resource map of Iraq

A study conducted by by AlQabas Oil Servies Co in Basra (Al-Qabas O. S. C., 2011)) determined the quality of water for the Shatt Al-Arab River and the Shatt Al-Basrah canal on May 31, 2011. One water sample was taken from each of the Shatt Al-Arab River and the Shatt Al-Basrah canal in May 2011 and sent to the company laboratory for analysis. The results of the water analysis are shown in table 10-1. Normally COD is higher than BOD and in the indicated study the COD is much higher than BOD which likely due to more organic compounds can be chemically oxidized than biologically oxidized.

Table 10-1: Water analysis results for Shatt Al-Arab and Shatt Al-Basrah

Parameter / Sample	Unit	Shatt Al - Arab 1*	Shatt Al- Basrah 3**
UTM – X		766001.77	765150.74
UTM– Y		3386272.49	3370817.96
Water Temp.	°C	27.9	29.3
pH	-	8.0	8.2
E.C.	µS/cm	2,310	26,800
T.D.S.	mg/l	1,564	19,790
T.S.S.	mg/l	20.4	218.8
Alk. as $CaCO_3$	mg/l	178.0	192
Alk. as HCO_3	mg/l	-	-
BOD	mg/l	4.3	15
COD	mg/l	2260	4440
T.H. as $CaCO_3$	mg/l	540	5,445
DO	mg/l	4.73	4.93
Oil & Grease	mg/l	6.8	0
Cd	mg/l	0.09	0.04
Cr	mg/l	4.7	0.11
Cu	mg/l	0.017	0.016
Ca	mg/l	123	592
Mg	mg/l	57	971
Na	mg/l	400	7,200
K	mg/l	9.1	106
Phenol	mg/l	1.2	0.5
Benzene	mg/l	-	-
Sulfide	mg/l	-	-
Chloride (Cl^-)	mg/l	422	3027
Sulphate ($SO_4^=$)	mg/l	400	3,000
Nitrate (NO_3^-)	mg/l	7.51	8.97
Phosphate (PO_4)	mg/l	0.16	0.16
Cyanide (CN^-)	mg/l	0.009	0.006
Turb.	NTU	23.3	160

* Near Sindbad land (Shatt Al-Arab)
** Near Zubair Bridge (Shatt Al-Basrah)

A recent study was conducted by EnvisolTECH team for sea water at the project site (please see figure 10-2 for location of samples). Three samples were collected in Oct 22, 2022 and analysed for different parameters to determine the baseline of the water prior starting the project operation and discharging any wastewater from the project to the

Arabian Gulf. These samples were deleivered to the company laboratory for analysis. The results of the water analysis are shown in table 10-2.

Table 10-2: Sea Water quality of Umm Qasr port , Oct 22, 2022			
Water parameters	Location 1	Location 2	Location 3
pH	7.9	7.9	8.00
Sali. (‰)	48.3	48.5	48.6
TSS (mg/l)	550	520	524
Turbidity (NTU)	142	140	140
DO (mg/l)	5.9	6.01	6.2
COD,mg/l	1384	1308	1320
TDS,mg/l	41000	41000	41000
Tot. Nitrogen (mg/l)	6.71	6.25	6.88
Tot. Phosphorus (mg/l)	0.98	0.92	0.87
Pb,mg/l	0.923	0.972	0.901
Cd,mg/l	0.051	0.041	0.048
Cr,mg/l	0.475	0.472	0.472
Hg mg/l	0.005	0.006	0.005
As mg/1	0.075	0.078	0.077
PAH ng/l (Polycyclic aromatic hydrocarbons)	0.05	0.02	0.05
Oil (µg/l)	4.22	4.62	5.03

Figure 10-2: Locations of samples taken from coastal line in front of Project site at Umm Qasr Port

10.2.3 Groundwater Resources:

Groundwater (GW) forms another permanent source of water in Iraq. WB (2006) stated that groundwater resources are about 1.2 billion cubic meters and form about 2% of the total water resources of Iraq. Large areas of the country (60%) still depend on groundwater for irrigation and domestic uses. GW recharge occurs from rainfall during the winter periods, and also from the Tigris and Euphrates Rivers. During high flow, both the Tigris and Euphrates are influent (rivers recharging groundwater) and their levels exceed that of the water table. During periods of low flow in the summer, the level of these rivers is below the water table, and they become effluent (GW discharges to the river). The regional flow of GW in Mesopotamia plain is from north and northwest towards the south and southeast, and the groundwater depth lowers as the Arabian Gulf Coast is approached, as shown in figure 10-3 (Saleh et al., 2020).

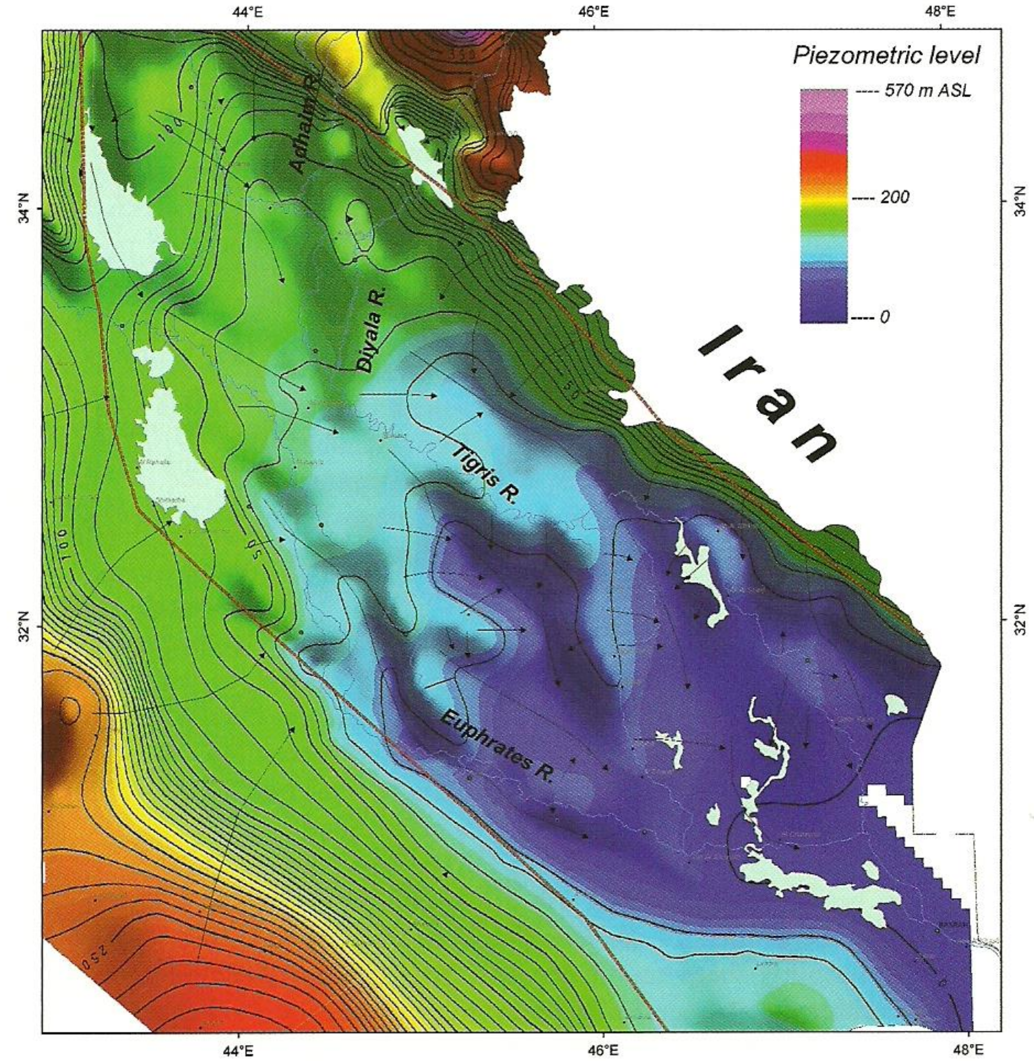


Figure 10-3: The Piezometric level of groundwater of the Mesopotamian Aquifer in Iraq (Source: Saleh et al., 2020)

The groundwater of the Mesopotamian zone is dominated by the chloride water type with a surrounding zone of sulphate water as shown in figure 10-4 (more details on quality of ground water at the project site are given in section 6: Terrestrial Environment).

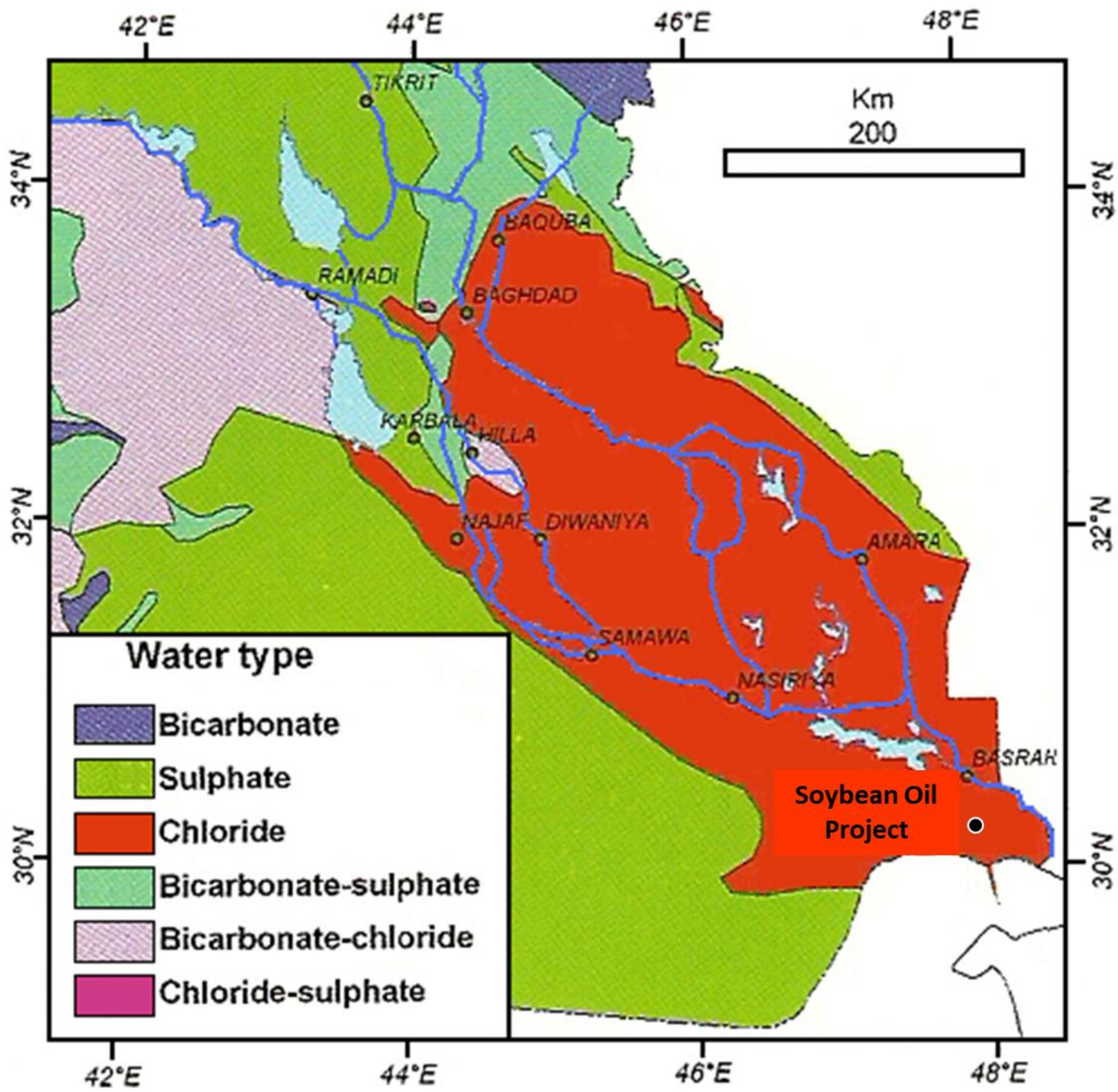


Figure 10-4: The chemical type of shallow groundwater in Iraq (Source: Krasny, (2006))

10.2.4 Water Quality Treatment Systems at the Project site

The Soybean Oil project will use treated ground water for the purposes of processing, cooling and irrigation. It is expected that usage of groundwater by this project will not have an impact on the water supply necessary for surrounding community areas because the Umm Qasr residential areas are provided with the required water by the government water network (Ministry of Water Resources) and not by groundwater wells as for this proejct.

The project will have the following two treatment systems:

1- Ground Water treatment system: The first system will be built to treat the groundwater before being used for different purposes such as process water and cooling water (figure 10-5). The quantities of water in and out of this system will be 79.2m^3/hr and 48m^3/hr respectively whereas the difference between these two values (31.2m^3/hr) will be either discharged to the Arabian Gulf or used for other purposes if it meets the applicable standards. This system will reduce most parameters from high levels to acceptable use levels. For example, the TDS will be reduced from 8,300 mg/l to less than 20mg/l.

2- Industrial Wastewater treatment system: the second system at the project site will be built to treat the industrial wastewater generated by the extraction unit and degumming process before it is discharged to the Arabian Gulf (figure 10-6). This system has an operating load of 15m^3/hour and will treat most parameters especially for COD, BOD, TSS, Oil and Grease and pH to put them in compliance with the Iraq standards and WB-IFC guidelines as shown in figure 10-6 and described in section 2. The locations of the groundwater treatment system, the wastewater treatment system and wastewater collection tanks on the property are shown in figure 10-7.

In this project the main wastewater effluents will be industrial wastewater and sanitary wastewater.

10.2.5 Potable and Process Water Systems

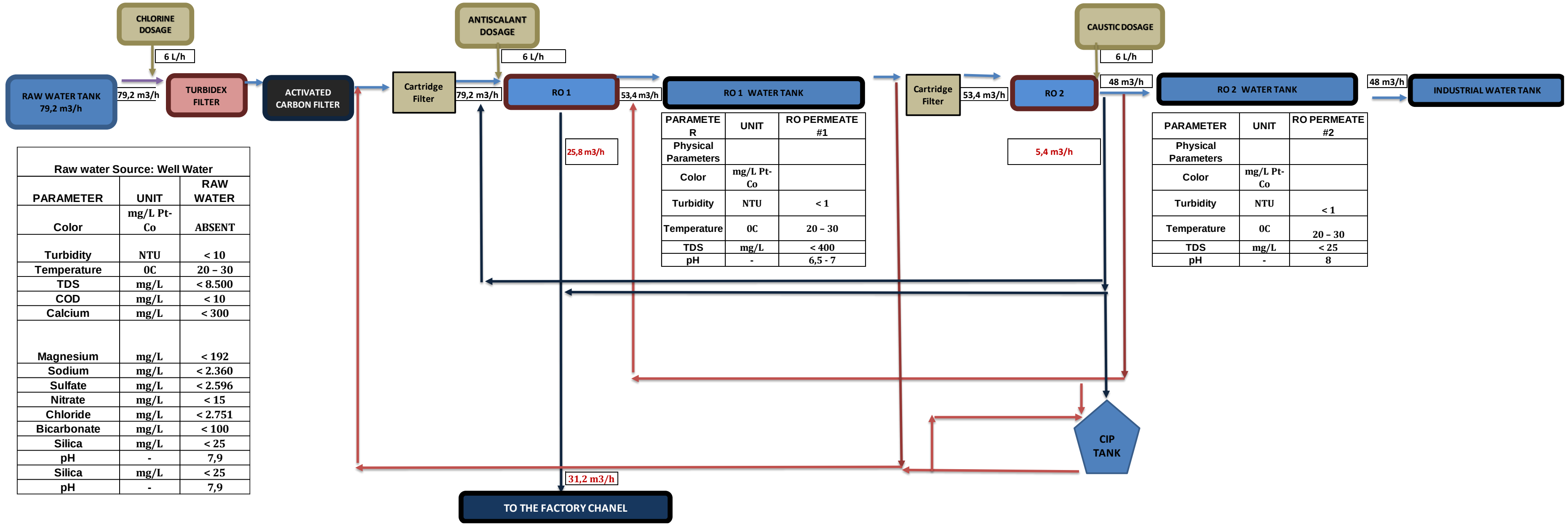
Potable water will be supplied by a well-known local supplier. This water will comply with the national and international standards (such as WHO). The design potable water usage rate is about 0.5 m^3/day.

10.2.6 Storm water

Storm water runoff at the site can be categorized based on the origin of the runoff: clean and potentially contaminated.

In this project all process areas will be covered to avoid any contamination to rainwater. Further, these areas will be curbed or diked to provide full containment of rainfall. The project will have storm water drainage system which will consists of channel, manholes and pipes for discharging the rainwater to the Arabian Gulf. On the other hand, all the surface drainage from the process areas will be collected in sumps and then pumped to a wastewater collection tank. The effluent from the tank is then transferred to the Wastewater Treatment System for treatment prior to discharge to the Arabian Gulf (see figure 10-7).

The wastewater collected in the sump (the Process Effluent Sump) will be transferred to the Wastewater Collection Tank which also collects process area runoff from the process areas. All remaining areas of the plant (outside process area) are considered “clean”. The runoff from these clean areas will be collected by surface ditches which will drain directly to the Arabian Gulf.

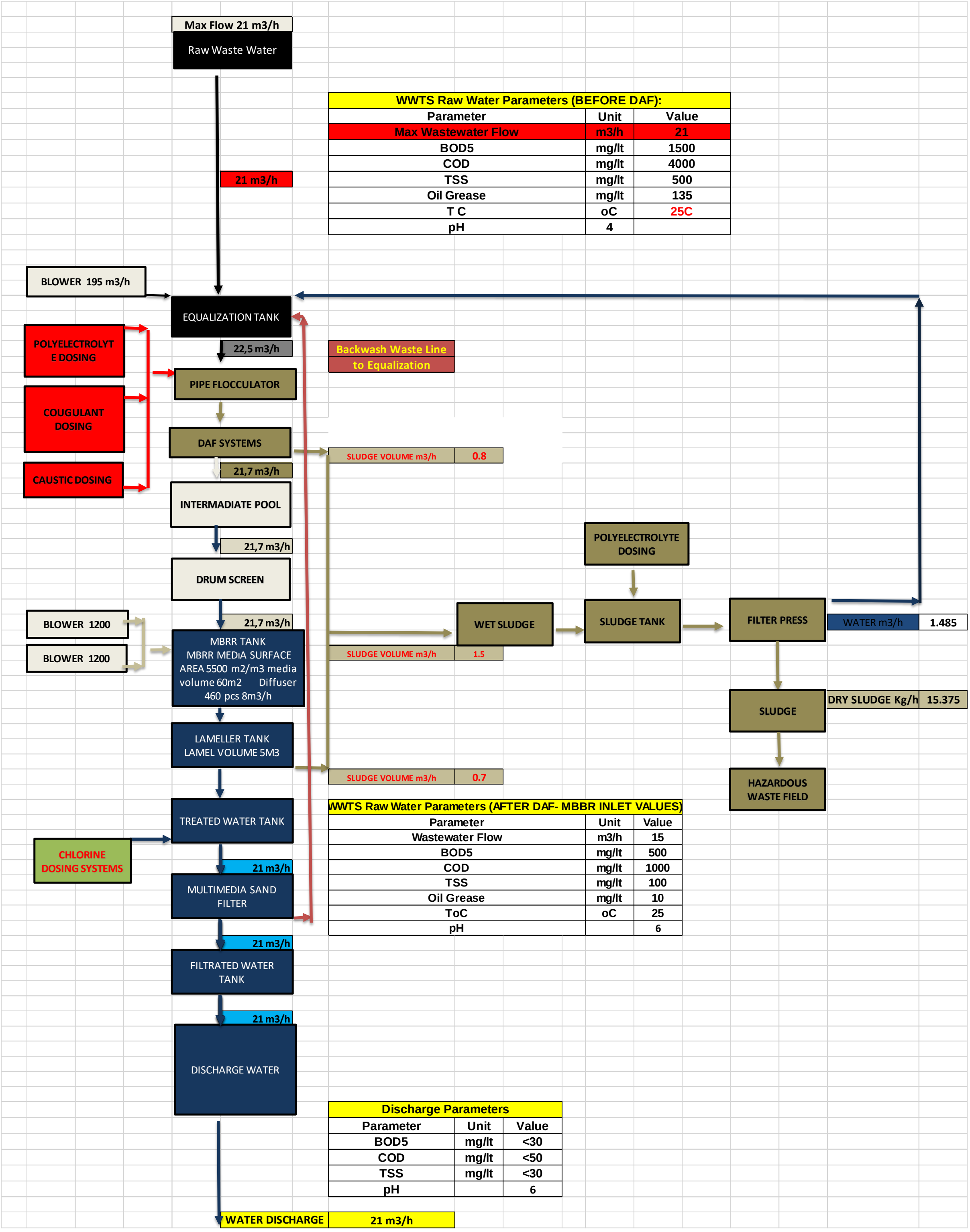


Raw water Source: Well Water		
PARAMETER	UNIT	RAW WATER
Color	mg/L Pt-Co	ABSENT
Turbidity	NTU	< 10
Temperature	0C	20 – 30
TDS	mg/L	< 8.500
COD	mg/L	< 10
Calcium	mg/L	< 300
Magnesium	mg/L	< 192
Sodium	mg/L	< 2.360
Sulfate	mg/L	< 2.596
Nitrate	mg/L	< 15
Chloride	mg/L	< 2.751
Bicarbonate	mg/L	< 100
Silica	mg/L	< 25
pH	-	7,9
Silica	mg/L	< 25
pH	-	7,9

PARAMETER	UNIT	RO PERMEATE #1
Physical Parameters		
Color	mg/L Pt-Co	
Turbidity	NTU	< 1
Temperature	0C	20 – 30
TDS	mg/L	< 400
pH	-	6,5 - 7

PARAMETER	UNIT	RO PERMEATE #2
Physical Parameters		
Color	mg/L Pt-Co	
Turbidity	NTU	< 1
Temperature	0C	20 – 30
TDS	mg/L	< 25
pH	-	8

Figure 10-5: Block flow diagram and mass balance for raw water treatment before being used for different purposes



WWTS Raw Water Parameters (BEFORE DAF):		
Parameter	Unit	Value
Max Wastewater Flow	m3/h	21
BOD5	mg/lt	1500
COD	mg/lt	4000
TSS	mg/lt	500
Oil Grease	mg/lt	135
T C	oC	25C
pH	4	

WWTS Raw Water Parameters (AFTER DAF- MBBR INLET VALUES)		
Parameter	Unit	Value
Wastewater Flow	m3/h	15
BOD5	mg/lt	500
COD	mg/lt	1000
TSS	mg/lt	100
Oil Grease	mg/lt	10
ToC	oC	25
pH		6

Discharge Parameters		
Parameter	Unit	Value
BOD5	mg/lt	<30
COD	mg/lt	<50
TSS	mg/lt	<30
pH		6

Figure 10-6: block flow diagram for influent and effluent industrial water in Soybean Oil Project

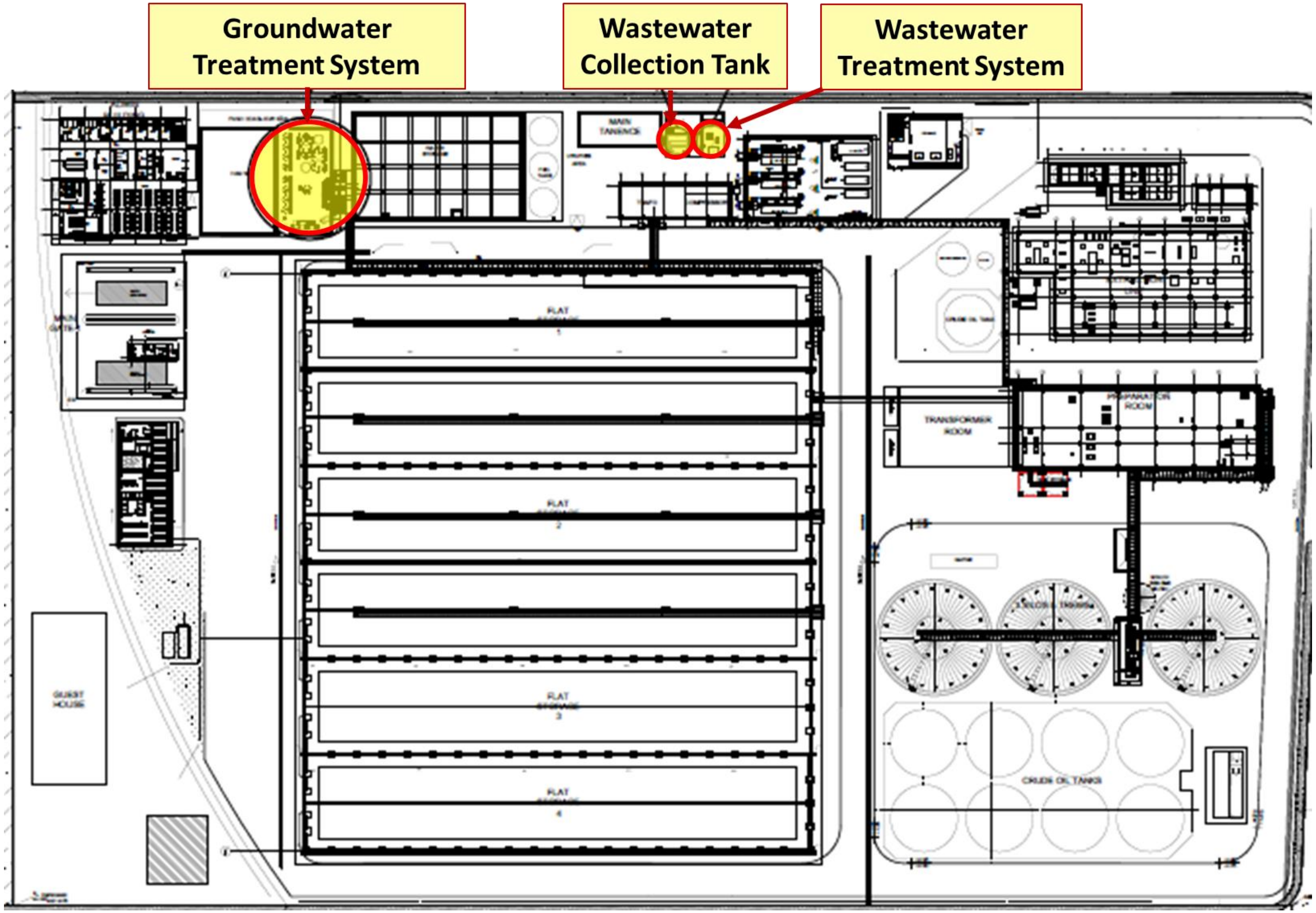


Figure 10-7: Locations of groundwater treatment system, wastewater treatment system and wastewater collections tanks in Soybean Oil Project

10.2.7 Process industrial wastewater (effluent wastewater)

Industrial wastewater generated from industrial operations includes process wastewater, wastewater from utility operation, runoff from process and miscellaneous activities including wastewater from laboratories, equipment maintenance shops, etc. The pollutants in an industrial wastewater may include high concentrations of certain parameters such as Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Oil & Grease, pH and others.

The estimated quantity of industrial wastewater generated by Soybean Oil Project will be about 21m3/hour. The wastewater will be treated by an advanced treatment system (See figure 10-6) before being discharged to the Arabian Gulf.

The Storm water, effluent wastewater and RO wastewater will be discharged through a pipeline extended to the facility channel and then to the Arabian Gulf. This pipeline has a length of 1000m and diameter of 70cm. This pipeleine has 27 mainholes. This pipeline is ended with one way gate which opens for discharge when the tide is low and closes automatically when the tide is high. This pipe line starts with a slope of 25 degree for 50m until it reaches the mouth of discharge (one way gate) as shown in figure 10-8.

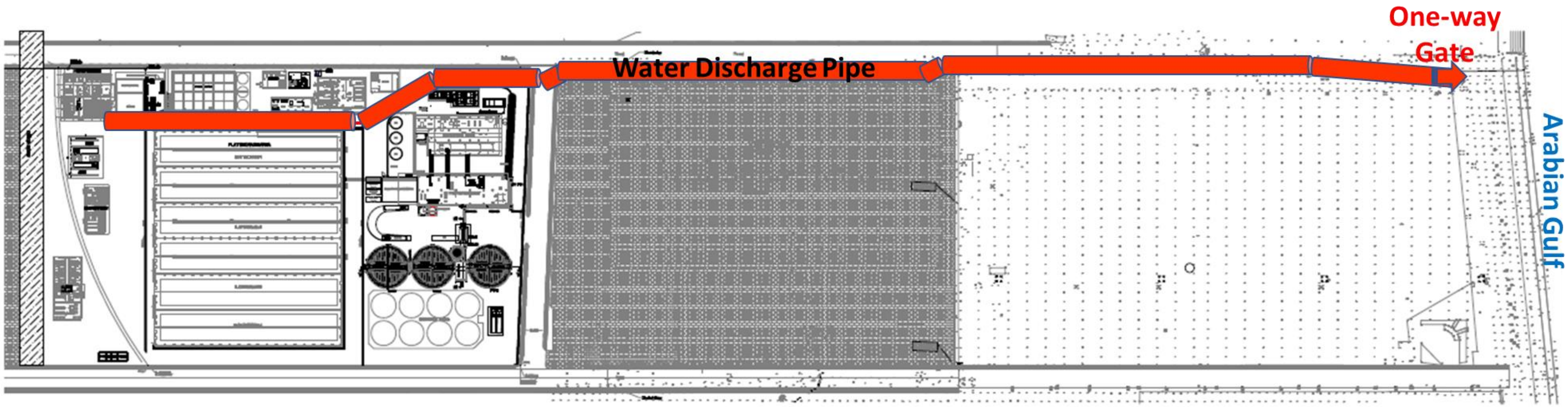


Figure 10-8: Waste discharge line (Industrial wastewater effluent, storm water and RO wastewater) to the facility channel and then to the Arabian Gulf

10.2.8 Sanitary Wastewater

All wastewater generated from buildings occupied by personnel such as from showers, kitchen, laundry facilities, and toilets are considered sanitary wastewater. These wastewaters will be stored in septic tank and then transferred to the off-site Sanitary Wastewater Treatment system which is located within Basra Province and managed and operated by government municipality system. An estimated 25m^3/day of sanitary wastewater will be generated on-site by Soybean Oil Project.

10.3 Impact Assessment

10.3.1 Introduction

This Section describes the impact of this project during various phases (construction, commissioning, operation and decommissioning) on any existing surface water system and quality.

10.3.2 Construction:

The expected wastewater generated during construction phase of this project will be low. Disposal of any water collected during construction dewatering process will be fully followed as per the Iraqi and WB-IFC requirements. In addition, sanitary wastewater will be generated on site. The sanitary wastewater generation during construction phase will be between 20 to 31m^3/day (assuming 125 litres of wastewater will be generated per person for construction camps) depending on manpower during this phase (ranging from 150 at the beginning of the project to 250 at the end of the construction phase). This water will be stored in septic tanks and later on will be transferred to the government sewage wastewater treatment plant.

Although there is no nearby surface water (such as rivers and lakes) except the Arabian Gulf/ Shatt Al-Basra, any surface water runoff could be contaminated as a result of accidental spills of hydrocarbons from the storage, fuelling and operation of construction vehicles, and may have increased total suspended solids as a result of the construction activity disturbing the ground.

As stated earlier, sanitary wastewater will be collected in septic tanks before delivery to the nearest government approved site for treatment. However, there is the potential for contamination of any surface water from leaks of overflowing septic tanks, or from spillages during the pumping out of septic tanks which could in turn negatively impact water quality; however, tanks are expected to be emptied regularly.

Impacts on groundwater due to potential fuel spillages are discussed in Section 6 – Terrestrial Environment.

The construction phase impacts on any nearby surface water (Arabian Gulf) are summarised in Table 10-3.

Impact from accidental spillages of hydrocarbons or sanitary wastewater (WQ1) – *Low Magnitude, Low Negative Significance*

Table 10-3: Construction Phase- Impacts Assessment due to Accidental Spillages of Hydrocarbons or Sanitary Wastewater

Factor	**WQ1**
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	Likely
Extent	Local
Duration	Short
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

10.3.3 Commissioning:

In the commissioning phase hydro-testing of the pipes and tanks has the greatest potential to impact on water quality and will involve some quantities of water. Hydro-testing requires the testing of the pipes or tanks with water to detect leaks and to ensure that the plant/industrial process is fully functioning before going into operation, thus waters can become contaminated.

Non-potable water and some demineralised water will be required for hydro-testing of pipes and tanks. As the raw water may contain high chlorides it will have to be treated before use on stainless steel due to potential corrosion issues. The water used during hydro-testing has the potential to collect contaminants from the pipes, such as oils or chemicals used to treat the pipes or tanks, as well as sediments. Hydro-test water is to be directed to contaminated stormwater ponds for analysis to confirm conformance with the Iraqi and WB-IFC standards, prior to discharge to the Arabian Gulf or use for irrigation or other purposes. Accidental release of potentially contaminated hydro-test water may contain chemicals, has the potential to negatively impact on water quality. The commissioning phase impacts are summarised in Table 10-4.

Impact from accidental release of contaminated hydro-test water (WQ2) – *Low Magnitude, Low Negative Significance*

Table 10-4: Commissioning Phase- Impacts Assessment due to Accidental Release of Contaminated Hydro-test Water

Factor	**WQ2**
Receptor Important/Sensitivity	Medium

Frequency	Rare
Likelihood	Certain
Extent	Local
Duration	Short
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

10.3.4 Operation

During the operation phase, the expected wastewater generated will be industrial wastewater and sanitary wastewater. The quantity of industrial wastewater effluent will be about $18m^3/hr$ and the quantity of sanitary wastewater will be about $25m^3/day$. As explained earlier, the industrial wastewater will be treated before being discharged to the Arabian Gulf to meet the Iraqi and IFC limits (especially for COD, BOD, TSS, Oil and Grease and pH) whereas the sanitary wastewater will be stored in septic tanks before it is delivered to a treatment facility recommended by the relevant environmental authorities.

The operation phase impacts are summarised in Table 10-5.

Impact from accidental release of industrial wastewater or sanitary wastewater (WQ3) – *Low Magnitude, Low Negative Significance*

Table 10-5: Operation Phase- Impacts Assessment due to Accidental release of Hydrocarbons or Sanitary Wastewater

Factor	**WQ3**
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	Unlikely
Extent	Provincial
Duration	Short to Medium
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

10.3.5 Decommissioning/Closure

Decommissioning of the facility is likely to comprise dismantling and removal of all process units and equipment, storage tanks etc. The impact during decommissioning will be similar to that during construction phase. The decommissioning phase impacts are summarised in Table 10-6.

Impact from dismantling and removal of the facility (WQ4) – *Low Magnitude, Low Negative Significance*

Table 10-6: Impacts Assessment due to Dismantling and Removal of the facility	
Factor	**WQ4**
Receptor Important/Sensitivity	Medium
Frequency	Rare
Likelihood	Unlikely
Extent	Provincial
Duration	Short to Medium
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

10.4 Mitigation:

Implementation of mitigation measures will be required during construction, commissioning, operation and decommissioning of the facility to minimise potential negative impacts of the activities on the water quality. The mitigation measures comprise a combination of physical design features of the facility, management procedures and monitoring arrangements and are described in the subsequent sections.

Since there are no medium or high significance impacts identified for all phases (construction, commissioning, operation and closure), mitigations are not given but only recommendations are provided for each phase.

10.4.1 Construction Phase

The construction contractor shall develop, implement and maintain a construction phase Environmental Emergency Response Plan (EERP) and a Construction Environmental Management Plan (CEMP) based on the Environmental Management and Monitoring Plan. These plans will detail responsibilities and procedures for environmental and emergency response management during construction, and should consider including:

- Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency;
- Spill control procedures, and procedures for the sound management of waste storage areas;
- Pollution prevention procedures, and best practise environmental management techniques such as storage of plant, materials and chemicals away from watercourses, appropriate storage of waste materials and use of spill control measures etc;

- Ensure compliance with discharge, and ambient water quality standards; and

The contractor should undertake regular audits of the above management plans to confirm their ongoing effectiveness.

The construction contractor should:

- Ensure that vehicles used to empty septic tanks are fit for purpose and operated by trained members of staff to prevent spillage.
- Construct designated refuelling and vehicle maintenance areas. These will comprise bunded and sealed areas and all scheduled refuelling and maintenance of construction and transportation vehicles will be undertaken within these designated area(s).
- Ensure hazardous material storage tanks, including for fuels, are located within bunded and hard surfaced areas with adequate capacity for the volume of hazardous materials stored within.
- Provide an adequate quantity of drip trays and spill kits will be provided to contain and recover potential releases of hazardous substances.

10.4.2 Commissioning Phase

The Construction Contractor shall

- undertake appropriate studies to locate an appropriate discharge point for clean hydrotest water to ensure sufficient drainage capacity is available.
- Prepare and implement procedures to be implemented following an accidental release of hazardous substances, including details of containment and recovery measures to be applied; and
- Ensure suitable availability of pumps and spill mitigation materials such as absorbent granules to contain and recover hazardous substances releases.

10.4.3 Operation Phase

Sama AlManar shall develop, implement, audit and maintain a Project Environmental Management and Monitoring Plan (EMMP) and an Environmental Emergency Response Plan (EERP). These plans will detail responsibilities and procedures for environmental management and environmental emergency response during operation of the facility. The following should be considered when preparing the mentioned plans:

- Routine plant inspection and maintenance schedules and procedures;
- Plant start-up and shut-down procedures;

- Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental releases of hazardous substances);
- Procedures to be implemented following an accidental release of hazardous substances, including details of containment and recovery measures to be applied; and
- Procedures for co-ordinating site staff action in emergency situations with off-site stakeholders / regulators.

According to the Water Resources Sustainability Assessment report conducted by the University of Basra;

a) Based on the results of the continuous pumping test for the aquifer, it was concluded that The well can sustain a yield of 25-30 m3 /hour. The aquifer can be classified as unlimited high groundwater potential. Total Well depth should not be less than 15 m from the ground surface. Screen length not less than 12 m.

b) By studying the wells drilled in the neighboring Umm Qasr region and examining a large number of wells, it was concluded that Basra Governorate stands out as containing a large strategic reservoir that is partially renewable.

c) From the results of the assessment of over-pumping plans, it was concluded that 25% over-pumping does not have a significant impact on aquifer depletion and salinity.

d) The modeling results indicate that the reduction in groundwater recharge will not be significant as the recharge value is likely to decrease from 20% to 17.18% of annual precipitation. Based on this fact, it is concluded that the groundwater supply is sustainable and the industrial activities of the project may not be affected much by climate changes.

10.4.4 Decommissioning/Closure Phase

Sama AlManar shall develop the outline closure plan prepared for the ESIA over the Project life, to provide adequate detail for sound, and sustainable site decommissioning and closure. The closure plan should detail procedures for the safe and environmentally sound removal of high value equipment and closure of moth-balled buildings, or facilities.

The plans should detail the procedures to be adopted for the safe decommissioning of the facility's tanks, pipelines, buildings and infrastructure. Furthermore, the plan should detail:

- Minimum technical standard of demolition plant;

- Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental releases of hazardous substances);
- Procedures to be implemented following an accidental release of hazardous substances, e.g., during tank drain-downs, including details of containment and recovery measures to be applied; and

11 MARINE ENVIRONMENT

11.1 Introduction

Umm Qasr Port is located close to the border with Kuwait near the entrance to the Arabian Gulf on the west bank of Khor Al Zubair canal. It is situated in the governate of Al-Basrah, Iraq, with geographical coordinates 30° 2' 3" North, 47° 55' 46" East. Umm Qasr is Iraq's only deepwater seaport (11m draft) and the largest port in the country. The port was blocked by vessels sunk during the early stages of the Iran-Iraq war (1980 – 1988). Iraq intended, after the war, to rehabilitate Umm Qasr port by dredging the channel to enable large vessels to dock. Due to its importance, Umm Qasr Port is handling significant cargo every year. Accordingly, water and sediment quality are expected must be understood.

Situated at Iraq's Gulf Coast, Umm Qasr is the main seaport of Iraq and also the only deep-water port of the country. It handles the majority of the country's export trade. This port comprises three different port zones: Umm Qasr South Port, North Port and Umm Qasr Mid port. The proposed soybean processing facility is proposed in the South Port. The Port lies along the Shatt Al-Basrah canal, between the Khor Abdullah and the Khor Al-Zubair.

The Port has 21 berths measuring around 5000m. It is connected to major oilfields in the south of Iraq. It is a multi-purpose port and can take care of diverse cargo such as liquid and dry bulk cargo, containerized cargo, Ro-Ro, and also general cargo. The types of vessels regularly calling at UMM QASR are Bulk Carrier (25%), Container Ship (22%), General Cargo (19%), Oil Products Tanker (6%), Oil/Chemical Tanker (5%). The port has a logistics depot. The South Port has 11 berths, as follows:

- **Berth No. 1:** Government (Military berth)
- **Berth No. 2:** Break Bulk/General Cargo IPA
- **Berth No. 3:** Break Bulk IPA
- **Berth No. 4:** Manarat Umm Qasr (Proposed soybean processing facility)
- **Berth No. 5:** CMA CGM and APL
- **Berth No. 6:** Belongs to IPA, general cargo
- **Berth No. 7:** IPA
- **Berth No. 8:** Gulf Tainer (used for containers, bonded corridor to Umm Qasr Logistics Centre)
- **Berth No. 9:** IPA

- **Berth No. 10:** Ministry of Trade – Silo for grains

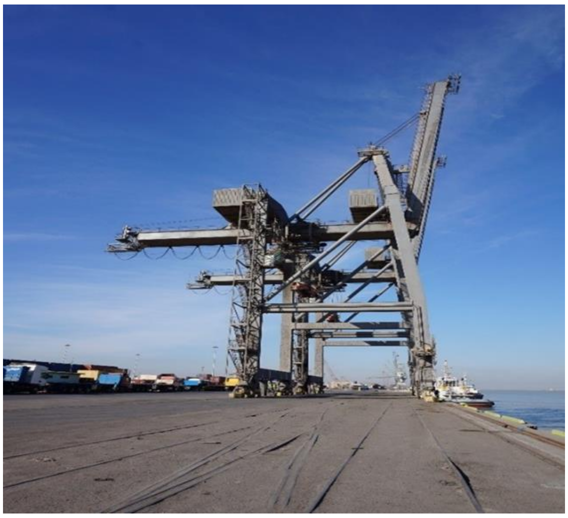


Figure 11-1: Left: gantry crane in South Port; Right: Berths in South Port

The Umm Qasr port can handle ships weighing about 166,601 max DWT. About 350 vessels visit this port annually.

The IFC performance standards that are germane for this section are:

- **Performance Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts
- **Performance Standard 3:** Resource Efficiency and Pollution Prevention
- **Performance Standard 6:** Biodiversity Conservation and Sustainable Management of Living Natural Resources

11.2 Baseline Conditions

Study Area

Umm Qasr port has been in operation since 1930, with briefly interrupted operations during the second Gulf War (1990-1991). As the only deep-water port in Iraq, it is an important national facility. The following sections describe baseline conditions at the port.

Shatt Al-Basrah Canal

The Shatt Al-Basrah canal was opened in 1983 to divert the flood water from the Euphrates River through the Hammar marshes during the flood periods, and subsequently to drain it to Khor Al-Zubair channel, into the Arabian Gulf. The backbone of the drainage system in Mesopotamia is the man-made Third River or the Main Outfall Drain. The Main Outfall Drain (MOD), which drains the water of the regions of the Euphrates basin, is an agricultural water drainage canal (which carries chemicals including pesticides, and herbicides used in agriculture washed off the farms) and is the only supplier of water to the Shatt Al-Basrah canal. The ammonium concentration in the canal is 2.41 mg/l, exceeding the 1.37 mg/l limit under the international water quality standards. In addition, its total dissolved solids (TDS) content of 7,328 mg/l also exceeds the international standards of 500 mg/l; the same is also true for water turbidity of 203.9 NTU compared to the international standard of 5 NTU. The Shatt Al-Basrah canal discharges the nutrient and suspended sediment-rich waters into Khor Al-Zubair, which empties into the northern Gulf.

Tides and currents

Tides are generally semi-diurnal (twice a day) in Umm Qasr, with a large variety in range and tidal current duration. Located on a large freshwater canal, with seasonally varying flows, the prediction of tidal currents is complex. The tidal ranges are large (varying from about 3.6 to 4.3m from neap to spring); amplified tidal ranges are due to the port's position along the north end of the Arabian Gulf. In general, tidal ranges are greater at Umm Qasr port than at other locations in the canal.

River/canal currents are largely tidal, but can be heavily influenced by the river inflow along the canal. There are readily available resources online for prediction of tides and currents at Umm Qasr for fishing purposes; these predictions, of course, will change with freshwater discharge in the canal and local weather conditions. Currents, particularly during ebb tide, can exceed 1m/sec. Because the port itself is in a siding to the main canal, currents within the canal are generally not strong.

Figure 11-2: Map of Umm Qasr port showing the sampling stations (1-5)

Sediment quality

Methods: Sediment samples were collected at five sampling stations using a Van Veen Grab sampler, then stored in aluminum foil, and transferred to the lab. Sediment samples were freeze-dried, ground finely in agate mortar and sieved through a 62 μm metal (stainless- steel) sieve. Extraction of oil as TPHs was performed as maintained earlier by Al-Yamani (2021), in which determination of petroleum hydrocarbons in the sediment proceeded as follows: sediment was soxhlet extracted with methanol: benzene (1:1) mixture for 24 hours, then the extracts were reduced in volume to about 10 ml in a rotary evaporator. Extracts were then saponified for 2 hours with a solution of 4N KOH in 1:1 methanol: benzene. After extracting the unsaponified matter with hexane, the extract was dried over anhydrous sodium sulfate, concentrated by a stream of N_2 prior to fluorescence analysis. Trace elements in the sediment samples were extracted by the general procedure of acid extraction by using mineral acid mixture, then for the determination of trace elements concentrations, Angstrom AA320N air acetylene flame Atomic Absorption Spectrophotometer was used, which is fitted with special Hallow Cathode Lamps for each element. Before analysis, elements stock solutions were prepared by dissolving the accurate amount of the salt of each element to prepare standard solutions of 1000 ppm for each element. Diluted solutions of each trace elements ion were prepared by accurate dilution of the stock solution. Measurements were done to prepare the calibration curve for each element ions. The measurements for trace elements were done for all water and sediment samples.

Table 11-1: Sediment analysis for Umm Qasr Port, (stations 1-5)					
	Station 1	**Station 2**	**Station 3**	**Station 4**	**Station 5**
Sand %	0.32	0.16	1	0.001	Fine gravel
Silt %	74.2	71.2	73.6	72.4	Fine gravel
Clay %	25.4	28.5	25.3	27.5	Fine gravel
Ignition loss (%H2O)	20.98	21.93	24.33	21.38	19.25
Hg	ND(Below the detection limit)				
As	ND Below the detection limit)				
Pb(μg/g)	16.28	6.1	6.08	28.5	ND
Cd(μg/g)	26.23	13.14	7.78	6.23	ND
Cr(μg/g)	9.41	14.22	14.25	9.48	ND
Oil Concentration (μg/gm)	13.53	19.66	10.12	11.03	15.92

Sediments are typically clayey silts, with a small coarse fraction, except at Station 5 where gravel was found. Organic content was about 20% at all stations.

Water quality

Water samples were collected from the selected stations 1-5 (Fig.11-2) using polyethylene bottles.

Sea water quality was monitored at two depths surface and bottom in the water column of the 5 stations except for the shallow station No. 3 only one depth was monitored. Temperature, pH, Salinity, Turbidity, and DO were monitored with a multi parameter prob. Samples were suction filtered and stored in fridge for analysis. For trace elements analysis, to each 50 ml water sample 5 ml of 2 M nitric acid was added which is digested in Teflon beaker until near dryness, the residue was then dissolved in 1 ml 0.5 N hydrochloric acid and made up to 25 ml with deionizer water and stored in 25 ml anlagen screw cap bottles and sealed for the determination of trace metals concentrations by using Atomic Absorption Spectrophotometer. For petroleum hydrocarbons determination, water samples were treated with carbon tetrachloride, and the organic layer was separated and analyzed by adopting the technique of spectrofluorometry.

Table 11-2: Water analysis for Umm Qasr Port, (stations 1-5)										
	Station 1		**Station 2**		**Station 3**	**Station 4**		**Station 5**		**Approx. standards**
surface	**bottom**	**Surface**	**Bottom**	**Surface**	**Surface**	**Bottom**	**surface**	**bottom**	**surface**	
Temp.ºC	26.20	26.04	26.0	26.0	26.0	26.5	25.9	26.2	25.8	
pH	8.05	8.17	8.21	8.23	8.25	8.25	8.21	8.22	8.25	6.5-9
Sali. (‰)	44.6	45.3	45.3	45.5	44.6	45.5	46.0	45.9	46.3	

TSS, mg/l	432	450	408	340	324	406	374	360	224	
Turb.NTU	277	473	105	189	147	249	209	239	385	
DO(mg/l)	7.46	6.4	10.17	6.01	10.4	9.61	6.86	9.16	5.76	>3
COD,mg/l	1264	1384	1256	1308	1320	1296	1320	1267	1360	
BOD,mg/l	8.4	6.0	6.8	6.8	2.2	2.6	3.2	4.4	12	
TDS,mg/l	39.4	40.0	40.0	40.1	39.4	40.0	40.5	40.4	40.7	100
Tot. N, (mg/l)	10.5	7.0	8.129	8.228	7.0	10.5	10.5	3.5	7.0	
Tot. P (mg/l)	1.49	0.74	0.99	0.99	0.99	0.1	0.91	0.59	1.017	
Tota. Col. UC/100ml	Nil	1	Nil	Nil	Nil	4	Nil	29	1	200
PAH,ng/l	0.03	0.02	0.01	0.02	0.03	0.03	0.02	0.04	0.03	1000 µg/l
Oil(µg/l)	8.32	5.26	6.01	5.52	6.23	4.82	1.23	3.21	4.08	5000 µg/l
Hg	ND(Below the detection limit)									50 µg/l
As	ND(Below the detection limit)									50 µg/l
Pb,mg/l	1.42	0.2	ND	0.41	ND	0.2	ND	0.2	ND	0.05 mg/l
Cd,mg/l	0.33	0.07	0.24	0.28	0.29	0.32	0.17	0.25	0.12	0.01 mg/l
Cr,mg/l	1.89	0.47	0.95	ND	ND	2.37	0.95	2.37	0.47	0.05 mg/l

Approximate standards are for ports and harbors (USEPA)

Compared with U.S. sediment quality standards, lead, chromium, and cadmium exceed the standards; oil is within sediment water quality standards. These values are not atypical of industrial ports having extended periods of operation. Salinity varies from a few ppt (parts per thousand or ‰) up to more than 45 ppt (depending on river flow, tidal stage, and other factors).

Other water quality measurements are included in Chapter 10: Water Quality.

BIOTA

Khor Al-Zubair is connected at its northern reaches with the Shatt Al-Basrah canal. The lower boundary of the Khor Al-Zubair is a lagoon located near Kuwait's Warbah Island about 8 km southeast of Umm Qasr. Thus, Khor Al-Zubair is commonly considered an extension of the Arabian Gulf. The length of Khor Al-Zubair lagoon is about 32 km with a width ranging between 100 and 800 m, and the depth of the navigational channel ranges between 10 and 15 m.

Thus, Khor Al-Zubair represents a channel of interaction between freshwater discharge of the Shatt Al-Basrah and the saline water of the Arabian Gulf.

Birds of Umm Qasr 2005-2020

In the northern Gulf region, it has been reported that mudflat-associated birds are in greater abundance than terrestrial birds. Some of the birds are migratory; some are not.

Of the 54 mudflat-associated birds observed at Umm Qasr, three are reported to be near-threatened (NT). From 2005 onwards, about 105 species of birds have been observed on the mudflats. Autumn is the peak season for birds in the flats.

Table 11-3: Bird species in the mudflat at Umm Qasr, during 2018-2020, LC: Least Concern, NT: Near-threatened

	Scientific Name	Common Name	IUCN
1	*Tadorna tadorna*	Common Shelduck	LC
2	*Anas clypeata*	Shoveler	LC
3	*Phoenicopter us ruber*	Greater Flamingo	LC
4	*Ciconia ciconia*	White Stork	LC
5	*Platalea leucorodia*	Spoonbill	LC
6	*Ardea Purpurea*	Purple Heron	LC
7	*Ardeola ralloides*	Squoacco Heron	LC
8	*Ardea cinerea*	Gry Heron	LC
9	*Ardea alba*	Great White Egret	LC
10	*Egretta garzetta*	Little Egret	LC
11	*Egretta gularis*	Western reef Heron	LC
12	*Phalacrocor ax carbo*	Cormorant	LC
13	*Circus aeruginosus*	Western MarshHarrier	LC
14	*Bueto rufinus*	Long-legged Buzzard	LC
15	*Falco tinnunculus*	CommonKestrel	LC
16	*Dromas ardeola*	Crab Plover	LC
17	*Phalaropus lobatus*	Red-necked Phalarope	LC
18	*Himantopus himantopus*	Black-winged Stilt	LC
19	*Ricurvirostra avosetta*	Avocet	LC
20	*Pluvialisfulva*	Pacific Golden Plover	LC
21	*Charadrius hiaticula*	Common Ringed Plover	LC
22	*Charadrius alexandrines*	Kentish Plover	LC
23	*Charadrius leschenaultii*	Greater Sand Plover	LC
24	*Limosalimosa*	Black-tailedGodwit	NT
25	*Numenius arquata*	Common Curlew	NT
26	*Tringa erythropus*	Spotted Redshank	LC
27	*Tringa nebularia*	Greenshank	LC
28	*Tringa totanus*	Redshank	LC
29	*Tringa stagnatilis*	Marsh Sandpiper	LC
30	*Xenus cienereus*	Terek Sandpiper	LC
31	*Calidris minuta*	Little Stint	LC
32	*Calidris alpina*	Dunlin	LC
33	*Larus genei*	Slender BilledGull	LC
34	*Larus ridibundus*	Black-headed Gull	LC
35	*Larus fuscus*	Lesser Black- backedGull	LC
36	*Larus armenicus*	Armenian Gull	NT
37	*Gelochelidon nilotica*	Gull-billed Tern	LC

38	*Sterna caspia*	Caspian Tern	LC
39	*Chlidonia leucopterus*	White-wingedTern	LC
40	*Streptopelia docaocto*	Collared Dove	LC
41	*Upupa epops*	Hoopoe	LC
42	*Lanius collurio*	Red-backedShrike	LC
43	*Galerida cristata*	Crested Lark	LC
44	*Hirundorustica*	Barn Swallow	LC
45	*Hippolais pallida*	Olivacious Warbler	LC
46	*Phylloscopus trochilus*	Willow Warbler	LC
47	*Muscicapastriata*	Spotted Flycatcher	LC
48	*Oenanthe oenanthe*	Northern Wheatear	LC
49	*Oenanthe* deserti	Desert Wheatear	LC
50	*Oenanthe finschii*	Finsch's Wheatear	LC
51	*Passer domesticus*	House Sparrow	LC
52	*Motacilla flava*	Yalow Wagtail	LC
53	*Motacillaalba*	White Wagtail	LC
54	*Anthus campestris*	Tawny Pipit	LC
	Total No.	**54**	

Fish of Umm Qasr

Fish in adjoining Kuwaiti waters are quite rich in number. Some 345 species representing 94 families have been documented in norther Kuwait waters. Some 21 species are of high commercial fisheries importance, in addition to crab and shrimp species.

The overall richness of fish assemblages in the Khor Al-Zubair underlines the area's importance as a nursery ground for several local species. Some of the most important commercial species that have been recorded in Khor Al-Zubair are *Pampus argenteus* (zobaidy: the silver pomfret), *Pomadasys argenteus* (current name is *Pomadasys kaakan*; nakroor: Javelin grunter), *Otolithes ruber* (nuwaiby: the silver croaker), *Acanthopagrus latus*

(sha'em: yellowfin seabream), *Acanthopagrus cuvieri* (current name is Sparidentex hasta; sobaity: sobaity seabream) and *Epinephelus coioides* (hamoor: the orange-spotted grouper), with the peak spawning period occurring in the spring.

A study on the composition and abundance of fish assemblage in Khor Al-Zubair. In their study, the highest temperature recorded was 32ºC in September, and the lowest of 12.8 ºC was observed in January; while the highest salinity was recorded in September (58.24 psu), and the lowest salinity was in January (21.6 psu). They also reported 38 species of fish belonging to 28 families of Osteichthyes and two species of Chondrichthyes (*Aetobatus narinari* and *Chiloseyllium grisum)* from the Khor's waters. Moreover, *Mastacembelus mastacembelus* and *Coptodon zillii* (previously *Tilapia zillii*) were recorded in the Khor environment for the first time.

There was a significant positive relationship of salinity with the number of species. During the past few years, there has been a reduction in freshwater flow rates from the upstream main outfall drain (MOD) or the man-made Third River. The MOD used to carry water to Shatt Al-Basrah canal, thus, affecting the water quality of Khor Al-Zubair. According to the 2013 report of the Marine Science Center at Al-Basrah, the flow of the MOD to Shatt Al-Basrah canal is currently less than 15 m^3/s and reduces to 0 m^3/s in some seasons, which could have serious implications to the region's fisheries resources.

A list of fish collected from Umm Qasr is shown below (39 species).

Table 11-4: Fish Fauna Collected from Umm Qasr (2003-2021)

#	Species Umm Qasr	Common Name
1	*Acanthopagrus arabicas*	Arabian Yellowfn Seabream
2	*Aetobatus narinari*	Spotted Eagle Ray
3	*Alepes djedaba*	Shrimp Scad (Slender Yellowtail Kingfsh)
4	*Arius bilineatus*	Roundsnout Sea Catfsh
5	*Bathygobius fuscus*	Dusky Frillgoby
6	*Chiloscyllium griseum*	Grey Bambooshark
7	*Chirocentrus dorab*	Dorab Wolf-Herring
8	*Cynoglossus arel*	Largescale Tonguesole
9	*Eleutheronema tetradactylum*	Fourfnger Threadfn
10	*Epinephelus coioides*	Orangespotted Grouper
11	*Euryglossa orientalis*	Oriental Sole
12	*Ilisha compressa*	Compressed Ilisha
13	*Johnius belangerii*	Belanger's Croaker
14	*Johnuis sina*	Silver Croaker
15	*Leiognathus bindus*	Orange Ponyfish
16	*Liza klunzingeri*	Klunzinger's Mullet
17	*Mastacembelus mastacembelus*	Euphrates Spiny Eel
18	*Nematalosa nasus*	Bloch's Gizzard Shad
19	*Otolithes ruber*	Tigertooth Croaker
20	*Pampus argenteus*	Silver Pomfret
21	*Periophthalmus waltonii*	Walton's Mudskipper
22	*Planiliza subviridis*	Greenback Mullet
23	*Platycephalus indicus*	Bartail Flathead
24	*Polydactylus sextarius*	Blackspot Threadfn
25	*Pseudorhombus arsius*	Largetooth Flounder
26	*Pseudosynanceia melanostigma*	Blackfn Stonefsh
27	*Rhynchorhamphus georgii*	Long-billed Halfbeak

28	*Sardinella albella*	White Sardinella
29	*Scatophagus argus*	Spotted Scat
30	*Scomberoides commersonnianus*	Talang Queenfsh
31	*Sillago sihama*	Silver Sillago
32	*Sparidentex hasta*	Sobaity Seabream
33	*Strongylura strongylura*	Spotted Needlefsh
34	*Tenualosa ilisha*	Hilsa Shad
35	*Thryssa hamiltonii*	Hamilton's Thryssa
36	*Thryssa whiteheadi*	Whitehead's Thryssa
37	*Tilapia zillii* (*Coptodon zillii*)	Redbelly Tilapia
38	*Trichiurus lepturus*	Largehead Hairtail
39	*Upeneus sulphureus*	Sulphur Goatfsh

Phytoplankton of Umm Qasr

For the entire Arabian Gulf, the winter phytoplankton community is diverse with 337 identified species. A total of 62 microalgal species are considered potentially harmful species, out of which, 20 species are potentially toxic to humans, 15 species could potentially cause marine fish mortality and 23 are potentially bloom-forming species (ROPME, 2013; Polikarpov et al., 2016). Kuwait to the south has reported 490 different taxa of phytoplankton just south of Umm Qasr.

A sampling of phytoplankton at Umm Qasr showed the following 66 species present.

Table 11-5: Phytoplankton of Umm Qasr (2009-2018)			
#	**Phytoplankton Species**	**#**	**Phytoplankton Species**
	Chlorophyceae	**35**	*Melosira* sp.
1	*Coelastrum microsporum* Naeg.	*36*	*Nitzschia sigma* (Kuetz.) W.Smith
2	*Pediastrum duplex var reticutum* Lagerh.	*37*	*N. hybrida*
3	*P. simplex* Meyen	*38*	*Odontella mobiliensis* (Bail.) Grun.
4	*P. simplex var.duodenarium*	*39*	*O. sinensis* (Grev.) Grun.
	Chrysophyceae	**40**	*Paralia sulcata* (Ehr.) Cleve
5	*Dinobryon sirtularia* Her.	*41*	*Petrodictyon gemma* Ehr.
	Bacillariophyceae	**42**	*Planktoniella* sp.
6	*Actinocyclus octonarius* Ehr.	*43*	*Plerosigma* sp.
7	*Asterionella japonica* Cleven	*44*	*Petroneis* sp.
8	*Caloneis* sp.	*45*	*Rhizosolenia alata forma indica* (Perag.) Gran
9	*Campylodiscus clypeus* Her.	*46*	*R. Shrubsolei* Cleve
10	*C. daemelinus*	*47*	*Rhizosolina* sp

11	*C. echeneis*	48	*Surirlla gemma* Her.
12	*C. noricus* ex Ktz	49	*S. recedens* A. Schmidt.
13	*Corethron cryophilum* Castr.	50	*S. striatula* Turp.
14	*Coscinodiscus asteromphalus* Ehr.	51	*Thalassionema nitzschioides* Grun.
15	*C. gigas var. praetetus* Jan ex Hust.	52	*T. frauenfeldii* Grun.
16	*C. oculus-iridis* Her.	53	*Thalassiosira leptopus (Grun.)*
17	*Chaetoceros decipience* Cleve	54	*Thalssiothrix longissima* Cleve and Grun.
18	*Ch. Peruvianus* Brightw.	55	*Trachneis aspera* (Her.) Cl.
19	*Cyclotella atomus* Hust.	56	*Triceratium favus* Ehr.
20	*C. striata* (Kuetz) Grun.		**Dinophyceae**
21	*C. Stylorum* Brightw	57	*Ceratium furca* (Her.) Clap. Et lach.
22	*Cyclotella* sp	58	*C. trichaios* Ehr.
23	*Cylindrotheca closterium* Ehr.	59	*C. tripos* (O.Muell.) Nitz.
24	*Cymatopleura elliptica*(Breb)W.Smith	60	*Dinophysis caudata* Sav.-Kent
25	*Ditylum brightweellii* (T.West)Grun.	61	*Prorocentrum minimum* Schiller
26	*D. sol* Grun.	62	*Prorocentrum micans* Ehr.
27	*Eucampia zodiacus* Ehr.	63	*Peridinium cinctum* (Muell.) Her.
28	*Gomphotheca sinensis*(Skvortzow)Hen.&Sims	64	*Protoperidinium* sp.
29	*Gyrosigma balticam* (Ehr.) Rabh.	65	*Pyrocystis obtuse*
30	*G.sinensis* Ehr.	66	*Pyrophocus horologium*
31	*Lauderia annulata* Cleve		
32	*Leptocylindrus minimus*		
33	*Leptocylindrus* sp		
34	*Melosira moniliformis*		

Zooplankton of Umm Qasr

The zooplankton community in the Arabian Gulf is diverse, comprised of about 210 main species (ROPME, 2010). The planktonic larvae of benthic animals (meroplankton) contribute up to 35.3% of total zooplankton, with mollusk larvae being the dominant component, followed by polychaete larvae. Decapod larvae are mainly represented by shrimp larvae and crabs. Just to the south of Umm Qasr in Kuwait waters, 183 species of zooplankton were observed.

A listing of the 46 zooplankton (including the important ichthyoplankton) at Umm Qasr is shown in the table below.

Table 11-6: Zooplankton of Umm Qasr (2009-2018)

#	Species	Mean of zooplankton (ind./m3)	±SD
1	*Acartia sp.*	234.	246.
2	*A. pacifica*	868.	1172.
3	*A. (Acartiella) faoensis*	654.	995.
4	*Acrocalanus gibber*	36.	25.
5	*Arctodiaptomus salinus*	67.	0.
6	*Bestiolina arabica*	638.	504.
7	*Clausocalanus minor*	225.	148.
8	*Diaptomus sp.*	953.	1202.
9	*Eucalanus subcrassus*	21.	15.
10	*Paracalanus subcrassus*	465.	467.
11	*Parvocalanus crassirostris*	433.	317.
12	*Phylodiaptomus sp.*	1.	0.
13	*Pseudodiaptomus sp.*	13.	0.
14	*P. marinus*	199.	0.
15	Copepodie stages	1385.	1139.
16	Total of calanoida	3673.	2411.
17	Other Cyclopoid	54.	25.
18	Total of Cyclopoida	61.	27.
19	*Oithona plumifera*	23.	5.
20	*Aegisthus sp.*	10.	5.
21	*Euterpina acuifrons*	1.	0.
22	*Microsetella rosea*	2.	0.
23	*Oncaea conifer*	142	136.
24	*O. cleve*	62	2.
25	Nauplii	3281	3438.
26	Total copepoda	6202.	4069.
27	Cirripede larvae	775.	1411.
28	Megaloba	508.	650.
29	Zoea of Crab	31.	22.
30	Mysis of shrimp	14.	12.
31	Amphipoda	1.	0.
32	Ostracoda	22.	40.
33	Mysids larvae	1.	0.
34	Total of Crustacea	7820.	5045.
35	Bivalve	104.	98.
36	Gastropoda	557.	998.
37	Rotifers	177.	177.
38	Polychaet larvae	227.	285.

39	Appendicularia	108.	73.
40	Conifera	21.	1.
41	Fish larvae	19.	27.
42	Fish eggs	786	1769.
43	Foraminifera	938.	38.
44	Sagitta	9.	9.
45	Jelly fish	1.	0.
46	Ephyra of coelenterate	1.	0.

Biodiversity issues

Besides the discussions on fish, phytoplankton, zooplankton, and birds, there are other elements of the Umm Qasr area that contribute to biodiversity. Riverine habitat, mudflat habitat, and other areas possess rich benthos and seagrass resources.

There are no protected areas close to Umm Qasr, and Iraq has no marine protected areas. The project lies outside but adjacent to the Khor Al-Zubair Important Bird Area (IBA) and Key Biodiversity Area (KBA) with the closest point located 2.5 km from the southwest of the Project site and on the opposite bank of the access channel. The Khor Al-Zubair IBA extends along the Khor southwards to a point on the river opposite Umm Qasr, but not including Umm Qasr.

Biodiversity in Iraq has not been properly assessed, but from this review it is clear key biodiversity elements might include saline marsh habitat, birds, fish, and perhaps mudflat habitats. However, since Umm Qasr is a long-standing port, the impact of this soybean processing facility on the environment will be small. Water quality and sediment quality are already affected by the ongoing and long-lived port activities (as well as local military conflicts), so the impact of the facility on the environment will be small.

11.3 Marine Impact Assessment (construction, operation and decommissioning)

Direct impacts of the project on the marine environment are minimal. The water quality impact is discussed in Chapter 10: Water Quality Management, and is assessed as low magnitude and low significant. Noise, dust, and vibration likewise will be minimal impact.

Potential receptors of project impacts in the areas of oceanography/marine biodiversity of the area might include:

- Birds: The birds from the Umm Qasr mudflats will not be significantly affected by the present project. No dredging nor dredge spoil disposal is proposed. Marine traffic is the sole impact directly on the birds, and these impacts are expected to be negligible due to rare occurrence of associated marine traffic.

- Mudflats: No significant impact on mudflats will occur as no dredging or dredge spoil disposal will take place, and the mudflats are at some distance from the soybean site.
- Saline marsh habitat: As no significant alterations will be made to any marine habitats, the impact of the project on marsh habitat will be negligible.
- Fisheries: Because of the distance of the project facilities from the marine habitat, and the lack of direct connectivity to effluent from the project to the marine habitat, there should be no impacts of the project on fisheries.
- Other biodiversity elements (plankton, marine mammals, cetaceans, etc.): again, due to sparsity of project overlap with the marine environment, there will be no significant impacts to these alternative biodiversity components.

Given the lack of direct project work on the site, the **Expected Impacts from the construction, commissioning, operation, and decommissioning of the soybean project on the marine environment are classified as follows: *– Low Magnitude, Low Negative Significance***

Overall Impact from various activities of the Project on oceanography/marine biodiversity of the area (ME1) – *Low Magnitude, Low Negative Significance*

Table 11-7: Construction Phase- Impacts Assessment due to Accidental Spillages of Hydrocarbons or Sanitary Wastewater

Factor	**ME1**
Receptor Important/Sensitivity	Medium
Frequency	Infrequent
Likelihood	Unlikely
Extent	Local
Duration	Short
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

11.4 Mitigation

Given the scarcity of direct impacts, there is no need for mitigation. However, ongoing marine monitoring of the marine water quality, air quality, and some limited marine species (birds, fisheries) would contribute to understanding of the marine environment around the project site. Given the confounding impacts of climate change, such monitoring would most likely not contribute to a significantly improved understanding of any environmental impacts on marine biodiversity or marine flora and fauna.

12 SOCIO-ECONOMIC ASPECTS

12.1 Introduction

The Soybean Oil project will result in positive effects from social and economic points of view, on the existing social and cultural settings at Basra Province. This assessment views the project on local, national and regional levels including aspects of demography, economic activity, infrastructure, and land use as well as education.

The project profile is assessed by review of existing published information primarily from the Directorate of Environment, Directorate of Planning, and the Municipility of Basra and Umm Qasr amongst other authorities.

This Section provides an understanding of the social and cultural context of Basra Province and identifies and evaluates the potential socio-economic and cultural impacts upon the lives and circumstances of the people, their families and their communities in the vicinity of the Project: specifically the Umm Qasr area.

National, regional and local socio-economic characteristics are described, including economy; population and demographics; employment; education; municipal and social services; and land use and ownership. The impact of the Project is assessed using the methodology detailed in Section 4 – Impact Assessment Criteria and Methodology and assesses changes in the following key socio-economic parameters:

- Effects of the project on socio-economic indicators;
- Involvement of local manpower in project operation;

The Project management commits to meet an obligation of positive contribution towards employees, the environment, economy and society. International Finance Corporation (IFC) Performance Standards has been central to the socio-economic assessment of this study. The below particular principles are relevance to this Section of the ESIA and are actively incorporating into day-to-day operations to ensure international best practises are adopted and adhered to.

- Principle 3: Uphold fundamental human rights and respect cultures, customs and values in dealing with employees and others who are affected by the Project activities.
- Principle 9: Contribute to the social, economic and institutional development of the communities in which the Project operates.
- Principle 10: Implement effective and transparent engagement, communication and independently verified reporting arrangements with the Project stakeholders.

In order to determine a baseline for the assessment, identifying impacts upon socio-economic characteristics and propose mitigation where necessary, the methodology described in the next subsection has been employed.

12.2 Baseline Conditions

12.2.1 Baseline condition Profiling

The establishment of baseline socio-economic conditions for the Project has been undertaken using a combination of a review of existing published information including government reports and statistics, academic studies, previous environmental reports, and any other available literature, and sourcing primary data from the community via stakeholder engagement activities, specifically interviews with local stakeholders and socio-economic questionnaires.

The information reviewed whilst profiling baseline socio-economic conditions is summarised below in Table 12-1.

Table 12-1: Information Reviewed for Baseline Conditions

Aspect	Information Reviewed
Socio-economic Indicators	• Demographic patterns, social structure, local economy • Local infrastructure, educational system and health and other services
Employment and Local Manpower	• Occupational statistics, educational levels and manpower skill • Locally available raw materials, supplies and services for the project
Land Use and Natural Resources	• Current land use patterns, including grazing area, agricultural sector, and availability of natural resources, such as groundwater and surface water

In compliance with the World Bank guidelines, stakeholder engagement has been undertaken in determining the project baseline and to capture potential socio-economic impacts. Consulted parties have included local Government officials and local Community Representatives.

12.2.2 Local Stakeholder Consultations

In order to obtain baseline information at the local level and to help determine the attitudes of local residents and government officials regarding the project, a community survey was undertaken in October 2022. The socio-economic survey involved presentation of a Project briefing followed by interviews or completion of an audience specific socio-economic questionnaire provided to the target stakeholder groups: Government representatives and the wider community.

Consultation with Government representatives involved the issue of the socio-econmic questionnaire, followed by face-to-face interviews with the following:

- Municipality of Basrah, Engr. Iman Hameed Majeed
- The municipalities of the province of Basra Directorate, Engr. Asad Saleh
- Municipility of Umm Qasr,
- Directorate of Environment in Basra, Dr. Karim Ghanim and Mr. Amer Hussain
- Directorate of Health in Basra, Dr. Nihad Qasim Mohamed
- Directorate of Basra Planning; Engr. Shahdi Abdul Ameer Majed

The Government representatives provided valuable information to contribute towards establishing the baseline for the project.

In order to obtain views and feedback from a range of respondents within the local community, the socio-economic survey utilised a number of approaches to reach both men and women of different age ranges, and socio-economic backgrounds. The approach was particularly successful in obtaining views from female respondents, who generally participate less actively in this type of survey.

The community socio-economic survey involved the distribution of approximately 50 survey questionnaires within Umm Qasr residential area, with 50 people completing and returning the survey between the 22nd to the 23rd October 2022. Answers were either written by the respondent or given verbally and recorded by the project team. The results of the survey are provided in Appendix C.

The following sectors were included in the community survey:

- Education sector – questionnaires were distributed to male and female teachers and students in local schools;
- Health sector – a project briefing was provided and the socio-economic questions posed orally. Respondents were primarily female nurses and their answers were recorded by the project team;
- Proprietors and customers in the local marketplace, which included restaurant, grocery store, supermarkets, pharmacy, and other shops.

Employment of those who responded to the survey included teacher; nurse; student; municipal employee; military; engineer; pharmacist; businessman; and retired. Approximately 30% of respondents indicated that they are currently unemployed (more details are given in Appendix C). There was diversity in the age, educational level and economic status of respondents. Interviewees were glad when they heard that a new soybean oil project will built in Umm Qasr aera as this project will support them in two main aspects: (1) hiring unemployed young people in Umm Qasr area and (2) it may lead to reduce the vigitable oil price (currently about USD 1.8 per liter of vegetable oil) as there will be more competition.

12.3 National Social and Economic Background:

12.3.1 Population and Demographics

Total estimated population in Iraq according to 2020 CIA WORLD FACTBOOK is about 40 million (July 2020 est.) with an annual growth rate of about 2%.

Country comparison to the world: 36

Detailed Iraqi Population distribution by age is presented below table:

Table 12-2: Iraqi Population Estimates by Sex and Age Group*				
Age Group	**Male**	**Female**	**Total**	**%**
Total	20,135,407	19,719,025	39,854,432	100
0–4	3,001,938	2,845,630	5,847,568	14.67
5–9	2,801,593	2,637,323	5,438,915	13.65
10–14	2,503,802	2,337,380	4,841,183	12.15
15–19	2,196,837	2,075,647	4,272,484	10.72
20–24	1,918,965	1,770,996	3,689,961	9.26
25–29	1,505,098	1,463,422	2,968,520	7.45
30–34	1,317,918	1,356,230	2,674,148	6.71
35–39	1,123,350	1,184,338	2,307,688	5.79
40–44	1,059,298	1,073,442	2,132,741	5.35
45–49	782,854	806,097	1,588,951	3.99
50–54	461,586	574,816	1,036,401	2.60
55–59	524,741	549,131	1,073,872	2.69
60–64	361,381	394,984	756,365	1.90
65-69	237,890	247,820	485,710	1.22
70-74	155,203	156,175	311,378	0.78
75-79	81,749	98,501	180,250	0.45
80+	101,202	147,093	248,296	0.6

* en.wikipedia.org/wiki/Demographics_of_Iraq

According to the CIA World Factbook (2018 version), the Iraqi population age structure can be summarized as follow:

- 0–14 years: 39.01% (male 8,005,327/female 7,674,802)
- 15-24 years: 19.42% (male 3,976,085/female 3,829,086)
- 25-54 years: 33.97% (male 6,900,984/female 6,752,797)
- 55-64 years: 4.05% (male 788,602/female 839,291)
- 65 years and over: 3.55% (male 632,753/female 794,489)

These two sources match well, indicating perhaps that the Wikipedia source was the CIA World Factbook.

The CIA World Factbook lists the following ethnic groups: Arab 75-80%, Kurdish 15-20%, other 5% (includes Turkmen, Yezidi, Shabak, Kaka'i, Bedouin, Romani, Assyrian, Circassian, Sabaean-Mandaean, Persian)

12.3.2 Provinces:

The Republic of Iraq is divided into 18 governorates (also known as provinces): Baghdad, Ninawa, Basra, Al-Anbar, Babil, Dhi Qar, Al-Qādisiyyah, Diyala, Duhok, Erbil, Karbala, Kirkuk, Maysan, Muthanna, Najaf, Salah Al-Din, Sulaymaniyah and Wasit (see figure 12-1). Each province has a governor designated by the Prime Minister.

The city with the highest population is Baghdad, with more than 8 million inhabitants. The next largest cities are Nanawa with more than 3.7 million and Basra with more than 2.9 million.

Figure 12-1: Administrative map of Iraq, 2021

12.3.3 National Economy:

The economy of the Republic of Iraq was agriculture-based with a largely nomadic population until oil was discovered in the 1930s. The Republic of Iraq holds the world's fifth-largest proved crude oil reserves, at about 145 billion barrels, representing 17% of proven reserves in the Middle East and 8% of global reserves. Over the last decade, oil revenues have accounted for more than 99% of exports, 85% of the government's budget, and 42% of gross domestic product (GDP). As of January 2021, in a country of about 40 million, Iraq's unemployment rate was more than 10% although this rate could be higher or lower depending on the provice.

The Iraqi economy is gradually recovering from the oil and COVID-19 shocks of 2020. Real GDP is estimated to have edged up by 1.3% in 2021, after a sharp contraction of 11.3% in 2020. Both oil and non-oil growths are on track to reach their pre-pandemic levels, as oil production increases and the easing of COVID-19 restrictions restores domestic economic activity. The non-oil economy grew by over 6% in the first nine months of 2021 (year-over-year), owing to a solid performance in the services sectors as COVID-19 containment measures were eased. This recovery outpaced the slowdown in the oil sector as Iraq adjusted to its OPEC+ quota early in the year.

On April 20, 2022 the World Bank announced that Iraq has achieved the first Arab position with the largest growth in GDP. Iraq's gross domestic product may grow this year by 8.9 percent, exceeding the rest of the Arab countries, including Qatar, which is expected to grow by 4.9 percent, Saudi Arabia 7 percent, Kuwait 5.7 percent, UAE 4.9 percent, Algeria 3.2 percent, and Egypt 5.5 percent, Jordan 2.3 percent and Morocco 4.3 percent.

Iraq initiated its process to World Trade Organization (WTO) Accession in 2004 to attract foreign investment and to help to diversify the economy but due to political and economic instability this was stalled until 2017 when Iraq expressed interest to reinstate their determination to join the WTO.

Table 12-3 illustrates the continued growth of the Iraqi economy and the strong correlation between Gross Domestic Product (GDP) and the average price of oil. It is expected that growth should accelerate in 2022 due to higher oil prices and increased investment from China. The forecast growth for Iraq is 7.8% in 2022 as expected by FocusEconomics.

Table 12-3: Economic Indicators for Iraq as of 2019*

Description	2015	2016	2017	2018	2019
Population (million)	35.2	36.2	37.1	38.1	39.1
GDP per capita (USD)	4,677	4,606	5,133	5,571	5,636
GDP (USD bn)	165	167	191	212	220
Economic Growth (GDP, annual variation in %)	2.6	13.8	-3.8	0.9	4.4
Industrial Production (annual variation in %)	22.2	8	-	-	-

Unemployment Rate	10.7	10.8	13	12.9	12.8
Fiscal Balance (% of GDP)	-12.8	-13.9	-1.6	7.9	-
Public Debt (% of GDP)	56.9	64.3	58.9	49.3	-
Inflation Rate (CPI, annual variation in %)	1.4	0.5	0.1	0.4	-0.2
Policy Interest Rate(%)	6	4	4	4	4
Exchange Rate (vs USD)	1,096	1,182	1,185	1,193	1,194
Exchange Rate (vs USD, aop)	1,148	1,171	1,177	1,192	1,193
Current Account (% of GDP)	-1.7	1.3	7.8	16.2	7.1
Current Account Balance (USD bn)	-2.8	2.2	14.9	34.4	15.8
Trade Balance (USD billion)	11	12.2	25.4	47.5	32.2
Exports (USD billion)	51.3	41.3	57.6	86.4	81.6
Imports (USD billion)	40.3	29.1	32.2	38.9	49.4
Exports (annual variation in %)	-39.9	-19.6	39.4	50	-5.5
Imports (annual variation in %)	-19	-27.9	10.7	20.8	27.1
International Reserves (USD)	50.9	42	45.6	60.8	-
External Debt (% of GDP)	38.6	39.4	36.4	-	-

* https://www.focus-economics.com/countries/iraq

Another source of income for Iraq is agriculture, which has traditionally accounted for one-fourth to one-third of Iraq's GDP, but now accounts for less than 10 percent.

12.3.4 Agriculture:

The Republic of Iraq can be considered as an agricultural country. Land potentially suitable for agricultural purposes is about 27% of the total area of the country. The rest includes deserts with extremely low rainfall and rocky/steep mountains which are the natural grazing grounds for the millions of head of sheep and goats in the country.

Agriculture in Iraq contributes (about 5%) of the Iraqi GDP and employs a comparable proportion of the workforce (roughly 20% of the country's workforce). The total area which has been used for agricultural production is about 8 to 9 million hectares which is almost 67% of the cultivable area (Food and Agriculture Organization of the United Nations, 2022). Thus, agriculture development is critical to allow Iraq to achieve their vision of a more diversified economy, in addition to generating employment and boosting private sector engagement.

However, Iraq's agricultural sector currently faces many problems besides soil salinity and drought, including floods and siltation, which impede the efficient operation of the irrigation system. A lack of access to fertilizer and agricultural spare parts after 1990 and a lengthy drought in the early 21st century led to a decrease in agricultural production. Republic of Iraq is one of the world's largest date producers , and other crops produced include melons, tomatoes, potatoes, grapes, rice, and wheat.

There are no agricultural farm or production establishments in the vicinity of Umm Qasr area, so effects of the Project on crops are negligible. However, this Project has a positive impact on animal grazing since it will produce soybean meal which will be used for animal feeding. This product (soybean meal) will be sold for clients inside Iraq and in particularly in Basra Province.

12.3.5 Industry

The Republic of Iraq is known to be an extremely oil-dependent country that lacks other developed sectors, leading the industrial sector to become highly dependent on the oil prices. The industrial sector in Iraq has gone through numerous phases in recent history. When the siege was imposed on Iraq in August 1990, the industrial development came to an end and the whole economic situation in the country was changed. The aftermath of the siege led to industrial sector failure with many factories shutting down. Lack of raw materials coupled with import/export restrictions left most workers unemployed with other portions heading to neighboring countries to find jobs. This siege lasted until 2003 invasion of Iraq, afterwhich, Industrial activities came back, gradually recovering after 2003. However, new challenges surfaced, like security instability and lack of governmental laws, becoming the new obstacle in the years after the war, and not until recently has the Iraqi industrial sector with the great market potential started seeing serious attempts to recover, as the security situation is stabilizing (Abdulshawi, 2011).

The industrial sector in Iraq covered about 22.3% out of the total employment in 2019 (World Bank Data). As of the year 2018, Iraq has 25,747 small establishments, 198 medium establishment, and 627 large establishments in both private and public sectors (Central Statistical Organization, 2018)

The leading industrial establishment in Iraq is the food and beverage industry (31.9%) distributed as 8,229 small establishments, 66 medium establishments, 182 large establishments; followed by metal processing industry except for the machinery (23.5%) distributed as 6,234 small establishments, 3 large establishments; and manufacturing of furniture (20.7%) distributed as 5500 small establishments, 2 medium establishments, and 3 large establishments. On the other hand, the least represented industrial activities were the manufacturing of motor vehicles (0.015%) distributed as 2 small establishments and 2 large establishments; mining activities (0.015%) distributed as 2 small establishments and 2 large establishments; and manufacturing of paper (0.023%) distributed as 3 small establishments, 1 medium establishment and 2 large establishments (Central Statistical Organization, 2018).

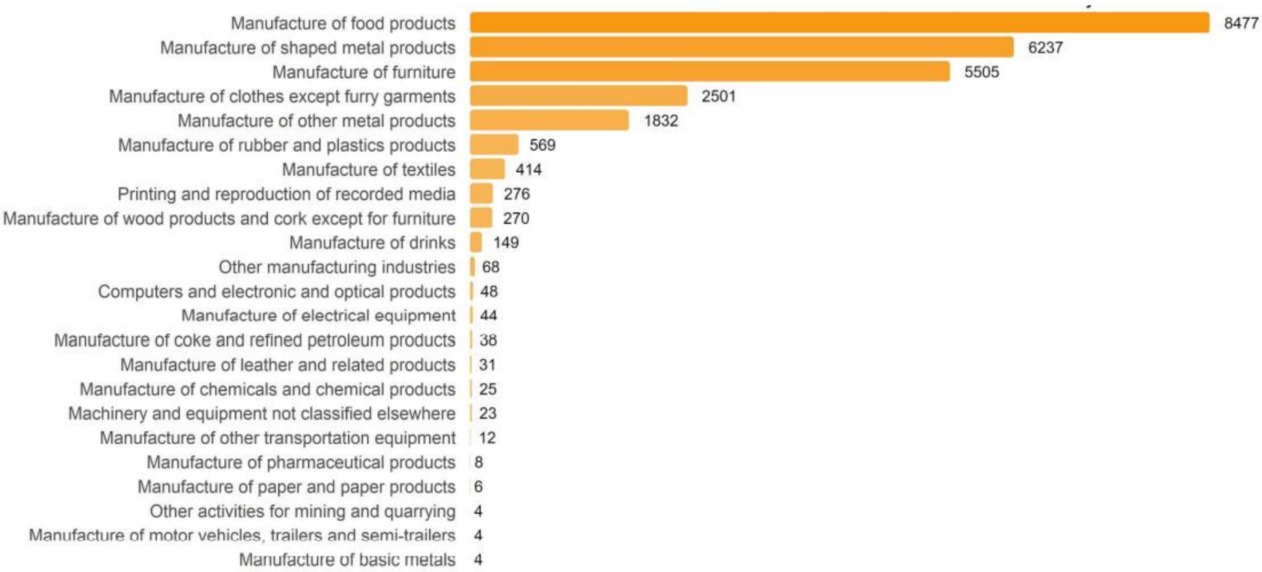


Figure 12-2: Number of establishments at each industry in Iraq (Data source: Central Statstical Organization Iraq)

12.3.6 Imports and Exports

The Republic of Iraq is relatively open to foreign trade, which represented more than 69% of the country's GDP in 2019 (World Bank, 2022). Iraq's exports consist mainly of crude oil (accounts for more than 90% of Iraqi exports) and related petroleum products; major imports are gas and other gaseous hydrocarbons, followed by tubes and pipes, as well as electrical transformers and cars. The United Arab Emirates and Turkey are among the major trading partners of Iraq. India, China and the United States are the top three destinations for Iraqi exports whereas Turkey and China are by the far the main suppliers in Iraq, accounting for nearly 60% of imports in Iraq (Comtrade, 2021).

Table 12-4: Imports and Export for Iraq during 2016 to 2020 (Source: World Trade Organisation (WTO) ; Latest available data)

Foreign Trade Values	2016	2017	2018	2019	2020
Imports of Goods (million USD)	47,900	48,506	56,876	46,262	44,484
Exports of Goods (million USD)	43,735	63,604	92,831	82,309	41,738
Imports of Services (million USD)	10,037	16,158	17,785	22,662	13,679
Exports of Services (million USD)	4,835	5,653	5,306	6,991	3,499

12.3.7 Electricity infrastructure

As of June 2013, the total capacity of the electricity sector in Iraq is about 10,000 megawatt (IFP Group. June 20, 2013).

Prior to the Iran–Iraq War in 1980, Iraq's infrastructure was among the best in the Middle East. The water and sanitation sector operated efficiently, utilizing then-current technology. Over 95% of the urban population and over 75% of the rural population had access to safe potable water. Sanitation services covered 75% of the urban communities with about 218 water treatment plants and 1,200 compact water treatment units. The total installed electricity generating capacity was about 9,296 megawatts (MW) with a peak demand of 5,100 MW, providing about 87% of the population with access to electricity (United Nations Development Group Iraq Trust Fund, 2008). Approximately 70% of the Iraqi population lives in cities, and up to the early 1980s, the government made considerable public investment to constantly improve access to basic infrastructure (United Nations / World Bank Joint Iraq Needs Assessment, October 2003).

However, after the war began in September 1980, years of conflicts, misdirected resources, and the effects of Iraq's centralized command economy have stifled economic growth and development, curtailing Iraq's ability to invest in new infrastructure and maintain existing facilities.

Prior to the year 1990 (the second Gulf War), the total installed generating capacity was 5,100 MW, which fell to about 2,300 MW after the Gulf War. A combination of several factors (i.e. wars, sanctions, looting and vandalism) has however, severely affected the entire power system infrastructure in Iraq.

Post 2003 war: Although the power system was not significantly affected by the last conflict, capacity was reduced to approximately 3,300 MW by a combination of further breakdowns, lack of spares and interruption of major maintenance cycles. The balance between generation versus demand as reported on 18 July 2004 by the Coalition Project Contracting Office (PCO) is as follows:

- Daily Electricity Demand: 6,400 MW
- Daily Average Output: 4,470 MW
- Summer peak demand 6,800–7,500 MW: 35 to 40% of the summer peak demand cannot be satisfied at present.

12.3.8 Transportation Infrastructure

Iraq's transport sector comprised an interconnected network of 40,690 km of roads, two international and three major domestic airports, six cargo ports, two dedicated oil terminals, and over 2,456 km of railway

Iraq's roads are classified in the following five categories: (i) expressways, with controlled access, grade separated six-lane divided carriageways; (ii) primary roads, which are mostly four-lane divided carriageways connecting the Governorates with Baghdad; (iii) secondary roads linking towns with the Governorates; (iv) village roads, which provide villages and towns with access to the secondary network; and (v) military/border roads that accommodate the movements of troops and facilitate the protection of borders (Joint Iraq Needs Assessment Working Paper – Transport and Telecommunications, 2003). Approximately 85% of the overall road network is paved and most of the unpaved network consists of secondary and village roads. While about 50% of the expressway system is considered to be in good condition, the percentage of primary and secondary roads in good condition is between 20 and 30%. Just 10% of village roads are considered to be in good condition.

Table 12-5: Roads, Length and Condition in Iraq
(Source: Joint Iraq Needs Assessment Working Paper – Transport and Telecommunications, 2003)

Classification	Length (km)	Condition of Roads (%)		
		Good	Fair	Poor
Expressway	1,061	60	40	10
Primary Roads	10,917	30	65	5
Secondary Roads	14,193	20	70	10
Village Roads	3,704	10	30	60
Military/Border Roads	10,815	NA	NA	NA
Total	**40,690**			

Civil Aviation:

Iraq's civil aviation sector is moving toward compliance with International Civil Aviation Standards as Iraqi Airways continues to rehabilitate its aging fleet. The Iraqi Civil Aviation Authority (ICAA) seeks to transform Iraq's civil aviation system into a results-based, value-driven organization of aviation professionals dedicated to excellence on the ground and in the skies. The critical success factor for this excellence will be an environment that promotes compliance with International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPS).

Railways:

The state-owned Iraqi Republic Railroad (IRR) is one of the main modes of surface transportation for the import and export of goods and efficient hauling of bulk commodities within the country. The MOT and the IRR hope the railroad will serve as a primary surface transportation option, connecting customers in Europe, the Far East and the Gulf States while also serving as an economic growth catalyst. The IRR consists of 2,405 kilometers of track, 109 stations, 31 locomotives and 1,685 units of rolling stock. Recent investments ($40M USD) in a state-of-the-art computer-based train control and microwave communication system are the beginning of a broad modernization program for the rail system. Iraq continues intermittent negotiations concerning the establishment of rail links with Turkey, Kuwait, and Saudi Arabia to complete a continuous Euro-Gulf rail route. Investment in supporting facilities such as inter-modal container terminals and corporatization of operations under a unified management contract continue to be areas of interest for Iraq's rail system.

Ports:

Maritime ports serve Iraq as the primary gateway for the import and export of goods. The ports of Iraq are owned and operated by the Ministry of Transportation (MOT) and General Company for Ports of Iraq (GCPI). GCPI, a governmental company under the Ministry of Transportation, owns and controls the Iraqi ports of Umm Qasr, Khor Al

Zubair, Abu Fulus and Al-Maqal. The ports are spacious and adaptable to further expansion. Improvements in operational efficiency and infrastructure investment are needed to continue modernization efforts underway in all ports. The work force would also benefit from additional training on modern port operating practices and procedures. In December 2020, Iraq signed a $2.6 billion contract with South Korea's Daewoo to complete the first phase of the Al-Faw port. Further details on Iraq ports are given in the next section-Regional and Municipal Socio-Economic Data.

12.3.9 Religion

Iraq is predominantly a Muslim country. According to CIA World Factbook, Iraq is approximately 95% to 98% Muslim. Two major sects of Islam are represented in Iraq where about three-fifths of the population is Shiʿi, and about two-fifths is Sunni. Largely for political reasons, the government has not maintained careful statistics on the relative proportion of the Sunni and Shiʿi populations. Shiʿis are almost exclusively Arab (with some Turkmen and Kurds), while Sunnis are divided mainly between Arabs and Kurds but include other, smaller groups, such as Azerbaijanis and Turkmen. Christian population represents less than 2% of the total population and two-thirds of Christians in the country are Chaldeans (an eastern rite of the Catholic Church) and nearly one-third are Assyrians (Church of the East). It is estimated that about 50% of the country's Christian population live in Baghdad, and between 30 and 40% live in Mosul, Erbil, Dohuk, and Kirkuk.

12.3.10 Gender Statistics

Although women represent about 50% of the population of Iraq, the female labor force participation rate is very low (12.1% of the female population aged 15 and older) compared to a staggering 76.7% in men. At the same time, the unemployment rate of women out of the female labor force is 32.1%, compared to only 11.3% for men which indicates there is a 20.8% gap between men's and women's unemployment (World Bank, 2020 and World Economic Forum, 2021). Furthermore, the study showed that women made up only 1.1% of senior management in Iraq.

The above figures are an indicator of a deficiency in women's employment due to various aspects, including social boundaries or lack of skills, among others. Based on a World Bank report from 2012, when asked about their reasons for not hiring more women, senior managers' main reason (regardless of company size) was that the security situation made it difficult for women to commute to work (World Bank, Climate Investment Report, 2012). This issue was a key consideration for 54% of firms. Governorates where this belief was held the strongest are Basra (94%), Najaf (80%), Karbala (78%), and Sulaymaniyah (75%). The second most commonly identified reason for not employing more women was that women were absent from work more often than men (46%).

The percentage of Iraqi women working in the government sector is higher than in the private sector, as their percentage is in the first (59.6%) and the second

(39.3%), which is completely opposite to the status of men, where the share of the first is 36.3% and the second is 62.2% (Central Statistical Organization, 2011). Women choose to work for the public sector because of the stability it brings, as well as the guaranteed labor law rights that are not guaranteed or enforced in the private sector.

Women are present across different fields of public employment. A report on "gender reality in ministries and institutions in Iraq" issued by the Iraqi Ministry of Planning reveals that in 2018 some ministries have a high percentage of female employees, such as the Central Bank, which employs 8 women for every 2 male employees, as well as the Ministry of Education, which employs 3 women for every 2 men, while men and women are almost equal in the Ministry of Finance. But on the other extreme, some ministries suffer from the very low percentage of women employees, especially the Ministry of Interior, where the percentage of women does not exceed 2%, and the Ministry of Industry, where the proportion of women does not exceed 10% (see figure 12-3).

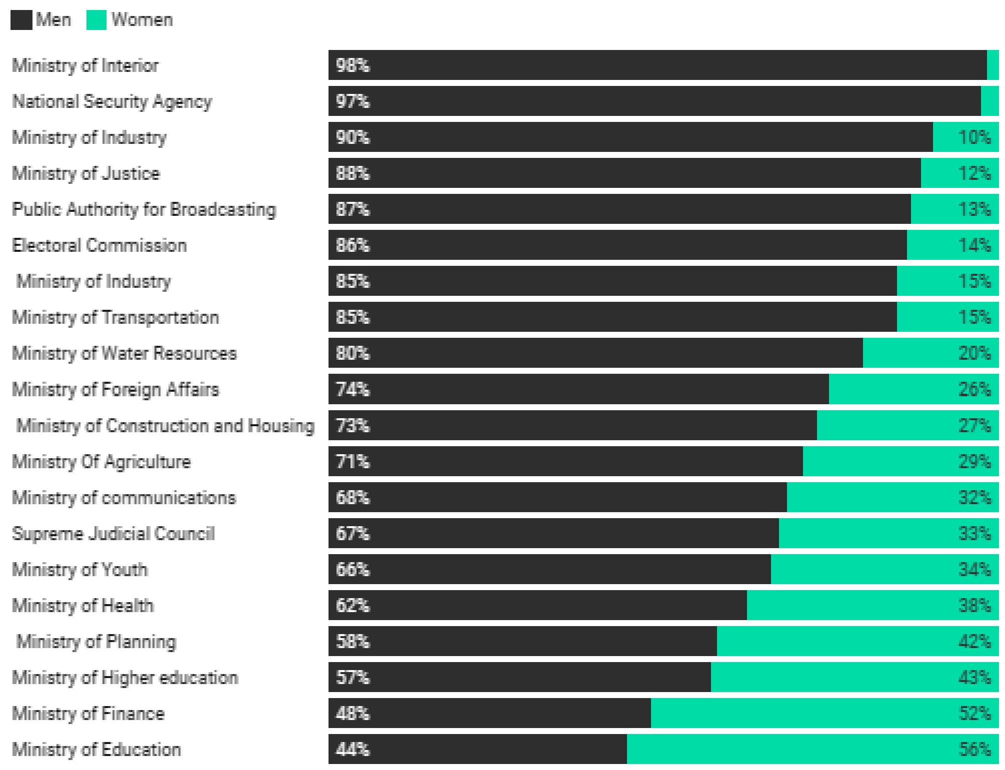


Figure 12-3: Distrubution of gender employment in the ministries and state institutions in Iraq (Data source: Central Statistical Organization (2018): The reality of gender in the ministries and state institutions in Iraq- Ministry of Planning)

Expanding women's economic opportunities is one of the most important driving forces behind economic growth and the fight against poverty. In fact, new research from the McKinsey Global Institute (MGI) finds that if women were to participate in the economy identically to men, they could add as much as $28 trillion or 26 percent to annual global

GDP in 2025 (https://www.mckinsey.com/mgi/overview/in-the-news/the-economic-benefits-of-gender-parity).

12.3.11 Safety and Security of Women:

Safety and security are two distinct concepts whose meanings are debated in the literature, as interpretations can vary between research disciplines and the reference context. A definition used by many in the transport sector describes safety as the condition of being protected from danger or harm caused by an unintentional accidental event. In contrast, a standard definition of security is the state of being protected from threats or damage caused by an intentional criminal act (Coppola & Silvestri, 2021).

Globally, the total direct and indirect costs of violence against women are estimated to be as high as 1–2 percent of a country's Gross National Product. At the global level, this amounts to billions of dollars (ttp://www.unwomen.org/en/what-we-do/ending-violence-against-women)

Violence against women and girls, and most notably domestic violence, has been consistently prevalent in Iraq in the last few decades. It is estimated that since 2003 the armed conflict in Iraq has led to the violent deaths of approximately 14,000 women. ISIS has subjected women, girls, men and boys to various forms of sexual violence, such as rape and sexual enslavement, physical and psychological violence and trafficking. According to UN Women, 37 percent of Arab women have experienced some form of violence in their lifetime. In Iraq one in five women and girls (21%) aged 15–49 were subject to physical domestic violence in 2008.

The Iraqi government reported 266 potential trafficking cases in 2017, down from 314 in 2016, of which 68 were suspected to be sex trafficking cases. There is a general lack of specific data showing the rate of sexual harassment in the workplace in Iraq in both the public and private sectors. While there are no statistics available for the past year on sexual harassment in Iraqi society, a 2015 survey published by the Iraqi Women's Journalists Forum (IWJF) found that eight in 10 women in Iraq have suffered some form of sexual harassment (http://www.iraqicivilsociety.org/wp-content/uploads/2015/10/Shahrazad-Study-FINAL.En .pdf). Penalties for sexual harassment during employment, the search for work, or vocational training are up to six months' imprisonment and/or a fine of one million IQD (Articles 10 and 11).

12.4 Regional and Municipal Socio-Economic Data

12.4.1 General

The governorate of Basra is composed of the following towns: Al-Qurna, Al-Zubair, Al-Midaina, Shatt Al-Arab, Abu Al-Khaseeb, AlHartha, AlDeer and Al-Faw, all located on the

Arabian Gulf. It is the only governorate among all other Iraqi governorates that is located at coastline.

12.4.2 Population and Demographics

The total population for Basra province is 3,063,059 with growth rate of 2.1%. The population in the province of Basra by governorate is shown in Table 12-. The most populated area is Basra city followed by Al-Zubair. As per the country wide statistics the proportion of men and woman is relatively even.

The Basra population age structure can be summarized as follow:

- 0–14 years: 43.3% (male and female 1,326,073)
- 15-64 years: 53.8% (male and female 1,647,915)
- 64 years and over: 2.9% (male and female 88,998)

Table 12-6: Population at Basra Province

Governorate	Total
Basra City	1,341,310
Abu Al-Khaseeb	235,563
Al-Zubair	538,393
Al-Qurna	189,532
Al-Faw	44,498
Shatt Al-Arab	183,640
Al-Midaina	247,107
AlHartha	171,272
AlDeer	111,744
Total	**3,063,059**
Umm Qasr is part of AlZubair and it population is 63,503	
Source: Direcctorate of Planning in Basra, 2020	

12.4.3 Employment Profile

The total employed persons in Basra province number about 619,393, out of which 571,489 are men and 47,904 women (Central Statistical Organization, 2022). These data evidence the unbalanced proportion of men and women in the workforce within the region.

There are 245,488 employed by the public sector while 371,470 are employed by the private sector. The above number is distributed amongst the following ages:

- Less than 30 years: 93,281
- 30-39 years: 211,369
- 40-49 years: 159,517
- 50-59 years: 48,504

- 60 years and over: 106,165

The majority of the workforce (59%) is employed in the services sector whilst about 29% work in industrial activities and only a small workforce (2%) works in agriculture and the remaining in other branches of economic activity (Iraqi Labour Force Survey 2021).

12.4.4 Economic Activity

Basra’s economy is largely dependent on the oil industry, since Basra governorate has the largest oil reserves in the country. Some of Iraq's largest oil fields are located in Basra province, and most of Iraq's oil exports leave from Al Basra Oil Terminal. After the mid-1970s, the government shifted its economic focus toward heavy industrialisation and import substitution. This led to the rapid development of the manufacturing sector. A great expansion of petrochemical production and oil refining in Basra was propelled by the construction of petrochemical, iron and steel plants at Khawr al-Zubayr (Chambers, R. L. et al., 2021).

The main economic activity in Basra is centred around the petrochemical industry, which includes the Southern Fertilizer Company and The State Company for Petrochemical Industries (SCPI). The Southern Fertilizer Company produces ammonia solution, urea and nitrogen gas, whereas the SCPI produces ethylene, caustic/chlorine, vinyl chloride monomer (VCM), polyvinyl chloride (PVC), low-density polyethylene, and high-density polyethylene.

The number and sizes of industries in Basra are shown in table 12-7.

Table 12-7: number of industries in Basra (source: directorate of planning in Basra)

Size of industry	Number of industry
Big industries	36
Medium industries	17
Small industries	2,338

Further, Basra can be considered as an agricultural region, with major products including rice, maize corn, barley, pearl millet, wheat, dates, and livestock. For a long time, Basra was known for the superior quality of its dates. The total production of dates from Basra provice during 2018 was 37,816 tonnes while during 2017 the production was 37,556 tonnes. Also, fishing was an important business before the oil boom.

The project area is theoretically restricted, where fishing is prohibited. Fishing activities are being performed at locations away from port area as shown in figure 12-4. The main fish catch locations in Basra Provicne are: Al-Qurna, Al-Midaina, Al-Dair, Al-Hartha, Abu-Al-Kaseeb and Al-Seeba (Abood and Mohamed, 2020). Fishing may be considered as an imported economic activity at the mentioned locations. Further, another main fishing area is located on the six-kilometre long river reach in Al-Faw. The town lies southeast of

Basra on the Shatt al-Arab river which is one of the richest fishing areas in Iraq, formed by the confluence of the Tigris and Euphrates rivers. These fishing areas are located far from the project site and therefore there are no impacts from this project on these sensitive areas.

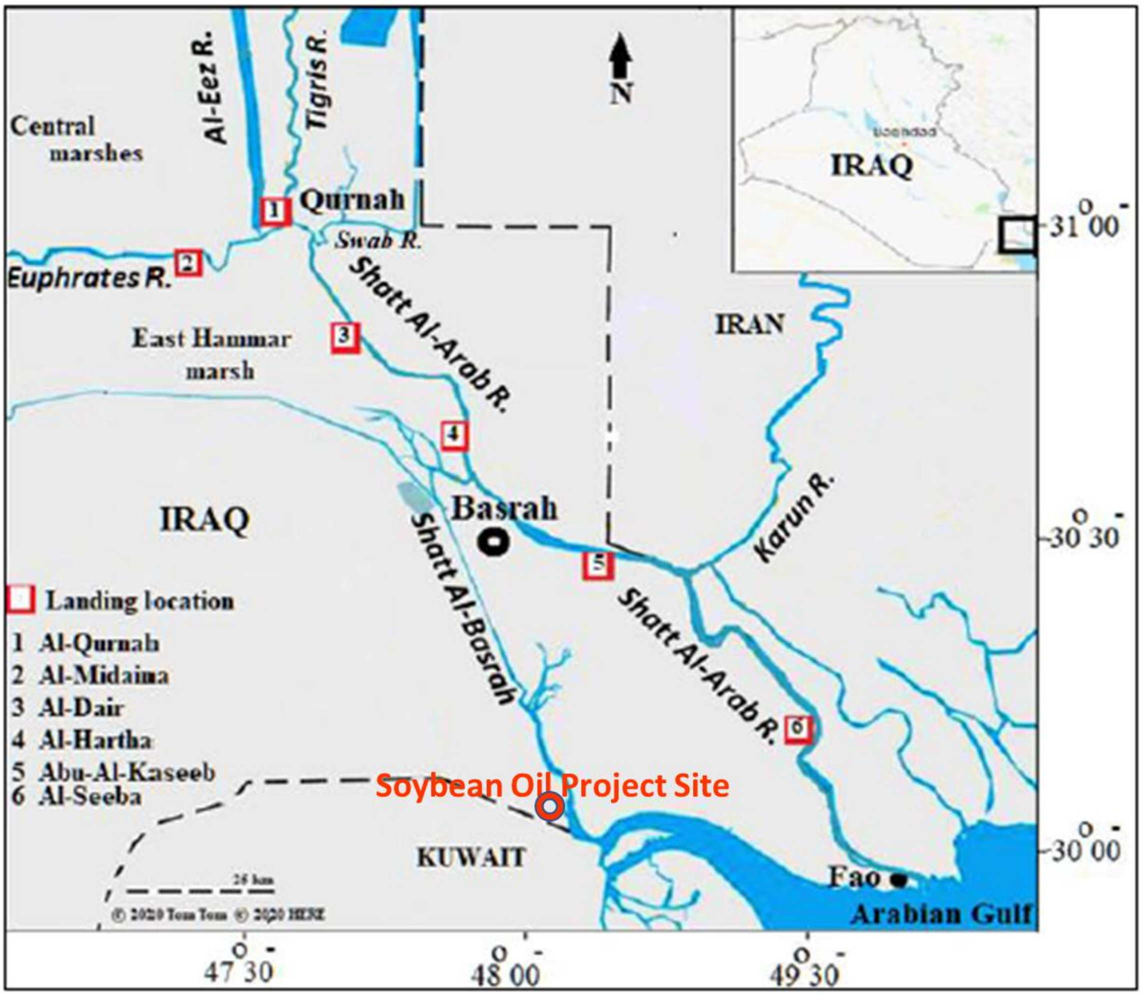


Figure 12-4: Main locations of fish catch at Basra Province (source: Abood and Mohamed, 2020)

12.4.5 Transportation Infrastructure

Roads, airports and seaports make up the national transport system, however the local authority in Basra is in charge of infrastructure and services within its jurisdiction and related to the development of the province.

Roads

Basra needs large-scale strategic projects to repair road networks in the city and build new ones as required because most roads have been destroyed due to the pressure caused by trucks transporting goods from ports and border crossings to all parts of Iraq. Moreover, official figures indicate that 61.4% of families in Basra live in homes accessed by unpaved dirt roads (Ali Taher Al-Hamoud, 2019).

Airports

Basra International Airport is the second largest international airport in Iraq, and is located in the southern city of Basra. This airport was designed and constructed in the early 1980s, and sits on 2,300 hectares. The complex consists of one runway (4,000 meters long and 44.8 meters wide) and one terminal building, which was designed to accommodate three million passengers per annum. As with Baghdad International Airport, much of Basra's airport deficiencies can be attributed to the prolonged general lack of servicing, maintenance, and spare parts for both facilities and equipment.

Ports

There are six cargo ports, plus two dedicated oil terminals, in Iraq, all located in the riverine area of Shatt al Arab. These include: Umm Qasr; Az Zubair; Maqal (Basra); Abu Al Khazib; Abu Flus; and Al Faw. Umm Qasr is the main deep-water port with 22 berths, some of which are dedicated to specific goods (such as sulphur, seeds, lubricant oil, etc.). This port is located adjacent to the Kuwaiti border and has established intermodal connections, both road and rail (rail in Umm Qast is currently not in service), with a number of spur lines throughout the port. The Port's property extends about 1 km to the west. The Port of Umm Qasr has the potential to become a major cargo and container-handling facility in the region. Should that occur, a considerable number of job opportunities would be created. However, this will require both physical rehabilitation and policy and institutional reform.

The other five ports are smaller in scale and more narrowly specialized compared to Umm Qasr Port. Al-Zubair Port, located 18 km north of Umm Qasr Port, is an industrial port built with specialized facilities for exporting fertilizer, importing iron ore, and processing general cargo. Maqal (Basra) Port, which served as Iraq's main port prior to the Iran/Iraq War, was heavily damaged during that conflict, and a decision was taken to develop a new port at Umm Qasr, rather than repair Maqal Port. Abu Al Khazib and Abu Flus Ports are situated on the Shatt al Arab waterway about 20 km south of Basra. These small ports serve as export terminals for the products of a nearby fertilizer plant (Abu Al Khazib), and for general cargo (Abu Flus). The Al Faw Port was a loading jetty that was used to supply two offshore oil platforms. Its structures are in poor condition.

12.4.6 Education

Education levels in Iraq continued to face some difficulties since the war. With underinvestment in education in Basra and elsewhere in recent years preventing local administrators from providing classrooms, instructors, and teaching materials, it remains a challenge to raise educational standards and enrollment rates.

There are 2,667 total schools (private and public) in Basra Province, of which 778 are secondary, 1,723 are primary school, 147 are kindergartens, and 19 provide education at the university, college, or institute level. The number of students at each educational stage in Basra provice is shown in table 12-8.

Table 12-8: Number of students in each educational stage during 2018

Educational stages	Male	Female	Total
Kindergartens	13,240	12,286	25,526
Primary	314,818	287,694	602,512
General Secondary	163,885	127,508	291,393
Industrial Secondary	4,800	795	5,595
University Education	28,128	27,643	55,771

12.4.7 Religion

The population of Basra province is assessed to be 98% Shia Muslim according to Coalition estimates. Within the Shia majority in Basra, there are a number of sub-sections. The majority of Basra's Shia coreligionists are from the more mainstream Usuliya and Akhbari strands of Twelver Shiite Islam, in which Muslims choose their Marja ("source of emulation") from among leading religious scholars from Najaf and Karbala in Iraq.

12.4.8 Tribal context

Tribes in Basra, like in other parts of Iraq, mainly have a socio-cultural influence, maintaining traditional ways of life, behaviors, norms, and customs. They also provide a kind of civil justice and a certain level of security. They are not political actors, but they get involved in politics to a certain extent. Some clans can support candidates or ally with some factions or militias to preserve their interests, especially when these candidates or political leaders have a solid tribal background.

It is important to note that most Basrawi tribes are not totally involved in criminal activities. Some of them are only marginally concerned, such as the Bani Tamim, the Eidan, the As-Sadeh, the Mousawiyeh, the As-Sadeh Annour, the As-Sadeh al-Shar, the Qharsan. Names of tribes and clans that were noted in the north-east area of Basra, are the Emarah, the Garamsha, the Bani Mansour, the Ahlaf, the Bani Saad, the Hajaj al'Abadeh, the Sheghabneh, the Bani Ka'ab, the Zergan and the beyt (household) Wafi while Names of tribes and clans, that are noted in the western and soutern parts of Basra and in al-Zubair, are the Bazzoun, the Freijat, Beyt Ruwaymi, Beyt Ashur, and the Youssefi. The three major Basra clans, that are noted in the central city, are the Battat, Halaf, and A'awaji.

Those tribes are not involved as a corporate hierarchic group. However, some clans, or sub-sections of clans, or even households, carry out illicit activities independently (and even sometimes fight each other). Further, some clans are involved in criminal activities, each representing about 50 families. The main criminal activities are abusive claims for compensation, asking oil companies for jobs, youth skills training, infrastructures for their villages, water and electricity supplies.

Many tribal armed disputes have occurred every year, leading to dozens dead and many injured (each year). Dozens of families have been forced to leave their hometowns. The main disputes are concentrated in the districts of al-Qurna and al-Midaina (both sites are more than 100km far from the Soybean oil project site). However, there has never been any major confrontation between security forces and tribes.

However, as the Soybean Oil project is located inside a custom zone (inside Umm Qasr area), it is unlikely to be affected by any tribal disbute. Regardless, the project managment agreed to improve its relation with the surrounding tribes of Umm Qasr area by hiring their young people (male and female) and providing training to their fresh graduates and support their health and education sectors.

12.4.9 Public Protest in Basra

During the last several years some protests took place in Basra and in particular at Umm Qasr area. For example, in October and November, 2019 Iraqi security forces dispersed by force on Friday protesters who had been blocking the entrance to the country's main Gulf Umm Qasr port and reopened it. During these protests, there were some accidents and injuries but without fatalities and was noted that the protestors were unable to access the port área as it is the most secure and protected place. Umm Qasr port is strategically important as it receives imports of grain, vegetable oils and sugar shipments that feed a country largely dependent on imported food.

12.4.10 Other related information

In accordance with the information provided by the directorate of planning in Basra for the year 2018 (more recent data were not available during our visit):

- Total number of medical centers is 246, total number of hospitals is 19 and total number of primary health centers is 139.
- Number of sewage treatment plants belonging to the goverment is one
- Number of municipality waste landfills belonging to the goverment is one
- Number of hotels for tourist and visitors in Basra is 51

12.5 Impact Assessment

12.5.1 Overview

The following section considers and assesses the potential impacts, both negative and positive, that the proposed Soybean Oil Project may have upon the socio-economic factors identified by the baseline. Consideration has been given to impacts associated with the construction, operation and decommissioning stages of the Project. Each aspect has been assessed subjectively in accordance with the methodology outlined by Chapter 4- Impact Assessment Criteria and Methodology.

This impact assessment considers the impacts of the Project only; it does not attempt to quantify or assess the impacts of the other sources. The assessment of impact is summarised and tabulated at the end of each subsection, the magnitude and significance of each impact are also stated below at the end of each subsection (noted in bold and italics). Next to each magnitude/significance statement and for ease of reference, each issue is identified by a unique number which is repeated in summary of impacts table in section 20 and subsequently in Section 21 summary of mitigation table.

12.5.2 Construction Impacts

Specific potential impacts involving socio-economic factors have been identified that are either likely or certain to occur due to project construction. The construction phase will require the highest number of employees at one time. The Construction of the Project is expected to last for approximately 12 months of a total project lifetime of 20 years, and is divided into early works and the main construction period.

Potential impacts on the socio-economic environment due to construction activities are summarised in and discussed in the following text. Impacts associated with noise have been addressed in Section 8 and those relating to air pollution have been addressed in Section 5, impacts associated with traffic, utility use, and health and safety of the local community, are addressed in the relevant sections of this ESIA (see outline).

Economic Growth

The construction phase of the Project is expected to employ up to 250 workers; the majority of which are expected to be from Basra Province (local workers). Services will be required for the construction workers, including provision of catering, and transportation, which may therefore provide economic opportunities for Umm Qasr businesses, and local vendors. Further, workers will spend some of their funds received from the Project on shops within the Umm Qasr area during and at the end of this phase, resulting in an increased sales and revenue to local businesses. Restaurants and local retail shops will benefit from the increased demand which ultimately will have a positive effect upon the local economy . The Project management should consider procuring most of materials from local sources for food and other services instead of importing by ship or truck to the Project site.

Construction materials will also be required, and while the Project is committed to sourcing materials locally where possible, the extent to which this can be achieved given the limited development in this region is unclear. The level of economic growth during this period is therefore considered likely to be relatively low, though it has the opportunity to have direct benefits to the local community.

Impact SE01 – Low Magnitude and Medium Positive Significance

Employment Impacts

As indicated earlier the construction phase of the Project will require up to 250 workers over the 12 month construction period. It is anticipated that a significant proportion of these will be local residents; therefore the unemployment rate in Basra Province (approximately 7.6%) will slightly improve.

On the other hand, while some construction materials of the Project are likely to be sourced from locations outside of the local and provincial project area, they are expected to be supplied from within Iraq. The supply of materials is therefore likely to lead to indirect employment opportunities (improve unemployment rate) on a national level for a short period of time over the duration of the construction stage for the Project. For example, construction equipment requires gasoline and diesel fuel. Contractors will supply fuels and lubricants via local sources.

The project's needs for purchase of raw materials will be of benefit to local industries; concrete produced in the existing ready mix concrete plants in Basra Province will contribute to an increase in local income. While this impact may increase income to local businesses, it is essential that supply is adequately maintained so that prices remain stable. If demand increases and supply remains static, local residents may be negatively affected by increased prices.

Impact SE02 – Low Magnitude and Medium Positive Significance

Education

The construction stage of the project is unlikely to create impacts related to education; however, offering employment opportunities to the local workers during the construction stage of the Project will help to promote knowledge of the construction industry. This experience would enable creation of a local/provincial workforce capable of supporting the future construction of other proposed elements of the Umm Qasr Development beyond the life of the Project construction stage.

Impact SE03 – Low Magnitude and Low Positive Significance

Transportation Impact

Transport infrastructure and traffic may have some impact associated with this project related to use/operation of existing infrastructure. Low negative impact due to construction works, thus increasing traffic and disruption in accessing community facilities /utilities for residents of Umm Qasr area, and traffic to and from the project site via Umm Qasr and AlZubai area may place some pressure on existing infrastructure and create possible inconvenience with some risk for traffic accidents and delays.

It is expected that there will be increases to traffic generated by workers and also resulting from the transport of some construction materials to the Project site.

It is recommended to implement mitigation measures to address the impact of traffic by coordinating with Umm Qasr port authority and deciding on the project's traffic flow, scheduling in such a way to reduce impacts, and perhaps inform stakeholders of potential impact (if any).

This impact may occur frequently with medium magnitude and occurs twice daily for an estimated construction period of 12 months.

Impact SE04 – Medium Magnitude and Low Negative Significance.

Cultural Impact

Interaction between senior expat (foreign) workforce with locals at markets and public places, is something that locals are familiar with considering the numerous other projects during which expats resided in Basra Province, so no significant issues between expatriate workers and the local population are expected.

Construction expat workforce will be on a temporary working visa and will return to their countries after their contract is ended, so the impact is restricted to a defined period only. *"A low magnitude, infrequent negative impact is assigned to this cultural impact"*

Results expected after departure of construction workforce: *Low temporary magnitude negative impact in income resulting from the reduction in number of workers.* Although the number of employed workers will be reduced significantly, on the other hand there will also be another expected increase in industrial development from infrastructure and businesses established after operations of the Project as they provide goods to new developments which will potentially nullify negative impact caused during demobilisation, as other projects will require the same or greater levels of service or products.

Impact SE05 – Low Magnitude and Low Negative Significance.

Overall Impact on Socio-Economic Environment– Low to Medium Magnitude, Low (Positive and Negative) Significance

Potential impacts on the Socio-Economic environment due to the above aspects are summarized in table 12-9.

Table 12-9: Construction phase potential impacts summary

Factor	*SE1* **Economic Growth**	*SE2* **Employment**	*SE3* **Education**	*SE4* **Transportation**	*SE5* **Cultural Impact**
Frequency	Continuous	Continuous	Continuous	Frequent	Continuous

Likelihood	Likely	Likely	Likely	Likely	Likely
Extent	Provincial	Provincial	Local	Provincial	International
Duration	Short	Short	Short	Short	Short
Magnitude	Medium	Medium	Low	Medium	Medium
Effect	Positive	Positive	Positive	Negative	Negative
Action	Direct	Direct	Direct	Direct	Indirect
Significance	Medium	Medium	Low	Low	Low

12.5.3 Commissioning Impact

Considering the fact that impact from construction workers has already been over, social impacts during commissioning are of low positive impact by influx of workers, creation of new jobs, and increased demand for goods and services.

Overall Impact on Socio-Economic Aspect–Low Magnitude, Medium (Positive) to Low Significance

12.5.4 Operational Impacts

The Project life is some 30 years, although it could be extended longer than 30 years. During the operation phase, a medium positive impact will occur through influx of some workers, creation of some new jobs, and increased demand for goods and services. Technical and supervisory staff and permanent workers have families and will spend more of their salaries locally which will be a new source of income for the local communities in the Umm Qasr area. The operational workforce will use existing services and infrastructure. The increased numbers represent a small growth in population.

Overall decline in workforce from commissioning to operation is unlikely to impact local employment as the expatriate workforce is relatively small in number. Once the operational phase begins, surplus workers will be deployed to another project or will return to their homes. A direct rise in unemployment is, therefore, not expected.

Likewise, the negative impact resulting from the increase on services demand during operation phase will be of low magnitude. For example, existing school infrastructure will likely accommodate the increase in project-related student enrollment. Primary health clinics and hospitals in Umm Qasr will provide medical care for the operational staff.

Specific impacts on the socio-economic environment due to operational activities are discussed in the following text.

Economic Growth

The Project is expected to be of benefit to the local, provincial, and national economy of the Republic of Iraq, through generation of employment opportunities, the purchase of goods and services, as a result of anticipated population growth increasing demand, and supply chain development. It is expected that indirect and induced employment will also be created by the Project, resulting in a cycle of further economic growth.

The Project is considered likely to create local and provincial, regional and national economic growth and development over the duration of the Project, and indeed beyond, leading to a medium magnitude, positive impact.

Impact SE06 – Medium Magnitude and Medium Positive Significance.

Increased Employment Opportunities

The operation stage of the Project will require the employment and housing of approximately 200 staff. The Project staffing plan envisages about 60% of these posts to be filled by Iraqi workers on commencement of operations, rising to approximately 80% in due course. This represents a significant opportunity for the local population in Umm Qasr and Basra Province to gain employment with the Soybean Oil Project. The Project can positively contribute to the current high level of unemployment in the area, particularly among fresh university/college graduates and high school graduates. The range of roles available, also improves the likelihood that suitably qualified individuals can be sourced from the local population.

In addition to the direct employment opportunities provided by the Project, jobs will be generated as a result of the increased population, and increasing spending potential, and the demand for goods and services. New jobs generated by the operation of the Project can be expected to have a positive impact on the levels of employment in businesses, and the range of employment opportunities available in supporting sectors.

Long-term direct, indirect and induced employment opportunities are also likely to be created on a regional and national level through supply chain development associated with the Project, resulting in a medium magnitude, positive impact.

Impact SE07 – Medium Magnitude and Medium Positive Significance.

Improved Education And Training

The Project itself includes provision of a training courses, which allows Soybean Oil facility to fulfil its objectives to employ local personnel by providing the necessary training to up-skill the local pool of human resources. Additionally, while the Project itself will not construct schools or other educational establishments, these, and other supporting infrastructure can be expected to develop in Umm Qasr area to fill the needs of the growing population resulting from the Project, and increasing economic activity in Umm Qasr and Basra Province.

Impact SE08 – Medium Magnitude and Medium Positive Significance.

Production of crude soybean oil and soybean meal as animal food

This project will produce crude soybean oil which will be used as cooking oil after refining. Further, the Project will produce soybean meal which will be used as animal food in the Iraqi market. Both products will be considered as positive impacts for the project on the Iraqi market. The soybean meal will be needed in the local market especially with the continue increasing demand for poultry meat and eggs due to population growth and rising individual consumption. These products will be sold to clients inside Iraq and in particularly in Basra Province.

Impact SE09 – Medium Magnitude and Medium Positive Significance.

Strain On Municipal And Social Services

The Project will lead to a long-term population increase in the local and provincial area, which will require a range of supporting infrastructure and services. The Project includes development of the essential services for the Project staff housing, but does not include provision of extensive municipal services for these, and are likely to be limited to connection to the electricity network, and the provision of roads, and public facilities. However, in the early years of operation, the municipal services required by the Project employees, (such as sanitary wastewater treatment, waste disposal and potable water) will be arranged by the Project itself until such time as the goverment infrastructure is in place. There is a potential impact from an increase in population on the availability and access to existing municipal and social services, which currently do not meet the requirements of the local population. Nevertheless, over the life of the Project, the infrastructure and social services, including education institutions and hospitals, are likely to be improved by the proposed goverment development to handle the potential local and provincial population increase.

Impact SE10 – Low Magnitude and Low Negative Significance.

Summary of potential impacts on the Socio-Economic environment due to the above aspects during operation phase are summarized in table 12-10.

Table 12-10: Operation phase potential impacts summary

Factor	*SE6* **Economic Growth**	*SE7* **Employment**	*SE8* **Education and Training**	*SE9* ***Production of Soybean Oil and Meal***	*SE10* **Strain On Municipal And Social Services**
Frequency	Continuous	Continuous	Continuous	Continuous	Continuous
Likelihood	Likely	Likely	Likely	Likely	Likely
Extent	National to International	National	Local	National	Local
Duration	Medium	Long	Long	Long	Short
Magnitude	Medium	Medium	Medium	Medium	Low
Effect	Positive	Positive	Positive	Positive	Negative
Action	Direct	Direct	Direct	Direct	Direct
Significance	Medium	Medium	Medium	Medium	Low

12.5.5 Decommissioning/Closure Impacts

De-commissioning is the phase where Soybean Oil Project may dismantle and remove structures from site, and returning site to its original condition, and is similar somewhat to the construction phase.

The specific impacts on the socio- economic environment due to these decommissioning/ closure activities are discussed hereunder.

Reduced Economic Activity

The closure and decommissioning of Project will result in a reduction in economic activity, both locally and at the regional and national levels. Since the Project is expected to promote direct, indirect and induced economic opportunities at a national level, there is potential for impacts upon the wider national economy following decommissioning of the Project.

However, economic growth over the Project life, may have led to the creation of an economy in the local and provincial area, which although linked, is not entirely reliant on the Project. This impact does not consider the potential this project has to sustain economic activity in the area beyond the life of the Project.

Impact SE11 – Medium Magnitude and Low Negative Significance

Loss of Employment

The closure of the Project can be expected to result in the loss of the approximately 200 direct jobs supplied by the Project, and the associated indirect and induced jobs generated. The decommissioning of the Project may result in the creation of some temporarily employment opportunities associated with the dismantling of infrastructure and facilities, and will require employment of staff to undertake ongoing management of facilities and the associated closure monitoring; these are expected to be significantly less than the workforce required for Project operation. There is also a potential impact on employment at a regional level through the loss of jobs in economies both directly and indirectly linked to the Project.

Over the duration of the Project, the growth in the economy may be sufficient to accommodate some of the workforce, however an overall loss of employment opportunity is envisaged.

Impact SE12 – Medium Magnitude and Low Negative Significance

Summary of potential impacts on the Socio-Economic environment due to the above aspects during Decommissioning phase are summarized in table 12-11

Table 12-11: Decommission phase potential impacts summary

Factor	*SE11* **Reduced Economic Activity**	*SE12* **Loss Of Employment**
Frequency	Rare	Rare
Likelihood	Likely	Likely
Extent	Regional	National
Duration	Short	Short
Magnitude	Medium	Medium
Effect	Negative	Negative
Action	Direct	Direct
Significance	Low	Low

12.6 Mitigation Measures

12.6.1 Introduction

Mitigation measures will be required during construction, operation and decommissioning of the Project to minimise potential negative impacts of the activities. The mitigation measures comprise primarily of management procedures and are described in the subsequent sections. Appropriate mitigation measures will be required if the impacts predicted as being of medium to high significance.

In accordance with the methodology outlined by Chapter 4 – Impact Assessment Criteria and Methodology, where appropriate, consideration has been given to the Equator Principles and IFC Performance Standards which are applicable to socio-economic factors, during the development of proposed mitigation measures.

Social Impact Management Plans (SIMP) should be produced for the various phases of the project, based on the impacts and findings detailed by the ESIA. SIMPs are generally prepared and implemented following completion of the Project Risk reviews and the ESIA process; however, the SIMP process should commence at an earlier Stage (i.e. in line with the risk review and ESIA process) in cases where:

- displacement of impacted communities may occur and resettlement may be required;
- the Project exists on indigenous lands, where customary or traditional land ownership applies and/or cultural heritage sites are located;
- there is a potential for significant population influx;
- significant health risks apply or are likely to apply; and
- there is a requirement to undertake training of people from local communities to achieve local employment targets.

Based on the above criteria, it seems that a SIMP for this Project may not be required since none of the above mentioned conditions are noted. The Environment and Communities Assurance Manual also requires the establishment of sustainable development objectives and targets (KPIs), which include environmental, community and economic factors, at the earliest possible stage of the Project lifecycle.

12.6.2 Construction Recommendations

The Engineering, Procurement and Construction contractor (EPC Contractor) shall be encouraged to make job opportunities during construction available to the local workforce, and promote engagement of the local population in the construction phase. The Project Management may consider committing to hire local workers at certain percentage for the construction phase.

The EPC contractor shall ensure appropriate recruitment terms (long experience with high qualification) for expatriate staff. The Project management may consider the provision of training during the construction phase, to increase local knowledge of the construction industry, and to advance training in skills required for the operation of the project.

The EPC Contractor shall consider the extent to which infrastructure provided within the project site can provide ongoing benefit to the local population. Further recommendations are included in the implementation plan provided as part of the Environmental Management and Monitoring Plan provided at later section.

12.6.3 Operation Recommendations

A number of positive socio-economic impacts have been identified as part of the impact assessment. These benefits may be maximised for the local community, through the implementation of the following recommendations.

The Project management should establish social performance criteria for their suppliers, to promote the maximisation of local sourcing of materials, local employment, and implementation of sound sustainable business practises. The Project management should establish its supply chain, and enter into a period of supply chain management and engagement to drive value to the community through its supply chain.

The Project management should consider supplementing the national policy requirements for hiring local workers and meeting a local Iraqi employment target to encourage the Project Human Resources to maximise local employments.

The Project management should consider establishing training programme for local students and school graduates, in advance of commencement of operation. This proactive approach will demonstrate Sama AlManar's commitment to local employment and training, addressing concerns raised in the consultation, while simultaneously benefiting Sama AlManar by up-skilling potential employees in advance, reducing the lag between Project start up and the availability of a trained and skilled workforce.

12.6.4 Decommissioning Recommendations

While the reduction in economic activity and loss of employment resulting from the closure of the Project are considered of low significance in the long term, they nonetheless represent a considerable challenge for the individuals affected. Therefore Sama AlManar should implement a proactive succession planning programme in advance of closure to identify alternative roles within the company, thus providing security for employees, and reducing the skills and experience loss from Project closures.

Monitoring

The EPC Contractor shall update (or develop new), implement, maintain and audit the Environmental Emergency Response Plan (EERP) and the Environmental Management and Monitoring Plan (EMMP) so the documents remain adequate and effective.

The Project management shall implement a monitoring and reporting strategy for the social Key Performance Indicators committed to in the Social Impact Assessment Plan. This will address the the collection of data and allow deviance from expected practices or targeted outcomes to be identified and corrective action to be proposed and implemented in response.

In setting KPIs, the Project managment should consider the findings presented in previous sections of this Socio-economic Impact Assessment. Examples of applicable socio-economic KPIs can include:

- Percentage of suppliers employment from the local workforce;
- Percentage of construction workforce from within the local or provincial area;
- Percentage of operational workforce from within the local or provincial area;
- Number of students / school graduates receiving Project-sponsored vocational training; and
- Percentage of operational workforce trained with transferable industry skills.

13 ARCHAEOLOGY AND CULTURAL HERITAGE

13.1 Introduction

As per WB-IFC Performance Standard 8, the Project management shall protect cultural heritage from any adverse impacts of project activities and support its preservation and shall promote the equitable sharing of benefits from the use of cultural heritage. Accordingly, in this section archaeology and cultural heritage baseline were compiled in order to highlight potential receptors that may be impacted by the proposed Soybean Oil Project in the Umm Qasr area with a general description of the archaeological and cultural characteristics on a national and regional level.

13.2 Baseline

The proposed project sites where excavation activities will occur appear to have been previously disturbed for much of the project area. Some limited locations may still have natural cover and undisturbed lower layers. There are no known archaeological features nor sensitive areas within the site boundary. However, in this section identification of any existing or potential archaeological resources and cultural heritage, at or near project site, that may be impacted by the project's construction and operation will be highlighted. Archaeological resources and cultural heritage can be defined as follows:

- Archaeological resources refer to any material remains or physical evidence of past human life or activities, including the record of the effects of human activities on the environment.

- Cultural heritage is the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations.

13.2.1 Methodology

Available information was assessed to determine the potential presence of any archaeological and cultural heritage resources in the project site and its surroundings. A physical site visit was undertaken that shows no indication of any archaeological artifacts since the Umm Qasr area has already undergone significant change and development, and the project site is located within the industrially developed Umm Qasr port.

There is no evidence or indication in any previous studies that there is likelihood of any archaeological sites below the ground under the Project site. On this understanding, no excavation work was needed for this assessment, and available information sources were reviewed which include:

- Collection and interpretation of available literature;

- Previous archaeology study of the area;
- Satellite imagery obtained from Google Earth.

After reviewing the impacts of the proposed project during various phases on local archaeology and cultural heritage resources, the following concerns were identified and assessed:

- Potential impact of construction activities (i.e., levelling, earthworks) on loss of the archaeological resources (referred as AC01).
- Potential impact of interaction between expatriate workers and local people during construction activities on cultural heritage (referred as AC02)
- Potential impact of vehicle movements on loss of the archaeological resources during operation phase (referred as AC03)
- Potential impact of expatriate workers on archaeological resources during their stay in Iraq making tourist expeditions to sites of archaeological interest (referred as AC04)
- Potential impact of interaction between expatriate workers and local people during the operations phase on cultural heritage (referred as AC05)

13.2.2 Archaeology

13.2.2.1 National

The Republic of Iraq is rich with 116 Archaeological sites spread across 17 administrative areas. The Republic's list includes Archaeological Sites, Historical Sites, Heritage sites, and Monuments. Major archaeological sites are listed below (more details are given in Appendix D).

- Hatra site in Nineveh Governorate, northwest Iraq. ***This archaeological site is extremely far (about 760km) from the project site*** .
- Babylon site in Babil Governorate, Central Iraq. ***This archaeological site is far (>400km) from the project site.***
- Nineveh site in Mosul province, northwest of Iraq. ***This archaeological site is far (860km) from the project site and located in Mosul province, northwest of Iraq.***
- Nimrud site in Mosul province, northwest of Iraq. ***This archaeological site is far (860km) from the project site.***
- Assur site in Saladin province, north of Baghdad Iraq. ***This archaeological site is far (750km) from the project site.***

- Eridu and Ur sites in Dhi Qar Province, Southern Iraq. ***Both sites (Eridu and Ur) are far (200km) from the project site.***

13.2.2.2 Basra Region

The historic places which are located within a circle of 50 km radius from the centre of the project site are:

- Ali bin Abi-Talib Maqam (Khitwa): It was founded in 635 AD during the era of the second Rashidun Caliph Umar ibn Al-Khattab. It is the first mosque built in Basra, and among the oldest mosques in the history of Islam. This place has a religious value to the Shi'at Muslim community in Basra province. Huge numbers of pilgrims make visits to this historic place on different occasions throughout the year. ***This Mosque is located at about 45 km north-west of the project and no effects are anticipated.***

Figure 13-7: Imam Ali Mosque in Al Zubair district, Basra province, Iraq

- Shrine of Hasan al-Basri is a historic place located in Zubayr district in Basra, Iraq. The mausoleum contains the tombs of Hasan al-Basri and Imam ibn Sirin, and the building is topped with a tower built in 1185 AD by the Abbasid Caliph Al-Nasir. ***This Maqam is located about 46 km northwest of the project and no effects are anticipated.***

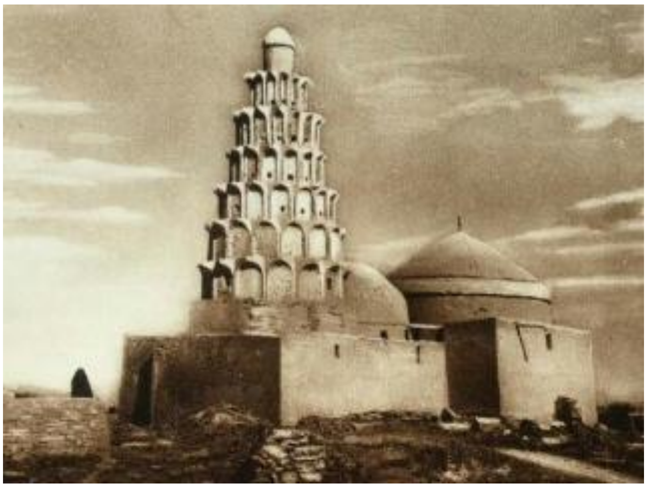


Figure 13-8: Shrine of Hasan al-Basri, Al Zubair district in Basra province, Iraq

- Archaeological resources of Old Basra: This historic site occurs opposite to Ali Bin Abi-Talib Maqam (across Basra – Al Zubair main road) at about 50 km northwest of the project. It represents the remains of the old city of Basra. This place has not been excavated yet.

The Soybean Oil Project is not expected to affect these historic places or their visitors in any way.

13.2.2.3 Local

No known archaeological sites have been identified in the project site through literature searches or the study of aerial photography and general site walkthrough as part of other site activities. Investigations did not identify the potential presence of any archaeological sites or sensitivities, and the location of Soybean Oil new project site has no effect on the old historical sites located at Al Zubair district.

Earlier discussions with representatives of the Basra municipality confirm that archaeological and cultural heritage sites are not known to exist within or immediately surrounding the Project site in Umm Qasr Port. However, as per the government rules and in all contracts signed with investors, there are special clauses that address the issue of chance-find procedures that should be put into place to ensure the correct procedures to be followed in the event of an archaeological or cultural heritage find during construction.

The following clause should be included in any construction contract considering the fact that the site is on leased land that is property of the Umm Qasr Port Authority:

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the site of work shall be the absolute property of the Iraqi Government and contractors shall take reasonable precautions to prevent his workmen or any other person from removing or damaging any such article or thing and shall immediately upon discovery and before removal inform the Umm Qasr Port Authority of such discovery and carry out orders at the expense of the Iraqi government as to the disposition of same.

13.2.3 Cultural Heritage

13.2.3.1 Islamic Heritage

The Republic of Iraq is home to many famous sacred places in Islam including the following (More details are given in Appedix D):

- Imam Ali Shrine, also known as Masjid of Ali in Najaf. ***The Soybean Oil project is located at a distance of 405km from this location and no effects are anticipated.***

- The Great Mosque of Kufa ,or Masjid al-Kufa, is located in Kufa, Iraq. ***The Soybean Oil project is located at a distance of 410km from this location and no effects are anticipated.***

- The Imam Hussain Shrine is located in the city of Karbala, Iraq. ***The Soybean Oil project is located at a distance of 465km from this location and no effects are anticipated.***

- The Mausoleum of Abdul-Qadir Gilani, also known as Al-Ḥaḍrat Al-Qadiriyyah, is located in Baghdad, Iraq.

- The Abu Hanifa Mosque is one of the most prominent Sunni mosques in Baghdad, Iraq.

- Al-Kadhimiya Mosque or Al-Kadhimayn Shrine is a Shi'ite Islamic mosque and shrine located in the Kadhimay suburb of Baghdad, Iraq.

- Al-Askari Shrine, or the Al-Askari Mosque, is a Shia Muslim mosque and mausoleum in the Iraqi city of Samarra 125 km (78 mi) from Baghdad.

  The Soybean Oil project is located at a distance (more than 500km) from any such locations and no effects are anticipated.

13.2.3.2 Regional and Local

Religious history in Iraq has resulted in a large number of cultural heritage sites from a diversity of periods and cultures. Some Iraqi cities (mainly Najaf and Karbala) boast some of the oldest mosques in the world such as Great Mosque of Kufa .

There is no evidence of the presence or likely presence of cultural resources at project site or its surroundings. It is therefore unlikely that cultural resource features will be present at the project site and as such unlikely that detailed investigations and or site walkovers would identify such features. Contractual provisions at the Umm Qasr Port already consider historical sites.

13.2.4 The World Heritage List

The World Heritage List (UNESCO) seeks to encourage the identification, protection, and preservation of cultural and natural heritage around the world considered to be of outstanding value to humanity. Six sites in Iraq are included World Heritage Sites as per the table below and the figure:

Table 13-1: World Heritage Sites in Iraq

Site name	Location	Year of Inscription
Hatra	Nineveh Governorate 35°35′17″N 42°43′06″E	1985
Ashur (Qal'at Sherqat)	Saladin Governorate 35°27′32″N 43°15′35″E	2003
Samarra Archaeological City	Saladin Governorate 34°20′28″N 43°49′25″E	2007
Erbil Citadel	Erbil Governorate 36°11′28″N 44°00′33″E	2014
The Ahwar of Southern Iraq: Refuge of Biodiversity and the Relict Landscape of the Mesopotamian Cities	Southern Iraq 31°33′44″N 47°39′28″E	2016
Babylon	Babylon Governorate 32°32′11″N 44°25′15″E	2019

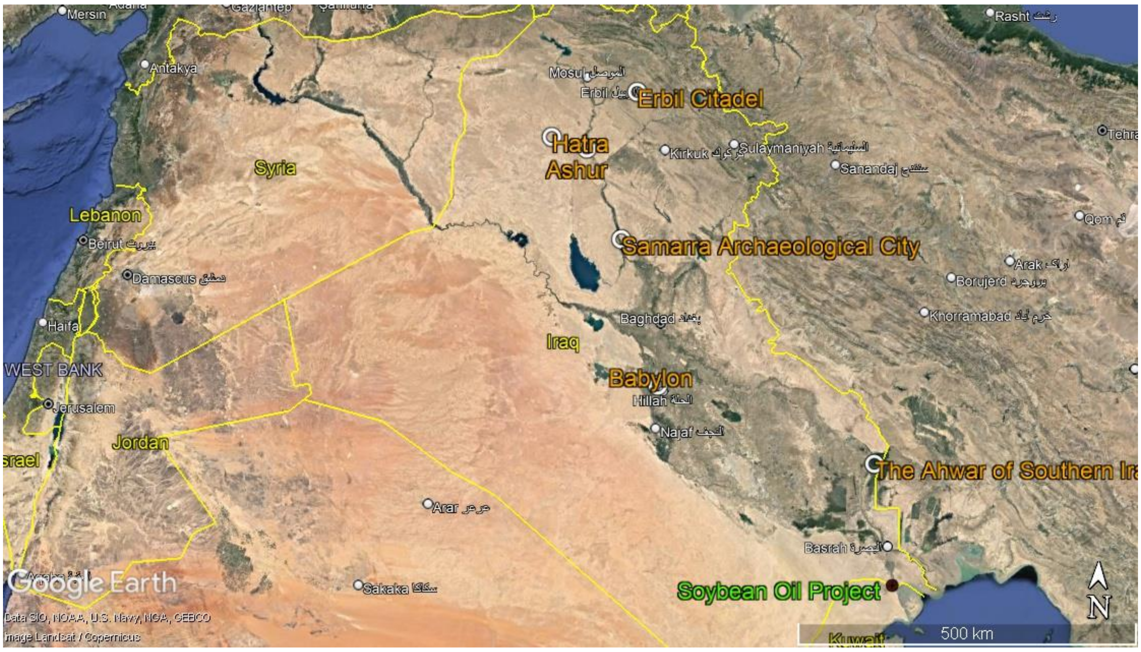


Figure 13-11: Locations of World Heritage Sites in Iraq

13.3 Impact Assessment

13.3.1 Overview

Key cultural heritage and archaeological issues associated with the Soybean Oil project site and surrounding areas potentially impacted during the site's construction, commissioning, operational and decommissioning phases are highlighted in this subsection.

The significance of impacts of the proposed project on local archaeology and cultural heritage resources, if any, have been assessed and where necessary, mitigation measures have been identified. For the assessment of potential impacts both project activities and baseline conditions for archaeological resources have been considered. The magnitude and significance of impact during each phase of the project are also stated below at the end of each subsection.

There may be potential to find exposed or buried cultural resources, particularly in coastal areas and specifically in the Umm Qasr area with the presence of road transport of goods to and from Umm Qasr Port at the Arabian Gulf. Strategic locations at coastal areas such as Umm Qasr port are likely to have attracted settlers and migrants to the area increasing the likelihood of finding archaeological remains. Such resources, if found, can be preserved by developing "archaeological chance find procedures" for any planned construction work.

13.3.2 Construction

Impact on archaeological resources due to construction activities:

Any construction activities such as site levelling, earthworks, facility construction, trenching for pipelines and cables, and vehicle movements at the Soybean Oil project site are considered the activities having a potential of causing some impacts on any archaeological and cultural resources.

Two potential impacts on the archaeological resources have been identified during any construction activities that derive from the accidental discovery of unidentified archaeological features or artefacts within the site during construction.

A discovery could either have a potentially negative impact if the feature or artefact is mechanically disturbed / degraded during earth movement activities or during vehicle movements. Alternatively, it could have a positive impact if it is exhumed intact, salvaged and made available to the authorities for documentation and preservation.

Although Basra Province has some archaeological and cultural resources, as mentioned earlier, no evidence suggests known archaeological sites of interest that exist in the Umm Qasr area where the Project site is located. In order to overcome this, the only suggested mitigation measure is the adoption of a "chance find" system which involves briefing workers and a notification system, which will imply trained observer(s) in this field may be contracted to oversee the excavation phase and a simple discovery action card be provided to workers as part of orientation to the site.

Impacts are characterised by a potential low consequence and low probability, and, given that the area to be excavated is not known to be archaeologically significant, the impact is of low significance. Both impacts are characterised by a high sensitivity, given that their impact would be greatest for those finds having a high degree of affinity or identity tied to cultural heritage.

Overall Impact on Archaeological Aspect (AC1)– Low Magnitude, Low (Negative & Positive) Significance.

Impact on cultural heritage due to interaction between expatriate workers and local people during construction:

Another potential impact on cultural heritage at all project phases may include the construction expatriate workers, due to interaction between persons from diverse cultural backgrounds with the local community deriving cross-cultural tension, specifically related to differences in religion, behaviour, and tradition.

Sensitive receptors for this impact are the local Iraqi population accustomed to their own traditions and culture, characterised as a medium sensitivity receptor. However, they could easily absorb the influx of expatriate workers in the area since expatriate workers are few in number but with low negative results, since various nationalities already co-exist in the area and locals likely have been accustomed to foreign worker's lifestyles. Impacts to the local population can be managed through stakeholder engagement processes. Considering the low number of expatriate workers to be employed during this phase the impact is assessed as being of low magnitude.

Overall Impact on Cultural Heritage (AC2)– Low Magnitude, Low Significance.

Summary of potential impacts on the archaeological and cultural resources due to the above aspects during the Construction phase are summarized in table 13-2

Table 13-2: Construction phase potential impacts summary

Factor	*AC1* **Loss of Archaeological**	*AC2* **Cultural Discovery / Heritage**
Frequency	Rare	Rare
Likelihood	Unlikely	Likely
Extent	Local	Provincial
Duration	Short	Short
Magnitude	Very Low	Low
Effect	Negative	Negative
Action	Direct	Direct
Significance	Low	Low

13.3.3 Commissioning

There are no identified potential impacts on the archaeological and cultural aspects resulting from commissioning activities.

Cultural heritage issues previously discussed under the construction section are kept through the project's lifetime; although the potential of a find would diminish as works completed and the related workforce leave the area.

Overall Impact on Cultural Heritage– Low Magnitude, Low Significance.

13.3.4 Operation

Impact on archaeological resources due to vehicle movements:

The Project operation phase may pose low impacts on archaeological and cultural heritage aspects of Basra Province during the following occurrences:

- Vehicle movements on-site/off-site
- Tourist expeditions by expatriate workers.

As for vehicle movements between supply centres and the Project site. The possibility of finding and consequently damaging archaeological wealth laying on the roads is quite unlikely and small considering:

- There are no known archaeological sites of interest that exist within site and surroundings
- Site and surrounding areas have already been subjected to heavy manmade activities, mainly from the surrounding industrial complexes

- Archaeological finds if any are likely be identified during any construction and operation only
- In case of existing roads, damage would have occurred prior to any project construction.

Magnitude of this potential impact (if any) is considered to be very low but unlikely and rare, so the impact is considered to be insignificant. Therefore, no mitigation measures are recommended.

Overall Impact on Archaeological Aspect (AC3)– Low Magnitude, Low (Negative) Significance.

Impact on archaeological resources due to abusive exploitation of historical sites by expatriate workers:

A negative impact on archaeological resources of low magnitude related to expatriate workers has also been identified as it is likely that expatriate workers want to explore the country during their stay in Iraq making tourist expeditions to sites of archaeological interest including the nearby Old Mosque of Basra or Imam Ali Mosque as well as Mausoleum of Hasan al-Basri located toward the north of the site at a distance of 45km. Serious impacts and legal consequences on the project may occur if workers who find archaeological artefacts decide to keep them as souvenirs or if they disturb the archaeological sites visited. Therefore, this impact has been considered as unlikely and of low magnitude.

Overall Impact on Archaeological Aspect (AC4)– Low Magnitude, Low (Negative) Significance.

Impact on cultural heritage due to interaction between expatriate workers and local people during operations:

Despite the low number of expatriate workers during the operation phase, there will inevitably be interaction between people from diverse cultural backgrounds with the local community due to the compound living arrangements. This could derive cross-cultural tension, specifically related to differences in behaviour and tradition. Therefore, this impact has been considered as possible but of low magnitude. Mitigation measures previously discussed during any construction should be retained.

Overall Impact on Cultural Heritage (AC5)– Low Magnitude, Medium duration, Low Significance.

Table 13-3: Operation phase potential impacts summary

Factor	***AC3*** **Loss Of Archaeological**	**AC4** **Loss Of Archaeological**	***AC5*** **Cultural Heritage**
Frequency	Rare	Infrequent	Infrequent
Likelihood	Unlikely	Likely	Likely
Extent	Local	Regional	Regional

Duration	Short	Short	Medium
Magnitude	Very Low	Low	Low
Effect	Negative	Negative	Negative
Action	Direct	Direct	Direct
Significance	Low	Low	Low

13.3.5 Decommissioning

As in the other phases of this project, vehicle movements for the removal of material to restore and rehabilitate land to pre-project conditions as per the land lease agreements and possibility of impacts on archaeological wealth lying under ground is to be considered. This impact is considered to have the same characteristics that impact identified and assessed for the construction phase.

Overall Impact on Archaeological Aspect – Low Magnitude, Low (Negative) Significance

13.4 Mitigation and Recommended Measures:

Generally speaking, magnitude of this potential impact during all phases of this project is considered to be low as well as unlikely and rare, so the impact is considered to be insignificant. Therefore, no mitigation measures are needed. However, some recommendations can be followed during each phase as indicated below.

Recommendations during Construction

- Contractual provisions should clearly indicate the procedure in case of any findings related to archaeology
- Every worker has to be trained in procedures to be applied in case of finding archaeological artefacts during any construction activities.
- A training session for new workers will need to be conducted as soon as workers arrive at the site.
- Contractors should take into account the possibility of finding archaeological artefacts during any excavation and construction work.
- If archaeological artefacts are uncovered, work in that area shall be stopped and the environmental protection committee notified.
- Site manager should inspect and secure site and notify the Project top management immediately

- The Project management shall inform the government authority so that measures are taken to ensure that concerned authorities are notified
- The EPC Contractor shall develop and implement a procedure (such as Archaeological chance find) for the management of unexpected archaeological resources and shall report any finds to the Project management and in accordance with National requirements.
- EPC Contractor shall provide the workforce with tool box talks on the subject to raise awareness of the importance of cultural and heritage resource finds.
- Educational and informative materials especially on promoting cross-cultural understanding is highly recommended for newcomers to the city in the form of leaflets prepared in languages of the target workers.

Recommendations during operation

- Recommendations previously discussed during construction phase should be retained.
- As mentioned earlier, potential impacts on cultural heritage issues derive from the employment of expatriate workers are maintained through the lifetime of the project.

14 OCCUPATIONAL AND COMMUNITY HEALTH AND SAFETY ASPECTS

14.1 Introduction

The World Health Organization defines health as: "A state of complete physical, mental and social well-being, and not merely the absence of disease". It also states that "Good health is essential to human welfare and to sustained economic and social development".

The maintenance of good health is promoted within the Qur'an. Hygiene is a prominent topic in Islam, and the Qur'an advises Muslims to uphold high standards of physical hygiene whenever possible. The government gives the health sector a high priority so to provide all Iraqi citizens with access to free and acceptable standards of health care.

This Section presents and overview of international and national Health and Safety legislation and standards and provides information on regional and local health infrastructure. Baseline health data for the country as a whole and the region in which the Project was located to give an understanding and an overall picture of health issues. Potential impacts with respect to Occupotional Health and Safety are evaluated for each phase of the Project to ensure compliance with WB/IFC Occupational health and safety requirements (EHS Guidelines, 2007) and ISO 45001.

This section focuses on:

(i) Baseline health data for Republic of Iraq and the region in which the Soybean Oil project is located, Basra Province;

(ii) Information on provincial health infrastructure as well as detailed in-depth analysis of health services available in Umm Qasr and surrounding areas;

(iii) Health and safety hazards that employees and the surrounding community may typically be exposed to in the operation of the Soybean Oil facility, and

(iv) Management of on-site/off-site hazards including emergency response facilities and outlines for Emergency Response and Communication.

14.2 Legislative & Corporate Context

14.2.1 Iraqi Legislations

The Environmental Regulator for the Umm Qasr and associated facilities is the Iraqi Ministry of Environment (IME). The IME defines, through a series of regulations and standards, thresholds and criteria, measures to protect public and employee health from harmful air quality emissions, noise, contaminant and pollution sources (both land and water), and disposal of hazardous waste materials.

The regulations are supported by a series of Environmental Standards on air quality, noise, waste management, water quality (including drinking water), and the prevention of major accidents.

The IME require the facilities to be designed to meet these standards, and exemptions can only be provided by the relevant minister. Compliance with the standards through design, therefore, automatically confers a level of protection for public and employee health.

In 2005 the Government of Iraq adopted a new constitution which include the following articles related to health care:

- Article 30: First: The State shall guarantee to the individual and the family - especially children and women - social and health security, the basic requirements for living a free and decent life, and shall secure for them suitable income and appropriate housing. Second: The State shall guarantee social and health security to Iraqis in cases of old age, sickness, employment disability, homelessness, orphanhood, or unemployment, shall work to protect them from ignorance, fear and poverty, and shall provide them housing and special programs of care and rehabilitation, and this shall be regulated by law.

- Article 31: First: Every citizen has the right to health care. The State shall maintain public health and provide the means of prevention and treatment by building different types of hospitals and health institutions. Second: Individuals and entities have the right to build hospitals, clinics, or private health care centres under the supervision of the State, and this shall be regulated by law.

14.2.2 World Bank

The World Bank (WB) has defined the principals for the Assessment of Health in EIA. Guidance is provided through the Environmental Assessment Sourcebook (2007) for the systematic integration of public health and safety concerns through early screening of proposed developments and implementation of appropriate measures to address risks during project preparation, implementation, and beyond.

Health aspects of particular interest are the potential risks associated with communicable and non-communicable diseases, accidents and injury, malnutrition (direct and indirect through land-use change), health infrastructure and the impact of the project on its capacity, integration into the project design, and monitoring of potential effects.

In addition, the World Bank has produced Environmental, Health and Safety (EHS) Guidelines (2007) which detail specific requirements for Occupational and Community Health, Safety and Welfare. The document sets out the minimum requirements for compliance with international best practise, provides exposure limits for various groups in terms of noise, radiation etc., and details minimum expectations for the provision of welfare facilities on site, and in accommodation camps. The guidelines also detail recommendations for the protection of workers and the community against the transmission of diseases, including the provision screening and vaccination programmes.

The IFC performance standards (as described in Section 2 Policy, Legal and Administrative Framework) also highlight the importance of health and welfare in Environmental and Social Sustainability. The following performance standards are particularly relevant to this Section:

- IFC Performance Standard 1 – Assessment and Management of Environmental and Social Risks and Impacts;
- IFC Performance Standard 2 – Labor and Working Conditions; and
- IFC Performance Standard 4 – Community Health, Safety and Security.

Performance Standard 2 requires the adoption of human resource policies and procedures to provide workers with clear documented information as to their rights under National Labour Laws and any relevant collective bargaining agreements. These rights working hours, wages, overtime, compensation, breaks, rest days, and any benefits including leave for illness, maternity leave, annual and statutory holidays etc.

Where accommodation is being provided, policies on the quality and management of the facilities should be implemented to ensure the provision of basic services which are defined as:

- Minimum space;
- Supply of water;
- Adequate sewage and waste disposal;
- Protection against heat, cold, damp, noise, fire, and disease carrying animals;
- Adequate sanitary and washing facilities;
- Cooking and storage facilities;
- Natural and artificial lighting; and
- Basic medical services where appropriate.

The accommodation should also not restrict workers' freedom of movement or of association.

The IFC with the European Bank for Reconstruction and Development (EBRD) have published a guidance note: Worker's Accommodation: Process and Standards (IFC 2009) with associated checklist which details the level of required facilities, layout and expectations for the provision of all workers' accommodation both during construction and operation.

The performance standard also states the minimum expectations under Occupational Health & Safety for employees, third party contractors, and workers in the supply chain. The standard requires the implementation of policies and procedures to good international industry practices which minimise the risks to workers from hazards including physical, biological, chemical, radiological and specific threats to women. The procedures should include the identification of hazards, their prevention or protective measures, reporting and documentation of accidents, diseases and incidents, and emergency preparedness. Training of workers should also be undertaken.

Policies and procedures should also be developed and implemented for the management and monitoring of third party contractors and the primary supply chain, and incorporate these where appropriate into their contractual obligations.

IFC PS 4 has the following objectives:

- To anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances; and
- To ensure the safeguarding of personnel & property is carried out in accordance with relevant human rights principals and in a manner that avoids or minimizes risks to the affected communities.

The implementation of the actions required to comply with this standard is managed through the Environmental and Social Management System (ESMS) outlined in IFC PS 1 of section 2. The Standard requires the evaluation of the risks and impacts to the Health and Safety of any affected communities during construction, commissioning, operation and decommissioning. Measures to prevent, minimise and manage these risks in line with international best practise are required to be implemented, and any mitigation measures should be commensurate with the nature and magnitude of the impact. Importantly, the standards call for the avoidance of risks and impacts in preference to minimisation and mitigation. The standard highlights the following aspects:

- Infrastructure and Equipment Design and Safety
- Hazardous Materials Management and Safety
- Ecosystem Services
- Community Exposure to Disease
- Emergency Preparedness and Response

The performance standard also provides guidance on the minimum requirements where security personnel are employed as part of the project (either directly or through contract). The requirements cover hiring, training, equipping, use of force, conduct towards affected communities, and monitoring. It also requires compliance with the United Nations (UN) Code of Conduct for Law Enforcement Officials, and the UN Basic Principles on the use of Force and Firearms by Law Enforcement Officials.

14.3 Baseline

14.3.1 National Health

The Republic of Iraq has a population of about 40million with a population growth rate of about 2%. The population is spread amongst 131 cities and towns. The provision of Health Services in Iraq falls under the remit of the Ministry of Health and Environment (hereafter called the Ministry of Health (MOH)) which manages 19 provincial health departments (one in each province and two in the capital, Baghdad). The MOH is the main agency responsible for both the provision of care and setting of overall policies for the entire health-care system. The MOH is divided into four major levels: the national level located in Baghdad, the regional level within the eighteen regions, each of which is responsible for public health as well as the management of tertiary care hospitals and primary health centres, a district level with management functions and a local level that consists of health care centres and secondary institutions. The healthcare system in Iraq is divided into two main sectors,:

1. Public sector: This sector is financed through the national annual budget. In 2021 the total expenditures of health sector in the federal annual budget was around 2 billion USD, forming only 2.3% of the total budget (Langhause, 2020). The public sector is divided into three main categories: Primary Health Care, Secondary Health Care, and Tertiary Health Care (Kapita, 2021).

    - Primary Health Care (provided by Health Centres). In Iraq there are 2,538 primary healthcare centers and sub-centers that serves an average of 20,000 to 30,000 people with preventive, diagnostic and curative services.

    - Secondary Health Care (provided by General Hospitals). These centers provide preventive, diagnostic, curative, and emergency services through public hospitals, maternity and child hospitals, and emergency hospitals on a 24/7 basis for cases that require treatment, also provides training, education, and research opportunities.

    - Tertiary Health Care (provided by Specialist Hospitals). These are specialized centers and hospitals that have the ability to provide health services with subspecialties to patients referred from secondary health care institutions with the provision of training, education, and research opportunities. Example of these category are general hospitals, women's and children's hospitals, emergency hospitals, and specialized hospitals.

2. Private sector, which includes:

    - Private hospitals.
    - Clinics.
    - Medical complexes (Langhause, 2020)

The stages that constitute the structure of the healthcare system in Iraq are illustrated in figure 14-1. As clear from the figure, education is the first step for individuals to become part of the system, movng on to health sources production (workforce, facilities, commodities, and technology), ending with the funding sources (public and private).

The public sector has 286 hospitals, classified into general hospitals, women's and children's hospitals, emergency hospitals, and specialized hospitals. There are 126 specialized centers. The MOH has endeavored to strengthen the infrastructure for secondary and tertiary healthcare services through the establishment of 62 modern hospitals of various capacities and specialties (The National Health Policy (2014-2023), 2014).

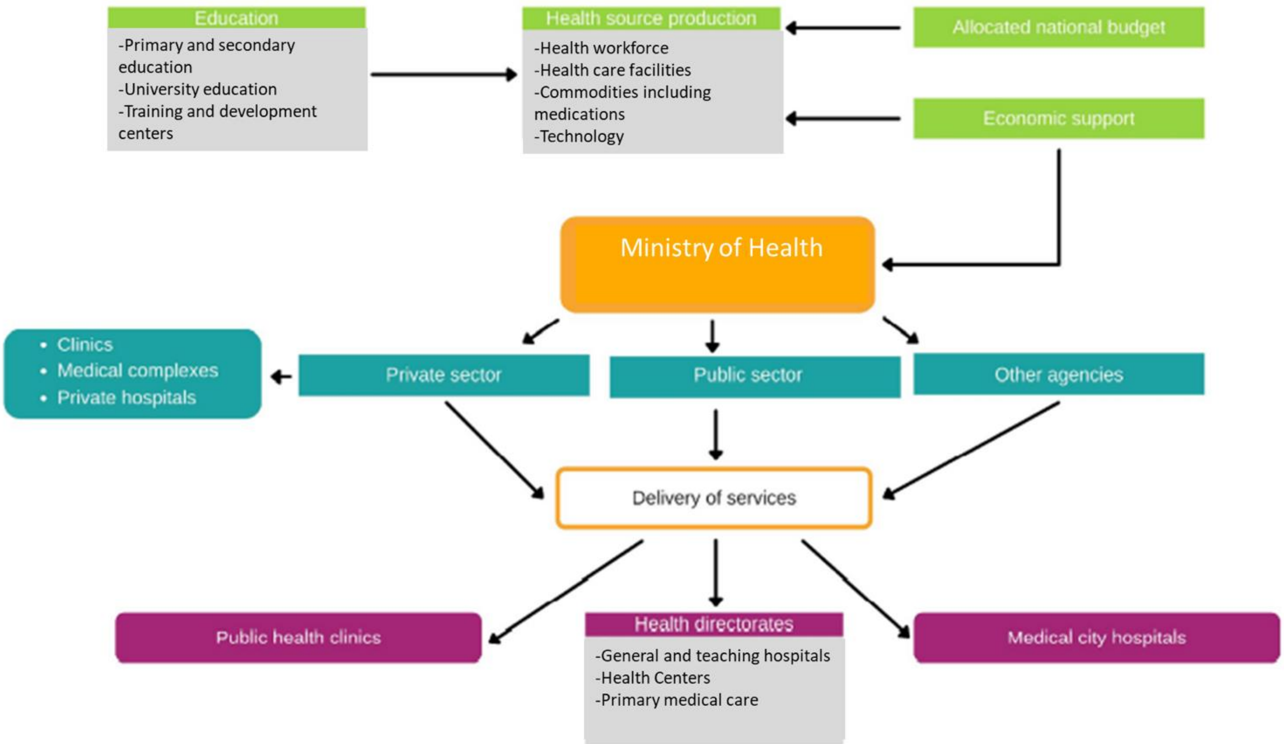


Figure 14-1: Structure of the healthcare system in Iraq (Source: Kapita, 2021).

The first national health account was established in 2010 when 8.4% of Iraq's gross domestic product (GDP) of USD 82.2 billion was spent on health, later reported to be 4.5% of its GDP of USD 110.83 billion in 2019. The percentage is low compared to the other Middle Eastern countries with comparable GDPs (Al-Jumaili et al., 2021). In 2019, the health expenditure per capita was USD 253.3, which had improved from USD 150.5 in 2010, but it was still far lower than Iraq's neighbouring countries (WHO, 2022).

As for the COVID-19 pandemic, on 28 January 2020, Iraq announced specific measures to prevent the entry of SARS CoV-2 into the country: evacuating citizens from Wuhan, China, checking temperatures, and quarantining symptomatic patients at the border. Iraq acted proactively in response to the novel coronavirus outbreak, even when its neighboring countries reported no cases. Additionally, the government established the Government Crisis Cell to coordinate its health-related response to COVID-19 under the guidance of the Minister of Health (Government of Iraq, 2020). About 11 million Iraqis had received at least one shot of the COVID-19 vaccine by the end of July 2022, representing more than 25% of the population (Al-Qerem et al., 2022)

An evaluation report of Iraq's health system's capacity to comply with the International Health Regulations (IHR) in 2019 showed that the system's score was 47%, which was below the regional average of 60%; it also showed that the country's abilities to prevent, detect, and respond to health emergencies were at 54%, 45%, and 47%, respectively (UN, 2022).

14.3.1.1 Health Care Infrastructures:

The number of medical doctors and nurses per 10,000 population in Iraq is lower than Iraq's neighboring countries except for Iran, where the number of nurses was comparable (WHO, 2022). These human resources are concentrated in Baghdad, leaving other governorates with even lower numbers of doctors and allied health professionals. The number and the distribution of these facilities are inadequate as they are concentrated in Baghdad and are not meeting the high demand due to population growth (see Figures 14-2 and 14-3).

As per WHO (2022) and UN (2022), there are 8.4 physicians and 19.4 nurses per 10,000 population; and there are 2,765 primary health centres (7.2 per 100,000); 281 public hospitals (0.7 per 100,000) and 13.8 hospital beds per 10,000 population in all of Iraq. On 2 March 2020, Reuters published an article 'The medical crisis that's aggravating Iraq's unrest,' which stated that Iraq has 1.1 hospital beds and 0.8 doctors per 1,000 people whereas the Kurdistan region of Iraq (KRI) has 1.5 beds and 1.4 doctors per 1,000 people. Another study by Duran (2020) states that Iraq has 1.3 beds per 1000 individuals and fewer than 1000 intensive care unit beds in total. However, Al-Bayan Center for Planning and Studies prepared a comprehensive statistical report (February, 2022) on "The reality of the health sector in Iraq and ways to improve it (preliminary reading)" which showed slightly higher results compared to those reported in WHO (2022) and UN (2022) possibly because the Center depend on more recent data. The results of this report on health care infrastructure in Iraq are given in table 14-1.

Table 14-1: Health care infrastructure in Iraq

Description	Number
Primary health care	
primary health care centers	2805
Primary health care centers (main)	1298
Primary health care centers (subsidiary)	1507
Secondary and Tertiary Health Care	
Number of government hospitals and specialized centers that have beds	295
The number of private hospitals	155
The number of government total beds	49,825
Number of government prepared beds without emergency beds	40,825
Average bed/1000 people	1.2
Health Human Resources (Indications)	

The number of human cadres working in the health field (Kurdistan Region and those affiliated with the Ministry of Higher Education included)	346,920
The number of human cadres working in the Ministry of Health (Except for the Kurdistan Region and those affiliated with the Ministry of Higher Education).	295,269
The total number of doctors	38,865
Average doctor/10,000 people	9.68
The number of specialist doctors in the Kurdistan region and those affiliated with the Ministry of Higher Education	14,266
The number of doctors affiliated with the Ministry of Higher Education	1,472
Number of dentists	14,003
Average dentist/10,000 people	3.49
The number of pharmacists	16,512
Pharmacist rate/10,000 people	4.11
The number of nursing staff	89,990
The ratio of nursing staff/doctor	2.3
Nursing staff/10,000 people	22.4
The number of health professionals	90,327
The rate of health professionals/10,000 people	22.50
Source: Al-Bayan Center for Planning and Studies (2022), https://www.bayancenter.org/en/2022/02/3117/ (accessed in Nov, 2022)	

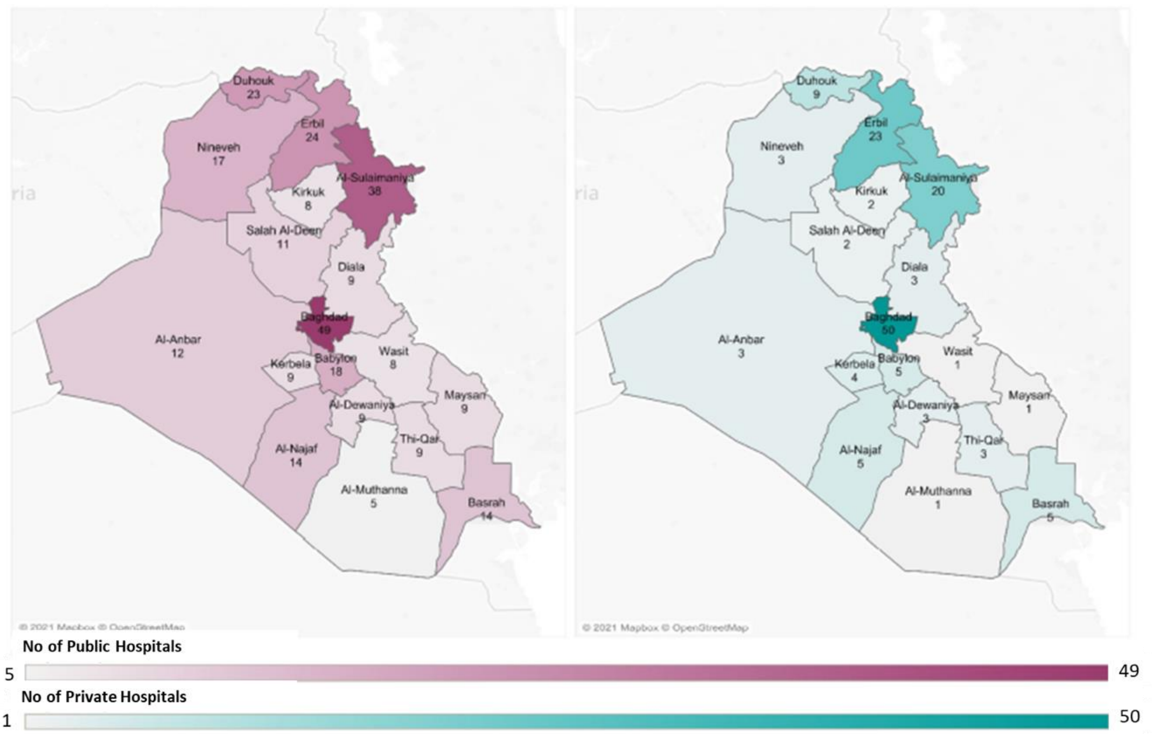


Figure 14-2: Number and distribution of public and private hospitals in each province of Iraq during 2019 (source: KAPITA, 2021)

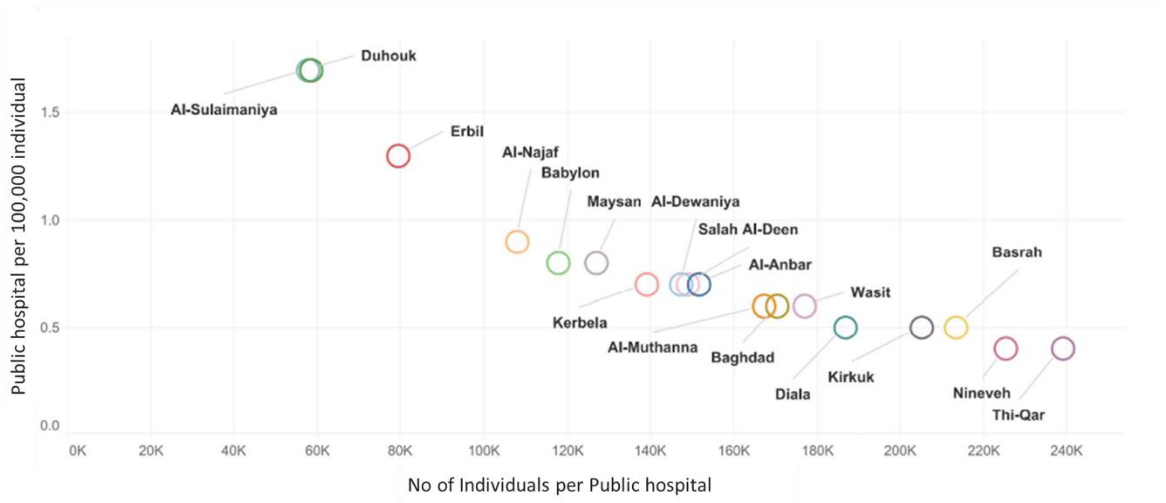


Figure 14-3: The number of the public hospitals per 100,000 individuals in Iraq in 2019 (source of data: Iraqi Ministry of Health and source of graph: KAPITA, 2021)

14.3.1.2 Communicable And Infectious Diseases

The latest Ministry of Health and Environment statistics show that communicable diseases account for 17% of all deaths in Iraq and are the second largest cause of mortality and morbidity in the country.

The World Health Organization (WHO) provides technical and logistical support to the Ministry to control many communicable diseases, including tuberculosis (TB), hepatitis, HIV/AIDS and neglected tropical diseases, and to tackle antimicrobial resistance, collect communicable disease surveillance data and help ensure adequate response to outbreaks.

Tuberculosis (TB):

The MOH estimates TB prevalence to be 42 new cases per 100,000 population (2017). Deaths due to TB are estimated at 1,100 annually, with a mortality rate of 2.9 per 100,000. In 2018, 7,104 cases of TB were detected and reported and 75 cases of multidrug-resistant TB were confirmed.

WHO and MOH developed national multidrug-resistant TB guidelines. Twenty-two staff were trained in the clinical and operational management of drug-resistant TB patients and to manage a range of clinical, diagnostic and therapeutic issues related to drug-resistant TB.

Hepatitis:

The number of cases of hepatitis B and of hepatitis C recorded in 2017 were 1,926 and 594 of respectively (WHO, 2022). National statistics on hepatitis are limited. WHO is working with the hepatitis control programme to train health care staff and provide technical support and advocacy material to raise awareness about hepatitis on a regular basis.

HIV/AIDS:

The Cases of HIV prevalence in Iraq is less than 1% although this number is expected to increase, especially in conflict-affected areas. In 2017, 86 people were enrolled in HIV care (WHO, 2022).

In 2018, WHO supported the Ministry of Health's procurement of antiretroviral drugs for the treatment of HIV/AIDS patients and conducted an evaluation of the national AIDS programme to identify gaps and recommend ways to scale up the detection of cases and improve service delivery for people living with HIV/AIDS.

Malaria:

Based on recent health data, there is no local transmission of malaria in Iraq (WHO, 2022). However, it seems the risk exists in southern and central governorates, from the Tigris-Euphrates river basin to the border with Islamic Republic of Iran. In 2017, all 9 malaria cases reported in Iraq were imported.

To improve the health awareness and maintain Iraq's malaria-free status, WHO trained 25 malaria focal points in the prevention, management, and control of the disease.

Antimicrobial resistance

Antimicrobial resistance has become a serious global public health challenge due to the misuse and overuse of antibiotics. The number of infections is increasing in Iraq due to resistant bacteria and a commensurate reduction in successful treatments for managing such infections. There are, however, no available data on antimicrobial resistance in Iraq (WHO, 2022).

The WHO gave technical support to the Iraqi MOH for developing a national action plan on antimicrobial resistance and training 50 health officials in surveillance using the global antimicrobial resistance surveillance system (GLASS) platform.

Neglected tropical diseases

The Iraqi MOH has developed an integrated vector management and control plan to strengthen prevention and control of neglected tropical diseases in all of Iraq, the most prevalent of which are leishmaniasis, soil-transmitted helminthiasis, and rabies.

14.3.1.3 Non-Communicable Diseases

Non-communicable diseases (NCDs) can be considered a major public health problem. Those diseases, mainly cardiovascular diseases, diabetes, cancers and chronic respiratory diseases contribute to the majority of causes of death and constitute a major burden for socio-economic development especially in developing countries like Iraq (Iraqi MOH, 2013).

NCDs are the leading cause of morbidity and death in Iraq (Iraqi Ministry of Health, 2019). It is estimated that 30% of Iraqis have high blood pressure, 14% have diabetes, and more than 30% are obese. Some 38% of Iraqi males smoke and a growing number of schoolchildren – 20% of males and 9% of females aged between 13 and 15 years – are tobacco users.

As per WHO 2022 for Iraq: Mortality due to NCDs, including heart disease, stroke, chronic lung disease, cancer and diabetes, accounts for 55% of all deaths. Cardiovascular disease alone accounts for an estimated 27% of total deaths, cancer 11%, diabetes 4%, and chronic lung disease 2%.

14.3.1.4 Occupational Health & Accidents

Occupational Health in Republic of Iraq is aimed at the prevention, treatment and monitoring of work-related injuries and diseases, especially in high risk industries such as metallic industries, petrochemical, plastic and textile industries. It also includes the prevention and measurement of exposure to radioactive isotopes, especially in health facilities.

The Ministry of Labor and Social Affairs for Republic of Iraq is responsible for the protection of workers, treating and compensating work injuries under the Occupational Hazards Branch (OHB), developing and updating schedules of occupational diseases in accordance with relevant international laws and legislation, and preparing the Annual Statistical Report on the occupational injuries in the Republic of Iraq.

Chapter 13 of Iraqi labor law under part of Occupational Safety and Health and labor inspection and Part 1: Occupational Safety and Health, Article 114 and paragraph 5 states: "Ensure that all workers undergo primary and periodic medical examinations regarding occupational health and safety and the work environment, with the inclusion of accidents, occupational injuries and diseases that occur at work or are related to it."

14.3.2 Regional Health

At the regional level, the province of Basra is relevant to this project, considering that's where the project will be carried out. The health governmental infrastructure in Basra province is shown in Table 0-2.

Table 0-2 Health Infrastructure

Indicator	Number
Hospitals (private and public)	18
Primary health care centres	139
Health care institutions and clinics	246
Number of Physicians	2,455
No of Dentist	364
No of Pharmacies	540
No of employees in health sector	5,347
Total Beds	2,500

Source: General statistics for year 2017, Central statistical Organization at Basra.

Basra city has a relatively better health care network compared to other provinces in the southern Iraq as it has 19 major hospitals and 139 health care centres providing services to both residents and visitors.

The names of public and private hospitals in Basra are listed below:

Teaching Hospitals

- Al Basra General Teaching Hospital (Formerly, Al Jomhouri Hospital)
- Al Sadir Teaching Hospital (Formerly, Sadaam Hospital)
- Al Mawani General Teaching Hospital
- Al Basra Maternity & Children's Teaching Hospital (Formerly, Ibn Gazwan Hospital)
- Al Fayhaa General Teaching

General Hospitals

- Om Qasir General Hospital (Om Al Maarik)
- Al Zubair General Hospital
- Al Midaina General Hospital
- Al Qurna General Hospital (Saddamiya)
- Al Fao General Hospital
- Abu Al-Khaseeb General Hospital

Private Hospitals

- Al- Mosawi hospital
- Mowasat hospital
- Al Saadi Private Hospital
- Al Noor Private Hospital
- Ibn Al Baitar Private Hospital
- Dar Alshifaa Private Hospital
- Al Mawada Private Hospital

Among these hospitals the recommended ones that provide relatively better emergency care in Basra province are shown below:

- Al Sadir Teaching Hospital located near Saad Square, Tel: +964 (0) 771 942 9460
- Al- Saadi Private Hospital located at Al- Sa'adi St, Buraiha, Tel: +964 (0) 780 862 0000
- Al- Mosawi Private Hospital located at Al- Saeed St , Tel: +964 (0) 770 394 9583

14.3.3 Local Health

Umm Qasr town is in the AlZubair district and within the governorate of AlZubair which is one of the eight governorates of Basra province. More details are given in section 12- Socio-Economics aspects.

The residential area of Umm Qasr offers a variety of medical care to residents. The health services department of Umm Qasr is responsible for providing health care to residents and has one general hospital which is equipped with equipment and professional staff.

Three levels of health care are provided within Basra city but not in Umm Qasr area: primary, secondary, and tertiary corresponding respectively, health centres, general hospitals and specialist hospitals.

Primary health services provide the following services: community educational programs on health-related issues of concern to the public, diagnosis and treatment of common diseases and injuries, simple surgical procedures, comprehensive maternal and child health care, prevention and control of locally endemic diseases, immunization of children against communicable diseases, dental care, and provision of essential drugs. Secondary care services provide medical, surgical, pediatric, obstetric and gynecological, dental and emergency service. Tertiary care is specialized consultative care, on referral from primary or secondary medical care personnel, by specialists/consultants working in Medical Center that has personnel and facilities for special investigation and treatment as well as the capability to respond to road accidents and emergency cases by a dedicated team of specialized paramedics available 24/7.

Patients are referred by the primary care physicians for further treatment or admission. Hospitals and specialized clinics provide primary care services, emergency medicine, and in-patient hospital services.

The general hospitals, including Umm Qasr general hospital and AlZubair general hospital, are available to all construction workers as well as operational and long-term workers (> 1 year residence). However, short term workers may be required to have insurance coverage or other arrangement, although the hospital will not turn away emergency cases.

The medical centres, including those in Umm Qasr and AlZubair district, or public/private hospitals and special clinics in Basra city, may have the capacity to provide healthcare for Soybean oil project staff. The locations of general hospitals and the distance to the soybean oil project are shown in figure 14-4.

Figure 14-4: Map showing the locations of general hospitals in province of Basra and distance to Soybean Oil Project

14.4 Health and Safety in Construction

The Soybean Oil facility will be developed over an 18-month construction programme. During this period, the workforce is expected to comprise an average of 250 workers during construction and 200 workers during the operation phase from a variety of backgrounds but mainly from local people - Iraqis.

The EPC contractor will be required to operate in compliance with relevant laws and standards outlined in earlier of this section.

The workforce (local and non-local) will be housed in accommodations that will be equipped with the utilities and support services necessary to accommodate the workforce, such as water, electricity, air conditioning, laundry, canteens, recreational and medical services.

Health screening will be carried out for the workforce. The implementation of this health screening will reduce the risk of health impacts to those with chronic conditions. First aid facilities at local construction sites will also be provided.

14.5 Health and Safety in Design

The Soybean Oil project corporate policies and procedures have been developed to ensure compliance with international best practise (i.e., ISO 45001 and ISO 9001 and ISO14001). This ensures the management system is fully compliant with IFC PS 1 and the WB/IFC General EHS Guidelines.

The Health and Safety of both employees and the local community have been considered as an integral part of the project design. The design process has included HAZID aspects which typically examines all possible sources of hazard during project design, construction, operation, and decommissioning activities, and for proposed changes to operations phase. Further, a series of detailed HSE assessments has been made for specific parts of the facility as part of the FEED (Front End Engineering Design) process.

Eliminating or reducing the risk of many of the potential operational Health and Safety impacts has been a central theme in the FEED stage, and it is therefore useful to incorporate a summary of this to avoid the assessment of an impact which will not be realised or be substantially reduced. A summary of this work is provided below.

14.5.1 HSE Design Basis

A Design Basis has been developed for the Project site which defined the minimum standards for design compliance. The hierarchy of controls required for the management of the Design HSE aspects and incorporated into this project are:

- Hazard Identification (HAZID);
- Eliminate or Minimize Hazards by Design (inherently safer design);
- Hazard Prevention (reduction of likelihood);
- Hazard Detection (transmission of information to control point);
- Hazard Control (limitation of scale, intensity and duration); and
- Hazard Mitigation of Consequences (protection from effects).

The design basis identifies hazards associated with the materials and process, and sets out a suite of guiding principles under the above hierarchy of controls. Hazards identified include:

- Material Hazards: including fires and explosions from ignition of fluids or dust; injury from exposure to strong acids; metal corrosion from exposure to strong acids; creation of flammable and explosive hydrogen gas; exposure to toxic fluids and gases (e.g., hexane).
- Chemical Corrosion: identifies chemicals which could corrode metals on contact requiring special construction of containment systems.
- Reaction Hazards: When chemical reactions are not properly managed, they can have harmful, or even catastrophic consequences.
- Operating Conditions: including high temperature and high pressure conditions.
- Plant and Equipment Hazards: including structural failure of equipment, and impacts from external forces (e.g.,s dropped items and collisions)

- Work Hazards: including human error, falls, manual handling. Exposure to chemicals and environmental factors (noise, temperature, radiation etc.), and traffic both on and off site.

An inventory of hazardous chemicals and materials with all details of properties of the chemicals should be prepared and documented at the project site. Principles adopted as part of the hazard control process are summarized in Table 14-3 below.

Table 14-3: Summary of Hazard Controls as detailed in the HSE Design: Design basis for FEED				
Hazard Elimination	**Hazard Detection**	**Hazard Control**	**Hazard Mitigation**	**Occupational HSE**
Early Identification of hazards to ensure risks are reduced (ALARP) through changes to the design	Provision of comprehensive Fire & gas detection system	Overpressure Protection Systems including: • Design compliance with international Specification • Equipment to withstand highest expected pressures in normal operation • No reliance on instrumentation for detection/response initiation to overpressure relief/ protection unless no practical alternative to reducing risks. • Containment of hazardous releases from overpressure relief devices. • Provision of reliable and appropriate overpressure relief	Provision of active fire protection in areas where there is potential for harm to personnel, damage to plant/equipment and/or risk of escalation. Design shall be in line with legislation and best practise	Medical services provision shall be provided including but not limited to: • Treatment beyond first aid including treatment and recovery rooms. • Equipment to include (not limited to): X-ray, ultra sound, slit lamp, blood analyser, ECG, defibrillation, etc. • Staffed by fully qualified personnel. Provision of safety showers in close proximity to any potential sources of exposure.
Minimum manning during operation and maintenance including: • simple robust design • specification of materials, • equipment & control systems, • optimisation of space, • provision of remote monitoring equipment	Design systems in line with legislative requirements & industry best practise	Process Control Systems to include: • Display of normal plant operating parameters • Generation of appropriate alarms • Automatic shutdown of plant deemed operating abnormally. • Operator interface for monitoring and control • Facilities for alarm and event logging • Interface with fire & gas/ emergency shutdown functions • Start up and sequencing • Trend logging • HVAC fire damper monitoring & control	Passive Fire Protection (PFP) to include: • Protection of structural supporting features from collapse (e.g.,walkways) • Protection of critical equipment and supporting cabling. • Consideration of design life, maintenance, corrosion resistance and normal operational limits in the selection of materials • Critical cabling in compliance with IEC 60331 • Diversity in cabling routing • Fire risk hazards assessment study to be carried out to support PFP requirements. • Fireproof ratings to be considered and compliant with International specifications	Exposure to Hazardous Chemicals: • Bulk handling of chemicals where appropriate • Provision of adequate storage to comply with separation and segregation needs. • Avoidance of use of chemicals where possible • Prohibition of use of human carcinogens (IARC Group 1) avoidance of those with high potential. • Provision of enclosed systems where possible • Location of exhaust stacks and vents away from personnel and HVAC intakes.

Table 14-3: Summary of Hazard Controls as detailed in the HSE Design: Design basis for FEED

Hazard Elimination	Hazard Detection	Hazard Control	Hazard Mitigation	Occupational HSE
Leak minimization through: • minimizing process complexity • reducing the number of joints • use of welded joints • use of shut-in pressure systems • corrosion resistant materials • double containment storage	Implementation of continuous monitoring in areas where potential exists for flammable/ toxic releases	Provision of fail-safe Safety Instrumented System to detect & inhibit unsafe conditions progressing to an "event" such as release of hazardous materials including: • Emergency shutdown system (through isolation, segmentation), including alarms, warning, and return to safe conditions. • Optimization of isolatable sections to minimise the inventory of materials which may be released during an "event".	Emergency Response to ensure personnel can reach a place of safety in any potential accident event.	• Obtain first aid • Report leaks, spills or ventilation failures immediately. • Isolate hazardous substances in separate storage areas • Purge or ventilate storage areas separately from the rest of the workplace • Thoroughly train employees in handling and safety procedures
Inventory Minimization including: • Elimination or minimization of flammable &/or toxic chemicals • Simplification /minimization of process equipment • Optimization of the hazardous chemical storage facilities (inc. production rates, rail supply/ loading rates & frequencies) • Use of small isolatable inventories.	Implementation of evacuation procedures	Hazardous Drainage and Bunding to include: • Separation of hazardous and non-hazardous drains • Closed drains separated from open drainage systems • Provision of surface drainage in areas with flammable liquids • Consideration of liquid release trajectories in design of bunding • Controlled collection and disposal of flammable release and firewater	Escape & Evacuation Facilities including: • Provision of escape routes • Training • Detailed emergency procedures • Provision of Safety equipment • Provision of lifesaving equipment	Thermal Environment • Location of exhaust stacks away from personnel • Workshop areas to be vented (natural or non-natural) • Adequate supply of drinking water provided at 24°C • Shade from solar radiation for outdoor work areas • Air conditioning for permanently manned areas
Facilities layout including: • Compliance with legislation • Segregation of normal & hazardous areas • Maximizing natural ventilation & blast overpressure venting • Maximize distances between ignition/toxic		Process & Utilities bunding and Drainage to be provide for: • Diesel storage and loading areas • Power generation & electrical transformer • Process equipment (pumps etc.) including drip trays • Oil/chemical laydown areas	Incident awareness including: • PA systems, • Beacons for visual identification • Alarm volumes, • Provision of different alarm tones for different response types	Hot Surfaces(>65°C): • Elimination or minimization of hot surfaces and equipment • Guards to be provided for protection where hot surfaces exist in preference to lagging.

Table 14-3: Summary of Hazard Controls as detailed in the HSE Design: Design basis for FEED				
Hazard Elimination	**Hazard Detection**	**Hazard Control**	**Hazard Mitigation**	**Occupational HSE**
sources and location of flammable & manned facilities. • Consider conditions (e.g., prevailing wind) in dispersion of toxic/ flammable materials, smoke & gas. • Orientation of instrument connections to maximize protection from blasts • Locate high potential ignition sources in well ventilation • Maximize escape routes in the facility.		• Workshop aprons • Roads • Water & Wastewater treatment units • Building Roofs • Vehicle Washdown Areas • Refueling areas		

14.5.2 Hazid Review and Design

A series of Hazard Identification (HAZID) reviews were carried out during the FEED stage of the project. HAZID review sessions were completed and the outcome from these sessions have been fed into the engineering design, and any outstanding actions included as part of the action list to be carried forward into the next phase of the project (detailed design & EPC).

The main objectives of this HAZID review were:

- To identify the significant hazards and threats associated with design, operation and maintenance of all facilities within the FEED design scope of work associated with the Project;
- To identify appropriate hazard management measures (safeguards) required to eliminate hazards, reduce risks and protect against the identified hazards;
- To raise actions and assign responsibility for assessment/evaluation of any potential additional safeguards; and
- To achieve a common understanding of all requirements towards achieving a safe design.

The review covers hazards associated with operations activities, however, those associated with construction activities that have been identified as relevant to design phase were considered. A HAZID session will be carried out on all units during the next phase of the project to address specific design hazards associated with construction, commissioning and maintenance activities

Actions identified by the HAZID process addressed many of the issues raised in the Health & Safety Design basis, however, additional hazards were identified and are listed below.

- Climatic Extremes, Radiation, Seismic activity, and Dust Control
- Diseases – including effect on promotion of diseases such as legionella from cooling towers, and diseases from contact with toxic materials. Assessment of design, layout and mitigation in compliance with relevant standards and best practise.
- Working Hazards – such as working at height, etc. Provision of a site permit to work system, incorporation of training, and implementation of site safety procedures in line with Occupational Safety guidance.
- Medical evacuation facilities – consideration of the type of facilities required for evacuation to specialist facilities in the region.

- Noise – including noise impacts on local communities. Noise levels at the site boundaries designed to be below required standards.
- Common Emergency Services – including fire, medical, police etc., for major emergency response. Consideration of resources available and impacts on the wider community and project requirements for incorporation into the design.
- Proximity to local community – including airport, affected communities, transport corridors etc.
- On-site traffic movements – protection of plant and personnel. To include segregation of vehicles, traffic barriers, signage etc.

In addition to the HAZID review, HAZOP reviews are also planned which will identify specific hazards in relation to construction, commissioning and decommissioning, however the results of these were not available for inclusion as part of the ESIA.

14.6 Impact Assessment

14.6.1 Overview

The following section considers and assesses the potential direct (e.g., air emissions) and indirect (e.g., increase in worker population) impacts, both negative and positive, that the proposed Soybean Oil Project may have upon the Health, Safety and Welfare of both the employees and the local communities. Sensitive receptors for the local community have been highlighted as part of the Section 12 - Socio-economic Aspects.

Consideration has been given to impacts associated with the construction, operation and decommissioning stages of the Project. The impact assessment has been completed in accordance with the methodology outlined by Section 4 - Impact Assessment Criteria and Methodology.

14.6.2 Construction

The influx of relatively large number of construction workers is the primary source of health impacts for this project during construction, to the degree that interactions with local communities occur. The degree of interaction with the local community will determine the significance of the impact. In addition, potential sources of impacts during the construction phase include the following:

- Exposure to environmental factors (Air Quality, Noise, Water & Contamination);
- Impacts of increased vehicle movement;

- Occupational Health & Safety of Construction Workers (including accidents and injuries, and mental health); and
- Communicable and non-communicable diseases.

Potential impacts from construction of this project were identified. These impacts are given hereunder.

Health Impacts from Air Quality and Noise:

During construction, impacts are generally associated with fugitive dust (PM_{10}) associated with construction activities and exhaust gases (NO_x and SO_2) emissions from generators and traffic. Fugitive dust is considered potentially significant within the project site.

Increased exposure to NO_x and SO_2 emissions from generators and vehicles may increase the sensitivity of certain groups especially those diagnosed with chronic conditions such as Asthma. As such, impacts are more likely to be seen in the local community then in the workforce which have a comprehensive health screening in place.

Construction also has the potential to increase the levels of particulate matter in the form of dust. Increased exposure to dust can increase the incidence of non-communicable respiratory disorders and chronic respiratory diseases.

Impacts on air quality from exhaust emissions from on-site generators and other operating equipment are considered low, due to rapid dispersion and dilution in more open areas, and are subject to maintenance programmes and are operated in compliance with HSES policies to protect on-site workers. The overall impact of air quality on workforce health is therefore considered to be low.

The increase in traffic movements have the potential to adversely impact on the local air quality. The nearest school and the general hospital lie approximately 3km from the main highway. The additional traffic movements from the construction traffic are unlikely to significantly impact on air quality in the area, given the current number of movements entering/leaving the Umm Qasr port from the other facilities, and will be temporary in duration. Therefore, community impacts are considered to be low.

Construction noise and vibration from on-site construction activities, machineries, transportation, can adversely affect peoples' quality of life. The health effects of noise and vibration during construction include hearing loss caused by exposure to noise at work which continues to be a significant occupational disease, and hand arm vibration exposure. Factors that contribute to the health effects are: the noise level, level and type of vibration, and the length of exposure (e.g., daily or over a period of years). Exposure to noise is more common and it can take years for the health effects to be realised. Management of noise will follow international best practice and will include consideration in the detailed design phases of changes in the construction process, and plant to minimise noise impacts, organisation of the programme and workforce to ensure rotation of staff, development of a comprehensive training programme and provision of PPE where required, and implementation of monitoring and health surveillance measures during construction. The implementation of these measures will reduce the impact to low significance.

Impact on Health (HS1) – Low Magnitude and Low Negative significance

Health Impacts Related to Waste (Liquid & Solid)

A Construction Site Waste Management Plan (SWMP) will be developed and implemented for the Project and will be specific to the requirements during the Early Works and main construction activities. The Plan will detail the types of waste and the mechanisms for storage and disposal (see Section 9 – Waste Management). Domestic, general and hazardous waste is required to be stored, collected and disposed of in according to National standards and procedures reducing any potential risks to the workforce.

Construction wastewater will take the form of sanitary wastewater. Sanitary wastewater will be stored in underground septic tank and then later delivered to a place indicated by the relevant environmental authority for treatment. The storage of water in these areas is likely be low during construction, and therefore the potential for exposure to water-based diseases and/or vector borne diseases (e.g., from rats) will be minimized and is considered to be low impact.

Health Impact (HS2) – Low Magnitude and Low Significance

Increase in Construction Traffic-Related Vehicle Accidents

Road accident potential is relatively high during the construction phase as on-site activity increases the number of heavy vehicle movements, long vehicles, pickups and passenger cars. The movement of construction raw material, construction workers travelling from and to site and passing by nearby communities, travel by the project suppliers and technical teams as wells as commuting workforce are all reasons to expect an increase traffic flows especially within site vicinity. In construction projects, road accidents could be a major cause of project-related fatalities due to high numbers of vehicles moving around the project site and large volumes of materials typically transported during construction. Other important aspects related to road accidents for consideration by the project management may include:

- *Drivers from least developed countries (LDC) countries are less familiar with local traffic rules applied in Iraq and driving habits in the home country may lead to serious accidents in Basra/Umm Qasr roads*
- *New drivers may not be familiar with road system and directions; Basra City road network, low traffic, high speed motorists and speed limit is not monitored by traffic police in most Basra Province roads and highways*
- *The EPC contractor should not be permitted to use old and un-maintained vehicles which may have potential to raise accident risks*
- *Lack of a public transportation system, lack of attention to highway codes, speeding, cultural attitudes toward risk, stray camels/animals.*

Impact on Community Safety (HS3) –Low Magnitude, Low Negative Significance.

Construction Stage Occupational HSE Impacts (Accident/ Injury & Communicable diseases)

Workplace accidents and injuries can be reduced through the implementation of international best practise in training, monitoring, HSE guidelines and practises. Injuries and accidents can be further reduced through the introduction of a programme which addresses culture and behaviours on site. Furthermore, Corporate Policy and engagement with staff, suppliers and contractors will have a major impact on the success of any safety practises implemented on site.

The Project will be implemented using processes and procedures designed to international best practice and be compliant with the IFC EHS General Guidelines (2007). First aid services and medical facilities will be provided on site during the main construction period, and workers will have access to the general hospitals in Umm Qasr and in AlZubair district.

An Environmental Emergency Response Plan (EERP) will be developed as part of ESIA which will detail the response to severe injuries/accidents. The provision of fully trained medical staff and comprehensive medical facilities will reduce this risk to low.

Mental health & stress is also an important consideration for any workforce. The accommodation camp will be designed to National Labor Law and in line with the guidance published in the IFC Workers Accommodation: Processes and Standards (IFC 2009). This will contribute to a reduction in stress and improved mental health. Working hours, holidays, pay, grievance mechanisms etc., will also be implemented according to National

Labor laws, ensuring the employment conditions are suitable and do not contribute to an increase in stress.

It is anticipated that the incidence rate of a variety of commonly occurring infectious ailments and diseases, such as chickenpox, hepatitis, and diarrhoea diseases will increase. Further, communicable disease refers to any infectious disease (such as COVID-19) transmittable from one individual to another either directly by contact or indirectly by vectors. The workplace is considered an important setting for interventions to prevent and control infections. During the construction phase, workers from a number of countries will be deployed on-site and housed in urban communities, where spread of infectious communicable disease may occur. ***The incidence of transmission amongst workers themselves and transmission between workers and the population of the local communities must both be considered.***

The Soybean Oil Project and its contractors will follow all precautionary measures related to COVID-19 pandemic including the following: physical distancing, wearing a mask, keeping rooms well ventilated, avoiding crowds, cleaning hands, and coughing into a bent elbow or tissue.

During the construction phase, workers will live at temporary accommodation, and food and water will be provided by the project management to each worker. The quality of food and the hygienic conditions in the kitchen are important factors in nutrition and workers' health and in potential communicable disease. The principle causes of water-transmitted illness may be a result of decline in accessible potable water quality as well as conditions of the worker's accommodations for feeding and housing.

Persons in the local communities might interact with workers if they provide services on site, or when the workers leave the facility for recreation, shopping, religious activities, doctor visits, grocery store and banks. Such interactions may provide potential pathways for transmission of communicable diseases to the public and may increase incidence rates of more common occurring infectious diseases ; COVID-19, cold, influenza, hepatitis and sexually transmitted diseases (though a remote possibility) to communities. The Project management commitment to health education and support of local programmes is an effective tool to control the spread of diseases (mainly COVID-19) is mandatary. Further, the implementation of a comprehensive health screening programme, compliance and implementation of international HSE standards and the World Bank EHS guidelines, providing medical services by fully trained staff, and the introduction of a comprehensive information/training programme will reduce the significance of the potential impact.

Impacts on Health (HS4)– Medium Magnitude & Medium Negative Significance.

Potential impacts during construction were identified and are summarised in below table.

Table 14-4: Construction phase potential impacts summary

Factor	HS1 **Air Quality and Noise**	HS2 **Waste (Liquid & Solid)**	HS3 **Vehicle Accidents**	HS4 **Occupational HSE**
Receptor Importance/Sensitivity	High	High	High	High
Frequency	Continuous	Infrequent	Frequent	Infrequent
Likelihood	Likely	Unlikely	Likely	Unlikely
Extent	Local	Local	Regional	Local
Duration	Short	Short	Short	Short
Magnitude	Low	Low	Low	Medium
Effect	Negative	Negative	Negative	Negative
Action	Direct	Direct	Direct	Direct
Significance	Low	Low	Low	Medium

14.6.3 Commissioning and Operations

Once construction is complete, the project will be commissioned, and normal plant operations will begin.

As discussed earlier, the operational health, safety and welfare of the workforce and community has been integral to the design of this Project and undertaken to internationally accepted standards. The number of workers will vary over the project life. The operational workforce will be lower than during construction and will be housed in permanent staff developed for the Project.

A full project description is provided in Section 3 - Detailed Description and Layout of the Proposed Development which describes the phases of operation, design of the plant and supply of materials, storage areas, wastewater treatment system, etc.

The operational assessment therefore considers only the residual impacts which have not been designed out, or minimised, and is limited in scope to:

- Air Quality & Dust;
- Traffic and Transport (including community effects);
- Occupational Health, Accidents and Incidents; and

- Communicable and Non-Communicable Diseases.

The potential impacts from the operational phase of the Project are given hereunder for each aspect.

Impacts from Air Quality & Dust

Air emission sources are identified in detail in *Section 5 Air Quality & Meteorology with focus on* significant impacts from air emissions. Potential mitigation actions to reduce incremental contribution of the project on overall emissions from all Project sources are addressed in that section.

The processes on site during operation include screening, crushing, and loading/unloading of raw materials. All of these processes have the potential to increase dust emissions.

The design of the site ensures that all the mentioned processes are in closed system to prevent impacts on human health, however, some dust may be dispersed inside the plant and as such has the potential to impact on the workforce through inhalation of dust particles increasing the risk of non-communicable cardiovascular disease, which can occur many years after the work has been completed.

Where possible, avoidance of exposure has already been implemented in the design, however minimisation of exposure through the enforcement of correct PPE on site (masks etc.), changing of work patterns to ensure staff are exposed for limited periods, and the implementation of a comprehensive occupation health programme will reduce these risks further.

Impacts from air quality during operation relate to the emissions from various sources (boilers and generators) and vehicles which can increase the sensitivity of individuals in vulnerable groups especially those diagnosed with chronic conditions such as asthma. The implementation of a comprehensive health screening for the workforce, combined with providing medical services will reduce the risk of health impacts to those with chronic conditions.

On the other hand, traffic movements have the potential to adversely impact on the local air quality. Heavy duty vehicles will supply the Project with the needed materials and carry the products from the plant to distribute it inside Iraq on a daily basis. Further, buses and small vehicles will be used for carrying personnel to and from site.

As identified in Section 5 – Air Quality and Meteorology, the area is achieving ambient air quality standards with the exception of PM_{10} concentrations which are high in background levels due to local sand storm events. The Project has been designed to comply with the national and international standards for air quality and emissions. A risk assessment will be undertaken which shall define the specific risks and mitigation for occupational health, including working hours, exposure limits, and use of PPE as required. A precautionary approach to the assessment has therefore been taken.

The overall impact of air quality on workforce and community health is therefore considered to be low from air quality.

Overall Impact on Health (HS5)–Low Magnitude, Low Negative Significance

<u>Impacts Related Road Traffic Accidents (RTA)</u>

The increase in road traffic will increases the risk of TRA both to the workforce (including suppliers) and local road users. The workforce is expected to be transported to site from the accommodation primarily by bus, reducing the need for driving.

The number of workers will decrease after completion of construction. Operational activities might lead to some increase in traffic as compared with baseline, but RTAs during the operation phase are expected to be less frequent than during the construction phase. However, during this phase, workers may not be housed in Umm Qasr residential area; therefore, there will be additional traffic as employees commute to the facility. Although worker numbers will be lower, efforts to limit RTAs will remain a priority because traffic accidents are likely to continue and can result in fatalities. Structured traffic management practices, as discussed during construction, should be retained.

A traffic management plan will be implemented, which will detail the rest requirements for driving, location of sensitive areas within the Industrial Complex, segregation of the work force from vehicle accessible area, and will be provided to employees and supported by a training and awareness programme. This will reduce the risk of both RTA and also risk of injury resulting from an accident.

Awareness programmes for suppliers and contractors, could be included to reduce the risk of RTA however, given the duration of the project and high incidence rate of RTA the increase in traffic movements is likely to have a moderate impact on affected communities and other road users.

Overall Impact (HS6)–Low Magnitude and Low Significance

Health Impacts from Accident & Injury

Many aspects related to occupational health have been considered as part of the Safety in Design Process. These international standards and systems (including lessons learned) in parallel with providing medical services, will be implemented on this project, and therefore the occupational health impacts in terms of accidents and injuries are considered to be low.

Mental health & stress is also an important consideration for any workforce. The Project management will ensure that the accommodation provided to the workforce shall comply with high standard (such as sports facilities, and access to on-site health care staff) which eventually will contribute to a reduction in stress and improved mental health. Working hours, holidays, pay, grievance mechanisms etc., will also be implemented according to National Labor laws, ensuring the employment conditions are suitable (including factors such as climate) and do not contribute to an increase in stress.

Operational stage impacts on the workforce and community are therefore considered to be low.

Impact (HS7) – Low Magnitude and Low Significance

Deterioration in Health from Communicable Disease

During the commissioning and operation phase, the workforce numbers will decrease compared to the construction phase. The workers will not be as transient and will be more likely to live with their families than in the high-density, all male workers' accommodations used during construction. These factors reduce the risk of infectious disease incidence in comparison to the construction phase but increase the risk of exposure to other diseases such as measles and rubella among others that are normally propagated at schools.

Further, the risk of communicable diseases such as COVID-19, childhood diseases, HIV, Hepatitis etc, will still exist. Providing health screening and services for the workers in these areas (canteen and guest house) will reduce the likelihood of the impact occurring. Therefore, the proximity to potentially affected workers will increase over the lifetime of the project and development of the area. Education, monitoring and treatment continue to be mitigation strategies. Vaccination programmes for viral infections should be implemented.

The implementation of the operational waste management plan will ensure all types of solid and liquid wastes (domestic, industrial and hazardous not permanently managed on site) are stored in covered areas, according to best practise and will be removed from site on a frequent basis. This will reduce the risk of attracting potential vectors (e.g. rats) to the site.

If water holding ponds were constructed at the site, they are considered unlikely to create a substantial increase in standing water areas. The operational impacts are therefore considered to be low.

Impacts (HS8) – Low Magnitude and Low Significance

Potential impacts during commissioning and operation phases were identified and are summarised in below table.

Table 14-5: Commissioning and Operation phases potential impacts summary

Factor	HS5 **Air Quality and Dust**	HS6 **Road Traffic Accidents**	HS7 **Accident & Injury**	HS8 **Communicable Disease**
Receptor Importance/Sensitivity	High	High	High	High
Frequency	Frequent	Infrequent	Infrequent	Frequent
Likelihood	Likely	Unlikely	Unlikely	Unlikely
Extent	Local	Local	Local	Local
Duration	Long	Short	Short	Medium
Magnitude	Low	Medium	Low	Low
Effect	Negative	Negative	Negative	Negative
Action	Direct	Direct	Direct	Direct
Significance	Low	Low	Low	Low

14.6.4 Decommissioning

The project will remain in operation as long as the land lease signed with the government authority is effective which is for a period of about 30 years, and it is ascertain that this project will not be sold and will continue in operation for a long period of time with possibility for extension of land lease. However, the decommissioning phase may involve dismantling the operating assets after completion of operating life cycle.

Potential impacts from this phase of the project are both short-term, resulting from decommissioning activities, and-long term legacy issues resulting from materials and conditions left in place.

The impacts of decommissioning are likely to be similar to that of construction, with risks from chemicals, waste materials, accidents and injuries being the most likely to be realised. Decommissioning will be planned by developing, procedures, and any HSE requirements to ensure the project is decommissioned safely and effectively, using the correct PPE etc. The Emergency Response Plan will also detail response during decommissioning. The decommissioning impacts are therefore considered to be low, and the details are given below.

Air Quality and Dust

Impacts to air quality during decommissioning are expected to be similar to impacts during the construction phase, involving primarily fugitive dust. Possible mitigation is addressed in *Chapter 5 Air Quality*, and no significant health impacts are anticipated for the communities during this phase.

Road Accidents

A short-term increase in traffic is expected during the decommissioning process; however, no significant impacts would be anticipated following the decommissioning process considering the fact that there will be a seize to all waste hauling activities, thus decreasing heavy vehicle movement in the area.

Communicable diseases

Temporary influx of workers may occur during decommissioning, raising similar concerns to those identified for the construction phase; however, no significant impacts are anticipated at this point.

Employment and Income

As in construction, decommissioning process is likely to require a temporary increase in workers; however, operations employment will cease and operations staff will need to find alternate sources of income. Stakeholders' income levels will decrease impacting their personal income and their lifestyles.

Overall Impact of Health and Safety on workforce (HS9) – Low Magnitude, Low Negative Significance.

Overall Impact of Health and Safety on Community (HS10) –Low Magnitude, Low Negative Significance.

Summary of Health and Safety Impacts of Decommissioning is shown in below table.

Table 14-6: Impacts Assessment due to Dismantling and Removal of the facility		
Factor	HS9 **Workforce**	HS10 **Community**
Receptor Important/Sensitivity	High	High
Frequency	Infrequent	Infrequent
Likelihood	Likely	Unlikely
Extent	Local	Local
Duration	Short	Medium
Magnitude	Low	Low
Effect	Negative	Negative
Action	Direct	Indirect
Significance	Low	Low

14.6.5 Mitigation and Recommendations

This section will detail the additional mitigation which should be included as part of the detailed design and operational stages to reduce potential impacts further and/or realise further benefits.

A hierarchical approach to mitigation development has been adopted to manage impacts identified for the construction, commissioning, operational and decommissioning phases of the Project. This approach consists of three distinct stages:

- Avoidance – eliminate impacts wherever possible.
- Minimise – Reduce the effect of negative impacts that cannot be avoided.
- Compensate – Implement compensatory measures for remaining significant impacts.

Implementation of mitigation measures will be required during construction, commissioning, operation and decommissioning of the facility to minimise potential negative impacts of the activities on Health and Safety Aspects. The mitigation measures comprise a combination of management procedures and further assessments to be undertake at detailed design and are described in the subsequent sections. The following text assesses the impacts predicted as being of medium to high significance against appropriate mitigation measures to predict the residual impact significance.

Mitigation for Construction phase

ID Code	Impact	Potential Significance	Mitigation Measure	Significance after Mitigation
HS04	Construction stage occupational HSE impacts on the Workforce (accident/ injury & Disease)	Medium Adverse Significance	Early engagement with local service providers to assess the capacity of the region to absorb any potential issues should be undertaken, and this will inform the design and staffing of the facilities to ensure local services are not adversely affected. This consultation should include all emergency services to ensure agreement is reached on the most effective mechanisms to deal with any major incident.	Low

Recommendations for Construction phase

The EPC Contractor shall develop, implement and maintain a Construction Environmental Emergency Response Plan (EERP) and Construction Environmental Management Plan (CEMP) as supporting documents to the Environmental Management and Monitoring Plan (EMMP), as well as occupational HSE Plans as required. These plans will detail responsibilities and procedures for environmental, health and safety management and emergency response during project construction, and should address the following specifically targeted to health and safety:

- Providing medical services to all workers;
- Provision of health screening for all workers
- Early engagement with local healthcare service providers to assess the capacity of the region to inform the design and staffing of the medical facilities to ensure local services are not adversely affected. This consultation should include all emergency services to ensure agreement is reached on the most effective mechanisms to deal with any major incident, including any evacuation to hospitals in Umm Qasr and AlZubair district.
- Provision of personal protective equipment and health surveillance monitoring for workers
- Implementation of measures to minimise exposure to noise
- Establishment and implementation of Occupational Health and Safety procedures in accordance with best practise for accidents and on-site safety

- Maintenance of construction accommodation areas in accordance with best practise and communal areas cleaned regularly to minimise potential for disease. The management should have its own specifications for the design, operation and maintenance of workers accommodations and maintain worker health and well-being, and workers are housed in dormitories that limit the number of occupants in each room to two or four depending on size after taking all precautionary measures for COVID-19 as required by MOH.
- Inclusion of safety performance, procedures and processes and safety record in any supplier evaluation
- Waste storage areas should be kept to a minimum, and should be fenced to protect workers from accidental contact. The required Construction Waste Management Plan should include measures to minimize potential health impacts from the storage and transportation of waste
- Minimisation and routing of construction vehicle movements away from Umm Qasr residential areas
- Provision of a comprehensive driver training programme for workforce, contractors and suppliers required to drive as part of the Project, with evidence on completion of training maintained and periodic reviews / audit of driver performance to confirm adherence to safe driving practices.
  - Conduct regular (prior to use of any vehicle and then at least once per week) maintenance checks on the vehicle conditions;
  - Prior to mobilizing a vehicle, confirm that it is well maintained and in good condition;
  - Enforce speed limits; and
  - Follow all precautionary measures for COVID-19 as required by the MOH
  - New emerging health patterns as identified by WHO on the occurrence of any new influenza pandemic is immediately considered by Health Services with special precautions to reduce spread of infectious diseases at an early phase;
  - The Project management should also observe any announcements with respect to special medical emergency response plans as developed by MOH particularly during the construction phase.
  - Monitoring of daily, weekly, monthly and annual incidence rates and prevalence statistics of diseases provide data to evaluate effectiveness of such measures. The

Project management should constantly be on track and engage with the top company management and local health authority on current policies and public health measures (especially for COVID-19) that are designed to reduce the incidence of disease and epidemics to protect health and well being of its staff at all levels; technical, managerial and labor.

Recommendations for Commissioning, Operations & Decommissioning Phase

The support to the local community, suppliers and contractors through the expansion of driver awareness training can be continued throughout the operational stage, to reduce the risk of potential RTA from the increase in traffic and transport. This should be in consultation with the relevant authorities to ensure it is appropriate for the region and targets those groups perceived to be most at risk.

A risk assessment should be undertaken to define specific risks and mitigations for occupational health including working hours, exposure limits, noise level, use of PPE.

A health screening programme should be implemented to manage potential health risks associated with chronic exposure.

Consideration should be given to provision of emergency evacuation facilities to the nearest comprehensive medical facility in umm Qasr and AlZubair and arrangements should be made for implementation in the event of a serious accident / injury that cannot be addressed by local healthcare staff.

Health and safety procedures and processes for the Project should be in compliance with international best practise and should include the following:

- Minimise exposure to pollutants, noise etc, and should include but not be limited to the provision and enforcement of PPE on site, changing working patterns to limit exposure periods etc.

- Segregation and suitable storage of wastes to minimise potential vectors for disease

A comprehensive site restoration plan should be included with the Closure plans to ensure the potential for long term health impacts on the local community are avoided and/or minimized. Where appropriate this can include monitoring post closure. This plan can be prepared in a later stage after commencing the project.

14.7 Other potential Risks - Accidents & Releases of Hazardous Substances

Site-specific occupational health and safety issues will be implemented by the Soybean Oil Project as part of the project's HSE program that is based on job safety analysis, hazard/risk assessment, using established methodologies such as hazard identification study (HAZID), hazard and operability study (HAZOP), quantitative risk assessment (QRA), hazard communication programs. The project HSE plans include the adoption of a systematic procedure for prevention and control of on-site/off-site physical, chemical, biological hazards.

The most significant occupational health and safety hazards occur during the operational phase of the facility and primarily include:

1. Process Safety
2. Oxygen deficient atmosphere
3. Chemical Hazards
4. Fire and explosions

14.7.1 Process Safety

The Project management shall implement a high standard process safety program that considers specific process characteristics, including complex chemical reactions, use of hazardous materials (e.g., toxic, reactive, flammable or explosive compounds), waste management and multi-step reactions.

The Project employees are trained on work hazards before commencement of specific job duties and special tailor-made job orientation programs are aimed at preventing risk of injury at work environment. A job-related injury is defined as any accident or injury to the employee occurring during performance of his duties. Every worker involved in any project’s activity at the facility will be provided with PPE according to his duties, following the plant HSE procedures.

Recommended Measures

Process safety management includes the following actions:

- Physical hazard testing of materials and reactions;
- Hazard analysis studies to review process chemistry and engineering practices, including thermodynamics and kinetics;

- Examination of preventative maintenance and mechanical integrity of the process equipment and utilities
- Worker training in each specific work area
- Use of the Buddy System where workers work in groups of 2 individuals
- Operating instructions in site specific work areas
- Environmental Emergency Response Procedure EERP

14.7.2 Oxygen Deficient Atmosphere

Potential releases and accumulation of nitrogen gas into confined work areas may result in the creation of asphyxiating conditions due to the displacement of oxygen.

Nitrogen constitutes about 78% of the atmosphere and oxygen approximately 21%. When Nitrogen concentrations increase (e.g., when purging equipment) and the oxygen levels drop below 19.5%, rapid suffocation can occur having adverse effects on workers' health and can sometimes lead to fatalities.

Nitrogen is an odourless, colourless, tasteless non-flammable gas. Unlike to other chemicals or substances that effect people according to their tolerance, nitrogen affects every individual the same way: it displaces oxygen. Inhalation of a Nitrogen enriched atmosphere (i.e. loss of oxygen) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness, and ultimately death. One deep breath of 100% N_2 will be fatal. 100% N_2 will displace CO_2 and O_2 completely. And, in the absence of a CO_2 signal to the brain, the stimulus to breath no longer exists.

This impact has the potential to affect a small number of workers required to conduct work in confined spaces. A permit system should be in place and full written procedures for all confined space work activities.

Recommended Measures

Prevention and control measures to reduce risks of asphyxiant gas release include:

- Design and placement of nitrogen venting systems according to industry standards;
- Installation of an emergency shutdown system that can detect and warn of uncontrolled release of nitrogen (including the presence of oxygen deficient atmospheres in work areas). Working areas with the potential for oxygen deficient atmospheres should be equipped with area monitoring systems capable of

detecting such conditions. Workers should also be equipped with personal monitoring equipment. Both types of monitoring systems should be equipped with a warning alarm set at 19.5% concentration of O_2 in air;

- Training and implementation of confined space entry procedures with consideration of facility specific hazards.

14.7.3 Chemical Hazards

Workers may be exposed to potential inhalation hazards during routine plant operations. Dermal hazards may include contact with acids, steam, and hot surfaces. Chemical hazards (such as hexane) should be managed based on the results of job safety analysis and industry hygiene survey and according to international health and safety guidance in line with OSHA requirements as mentioned earlier.

Recommended Measures

Protection measures include worker training, work permit systems, use of personal PPE, and toxic gas detection systems with alarms. Prevention and control measures to reduce risks of release include:

- Workers may be exposed to extremely hazardous material (such as hexane, ethylene, ethylene oxide, toluene)
- Occupational safety measures include the following:
    - Reducing volatility by adding suitable vapor pressure suppression additives;
    - Designing plant lay-out to limit extent of plant areas exposed to potential hazards, and to facilitate escape routes for workers;
    - Clearly identifying hazardous "hot spot" areas
    - Clearly indicating type of PPE should be adopted;
    - Transport of material to and from the plant should be handled according to the guidance for the transport of dangerous goods as per MSDS for each material
    - Implementing a worker decontamination procedures in dedicated area;

14.7.4 Fires and Explosions

Fire and explosion hazards generated by process operations include the accidental release of chemical hazards (such as hexane, benzene and toluene) causing flash fires, if ignited in the release section, or give rise to vapor cloud explosion (VCE), fireball or flash fire, depending on the quantity of flammable material involved and the degree of confinement of the cloud. Flammable liquid spills may cause pool fires. Explosive hazards may also be associated with accumulation of vapors in storage tanks.

Recommended Measures

Recommended measures to prevent and control fire and explosion risks from process operations include the following:

- Providing early release detection, such as pressure monitoring of gas and liquid conveyance systems, in addition to smoke and heat detection for fires;
- Designing, constructing and operating the facility according to international standards for the prevention and control of fire and explosion hazards
- Safety distances can be derived from specific safety analysis for the facility, and through application of internationally recognized fire standards;
- Provisions for segregation of process, storage, utility and safe areas.
- Evaluation of potential for vapor accumulation in storage tanks and implementation of prevention and control techniques;
- Avoid potential sources of ignition (e.g. by configuring layout of piping to avoid spills over high temperature piping, equipment, and/or rotating machines);
- Providing passive fire protection measures within fire zone that are capable of withstanding the fire temperature for a time sufficient to allow implementation of appropriate fire mitigation strategy;
- Limiting the areas that may be potentially affected by accidental releases by:
    - Defining fire zones and equipping them with a drainage system to collect and convey accidental releases to a safe containment area, including secondary containment of storage tanks;
    - Installing fire/blast partition walls in areas where appropriate separation distances cannot be achieved;

Coverage of emergency response is borne by the project internally, at initial stages, and it is required that personnel are trained on these types of events before occurrence.

Links between first response health care providers and emergency responders is vital in the preservation of life in any incident.

14.8 Environmental Emergency Response Plan (EERP)

The Soybean Oil facility shall prepare and submit a general operational Environmental Emergency Response Plan (EERP) covering at least the following elements:

- Administration (policy, purpose, distribution, definitions, etc.)
- Organization of emergency areas (command centers, medical stations, etc.)
- Roles and responsibilities
- Communication systems
- Emergency response procedures
- Emergency resources
- Training and updating
- Checklists (role and action list and equipment checklist)
- Business continuity and contingency

Emergency Communications

Worker Notification and Communication

Alarm bells, visual alarms, or other forms of communication should be used to reliably alert workers to an emergency. Related measures include:

- Testing warning systems at least annually (fire alarms monthly), and more frequently if required by local regulations, equipment or other considerations

- Installing a back-up system for communications on-site with off-site resources, such as fire departments or other facilities, in the event that normal communication methods may be inoperable during an emergency

Media and Agency Relations

Emergency information should be communicated to the media through: -

- A trained spokesperson from the Project able to interact with relevant stakeholders, and offer guidance to the company for speaking to media, government and other agencies
- Written press releases with accurate information, appropriate level of detail for the emergency, and for which accuracy can be guaranteed.

Community Notification

If workers may be at risk from a potential emergency arising, the Project management should implement communication alert measures:

- Audible alarms, such as fire bells or sirens
- Fan out telephone call lists
- Vehicle mounted speakers
- Communicating details of the nature of the emergency
- Communicating protection options (evacuation, quarantine)

Providing advice on selecting an appropriate protection option

14.9 Community Health and Safety

14.9.1 Construction Phase

There will be a slight traffic increase during the construction phase on the main road passing from the northwest of the Project site which will be used for transportation of construction materials to the Project site inside Umm Qast port. 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 expected to be low as discussed in section 5 (air quality) and section 8 (noise).

The construction site itself will be fenced and the entrance gates will be guarded by security staff in order to prevent any unauthorized access to th site although the project site is located inside port area which is prohibited for community to enter inside.

Sama AlManar shall also assist and collaborate with the potentially affected communities and local government agencies in their preparation to respond effectively to emergency situations. Sama AlManar shall provide appropriate information to potentially affected communities and relevant government agencies. The emergency response activities shall be periodically reviewed and revised, if necessary. The impact on human health for the public during construction can be assessed to be low, if the below suggested mitigation measures are implemented.

Table 14-7: Construction phase potential impacts summary

Factor	HS11 **Community HSE**
Receptor Importance/Sensitivity	High
Frequency	Continuous
Likelihood	Likely
Extent	Local
Duration	Short
Magnitude	Medium
Effect	Negative
Action	Direct
Significance	Low

14.9.2 Operation Phase

During operation the air dispersion modeling results showed that ground level concentration over surrounding community areas are far below the WB/IFC and National standards for all air pollutants (further details are given in section 5). The noise modelling results also showed noise level during construction and operation of this project will be within the acceptable limits.

Water required during operation phase of the Project will be supplied from the ground wells at the project site. Water consumption and potential impacts of the Project was assessed in Section 10- water quality. During the operational phase, the contribution to the existing traffic load is expected to be low. The Project will employ about 214 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.

However, the health impact from this project on the community area will be low.

Table 14-8: Operation phases potential impacts summary

Factor	HS12 **Community HSE**
Receptor Importance/Sensitivity	High
Frequency	Continuous
Likelihood	Unlikely
Extent	Local
Duration	Long
Magnitude	Low
Effect	Negative
Action	Direct
Significance	Low

14.9.3 Suggested Mitigation Measures:

Mitigation Measures during construction phase:

- 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 close to main road 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.
- 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 previous experience, if there is no possibility for construction of a bypass road.
- On the transportation route, equipment with a maximum length of 30 m can be transported with some minor civilworks. Transport length can be increased following major civil works.
- The maximum width of equipment that can be transported on the transportation route, 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 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.
- 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 9-waste management for further information).
- 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 Security Management Plan will be 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 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.

Mitigation Measures during operation phase:

- A traffic management plan shall be developed and implemented for the Project.
- Load and speed limits shall be applied during the transportation of heavy equipment.
- In order to prevent unauthorized, the Project site should be fenced with a high grade security fence with razor wire, security cameras, lookout points, and internal lighting.
- Drivers shall be trained for complying with traffic rules in order to minimize traffic accident risk.
- A Community Health Safety Security Plan shall be prepared.

- An Emergency Response Plan shall 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.
- 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.

15 TRAFFIC AND TRANSPORTATION INFRASTRUCTURE

15.1 Introduction

The purpose of this Section is to describe the existing traffic and transport infrastructure and assess the impact of various phases of the Project (construction, commissioning, operation, closure) on this infrastructure. At the end of this section, mitigation and recommended measures will be given.

Impacts arising from traffic and transport in terms of noise, air quality and safety are addressed in the relevant Sections 5.0 – Air Quality and Meteorology; 7.0 – Noise and Vibration; and 15.0 – Health and Safety.

15.2 Baseline conditions

15.2.1 National background

Air:

Air travel represents the fastest means of transport between the large towns and cities. Iraq has 116 airports, out of which 7 are civilian international airports, spread across the Republic of Iraq. The three major International airports are Baghdad International Airport, Basra International Airport and Erbil International Airport. The other civilian airports, considered as relatively small, include Balad Southeast airport, Ubaydah Bin Al-Jarrah airport, Bashur airport, Al Iskandariyah airport, Jalibah southeast airport, Qasr Tall airport, Umm Qasr airport, and Numaniyah airport.

On the other hand, there are several military airports in Iraq: such as Al Taji AAF, Muthenna Airbase, Tall Afar AAF, Al Asad Airbase, and Al Taqaddum Airbase. Civilian airports in Iraq are under the control of the Iraqi Civil Aviation Authority (ICAA) which operates under the Iraqi Ministry of Transportation. The ICAA announced that air traffic of Iraqi airports working in the country during 2019 had a total of departing and arriving travellers to Iraqi airports reaching (8,728,512) passengers and the number of departing flights reaching (100288) flights. (More details on Iraq's Civil Aviation are given in section 11- Socio-Economy).

Figure 15-1: Baghdad International airport

Rail:

The Iraqi rail system has a length of about 2,000 kilometres and runs along the following lines (1) Rabiya southward through Mosul, Baiji, and Baghdad to Basra, with a branch line from Shouaiba Junction (near Basra) to the ports of Khor Az Zubair and Umm Qasr, (2) westward from Baghdad through Ramadi and Haqlaniya to Al Qaim and Husayba, with a branch line from Al Qaim to Akashat (this line was completed in 1983), and (3) east-west from Haqlaniya through Bayji to Kirkuk (this line was opened in 1987). However, most of rail networks are not in service due to the damage caused by wars and other reasons.

In October 2008, a commuter service resumed between Baghdad Central and the southern suburb of Doura. There is a nightly service between Baghdad and Basra and a Friday-only pilgrims service to Samarra. In March 2009, a weekly service started between Baghdad and Fallujah. The Baghdad - Mosul line is almost ready for passenger services to resume. The Ministry of Transportation is planning to extend the existing network of 1,243 miles (2,000 km) to between 2,485 miles (3,999 km) and 3,107 miles (5,000 km), but there are obstacles such as budget restraints and contract approvals.

In 2011, a 650 km (400 mi) 250 km/h (155 mph) line between Baghdad and Basra was planned, with the Iraqi Railways and Alstom designing the route. It started operations in 2014, and at that time was not classified as a true high-speed rail. New trainsets for use on the Baghdad-Basra route were unveiled in China in February 2014 before being shipped to Iraq.

According to Central Statistical Organization CSO, 1.7 million tons of goods were transported by railway in 2013, more than 60% of these through the Basrah-Baghdad route. In 2014, the quantity transported fell to 1.1 million tons, likely because of the closing of routes going through territory controlled by ISIL/Da'esh. The Iraqi government has plans to expand the railway to the Turkish border from Kirkuk via Mosul, but the government of Kurdistan has an alternative plan, which would add 625 km of railway from Kirkuk to the Turkish border via Sulaymaniyah, Erbil, and Dahuk. However, rail services are currently only operating in the southern part of the country (Figure 15-2).

Figure 15-2: Iraqi Republic Railways currently functioning passenger rail service (source: Ministry of Transport)

Figure 15-3: Picture of the Baghdad-Basra train in 2019

Road:

Iraq's road network is relatively developed in terms of efficiency and capacity. However, most of the road network suffers from extensive deterioration and damage due to decades of war and instability, as well as the lack of routine and periodic maintenance. This has led to deterioration of the road network's efficiency, and road network capacity has been compounded by loss of and damage to road infrastructure. In addition, overreliance on the road network for transport has put further pressure on the quality and performance of the road network.

There is a wide net of main roads and highways which link the capital Baghdad to its south, north, east, and west. Among the most important of these is the international highway which links Baghdad to Jordan, in addition to the international highway which links Basra to Turkey through Zakho in the north passing through Baghdad, the capital.

Iraq had 110,345 km of paved roads in 2015, more than double that existing in 2010 (41,716 km). In 1985, there were just 22,397 km (Library of Congress. "Iraq: Country Study," 1990). Over the period from 2010 to 2015, the country saw a 12% decrease in traffic accidents - accidents went down from 10,082 in 2010 to 8,836 in 2015. The total length of the external roads network (outside the boundaries of the municipalities including the Municipality of Baghdad) is about 42,100 km comprising:

- Freeway 1: The first and longest freeway in Iraq, extending from Umm Qasr Port in Basra to Ar Rutba in Anbar with a length of 1,200 km (750 mi).

- Freeway 2: the second longest freeway, extending from Baghdad to Safwan-Basra interchange with a length of 510 km.
- Arterial roads: That link the provincial centres with a length of 11,000 km.
- Secondary roads: That link districts, counties with a length of 15,200 km.
- Rural roads: That linking residential complexes in villages and rural areas with secondary arterial roads with a length of 3,700 km.
- Border roads: That link the borders crossings with a length of 11,000 km.

The World Bank has pledged to loan 355 million USD to Iraq for a project to revive two transport corridors in the country, focusing resources on restoring Expressway One in the south, and a section of highway between Girsheen and the Suhiela intersection in Kurdistan. This second part, in Kurdistan, is part of a larger expansion of the route from the Ibrahim al-Khalil border crossing near Zakho, and Semel (Simele), located near Dahuk, intended to facilitate the movements of goods from Turkey into Kurdistan and the rest of Iraq. As of March 2017, 187 million USD has been committed to the Expressway One portion in the south, and an additional 56 million USD was expected to be committed to the Kurdistan portion of the project.

The total number of private sector cars, including in Kurdistan Region, amounted to (7,026,106) cars for the year 2020; this total includes cars having plates (permanent, temporary inspection, national and parallel project).

15.2.2 Regional And Local Background

Airport:

Basra International Airport, which is the closest airport to the project site in Umm Qasr, was established in the 1960s as a public/military airport in Iraq, and later in the 1980s developed as a gateway to Iraq's only port by the Iraqi government's State Organization for Roads and Bridges (SORB). It's considered the fourth largest airport in Iraq in terms of passenger numbers, according to air transport statistics from the Iraqi Ministry of Planning. The airport receives dozens of flights from around the world from which aircraft take off. Basra International Airport is witnessing increased activities from incoming flights and departures due to the large economic and investment activities in Basra.

The Basra International airport is around 10.5 km (6.5 miles) from the city centre of Basra. This airport is the closest airport to Umm Qasr (Soybean Oil Project site): the distance from Basra International Airport to Umm Qaşr is 38.7 miles / 62.2 kilometers. The closest airports after Basra airport to Umm Qasr area are Al Najaf Airport, 406km to the north-west, and then Baghdad Aairport, 490km to the north-west. Both provide regular flights to Basra.

The Iraqi Civil Aviation Authority issued statistics on the air traffic of Basra International airport during 2019: the total number of travellers to Basra International Airport reached 984,985 passengers and the total number of trips reached 10,106 trips while the total number of passengers traveling to Najaf airport, 2,579,355 passengers, the total number of flights reached 22,123 flights.

Rail:
There is only one rail line linking Umm Qasr with the other Iraqi cities but this line seems not in service as we observed during our visit to the site. This line runs from Rabiya southward through Mosul, Bayji, and Baghdad to Basra, with a branch line from Shouaiba Junction (near Basra) to the ports of Khor Az Zubair and Umm Qasr (where the project is located). More details are given in earlier part of this section and in section 11- Socio-Economic Aspects.

Road:
As mentioned earlier, the first and longest freeway in Iraq extends from Umm Qasr Port in Basra (far south part of Iraq) to Ar Rutba in Anbar (west of Iraq) with a length of 1,200 km (750 mi). Basra and Umm Qasr have many roads that are in good condition especially the road linking Basra city to AlZubair and the Umm Qasr area.

15.2.3 Traffic Survey

In support of the ESIA, a traffic count survey was undertaken manually over a consecutive three-day period (one hour on each day) from Friday 21st to Sunday 23rd October 2022. The survey site (30° 3'36.90"N 47°54'48.82"E) was located near the main gate of Umm Qasr Port, approximately 5.2km north-west of Soybean Oil Project site, as identified in Figure 19-4. The survey location was chosen to gain an understanding of the current volume of traffic entering Umm Qasr Port.

The traffic count classified the vehicles into the following 4 types: Passenger Car, Pickup/Van, Bus and Truck+Full Trailer.

Figure 15-4: Map showing location of selected point for traffic count conducted manually by the EnviroSOLTECH team

The numbers and types of vehicles moving on the main road to Umm Qasr Port gate were counted during the following set time periods over the three-day survey:

- Friday (21-10-2022) covered the time period of 09:00 to 10:00 am.
- Saturday (22-10-2022) covered the time period of 11:00 to 12:00 am.
- Sunday (23-10-2022) covered the time period of 01:00 to 02:00 pm.

A summary of the results of the survey are provided in Table 15-1. Based on the traffic count, personal cars (or private cars) are the most commonly used vehicles, representing over 46 to 54% of hourly traffic count made on 21 and 23/10/2022 respectively while trucks with full trailer represented 78.7% of the total traffic count on 22/10/2022 due to the likely reason that there was ship unloading at that time and date (22-10-2022 at 12:00am) which make the number of trucks increase. The number of truck movements during the recorded dates and times ranged from 148/hr to 340/hr whereas the number of small cars ranged between 72/hr and 320/hr. The number of pickup/van and buses is relatively low.

Table 15-1: Manual traffic count data results at Umm Qasr port gate					
	Personal cars	**Pickup/Van**	**Bus**	**Truck+Full Trailer**	**Total per hour**
21/10/2022 at 09:00-10:00am	320	16	24	232	**592**
22/10/2022 at 11:00-12:00am	72	8	12	340	**432**
23/10/2022 at 1:00-2:00pm	160	16	20	148	**344**
Average	184	13	19	240	**456**

15.3 Impact Assessment

15.3.1 Introduction:

As the project will utilise the existing transport and traffic infrastructure of the Umm Qasr area and Basra province, this section describes the impact of this project during the construction, operation and decommissioning/closure on this infrastructure. The significance of the potential impacts are characterised in accordance with the methodology described in Section 5 – Impact Assessment Methodology.

Potential impacts from traffic and transport on other aspects of the environment are addressed in the relevant sections of this report as follows:

- Section 5– Air Quality and Meteorology;
- Section 8 – Noise and Vibration;
- Section 12 – Socio-economic Aspects; and
- Section 14 – Health and Safety.

While Iraqi Ministry of Environment Regulations and guidance make no specific reference to this aspect of project development, Section 3 Community Health and Safety of the International Finance Corporation (IFC) General Environment Health and Safety (EHS) Guidelines 2007, has been used to inform the impact assessment.

15.3.2 Construction Phase

The construction phase began in the fourth quarter of 2022 and is due to be completed by the end of 2023 or early 2024. At its peak, a maximum of 250 workers are expected to be required for the construction of the Project. Almost all workforce during construction phase (about 90% i.e. about 225 workers) will be local people and will be living within Umm Qasr and surrounding areas. However, some staff will stay at the accommodation camp located at the project site. The project management will provide all utilities and amenities required by the workers including accommodation, welfare and recreational facilities, healthcare services and religious requirements. The construction phase will require the delivery of construction materials and process equipment from across the Republic of Iraq and Internationally.

The construction of the facility has the potential to impact upon the existing transport and traffic infrastructure. The construction phase impacts are summarised in Table 19-2 and are discussed in more detail hereunder.

Air:

Air travel to or from Umm Qasr as a result of the construction of the project may be expected to increase slightly as a result of construction supervisors and management travelling from their home to the site. Construction workers are not expected to travel by air because most of workers are locals and therefore a significant increase in passenger numbers is not envisaged.

The use of the airport is expected to be continuous during the construction phase, with some peaks associated with holiday travel; however, any increase in passenger numbers is expected to be accommodated by the existing facilities.

Impact (TI1): Low magnitude and Low Significance

Railway:

The project is not planning to utilize the railway network for any purpose and therefore there will be no impact on this sector.

Roads:

During the construction phase, an increase in traffic can be expected as a result of the influx of workers, and the delivery of materials and equipment although some heavy equipment will be delivered to the project site by sea.

The early works set-up will require the delivery of earthmoving equipment to the site. During the early works phase it is estimated that there will be some water truck movements each day and other miscellaneous vehicle movements.

During the main construction phase, as stated earlier, some workforce will live at the project site while others will live in Umm Qasr or surrounding areas. Workers who live outside the project site are anticipated to be transported to the site in a fleet of buses (estimated 3 to 4 buses). In accordance with IFC General EHS Guidelines 2007, the accommodation camp for workforce is either located at the project site or close to the site to minimize the impact of increased traffic. However, there will be small increase in traffic volume during the construction phase.

On the other hand, the majority of construction materials may be transported to the site by road, from the local market in Iraq, where materials would be unloaded and delivered to the site by heavy goods vehicles (HGV). Locally-sourced materials, such as sand and cement, will be utilized wherever possible to reduce the requirement to import bulk materials from other locations, therefore reducing HGV movements bringing material from farther afield. As an example, the early works cut, and fill operation does not require the import of any additional material to the site. Oversized equipment will be brought to the site either via Umm Qasr port or using the existing road network, primarily on low load trailers, or where appropriate, driven in convoy to the site.

Based on the estimated quantities of materials during peak construction time, there is a requirement for the movement of approximately 7 to 10 HGV/day to remove material from site and deliver construction materials to the site over the 18 to 20 month construction program. To supply the temporary accommodation camp with potable water at the project site, a further 2 water tanker movements per week are required. This will cease once a well and water treatment plant are in place. Overall, there is likely to be a requirement for 9-12 HGVs to access the site per day. If the deliveries are undertaken in a 24 hour period then this represents approximately less than one HGV movement per hour.

This equates to an increase in traffic number of less than 1% per day, based on an average of 456 vehicles over one hour period identified earlier in table 19-1.

Based on the traffic survey data and the projected additional traffic from the peak construction activities, the main road to Umm Qasr Port will continue to operate within its capacity. There will be very low increase in the amount and type/size of traffic using the existing road network by this project, but this will be temporary during the construction phase.

Impact (TI2): Low magnitude and Low Significance

Marine Transport:

The anticipated marine transport impacts due to transporting of some heavy equipment to the project site during construction phase on marine traffic is low since the shipment will be limited. Further, shipping of equipment by approved company will adhere to appropriate environmental and health regulations (e.g., IFC, Environmental, Health, and Safety Guidelines for Shipping. 2007; International Maritime Organization — various regulations; etc.). Sama AlManar will be in charge of shipping operations and will be the responsible party for adhering to all applicable national and international regulations.

Impact on Marine traffic (TI3) – Low Magnitude and Low Significance

Summary of potential impacts on the existing transport infrastructure due to the above aspects during Construction phase are summarized in table 15-2

Table 15-2: Construction phase potential impacts summary

Factor	*TI1* **Airport**	*TI2* **Road**	*TI3* **Marine Traffic**
Receptor Importance / Sensitivity	Low	High	Low
Frequency	Infrequent	Continuous	Infrequent
Likelihood	Certain	Certain	Certain
Extent	Regional	National	Regional
Duration	Short	Short	Short
Magnitude	Very Low	Low	Very Low
Effect	Negative	Negative	Negative
Action	Direct	Direct	Direct
Significance	Low	Low	Low

15.3.3 Commissioning

The commissioning for the Project is not anticipated to have any impact on the existing transport infrastructure over and above the impacts identified for the construction phase and will all be of lower magnitude in this phase.

15.3.4 Operations

Air:

The proposed works do not include any alterations to the existing airport at Basra city. The operation of the facility requires 190 to 200 staff; however, it is assumed that these will be full-time employees. There may an increased demand in air-travel due to staff travelling to and from the facility, particularly during holiday periods when the limited flights available from Basra are already known to result in a shortage of seats. This situation may be exacerbated slightly by the soybean development. However, it is anticipated that only management and supervisory staff will travel by air, and therefore the increased passenger numbers will be relatively low.

Due to the perceived low demand for use of the airport through the operation of the facility the impact is considered to be very low.

Impact TI4 – Low Magnitude and Low Significance.

Railway:

The project is not planning to utilize the railway network for any purpose and therefore there will be no impact on this sector.

Roads:

During the operation of the Soybean Oil Project, it is anticipated that the project will require approximately 190 to 200 full-time staff working three shifts per day, 300 days per year. Project staff will reside in Umm Qasr residential area or Basra City for the purpose of providing essential services for the employees of the Project. It is anticipated that the maximum level of traffic will be around the time of the change of shifts, with significantly less car traffic movements during the working day. Some staff (e.g. Boiler Room Foreman (4 workers), Seed Preparation Unit Foreman (6 workers), Seed Preparation Unit Auxiliary Staff (20 workers), Electrician Foreman (11 workers), Extraction Department Foreman/staff (24 workers), Maintenance Team Foreman (10 workers and others) will be moved to the project site as a group by small buses (20 Seat Standard Mini Bus) while other staff (manager, engineer, specialists) will use small cars for transportation from their accommodation to the project site. The estimated number of car trips used by staff is about 3-5 buses and 20-30 small cars.

During operation the majority of products (daily production of soybean crude oil (600 tons) and soybean meal (2,400ton)) will be moved to clients by road. The estimated number of tankers for delivering the soybean oil product will be 25 tankers/day (i.e. less than 2 tanker per hour) assuming the tanker load will be 25ton while the estimated number of heavy goods vehicles (or trucks) for delivering the soybean meal product will be 60 vehicles/day (i.e. less than 3 truck per hour) assuming the truck load will be 40ton.

It is likely there will be an emphasis on the movement of vehicles during daylight hours, so it is likely that the numbers of trucks would increase in this period and decrease at night. The heavy goods vehicles and product tankers will not pass through any sensitive community receptors (such as school, hospital etc.) but they will take the roads that are away from the community to avoid any impacts on the local residents of Umm Qasr Area. Hence the expected impact of traffic on sensitive receptors within Umm Qasr area will be low magnitude and of low significance.

The average traffic count undertaken in October 2022 indicates that there is a maximum of 340 HGV movements in an hour period. The operation of the facility requires approximately 2 tankers and 3 trucks per hour, which represents approximately less than 2% increase in vehicle movements. The estimated number of small cars and buses (23 to 35) used by the project site is about 7% of the total traffic volume although this percentage will be reduced to less than 4% if the traffic count was taken in peak hours (07:00 to 08:00am) since the total number of traffic would increase to about double compared to selected time (9am to 2pm). The increase of movements is within the capacity of the existing road infrastructure.

The addition of 5 tankers and trucks (i.e. HGV) and 23 to 35 small cars movements over an hour period during peak time (07:00 to 08:00am) would not have a significant negative impact on the existing road network.

Impact TI5 – Low Magnitude and Low Significance.

<u>Marine Transport:</u>

Raw material (Soyabeans) will be imported from abroad (mainly Brazil) and ship it to Umm Qasr with 35,000 – 50,000 tons vessels. Based on the daily production (3,000 ton/day of Soybean oil and soybean meal) and the vessel load, the project will need one shipping every 12 to 17 days. Accordingly, the number of shipping is relatively low and accordingly the impact of importing the raw material to this project on marine traffic is low. Further, Sama AlManar will adhere to appropriate environmental and health regulations (e.g., IFC, Environmental, Health, and Safety Guidelines for Shipping. 2007;

International Maritime Organization — various regulations; etc.) during the shipping of raw materials. Further, Sama AlManar will be in charge of will be in charge of shipping of raw maeriasl and any product is any.

Impact on Marine traffic (TI6)– Low Magnitude and Low Significance

Summary of potential impacts on the existing transport infrastructure due to the above aspects during Operation phase are summarized in table 15-3.

Table 15-3: Operation phase potential impacts summary

Factor	*TI4* **Airport**	*TI5* **Road**	*TI6* **Marine Traffic**
Receptor Importance / Sensitivity	Low	Medium	Low
Frequency	Infrequent	Continuous	Infrequent
Likelihood	Certain	Certain	Certain
Extent	Regional	National	Regional
Duration	Medium	Medium	Medium
Magnitude	Very Low	Low	Low
Effect	Negative	Negative	Negative
Action	Direct	Direct	Direct
Significance	Low	Low	Low

15.3.5 Closure / Decommissioning

Air:

The closure and decommissioning of the facility would see a reduction in the number of employees using the air transportation; however, the airport would continue to be used by the residents of Basra Province.

Impact TI7 – Low Magnitude and Low Significance.

Rail:

The project is not planning to utilize the railway network for any purpose and therefore there will be no impact on this sector.

Roads:

The closure /decommissioning of the Soybean Oil Project, while likely to result in a short-term increase in vehicle movements as the site is cleared, would have a positive effect on the existing road infrastructure in the long term through reduced traffic and subsequent maintenance requirements. This could also have a potentially positive effect on the local communities by reducing the potential for motor vehicle accidents and improving air quality.

Impact TI8 – Low Magnitude and Low Significance.

Summary of potential impacts on the existing transport infrastructure due to the above aspects during Decommissioning/Closure phase are summarized in table 15-4.

Table 15-4: Decommissioning/Closure phase potential impacts summary

Factor	*TI7* **Airport**	*TI8* **Road**
Receptor Importance / Sensitivity	Low	Medium
Frequency	Continuous	Continuous
Likelihood	Certain	Certain
Extent	Regional	National
Duration	Long	Long
Magnitude	Very Low	Medium
Effect	Positive	Positive
Action	Direct	Direct
Significance	Low	Medium

15.4 Mitigation

15.4.1 Overview

In accordance with the methodology established in Section 4 – Impact Assessment Criteria and Methodology, mitigation measures are to be implemented during construction, commissioning, operation and decommissioning/closure of the facility to minimise potential negative impacts on the existing traffic and transport infrastructure. The impact assessment has identified no negative impacts of medium or high significance; however, recommendations can be made to apply good management practice and mitigate those negative impacts identified of low significance, or to further enhance positive impacts.

15.4.2 Construction Recommendations

The Engineering Procurement and Construction (EPC) Contractor shall develop, implement and maintain a construction phase Traffic and Transportation Management Plan, which will be approved by the Soybean Project Management Team prior to commencement of construction. This plan should detail, but not be limited to, the following:

- Responsibility and procedures for co-ordination and liaison with the Iraqi Ministry of Transport during construction;
- Outcomes of traffic risk assessments undertaken;
- Access routes for construction plant and materials;
- On-site traffic management;
- Off site speed limits and road safety and community health and safety
- Measures to segregate the workforce from vehicle areas;
- Training and awareness; and
- Measures to protect the local community where appropriate.

The contractor will undertake regular audits of the management plan to confirm ongoing effectiveness.

Shipping of heavy equipment during construction phase should adhere to appropriate environmental and health regulations (e.g., IFC, Environmental, Health, and Safety Guidelines for Shipping. 2007; International Maritime Organization — various regulations; etc.)

In accordance with the IFC General EHS Guidelines 2007, vehicles will not access the community roads (that are passing in front of schools, hospitals etc.) wherever possible. Where vehicles must use the road network, vehicles should access the site from the roads away from community to avoid impacts on the local community in Umm Qasr Area.

No vehicles shall leave the site with materials adhering to the wheels in a quantity which may result in deposit on the public highway, creating a nuisance or hazard to vehicles. Suitable wheel washing equipment to avoid such problems shall be installed, operated and maintained on site until the development is completed.

15.4.3 Operation Recommendations

The Soybean Oil project management should develop, implement and maintain a Traffic Management Plan appropriate for operational use. This should include, but not be limited to:

- Responsibility and procedures for co-ordination and liaison with the Iraqi Ministry of Transport during operation;
- On-site traffic management;
- Off site speed limits and road safety, community health and safety;
- Measures to segregate pedestrians from vehicle areas;
- Training and awareness in road safety; and
- Measures to protect the local community where appropriate.

The project management should adhere to all applicable environmental and health regulations (e.g., IFC, Environmental, Health, and Safety Guidelines for Shipping. 2007; International Maritime Organization — various regulations; etc.) during the shipping of raw materials (soyabeans).

16. SUSTAINABLE DEVELOPMENT ASSESSMENT

16.1 Introduction

Sustainability is an important part of any Environmental and Social Impact Assessment (ESIA) study that should meet the IFC requirements. In this context, this proposed development is evaluated against a range of recognized criteria, giving consideration to economic, social and ecological processes. The assessment of sustainability provided by this section has been undertaken by analyzing how the three elements of sustainable development were integrated into the ESIA process and into the design and planning of the Soybean Oil Project itself. The sustainable development assessment is designed to ensure that the entire project lifecycle is taken into consideration.

16.2 Sustainable Development Context

16.2.1 Definition of Sustainability

Sustainable development, as defined by the Brundtland Commission in 1987, is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs (UNECE)."

Many countries around the world particularly in Europe , USA , Japan , Latin America (Costa Rica in particular) in addition to some parts of the Middle East, have applied this concept to the fullest, and have included "sustainability" as part of their economic growth and development plans, utilizing natural resources with respect to socio-economic "prosperity", and includes three policy areas: economic, environmental, and social (community) , which are the main pillars of sustainable development by as defined by international organizations. Figure 0-1 presents a scheme showing the interrelatedness of concepts and, specifically, the confluence of the three main elements of sustainable development.

Figure 0-1 Pillars of Sustainable Development

16.2.2 Sustainable Development as a Policy

In 1987, the Bruntlund Commission outlined its "strategic imperatives," or "critical objectives," inherent in their concept of sustainable development, which include: *reviving growth; changing quality of growth; meeting essential needs for jobs, food, energy, water, and sanitation; ensuring a sustainable level of population; conserving and enhancing the resource base; reorienting technology and managing risk; and merging environment and economics in decision making*.

In 1992, the United Nations Conference on Environment and Development (also known as UNCED or the 'Earth Summit') was held in Rio de Janeiro and attended by 150 nations, 1,400 non-governmental organizations, 8,000 journalists, and in total, thousands of attendees. The Earth Summit achieved a broad political consensus around the concept of sustainability as articulated in the adopted 27 Principles in the Rio Declaration, which provided a framework for governments to use to improve environmental and economic conditions around the world. The Summit also initiated Agenda 21, which introduced a comprehensive global Programme of Action in all areas of sustainable development. The establishment of the Millennium Development Goals (MDGs) at the Millennium Summit in 2000 continued the global planning movement towards the elimination of poverty and achievement of sustained development.

Since its inception four decades ago, the adoption of sustainable development principles has become factored into decision-making at all levels in government, public and private sector organizations throughout the world. However, adoption of these Principles has not notably achieved the goals of elimination of poverty and sustainable development.

16.2.3 Sustainable Development in the Republic of Iraq

The sustainable development concept is reflected in Islam related to the relationship between man and his natural environment. Islamic principles consist of developing natural environments for current and future generations, while applying conservation and protection of natural resources.

Sustainability is an integral part of Iraq's basic law of governance in both public and private sectors. The private sector is committed to sustainability by improving on-site environmental procedures, preparing environmental impact assessments for projects; complying with national/local environmental regulations, implementing energy efficiency procedures avoiding over-consumption of materials, recycling programs, preserve natural resources; waste reduction plans; and improved operations.

In 2008, the Iraqi government made a new law No. 37 of 2008 aimed at protecting and improving the environment to save public heath, natural resources, biological diversity and the cultural and natural heritage, in order to ensure sustainable development and to achieve international and regional cooperation in this field.

In 2009, the Iraqi Law of Protection and Improvement of the Environment, No. 27, was introduced aiming on the following:

- The law aims at protecting and improving the environment through elimination and treatment of existing damages or likely future damages. It also aims to preserve 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.
- The Law sets forth provisions for the protection of the environment. The regions responsible for environmental pollution have to mandate clean technologies and set up a suitable environmental policy. The use of sensors for pollution monitoring and control is recommended as well as renewable energy technologies. An environmental impact assessment shall be done for any new project held in the country.
- The Law concerns also the protection of water from pollution. It regulates the discharge of effluents whether they are of domestic, industrial or agricultural origin.

- This Law covers as well the following subjects: regulation of air pollution and noise reduction; earth protection; biodiversity protection; management of hazardous waste; protection of the environment from pollution resulting from exploration and extraction of oil and natural gas; establishment of an environmental protection fund; compensation for damages; and penal provisions.

More recently, in 2019, the Iraqi ministry of Planning has set an Iraq vision for Sustainable Development 2030 which is based on the sustainable development dimensions to meet national aspirations for empowered Iraqis in a safe and unified country, a society in which all have equal rights, an economic system having a diversified social market orientation and stable macroeconomic indexes, and creating a clean, safe and sustainable environment for the current and future generations. Further, the vision's aim is to achieve a sustainable improvement in the quality of people's lives, to ensure the sustainability of production and consumption patterns, to reduce the repercussions of pollution and climate change, and to enhance biodiversity protection through governmental institutions which guarantee the respect of political, civil and human rights of people to meet the desired results and achieve equality for all citizens.

The Soybean Oil Project will be in line with the national sustainable development strategy of the Republic of Iraq through reduction of air pollution emissions, waste reduction and limitations in consumption of natural resources, and through the implementation of measures for the conservation of natural resources, as well as special programs aimed at waste reduction.

16.2.4 IFC and Sustainable Development

The International Finance Corporation (IFC) considers multiple dimensions of sustainability in its approach to risk management with regards to decision-making on its investments. This approach is articulated through the Sustainability Framework, an integral part of the IFC's strategic commitment to sustainable development.

The Sustainability Framework consists of the Policy on Environmental and Social Sustainability (IFC, 2012), which defines the IFC's commitments to environmental and social sustainability, and the Performance Standards, which define a client's responsibilities for managing the environmental and social risks associated with their project (IFC, 2012). This framework applies to all clients whose projects go through the IFC's initial credit review process, and therefore the Sustainability Framework applies to the Soybean Oil Project.

16.2.5 Sustainable Development Policies of the Soybean Oil Project

The Soybean Oil Project is committed to Sustainable Development by applying the following aspects:

- Incorporate environmental, social and economic considerations and principles into the decision-making process for the entire project lifecycle;
- Identify risk with regards to environmental, social and economic impacts and implement measures to manage and mitigate risk;
- Implement measures to ensure continual improvement in environmental, social and economic performance;
- Implement measures to maximise conservation of natural resources and increase the efficiency of resource use;
- Ensure communication and engagement with stakeholders throughout the duration of the project and ensure the concerns of different stakeholders affected by the project are addressed;
- Be transparent and accountable by measuring and reporting environmental performance;
- Issue sustainability reports (published on website if possible);
- Positively impact communities;
- Operate to the highest HSE standard;
- Minimize environmental impact of operations;
- Invest in the well-being and development of employees;
- Improve energy and material efficiency;
- Practice and uphold the highest ethical standard;
- Ensure long term financial viability of the company.

The Project's approach to Sustainable Development is to deliver on these commitments, prioritize issues, establish plans for action with clear goals and monitor its performance.

The Project Commitment:

The Project is committed to protect the environment, and the safety and health of employees, contractors, customers, and the public. The Project management believes that all workplace injuries, illnesses and adverse environmental impacts are preventable. Safety, Health, and Environmental Excellence is a global value and contributes to the Project’s sustainability.

In support of this policy, the Project committed to:

Legislative & Standards Compliance

• Meet or exceed all applicable laws, regulations and company standards in all places where the company does business.

Workplace and SHE Accountability

• Make safety, health, protection of the environment, and security the direct responsibility and accountability of all employees, contractors and visitors. Working in a safe, healthy, secure and environmentally responsible manner is a condition of employment or contract.

• Maintain a safe and healthy workplace, operate the Project's facilities in an environmentally responsible manner and assure safe and secure supply chain practices.

• Promote and encourage safety, health and wellness programs on and off the job.

Safety, Health and Environmental Priorities

• Provide workplace policies, standards, procedures and training to ensure that employees and contractors can perform their jobs in a safe, healthy and environmentally responsible manner.

• Implement the principles of risk analysis and risk management in all areas of safety, health and environmental protection.

Resource Conservation:

• Establish focused efforts to preserve natural resources through rational utilization of operating facilities and raw materials.

Product Stewardship:

Incorporate sustainability and product stewardship in company's product and process development efforts and decision-making process in a way that reduces the impacts of the Project's products and processes on the environment and develops new products that contribute to a cleaner environment.

The Product Stewardship vision is "to be a recognized leader in products and services through successfully managing product risk, ensuring products meet regulatory requirements, and providing services that meet the expectations of our people and customers."

Product Stewardship affects nearly every functional area within the Project, including: Manufacturing - Distribution - Purchasing - Sales - Marketing - Engineering - Regulatory Affairs - Customer Service - Business groups

In-depth reviews for new/existing products will be done by conducting a formal risk assessment. This Risk Assessment and Management Process (RAMP) helps ensure proper understanding of products, compliance with global regulatory developments and product controls and documentation in place to assure safe use.

Community Service:

• Actively participate in communities and support efforts to positively impact the quality of life locally and beyond.

Continual Improvement:

• Investigate incidents to determine root causes and take prompt and appropriate actions to correct deficiencies. Communicate the knowledge gained and lessons learned to prevent recurrence in the company.

• Periodically review the Safety, Health and Environmental Management System with special emphasis on possible improvements.

Safety, Health and Environmental Excellence:

• Establish Safety, Health and Environment measurable objectives to drive continual improvement, and routinely communicate the progress against objectives.

• Promote discussion, sharing of best practices across all company facilities.

• Actively engage in dialog with the stakeholders to promote safety, health, security and environmental outcomes which are mutually acceptable and fully compliant with regulations.

16.3 Assessing Sustainable Development

Most industrial projects, such as the Soybean Oil Project, have the potential for negative and positive impacts upon both the environment and the community during their construction, commissioning, operation, and closure. However, through suitable assessment, opportunities to manage and mitigate such impacts can be identified and incorporated at an early stage, leading to the incorporation of sustainable development considerations into the project lifecycle.

There is no single methodology for assessing the incorporation of sustainable development principles by new projects. In the case of this Project, it is important that the assessment incorporates consideration of the sustainable development requirements of the Project's interested parties, namely the Lending Institution (World Bank/International Finance Corporation (IFC)) and the Iraqi Ministry of Environment, as well as the three core elements of sustainable development (environmental, social and economic factors).

The assessment considers the incorporation of sustainable development in the various sections of the ESIA and the incorporation of sustainable development into the Project itself as discussed earlier. The sustainability assessment assists in determining the extent to which sustainable development has been considered and incorporated into the ESIA process, which then in turn enables a more thorough assessment of sustainable development for the Project.

16.3.1 Sustainable Development Assessment Methodology

This ESIA has been prepared to address the environmental, social and economic requirements of the WB and IFC performance standards. Environmental, social and economic requirements as stipulated by the Republic of Iraq, Ministry of Environment, have also been given due consideration in the preparation of the ESIA. Table 2-1 of Section 2 - *Policy, Legal and Regulatory Framework*, demonstrates how the ESIA addresses the performance standards, and thus the integration of sustainable development principles. Therefore, the sustainable development assessment in this section has been focused on two aspects, the extent and the timescale, to which the project may be considered sustainable.

The sustainability of any project development can be judged in terms of the extent to which it meets the needs of the present, without impinging on the needs of future generations. The principles of intra-generational and inter-generational equity can be applied to evaluate this on the basis of both the temporal and spatial extent of the impacts. Intra-generational equity is the principle of equity between different groups of people alive today. Similar to inter-generational equity, intra-generational equity implies that consumption and production in one community should not undermine the ecological, social, and economic basis for other communities to maintain or improve their quality of life (International Institute for Sustainable Development (IISD), 1997). Examples of intra-generational equity include identifying impacts that may affect different social groups and ensuring suitable mitigation exists and giving consideration to the comments made by members of the public with regards to the project and ESIA

Inter-generational equity is the principle of equity between people alive today and future generations. The implication is that unsustainable production and consumption by today's society will degrade the ecological, social, and economic basis for tomorrow's society, whereas sustainability involves ensuring that future generations will have the means to achieve a quality of life equal to or better than today's (IISD, 1997). Examples of inter-generational equity include identifying ecosystems that may be affected by the development and assessing the risk of irreversible damage occurring to them and ensuring that an integrated assessment approach has been applied by the ESIA, weighing environmental, social and economic factors against one another. Consideration is also given to global impacts such as climate change, loss of biodiversity, the depletion of natural resources and human rights.

The methodology employed for the sustainable development assessment of this project will consider the impacts identified within the ESIA of the Soybean Oil Project using the criteria of timescale and extent. The principles of intra-generational equity and inter-generational equity will be used to take into account the duration associated with each significant impact identified during all project phases. Together these factors provide a means to evaluate the sustainability of the project.

The matrix presented in Figure 16-2, has been developed using the principles of a risk assessment, and will be used to assess the sustainable development implications of the significant environmental, social and economic impacts of the Project.

TIMESCALE	**Extended**				
	Long				
	Medium				
	Short				
		Local	**Regional**	**National**	**International**
		EXTENT			

Figure 16-2: Criteria for Sustainable Development Assessment

The following definitions provided in Table ***16-1*** apply to each of the criteria for the sustainable development assessment.

Table 16-1: Definitions for Sustainable Development Assessment		
Extent	Local	Within a 2km radius of the immediate Project area
	Provincial	Outside of the local area, but within 200km
	National	Within the borders of the Republic of Iraq
	International	Outside of the borders of the Republic of Iraq
Timescale	Short	Less than one year
	Medium	More than one year, but less than or equal to the operational lifetime of the project (25-30 years for Soybean Oil Project)
	Long	Greater than the lifetime of the project, but less than or equal to 100 years
	Extended	Greater than 100 years

All environmental, social and economic impacts, regardless of significance, identified by the ESIA will be assessed against the sustainable development assessment criteria in order to give an indication of the sustainability of the project and plotted into the matrix illustrated in Figure *16-3*.

Those impacts which are grouped towards the bottom left of the table (i.e., shorter-term, localized impacts) can be considered to have a reduced impact on sustainable development (i.e., the project is more sustainable), whereas those impacts grouped towards the top right of the table (i.e., longer-term, widespread impacts) can be considered to have a greater impact on sustainable development (i.e., the project is less sustainable). This approach is illustrated in Figure *16-3*.

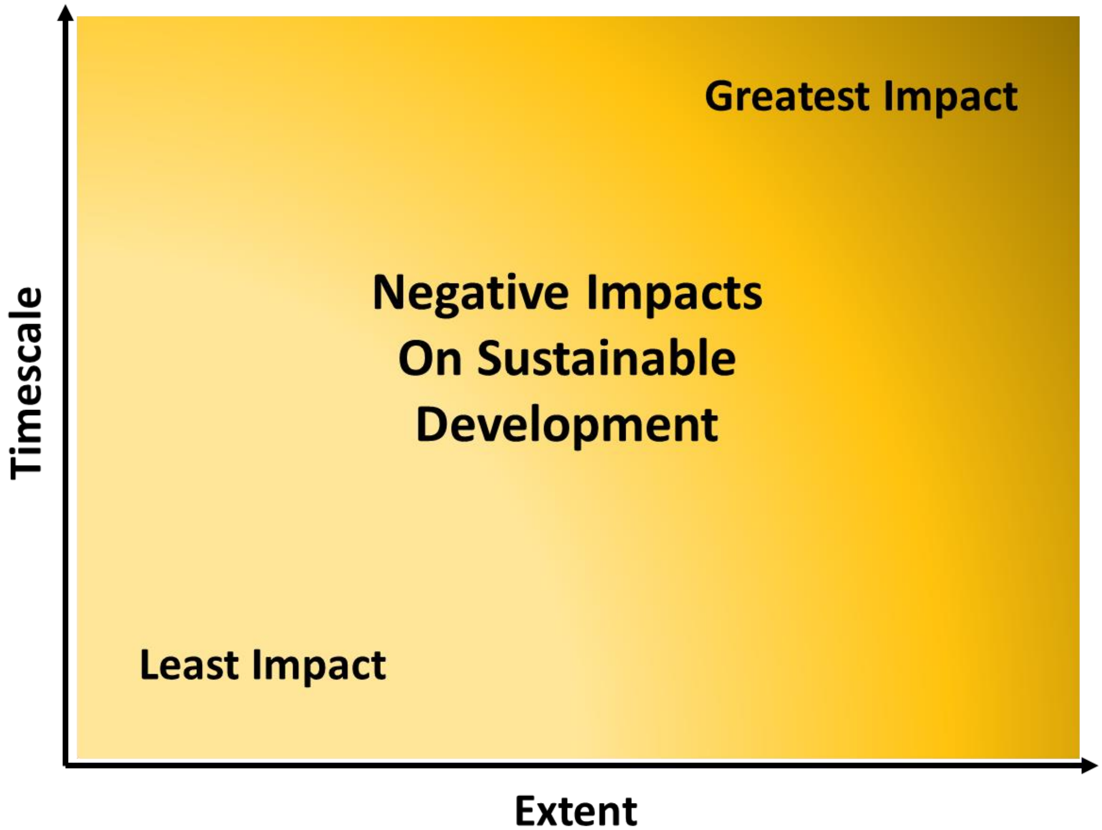


Figure 16-3: Diagrammatic representation of the classification of sustainable development impacts

Positive impacts identified by the ESIA will also be plotted to identify the positive impacts on sustainable development generated by the project. However, in the case of positive impacts, those grouped towards the top right can be considered more sustainable and those grouped towards the bottom left can be considered less sustainable.

16.3.2 Sustainable Development Assessment of The Project

This ESIA and its associated studies, such as the air dispersion modelling and noise study, have been performed during the design phase so that any modification in facility units can be made at an early stage if required. The ESIA various parts evaluate the effects of the project from environmental, social and economic perspectives. Predictions of potential significant impacts on both social and environmental components help to establish appropriate mitigation and enhancement measures at an early stage of the project.

Another key factor taken into account during the design phase, and which is considered to be aligned with good sustainable development practices, is the implementation of Best Available Techniques (BAT) in the different process units. In essence, BAT balances the costs to the operator against benefits to the environment, and therefore to society. The application of BAT will responsibly control significant potential impacts to the environment during the operation phase.

Throughout the ESIA, measures required to prevent, minimize or mitigate the identified impacts have been identified. These are also summarized within Section-20 of Summary of Impacts and Mitigation Measures. Implementation of the proposed measures is anticipated to minimize negative impacts and enhance positive impacts to maximize the sustainability of the project.

The negative and positive impacts identified throughout the ESIA have been classified in terms of their temporal and spatial extent. These are presented in the following tables, by reference to the impact Identification Code (ID Code), which is consistent with the coding presented in each respective section of the ESIA. Colours used to indicate the significance of each impact are included within the key below each table.

Table 16-2 considers the results of this classification for the negative impacts, and Table 16-3 does so for the positive impacts associated with the Project.

Table 16-2: Sustainable Development Assessment – Negative Impacts

TIMESCALE	EXTENT: Local	Provincial	National	International
Extended				
Long	TE2 TB4 HS5			
Medium	AQ2 AQ3 AQ4 AQ5 AQ6 AQ3 AQ11 AQ1 TE1 TE3 TE5 TE9 TE10 TE11 TE13 TB1 TB2 TB3 NV4 HS8 WM5 HS10 TE7 TE8	WM4 AC5		AQ13
Short	AQ1 AQ7 AQ8 AQ9 AQ12 TE4 TE6 TE12 NV1 NV2 NV3 WM2 WM3 WM6 WQ1 WQ2 01 SE3 AC1 AC3 HS1 HS2 HS4 HS6 HS7 HS9	WM1 HS3 WQ3 WQ4 WM7 SE1 SE2 SE4 SE10 AC2 AC4	SE11	SE5

Key: Grey Text Low Negative Impact

Orange Text Medium Negative Impact

Red Text High Negative Impact

Table 16-3: Sustainable Development Assessment – Positive Impacts

TIMESCALE	EXTENT: Local	Provincial	National	International
Extended				
Long	TB5 SE8		SE7	
Medium				SE6
Short	SE3	SE1 SE2		

Key: Grey Text Low Positive Impact

Sky Blue Text Medium Positive Impact Blue Text
High Positive Impact

The spatial and temporal classification of negative impacts identifies that the majority of negative impacts are localized to the Project area, and are of generally low significance. The duration of these local impacts extend from the short term to medium term (not greater than the lifetime of the project). This indicates that these impacts are anticipated to cease on completion of the Project life.

Table 16-3 indicates that the majority of the negative impacts affect Air Quality environment (Section 5 Air Quality and Meteorology), Terrestrial environment (Section 6 *Terrestrial Environment*) and the local community (Section 12 Socio-Economic Aspects) within the local and provincial areas, over the construction and operational lifetime of the Project. It is also of note that those impacts of medium significance when mitigations are not applied, anticipated to extend a number of years until Project completion are entirely associated with impacts to the protected and vulnerable species in the area. The negative impacts that extend beyond the Project life are primarily associated with potential degradation of already degraded soils if the mitigations are not applied for those impacts.

Some low negative impacts have also been identified that are expected to extend up to 200km from the site, therefore impacting areas within Basra province. The majority of the impacts with this extent are expected to be short term and only two impacts could last for the Project lifespan, and again those of significance relate to the impacts on protected species. Two potential long-term low impacts primarily relate to the waste management and archaeology and cultural heritage.

Two potential negative low impacts on national and international levels have been identified related to loss of employment during decommission/closure phase of the project and another impact on culture due to interaction between senior expat workforce with locals during operation phase.

A number of positive impacts on sustainable development created by the Project have also been identified by the ESIA at a local and provincial level, and to a lesser extent, to national and international levels. While there are fewer impacts in total, the majority of the positive impacts identified are of low or medium significance and are clustered such that these positive impacts are expected to last beyond the Project lifetime, and extend beyond the local area of the Project. These positive impacts are primarily associated with economic, and social benefits. This project has positive impacts not only on national extend but also on international scale. For example, there will be some international benefits (shipping internationally); also, the project will source material from Brazil, an international positive impact for Brazil.

In reference to Figure *16-3*, the single greatest negative impact in terms of sustainable development comes from impact AQ8 (Air Quality), although collectively, the large number of negative low impacts in the local area over the short, medium and long- term provides a greater indication of the sustainability of the project.

Although a high number of negative impacts have been identified from the Project ESIA, the majority are low impact and situated towards the bottom left half of the grid indicating an overall lower impact from a sustainable development perspective. Conversely, the positive impacts identified are predominantly situated in the middle of the grid, indicating an increased positive impact on sustainable development from the project. *Figures 16-4 and 16-5* present the results visually, with the image on figure 16-3 representing negative impacts, and the image on figure 16-4 representing positive impacts. The size and colour (using the same colours as Table 16-3 and Table *16-4)* of the points indicate their significance.

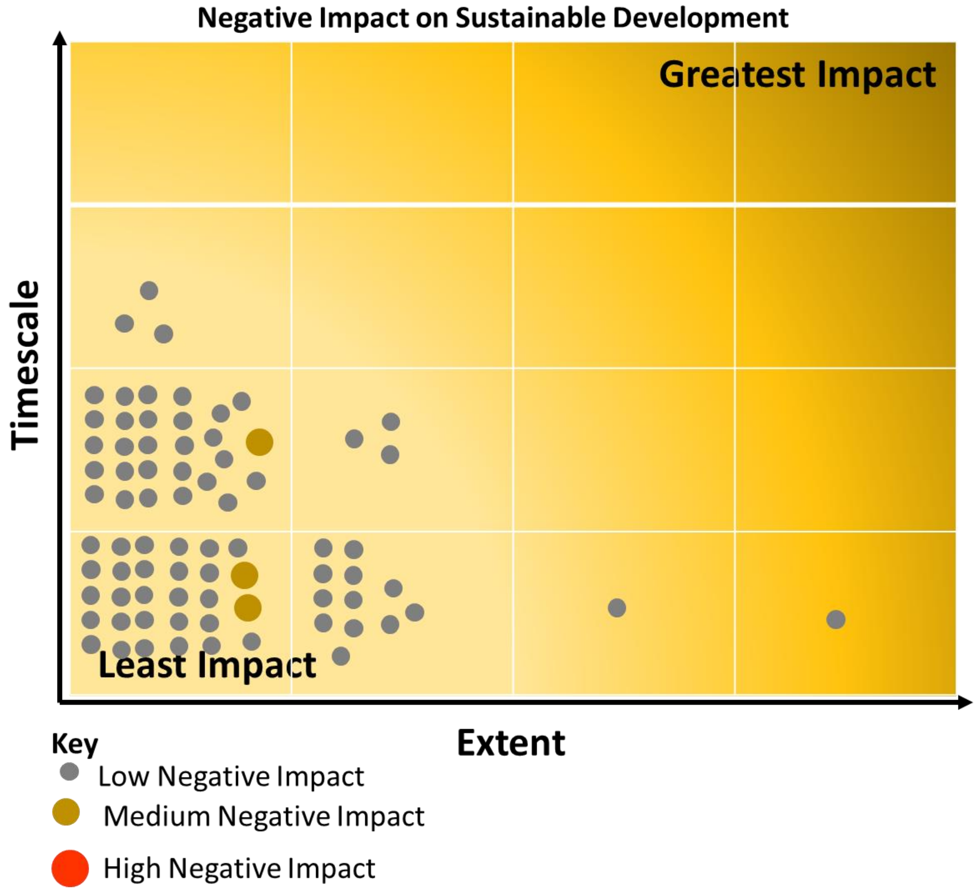


Figure 16-4: Diagrammatic representation of Project Negative Impacts

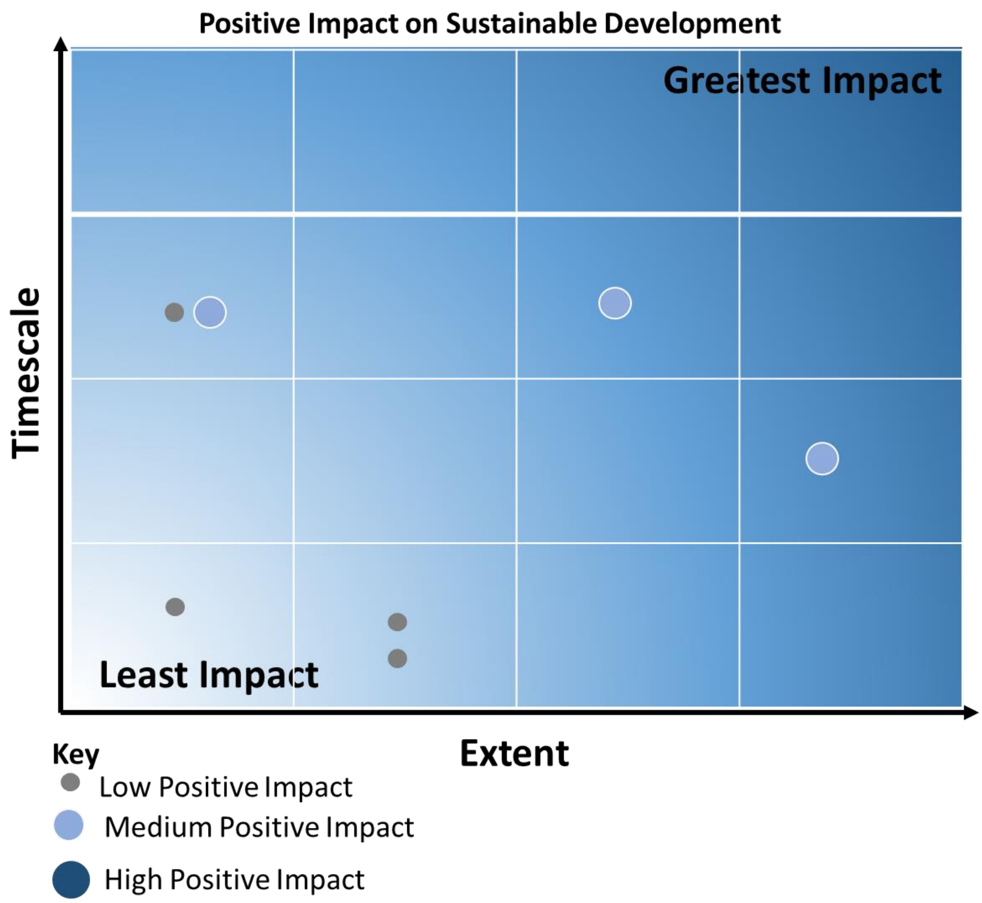


Figure 16-5: Diagrammatic representation of Project Positive Impacts

As the Project develops, the implementation of the mitigation proposed for the impacts identified by the ESIA and associated recommendations will reduce medium impacts and increase the sustainability of the Project.

The implementation of the requirements of the ESIA and compliance with the existing Soybean Oil project processes will support the overall promotion of sustainability within the Project. Features of this which support enhancement of sustainability include development of: (1) the Environmental Management System (EMS); (2) Sustainable Development Objectives and Targets; (3)Environmental Management and Monitoring Plan (EMMP); and (4) Social Impact Management Plan (SIMP), etc. for the Project. Furthermore, the Project Management will use their experience in project processes to further reduce the negative impacts identified by the ESIA and to develop and improve the Project's positive sustainability performance

16.4 Sustainability Conclusion and Recommendations

The sustainable development assessment identifies that although some negative impacts are associated with the project, the categorization of these indicate that the Project faces a common challenge in terms of sustainability. While there are a higher number of negative impacts, which primarily affect the environmental dimension of sustainability, most of these impacts are low although there are some medium impacts which will become low after implementing the mitigations and recommended measures indicated in this study. On the other hand, there are counter positive impacts which though fewer in number are of medium magnitude and principally affect the economic and social dimensions. As with many projects there is a trade-off between negative impacts on the shorter term to the environment and positive, and sometimes longer term socio-economic impacts.

The ESIA presents mitigation measures to reduce impacts to the impacts assessed within this section, however it also provides recommended good management practices which are in turn incorporated into the EMMP. Thus, implementation of the EMMP, and the good management practices contained therein, has the potential to further address negative impacts, and improve on the sustainability of the Project.

On this basis the recommended areas of focus for the Project management in terms of sustainability which should be assigned high priority are:

- Establishment of objectives, targets and KPIs to monitor achievement of the goals established for the Project and progress towards better sustainable development;
- Implementation of mitigations and recommended measures proposed within the ESIA, and the resultant EMMP and all procedures and action plans developed to support the EMMP; and
- Implementation of continuous improvements as identified by the Project's Environmental Management System and associated monitoring, measurement, auditing.

17. ANALYSIS OF ALTERNATIVES

17.1 Introduction

This Section provides an overview of the justification for the Soybean Oil Project at Umm Qasr Port and then examines various alternatives which would reduce the overall environmental effects of the project. Consideration is given to the application of Best Available Techniques (BAT) to the Project in accordance with the requirements of the Iraqi Ministry of Environment in addition to International Finance Corporation (IFC) Performance Standards. Through their Performance Standard 3, the IFC outlines requirements for Resource Efficiency (Greenhouse Gases and Water Consumption) and Pollution Prevention (General, Hazardous Materials Management and Pesticide Use and Management). The objectives for this Performance Standard are as follows:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities;
- To promote more sustainable use of resources, including energy and water; and
- To reduce project-related Greenhouse Gas (GHG) emissions.

The project and design alternatives considered for the proposed Soybean Oil Project include:

- Do nothing option (no project);
- Alternate Locations;
- Alternative Production Options and Plant Design;
- Pollution control alternatives;
- Wastewater pre-treatment alternatives; and
- Waste management alternatives.

Following the consideration of these alternatives, the selected Project elements are developed to front end engineering design (FEED). Section 3, *Detailed Description and Layout of the Proposed Development,* provides a detailed description of the ensuing Project design option which was brought forward to the environmental and social impact assessment process.

The analysis of alternatives takes into account a range of factors with varying criteria depending on the option being assessed. Examples include health, safety, social, and environment; technical risk; capital and operating costs; operability; construction schedule; and geo-political risk. Typically, the selected alternative represents a compromise or balanced outcome as it is unlikely that all criteria for all factors can be simultaneously maximised and in fact maximising one factor may come at the expense of another. The analysis of alternatives is therefore iterative and represents an interplay of potentially competing demands.

17.2 Project Justification

One of the priorities of the Iraqi Government is the diversification of the industrial sector and diversification of exports to reduce Iraq's dependence on crude oil export and hydrocarbon extraction and refinement.

In view of the high increase in the world population in addition to the increase in the consumption rate per capita of food as well as energy, two main crises are currently facing the world: the food and energy crises. For example, global human population increases about 75 million annually or 1.1% per year (World Population Data Sheet, 2014). It has grown from 1 billion in 1800 to 7 billion in 2012. It is expected to keep growing, where estimates have put the total population at 8.4 billion by mid-2030 and 9.6 billion by mid-2050. On the other hand, Iraq's population increased from 13.6 million in 1980 to more than 40 million in 2020 (further details are given in Section 12- Socio-Economics Aspects). Accordingly, current forecasts of market conditions indicate the demand on vegetable oil will definitely increase in the near future. Vegetable oil which can be extracted from oilseed is considered one of the main components of our food, and it can be also used for the production of non-conventional alternative fuels.

As clear from Figure 17-1, global vegetable oil production is expected to grow by 4 percent, with gains for all nine major oils. The gains are driven primarily by palm, sunflower seed, and soybean oils. The United States and Brazil account for roughly two thirds of this gain with similar expansion expected in areas planted and production capacity. The USA grows soybean over the largest area and holds a share of about 32% of the world's soybean production, followed by Brazil (31%), Argentina (19%), China (6%), and India (4%) (El-Hamidi and Zaher, 2018 and Yadava et al., 2012). Global vegetable oil trade is forecast to be a record in 2022/23. Continued strong demand for vegetable oil is expected to continue. In view of the crises of food facing the whole world and Iraq in particular, it became necessary to encourage new projects for producing vegetable oil.

Based on the above understanding, SAMA AlManar Co decided to build a new project for producing soybean oil which will mainly support the Iraqi market demand for this product.

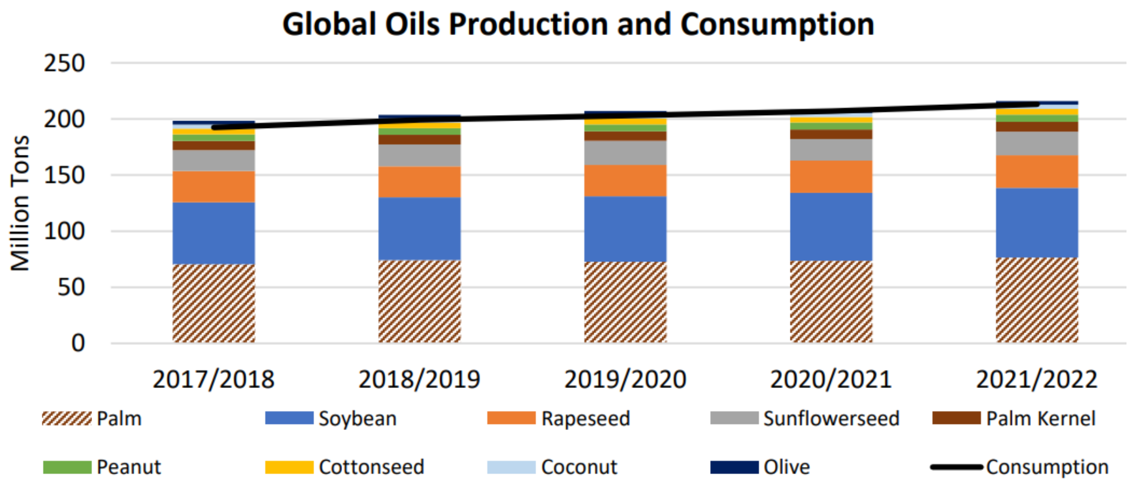


Figure 17-1: Production of major vegetable oils worldwide by type (in million metric tons) from 2012/13 to 2021/2022 (Source: USDA, Global Market Analysis, 2021)

17.3 Analysis of Alternatives

17.3.1 Alternate Locations

Key factors that were taken into consideration during the site selection process were:

- The availability of existing port and harbour facilities;
- Existing set-up of Umm Qasr Port facilities
- Location inside Umm Qasr Port which is the main seaport of Iraq as well as the only deep-water port,;
- Proximity to transport links;
- Site accessibility;
- Available infrastructure /common utilities.

The location of the new soybean oil project is based on internal negotiation between various shareholders. The proximity of infrastructure (inside Umm Qasr port) gives a big advantage in terms of import of raw material and export of products to reach its worldwide market . Based on the above key factors, the current site is the best option within Iraq.

Development at alternative locations would represent an increased risk to the environment through a greater footprint, higher investment costs and increased emissions for the facility if existing infrastructure, common utilities and strategic location (inside the seaport) were not available locally. As such, no further options have been explored.

17.3.2 "Do Nothing" Option

The 'Do-Nothing' option involves abandoning the idea of the Soybean Oil Project; in this scenario the Project would not be established. This option would lead to no change in the current environmental or social impacts, however the economic and social benefits of developing the Project would not be realised. The development of such a project, the Soybean Oil industry, is one of the important strategies for diversifying the economy of the Republic of Iraq. The 'Do-Nothing' option will not help growth and diversity in the Iraqi economy, given that a significant percentage of the Iraq's GDP is based on the development and export of oil resources. This dependence reduces the resiliency of the economy during times of global financial instability, such as during the Global Recession of 2009. Industrial diversification is an imperative to ensure that Iraq maintains economic growth.

Furthermore, the Project represents a good step in developing and improving economic development in Basra Province (particularly the Umm Qasr area). The 'Do- Nothing' option would hamper the development of the area. As a result the 'Do- Nothing' option would stymie the wider development potential in this region of Iraq. Further, in the absence of the Project, the land allocated would either be used for another industrial development or would remain in its present condition with gradual change over the coming years. The location of the site and its ecological isolation due to the surrounding road network and land use will continue to limit its ecological value. No significant change in the status of the land in the short-to-medium term is envisaged in the absence of the Project proceeding.

The proposed project follows internationally accepted protocols and relevant legislation, to design out where possible environmental and social impacts, and where impacts remain, to apply project-specific mitigation and monitoring measures as identified in other sections of this Environmental and Social Impact Assessment (ESIA). In this way the Project will be developed with an acceptable level of negative environmental and social impacts, and will contribute positively to Iraq's economy. Based on the above-mentioned facts, the 'do nothing' option was rejected as it is counter to the Republic of Iraq's economic development and the legitimate business aspirations of Sama AlManar Co.

17.3.3 Alternative Production Options and Plant Design

The proposed project is an advanced soybean oil plant that will apply state-of-the-art and BAT technology where possible in the conversion of soybean seeds into crude soybean oil products. The key processing components of the Project are described briefly herein and in detail in the Detailed Project Description (Section 3).

As an overview, the soybean oil process plant includes the following three major sections: preparation section (Pre-treatment and Pre-press section); solvent extraction; and degumming section.

Pre-treatment part of the soybean oil extraction plant:

Soybean → Cleaning → Crushing → Softening → Flaking → Puffing (Drying) → Solvent extraction

Solvent extraction of the soybean oil extraction plant:
Soybean flakes → Extractor → Desolventizer Toaster → Stripping Tower (Oil Stripper) → Crude Soybean Oil

Additionally, although boiler combustion emits NO_x, SO_2, CO_2 and PM_{10}, boilers are critical to plant operation and for providing an overall net environmental benefit. In the event of a plant upset or during a power failure, the plant will utilize all 5 generators.

To minimize SO_2 emissions, light fuel oil (LFO) having low sulfur content (1%) will be used to operate the boilers whereas diesel fuel with 10ppm sulfur content will be utilized to operate generators. The selected fuel for operating boiler and generators could be considered as the best available option although replacing gas with LFO would be better option to reduce the SO_2 emission. On the other hand, the stack height for the boilers was calculated using Good Engineering Practice (based on united States 40 CFR, part 51.100 (ii))which depends on height of the nearby structures and the lesser dimension (height and width of nearby structure) as given in the General EHS Guidelines WB-IFC 2007. The aim of optimum stack height is to have maximum dilution for air pollutants before reaching ground level.

Although the proposed process design of the plant is a standard design, it is critical that the design of this project focus on energy management impacts. Suggested focus areas can include enhancing the recovery of heat and power; application of waste heat boilers to reduce the use of fuel for steam production; and using clean fuel gas instead of LFO.

The estimated total of CO2 emissions from combustion and process sources is about 42,000MT/year during normal operation and is about 62,000MT/year during abnormal operation considering that these sources will operate 300 days per year. According to the Equator Principles, Principle 2, if the Project is expected to emit more than 100,000 Metric tonnes of CO2 equivalent annually, an alternative analysis to evaluate less greenhouse gases (GHG) intensive alternatives is required. Therefore, emissions associated with the processed facility are not expected to significantly incrementally impact global greenhouse gas emissions.

Based on the above-mentioned emissions and plant designer, the best option was selected and no better alternative available other than this exists.

17.3.4 Wastewater Pre-Treatment Alternatives

Industrial wastewater treatment system in Soybean Oil Project is designed to reduce impact to the surrounding environment.

In terms of BAT, the EU BREF refers to the establishment of an Environmental Management System (EMS) which contains elements to minimize wastewater generation and applying pollution control measures. In relation to wastewater, EMS should include operating to maximise performance while minimising wastewater production; and implementing good housekeeping activities. Specific measures may include:

- Direct discharge of un-treated wastewaters to the Arabian Gulf should be avoided.
- Avoid storing contaminated wastewater in open ponds. However, if contaminated wastewater is retained in an open pond, it shall be discharged within a maximum of 7 days and the pond shall be kept empty to minimize fugitive air emissions.
- Cleaning and assembly of equipment to occur only in specially constructed and dedicated areas;
- Dedicated drainage systems required for collection of storm water;
- Bunding/swaling for leak retention is required around areas where hazardous materials spillage may occur;
- Minimizing underground piping;

The above measures are recommended to be adopted by the Soybean Oil unit.

The Project management has selected the best option in treating wastewater to reduce the contamination levels to acceptable levels and to minimize air emissions and avoid odor problems, which meets the Iraqi standards and IFC wastewater effluent guidelines.

17.3.5 Pollution Control Alternatives

The selection of pollution control measures is an integral part of the design process. Pollution control measures have been included in the FEED to achieve the more stringent of the emissions / discharge limits provided by the national environmental regulator (the Ministry of Environment), or the IFC. Both require consideration, and application, where appropriate of Best Available Technique (BAT). The following parts outline the application of BAT within the FEED.

The development of the Detailed Design by the selected Engineering Procurement and Construction (EPC) contractor, may result in modifications to the BAT selection; however compliance with the regulatory requirements of the International Finance Corporation (IFC) and the Iraqi Ministry of Environment are necessary as a minimum.

The selected design addresses and takes into account maximum pollution reductions achievable and is aligned with the top levels of control recommended by WB-IFC, US and EU guidance and regulations, and focuses on pollutant emissions to the air, water and waste (air emissions and wastewater are considered to be primary environmental impacts from the Soybean Oil facilities).

Several major sources of air emissions at this Project (i.e., boiler and generator, storage tanks and wastewater treatment system) will meet the Iraqi Ministry of Environment requirements for air emissions for all mentioned sources and can be considered as the best option selected by the Project Management for this Project.

For reference, Best Available Control Technology (BACT) is considered as an appropriate indicator of best practice of current US air emissions controls. It is an emission limitation that considers the cost of energy, environment, and economics in developing a degree of emission reduction that is achievable through application of good production processes, control systems, and techniques. BACT is the determination, on a case-by-case basis, for the maximum degree of emission reductions that are technically achievable and demonstrated, taking into account the associated economic, environmental and energy impacts.

17.3.6 Waste Management Alternatives

Some waste will be generated during all stages of the Soybean Oil project, including preliminary site preparation, construction, operation and maintenance, and decommissioning. Potential characteristics of waste are defined to generate baseline for design of a comprehensive waste management plan. At all stages, waste management alternatives will be considered with a view to minimise waste generated by project activities and potential recycling options. A detailed waste management plan should be established, if it is not yet done, that will evaluate and identify feasible waste management alternatives (See Section 9 (Waste) for further details).

There are limited quantities of industrial wastes generated by this Project. However, these wastes can be treated and disposed by different waste management facilities within Basra Province. The Iraqi authority require use of facilities within the boundaries of Iraq to treat and dispose all type of wastes. During constrction phase all wastes (including non-hazardous waste such as empty packaging, consumed cans/tins, pallets and hazardous wastes such as paint containers, used fuel, waste fluids/lubricants/additives for machinery, diesel, greases, waste oils) will be transported offsite to government-approved facilities. Furthermore, during the operation phase, certain wastes (such as chemical/biological sludge from wastewater treatment system, waste oils, used lube oil, transformer oil) can be treated by an approved waste management facility within the Republic of Iraq upon the approval of Ministry of Environment.

17.3.7 Application of BAT

The European Union (EU), under its Directive on the Control of Pollution (Integrated Control and Pollution Prevention (96/61/EC)) and more recently the EU Directive 2008/1/EC, has established a benchmark standard for industrial activities, which relates to the main aspects of industrial design and operation and sets out the Best Available Techniques (BAT) for pollution prevention and control. The BAT is detailed for each major industrial activity in a series of documents called the EU BAT Reference (BREF) notes.

The Soybean Oil project generates various types of wastes (liquid waste, solid waste and air emissions) from different process units during normal operation phase.

The following paragraphs assess the compliance of the Soybean Oil project with the best practices and application of BAT.

17.3.7.1 Wastewater treatment system:

Wastewater from the soybean processing industry if not managed properly will have an impact on the environment. The soybean processing industry wastewater has an impact including physically, namely a thick odor and changes in the color of water bodies, as well as chemical and biological impacts, namely increasing levels of BOD, COD, Oil & grease and TSS.

BAT analysis was undertaken to establish the most effective and reliable treatment system. Analysis and comparison of different physical, chemical and biological technologies (such as dissolved air flotation (DAF), neutralization, coagulation/ flocculation, precipitation, oxidation, Anaerobic, solvent extraction, evaporation, carbon adsorption, ion exchange, membrane filtration, biodegradation and phytoremediation) have been made during the design phase. The results of the analysis indicated that each technology has its own advantages and constraints not only in terms of cost but also in terms of efficiency, feasibility and environmental impact as shown by different studies (Barakat 2011; Rathoure and Dhatwalia 2016; Morin-Crini and Crini 2017). In general, elimination of pollutants in industrial wastewater is done by physical, chemical and biological means. At the present time, there is no single method capable of complete treatment, mainly due to the complex nature of industrial effluents. In practice, a combination of different methods is used to achieve the desired water quality in the most economical way.

Based on the analysis and the results of comparison between various technologies, it is found that the combined units below showed cost effective and highly efficient in removal of COD, BOD, Oil & Grease and TSS in order to comply with the national requirement and WB-IFC guidelines for the mentioned parameters. This combination of units can be considered as the best option as it meets the BAT criteria.

The technologies below are applied for treating industrial wastewater in the Soybean Oil Project:

1) Physical Treatment (including screening and equalisation for removal of solid particles),

2) Chemical Treatment (including Rapid (flash) mixing and coagulation)

3) DAF (Dissolved Air Flotation) (including Coagulation, flocculation and flotation for removal of suspended matter such as oil or floatable solids and removal of emulsified oil and flocs)

4) Biological Treatment (including activated sludge system and anaerobic and aerobic microorganisms for decomposing organic substances (COD and BOD) that cause pollution in wastewater, by which end products such as CO_2, H_2O and activated sludge are formed)

The efficiency of each treatment unit to be used in the Soybean Oil project is shown in table 17-1. It clear from the table that the chemical treatment efficiency is 50% for COD, 50% for BOD, 80% for TSS and 90% for Oil and Grease whereas the biological treatment system will reduce the BOD wastewater content by 90%, COD by 85%, and TSS by 60%. The advantage of this technology is that it is easy to apply and operate and does not require large costs. Further, the wastewater effluent from this system is in compliance with the IFC guidelines for the mentioned parameters (as will be shown in the next subsection). Based on these findings, the system complies with the BAT elements (cost, environment and performance).

Table 17-1: Efficiency (%) for each treatment unit within the system

	Coarse Screen Efficiency (%)	Presetling - Equalisation Tank Efficiency (%)	Chemical Treatment Efficiency (%)	DAF Efficiency (%)	Biological Treatment Efficiency (%)
COD	5	5.00	50.00	50.00	85.00
BOD5	0	5.00	50.00	50.00	90.00
TSS	5	30.00	80.00	20.00	60.00
Oil & Grease	5	30.00	90.00	70.00	0.00
pH	0	0.00	0.00	0.00	0.00

Note: % refers to the percentage of incoming pollutant removed by the treatment process; the % efficiency numbers are serial. For instance the total amount of COD removed is 100%*(1-.05)*(1-0.05)*(1-0.5)*(1-0.5)*(1-0.85) or 3.4%.

Alternative options:

Other technologies or method of treatment could give similar performance or slightly better than the selected option but at higher cost, although both options will lead to similar results that meet with the IFC guidelines for wastewater effluent. Accordingly, the selected option is the best in terms of process efficiency and cost efficiency.

17.3.7.2 Solid Wastes:

IPPC Directive (96/61/EC) EU and the EU Directive 2008/1/EC Environmental Legislation aim to prevent industrial pollution and to provide waste minimization by the industrial facilities within the framework described in the Directive, effective and efficient use of raw materials and energy used in the production, noise reduction and introduction of risk management. Accordingly, limit values, parameters or equivalent technical measures that will be determined for the emissions should be based on the "Best Available Technology". The table below provides a comparison between the proposed activities of the Project and the BAT requirements.

Table 17-2: Comparison between the BAT activities/best practices and the Project's compliance	
BAT activities recommended to meet the best practices and high standards	Project's compliance
The use of technologies that produce less waste	The Project management selected the best technologies that generate the minimum solid wastes
Development and implementation of re-use and recycling of materials and wastes used for the substances produced and used, where possible	General waste generated by the Project (includes waste pipe, angle iron, steel, cans, plastic, glass bottles and papers). Tin cans and scrap waste, used containers, caps and cans are the wastes resulting from production area, and are temporarily stored in the factory area, and then sold for recycling. The rest is temporarily stored in the factory area and sent to landfills.
Prevention or minimization of the environmental effects or the risks of pollutant	Chemical or biological sludges gathered from the bottom of sedimentation tanks of physico-chemical and/or biological treatment will be returned to the biological treatment processes whereas the excess sludge is sold as a fertilizer or stored in landfills
-Environmental Management System (EMS); measures to prevent waste generation -Annual reporting of waste quantities; waste reduction and recycling plan; and implementing good housekeeping activities. -Waste management plan; waste minimization/recycling, reduce wastes quantities (as much as technically possible) for treatment and disposal as per site Waste Management Plan.	The following options will be applied in this Project to prevent and control solid wastes and by-products in compliance with the best practices and high standards; - Uncontaminated wastes/sludge from on-site wastewater treatment will be as fertilizer for agricultural purposes; - Contaminated wastes/sludge from wastewater treatment will be properly disposed at a sanitary landfill or by incineration. - Production processes will be carefully designed and controlled to reduce product losses. For instance, air humidity should be monitored and adjusted to prevent product losses caused by the formation of molds on edible materials;

17.3.7.3 Air Emissions to Atmosphere:

Particulate matter (dust) and volatile organic compounds (mainly hexane) are the main emissions from vegetable oil processing. Dust results from the processing of raw materials, including cleaning, screening, and crushing, whereas VOC emissions are caused by the use of oil-extraction solvents, typically hexane (Environmental Technology Program for Industry (1999)). However, this project will control the PM and VOC emission by applying closed system flow. However, a small quantity of solvent may be emitted to the atmosphere but this value is in compliance with the IFC guideline as will be highlighted in the next subsection.

The suggested management strategies, which comply with the best practices and BAT requirements to prevent and control VOCs are listed below:

a) The efficient recovery of solvent by distillation of the oil from the extractor should be ensured;

b) Solvent vapors should be recovered where feasible, during vegetable oil extraction;

Further, the following management techniques, which can be considered as best practices and comply with the BAT activities, will be applied in this Project to prevent and control dust and odors:

- Proper maintenance of cleaning, screening, and crushing equipment, including any ventilation and air handling systems should be ensured to reduce emissions of fugitive dust;
- If deemed necessary, cyclones and/or fabric filters or electrostatic precipitators will be installed on selected vents to remove dust and odor emissions. Either emissions control devices (cyclones and/or fabric filters or electrostatic precipitators) will be acceptable as the emission from this project will be relatively low.
- If deemed necessary, odor emissions (e.g., from wastewater treatment system, soap splitting, cookers in the extraction process, vacuum systems, and pressurized systems) should be reduced to a minimum level by using appropriate measures (such as a caustic, alkaline, or ozone scrubber system) or the gas should be incinerated in a boiler plant or in a separate incinerator system.

Exhaust Gases

Vegetable oil processing plants are large energy and steam consumers making use of auxiliary boilers for the generation of steam energy. Emissions related to the operation of these steam energy sources typically consists of combustion by-products such as NO_x, SO_x, PM, CO, and greenhouse gases (namely CO_2). The air emission from this Project will be relatively low in quantity and will be in compliance with IFC guidelines.

Recommended management techniques in compliance with the best practices and BAT requirements include a reduction in energy demand, use of cleaner fuels, and application of emissions controls where required.

In conclusion, the project management has selected the best option to control air pollutants and dust emission from various sources and there is no need to review or study alternative options.

17.3.8 Resource Efficiency

IFC Performance Standard 3 provides for the consideration of resource efficiency and pollution prevention and control. Within this context, the IFC EHS Guidelines provides specific resource efficiency and energy efficiency benchmarks indicators against which projects may be assessed. Thus, over and beyond the assessment of the application of BAT, the Project can be assessed in terms of the extent to which it meets the resource efficiency benchmark indicators set out in both the General and Sector Specific EHS Guidelines. These industry benchmark indicators are supplied to provide guidance on industry best practice.

Table 17-3 provides a comparison between the IFC industry benchmark indicators, and Project performance. The comparison demonstrates that the Project meets or exceeds industry benchmark indicators.

Table 17-3: Comparison between the IFC benchmark indicators, and Project Effluent/emissions

Process Unit	Parameter name	IFC Industry Benchmark (EHSG, WB-IFC, 2007)	Project Emission/Effluent
Wastewater Treatment System	pH	6-9	7
	BOD (mg/l)	50	23.8
	COD (mg/l)	250	118.5
	Total Suspended Solids (TSS) (mg/l)	50	10.6
	Oil & Grease (mg/l)	10	2.7
Small Fuel Combustion facility (Boiler) with operation load (less than 50MWth)	Particulate (mg/m^3)	50 or up to 150 if justified by environmental assessment	<150
	Sulfur Dioxide (mg/m^3)	2,000	Much lower than 2,000
	Nitrogen Dioxide (mg/m^3)	460	Much lower than 460

18 RISK ASSESSMENT

18.1 Introduction

This section addresses elements of a risk assessment related to The Soybean Processing plant. This section is closely tied to Section 18: Equipment Design Safety Requirements, as safety and risk are closely related considerations.

Besides general risk assessment requirements, this section is guided by the World Bank Group (2007) document on ENVIRONMENTAL, HEALTH, AND SAFETY GUIDELINES, as well as relevant Iraqi national guidance as outlined in Section 2: Policy, Legal, and Administrative Framework.

Human health or environmental risk represents the intersection of three factors: stressor, receptor, and pathway. The stressor may be any of a number of environmental factors (in this case), such as noise, contaminants (chemicals, wastes), climate, energy use, etc. Receptors may be either human or ecological (flora and fauna, terrestrial or marine). Pathways are the linkage between the stressor and the receptor: how the stressor interacts with the receptor. Without an appropriate pathway, there will be no risk from the contamination, for instance. Some common pathways include airborne transmission (dust, pathogens), ingestion, contact, groundwater, etc.

To examine the risk from a particular combination of stressor, receptor, and pathway, several steps can be taken:

1. Risk screening;
2. Interim risk management;
3. Detailed quantitative risk assessment; and
4. Permanent risk reduction measures.

This ESIA represents the risk screening, as has been presented in previous sections. Previous sections identify stressors, receptors, and pathways for various risks, broken out according to environment (terrestrial and marine), receptor (human or ecological), and stressor (noise, contaminants, etc.). In most of these sections, interim risk management actions have been identified. Therefore, the following sections should be viewed hand-in-hand with this risk assessment summary.

Section 3: Detailed description and layout of proposed Development

Sections 6 and 7: Terrestrial environment

Section 8: Noise and vibration

Section 9: Waste management

Section 10: Water quality management

Section 11: Marine environment

Section 13: Archaeology and cultural heritage

Section 14: Health and safety management

Chapter 19: Equipment Design Safety Requirements.

18.2 Assessment of Significant Environmental and Health Aspects

Key environmental and health aspects include:

- Noise
- Hazardous materials (including dust)
- Atmospheric emissions
- Greenhouse gases
- Solid and liquid waste
- Energy Consumption

The Soybean Processing Project has implemented many of the risk minimization requirements in their design. These are described in detail in the sections referenced above.

18.3 Construction Phase – Risk Assessment

Table 18-1: Risk assessment for construction phase

No	Hazard	Cause	Effect	severity	probability	Risk	Action (Engineering Control)	Administrative Control	Residual Severity	Residual Probability	Residual Risk	Residual Reduction %
1	Exposure to Noise	Working with equipment more that 85 db. (such as Vehicles Earth-moving equipmentt)	1.Auditory disease. 2. Fatigue.	4	3	12	1.Use auditory PPE where needed (earmuff, Earplug). 2.Isolateting the noise source. 3.Equipment maintenance.	1.Periodical Medical check. 2.Personal rotation. 3.limitation of working hours	4	1	4	67%
2	Exposure to vibration	1.Vibrating compactor. 2.Plate compactor. 3.Roller steal compactor. 4.Drill hummer.	1.Peripheral neuropathy.	4	3	12	1.Equipment maintenance. 2.Isolating the vibration source.	1.Periodical Medical check. 2.Personal rotation. 3.limitation of working hours	4	1	4	67%
3	Exposure to hazardous substances as airborne contaminants e.g. dust, fume, vapors & aerosols	1.Use paint. 2.high wind. 3.Fire smoke. 4.In-situ contaminants	1.Irritation. 2.Respiratory diseases.	4	3	12	1.Use respiratory PPE. 2.Follow the chemical safe working procedure. 3.Provide a ventilation.. 4. Dust Control Measure. 5.Contaminants/fuels confined (storage)	1.Provide chemicals MSDS. 2.Use chemical Safety signs.	4	1	4	67%
4	Atmospheric emission/Presence of toxic gases or other contaminants, natural or otherwise	1.Natural source. 2.Emssion from stack and vehicles. 3.Gas cylinders	1.Fainting. 2.Respiratory diseases. 3.Fatality.	5	3	15	1.Use ventilator. 2.Use SCBA. 3.Use a Multi-gas detector. 4.Use gas alarm 5.Vehicles maintained 6.Dust control measures	1.Use body system monitoring. 2.Use only authorized person sign	5	1	5	67%
5	Greenhouse gases	1.Vehicles/fuel 2.Shipping	Climate change and seawater rise	4	3	12	1.Adhere to (IMO) shipping guidelines 2.Maintain all equipment	Follow the applicable regulations	4	1	4	67%
6	Solid and liquid waste	1.Sanitary waste 2.Shipping materials		4	3	12	1.Solid waste management implemented 2.Liquid waste management implemented	Follow the applicable regulations on hazardous waste management	4	1	4	67%
7	Exposure to hazardous chemicals	1.use chemical material.	1.Major burn. 2.Irritation. 3.Respiratory diseases.	4	2	8	1.Use chemical PPE. 2.Follow the chemical safe working procedure	1.Provide chemical MSDS. 2.Use chemical Safety signs.	4	1	4	50%
8	Working in hot and or humid environments including heat stress	1.work in extremely hot areas.	1.Heat stroke. 2.Heat exhaustion.	3	3	9	1.First Aider on site. 2.Provide A resting Shaded area. 3. A day off work should be given if temperatures rises to above 50C (122F).	1.Provide sufficient drinking water. 2.Post a Hydration chart.	3	2	6	33%
9	Fatigue	1.long time working.	1.Stress. 2.Dizziness. 3.Fainting.	3	3	9		1.Periodical Medical check. 2.Personal rotation. 3.limitation of working hours	3	1	3	67%
10	Possible exposure to infectious diseases e.g. COVID-19	1.Work in low medical precaution site. 2.Work in infected working site.	1. Multiple medical issues 2. Fatality.	5	3	15	1.Wear face mask. 2.Use sterilizers. 3.Increase self-cleaning and hygiene. 4.Housekeeping.	1. Periodical Medical check. 2. Isolation of suspected infected. 3. Report any infection cases.	5	2	10	33%

11	Oxygen deficient atmosphere	1.Low O2 level	1.Dizziness. 2.Fainting. 3.suffocation.	5	2	10	1.Use ventilator. 2.Use SCBA. 3.Use a Multi-gas detector. 4.Use gas alarm.	1.Use body system monitoring. 2.Use only authorized person sign	5	1	5	50%
12	Flooding	1.Rain. 2.under ground water	1.Soil collapse. 2.sub-mearg of equipment.	5	2	10	Daily Site inspection.	Weather check one week a head.	5	1	5	50%
13	contact with dangerous moving parts of machine-shearing, cutting, entanglement, drawing in, stabbing or impact etc.	1.Unprotected machine. 2.Electrical tools.	1. Skeleton injuries. 2. Muscular injuries. 3. Skin cut and wound. 4. Fatality.	5	4	20	1.Use equipment protection. 2.Periodical check (Daily, Weekly and monthly) for equipment and tools.	1.Daily TBT explain all hazards and change on the working site. 2.Use the PTW system. 3.Only skilled workers use dangerous tools.	5	1	5	75%
14	Electrical Shock	1.Work near or adjacent to overhead linesphysical contact. 2.Potential contact with underground electrical power cables. 3.Work near live electrical conductors.	1.Major burn. 2.Fatality.	5	3	15	1.Good cable management. 2.Isolat cable and connections. 3.Electrical inspection 4.Site monitoring by the HSE team. 5.Use LOTO system.	1.Daily TBT explain all hazards and change on the working site. 2.Use the PTW system. 3.Pre job planning.	5	1	5	67%
15	Electrical Fire	1.Bad cable management 2.Potential of short circuit.	1.Major burn. 2.Fatality.	5	3	15	1.Good cable management. 2.Isolat cable and connections. 3.Electrical inspection 4.Site monitoring by the HSE team. 5.Use LOTO system. 6.Provide fire extinguisher.	1.Daily TBT explain all hazards and change on the working site. 2.Use the PTW system. 3.Pre job planning.	5	1	5	67%
16	Potential for exposure to arc flash	Welding	1. Eye Irritation. 2. Temporary Blindness	3	3	9	Use the welding screen.	1. Daily TBT. 2. Use the PTW system. 3. Pre-job planning. 4. Use body System monitoring.	3	1	3	67%
17	Possible exposure to static or induced voltages e.g. overhead line equipment	1.Work near or adjacent to overhead linesphysical contact. 2.Work near live electrical conductors.	Electrical Shock	3	2	6	1. Use Electrical PPE. 2. Use the Log out / Tag out system. 3. Follow the electrical engineer's instructions.	1. Daily TBT. 2. Use the PTW system. 3. Pre job planning. 4. Use body System monitoring.	3	1	3	50%
18	Potential Heat or cold stress	Due to hot or cold working environment	1. Sickness. 2. Stress. 3. High blood pressure.	3	3	9		1. Use proper PPE according to the weather. 2. Follow the hydration chart according to the weather.	3	1	3	67%
19	Slip, Trip and Fall	All work activities	1. Concussion. 2. Broken Bone. 3. Torn ligaments and muscles	3	3	9	1. Maintain good housekeeping. 2. Maintain good storage methods. 3. Follow the manual handling procedure.	1. Daily site check. 2. Pre-Job Planning	3	1	3	67%
20	Manual lifting operations with loads	1. Offloading / loading material. 2. Forceful positions or efforts required. 3. stooping, twisting, pulling or pushing.	1. Torn ligaments and muscles. 2. Neurological diseases. 3. Spine Diseases. 4. Skeleton injuries.	4	4	16	1. Following the manual lifting safe working procedure. 2. Maintain good housekeeping.	Periodical Medical check.	4	1	4	75%
21	Poor ground conditions/unstable ground	1. Inadequate sloping. 2. Heavy equipment operating adjacent to the excavation, the potential for collapse of excavation. 3. Overturning	1. Multiple injures. 2. Multiple equipment damage.	4	4	16	1. Maintain good sloping. 2. Maintain inadequate entrance and access for personal and equipment.	1.Daily site check. 2. Pre-Job Planning	4	1	4	75%

		of the mobile plant into an excavation.										
22	Potential for water ingress	Heavy rain	1. Flooding. 2. Collapsing of excavation.	4	2	8	1. Maintain good sloping. 2. Maintain inadequate entrance and access for personnel and equipment. 3. Provide a dewatering system incase of flooding.	1. Daily site check. 2. Pre-Job Planning	4	1	4	50%
23	Dropped object	Potential for objects to be dropped or fall	Multiple injures.	4	2	8	1. Maintain good housekeeping. 2. Maintain good storage methods. 3. Follow the manual handling procedure. 4. Use a toy board in scaffolding.	1. Daily site check. 2. Pre-Job Planning	4	1	4	50%
24	Scaffolding Structural failure	1. Falling of material while erection & dismantling scaffolding. 2. Falling of Scaffolding.	1. Multiple injures. 2. Multiple equipment damage. 3. Fatality	5	2	10	1. Maintain good housekeeping. 2.Maintain good storage methods. 3. Follow the manual handling procedure. 4. Follow the scaffolding erection & Dismantling safe working procedure. And 5. Use engineering controls and high quality/safe equipment for scaffolding.	1. Daily site check. 2. Pre-Job Planning. 3. Use scaffolding loading chart and calculation. 4. Daily TBT.	5	1	5	50%
25	Fall of items from a load being lifted or transported	1. Loading & Offloading. 2. Mobilizing material.	1. Multiple injures. 2. Multiple equipment damage.	4	2	8	1. Maintain good housekeeping. 2. Maintain good storage methods. 3. Follow the manual handling procedure. 4. Follow the manual handling procedure.	1. Daily site check. 2. Pre-Job Planning	4	1	4	50%
26	Potential Lifting equipment failing	1. Potential of mechanical failing. 2. Potential of lifting accessories filing.	1. Multiple injures. 2. Multiple equipment damage. 3. Fatality.	5	3	15	1. Use a lifting plan. 2. Daily Check for lifting accessories.	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. All personnel need to be trained and certified.	5	1	5	67%
27	Welding or other "Hot Work"-includes cutting	All work activities	1. Fire. 2. Explosion. 3. Flying hot parts. 4. Toxic smoke.	4	3	12	1. Isolation of working area. 2. Use a fire blanket to isolate the friable material. 3. Use a body working system.	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. All personnel need to be trained and certified.	4	1	4	67%
28	Potential failure of lifting equipment due to overloading	1.Potential of mechanical failing. 2. Potential of lifting accessories filing.	1.Multiple injures. 2.Multiple equipment damage.	5	3	15	1. Use a lifting plan. 2. Daily Check for lifting accessories.	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. All personnel need to be trained and certified.	5	1	5	67%
29	Potential failure due to use of defective equipment	1. Potential of mechanical failing. 2. Potential of lifting accessories filing.	1. Multiple injures. 2. Multiple equipment damage. 3. Fatality.	5	4	20	1. Use a lifting plan. 2. Daily Check for lifting accessories.	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. All personnel need to be trained and certified	5	1	5	75%
30	Potential for overturning due to poor ground conditions	Potential of mechanical failing	1. Multiple injures. 2. Multiple equipment damage. 3. Fatality	5	2	10	1. Use a lifting plan. 2. checking the ground before and while lifting operation. 3. Use outrigger pads.	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. All personnel need to be trained and certified.	5	1	5	50%

31	Potential to fall from height >1.5m	1. Working on the Scaffolding platform. 2. Working on MEWP. 3. Working on Fragile roof.	1. Broken bone. 2.Torn ligaments and muscles. 3. Concussion. 4. Fatality.	5	4		1. All Scaffolding should follow the safe working procedure. 2. All working at height workers should use a Safety harness. 3. All access should be secured and rigid	1. Daily TBT. 2. Daily site check. 3. Daily check for tools and equipment. 4. Pre-Job Planning. 5. All personnel need to be trained and certified.	5	1	5	75%
32	Fall from ground level to a level below	Working near the excavation edge.	1. Broken bone. 2. Torn ligaments and muscles. 3. Concussion. 4. Fatality.	5	3	15	1. All excavation or different level ground needs to be barricaded by hard barricading. 2. All activities need to have a 1.5m distance form the excavation edge.	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning.	5	1	5	67%
33	Working alone	1. Working in a confined space. 2. Working inside of the trench.	1. Fatality. 2. Suffocation. 3. Multiple injures.	5	3	15	1. Use the body system. 2. Use gas testing and monitoring. 3. Provide a good ventilation system. 4. Provide good lighting. 5. Use SCBA when needed	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. Personal rotation.	5	1	5	67%
34	Fog	1. Lifting by mobile crane in Foggy weather. 2. Lifting by Forklift in foggy weather. 3. diving or movement in foggy weather.	1. Multiple injuries. 2. Multiple equipment failures. 3.Facilities	5	3	15	1. All lifting operations by mobile crane must be stopped according to the visibility distances, at least 100 m. 2. All lifting operations by forklift must be stopped according to the visibility distances, at least 50 m. 3. All vehicle needs to be stopped if the visibility is less than 150 m.	1. All Lifting equipment operator needs to be certified. 2. All vehicle driver needs to have DDT certification. 3. Poster for limited speed and lifting operation needs to be posted on the working site.	5	1	5	67%
35	High Wind Speed	1. Lifting by mobile crane in windy weather. 2. Lifting by Forklift in Windy weather. 3. diving or movement in windy weather.	1. Multiple injuries. 2. Multiple equipment failures. 3.Facilities	5	3	15	1. All lifting operations by crane must be stopped according to GHSQ.	1. All vehicle driver needs to have DDT certification. 2. All vehicle journey needs to be monitored.	5	1	5	67%

		Probability					Definitions	
		5	4	3	2	1	**Probability**	
Severity	5	**25**	20	15	10	5	5 - Highly likely	Event is highly likely to occur if controls not in place or adequate.
	4	20	16	12	8	4	4 - Likely	Event is likely to occur if controls not in place or adequate.
	3	15	12	9	6	3	3 - Possible	Event is a very real possibility if controls not in place or adequate.
	2	10	8	6	4	2	2 - Unlikely	Event is unlikely if controls not in place or adequate
	1	5	4	3	2	1	1 - Remote	Very rare event predicted

RED: risk MUST be addressed immediately with suitable and effective control measures or tasks avoided	ORANGE: risk SHOULD be addressed	GREEN: risk acceptable
DARK RED: the activities must stop		

Severity	
5 - Fatal Injury	Multiple or single fatality per event
4 - Severe Injury	• A major fracture of any bone apart from hand, wrist or ankle • Loss of limb or eye • Lost of sight or hearing (permanent) • Acute illness requiring medical treatment •Any injury resulting in unconsciousness requiring hospitalisation.24 hours. • Any injury requiring > 30 days off wor
3 - Major injury	• Fracture of the hand, wrist, or ankle • Unconsciousness • Major burn • Amputation of fingers or toes • Loss of sight or hearing (temporary) • Any injury leading to 3-30 days off work
2 - Minor injury	• Fracture of digits • Strains, scratches, cuts and abrasions • Minor burn • General discomfort • Minor occupational related illness • Occupationally induced allergic reaction • Any injury resulting in < 3 days off work
1 - Superficial	• Very minor or superficial injury where First Aid may be required but no lost time or medical treatment results.

18.4 Operational Phase – Risk Assessment

Most of the risks indicated in table 18-1 for construction are also applicable to the operation phase. There other risks may occur during operation phase as shown in below table.

Table 18-2: Risk assessment for Operation phase

No	Hazard	Cause	Effect	severity	probability	Risk	Action (Engineering Control)	Administrative Control	Residual Severity	Residual Probability	Residual Risk	Residual Reduction %
1	Exposure to toxic gases (such as VOC, hexane, SO_2)	1-Leakage from pipes or storage tanks 2-Emission from stacks or vents	1.Irritation. 2.Respiratory diseases.	4	3	12	1.Use respiratory PPE. 2.Follow the chemical safe working procedure. 3.Provide a ventilation.	1.Provide chemicals MSDS. 2.Use chemical Safety signs.	4	1	4	67%
2	Storage, handling and use of cylinders of compressed gases	1. Storing gas cylinders. 2. Mobilizing gas cylinders. 3. Installation of gas cylinders	1. Fire. 2. Explosion	5	2	10	1. All gas cylinders need to protect. 2. Use the flashback arrester. 3. All connection hoses are checked before any activity and while working.	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. All personnel need to be trained and certified. 5. Provide MSDS of the gas cylinders. 6. Use a remote well-ventilated cage area to store the gas cylinders.	5	1	5	50%
3	Exposure to Noise	Working with equipment generating sound level more than 85dB (such as generators without sound controler)	1.Auditory disease. 2. Fatigue.	4	3	12	1.Use auditory PPE where needed (earmuff, Earplug). 2.Isolateting the noise source. 3.Equipment maintenance. 4. Maintain industrial equipment	1.Periodical Medical check. 2. Maintain industrial equipment 3.limitation of working hours 4. Equipment design to minimize noise	4	1	4	67%
4	Improper hazardous-wastes handling	Incorrect storage Leakage, spills	1.Major burn. 2.Irritation. 3.Respiratory diseases.	4	2	8	1.Use chemical PPE. 2.Follow the waste management procedure.	1.Provide chemical MSDS. 2.Use chemical Safety signs.				
5	The interaction between the mechanisms and the workers	1.Crowded working layout. 2.Cramped working conditions	1. Skeleton injuries. 2. Muscular injuries. 3. Skin cut and wound.	4	3	12	1.Working area isolation and barricading. 2.Site monitoring by the HSE team	1.Daily TBT explain all hazards and change on the working site. 2.Use the PTW system. 3.Pre job planning	4	1	4	67%
	Lack of or inadequate ventilation inside some rooms/offices	work in confined or enclosed spaces.	1.Dizziness. 2.Fainting. 3.suffocation because of Low Oxygen.	4	2	8	1.Use ventilator. 2.Use SCBA. 3.Use a Multi-gas detector. 4.Use gas alarm.	1.Use body system monitoring. 2.Use only authorized person sign	4	1	4	50%
6	Combustible or explosive gases present e.g. LPG	1. Cooking. 2. Oxy-acetylene welding	1.Fire. 2. Explosion. 3. Flying hot parts.	4	2	8	1. All gas cylinders need to protect. 2. Use the flashback arrester. 3. All connection hoses are checked before any activity and while working	1. Daily TBT. 2. Daily site check. 3. Pre-Job Planning. 4. All personnel need to be trained and certified. 5. Provide MSDS of the gas cylinders	4	1	4	50%
7	Working in inadequate local lighting	1.Night Working. 2.Working in enclosed or confined places	Multiple injures	4	3	12	. provide an adequate lighting system.	1. Night working supervision. 2. Limitation of activities. 3. Pre-Job planning.	4	1	4	67%
8	Cable management and electrical connection	1.Disruption of power supply. 2.Electrical fire. 3.Electrical shock	1. Electrical Shock. 2. Electrical Fire.	4	3	12	1. Use Electrical PPE. 2. Use the Log out / Tag out system.	1. Daily TBT explain all hazards and change on the working site. 2. Use the	4	1	4	67%

							3. Follow the electrical engineer's instructions.	PTW system. 3. Pre job planning. 4. Periodical check for electricity cable and connections				
9	Working area obstruction	1.Bad Housekeeping. 2.Crowded working layout.	1.Skeleton injuries. 2.Muscular injuries. 3.Skin cut and wound.	3	2	6	1.Site monitoring by the HSE team. 2.Daily Periodical housekeeping.	1.Daily TBT explain all hazards and change on the working site. 2.Use the PTW system. 3.Pre job planning.	3	1	3	50%
10	Contact with hot or cold surfaces	1.Plastic pipe iron. 2.Use equipment or tools that generate high temperature.	1.Major burn. 2.injury resulting in unconsciousness requiring hospitalization.	4	3	12	1.Use equipment protection. 2.Site monitoring by the HSE team.	1.Daily TBT explain all hazards and change on the working site. 2.Use the PTW system. 3.Only skilled or certified workers use dangerous tools.	4	1		67%
11	Contact with rotating or moving workpiece	1.Unprotected machine. 2.Electrical tools.	1.Skeleton injuries. 2.Muscular injuries. 3.Skin cut and wound. 4.Fatality.	5	3	15	1.Use equipment protection. 2.Periodical check (Daily, Weekly and monthly) for equipment and tools.	1.Daily TBT explain all hazards and change on the working site. 2.Use the PTW system. 3.Only skilled or certified workers use dangerous tools.	5	1	5	67%
12	Access restrictions	1.left material. 2.Bad housekeeping	1.Skeleton injuries. 2.Muscular injuries. 3.Limited access	3	2	6	1.Daily Periodical housekeeping. 2.Site Inspection.	1.Daily TBT explain all hazards and change on the working site. 2.Use PTW system	3	1	3	50%
13	Oxygen deficient atmosphere	1.Low O2 level	1.Dizziness. 2.Fainting. 3.suffocation.	5	2	10	1.Use ventilator. 2.Use SCBA. 3.Use a Multi-gas detector. 4.Use gas alarm.	1.Use body system monitoring. 2.Use only authorized person sign	5	1	5	50%

18.5 Decommissioning Phase – Risk Assessment

These risks are essentially similar to those during the construction phase. However, additional care must be taken for building removal, waste management and disposal.

18.6 Management Plans and Monitoring

To help assure risks are limited to the levels discussed in this ESIA, management plans and monitoring are implemented. The specific details of these plans are included in Chapter 21: Environmental Management and Monitoring Plans. This section contains several plans for the project.

- Construction Phase Environmental and OHS Management Plans
- Operations Phase Environmental and OHS Management Plans
- Environmental Monitoring Plan

Each subsection discusses:

- Training and awareness for staff
- The objectives of the plan
- Roles and responsibilities for the plan
- Assessment of significant environmental aspects
- Environmental reporting
- Environmental auditing
- Environmental inspection

The management plans help assure the communication of health and environmental expectations associated with the project. They also lay out the requirements for intake training and in-service continuous training to assure a culture of safety in the project. The monitoring plan is set out to assure appropriate information is available to take decisions related to health and the environment, related to the project.

19 EQUIPMENT DESIGN SAFETY REQUIREMENTS

19.1 Introduction

This section addresses some major equipment design elements related to equipment safety requirements. This section is closely tied to Section 17: Risk Assessment, as safety and risk are closely related considerations.

Besides general equipment design safety requirements, this section is guided by the World Bank Group (2015) document on ENVIRONMENTAL, HEALTH, AND SAFETY GUIDELINES FOR VEGETABLE OIL PRODUCTION AND PROCESSING, the IFC General EHS Guidelines, as well as relevant Iraqi national guidance as outlined in Section 2: Policy, Legal, and Administrative Framework.

This section focuses on the equipment requirements, rather than the operations guidance/management issues (e.g., dust control, signage, awareness, etc.). These operation guidance/management issues are covered in other sections of the report addressing:

Section 3: Detailed description and layout of proposed Development
Sections 6 and 7: Terrestrial environment
Section 8: Noise and vibration
Section 9: Waste management
Section 10: Water quality management
Section 11: Marine environment
Section 13: Archaeology and cultural heritage
Section 14: Health and safety management

Thus, this section should be read and assessed in concert with the above sections dealing with topic-specific operational issues.

This section is laid out considering the three major project phases:

- Construction Phase (and Commissioning)
- Operations Phase
- Decommissioning Phase

Safety goals

High level safety goals might include:

- Fulfill applicable regulatory requirements relating to safety and environment.

- Implement inherent safer design principles.
- Meet risk tolerability criteria and/or as low as reasonably practicable (ALARP) criteria.

Some general principles to follow for equipment design safety include:

- Eliminate:
  - Where possible, eliminate hazardous materials, processes and activities;
- Minimize:
  - Minimize quantities of hazardous substances;
- Substitute:
  - Reduce number of hazardous activities to a minimum;
  - Replace hazardous materials with less hazardous ones;
- Moderate:
  - Reduce the impact of a release of hazardous material or energy, by changing the layout/configuration, adopting less hazardous operating conditions or a less hazardous form of a material, facilities;
- Simplify:
  - Design facilities and processes to eliminate unnecessary complexity, to minimize the possibility of human errors.

Assessment of Significant Environmental and Health Aspects

Key environmental and health aspects include:

- Noise
- Hazardous materials (including dust)
- Atmospheric emissions
- Greenhouse gases
- Solid and liquid waste
- Energy Consumption

The Soybean Processing Project has implemented many of these requirements in their design. These are described in detail in Section 3: detailed description and layout of proposed development.

The following is a schematic of the process flow at the facility:

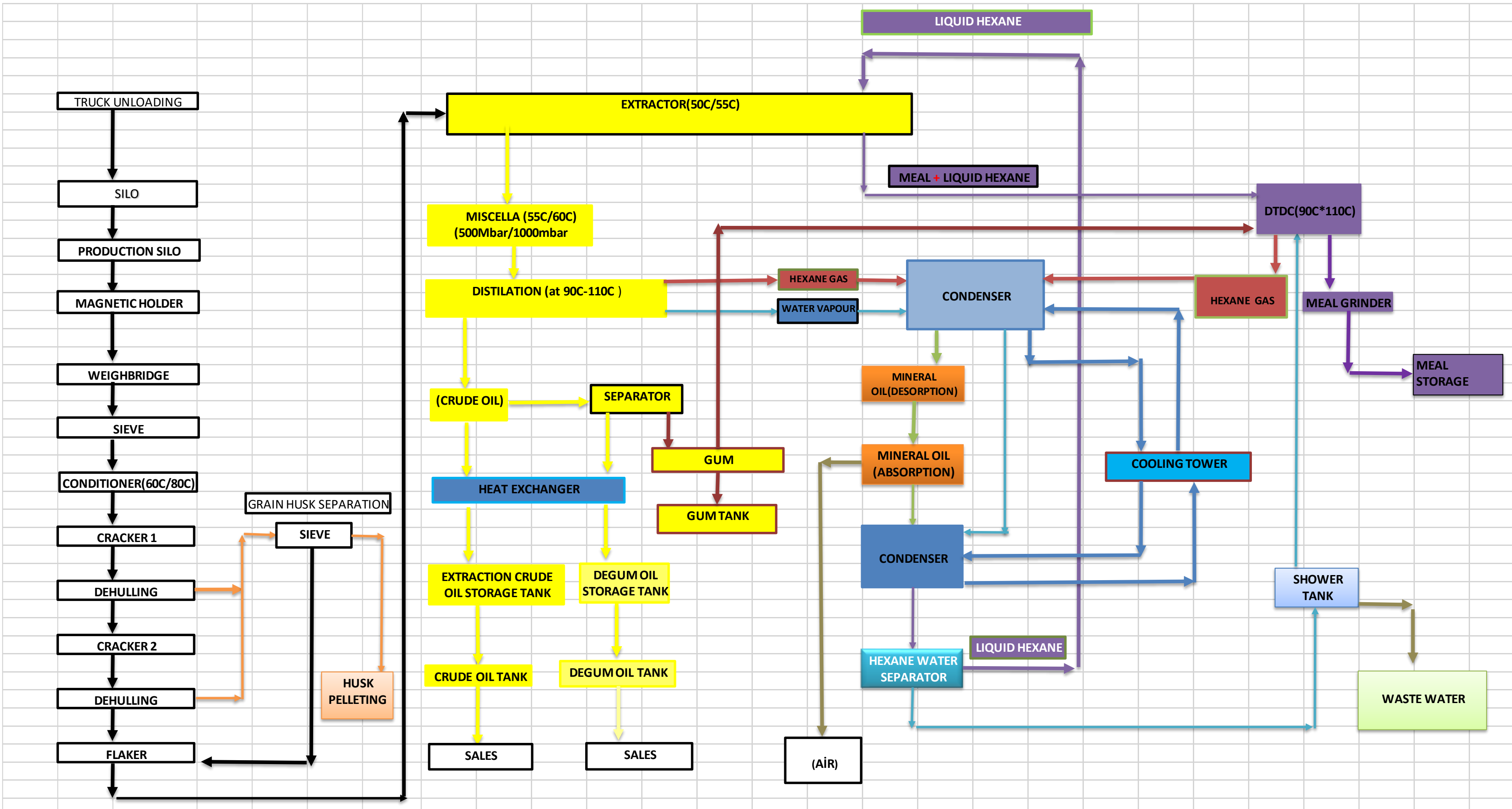


Figure 19-1: Process flow diagram for the soybean oil facility

The main processes served by this facility can be classified into the following major areas:

1. Storage/Silos
2. Preparation
3. Extraction
4. Meal warehouse
5. Boiler
6. Wastewater

Each of these processes is addressed below, focusing on the specific equipment used and the risk assessment showing how the risks will be eliminated, minimized, or mitigated for each of these processes.

The layout for the facility is shown below:

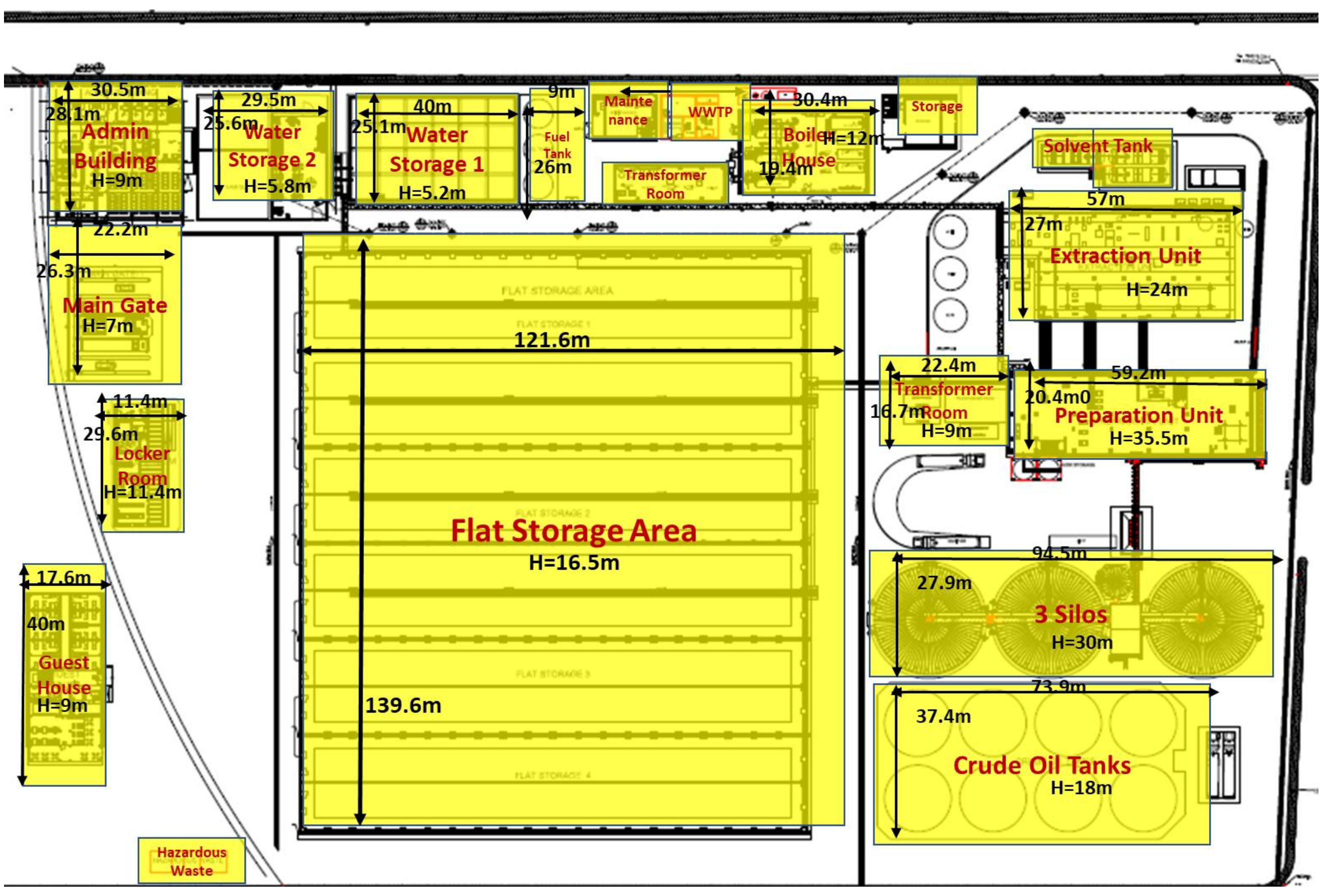


Figure 19-2: Layout for the facility

19.2 Storage Silos

19.2.1 Equipment

The major equipment to be used in this process is the silo. Three silos are used for the raw material (soybeans), as shown in the lower right portion of the site plan. No special equipment is required for this process. Raw materials are offloaded from the ship, and then placed in silos using material handling equipment.

19.2.2 Risk Assessment

The Risk Assessment for the Silos is shown below.

Table 19-1: Risk assessment for the Silos

No	Revision Date	Process/Activity Unit	Routine (R)/Non-Routine (NR)	Hazard Definition or Source	Risk Definition	Without Necessary Precautions/Impact	Current Situations/Precautions	Risk Assessment for Current Position			Engineering Control	Administrative Control	Risk Assessment After Necessary Precautions Taken					
								Severity	Probability	Risk			Severity	Probability	Risk	Oppurtunity	Risk Responsee	Residual Reduction %
1		Silos Area	RO	Dust Explosion, Fire	Dust collected in exposed sockets in the area above the silo may cause fire by ignition. Dust in silos may ignite as a result of heating the product. Hot work around silos may cause hot surfaces. Lightning strikes on silos	Injury, Fatality	1- It is forbidden to use sparking equipment, mobile phone, smoking, etc. in the unit. 2-Entry and exit to the unit are controlled and unauthorized persons are not allowed to enter. 3-Unit electrical equipment, cables, etc. other equipment has been chosen as dust-proof material. 4-The staff are informed about the OHS rules that should be applied in the unit during routine OHS trainings. 6- In hot work works that may occur in the unit, dust measurement is made with the hot work permit and the necessary precautions are taken. 7- Lightning rod will be placed to protect the silo area from lightning.	5	3	15	1-The unit will continue to work with EX ambient operating conditions. 2-Detector controls and calibrations will continue to be checked.	1- In the periodic OHS training, information about the rules to be followed in the work done in a dusty environment will continue.	5	2	10	Financial loss that may occur in the event of a possible fire & explosion is prevented.		33.3%
2		Silos Area	R	Ignition inside conveyor system	Ignition as a result of static electricity or wrong material selection of elevators. ignition caused by stray electric currents , sparks caused by metal parts which can remain in the material , hot works resulting in hot surfaces	Injury, Fatality,Fire	1-To ensure that the metal parts are held with the magnetic holder. 2-When maintenance and repairs are to be made on the lines, the lines are emptied, the product flow is interrupted and work is carried out after the cooling processes. 3- Necessary grounding works and measurements are made and precautions are taken. 4-Elevators used in silos are antistatic. 5-Continuous cleaning of the elevator pit is recorded with a control form.	4	3	12	1-Magnetic holders will be maintained continuously. 2-Regular grounding measurements will be made and reported. 3-Cleaning of the elevator pit will continue to be done periodically.	1-Staff will continue to be informed about the rules to be followed in hot areas during routine training.	4	2	8			33.3%
3		Silos Area	R	Walkways, platforms, stairs (highgrounds)	The risk of workers falling from a height in high areas during work	Injury, Fatality	1-The floors of the platforms and stairs used in the silo are generally without gaps and have railings at a height in accordance with the standard. Deficiencies have been identified at some points. 2- In inappropriate situations such as possible malfunctions of the platform and stairs on which you can walk, the maintenance team is informed and the work is stopped, and the work continues after the improvements are made. 3-Regular cleaning is done on the platforms and stairs.	5	3	15	1-Regular checks and cleanings will continue on the relevant equipment. 2-In the case of working on fragile roofs or WAH without guardrails, getting a WAH permit to work is obligatory, and using the safety harness is obligatory. 3-In case there is no suitable anchorage point for work at height, baskets, men lifts or scaffolding in accordance with standards, etc.	1-Any non-conformities that may occur on the platforms will be reported to the unit supervisor by the workers and measures will be taken. 2-Periodic OHS training on working at height will be held for the workers on a regular basis,	5	3	15			0.0%

											should be used for Working at height.	and all the hazards should be addressed in TBT. 3-The safe working procedure will be reviewed and updated every 3 months or according to the need, To eliminate or decrease the risk of the operation.						
4		Silos Area	RO	Fire	Product, raw material, intermediate product, wastewater pool, chemical, packaging, process waste, material etc. equipment in the unit ignited for various reasons and a fire may occur.	Property damage , injury , fatality	1- Fire training & drills are carried out regularly and irregularly at certain intervals, and the workers are trained and conscious about fire. 2- The fire extinguishers in the unit are checked regularly by the OHS unit every 3 months and an external company every 6 months and recorded. 3- Fire extinguishers are maintained by the authorized company. 4- Fire detection (smoke - heat) and alarm system are available. Improvements should be made for those who are missing and have malfunctions. 5- The operation of fire cabinets and spring system is checked regularly. 6- Smoking is prohibited in the unit and smoking is allowed only in defined areas. 7- Emergency response team lists were posted on various notices and boards of the unit, giving information about contact numbers and the route to be followed in a fire.	5	3	15	1- It will be ensured that flammable, combustible and explosive materials are not kept with ignition sources in the working environment. 2-Periodic fire system compliance checks will continue. In case of non-conformity, necessary corrections will be made. 3- In fire alarm and detection systems, necessary system improvements will be made in the type and number of equipment suitable for the unit.	1- For situations that require spark and heat treatment inside the unit, the Hot Work Permit form procedure will continue to be applied.	5	2	10	Financial loss that may occur in the event of a possible fire & explosion is prevented.		33.3%
5		Silos Area	RO	Ceiling cranes	Objects falling on workers while working with ceiling cranes	Injury, Fatality	1-Annual periodic inspections of overhead cranes are carried out. (Crane rope, hook, motor assembly, load tests, etc.) 2- Necessary maintenance and repair are carried out in unsuitable cases. 3-The operating instructions of the ceiling cranes are hanging in the working area. 4- In the annual OHS trainings, workers are given awareness-raising trainings for the safety use of overhead cranes and lifting equipment.	5	2	10	1-There is no worker under the suspended load of the crane during the operation. 2-Periodic lifting plan update. 3-all lifting needs to have a lifting plan according to the load chart. 4-In case of possible malfunctions, the unauthorized company will be called and the corrections will be continued.	1-Area isolation.	5	1	5			50.0%
6		Silos Area	R	Moving equipment (conveyor, screw conveyor etc.)	The risk of workers contacting the moving parts (belt, pulley, fan, coupling, etc.) of all kinds of machinery, equipment, products and transportation equipment in the unit during operation.	Limb loss, injury, fatality	1-The moving parts of the equipment in the unit have protectors for possible contacts. 2- During operation, it is worked in the position where the protectors are attached. 3-Work is not carried out with equipment which protection has been removed. 4- During maintenance and repair, the energy of the system is cut off and the	5	3	15	1-Periodic maintenance of machinery and equipment will be continued regularly. 2- Improvements will be made in the lines related to the conveyor covers that are kept in the semi-open position.	1-The rules that must be followed when working with the moving equipment in the unit will continue to be given to the workers during	5	2	10			33.3%

							risks of accidents arising from the equipment are eliminated. 5- Periodic controls of the protectors and components are carried out on certain dates. 6-Machine operating instructions are kept on the machine where the workers can see it.					the periodical OHS training. 2-Trainings will be given by the unit supervisors & foremen before starting work and the hazards will be remembered again. 3-Dangling, loose, wide-leg and sleeved clothes, neckties, etc. accessories are not worn, watches, jewellery, necklaces, rings, etc. accessories are not used while working. 1-Safety sign for all moving parts and semi-open mechanical.						
7		Silos Area	RO	Closed areas	Work accident due to exposure of the workers to dust, gas, etc. in the closed area in the silo, oxygen deficiency, etc.	Shortness of breath , Injury , Fatality	1- It is checked whether the worker who will enter the closed area during maintenance and repair works are suitable for indoor work during the employment examination. 2- Workers are informed about indoor work in periodic OHS trainings. 3- Before the start of the work, the closed area work permit form procedure is applied. 4- In indoor work, work cannot be started without providing suitable ventilation and lighting devices. 5- During indoor work, a staff member is constantly kept as an observer. 6- Before starting the work, ambient gases are detected with a gas measuring device. 7- If heat treatment is to be applied indoors, the hot work permit form procedure is applied. 8- Workers are not allowed to enter while the system is active. 9- Workers should use the necessary personal protective equipment (glasses, mask, work shoes) before starting to work indoors.	5	3	15	Before working in a closed area, the hazards will be identified and transferred to the worker and the necessary precautions will be taken and the work will continue.		5	2	10			33.3%
8		Silos Area	R	Dusty Environment	Exposure of workers to dust due to working in dusty conditions	Occupational disease	1-The workers working in the unit use CE certified masks for dust. 2- In case the dust masks are not sufficient, work is carried out with full face masks with PP filters. 3-Tyveck overalls are used to prevent	4	2	8	1-Periodic health checks and tests will continue, and improvements will be made when necessary. 2- The suitability of		4	1	4			50.0%

							dust exposure to the body and work clothes. 4- In the annual OHS trainings, awareness-raising trainings are given to the workers for dust-related occupational diseases. 5- The working environment is selected by considering the suitability of the worker for the job to be done with the employment examination and health examinations. Diseases that may occur due to dust are controlled through annual periodic controls, and remedial measures are taken for possible ailments. 7-Ambient dust measurements are made by accredited organizations.				personal protective equipment used in dust control will be checked and improvements will be made when necessary. 3-Required routine cleaning for dust reduction will continue. 4-The staff will continue to be informed about the dusty environment and its risks during periodic OHS trainings. 5- In their training, the workers will be informed about the dusty environment working conditions and the rules to be followed.							
9		Silos Area	R	Electric panels	The risk of fire that may occur in the electrical panel Exposure of workers to electricity from the switchboard	Financial damage , Injury , Fatality	1-The panels are isolated separately to be isolated from the environment, and the unit's exposure to the dusty environment is considerably reduced. 2-Cool air conditioners are located in some of the panel rooms for hot environment conditions. 3- Ventilation is done with a fan in the panel rooms. 4-There are warning signs on the panel covers. 5-In case of possible malfunctions, an authorized electrician is called, and no intervention is made in the electrical breakdown and maintenance, except the electrician. 6-There are insulating mats under the electrical panels that prevent collision by providing grounding in case of possible leakages. 7-Panel cleaning is done regularly by authorized electricians. 8-Annual electrical controls are carried out by accredited institutions and nonconformities are promptly resolved.	5	2	10	1-Regular maintenance and cleaning of the panels will continue. 2-Panel thermal temperature measurements will be made regularly and measures will be taken for heating conditions. 3-In case of a possible fire, a device will be installed for the automatic extinguishing of the system.	1-In case of possible maintenance failures, a Lokout-Tagout system will be applied to keep the energy of the system off. 2-The necessary information will continue to be given to the workers in the periodic OHS training on electrical hazards and risks.	5	1	5	Within the scope of fire fighting, financial loss that may occur in possible fires is prevented.		50.0%
10		Silos Area	R	Noise	Exposure of personnel to noise in the working environment	Temporary & permanent hearing loss, occupational disease	1-A suitable type of ear protection is used while working in the noisy area. (Ear protectors are given to the person by embezzlement. The personal exposure measurement value has increased to 89 dB, and it is obligatory to use PPE ear protectors. 2-Ambient noise measurement is carried out by accredited companies and compliance with the legislation is checked. 3- In the annual OHS trainings, awareness-raising trainings are given to the workers for occupational diseases related to noise. 4-The working environment is selected by considering the suitability of the	3	2	6	1-Periodic health checks and tests will continue, and improvements will be made when necessary.	1-The staff will continue to be informed about the noisy environment and its risks during periodic OHS training. 2- In their training, the workers will be informed about the noisy environment and working	3	1	3	While reducing exposure to noise reduces the risk of occupational disease, it also reflects positively on the workers in a psychological sense.		50.0%

							worker for the job to be done with the employment examination and health examinations. Diseases that may occur due to noise are controlled through annual periodic controls, and remedial measures are taken for possible ailments.					conditions and the rules to be followed.						
11		Operation Control Room Silos Area	RO	Planned & unplanned maintenance activities	Various accidents that may occur during planned and unplanned maintenance works in the silo	Fire, Explosion, Injury, Fatality	1- The mechanical maintenance unit intervenes in the mechanical failures that occur in the unit. 2- The electrical maintenance unit intervenes in the electrical faults that occur in the unit. 3- In the unit, maintenance and repair are carried out by the unit personnel during the planned maintenance. Work is carried out by taking necessary precautions with hot work permit in cutting, welding, etc. works that may be in planned maintenance. Work is carried out by taking the necessary precautions with a work permit at height. In the works to be carried out in closed areas, the work is carried out by taking the necessary precautions with the permission of the closed area. 4- During the maintenance and repair works carried out in the unit, the energy of the system is cut off during the maintenance of the moving machinery and equipment. 5- Maintenance and malfunction works that are not under the responsibility of the unit staff are not interfered with. 6- In the periodic OHS trainings, trainings are provided to the workers in the routine work performed in maintenance and repair activities (working at height, working with chemicals, working with work equipment, working in closed areas, working with hand tools, etc.) to the extent required by the legislation. 7- Workers are informed about OHS hazards and precautions related to maintenance and repair activities in their training.	5	2	10	Necessary measures will continue to be taken.		5	1	5			50.0%
12			R	Ergonomics	Inconveniences that may occur as a result of long-term use due to ergonomically unsuitable tables and chairs used in automation control rooms	Occupational disease	Equipment suitable for ergonomic conditions is used.	3	2	6	Appropriate equipment will continue to be used. In inappropriate cases workers complaints, etc.), necessary improvement works will be carried out.		3	1	3			50.0%

19.3 Preparation

19.3.1 Equipment

Preparation consists of the following activities, with the following major equipment used:

- Oilseed Scaling and Cleaning: Conveyor system, magnetic separator, sifter, with aspiration system to reduce dust.
- Soybean Conditioning: Conditioning tower to soften and de-water soy, heating of product using low pressure steam, cyclone used to extract impurities in heated air, drying system consisting of heaters. Use of steam from other processes used to reduce heating cost.
- Soybean Cracking, Dehulling and Kernel Fines Recovery: Crackers (primary and secondary), aspirators (primary and secondary) to remove hulls, cyclone to collect hulls and dust, gyratory vibrating screen, and various collectors to separate screen underflow and overtail, which are directed to separate system components. Dust collection is performed at all steps.
- Flaking: Crushed soy kernals conveyed to flaker, consisting of double hydraulic roller.
- Drying and cooling: Heater, feeder, pressing section and discharge to expand flakes, then into a drying cooler.
- Hull Grinding, Addition or Pelleting,Conveying, Storage, and Bagging: Collected hulls ground by Hammer mill, conveyed to storage bins by screw conveyor, and bagged to warehouse. Pelleting may also be selected.
- Meal Crushing, Metering, and Mixing: Meal crusher to eliminate large pieces from the solvent extraction plant, then sieved for grinding or bagging.

- Condensate Water Recovery: Condensate from heating devices collected to flash tank and releasing secondary steam to the conditioning tower, using heat pump technology.

19.3.2 Risk Assessment

The Risk Assessment for the Preparation phase is shown below.

Table 19-2: Risk assessment for the Preparation Unit

No	Revision Date	Process/Activity Unit	Routine (R)/Non-Routine (NR)	Hazard Definition or Source	Risk Definition	Without Necessary Precautions/Impact	Current Situations/Precautions	Risk Assessment for Current Position			Engineering Control	Administrative Control	Risk Assessment After Necessary Precautions Taken					
								Severity	Probability	Risk			Severity	Probability	Risk	Oppurtunity	Risk Responsee	Residual Reduction %
1		Preparation Unit Area	R	Electric panels	The risk of fire that may occur in the electrical panel Exposure of personnel to electricity from the switchboard	1-Multiple Injury. 2-Fatality. 3-Property damage.	The covers of the electrical panels are open. Room temperature is high. Water escapes from an unknown source on the floor of the room and electrical cables are transmitted through the water. There are flammable materials around the panels. Water flows from above to the control and panel parts and dust insulation is insufficient.	5	3	15	1-The inconveniences in the board room will be fixed. 2-In case of possible maintenance failures, a locking-labeling system will be applied to keep the energy of the system off. 3-Panel thermal temperature measurements will be made regularly and measures will be taken for heating conditions. 4-In case of possible fire, a device will be installed for automatic extinguishing of the system.	The necessary information will be implemented to be given to the workers in the periodic OHS trainings on electrical hazards and risks.	5	2	10	job supervisor HSE	job supervisor HSE	33%
2		Preparation Unit Area	R	Moving equipment (conveyors, screw conveyors etc.)	The risk of personnel contacting the moving parts (belt, pulley, fan, coupling, etc.) of all kinds of machinery, equipment, product and seed transport equipment (conveyor, spiral, agitator, crushing machines, flaker, etc.) in the unit during operation.	1-Multiple Injury. 2-Fatality. 3-Limb loss.	1-The moving parts of the equipment in the unit have protectors for possible contacts. 2-Some couplings have a lack of protection. 3-Long conveyor, extraction conveyor, some of the under-conditioner screw conveyor protective covers are open. 4- It has been observed that the covers of the parts where the belt and pulley assembly of the seed crushing and flaker machines are located are left open due to the temperature and the incomplete closing of the covers. 5-The machine operating instructions are kept on the machine where the workers can see it.	5	4	20	All the moving parts will be inside the protections.The risk should be prevented by eliminating the deficiencies and nonconformities.		5	2	10		job supervisor HSE	50%
3		Preparation Unit	R	Walkways, platforms, stairs (highgrounds)	Machinery, equipment (toaster, extractor, etc.) located in high areas during work, the risk of	1-Multiple Injury. 2-Fatality.	1-The floors of the platforms and stairs used are without gaps, and they are surrounded by railings at a height in accordance with the standards.	5	2	10	1-Regular checks and cleanings will implemented on the relevant equipment.	1-Any non-conformities that may occur on the platforms will be	5	1	5		job supervisor HSE	50%

					personnel falling from a height on floors		2- In unsuitable situations such as possible malfunctions of the platform and stairs that can be stood on and walked on, etc., the maintenance team is informed and the work is stopped, and the work implementeds after the necessary improvements are completed. 3-Regular cleaning is done on the platforms and stairs.				2-In the case of working on fragile roofs or WAH without guardrails, getting a WAH permit to work is obligatory, and using the safety harness is obligatory. 3-In case there is no suitable anchorage point for work at height, baskets, men lifts or scaffolding in accordance with standards, etc. should be used for Working at height.	reported to the unit supervisor by the workers and measures will be taken. 2-Periodic OHS training on working at height will be held for the workers on a regular basis, and all the hazards should be addressed in TBT. 3-The safe working procedure will be reviewed and updated every 3 months or according to the need, To eliminate or decrease the risk of the operation.						
4		Preparation Unit Area	NR	Overhead Cranes	Objects falling on personnel while working with overhead cranes	1-Multiple Injury. 2-Fatality.	1-Annual periodic inspections of overhead cranes are carried out. (Crane rope, hook, motor assembly, load tests, etc.) 2- Necessary maintenance and repair are carried out in unsuitable cases. 3-The operating instructions of the overhead cranes are hanging in the working area. 4- In the annual OHS trainings, workers are given awareness-raising trainings for the safety use of overhead cranes and lifting equipment.	5	2	10	1-There is no worker under the suspended load of the crane during the operation. 2-Periodic lifting plan update. 3-all lifting needs to have a lifting plan according to the load chart. 4-In case of possible malfunctions, the unauthorized company will be called and the corrections will be implementedd.	1-Area isolation.	5	1	5		job supervisor HSE	50%
5		Preparation Unit Area	R	Dusty Environment	Exposure of workers to dust due to working in dusty conditions	Occupational disease	1-The personnel working in the unit use CE certified masks for dust. 2- In case the dust masks are not sufficient, work is carried out with full face masks with PP filters. 3-Tyveck overalls are used to prevent dust exposure to the body and work clothes. 4- In the annual OHS trainings, awareness-raising trainings are given to the personnel for dust-related occupational diseases. 5- The working environment is selected by considering the suitability of the personnel for the job to be done with the employment examination and health examinations. 6-Diseases that may occur due to dust are controlled through annual periodic controls, and remedial measures are taken for possible ailments.	4	2	8	1-Periodic health checks and tests will implemented, and improvements will be made when necessary. 2- The suitability of personal protective equipment used in dust control will be checked and improvements will be made when necessary. 3-Required routine cleaning for dust reduction will implemented.	1-In the TBTs, the workers will be informed about the dusty environment working conditions and the rules to be followed. 2-The staff will implemented to be informed about the dusty environment and its risks during periodic OHS training.	4	1	4		job supervisor HSE	50%

							7-Ambient dust measurements are made by accredited organizations.											
6		Preparation Unit Area	R	Noise	Exposure of workers to noise in the working environment	1-Temporary & permanent hearing loss 2-occupational disease	1-A suitable type of ear protection is used while working in the noisy area. (Ear protectors are given to the person by embezzlement.) 2-Ambient noise measurement is carried out by accredited companies and compliance with the legislation is checked. 3- In the annual OHS trainings, awareness-raising trainings are given to the personnel for occupational diseases related to noise. 4-The working environment is selected by considering the suitability of the personnel for the job to be done with the employment examination and health examinations. 5- Diseases that may occur due to noise are controlled through annual periodic controls, and remedial measures are taken for possible ailments.	3	2	6	1-Periodic health checks and tests will implemented, and improvements will be made when necessary.	1-In TBT, the workers will be informed about the noisy environment working conditions and the rules to be followed. 2-The staff will implemented to be informed about the noisy environment and its risks during periodic OHS trainings.	3	1	3		job supervisor HSE	50%
7		Preparation Unit Area	NR	Fire	Product, raw material, intermediate product, wastewater pool, chemical, packaging, process waste, material etc. equipment in the unit ignited for various reasons and a fire may occur.	1-Multiple Injury. 2-Fatality. 3-Property damage.	1- Fire training & drills are carried out regularly and irregularly at certain intervals, and the personnel are trained on fire. 2- The fire extinguishers in the unit are checked regularly by the OHS unit every 3 months and an external company every 6 months and recorded. 3- The maintenance of fire extinguishers is carried out by the authorized company. 4- Fire detection (smoke - heat) and alarm system are available. Improvements should be made for those who are missing and have malfunctions. 5- The operation of fire cabinets and spring system is checked regularly. 6- Smoking is prohibited in the unit and smoking is allowed only in defined areas. 7- Emergency response team lists were posted on various notices and boards of the unit, giving information about contact numbers and the route to be followed in a fire.	5	3	15	1- It should be ensured that flammable and explosive materials are not kept in the working environment. 2- For situations that require spark and heat treatment inside the unit, the Hot Work Permit form procedure should be applied. 3-Periodic fire system compliance checks will implemented. In case of nonconformity, necessary corrections will be made. 4- In fire alarm and detection systems, necessary system improvements should be made in the type and number of equipment suitable for the unit.		5	2	10	By preventing possible fires, financial losses are also prevented.	job supervisor HSE	33%
8		Preparation Unit Area	NR	Planned & unplanned maintenance and repair activities	Various accidents that may occur during planned and unplanned maintenance and repair works in the unit	Fire , Injury , Death	1- The mechanical maintenance unit intervenes in the mechanical failures that occur in the unit. 2- The electrical maintenance unit intervenes in the electrical faults that occur in the unit. 3- In the unit, material maintenance and repair are carried out by the unit workers during planned maintenance. Cutting, welding, etc. that may be in planned maintenance. work is carried out by taking necessary precautions with hot work permit. Work is carried out by taking the necessary precautions with a	5	2	10	1-Necessary measures will continue to be taken. 2-No intervention will be made outside of the authorized staff	1-The staff will continue to be informed about the risks during periodic OHS training	5	2	10		job supervisor HSE	0%

							work permit at height. In the works to be carried out in closed areas, the work is carried out by taking the necessary precautions with the permission of the closed area. 4- During the maintenance and repair works carried out in the unit, the energy of the system is cut off during the maintenance of the moving machinery and equipment. 5- Maintenance and repair works that are not under the responsibility of the unit personnel should not be interfered with. 6- In the periodic OHS trainings, trainings are provided to the workers in the routine work performed in maintenance and repair activities (working at height, working with chemicals, working with work equipment, working in closed areas, working with hand tools, etc.) to the extent required by the legislation. 7- In toolbox trainings, the workers are informed about OHS hazards and precautions related to maintenance and repair activities.											
9		Operation Control Room	R	Ergonomics	Inconveniences that may occur as a result of long-term use due to ergonomically unsuitable tables and chairs used in automation control rooms	Occupational disease	Equipment suitable for ergonomic conditions is used.	3	2	6	Appropriate equipment will implemented to be used. In inappropriate cases workers complaints, etc.), necessary improvement works will be carried out.		3	1	3		job supervisor HSE	50%
10		Stretching the	R	Getting on a truck & working at height	Falling from a height due to slippery ground, tripping, etc. when climbing on the truck for tarpaulin stretching & opening	1-Multiple Injury. 2-Fatality.	1-Places with designated lifelines are used in cases of climbing on a truck. 2-Basic job introduction OHS trainings provide information on the subject. 3-Sampling from tankers is not allowed, except for authorized personnel.	5	2	10	Necessary information and control measures will implemented.		5	1	5		job supervisor HSE	50%
11		Preparation Extraction pass	R	Working in the Ex area without taking precautions	The person who passes from the preparation unit to the extraction facility enters the extraction facility without taking EX area precautions and does inappropriate work	1-Multiple Injury. 2-Fatality.	The waypoint is controlled and locked. Grounding bar is available. Transitions are made only with the knowledge and approval of the preparation facility officials. Warning signs are available.	5	2	10	Necessary information and control measures will implemented.		5	1	5	By preventing possible fires, financial losses are also prevented.	job supervisor HSE	50%

		Probability					Definitions	
		5	4	3	2	1	**Probability**	
Severity	5	25	20	15	10	5	5 - Highly likely	Event is highly likely to occur if controls not in place or adequate.
	4	20	16	12	8	4	4 - Likely	Event is likely to occur if controls not in place or adequate.
	3	15	12	9	6	3	3 - Possible	Event is a very real possibility if controls not in place or adequate.
	2	10	8	6	4	2	2 - Unlikely	Event is unlikely if controls not in place or adequate
	1	5	4	3	2	1	1 - Remote	Very rare event predicted

RED: risk MUST be addressed immediately with suitable and effective control measures or tasks avoided	ORANGE: risk SHOULD be addressed	GREEN: risk acceptable
DARK RED: the activities must stop		

Severity	
5 - Fatal Injury	Multiple or single fatality per event
4 - Severe Injury	• A major fracture of any bone apart from hand, wrist or ankle • Loss of limb or eye • Lost of sight or hearing (permanent) • Acute illness requiring medical treatment •Any injury resulting in unconsciousness requiring hospitalisation.24 hours. • Any injury requiring > 30 days off wor
3 - Major injury	• Fracture of the hand, wrist, or ankle • Unconsciousness • Major burn • Amputation of fingers or toes • Loss of sight or hearing (temporary) • Any injury leading to 3-30 days off work
2 - Minor injury	• Fracture of digits • Strains, scratches, cuts and abrasions • Minor burn • General discomfort • Minor occupational related illness • Occupationally induced allergic reaction • Any injury resulting in < 3 days off work
1 - Superficial	• Very minor or superficial injury where First Aid may be required but no lost time or medical treatment results.

19.4 Extraction

19.4.1 Equipment:

The extraction consists of the following

Extractor System: Flakes are fed by hopper into the extractor using a screw conveyor. In the extractor, a drag chain moves the flakes, flipping them and dropping them to a lower grid tray to a discharge point. Fresh solvent (hexane) is added near the discharge end to form wet meal, which is soaked by miscella. Discharge of solvent to a liquid collection hopper under reduced pressure recycles the solvent. Wet meal is conveyed into the DTDC system. Concentrated micella is cleaned by hydrocyclone, filtered, and stored for future use in the extractor.

DTDC System: The wet meal goes into a pre-desolvent tray, desolvent tray, stripping tray, integration tray, and drying/cooling tray. Direct steam contacts the wet meal to remove the solvent, and hot air is used for drying, followed by cooling using ambient air. Where possible steam and hot air are recycled to increase sustainable practices. Meal powder is separated from waste air using a cyclone. Finished meal is conveyed to the meal warehouse. A cyclone and/or a hot water scrubber will maintain hot air quality for reuse. Recycling of heat, air, moisture is maximized using these processes.

Miscella Evaporation System: Miscella is evaporated using negative pressure, reducing its boiling point to conserve heat. Miscella is buffered and dregs discharged to the upper meal bed of the extractor. Solvent gas from the two evaporators will be sucked into an evaporator condensor. Oil from the evaporators is pumped out, cooled by heat exchanger, and collected.

Solvent Condensation and Water Separation System : Free gas is sucked into the condensers, where the solvent is separated from water. Condensate water flows into waste water collection tank after residual solvent is removed by boiling. The solvent enters the vent condenser for collection.

Vent Gas Adsorption System: Non-condensable gas enters an absorption column for solvent adsorption. Vent gas is discharged to the atmosphere. Solvent oil is then collected for reuse.

Water Degumming System: Gums (lecithin and others) are removed from the soy oil with hydration using shear mixing and centrifuging. Traces of water are removed from the de-gummed oi by vacuum drying. Gums are removed into the oil residue tank, whereas the degummed oil goes to separate tanks. Cooling and drying are accomplished by heat exchanger and steam. Gums containing water are recycled to the DTDC unit for reprocessing.

19.4.2 Risk Assessment

The risk assessment for the extraction process is shown in the following table.

Table 19-3: Risk assessment for the Extraction Process

No	Revision Date	Process/Activity Unit	Routine (R)/Non-Routine (NR)	Hazard Definition or Source	Risk Definition	Without Necessary Precautions/Impact	Current Situations/Precautions	Risk Assessment for Current Position			Engineering Control	Administrative Control	Risk Assessment After Necessary Precautions Taken					
								Severity	Probability	Risk			Severity	Probability	Risk	Oppurtunity	Risk Responsee	Residual Reduction %
1		Extraction Unit Area	R	Chemical factors (Toxic gases and vapors, organic solvents and dusts)	The hexane chemical used in various stages of the process in the extraction unit, reaching a certain concentration level in the process lines, in the equipment, in the unit air environment during the discharge and shipment, coming together with the ignition source and creating combustion and explosion.	1-Multiple Injury. 2-Fatality.	1-The unit has been determined as an Ex-Proof area due to the nature of the chemical used, entrances are controlled by restricting the area. 2-It is forbidden to use sparking equipment, mobile phones, cigarettes and igniting factors in the unit. 3-Entries and exits to the unit are controlled and unauthorized persons are not allowed to enter.. 4-Unit electrical equipment, cables etc. other equipment has been chosen as ex-proof material. 5-MSDS forms indicating the dangers of the hexane chemical in the unit are hung in visible places. 6-The workers are informed about the OHS rules that should be applied in the unit during routine OHS trainings. 7-On-the-job training in the unit workers are reminded of the dangers of hexane. 8-Ex-proof tools and equipment are provided in the unit, and all of the hand tools to be used in maintenance and repair are selected as non-sparking. 9-The pressure values of the equipment (toaster, extractor, etc.) where hexane is in intensive circulation in the unit are regularly checked in the system automation room. 10- Fixed hexane gas detectors are located inside the unit in order to take necessary precautions in case of possible gas leaks in the unit. 1In high temperature works that may occur in the unit, gas measurement is	5	3	15	1-The unit will continue to work with Ex-Proof ambient operating conditions. 2-Hexane detector controls and calibrations will continue. 3-Hexane pipelines and hexane-using equipment are regularly checked for pressure.	1-In the periodic OHS training and TBT 2-SWP must follow the regulations made with hexane chemicals.	5	2	10	The financial loss that may occur in the event of a possible fire & explosion is prevented.	job supervisor HSE	33%

							made with hot work permit and necessary precautions are taken in a gas-free environment. 12-Maintenance and repair work in the unit, hot work, etc. In such cases, the hexane gas in the system is discharged and the operation is started.13-During the filling of the hexane tanks with the arriving vehicle, a limited area is created in the area, lane and warning barges are pulled and unloading is carried out under the supervision of security and OHS personnel.											
2		Extraction Unit Area	R	Hot Surfaces	The risk of personnel coming into contact with hot water, oil, hot lines passing through the extraction unit and hot surfaces in the machine connections.	1-Multiple burns 2-Multiple injury.	1-There are insulations that prevent heat loss in hot lines and reduce the burning effect in contact with the hot surface. 2-When maintenance and repairs are to be made on the lines, the lines are emptied, the product flow is interrupted and work is carried out after the cooling processes.	4	3	12	1-Missing isolations have been completed. 2-TBT should be held periodically. 3-SWP will be updated according to the operation.	1- a safety sign for hot surfaces and hot material.	4	2	8	Steam consumption has been reduced.	job supervisor HSE	33%
3		Extraction Unit Area	R	Walkways, platforms, stairs (highgrounds)	Machinery, equipment (toaster, extractor, etc.) located in high areas during work, the risk of personnel falling from a height on floors	1-Multiple Injury. 2-Fatality.	1-The floors of the platforms and stairs used in the unit are generally without gaps and are surrounded by railings at a height appropriate to the standard. 2- In unsuitable cases such as possible malfunctions of the platform and stairs that are on and walked on, the maintenance team is informed and the works are stopped, and the works are continued after the improvement. 3-Regular cleaning is done on the platforms and stairs. 4- During the maintenance and controls of the cooling tower, railing deficiencies were detected on the passage route and on the stairs. 5- It has been determined that there are openings around the area where the distillation tanks of the extraction unit are located. 6- While checking the level sensor of the extractor feeder pipe, a platform deficiency was detected. 7-During the maintenance of the Meal warehouse, deficiencies were detected in the passageway. 8-Openings were detected in the area of the conveyor at the inlet of the extractor cake. 9-Openings were detected in front of the extractor deposition hydrocyclones. 10-While the Toaster dust cyclones are being maintained, it has been determined that the mobile ladder is insufficient and there is a lack of platform.	5	3	15	1-Regular checks and cleanings will continue on the relevant equipment. 2-In the case of working on fragile roofs or WAH without guardrails, getting a WAH permit to work is obligatory, and using the safety harness is obligatory. 3-In case there is no suitable anchorage point for work at height, baskets, men lifts or scaffolding in accordance with standards, etc. should be used for Working at height.	1-Any non-conformities that may occur on the platforms will be reported to the unit supervisor by the workers and measures will be taken. 2-Periodic OHS training on working at height will be held for the workers on a regular basis, and all the hazards should be addressed in TBT. 3-The safe working procedure will be reviewed and updated every 3 months or according to the need, To eliminate or decrease the risk of the operation.	5	2	10		job supervisor HSE	33%
4		Extraction Unit Area	NR	Fire	Product, raw material, intermediate product, wastewater pool, chemical, packaging, process waste, material	1-Multiple Injury. 2-Fatality. 3-Property damage.	1- Fire trainings are made regularly and irregularly at certain intervals and training and awareness is made to the workers. 2- Fire extinguishing devices found in the unit are regularly checked and recorded	5	3	15	1- It will be ensured that flammable and explosive materials are not kept with ignition sources in the working environment. 2- For situations that		5	2	10	Financial loss that may occur in the event of a possible fire &	job supervisor HSE	33%

					etc. equipment in the unit ignited for various reasons and a fire may occur.		every 6 months. 3- Fire extinguishing devices are maintained by the authorized company. 4- Fire detection (smoke - heat) and notice system is placed. Improvement should be made for those who are missing and malfunction. 5- Fire cabinets and Spring system work are regularly controlled. 6- In the unit, smoking is prohibited only in defined areas. 7- The unit has been given information about the contact numbers and the way to be followed in the fire by hanging the list of emergency intervention team lists on various ads and boards.				require spark and heat treatment inside the unit, the Hot Work Permit is obligatory. 3-Periodic fire system compliance checks will continue. In case of non-conformity, necessary corrections will be made. 4- In fire alarm and detection systems, necessary system improvements will be made in the type and number of equipment suitable for the unit. 5-The surface of the pool will be cleaned on a regular basis for possible hexane leakage in the unit wastewater fattrap pool and fire that may occur due to oil					explosion is prevented.		
5		Extraction Unit Area	NR	Hot steam , oil , water	Exposure of workers to hot steam, oil, water leakage that may occur in the process lines during work	1-Multiple burns 2-Multiple injury.	1-The process line is insulated and closed circuit. Periodic control and maintenance of the lines are carried out. 2- Employees are informed about hot lines in periodic OHS trainings. 3- In TBTs, reminders and warning information are given to the workers. 4- In maintenance and repair works that may occur on the lines, the system is emptied and the source is cut, and the necessary precautions are taken.	3	2	6	Periodic line control and maintenance will be continued.		3	1	3	Steam & heat loss is also prevented by the insulation made on the lines.	job supervisor HSE	50%
6		Extraction Unit Area	NR	Overhead Cranes	Objects falling on personnel while working with overhead cranes	1-Multiple Injury. 2-Fatality.	1-Annual periodic inspections of overhead cranes are carried out. (Crane rope, hook, motor assembly, load tests, etc.) 2- Necessary maintenance and repair are carried out in unsuitable cases. 3-The operating instructions of the overhead cranes are hanging in the working area. 4-In annual OHS trainings, workers are given awareness-raising trainings for the safety use of overhead cranes and lifting equipment. 5-The crane, which has Exproof electrical parts, has been detected and closed for use.	5	2	10	1-There is no worker under the suspended load of the crane during the operation. 2-Periodic lifting plan update. 3-all lifting needs to have a lifting plan according to the load chart. 4-In case of possible malfunctions, the unauthorized company will be called and the corrections will be continued.	1-Area isolation.	5	1	5		job supervisor HSE	50%
7		Extraction Unit Area	R	Moving equipment (conveyors, screw conveyors etc.)	The risk of personnel contacting the moving parts (belt, pulley, fan, coupling, etc.) of all kinds of machinery, equipment, product handling equipment (conveyor, screw conveyor, conditioning pan equipment, condensate tank, etc.)	1-Multiple Injury. 2-Fatality. 3-Limb loss.	1-The moving parts of the equipment in the unit have protectors for possible contacts. 2- During operation, it is worked in the position where the protectors are attached. 3-Work is not carried out with equipment whose protection has been removed. 4- During maintenance and repair, the energy of the system is cut off and the risks of accidents arising from the equipment are eliminated.	5	3	15	1-Periodic maintenance of machinery and equipment will be on regular bases. 2-The rules that must be followed when working with the moving equipment in the unit will continue to be given to the personnel during the periodical OHS training.	1-Safety sign for all moving parts and semi-open mechanical.	5	2	10		job supervisor HSE	33%

					in the unit during operation.		5- Periodic controls of the protectors and components are carried out on certain dates. 6-Machine operating instructions are kept on the machine where the workers can see it. 7- It has been observed that in some of the extraction unit flake inlet conveyor enclosures, the lids are kept in the half-open position due to temperature and product overflow.				3-TBT will be given by the unit supervisors & foremen before starting work and the hazards will be remembered again. 4-Dangling, loose, wide-leg and sleeved clothes, ties, etc. accessories are not worn, watches, jewellery, necklaces, rings etc. accessories are not used while working. 5- Improvements will be made in the lines related to the conveyor covers that are kept in the semi-open position.							
8		Closed Areas in Extraction Unit	NR	Closed Areas	Exposure of the workers to dust, gas, etc., in the production equipment such as tank equipment in the extraction unit, while working indoors, and having a work accident due to oxygen deficiency	1-Shortness of breath 2-Injury 3-Intoxication 4-Fatality.	1- It is checked whether the worker who will enter the closed area during maintenance and repair works is suitable for indoor work during the employment examination. 2- Workers are informed about indoor work in periodic OHS training. 3- Before the start of the work, the closed area work permit form procedure is applied. 4-In indoor work, work cannot be started without providing suitable ventilation and lighting devices. 5- During indoor work, a staff member is constantly kept as an observer. 6- Before starting the work, ambient gases are detected with a gas measuring device. 7- If heat treatment is to be applied indoors, the hot work permit form procedure is applied. 8- Workers are not allowed to enter while the system is active. 9- Personnel should use the necessary personal protective equipment (glasses, mask, work shoes) before starting to work indoors.	5	3	15	1-Ventlation system should be installed. 2-SCBA needs to be used by the worker. 3-A body System will be applied in the confined space working area.	1-A confined space PTW should be used and all control masseur needs to be followed.	5	2	10		job supervisor HSE	33%
9		Meal Grinding Section	R	Dusty Environment	Exposure of workers to dust due to working in dusty conditions	Occupational disease	1-The workers working in the unit use CE certified masks for dust. 2- In case the dust masks are not sufficient, work is carried out with full face masks with PP filters. 3-Tyveck overalls are used to prevent dust exposure to the body and work clothes. 4- In the annual OHS trainings, awareness-raising trainings are given to the workers for dust-related occupational diseases. 5- The working environment is selected by considering the suitability of the worker for the job to be done with the employment examination and health examinations.	4	2	8	1-Periodic health checks and tests will continue, and improvements will be made when necessary. 2- The suitability of personal protective equipment used in dust control will be checked and improvements will be made when necessary. 3-Required routine cleaning for dust reduction will continue. 2-The staff will continue to be informed about the		4	1	4		job supervisor HSE	50%

							Diseases that may occur due to dust are controlled through annual periodic controls, and remedial measures are taken for possible ailments. 7-Ambient dust measurements are made by accredited organizations.				dusty environment and its risks during periodic OHS trainings. 3- In the TBTs, the workers will be informed about the dusty environment working conditions and the rules to be followed.							
10		Extraction Unit Area	R	Electric panels	The risk of fire that may occur in the electrical panel Exposure of personnel to electricity from the switchboard	1-Multiple Injury. 2-Fatality. 3-Property damage.	1-The panels are isolated separately to be isolated from the environment, and the unit's exposure to the dusty environment is considerably reduced. 2-Cool air conditioners are located in some of the panel rooms for hot environment conditions. 3- Mechanical fan are installed in panel rooms. 4-There are warning signs on the panel covers. 5-In case of possible malfunctions, an authorized electrician is called, and no intervention is made in the electrical breakdown and maintenance, except the electrician. 6-There are insulating mats under the electrical panels that prevent collision by providing grounding in case of possible leakages. 7-Panel cleaning is done regularly by authorized electricians. 8-Annual electrical installation controls are carried out by accredited institutions and nonconformities are eliminated.	5	2	10	1-Regular maintenance and cleaning of the panels will continue. 2-In case of possible maintenance failures, a locking-labeling system will be applied to keep the energy of the system off. 3-The necessary information will continue to be given to the workers in the periodic OHS trainings on electrical hazards and risks. 4-Panel thermal temperature measurements will be made regularly and measures will be taken for heating conditions. 5-In case of possible fire, a device will be installed for automatic extinguishing of the system.		5	1	5	Within the scope of fire fighting, financial loss that may occur in possible fires is prevented.	job supervisor HSE	50%
11		Extraction Unit Area	R	Noise	Exposure of workers to noise in the working environment	1-Temporary & permanent hearing loss 2-occupational disease	1-A suitable type of ear protection is used while working in the noisy area. (Ear protectors are given to the person by embezzlement.) If the personal exposure measurement value is 89 dB, it is obligatory to use PPE ear protection. 2-Ambient noise measurement is carried out by accredited companies and compliance with the legislation is checked. 3- In the annual OHS trainings, awareness-raising trainings are given to the workers for occupational diseases related to noise. 4-The working environment is selected by considering the suitability of the worker for the job to be done with the employment examination and health examinations. Diseases that may occur due to noise are controlled through annual periodic controls, and remedial measures are taken for possible ailments.	3	2	6	1-Periodic health checks and tests will continue, and improvements will be made when necessary.	1-In the TBTs, the staff will be informed about the noisy environment and working conditions and the rules to be followed. 2-The staff will continue to be informed about the noisy environment and its risks during periodic OHS training.	3	1	3	While reducing exposure to noise reduces the risk of occupational disease, it also reflects positively on the workers in a psychological sense.	job supervisor HSE	50%

12		Extraction Unit Area	NR	Planned & unplanned maintenance and repair activities	Various accidents that may occur during planned and unplanned maintenance and repair works in the unit	1-Fire. 2-Explosion. 3-Multiple Injury. 4-Fatality.	1- The mechanical maintenance unit intervenes in the mechanical failures that occur in the unit. 2- The electrical maintenance unit intervenes in the electrical faults that occur in the unit. 3- In the unit, material maintenance and repair are carried out by the unit workers during planned maintenance. Cutting, welding, etc. that may be in planned maintenance. work is carried out by taking necessary precautions with hot work permit. Work is carried out by taking the necessary precautions with a work permit at height. In the works to be carried out in closed areas, the work is carried out by taking the necessary precautions with the permission of the closed area. 4- During the maintenance and repair works carried out in the unit, the energy of the system is cut off during the maintenance of the moving machinery and equipment. 5- Maintenance and repair works that are not under the responsibility of the unit personnel should not be interfered with. 6- In the periodic OHS trainings, trainings are provided to the workers in the routine work performed in maintenance and repair activities (working at height, working with chemicals, working with work equipment, working in closed areas, working with hand tools, etc.) to the extent required by the legislation. 7- In toolbox (on-the-job) trainings, the personnel are informed about OHS hazards and precautions related to maintenance and repair activities.	5	2	10	1-Necessary measures will continue to be taken. 2-No intervention will be made outside of the authorized staff	1-The staff will continue to be informed about the risks during periodic OHS training	5	1	5		job supervisor HSE	50%
13		Operation Control Room	R	Ergonomics	Inconveniences that may occur as a result of long-term use due to ergonomically unsuitable tables and chairs used in automation control rooms	1-Occupational disease. 2-Peripheral neuropathy	Equipment suitable for ergonomic conditions is used.	3	1	3	Appropriate equipment will continue to be used. In inappropriate cases (personnel complaints, etc.), necessary improvement works will be carried out.		3	1	3		job supervisor HSE	0%

19.5 Meal Warehouse

19.5.1 Equipment

No special equipment required for this facility.

19.5.2 Risk Assessment

The risk assessment for the meal warehouse is shown below.

Table 19-4: Risk assessment for the Meal Warehouse

No	Revision Date	Process/Activity Unit	Routine (R)/Non-Routine (NR)	Hazard Definition or Source	Risk Definition	Without Necessary Precautions/Impact	Current Situations/Precautions	Risk Assessment for Current Position			Engineering Control	Administrative Control	Risk Assessment After Necessary Precautions Taken					
								Severity	Probability	Risk			Severity	Probability	Risk	Oppurtunity	Risk Responsee	Residual Reduction %
1		Meal Warehouse	R	Walkways, platforms, stairs (higher areas)	The risk of workers falling from a height on machine floors located in high areas during operation	1-Multiple Injury. 2-Fatality.	1-The floors of the platforms and stairs used are generally without gaps and have railings at a height in accordance with the standard. However, there are deficiencies at some points and improvement is required. 2- It has been determined that the functionality of the railing of the sailor's ladder in the southwest corner of the K1 warehouse is impaired. 3- It has been determined that the catwalk connected to the conveyor in the K3 warehouse has a lack of guardrail. 4- It has been determined that the functionality of the railing of the sailor's ladder leading to the K4 warehouse control room is impaired. 5- In unsuitable situations such as possible malfunctions of platforms and stairs that are on and walked on, the maintenance team is informed and the work is stopped, and the work continues after the improvement. 6- Regular cleaning is done on platforms and stairs.	5	3	15	1-The necessary deficiencies have been eliminated and the environmental conditions have been improved. 2-Routine controls should be implemented.	1-Information about working at height will continue to be given to the personnel in periodic OHS training.	5	2	10		job supervisor HSE	33.33 %
2		Meal Warehouse	NR	Piles of Stored Meal	Falling of meal on workers for various reasons	1-Multiple Injury. 2-Fatality.	1-There are warning signs in the working environment. 2-Personnel are given training on the subject at regular intervals. 3- No work is done near high piles. 4- Efforts are made to deliver the products without reaching high heights in the warehouse.	5	2	10	Routine controls will continue.	1-Necessary precautions and periodic training will be continued.	5	1	5		job supervisor HSE	50.00 %

3		Meal Warehouse	R	Use of motor vehicles, transport and roads	During the use of motor vehicles, the risk of hitting the frames of the warehouse entrance door, the columns in the middle of the warehouse if any, and hitting vehicles and / or people while leaving the warehouse.	1-Multiple Injury. 2-Fatality.	1-Operators using motor vehicles are given specific training within the basic induction training. 2-The operability of the lighting and signaling equipment of the vehicles is controlled by the operators while taking over the shift, 3-Training and instruction were given to use audio and visual signaling equipment at the entrance and exit of the warehouse.	5	2	10	1- If there are door frames and middle columns of the warehouses, they should be intervened with various determining substances and the attention of the operators and drivers should be drawn. 2- Pedestrian and equipment paths around the meal stores should be made clear.	1-The frequency of training on this subject should be evaluated, and if necessary, it should be increased. 2-It should be ensured that non-authorized personnel do not pass through the entrance and exit parts of the warehouse.	5	1	5		job supervisor HSE	50.00 %
4		Meal Warehouse	R	Falling from highgrounds	The possibility of the drivers falling from the truck while pulling the tent.	1-Multiple Injury. 2-Fatality.	1- Drivers are provided to read and sign the OHS instructions before they are taken into the facility area. 2-A life line has been established as a security measure in the tent towing area in the mentioned place. 3-The driver wears the seat belt attached to the lifeline and goes out to pull the tent. Relevant lifeline equipment is periodically checked by the authorized company and also regularly maintained.	5	2	10	Work environment controls and equipment maintenance will continue regularly. Drivers will continue to be informed.		5	1	5		job supervisor HSE	50.00 %
5		Meal Warehouse	R	Electric panels	The risk of fire that may occur in the electrical panel Exposure of personnel to electricity from the switchboard	1-Multiple Injury. 2-Fatality. 3-Property damage.	1-Panels are separated to be isolated from the environment. 2-Cool air conditioners are located in some of the panel rooms for hot environment conditions. 3-There are warning signs on the panel covers. 4-In case of possible malfunctions, an authorized electrician is called, and no intervention is made in the electrical breakdown and maintenance, except the electrician. 5-There are insulating mats under the electrical panels that prevent collision by providing grounding in case of possible leaks. 6-Panel cleaning is done regularly by authorized electricians. 7-Annual electrical installation controls are carried out by accredited institutions and nonconformities are eliminated.	5	3	15	1-Regular maintenance and cleaning of the panels will continue. 2-In case of possible maintenance failures, a Lockout - Tagout system will be applied to keep the energy of the system off. 3-Panel thermal temperature measurements will be made regularly and measures will be taken for heating conditions. 4-In case of a possible fire, a device will be installed for the automatic extinguishing of the system.	1-The necessary information will continue to be given to the workers in the periodic OHS training on electrical hazards and risks.	5	2	10		job supervisor HSE	33.33 %
6		Meal Warehouse	NR	Fire	Product, raw material, chemical, packaging, process waste, materials etc. equipment in the warehouses ignite for various reasons and cause a fire.	1-Multiple Injury. 2-Fatality. 3-Property damage.	1- Fire extinguishers in the unit are regularly checked and recorded by the OHS unit every 3 months, and an external company every 6 months. 2-Fire extinguishers are maintained by the authorized company. 3- Fire detection (smoke - heat) and alarm system are available. Improvements should be made for those who are missing and have malfunctions. 4- The operation of fire cabinets and spring system is checked regularly. 5- Smoking is prohibited in the unit, and smoking is allowed only in defined areas. 6- Emergency response team lists were posted on various notices and boards of	5	3	15	1- It will be ensured that flammable, combustible and explosive materials are not kept with ignition sources in the working environment. 2-Periodic fire system compliance checks will continue. In case of non-conformity, necessary corrections will be made. 3- In fire alarm and detection systems, necessary system	1- For situations that require spark and heat treatment inside the unit, the Hot Work Permit form procedure will continue to be applied.	5	2	10	Material damage is prevented by preventing fire.	job supervisor HSE	33.33 %

							the unit, giving information about contact numbers and the route to be followed in a fire.				improvements will be made in the type and number of equipment suitable for the unit. 4-The transportation and cooling processes of the wastes that may cause a fire in the unit will continue without waiting for a long time in the unit.							
7		Meal Warehouse	R	Noise	Exposure of personnel to loud operating noises of fossil fuel vehicles	1-Temporary & permanent hearing loss 2-Occupational disease	1-A suitable type of ear protection is used while working in the noisy area. (Ear protectors are given to the workers by embezzlement.) 2-Ambient noise measurement is carried out by accredited companies and compliance with the legislation is checked. 3- In the annual OHS trainings, awareness-raising trainings are given to the workers for occupational diseases related to noise. 4-The working environment is selected by considering the suitability of the worker for the job to be done with the employment examination and health examinations. Diseases that may occur due to noise are controlled through annual periodic controls, and remedial measures are taken for possible ailments.	3	2	6	Periodic health checks and tests will continue, and improvements will be made when necessary.	1-The staff will continue to be informed about the noisy environment and its risks during periodic OHS training. 2- In the TBTs, the staff will be informed about the noisy environment and working conditions and the rules to be followed.	3	1	3	In addition to preventing occupational diseases by reducing noise exposure, it positively affects the psychological mood of the workers.	job supervisor HSE	50.00 %
8		Meal Warehouse	R	Use of motor vehicles, transport and roads	Occupational accidents that may occur if the personnel do not use the walking paths	Injury , death	1-Walking and equipment working areas have been determined in the warehouse and on the field. 2- Necessary instructions and informative information (signboards, written announcements, etc.) regarding the use of the walking paths by the personnel were provided. 3-The staff were trained on the subject and supported with TBTs.	5	2	10	Areas for vehicles and pedestrians will be clearly identified and inspected.	Training and warnings will be provided.	5	1	5		job supervisor HSE	50.00 %
9		Meal Warehouse	NR	Untrained & unconscious personnel	Exposure of personnel to inconveniences and work accidents due to fast work	1-Multiple Injury. 2-Occupational disease.	1-Workers have been trained not to act hastily and carelessly during work in unnecessary situations. 2-Workers have been warned to avoid working at a speed that will exceed their working capacity.	4	2	8	Areas for vehicles and pedestrians will be clearly identified and inspected.	Training and warnings will be provided.	4	1	4		job supervisor HSE	50.00 %
10		Meal Warehouse	R	Dusty Environment	Exposure of workers to dust due to working in dusty conditions	Occupational disease	1-The staff working in the unit use CE certified masks for dust. 2- In case the dust masks are not sufficient, work is carried out with full face masks with PP filters. 3-Tyveck overalls are used to prevent dust exposure to the body and work clothes. 4- In the annual OHS trainings, awareness-raising trainings are given to the workers for dust-related occupational diseases. 5- The working environment is selected by considering the suitability of the worker for the job to be done with the	4	2	8	1-Periodic health checks and tests will continue, and improvements will be made when necessary. 2- The suitability of personal protective equipment used in dust control will be checked and improvements will be made when necessary. 3-Required routine cleaning for dust reduction will continue.	1-The staff will continue to be informed about the dusty environment and its risks during periodic OHS training. 2- In the TBTs, the workers will be informed about the dusty environment	4	1	4		job supervisor HSE	50.00 %

							employment examination and health examinations. Diseases that may occur due to dust are controlled through annual periodic controls, and remedial measures are taken for possible ailments. 7-Ambient dust measurements are made by accredited organizations.					working conditions and the rules to be followed.						

19.6 Boilers

19.6.1 Equipment

Three LFO-powered, fire tube boilers of 20 ton steam/hr each (20MW each). Two working at any time; third is back-up.

19.6.2 Risk Assessment

The risk assessment for the boilers is shown below.

Table 19-5: Risk assessment for the Preparation Unit

No	Revision Date	Process/Activity Unit	Routine (R)/Non-Routine (NR)	Hazard Definition or Source	Risk Definition	Without Necessary Precautions/Impact	Current Situations/Precautions	Risk Assessment for Current Position			Engineering Control	Administrative Control	Risk Assessment After Necessary Precautions Taken					
								Severity	Probability	Risk			Severity	Probability	Risk	Oppurtunity	Risk Responsee	Residual Reduction %
1		Boiler Unit Area	NR	Fire	The product, raw material, intermediate product, wastewater pool, chemical, packaging, process waste, material etc. in the unit.	1-Multiple Injury. 2-Fatality. 3-Property damage.	1- Fire training exercises are carried out regularly and irregularly at certain intervals, and the personnel are trained on fire. 2- The fire extinguishers in the unit are checked regularly by the OHS unit every 3 months and an external company every 6 months and recorded. 3- Fire extinguishers are maintained by the authorized company. 4- Fire detection (smoke - heat) and alarm system are available. Improvements should be made for those who are missing and have malfunctions. 5- The operation of fire cabinets and spring system is checked regularly. 6- Smoking is prohibited in the unit and	5	2	10	1- It will be ensured that flammable, combustible and explosive materials are not kept with ignition sources in the working environment. 3-Periodic fire system compliance checks will continue. In case of non-conformity, necessary corrections will be made. 3- In fire alarm and detection systems, necessary system improvements will be made in the type and number of equipment	1-For situations that require spark and heat treatment inside the unit, the Hot Work Permit form procedure will continue to be applied.	5	1	5	Material losses are prevented.	job supervisor HSE	50.0%

							smoking is allowed only in defined areas. 7- Emergency response team lists were posted on the notices and boards of the unit, giving information about contact numbers and the route to be followed in case of fire.				suitable for the unit. 4-The transportation and cooling processes of the wastes that may cause a fire in the unit will continue without waiting for a long time in the unit.							
2		Boiler Unit Area	R	Dusty Environment	Exposure of workers to dust due to working in dusty conditions	Occupational disease	1-The workers working in the unit use CE certified masks for dust. 2- In case the dust masks are not sufficient, work is carried out with full face masks with PP filters. 3-Tyveck overalls are used to prevent dust exposure to the body and work clothes. 4- In the annual OHS trainings, awareness-raising trainings are given to the workers for dust-related occupational diseases. 5- The working environment is selected by considering the suitability of the workers for the job to be done with the employment examination and health examinations. Diseases that may occur due to dust are controlled through annual periodic controls, and remedial measures are taken for possible ailments.	4	2	8	1-Periodic health checks and tests will continue, and improvements will be made when necessary. 2- The suitability of personal protective equipment used in dust control will be checked and improvements will be made when necessary. 3-Required routine cleaning for dust reduction will continue.	1-The staff will continue to be informed about the dusty environment and its risks during periodic OHS training. 2- In the TBTs, the personnel will be informed about the dusty environment working conditions and the rules to be followed.	4	1	4		job supervisor HSE	50.0%
3		Boiler Unit Area	R	Mobile access equipment (Ladders, platforms)	Risk of workers contacting all kinds of machinery, equipment, products, moving parts (belt, pulley, fan, coupling, etc.) in the unit during operation.	1-Multiple Injury. 2-Fatality. 3-Lumb loos.	1-The moving parts of the equipment in the unit have protectors for possible contacts. 2- During operation, it is worked in the position where the protectors are attached. 3-Work is not carried out with equipment whose protection has been removed. 4- During maintenance and repair, the energy of the system is cut off and the risks of accidents arising from the equipment are eliminated. 5- Periodic controls of the protectors and components are carried out on certain dates. 6-Machine operating instructions are kept on the machine where the workers can see it.	5	3	15	1-Periodic maintenance of machinery and equipment will be continued regularly. 2-The SWP that must be followed when working with the moving equipment in the unit will continue to be given to the personnel during the periodical OHS training. 4-Dangling, loose, wide-leg and sleeved clothes, ties, etc. accessories are not worn, watches, jewellery, necklaces, rings, etc. do not use accessories while working.	1-TBTs will be given by the unit supervisors & foremen before starting work and the hazards will be remembered again.	5	2	10		job supervisor HSE	33.3%
4		Boiler Unit Area	R	Electric panels	The risk of fire that may occur in the electrical panel Exposure of personnel to electricity from the switchboard	1-Multiple Injury. 2-Fatality. 3-Property damage.	1-The panels are isolated separately to be isolated from the environment, and the unit's exposure to the dusty environment is considerably reduced. 2-Cool air conditioners are located in some of the panel rooms for hot environment conditions. 3- Ventilation is done with a fan in the panel rooms. 4-There are warning signs on the panel covers. 5-In case of possible malfunctions, an authorized electrician is called, and no external intervention is made to electrical malfunctions and maintenance. 6-There are insulating mats under the electrical panels that prevent collision by	5	3	15	1-Regular maintenance and cleaning of the panels will continue. 2-In case of possible maintenance failures, a locking-labelling system will be applied to keep the energy of the system off. 3-Panel thermal temperature measurements will be made regularly and measures will be taken for heating conditions. 4-In case of a possible fire, a device will be	1-The necessary information will continue to be given to the personnel in the periodic OHS trainings on electrical hazards and risks.	5	2	10		job supervisor HSE	33.3%

							providing grounding in case of possible leakages. 7-Panel cleaning is done regularly by authorized electricians. 8-Annual electrical installation controls are carried out by accredited institutions and nonconformities are promptly resolved.				installed for the automatic extinguishing of the system							
5		Boiler Unit Area	R	Hot steam	Exposure of workers to hot steam and water leakage that may occur in boiler lines during work.	Multiple Injury.	1-The process line is insulated and closed circuit. Periodic control and maintenance of the lines are carried out. 2- Employees are informed about hot lines in periodic OHS trainings. 3- In TBTs, reminders and warning information are given to the workers. 4- In maintenance and repair works that may occur on the lines, the system is emptied and the source is cut, and the necessary precautions are taken.	3	2	6	Periodic line control and maintenance will continue.		3	1	3		job supervisor HSE	50.0%
6		Boiler Unit Area	R	Hot surfaces	The risk of the workers contacting the hot water, steam, etc. hot lines passing through the boiler room and the hot surface in the machinery equipment.	1-Multiple burns 2-Multiple injury.	1-There are insulations that prevent heat loss in hot lines and reduce the burning effect in contact with the hot surface. 2-When maintenance and repairs are to be made on the lines, the lines are emptied, the product flow is interrupted and work is carried out after the cooling processes.	4	3	12	Incomplete and/or damaged insulations will be completed.	Staff will continue to be informed about the rules to be considered in hot areas during routine training and TBT.	4	2	8	Steam consumption is reduced.	job supervisor HSE	33.3%
7		Boiler Unit Area	NR	Walkways, platforms, stairs (higher areas)	The risk of workers falling from a height on machine floors located in high areas during operation	1-Multiple Injury. 2-Fatality.	1-The floors of the platforms and stairs used are generally without gaps, and they are surrounded by railings at a height in accordance with the standard. 2- In cases such as possible malfunctions of the platform and stairs on which one can walk and stand on height, etc., the maintenance team is informed and the works are stopped, and the works are continued after the improvement. 3-Regular cleaning is done on the platforms and stairs.	5	2	10	1-The necessary deficiencies should be eliminated and the environmental conditions should be improved. 2-Routine controls should be continued.	1-Information about working at height will continue to be given to the workers in periodic OHS training.	5	1	5		job supervisor HSE	50.0%
8		Boiler Unit Area	NR	Steam Boilers	Explosion of steam boilers	1-Multiple Injury. 2-Fatality.	1-Pressure is controlled with a manometer. 2-The suitability of the boiler is confirmed by annual periodic controls, and necessary measures are taken in inappropriate cases. 3-In case of excessive pressure rise, there are safety valves that will discharge the excess pressure in the system. 4-System pressure is continuously controlled by the operator from the automation room.	5	2	10	1-Checking the suitability of the system and making improvements when necessary will continue. 2-Full-empty sensor will be added to prevent high pressure, the boiler will not work when it is empty.	1-Informative training on the subject will be continued in the annual periodical OHS training.	5	1	5		job supervisor HSE	50.0%
9		Boiler Unit Area	R	Planned and unplanned maintenance and repair activities	Various accidents that may occur during planned and unplanned maintenance and repair works in the unit	1-Multiple Injury. 2-Fatality. 3-Fire.	1- The mechanical maintenance unit intervenes in the mechanical failures that occur in the unit. 2- The electrical maintenance unit intervenes in the electrical faults that occur in the unit. 3- In the unit, material maintenance and repair is carried out by the unit personnel during planned maintenance. Work is carried out by taking necessary precautions with hot work permit in cutting, welding, etc. works that may be	5	2	10	1-Necessary measures will continue to be taken. 2-No intervention will be made outside of the authorized staff	1-The staff will continue to be informed about the risks during periodic OHS training	5	1	5		job supervisor HSE	50.0%

							in planned maintenance. Work is carried out by taking the necessary precautions with a work permit at height. In the works to be carried out in closed areas, the work is carried out by taking the necessary precautions with the permission of the closed area. 4- During the maintenance and repair works carried out in the unit, the energy of the system is cut off during the maintenance of the moving machinery and equipment. 5- Maintenance and repair works that are not under the responsibility of the unit personnel are not interfered with. 6- In the periodic OHS trainings, trainings are provided to the personnel in the routine works performed in maintenance and repair activities (working at height, working with chemicals, working with work equipment, working in closed areas, working with hand tools, etc.) to the extent required by the legislation. 7- In TBTs, workers are informed about OHS hazards and precautions related to maintenance and repair activities.										
10		Boiler Unit Area	R	Lighting	Insufficient lighting in the work area	Multiple Injury.	1-Lighting measurements were made in the relevant area and it was determined that it was in a suitable condition. 2- Improper and insufficient lighting is taken into the agenda in the board meetings and improvements are made. 3- Measurements are made by the electricity unit with a luxmeter according to the need, and corrections are made in accordance with the legislation.	3	2	6	1-Working environment lighting status control will be continued and necessary corrections and improvements will be made according to the needs. 2- In case of environmental conditions change due to unit expansion, machine equipment change, etc., the lighting measurement will be revised and action will be taken.		3	1	3		job supervisor HSE	50.0%
11		Boiler Unit Area	R	Toxic gases	Poisoning of the workers by the smoke emerging at the place where it is poured due to the continuation of burning from the fuel, gas, etc. wastes used in the boiler room.	1-Multiple Injury. 2-Fatality.	1-Fixed gas detectors are located in the unit. 2-There are embezzled gas masks for the personnel to use in case of possible leaks. 3- With periodic OHS trainings, personnel are trained about personal exposure and protection measures against possible poisoning hazards.	5	2	10	Necessary measures will continue to be taken.		5	1	5		job supervisor HSE	50.0%
12		Rever Osmosis & Water Treatment	R	Chemicals	Workers contacting the chemicals used	1-Multiple burns 2-Multiple injury. 3-Eye Irritation.	1- While working with chemicals, necessary precautions are taken by reading the MSDS, which gives information about the hazards of the chemical. MSDSs are hung in the working areas. 2-Chemical-appropriate PPE (full protective goggles, visor, chemical-resistant overalls and gloves) is used. 3- In periodic OHS trainings, information about the hazards of chemicals and	4	2	8	Necessary information and controls will continue to be made.		4	1	4		job supervisor HSE	50.0%

							protection measures is given to the personnel. 4-Emergency eye & body showers, isotonic and diphoterine eyewashes are located in various parts of the units in case of exposure to chemicals.										

19.7 Wastewater

19.7.1 Equipment

Wastewater treatment is described in Section Water Quality Management. For wastewater treatment, the untreated water will undergo equalization, flocculation, DAF treatment, MBBR (moveable bed bio-reactor) treatment, filtration, and then be stored and/or discharged.

19.7.2 Risk Assessment

The risk assessment for the wastewater treatment is shown below.

Table 19-6: Risk assessment for the Wastewater Treatment Unit

No	Revision Date	Process/Activity Unit	Routine (R)/Non-Routine (NR)	Hazard Definition or Source	Risk Definition	Without Necessary Precautions/Impact	Current Situations/Precautions	Risk Assessment for Current Position			Engineering Control	Administrative Control	Risk Assessment After Necessary Precautions Taken					
								Severity	Probability	Risk			Severity	Probability	Risk	Oppurtunity	Risk Responsee	Residual Reduction %
1		Waste Water Area	R	Hot steam , oil , water	Exposure of workers to hot steam, oil, water leakage that may occur in the treatment plant during work	Burning	1-The process line is insulated and closed circuit. Periodic control and maintenance of the lines are carried out. However, a lack of isolation was detected by acid oil production. 2- Employees are informed about hot lines in periodic OHS trainings. 3- In TBTs, reminders and warning information are given to the workers. 4- In maintenance and repair works that may occur on the lines, the system is emptied and the welding is cut, and the necessary precautions are taken.	4	3	12	The missing insulation has been completed. Necessary measures will continue to be taken		3	2	6	Steam consumption has been reduced.	job supervisor HSE	50%
2		Waste Water	R	Pumps	Exposure of workers to moving parts while	1-Limb loss	1-The equipment has a protector. 2-Work is not carried out with	4	2	8	Checking the suitability of	periodic OHS training on the	4	1	4		job supervisor HSE	50%

					working with equipment such as pumps, etc.	2-Multiple Injuries.	equipment that does not have a protective device. 3- In periodic OHS trainings, trainings are provided for the safe use of work equipment.				equipment and informative.	subject will continue.						
3		Waste Water Area	R	Treatment pools (balancing, DAF, aeration, fattrap, final settling)	Falling into the pool due to slipping etc.	1-Multiple Injuries. 2-Fatality. 3-Choking	1-There are guardrails around the pools. 2-Regular and periodic cleaning is carried out. 3-There is a life buoy for emergencies and a lifeline to avoid falling.	5	2	10	Routine checks and necessary improvements regarding the suitability of the business environment will be continued.	The staff will be told about the dangers of pools in TBTs.	5	1	5		job supervisor HSE	50%
4		Waste Water Area	R	Electric panels	The risk of fire that may occur in the electrical panel Exposure of personnel to electricity from the panel	1-Multiple Injuries. 2-Fatality. 3-Property damage.	1-It has been observed that the main electrical panel of the system is quite old, there is too much cable assembly inside, and the cables are transmitted in a mixed manner. 2- Some of the pumps are intervened from inside the panel, it has been observed that the transmitted cables pass near the watery areas. 3-There are warning signs on the panel covers. 4-In case of possible malfunctions, an authorized electrician is called, and no intervention is made in the electrical breakdown and maintenance, except the electrician. 5-Panel cleaning is done regularly by authorized electricians. 6-Annual electrical installation controls are carried out by accredited institutions and nonconformities are promptly resolved.	5	4	20	1-A new panel room was built together with the new treatment plant, the surrounding of the panel room was away from the indoor pool, the manual intervention was eliminated, and the relevant places were isolated. 2-Panel thermal temperature measurements will be made regularly and measures will be taken for heating conditions. 3-In case of a possible fire, a device will be installed for the automatic extinguishing of the system.	1-A Lockout/Tagout system is applied in the panels, which will keep the energy of the system off in case of possible maintenance failures. 2-The necessary information will continue to be given to the personnel in the periodic OHS training on electrical hazards and risks.	5	2	10	Electricity consumption has been reduced.	job supervisor HSE	50%
5		Waste Water Area	R	Pumps (submersible , gear , air diaphragm , dosage)	Intervention and exposure of the personnel to the electrical and moving parts of the pumps used during the work	1-Multiple Injuries. 2-Fatality.	There is a protector, the electrical system is in good condition.	5	2	10	The control of the suitability of the equipment will continue.	Information on the subject will be given in TBTs.	5	1	5		job supervisor HSE	50%
6		Chemical Treatment	R	Chemical factors (Toxic gases and vapors, organic solvents and dusts)	Chemical exposure to the personnel in case of leaks in the sulfuric acid and caustic supply lines to the DAF pool.	Skin burn, temporary-permanent blindness	There are leaks at some points of the acid lines. Personnel use appropriate personal protective equipment while working with related chemicals in the field.	4	4	16	Existing leaks in the lines are eliminated and the lines are checked periodically to prevent possible leaks.		4	2	8	Chemical consumption is reduced.	job supervisor HSE	50%
7		Chemical Treatment	NR	Chemical factors (Toxic gases and vapors, organic solvents and dusts)	Chemical splashes on personnel during activities performed during chemical discharge (caustic, sulfuric acid)	1-Skin burn 2-Multiple Injuries.	During loading, workers use PPE.	4	2	8	In the unloadings, the truck drivers are given more information by warning them, and the PPE is temporarily delivered for the drivers to use.		4	1	4		job supervisor HSE	50%
8		Waste Water Area	R	Slippery ground	The slipping and falling of the personnel due to the slippery working environment for various reasons.	1-Multiple Injuries. 2-Fatality.	1-The lines throughout the facility are positioned as insulated and closed circuit in order to prevent the products from spilling due to slippage. 2-An attempt is made to improve the slippery environment by performing routine cleaning in the unit. 3- In environments with slippery floors, the staff is warned with a slippery floor warning sign.	5	2	10	1-Looking at the dirtiness and slipperiness of the floor, routine cleaning and controls will continue, and slippery floor conditions will continue to be reduced.	1-The staff will continue to be informed about the rules to be considered in slippery working conditions during periodic	5	1	5	Environmental cleanliness is increased.	job supervisor HSE	50%

											2-Staff use non-slip work shoes.	OHS training. 2- Reminding information about slippery environment conditions will continue to be given to the staff in TBTs.						
9		Waste Water Area	R	Lighting	Insufficient lighting in the work area	1-Multiple Injuries. 2-Fatality.	1-Lighting measurements were made in the relevant area and it was determined that it was in a suitable condition. 2- Improper and insufficient lighting is taken into the agenda in the board meetings and improvements are made. 3- Measurements are made by the electricity unit with a luxmeter according to the need, and corrections are made in accordance with the legislation.	5	2	10	1-Working environment lighting status control will be continued and necessary corrections and improvements will be made according to the needs. 2- In case of environmental conditions change due to unit expansion, machine equipment change, etc., the lighting measurement will be revised and action will be taken.		5	1	5		job supervisor HSE	50%
10		Chemical Treatment	R	Chemical factors (Toxic gases and vapors, organic solvents and dusts)	Exposure to chemicals while working with treatment chemicals (coagulant, anionic and cationic polymer)	1-Skin irritation, 2-Multiple burn.	1-Personnel use appropriate protective equipment while working with chemicals. 2-Material safety data sheets (MSDS) of the relevant chemicals are hung in the working areas and the personnel are informed about the hazards of the chemical. 3-Chemical dosage lines are in good condition and there is no leakage.	3	2	6	Periodic control, training and precautions will be provided.		3	1	3		job supervisor HSE	50%
11		Facility	R	Noise	Hearing loss of staff due to exposure to noise	Occupational disease	1-Personnel were given ear protection. 2- Awareness about the subject is increased through trainings. 3-Necessary warning instructions are hanging in the work area.	3	2	6	Necessary controls and measures will be implemented.		3	1	3		job supervisor HSE	50%
12		Facility	R	Gaps, bumps	Workers getting stuck in stormwater transport channels around the treatment plant or falling to the ground by tripping over the bumps around the plant	1-Multiple Injuries.	Rain channels and wastewater lines are closed with protective gratings.	4	2	8		Periodic control, training and precautions will be provided.	4	1	4		job supervisor HSE	50%

19.8 Construction Phase - Equipment design safety requirement

Some equipment design safety requirements include the following:

- Noise:
  - Maintain noise reducing technology on equipment, such as mufflers.
- Hazardous materials (including dust):
  - Reduce and contain hazardous materials (fuel storage, material storage)
- Atmospheric emissions:
  - Assure vehicle engines are in proper operating condition (minimizing emissions)
  - Assure emission control devices are fully operational
  - Use low-carbon fuels where possible
- Greenhouse gases:
  - Reduce and contain hazardous materials (covered but vented fuel storage)
  - Assure vehicle engines are in proper operating condition (minimizing emissions)
  - Assure emission control devices are fully operational
  - Use low-carbon fuels where possible
- Solid and liquid waste:
  - Follow waste minimization procedures
  - Re-use and recycle wastes as possible
- Energy Consumption
  - Assure vehicle engines are in proper operating condition (minimizing emissions)
  - Assure vehicles are properly maintained to maximize efficiency (engines, treads, tires, etc.)

19.9 Operational Phase - Equipment Design Safety Requirements

NFPA 36 Standards will be applied in design safety during operation phase as given below:

- Where practicable, all pumps handling solvent in the processing equipment located on the first floor level.
- Pump houses are noncombustible construction and ventilated. Every equipment Ex-Proof.

- Pipe systems substantially supported and protected against physical damage caused by expansion, contraction, and vibration.
- After installation and before covering or painting, all piping systems, including suction lines, pressure tested to not less than 1½ times the working pressure, but not less than a gauge pressure of 35 kPa (5 psig) at the highest point in the system. Tests will continue for not less than 30 minutes without any noticeable drop in pressure.
- An approved water spray, deluge, or foam-water system, or a combination of these types of fixed protection systems are provided to protect the extraction process equipment and structure.
- An approved system of automatic sprinklers is provided in the preparation area.
- A system of yard hydrants provided in accordance with accepted good practice.
- Approved portable fire extinguishers of appropriate size and type provided.
- Where standpipe and hose protection is installed, combination water fog and straight steam nozzles provided.
- Every hand tool used in process are non sparking brass tools.
- Extraction building is open and ventilated all the time.
- Solvent storage tanks designed and placed underground according to standards
- Vessels or tanks containing solvent, including extractors, solvent work tanks, miscella tanks, and solvent-water separating tanks, protected with emergency venting to relieve excessive internal pressure in the event of fire.
- Building frames, metal structures and every equipment grounded seperately and will be tested periodically.
- Dust collecting system provided at necessary points.
- All electrical installations will be made under applicable standards and according to Ex-Proof working environment.

Further, some equipment design safety requirements include the following:

- Noise:
    - Contain high noise processes using improved equipment and/or structural containment
    - Maintain equipment, including noise reduction equipment as well as functional operation (alignment, lubrication, etc.)
- Hazardous materials (including dust):

    - Reduce quantities of hazardous materials
    - Contain all hazardous materials
    - Prevention of leaks and unplanned releases
    - Re-cycle hazardous materials where possible (e.g., hexane)
- Atmospheric emissions:
    - Use light fuel oil with less than 1% sulfur where possible
    - Design for appropriate stack height to reduce ground level emission concentrations
    - Tighten fuel storage and guard against spillages/leakages
    - Tighten air flow systems to prevent leaks; properly and routinely maintain all air handling systems
    - Strong hexane containment, recycling, and reuse. Hexane process should be closed-loop
    - Use of dust capture devices to reduce risk of explosion and poor air quality (use of fans for air circulation and cyclones for removal)
    - Use back-venting as possible to reduce high particulate matter levels
- Greenhouse gases:
    - Use light fuel oil with less than 1% sulfur where possible
    - Use efficient boilers, generator sets, etc.
    - Assure proper equipment maintenance (including wastewater systems) to minimize greenhouse gas emissions
- Solid and liquid waste:
    - Optimize storage facilities to control environmental conditions to minimize spoiled raw and produced materials (humidity, temperature, pest management, etc.)
    - Focus processes on reuse and recycling (e.g., process water, sanitary wastewater, raw materials) using accepted practice
    - Productize waste into by-products where possible (e.g., hulls and fines)
    - Investigate use of solid by-products as fuel for boilers
    - Investigate alternative uses for building materials (bricks, blocks, cement)
    - Investigate use of sludge for agricultural purposes
    - Recycle and reuse industrial waters, including steam
- Energy Consumption:
    - Maximize re-use of heat/steam using heat exchangers where appropriate
    - Assure proper maintenance of all equipment to optimize energy consumption
    - Assure uniformity of feed to stabilize energy requirements

- Consider anaerobic digestion for sanitary water and capture methane as fuel source

19.9.1 Roles and Responsibilities

Proper design is the responsibility of the FEED contractor, and the company management. Implementation will be the responsibility of the operating company, through its Health, Safety and Environment (HSE or SHE) department.

19.9.2 Reporting

Reporting on the effectiveness of the equipment design safety and ongoing operational equipment safety should be done annually to senior management, along with recommendations for improvement in processes or equipment. Senior management at that time will determine the road to implement those improvements.

19.10 Decommissioning Phase - Equipment Design Safety Requirements

These requirements are essentially similar to those for the construction phase. However, additional care must be taken for building removal, waste management and disposal.

20 SUMMARY OF IMPACTS AND MITIGATION

The environmental and social impacts identified within Sections 6-19 of this ESIA pertain to the construction, commissioning, operation and decommissioning of the Project. In accordance with Section 4: Impact Assessment Criteria and Methodology, two types of mitigation measures are identified through this ESIA Report in order to alleviate or manage the potential impacts identified:

- Type 1: Measures to be taken to manage potential impacts considered to be of medium or high significance. Following application of these measures, residual impacts are expected to be lower.
- Type 2: Recommended measures that could be taken to manage impacts classified as low/insignificant. These measures can be considered as good management practices.

Table 20-1 summarises the medium and low impacts identified throughout this ESIA, and the corresponding mitigation measures for medium impacts and recommended measures for low impacts. These mitigations are incorporated into the Environmental Management and Monitoring Plan (EMMP) provided in the next section (section 21)

Table 20-1: Summary of Environmental Impacts and Mitigation

ID	Impact [1]	Impact Phase				Potential Significance [2]	Mitigation Measure for medium impact[3] [4] Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
Air Quality and Meteorology												
AQ1	Impact from Dust and Gases Emissions	X				Low	• Develop, implement and maintain a construction phase Environmental Emergency Response Plan (EERP); • Cover of all dust generating materials being moved by trucks, etc., with a suitably weighted tarpaulin; • **Minimize the amount of materials stockpiled as far as is practicable, with any required stockpiles aligned parallel to the prevailing wind direction;** • **Cover of exposed soils in heavily trafficked areas such as roads or car parks and dust generating stockpiles where feasible with gravel or crushed stone to reduce wind blown dust generation;** • **A reduced site speed limit to prevent the generation of large dust clouds from vehicles;** • **Subject to water availability and the time of the year, surface spraying of road surfaces with water and a soil binding agent;** • **Periodic grading of any uneven surface that arise on construction traffic routes; and** • **Implementation of a monitoring programme to verify construction vehicle comply with regulations and standards.**	X				Very Low
AQ2	**Impact from NO_x Emissions - Normal Scenario**		X	X		Low	• **Develop, implement and maintain an operational phase Environmental Emergency Response Plan (EERP)** • **Conducting performance test to ensure the air pollutants emissions (SO2, NOx, PM and hexane) are in compliance with the Iraqi source emission standards and WB acceptable limits** • **Competence and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental releases of hazardous substances).** • **Monitoring and maintenance of any dust and gases control devices to ensure effectiveness;** • **Prior to commencement of operations, ambient air quality data should be again gathered and such data sets built on during the course of the operations.**		X	X		Very Low
AQ3	***Impact from SO_2 Emissions*** **- Normal Scenario**		X	X		Low	**In addition to the recommended measures presented for AQ2, the following should be adopted.** • It is recommended to use ultra-low sulphur fuel (less than 100ppm sulphur content) in case natural fuel gas is not provided by Iraqi Authority.		X	X		Very Low
AQ4	Impact from PM Emissions - **Normal Scenario**		X	X		Low	Apply the recommended measures mentioned in AQ2 for this impact		X	X		Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation													
ID	**Impact (1)**	**Impact Phase**				**Potential Significance (2)**	**Mitigation Measure for medium impact(3) (4)** **Recommended measures for Low impact**	**Mitigation Phase**				**Significance after Mitigation**
		Cs	**Cm**	**Op**	**Dc**			**Cs**	**Cm**	**Op**	**Dc**	
AQ5	Impact from CO Emissions - **Normal Scenario**		**X**	**X**		Low	Apply the recommended measures mentioned in AQ2 for this impact		**X**	**X**		Very Low
AQ6	Impact from VOC (mainly hexane) Emissions - **Normal Scenario**		**X**	**X**		Low	**In addition to the recommended measures presented for AQ2, the following should be adopted.** • Monitor the hexane emission from vent to ensure it is in compliance with the WB limit. • Inspect and test the hexane leak prevention systems. • Ensure the recovery of solvents is optimized. • Back-vent to the solvent tanks during bulk storage tank filling and ensure the underground hexane tanks are connected to the plant via a low vacuum system. • Ensure the exhaust air is vented through the condensers and then through the solvent absorber to minimize VOC emissions. • Develop and implement an inspection checklist for daily and monthly inspections to ensure all abatement measures (especially for VOC emissions) are working optimally.		**X**	**X**		Very Low
AQ7	Impact from NO_x Emissions - Abnormal operation		**X**	**X**		Low	Apply the recommended measures mentioned in AQ2 for this impact		**X**	**X**		Very Low
AQ8	***Impact from SO_2 Emissions - A***bnormal operation		**X**	**X**		Medium	**In addition to the recommended measures presented for AQ2, the following should be adopted.** • Replacement of LFO (with sulfur content of 1%) with diesel or ultra-low sulfur content fuel (with sulfur content of less than 100ppm) • Use three boilers only for short time and after ensuring there is no impact on the ambient air (normal operation is two boilers) • Use five generators only during emergency cases and for short-time and ensuring there is no impact on ambient air (normal operation is four generators) • Apply of BAT for controlling SO_2 emission if ultra-low sulphur fuel is not provided and if the management decided to use the three boilers contiously • Apply state of the art online continuous emission monitoring systems		**X**	**X**		Low
AQ9	Impact from PM Emissions **- *A***bnormal operation		**X**	**X**		Low	**In addition to the recommended measures presented for AQ2, the following should be adopted.** • Installing approved control device for minimizing particle emissions if ultra-low sulphur fuel is not provided and if the management decided to use the three boilers contiously. • Apply state of the art online continuous emission monitoring systems .		**X**	**X**		Very Low
AQ10	Impact from CO Emissions **- *A***bnormal operation		**X**	**X**		Low	Apply the recommended measures mentioned in AQ2 for this impact		**X**	**X**		Very Low
AQ11	Impact from Odor		**X**	**X**		Low	Modelling results showed that there will be no potential odour problem during normal operation and accordingly there is no need for control odour measure. However during		**X**	**X**		Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation

ID	Impact [1]	Impact Phase				Potential Significance [2]	Mitigation Measure for medium impact[3] [4] Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
							abnormal scenario, apply the recommended measures mentioned in AQ8 for this impact. Further, develop and implement an inspection checklist for daily and monthly inspections to ensure all abatement measures (especially for VOC emissions from wastewater treatment system and hexane from vents) are working optimally.					
AQ12	***Impact from GHGs Emissions***		X	X		Low	Although the GHGs emission from this project is not significant, additional recommended measure could be taken to farther reduce the GHGs emission including the following: • Avoiding or reducing or limiting GHGs emissions where practical • Apply Energy efficiency in all part of the project • Review energy demand and use management • Try for GHG capture and storage in, typically, a GHG reservoir • Management of transport and travel demands		X	X		Very Low
Terrestrial Environment												
TE1	Impact on soil resources	X				Low	• Where possible soils will be stockpiled and reused as part of the Project design to minimize impact • Good practice construction site measures to reduce risk of pollution incident occurring • designated refuelling and maintenance areas will be constructed and areas for delivery and storage (in tanks/containers) of potentially contaminative liquids. These areas will be hard-surfaced and contained by walls or bunds, with drainage systems and collection arrangement for spills and stormwater management. • all storage tanks shall be above ground and maintained in good condition and inspected regularly. A record must be kept of all liquids/tanks/containers delivered to the site. • all vehicles used on site shall be serviced and maintained to the highest standard, with a record kept of maintenance undertaken. • at each vehicle wash area, there shall be a regularly maintained washwater collection and recycling system	X				Very Low
TE2	**Alteration of Topography**	X				Low	Apply the recommended measures mentioned in TE1 for this impact	X				
TE3	Degradation of soil and groundwater quality due to industrial operations, minor spillages, traffic and emplacement of fill material	X				Low	Apply the recommended measures mentioned in TE1 for this impact	X				
TE4	Degradation of soil quality due to maintenance activities	X				Low	Apply the recommended measures mentioned in TE1 for this impact	X				Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation													
ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
TE5	Degradation of soil and groundwater quality due to waste generation	X				Low	Apply the recommended measures mentioned in TE1 for this impact	X				
TE6	Subsurface contamination resulting from transfer of hazardous waste	X				Low	Apply the recommended measures mentioned in TE1 for this impact	X				
TE7	Degradation of Soil Quality		X			Low	In addition to the recommended measures presented for TE1, the following should be adopted: • Specific commissioning activities such as hydrotesting and flushing and disposal of wastewater will be undertaken in line with methodologies, agreed in advance, which contain appropriate measures to control, collect and treat the produced water as appropriate. • Hydrotest will be treated if required to comply with water quality standards applied to discharge for the Arabian Gulf		X			
TE8	Degradation of Groundwater Quality		X			Low	• Groundwater level monitoring should be undertaken prior to and during the Project life to allow appraisal of long-term impacts. • Efficient re-use of suitable water within the project is a key consideration and all practical design measures (during detailed design stage) should be taken to maximize extent		X			Very Low
TE9	Degradation of soil quality due to waste generation			X		Low	• Develop and implement an Environmental Emergency Response Plan. • Develop and implement a comprehensive waste management plan as per the Iraqi regulations and standards to ensure safe handling, onsite storage, transfer and disposal. Continually monitor and re-evaluate the effectiveness of the plan. • Store hazardous wastes temporarily onsite in secure and well-engineered storage areas. • Minimize onsite storage of liquid hazardous wastes. • Provide secure means of transferring wastes safely into and out of the tank to minimize spills. • Audit contractor to ensure that wastes arising from the Soybean Oil project are compliant with the national waste management requirements. • Alternate plan in the event that the offsite waste storage area reaches capacity. • Follow guidance on storage of hazardous waste as per the World Bank Group EHS Guidance			X		Very Low
TE10	Degradation of soil quality due to Accidents and Spills			X		Low to Medium	• Measures additional to those described in TE9 above and applicable to the operational stage of the project • Prepare and implement Environmental Emergency Response Plan (EERP) for operation phase and updated this plan periodacally. • Provide transporters with instruction on spill response on route, including safety provisions for each vehicle during transit		X			Low

Table 20-1: Summary of Environmental Impacts and Mitigation												
ID	**Impact [1]**	**Impact Phase**				**Potential Significance [2]**	**Mitigation Measure for medium impact[3] [4]** **Recommended measures for Low impact**	**Mitigation Phase**				**Significance after Mitigation**
		Cs	**Cm**	**Op**	**Dc**			**Cs**	**Cm**	**Op**	**Dc**	
							• Any accidental spill/leak will be fully cleaned as soon as the incident occurs, and if required polluted soil/sand will be excavated and removed to a licensed waste disposal site. Any accidental spill/leak will be recorded. • where possible the site design would be such that accidental release from bunded containment areas would still discharge to a site drainage system in preference to entering the ground.					
TE11	Degradation of soil and groundwater quality due to irrigation with treated wastewater			**X**		Low	Any treated wastewater should be monitored prior to use for irrigation to ensure it is in comply with the national standards for the attended purpose		**X**			Very Low
TE12	Degradation of general soil / groundwater quality				**X**	Low	• Apply the recommended measures mentioned in TE1 for this impact • Good practice decommissioning site measures to reduce risk of pollution incident occurring				**X**	Very Low
TE13	Other activities related to closure/decommissioning phase				**X**	Low	• Apply the recommended measure mentioned in TE1 for this activity • Demolition and other waste materials to be contained and treated, as necessary				**X**	Very Low
Terrestrial Biological Resources												
TB1	Disturbances on-site and off-site	**X**	**X**			Low	-Develop procedures for environmental management and emergency response during construction and commissioning, including the following specifically targeted to terrestrial biological resources: • Speed restrictions to reduce dust emissions from construction vehicles; • On-site landscaping by implanting trees, bushes and shrubs of species that need less irrigation • Site clearance procedures that allow species to move away before clearance, rather than being trapped within the construction area; • A dust management strategy to reduce dust emissions from construction activities. • A construction site waste management plan and erosion and pollution prevention measures to reduce the risk of contaminants entering the natural environment; • Identification and control of water discharges, to ensure the drainage capacity of the location, and to minimise erosion potential. • Participating in green projects in Umm Qasr and surrounding areas • Supporting local government in providing Environmental education programs • Use the following precautions when dealing with digging and earth moving equipment: low-noise engines, noise tempering covers and procedures to keep the engine cover closed.	**X**	**X**			Very Low
TB2	Pollution on-site and off-site	**X**	**X**			Low	• Follow all applicable recommended measures mentioned in TB1 to this impact	**X**	**X**			Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation

ID	Impact [1]	Impact Phase				Potential Significance [2]	Mitigation Measure for medium impact[3] [4] Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
							• Applying BAT (Best Available Technique) and/or BACT (Best Available Control Technology) in process design, to reduce cumulative impacts effects. • Ensure all designed controls are implemented to reduce air pollution and noise emissions. • Minimizing any effects of elevated particles and gases (such as NO_x and SO_2) emissions on vegetation and should be monitored as part of a routine ecological monitoring programme established to preserve and protect the natural resources. • Usage of the latest model vehicles for lower emissions • On-site implantation of suitable plant species • A waste management plan and erosion and pollution prevention measures to reduce the risk of contaminants entering the natural environment;					
TB3	Disturbances on-site and off-site			**X**		Low	• Follow all applicable recommended measures mentioned in TB2 to this impact • Applying energy efficient lighting systems to minimize light disturbance to nocturnal animals			**X**		Very Low
TB4	Pollution on-site and off-site			**X**		Low	• Follow all applicable recommended measures mentioned in TB2 to this Impact			**X**		Very Low
TB5	Biological Resources				**X**	Low+	• Develop/implement habitat restoration plan				**X**	Low+
							Noise and Vibration					
NV1	Impact From Increase of Noise at Receptors	**X**			**X**	Low	None specifically required; however, the following standard measures can be applied during construction: • Develop, implement and maintain construction Noise Management Plan- detailing measures to control noise and vibration emissions during construction; • Monitoring to verify construction works comply with the national standards and regulations for noise • Reduce noise level for nighttime construction • Reduction of vehicle movements to minimize noise • Temporary sound-proof enclosures and anti-vibration measures should be employed to reduce noise levels on sit • Select equipment with lower noise generation, wherever possible. • Ensure machinery is properly maintained, particularly engine exhaust silencers. • Machinery should be turned off when not in use (not left idling); • Use of screening afforded by spoil stockpiles for high noise activities if any	**X**			**X**	Very Low
NV2	Impact From Increase of Vibration at Receptors	**X**			**X**	Low	In addition to the recommended measures presented for NV1, the following should be adopted: • Prepare an apply operations risk assessment for vibration exposure. • Prevent injury by: low vibrant equipment, reducing vibration exposure, maintenance as per technical supplier specs. • Procurement of machinery with low vibration levels.	**X**			**X**	Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation

ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
							• Review vibration impacts, along with other risks, should a change in circumstances occur.					
NV3	Impact From Increase of Noise at Receptors		X			Low	Follow all applicable recommended measures mentioned in NV1 to this impact		X			Very Low
NV4	Impact From Increase of Noise at Receptors			X		Low	• Develop and apply noise monitoring program and procedures for the implementation of such to demonstrate compliance with ambient noise standards duirng operation • Engineering measures to be considered during designs to reduce the impacts of Noise in addition to inbuilt design controls. • Monitoring of vibration levels and air over pressure levels to demonstrate these meets regulatory/good practice requirements; • Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of complaint; and • Maintenance procedures of all equipment in place to minimize noise from equipment • Generators should be housed in an acoustic container designed to achieve acceptable noise level at 1m. • Reduction of vehicle movements to minimize noise.					Very Low
Waste Management												
WM1	Impact from Hazardous and Non-hazardous Construction Wastes during storage and Transport	X				Low	• SAMA AlManar to devise a waste management strategy for the disposal of construction wastes • The EPC Contractor shall develop, implement and maintain a Construction Waste management Plan (CWMP) based on good industry practise, an Environmental Emergency Response Plan (EERP) and the plan shoul dinclude the following: ○ Minimise the on-site storage times; ○ Utilise / ensure the use of covered vehicles for the transportation of waste; ○ Minimise the distance travelled; ○ Provide training of all suppliers and sub-contractors in site waste management procedures ○ Undertake an extensive audit of waste management facilities to confirm capacity to receive future quantities of waste, and operation in compliance with licence conditions and good industry practise ○ The hazardous and non-hazardous construction wastes shall be transported by an authorized transpoeter.	X				Very Low
WM2	Impact of degradation Due to Incorrect Storage / Spillage during construction	X				Low	In addition to the recommended measures presented for WM1, the following should be adopted. • A Hazardous Spill Response Plan should be developed and spill clean-up and response capability adequate for addressing spills for construction phase. Spills should be immediately contained and cleaned up. Contaminated areas will be remediated. • Provide transporters with instruction on spill response on route, including safety provisions for each vehicle during transit	X				Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation

ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
							• Develop, implement and maintain spill control procedures and waste segregation, and storage procedures • Refueling of equipment and vehicles should be carried out in a designated area on hard standing ground to prevent seepage of any spills into the ground. Collection systems will be installed in these areas to manage any spills. Fuels will be collected and either reused or removed by a local contractor. Drip trays will be used when refueling and servicing vehicles or equipment where there is no hard standing surface. • Implement procedures indicating vehicle specs to minimize as much as possible potential release/spills due to poor valves, pumps in trucks, etc.					
WM3	Impact from Hazardous and Non-hazardous Commissioning Wastes during storage, transport and disposal		X			Low	• Sama AlManar to devise a waste management strategy for the disposal of operations wastes • Develop and implement waste management plan as per national standards to ensure safe handling, onsite storage, transfer and disposal. • Monitor and evaluate the effectiveness of the plan. • Keep onsite storage times at the project site to a minimum and control access to stored wastes (no longer than 180 days after waste generation). • Audit landfill contractor and waste transporter to ensure that wastes arising from Soybean Oil Project are compliant with waste management requirements. • Follow guidance on storage of hazardous waste as per the World Bank Group EHS Guidance, • Contingency plan in the event that the offsite waste storage area reaches capacity.		X			Very Low
WM4	Impact from Hazardous and Non-hazardous Wastes during storage and Transport			X		Low	• Sama AlManar to devise a waste management strategy for the disposal of operations wastes • Sama AlManar to develop and implement a Project Waste Management Plan which shall include the following: o Waste and recycling objectives and targets; o Waste segregation, storage and recycling / waste management procedures; o Maximum storage times, and details of waste handling and labelling requirements; o Selection, monitoring and auditing of waste contractors, and off-site waste management facilities; o Waste vehicle requirements; and o Competencies and training requirements of staff with responsibilities for managing waste storage areas, and procedures and lines of communication in the event of an emergency (including accidental releases of hazardous substances);			X		Very Low
WM5	Impact of degradation Due to Incorrect Storage / Spillage during Operation			X		Low	• Sama AlManar to devise a waste management strategy for the disposal of operations wastes • Develop and implement a Waste Management Plan;			X		Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation												
ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
							• Develop and implement a Hazardous Spill Response Plan which inludes procedures for spill clean-up and response capability adequate for addressing spills for operation phase of the Project. • Any spills should be immediately contained and cleaned up. Contaminated areas will be remediated. • Refueling of equipment and vehicles will be carried out in a designated area on hard standing ground to prevent seepage of any spills into the ground. Collection systems will be installed in these areas to manage any spills. Fuels will be collected and either reused or removed by a local contractor. • Hazardous material storage (such as liquid fuel) will be on hard standing and impermeable surface and the storage facility will be bunded. The storage and handling of hazardous materials and fuels will be restricted to bunded areas of sufficient capacity to contain a release.					
WM6	Impact from Hazardous and Non-hazardous Decommissioning Wastes during storage, Transport and Disposal				X	Low	• Sama AlManar shall develop a closure plan which shall include the following: • Maintenance programme, monitoring and reporting strategy and emergency action plan • Procedures for removal and disposal of wastes during closure / decommissioning; • Waste segregation, storage and recycling / waste management procedures; • Waste handling and labelling requirements; • Selection, monitoring and auditing of waste contractors, and off-site waste management facilities; • Competencies and training requirements of staff with responsibilities for waste management in decommissioning, and lines of communication in the event of an emergency (including accidental releases of hazardous substances) • Procedures for the ongoing management, maintenance and monitoring of the retained waste storage facilities, including monitoring location, and frequencies, and analysis of resultant data. • Implement waste segregation, and where possible recycling programme					Very Low
WM7	Impact from Hazardous and Non-hazardous Wastes and Hazardous Materials **during emergency incidents**	X	X	X	X	Low to Medium	• Develop a Waste Management Strategy for the Project lifecycle durign emergency incident, which shall apply the waste hierarchy and shall be commensurate with good practice within the waste management industry • Develop and implement EERP • Develop, implement, audit and maintain a Project Waste Management Plan in accordance with regulatory requirements and good industry practise, building on the Project EMMP and an EERP • Develop, implement and maintain procedures to be implemented following an accidental release of hazardous substances, e.g., during refuelling, including details of measures to be adopted to stop, contain as far as practicable on site, and clean up spills, and to inform the relevant authorities in the event that a spill migrates (or occurs) off-site so that appropriate regional plans can be activated	X	X	X	X	Low

Table 20-1: Summary of Environmental Impacts and Mitigation													
ID	**Impact (1)**	**Impact Phase**				**Potential Significance (2)**	**Mitigation Measure for medium impact(3) (4)** **Recommended measures for Low impact**	**Mitigation Phase**				**Significance after Mitigation**
		Cs	**Cm**	**Op**	**Dc**			**Cs**	**Cm**	**Op**	**Dc**	
							• Design, construct and manage and maintain storage areas for non-hazardous and hazardous waste to prevent accidental and/or uncontrolled discharges of material • Competencies and training requirements of staff managing waste storage areas and communication and procedures in the event of an emergency incident • Ensure hazardous substances have a Risk Assessment detailing control measures and emergency procedures, storage, use and disposal of the material. • Ensure any third party supplying hazardous substances/materials complete a risk assessment of their own. • Obtain Material Safety Data Sheets (MSDS) from the manufacturer to enable Risk Assessment to be carried out. MSDS should be widely available for staff and employees. • Draft a method statement detailing control measures and other key elements including product disposal. • Provide education and training on risks and control measures required, including need for control of hazardous substances. This should be delivered through daily task briefings and toolbox talks.					
Water Quality Management												
WQ1	Impact from accidental spillages of hydrocarbons or sanitary wastewater	**X**				Low	• SAMA AlManar shall develop, implement and maintain a construction phase Environmental Emergency Response Plan (EERP) and a Construction Environmental Management Plan (CEMP). These plans should include but not limited to the following: • Ensure that vehicles used to empty septic tanks are fit for purpose and operated by trained members of staff to prevent spillage. • All hydrocarbons drums and pails shall be kept under designated shaded areas with proper spill containment arrangement and proper labelling and signs posted • Staff training on response to release/spills in case material is not properly managed. • Training courses for subcontractors involved in works related to areas where material is stored or managed. • Response procedures and duties/action for staff during emergency. • Follow guidance on storage of hazardous waste as per Iraqi Ministry of Environment requirements and World Bank Group EHS Guidance. • Contain hazardous materials transported by pipeline onsite, providing them with suitable secondary containment, shelter and barrier protection, where necessary. • Availability of emergency response tools on-site at all times • Procedures and duties for EERP staff during emergencies.	**X**				Very Low
WQ2	Impact from accidental release of contaminated hydro-test water		**X**			Low	• Undertake appropriate studies to locate an appropriate discharge point for clean hydrotesting water to ensure sufficient drainage capacity is available. • Ensure the hydrotesting water is not contamainated before it is used other useage or discharge to the Arabian Gulf		**X**			Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation												
ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
							• Prepare plant start-up and shut-down procedures; • Prepare and implement procedures to be implemented following an accidental release of contaminated hydrotesting water or hazardous substances, including details of containment and recovery measures to be applied; • Procedures for co-ordinating site staff action in emergency situations with off-site stakeholders / regulators • Routine plant inspection and maintenance schedules and procedures; • Ensure suitable availability of pumps and spill mitigation materials such as absorbent granules to contain and recover contaminated water or hazardous substances releases. • Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental releases of contaminated water or hazardous substances);					
WQ3	Impact from accidental release of industrial wastewater or sanitary wastewater			**X**		Low	Follow all applicable recommended measures mentioned in WQ2 to this Impact			**X**		Very Low
WQ4	Impact from dismantling and removal of the facility				**X**	Low	Sama AlManar shall develop and implement a closure plan which shall be in accordance with USEPA and other applicable international standards and shall include the following: • closure start/ completion dates • Description of closure methods and steps to comply with closure standards • Minimum technical standard of demolition plant; • Competencies and training requirements of staff with environmental responsibilities, and lines of communication in the event of an emergency (including accidental releases of hazardous substances); • Procedures to be implemented following an accidental release of hazardous substances, e.g., during tank drain-downs, including details of containment and recovery measures to be applied; and				**X**	Very Low
Marine Environment												
ME1	Overall Impact from various activities of the Project on oceanography/ marine biodiversity of the area	**X**	**X**	**X**	**X**	Low	Develop and implement a plan for marine water quality monitoring due to discharging treated wastewater or hydrotesting water to the Arabian Gulf	**X**	**X**	**X**	**X**	Very Low
Socio-Economic Aspects												
SE1	Economic growth	**X**				Medium+	N/A	X				Medium+
SE2	Increased employment opportunities	**X**				Medium+	N/A	X				Medium+
SE3	Education	**X**				Low+	N/A	X				Low+
SE4	Transportation	**X**				Low	N/A	**X**				Low

Table 20-1: Summary of Environmental Impacts and Mitigation												
ID	**Impact (1)**	**Impact Phase**				**Potential Significance (2)**	**Mitigation Measure for medium impact(3) (4)** **Recommended measures for Low impact**	**Mitigation Phase**				**Significance after Mitigation**
		Cs	**Cm**	**Op**	**Dc**			**Cs**	**Cm**	**Op**	**Dc**	
SE5	Cultural						EPC Contractor shall develop and implement a procedure about raising awareness of local cultural and heritage resource					
SE6	Economic Growth			**X**		Medium+	N/A			X		Medium+
SE7	Increased employment opportunities			**X**		Medium+	• A hiring mechanism will be established to ensure no employee or job applicant is discriminated against on the basis of gender, marital status, nationality, ethnicity, age, religion, or sexual orientation. • Contractors will be supported in adhering to labor and working conditions in compliance with Iraqi labor laws and in alignment with IFC PS 2 through awareness raising and information provision, as necessary.			X		Medium+
SE8	Education and Training			**X**		Medium+	N/A			X		Medium+
SE9	Strain On Municipal and Social Services			**X**		Low	Sama AlManar to enter into an agreement with Umm Qasr Municipality regarding the capacity of municipal services to be supplied to the project housing during the early stages of operation. Where capacity is not available, SAMA AlManar to establish alternative service provision.			X		Very Low
SE10	Reduced Economic Activity				**X**	Low	N/A				**X**	Very Low
SE11	Loss Of Employment				**X**	Low	Sama AlManar should implement a proactive succession planning programme in advance of closure to identify alternative roles within the company, thus providing security for employees, and reducing the skills and experience loss from Project closures				**X**	Very Low
Archaeology and cultural Aspects												
AC1	Loss of Archaeological	**X**			**X**	Low	• The EPC Contractor shall develop and implement a procedure (such as Archaeological chance find) for the management of unexpected archaeological resources prior to starting work and shall report any findings to top management. • Contractual provisions should clearly indicate the procedure in case of any findings related to archaeology • Every worker has to be trained in procedures to be applied in case of finding archaeological artefacts during any construction activities. • Training of workers in correct procedures if archaeological artifacts are found during construction. • EPC Contractor shall provide the workforce with tool box talks on the subject to raise awareness of the importance of cultural and heritage resource finds. • Contractors should take into account the possibility of finding archaeological artefacts during any excavation and construction work. • If archaeological artefacts are uncovered, work in that area shall be stopped and the environmental protection committee notified. o Site manager should inspect and secure site and notify the Project top management immediately o The Project management shall inform the government authority so that measures are taken to ensure that concerned authorities are notified	**X**			**X**	Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation												
ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
AC2	Cultural Discovery / Heritage	X			X	Low	In addition to the recommendations previously discussed during construction phase (AC1), the following should be retained • The EPC contractor should distribute to its workers educational and informative material on cross-cultural understanding of the Republic of Iraq and Umm Qasr area in particular • Information is in languages of the target workers and transmitted to all workers at early stage of employment.	X			X	Very Low
AC3	Impact on archaeological resources due to vehicle movements		X	X		Low	• Recommendations previously discussed during construction phase (AC1) should be retained		X	X		Very Low
AC4	Impact on archaeological resources due to abusive exploitation of historical sites by expatriate workers		X	X		Low	• Recommendations previously discussed during construction phase (AC1) should be retained		X	X		Very Low
AC5	Impact on cultural heritage due to interaction between expatriate workers and local people		X	X		Low	• Recommendations previously discussed during construction phase (AC2) should be retained		X	X		Very Low
Health and Safety												
HS1	Health Impacts from Air Quality and Noise	X				Low	• Recommendations previously discussed during construction phase (AQ1) should be retained The EPC Contractor shall develop, implement and maintain a Construction Environmental Emergency Response Plan (EERP) and HSE Plan as required and these plans should address the following specifically targeted to health and safety: • Provision of personal protective equipment and health surveillance monitoring for workers • Provision of health screening for all workers • Implementation of measures to minimize exposure to air pollutants and noise • Providing medical services to all workers; • Conduct regular (prior to use of any vehicle and then at least once per week) maintenance checks on the vehicle conditions to minimize the air emissions and noise generation;	X				Very Low
HS2	Health Impacts Related to Waste (Liquid & Solid)	X				Low	• Construction Waste Management Plan should be developed and implemented. The plan should include all required measures to minimize potential health impacts from the storage and transportation of waste • Storage areas for solid and liquid wastes should be kept to a minimum, and should be fenced to protect workers from accidental contact.	X				Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation												
ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
HS3	Increase in Traffic-Related Vehicle Accidents	X				Low	• Minimization and routing of construction vehicle movements away from Umm Qasr residential areas • Providing a comprehensive driver training programme to workforce and contractors on adherence to safe driving practices. • Enforce speed limits in all on-site/off-site areas • Specify use of modern, properly maintained vehicles. • Regular maintenance of vehicles as per manufacturer manual. • Vehicle conditions should conform to SAMA AlManar maintenance standards	X				Very Low
HS4	Occupational HSE Impacts (Accident/ Injury & Communicable diseases)	X				Medium	• A health and safety program should be developed and implemented. This program includes risk assessments, work permit systems, and a H&S management system, in line with industry best practice, including worker performance safety tracking (safety observations) to assure worker safety. • Workforce training will be provided on communicable diseases, disease prevention, and treatment to raise awareness. • Maintenance of construction accommodation areas in accordance with best practice and communal areas cleaned regularly to minimise potential for disease. The management should have its own specifications for the design, operation and maintenance of workers accommodations and maintain worker health and well-being, and workers are housed in dormitories that limit the number of occupants in each room to two or four depending on size after taking all precautionary measures for COVID-19 as required by MOH • Follow all precautionary measures for COVID-19 as required by the Iraqi MOH • New emerging health patterns as identified by WHO on the occurrence of any new influenza pandemic is immediately considered by Health Services with special precautions to reduce spread of infectious diseases at an early phase; • The Project management should also observe any announcements with respect to special medical emergency response plans as developed by MOH particularly during the construction phase. • Contractors will be supported in adhering to labour and working conditions in compliance with Iraqi labour laws and in alignment with IFC PS 2 through awareness training and information provision, as necessary • The contractor and supplier selection process will ensure that performance with regards to worker management, worker rights, and health and safety as outlined in Iraqi law and international standards will be managed and reported. • Regular checks of contractors will be undertaken to ensure compliance with applicable labour laws • There will be a first aid area on site to avoid adding pressure on local health facilities. Arrangements will be made with nearby hospitals and clinics, however,	X				Low

Table 20-1: Summary of Environmental Impacts and Mitigation												
ID	**Impact** [1]	**Impact Phase**				**Potential Significance** [2]	**Mitigation Measure for medium impact**[3] [4] **Recommended measures for Low impact**	**Mitigation Phase**				**Significance after Mitigation**
		Cs	**Cm**	**Op**	**Dc**			**Cs**	**Cm**	**Op**	**Dc**	
							so sick Project workers who cannot be fully treated at the Project first aid area can be referred for treatment.					
HS5	Health Impacts from Air Quality & Dust			**X**		Low	• Recommendations previously discussed during construction phase (HS1) should be retained • A health screening programme should be implemented to manage potential health risks associated with chronic exposure. • Early engagement with local healthcare service providers to assess the capacity of the region to inform the design and staffing of the medical facilities to ensure local services are not adversely affected. This consultation should include all emergency services to ensure agreement is reached on the most effective mechanisms to deal with any major incident, including any evacuation to hospitals in Umm Qasr and AlZubair districts. • Health and safety procedures and processes for the Project should be in compliance with international best practise and should include the following: ○ Minimise exposure to pollutants, noise etc., and should include but not be limited to the provision and enforcement of PPE on site, changing working patterns to limit exposure periods etc. ○ Emergency shutdown system to detect and warn of uncontrolled release of gases; presence of oxygen deficient atmospheres in work areas ○ Monitoring systems in working areas with potential for oxygen deficient atmospheres ○ Workers should be equipped with personal monitoring equipment. ○ Warning alarm set at 19.5 percent concentration of oxygen in air. ○ Confined space entry procedures with consideration of facility specific hazards.			**X**		Very Low
HS6	Impacts Related Road Traffic Accidents			**X**		Low	• Recommendations previously discussed during construction phase (HS3) should be retained • Road transport safety program should be developed and implemented during lifetime of Soybean Oil project. • Traffic management and vehicle standards implement safety measures. • Support regional road safety program			**X**		Very Low
HS7	Health Impacts from Accident & Injury			**X**		Low	• Recommendations previously discussed during construction phase (HS3) should be retained			**X**		Very Low
HS8	Deterioration in Health from Communicable Disease			**X**		Low	• Recommendations previously discussed during construction phase (HS4) should be retained • SAMA AlManar should provide high living standards for any accommodations at the Project site.			**X**		Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation													
ID	Impact (1)	Impact Phase				Potential Significance (2)	Mitigation Measure for medium impact(3) (4) Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
							To prevent infection and to slow transmission of COVID-19 between employees and outside people, the following conditions should be met: o Wash hands regularly with soap and water, or clean them with alcohol-based hand rub. o Maintain at least 1 metre distance between one person and the other one who is coughing or sneezing. o Avoid touching your face. o Cover your mouth and nose when coughing or sneezing. o Stay home if you feel unwell. o Refrain from smoking and other activities that weaken the lungs. o Practice physical distancing by avoiding unnecessary travel and staying away from large groups of people. o Managing centralized mess facilities including monitoring health of kitchen staff and staff awareness and training. o Follow the internartional Environmental Health codes for preparation, proper storage and handling of foods. • Workforce training will be provided on communicable diseases, disease prevention, and treatment to raise awareness. • Project areas, project site toilet, and eating facilities, will be kept clean and free from accumulation of wastes as well as supplied with clean potable water. This includes ensuring appropriate food preparation and monitoring measures are in place. • Workers will be provided with gender appropriate sanitary facilities that are properly designed to prevent contamination.					
HS9	Health and Safety Impact on workforce				X	Low	• A comprehensive site restoration plan should be included with the Closure plans to ensure the potential for long term health impacts on the local community are avoided and/or minimized. • Establishment and implementation of Health and Safety procedures in accordance with best practice for accidents and on-site safety. The following should be followed to avoid safety issues during closure phase: • Prevent injury by heavy load sharing, position loads by machine / reducing height to be lifted and reduce carrying distance • Training in safe lifting techniques and proper load handling • Order bagged materials in small easily handled sizes • Review risk assessment if a change in circumstances occurs such as change in process units or machinery, handlers involved or carrying/loading/unloading operations. • Brief workers on proper loading/unloading methods to ensure they are aware of manual labor risks and how to mitigate such risks.				X	Very Low

Table 20-1: Summary of Environmental Impacts and Mitigation

ID	Impact [1]	Impact Phase				Potential Significance [2]	Mitigation Measure for medium impact[3] [4] Recommended measures for Low impact	Mitigation Phase				Significance after Mitigation
		Cs	Cm	Op	Dc			Cs	Cm	Op	Dc	
HS10	Health and Safety Impact on community				X	Low	• An appropriate decommissioning plan should be developed and implemented, including providing assistance for the redeployment of affected workers. • The plan should anticipate these social and economic consequences and consider options to minimize adverse health impacts from loss of employment and income.				X	Very Low
Traffic and Transportation Infrastructure												
TI1	Impact on airport	X				Low	Traffic and Transportation Management Plan should be developed and implemented, and this plan should address all matters specifically targeted to impact on airport					Very Low
TI2	Impact on Roads	X				Low	Traffic and Transportation Management Plan should be developed and implemented, and this plan should address the following specifically targeted to impact on roads and include • Outcomes of traffic risk assessments undertaken; • Access routes for construction plant and materials; • On-site traffic management; • Measures to segregate the workforce from vehicle areas; • Training and awareness; and • Enhanced driver safety awareness will be implemented • Traffic routes will be planned to limit road use by the Project during high traffic periods (including pedestrian traffic) and in sensitive areas such as near schools in order to reduce interaction with public road use • Awareness campaigns will be implemented to address traffic and road safety in communities along the transportation corridor					Very Low
TI3	Marine Traffic	X				Low	Shipping of heavy equipment during construction phase should adhere to appropriate environmental and health regulations (e.g., IFC, Environmental, Health, and Safety Guidelines for Shipping. 2007; International Maritime Organization — various regulations; etc.)	X				Very Low
TI4	Impact on airport		X	X		Low	Apply same recommended measured addressed in TI1		X	X		Very Low
TI5	Impact on Roads		X	X		Low	Apply same recommended measured addressed in TI2					
TI6	Marine Traffic			X		Low	The project management should adhere to all applicable environmental and health regulations (e.g., IFC, Environmental, Health, and Safety Guidelines for Shipping. 2007; International Maritime Organization — various regulations; etc.) during the shipping of raw materials (soyabeans).			X		Very Low
TI7	Impact on airport				X	Low+	N/A				X	Low+
TI8	Impact on Roads				X	Low+	N/A				X	Low+
Notes: (1) Mitigation measures are given for impacts that are categorized as 'medium' or 'high' significance whereas recommended measures are given for 'Low' Impacts that are categorized as 'Low'.												

<table>
<tr><th colspan="13">Table 20-1: Summary of Environmental Impacts and Mitigation</th></tr>
<tr><th rowspan="2">ID</th><th rowspan="2">Impact (1)</th><th colspan="4">Impact Phase</th><th rowspan="2">Potential Significance (2)</th><th rowspan="2">Mitigation Measure for medium impact(3) (4)
Recommended measures for Low impact</th><th colspan="4">Mitigation Phase</th><th rowspan="2">Significance after Mitigation</th></tr>
<tr><th>Cs</th><th>Cm</th><th>Op</th><th>Dc</th><th>Cs</th><th>Cm</th><th>Op</th><th>Dc</th></tr>
<tr><td colspan="13">(2) The factors used to determine the significance of a potential impact are defined in Section 4 Impact Assessment Criteria and Methodology and tabulated for each impact in the corresponding section of the ESIA report. A notation with a "+" indicates the impact is positive (beneficial to human health and the environment).
(3) Mitigation to be taken to manage potential impacts considered to be of medium or high significance.
(4) All plans including EERP, EMMP, Closure plan, Waste Management plan, Traffic and Transportation Management Plan shall be prepared in accordance with national (Iraqi environmental regulations and standards) and international requirements (i.e., WBG EHS Guidelines (2007) and IFC Performance Standards on Environmental and Social Sustainability (2012))

Cs: Construction Phase
Cm: Commissioning Phase
Op: Operations Phase
Dc: Decommissioning Phase / Closure</td></tr>
</table>

21 ENVIRONMENTAL AND SOCIAL MANAGEMENT & MONITORING PLAN (ESMMP)

21.1 Environmental and Social Management Monitoring Plan

The Environmental and Social Management and Monitoring plan (ESMMP) is an essential part of an ESIA study for large projects (such as the soybean oil project). As per IFC's Performance Standard 1 (Assessment and management of Environmental and Social Risks and Impacts), the ESIA study should contain an Environmental and Social Management Monitoring Plan which should consist of the set of mitigation, monitoring and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts. Accordingly, this ESMMP will describe the set of mitigation, monitoring, and institutional measures to be taken during construction and operation of project to eliminate or reduce adverse environmental and social impact to acceptable levels. The ESMMP also includes the necessary actions needed to implement these measures.

The ESMMP will provide a detailed framework of specific management responses to environmental impacts and issues identified measures during this ESIA, all of which are in compliance with recognised environmental management guidelines and other site management plans.

The ESMMP will undergo periodic reviews (perhaps at five year intervals) and updates by the Project management for all units within the facility as the project develops. This ESMMP includes the following components

- Objective of ESMMP
- Training and Awareness for Staff
- Construction phase- ESMMP
- Operation phase- ESMMP
- Environmental Monitoring Plan
- Social Management Plans

21.1.1 Objective of ESMMP

The main objective of the ESMMP is to minimize the direct and indirect negative environmental and Social impacts of the project through sound planning and the introduction of proper construction and monitoring techniques during all phases of project implementation. To ensure that proper design and operational standards are adhered to, and that the environment and public safety are not compromised, site practices and procedures of the ESMMP should be followed strictly throughout the lifetime of the Project.

The general procedures that would be implemented at the Project site should include:

- compliance with all Iraqi and IFC regulatory requirements in environmental matters;
- application of good environmental management practices with a view to on-going improvement;
- ensuring the effective and efficient use of raw materials and energy;
- provision of written standard operating procedures (SOPs) for all processes and appropriate document control;
- provision of awareness training for all employees including management, office staff and technical staff on pollution prevention and control techniques and best practices;
- establishment of daily checklists for the facility and office areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy problems found;
- details and properties for each material should be clearly detailed which include its nature (poisonous, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill);
- a signed checklist should be developed for users of hazardous materials detailing amount taken, amount used, amount returned and disposal of spent material;
- continuous monitoring and reporting of the facility units' performance should be undertaken in order to establish baseline conditions and whether conditions are improving or deteriorating;
- records should be maintained of water, air and solid waste quantities and quality tests and their disposition;
- a mass balance of incoming, outgoing and on-site materials should be maintained to ensure that loses are traced and accounted for; and,

- regular reviews of emergency response procedures should be undertaken, including a contingency plan for spills, leaks, weather extremes, etc.

21.1.2 Training and Awareness for Staff

To apply mitigation measures effectively during the project lifetime, the ESMMP will describe the importance of environmental requirements on site as per national and IFC requirements and if necessary, it recommends establishment and expansion of such requirements. Through these environmental requirements the Project management will undertake training of staff, to allow implementation of impact mitigation recommendations during construction and operation phases of the project. Specifically, the ESMMP provides a specific description of institutional arrangements on who is responsible for carrying out the mitigatory and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). To strengthen environmental management capability in the entities responsible for implementation, most ESMMPs cover one or more of the following additional topics: (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes.

21.1.3 Construction Phase- Environmental and Social Management & Monitoring Plan (CESMMP)

The CESMMP provides an environmental framework for the construction activities to ensure that the potential impacts that may arise in this phase of the development are actively managed and minimize. The CESMMP also addresses the monitoring, inspection and test plans for all activities and environmental qualities which are important to the environmental management of the project, including performance criteria, specific tests and protocols (e.g., frequency and location).

The CESMMP will be prepared prior to the commencement of substantial construction at the Project site but it will continue to develop as the project progresses to ensure its content reflects the current construction program, and gives the opportunity to address any unforeseen issues that may arise.

The CESMMP for the soybean oil project includes:

- Management structure with clear designation for environmental (and health and safety) duties and responsibilities;
- Programme of meetings and reporting to provide on-going monitoring of the construction works;

- The temporary infrastructure such as access routes to and from the site, temporary work areas and designated storage compounds for construction materials and segregated wastes;
- Site HSE Policy applied to the Construction Workforce: including accommodation, shifts and facilities establish for them. Emergency Planning as part of the HSE requirements;
- Environmental induction training for all construction workers when they come onto site and specific training (tool box talks) where appropriate;
- provision of specific working procedures which take account of environmental issues and reduce risk of accidental spillages;
- Pollutant Abatement and Environmental Monitoring, such as dealing with storage and disposal of waste, air, soil, noise, water; and biodiversity, transport and cultural heritage.

21.1.4 Roles and Responsibilities

The Environmental Co-ordinator or HSE manager is responsible for all environmental and safety activities during project construction works and will report directly to the Facility Operation Manager. The suggested organogram for HSE team and other related sections is shown in figure 21-1. The team consists of HSE manager, site safety officer, environmental awareness and training officer, environmental monitoring officer. The duties of HSE team involve the following:

- Overall management of the environmental component of the project;
- Manage day-to-day activities to ensure significant environmental effects are avoided;
- Review and update the Site CESMMP;
- To act as the main point of contact between the environmental regulator (Umm Qasr Port authority or Directorate of Environment in Basra) and the project management on environmental issues;
- To act as the main point of contact between the local community and the project management;
- Development and delivery of environmental training (induction and toolbox talks) for site personnel and sub-contractors;
- Ensure Best Practices, particularly pollution prevention, are promoted at all times;
- Assisting with the development of procedures which highlight the emergency response to environmental incidents;
- Management of the monitoring programme, including noise, dust and water quality; and
- Environmental incident monitoring and reporting.

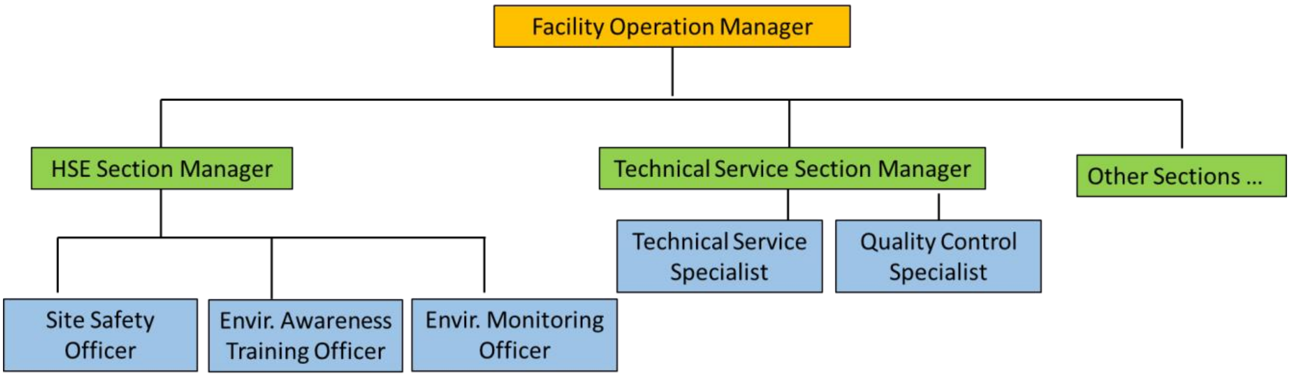


Figure 21-1: Suggested organogram for HSE team and other related sections in Soybean Oil Project

21.1.5 Assessment of Significant Environmental Aspects

The environmental aspects identified should be evaluated in terms of significance to ensure that resources are targeted appropriately and effectively. The environmental aspects determined to be of most significance are the activities of the project that require managing and should be subject to improvement in performance.

Consideration and Responsibility

All works will be carried out with consideration of the surrounding worker housing and the environment. Works that may cause an impact to neighbouring receptor sites will be discussed internally with the project management to minimize or avoid such an impact. The contractor will ensure that all site personnel, specialist subcontractors, delivery drivers and any other persons working on or visiting the site fully understand and implement the obligations of the CESMMP and monitor their compliance with it. This will be achieved by including the CESMMP and its obligations in the safety induction that everyone working on site must attend. The inductees will be required to sign a statement stating that they have understood and will abide by the content of the CESMMP. This list should be available for review by management and by environmental regulators,

The important actions during the the pre-construction/design stage would be rehabilitation and resettlement, planning for natural disasters, water conservation and development and energy conservation. Construction mitigation measures include;

1) Soil disposal;
2) Recycling of construction waste;
3) Air pollution and noise control during earth work and other construction activities;

4) Management of construction waste; and
5) Safety and health of workers.

A summary of the impacts and mitigation measures were reported in previous sections of this ESIA study. All equipment supplied will be designed to ensure satisfactory operation under working conditions. All plant containing rotating parts will be capable of operating at speeds up to the maximum duty specified without vibration or excessive noise.

21.1.6 Operational Phase- Environmental and Social Management & Monitoring Plan (OESMMP)

The facility operation manager will be required to implement a comprehensive Management Plan that considers Health, Safety and Environmental issues. The OESMMP will identify, monitor and control all potential health, safety and environmental aspects associated with the operation of the site, for this purpose the OESMMP shall address the following:

- Identification of the statutory and other obligations which SAMA AlManar Company (owner of the project) and EPC contractor are required to fulfill, including all licences/approvals and consultations/agreements required from authorities and other stakeholders and key legislation and policies which control the project operations;
- Sampling strategies and protocols to ensure the quality of the monitoring program including specific requirements of the relevant national environmental legislations;
- Monitoring, inspection and testing all relevant activities having environmental impacts which are important to the environmental performance of the project during its operation, including description of potential site impacts, performance criteria, specific tests and monitoring requirements, protocols (e.g., frequency and location) and procedures to follow;
- Steps the Project management intends to take to ensure compliance with all plans and procedures;
- Strategies for managing the main environmental impacts including, but not limited to: the social impact, noise, water quality, source and ambient air quality, access and traffic, waste/resource management/removal/disposal, visual

screening, landscaping and rehabilitation, hazards and risks, and energy use, resource and recycling.

The OESMMP should be prepared and approved prior to commissioning of the Project. The plan will also need to consider the environmental actions required at the site. Implementation of a controlled informal system will be dependent on level and form of risk management required and the reasons for implementing the system (i.e., Certification to ISO 14001 would demonstrate a commitment to maintaining environmental compliance, adherence to best practice and a strategy for continuous environmental improvements through the 30-year expected operational period).

Operation period mitigation management would include:

1) Air pollution and noise control;
2) Good housekeeping and solid waste management practice (e.g. hazardous and non-hazardous materials management, maintenance and site security plans, emergency and contingency plans);
3) Wastewater treatment and discharge;
4) Hazardous material handling
5) Hazardous and non-hazardous waste treatment and disposal, and
6) Maintenance/upbringing of green area/plantation.

21.1.7 Roles and Responsibilities

The contractor's Environmental Management Policy provides the guiding principles and is a driving force to create value and through this secure its business. The policy emphasises continuous environmental improvement, setting progressively higher environmental commitments and developing the roles and responsibilities for environmental management.

The Facility Operations Manager is recognized as having the primary responsibility for compliance with a continued chain from the Operation Manager to the local operators in the installations. In addition, HSE Manager will be nominated at an appropriate level and will report directly back to the Facility Operations Manager. The HSE Manager will have a defined role in implementing and maintaining the ESMMP at the site and will include:

- Communicating the Environmental Policy to staff and personnel;

- Be responsible for environmental issues in the areas of reporting any potential incidents to the operational hierarchy and implementing corrective actions once decided by the Facility Operations Manager;
- Co-ordinate with other internal systems (e.g., Quality and Health and Safety);
- Environmental awareness training for plant operators;
- Environmental Compliance with national and international requirements; and
- Identification of opportunities for continuous environmental improvement.

21.1.8 Environmental Reporting

The Environmental Regulations include a number of environmental indicators that need to be monitored and reported to ensure compliance with environmental regulations and standards. Data collection requirements for appropriate environmental reporting include but are not limited to the following:

- Data from its on-line monitoring system for stack emissions of certain parameters which may need to report periodically as part of the required operation report;
- Data for wastewater treatment system to assure its performance as required;
- The provision of groundwater, seawater and soil samples for regular monitoring and analysis; and
- The preparation and submittal of any accident / incident reports;

The HSE Manager will be responsible for coordinating all data via monthly / yearly reports and verifies any non-compliances.

21.1.9 Environmental Auditing

An environmental auditing procedure will be implemented for the processes at the facility to ensure compliance with relevant statutory legislation and regulations. The responsibility of initiating the environmental audit will be with the Facility Operations Manager and the HSE Manager.

The operational ESMMP is of the Integrated Pollution Prevention and Control (IPPC) type which requires material consumption, energy efficiency and waste minimisation processes to be implemented as part of the operating procedures.

Regular reviews of the facility environmental performance are necessary during the operational phase of a project to ensure procedures are appropriate and to ensure that the environmental objectives and targets are being achieved. Audit with respect to environmental compliance of soybean oil project to the Iraqi and IFC requirements will be undertaken which forms part of on-going facility operations in order to:

- Comply with legal, regulatory, and other requirements;
- Track facility environmental performance;
- Track facility environmental operational controls;
- Monitor material use and production; and
- For setting objective & targets.

Internal environmental reporting requirements which include compliance evaluation reports based on the daily maximum limits and monthly averages of the parameters of all functional departments such as air emission, noise and water treatment and discharges are compiled.

The operational parameters for daily allowable maximum units are compared with the applicable daily criteria and similarly monthly averages are compared with the allowable monthly limits. Monthly compliance status reports for each unit of the facility are accomplished by the Technical Service Specialist to provide the compliance status of the facility as an overall compliance against the required conditions. The report will be reviewed by the top management during routine management reviews.

The Facility Operations management is responsible for self-monitored compliance status; the technical services section, upon request from facility operations, will assist in the overall facility assessment and legal compliance status of the facility. The technical service team are responsible in making budgetary provisions & requirements, technical services requests and facility complying requirements.

The Technical services/HSE section in consultation with the facility operations section develops and updates as necessary, a schedule for conducting environmental compliance audits so that at least minimum one internal assessment is completed for the entire facility every year.

21.1.10 Environmental Inspection

Inspection and monitoring of the environmental effects of construction and operational activities will enable the effectiveness of environmental mitigation to be evaluated and to allow environmental problems to be identified and responded to an early stage. In fact, adverse impacts on the environment could be controlled if averted at an early stage and necessary mitigating measures are applied.

The HSE section manager will be responsible for the implementation of an appropriate inspection and monitoring programme to the satisfaction of soybean oil facility management. This will enable the project management to ensure that the works are being carried out in accordance with the requirements and to identify and implement any environmental improvements.

Suggested topics for environmental inspection and monitoring during and where appropriate will include but not limited to the following:

- Wastewater treatment and discharges
- Noise levels at sensitive receptors
- Air emissions for all sources
- Waste management procedures (Hazardous and non-hazardous)
- Storage and handling of chemical substance
- Traffic movement and the condition of roads and highways

In addition to the independent internal audit, any monitoring requirement specified on this ESIA will be fully complied with.

21.2 Environmental Monitoring Plan

The purpose of an Environmental Monitoring Plan is to evaluate the effectiveness of implementation of Environmental Management Plan (EMP) by periodically monitoring the important environmental parameters within the impact area for the important receptors, so that any adverse effects are detected and timely action can be taken.

The Soybean Oil plant management will undertake a comprehensive environmental monitoring program on-site which consists of procedures to characterise and monitor pollution indicators in order to ensure that the quality of environment meets the Iraqi environmental standards and regulations and the IFC requirements. Normally, the Environmental Department will be the executor of this monitoring.

Environmental monitoring is an essential part of daily operations in the Project site as there are certain circumstances in which human activities on-site carry a risk of harmful impacts on the natural environment. Environmental monitoring strategies and programmes on site are justified and are designed to establish the current status of the ambient environment within the soybean oil facility and will be able to establish trends in environmental parameters and compliance with limits as set by the Iraqi Ministry of Environment.

Results of monitoring will be reviewed, analysed, studied and verified statistically, and concise environmental monitoring reports will be submitted to the top management and if required by the local environmental authority. The design of this monitoring programme has considered final use of the data before actual monitoring starts. The monitoring program will focus on the following

- Air quality with respect to SO_2, CO, NO_x, PM_{10}, $PM_{2.5}$ and VOCs (mainly hexane);
- Treated wastewater quality with respect to COD, BOD, TDS, Oil and Grease and pH (other parameters such as E.coli and total coliforms, Sulphates, Ammonium, Zinc, Iron, Lead, Cadmium if required).
- Noise levels inside facility and around sensitive locations.

21.2.1 Objectives of the Monitoring Plan

The main objectives of the monitoring plan can be summarised as follows:

- Protection of environment and resources
- Establish and maintain baseline data
- Documentation of environmental status
- Improved operational efficiency
- Detect contamination and leakage (if any) at an early stage
- Meet regulatory requirements as set by the Iraqi Ministry of Environment
- Record results and data in project database
- Use of data in possible research & development studies

21.2.2 Environmental Aspects

Operations of the soybean oil project may cause a number of undesirable environmental effects with measurable parameters that will be monitored regularly to determine level of compliance with relevant Iraqi standards. The following are the main pollution hazard indicators on-site:

- Leakage: hazardous materials storage that may contaminate soil or surface water or seep into groundwater
- Fires: Spontaneous combustion of flammable materials is unlikely as there is limited flammable materials in use at the site. The exception will be for certain substances (mainly hexane) which will be stored in an

underground tank at a location designed to minimize the effects of a fire. Also, high levels of dust in the operational environment may cause spontaneous combustion.

- Dust: Dust storms and high winds are a natural occurrence in Umm Qasr area, and soybean oil project operations will be incompliance with the Iraqi Ministry of Environment requirements during normal operation as explained in details in section 5-Air Quality and Meteorology.
- Handling: Contamination to workers is a high probability if handling procedures for hazardous materials are not followed
- Insects, Vermin, rodents and pests: Insects, flies, cockroaches, stray cats, rats, birds and other vector breeding, living near or feeding on wastes.
- Noise: Noise levels are expected within the acceptable range inside the facility boundary as long as the Project installs the required noise control measures for sources that may generate noise level that exceed 85dB during construction and operation phases.
- Traffic congestion: If proper routing schedule is not followed tankers, long vehicles movement on roads around site and onsite may cause traffic jams and disturbance of public roads.

21.2.3 Environmental Control Measures

The soybean oil project will adhere to all applicable regulations and will be operated in accordance with applicable national environmental requirements and IFC Guidelines. With respect to its boilers and generators, wastewater treatment and waste management, the Project management will apply best practices in reducing air emission, wastewater treatment and waste business to minimize, control, reduce, eliminate and contain any adverse impacts due to operation of the Project and reach the required level of environmental compliance.

"Monitoring will meet national and international standards; laboratory sampling, testing and analysis will follow the international approved methods (such as American Standard Test Methods and USEPA approved methods) for monitoring air monitoring and analysis of water, wastewater and waste."

21.2.4 Environmental Monitoring Program during Project construction and operation

The soybean oil project will prepare and enforce effective and efficient environmental monitoring plans and procedures for conservation of environmental resources and safeguarding the public health. As per the Iraqi environmental authority, the project management will allow environmental authority staff right of entry and access to the project site based on a prior notice of 24 hours for the purpose of surveillance, monitoring and inspection to verify compliance status of regulated pollutant parameters. Environmental authority staff will be given right to entry for inspection purposes without any prior notice in the event of any complaint or abnormal situation or incident related with the environmental impacts arising from facility operation. The Project management reserves its right to restrict their entry in case of any emergency, which gives rise to any immediate personal safety hazard.

Records and data available at the project site will also be accessible to governmental authorities in case of emergency. Groundwater testing will be done by an accredited outside laboratory, that will carry out all sampling, testing and analysis as per the approved national and international standards including those of the American Society for Testing and Materials (ASTM). Routine laboratory tests will be performed as per pre-set program planned by the Project and as required by Iraqi environmental authorities and IFC and implemented by the environmental laboratory.

21.2.4.1 Water Quality Monitoring

The project team will collect the initial (first flush) storm water from process areas and hazardous material storage and handling areas. First flush will be considered to be the first 30mm of rainfall from each storm event. The collected water will be analyzed and if it is contaminated, this water will be treated by the water treatment system at the facility before discharge to the Arabian Gulf.

The water quality monitoring program consists of monitoring treated wastewater which will be done in compliance with national regulations and requirements particularly in regards to treated wastewater effluent. The monitoring schedule for treated water generated from various sources, and the parameters to be analyzed, are summarized below.

The daily monitoring of treated wastewater should be conducted to ensure compliance of certain parameters (BOD, COD, pH, Oil and Grease) with the national standards and IFC guidelines. The frequency of reporting to the top management regarding compliance of treated wastewater is on a monthly basis.

21.2.4.2 Air Quality Monitoring

Stack testing for all air emission sources shall be conducted during performance tests and whenever required. The test shall be conducted by an approved consultant to ensure its compliance with the Iraqi source standards as defined in section 2 of this ESIA. Also, point source monitoring for SO_2, NO_x, PM and Hexane may be needed for certain sources if required by the Iraqi environmental authority.

For odour assessment and monitoring, it is recommended that the environmental coodinator should walk along the facility fence line on a daily basis, to observe any discernible or objectionable level of odour which could give raise to nuisance complaints.

21.2.4.3 Soil Monitoring

Soil should be monitored and analyzed by a qualified third party for presence of any signs of contamination. Soil subject to any leakage shall be tested and monitored. If toxicity is detected in the soil column during construction and operation, the project management will undertake an action to investigate the source and rectify the contaminated soil and it will be removed, scratched, raked, trenched, or washed and bio-remediated.

21.2.4.4 Noise Monitoring

The Project management will monitor noise generated during the construction phase and during operations at the project site. Construction and operational staff subject to high noise levels that exceed 85dB will use PPE/ earmuffs as an effective protection device. As per international and local noise standards, noise levels will be measured at work areas adjacent to noise sources. The Project management will always ensure that noise levels are well below a maximum of 85dB at all times.

The project management will maintain employee noise exposures below the 85dBA 8-hour time weighted average (TWA) exposure limit through a combination of equipment selection, noise control devices, PPE, and administrative controls.

21.2.4.5 Quality Assurance

The project management applies its own internal Quality Assurance for planned and systematic operations that provide confidence in overall performance of the project site and it's final product's suitability for its intended purpose by clients. All project activities are intended to ensure that final product and services satisfy client requirements in a systematic, reliable fashion.

The Project management emphasizes on the following key principles to characterize QA at facility site:

- Product is suitable for intended purpose and "right first time" (mistakes should be eliminated).

- QA includes regulation of the quality of (raw materials), operations, products, services and management, and inspection processes.

The project management realizes that quality is determined by the intended users, clients or customers, and does not necessarily have to meet higher standards than set targets by Soybean oil project management or to be 'expensive' or 'high quality'. Final product is considered as a quality item as long as it meets client and market need.

The Project "company quality" concept focuses on management and staff, where all components in soybean oil facility site are required to approach desired quality, and the facility management leads the quality improvement process.

The company-wide quality approach places an emphasis on four aspects:

- Elements such as controls, job management, adequate processes, performance and integrity criteria and identification of records
- Competence such as knowledge, skills, experience, qualifications
- Soft elements, such as personnel integrity, confidence, organizational culture, motivation, team spirit and quality relationships.
- Infrastructure and site components (as it enhances or limits functionality)

Quality of the outputs will be at risk if any of these aspects is deficient in any way, and the continuous quality assurance or total quality control applied by the facility is one of the more effective tools on-site as part of the monitoring program.

21.2.4.6 Exposure Monitoring

Airborne and gaseous contaminants can present a significant threat to employee safety and health, thus making air quality monitoring an important component of an effective safety and health program. The Project management will develop and implement a baseline and on-going industrial Hygiene monitoring program based on an internal standard designed to identify potential exposure hazards, evaluate and monitor those hazards and implement controls such as isolation, ventilation and PPE.

Accurate information on the identification and quantification of airborne contaminants is useful for the following:

- Indicating work areas and identifying tasks and operations where exposure controls are needed,
- Selecting the right type of PPE, with aim at quality, size and number

- Assessing potential health effects of exposure, and
- Determining need for specific medical monitoring.

During operations, the project management will periodically monitor employees who are likely to have higher exposures to determine if they have been exposed to hazardous substances in excess of permissible exposure limits. The company will monitor for any potential condition that is IDLH or for exposures over TWA or STE or PELs or other published exposure levels since prior monitoring phase.

Situations where the facility will conduct a risk assessment to identify potential health risks and monitoring, if indicated by the risk assessment includes:

- Work begins on a different portion of the site,
- New contaminants are being handled,
- Different type of operation is initiated, and
- Handling leaking drums or working in areas with obvious contamination

The Project management will implement special monitoring programs for measuring the effectiveness of mitigation and for identifying potential impacts during the project's construction, commissioning, operational or decommissioning phases.

Point source or fugitive emissions or treated wastewater monitoring should be undertaken by the project’s concerned staff to ensure compliance with the relevant environmental standards (e.g., wastewater discharges to the Arabian Gulf, stack emissions, fugitive emission, groundwater monitoring, etc.).

It shall be noted that certain monitoring items cover several issues and, therefore, not every impact/mitigation has a separate monitoring measure description.

Monitoring measures to minimise environmental impacts resulting from the construction, commissioning, operation and decommissioning of soybean oil project are presented in Table 21-1 for air quality, onshore physical (including wastes), terrestrial biological resources, human health, and for impacts from noise and vibration. Table 21-1 presents the impacts of the project entailing a mitigation measure (from Table 20-1) and/or a monitoring measure. Impact is provided with the same number as the unique issue number used in the impact and mitigation tables (Table 20-1) for ease of reference.

21.3 Social Management Plan

The social management plan shall be developed and implemented throughout the life of the Project and cover the following parts (further details are given in Appendix E):

- Human Resources Policy for Construction Site (applicable to contractors)

- Human Resources Policy of Sama al Manar
- Code of Conduct for Workers (to avoid any gender based violence risks or conflicts with the community)
- Worker Accomodation Plan (to ensure the accomodation arrangements of the project are in line with PS2)
- Local Recruitment Plan (to ensure job opportunities of the project are transparently disclosed to community members and the hiring process is formally designed based on competency and pre-defined criteria, avoiding any discrimination based on ethnicity, gender, political orientation, tribal affiliation etc.)
- Worker Grievance Mechanism
- External Relations Procedure and Grievance Mechanism
- Security Risk Assessment and Management Plan

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility		
Item No.	**Impact**	**Monitoring Measure**
Air Quality & Meteorology		
AQ1	Dust emissions during construction of the project	***Monitoring Measures:*** - Routine visual assessment of dust during initial site preparation work and periodically thereafter, depending on the nature of the work activity. - Monitor speed limit of 30kph on unpaved road - Transported materials will be covered with a tarpaulin to prevent fugitive dust ***Timing:*** Continuous throughout construction phase ***Responsibility:*** EPC Contractor
AQ1	Exhaust emissions from vehicle movements during construction and decommissioning	***Monitoring Measures:*** - Routine vehicle maintenance and check of vehicle's inspection records - Vehicles should be switched off when not in use, unless impractical for health and safety reason. ***Timing:*** upon manufactures indications ***Responsibility:*** EPC Contractor
AQ2, AQ3, AQ4, AQ5, AQ6, AQ7, AQ8, AQ9, AQ10, AQ11 AQ12 and AQ13	Gases (such as NOX, SO2, CO, Hexane) and PM emissions from combustion sources and others Fugitive Emission from pump, valves, connectors, compressors, relief valve Odor Emission during abnormal operation and from wastewater treatment system	***Monitoring Measures:*** • Continuous ambient air quality monitoring is required by an approved third-party consultant. Parameters to be monitored include SO2, NOx, CO, hexane, PM_{10} • Ensure the source emission of dust and gases as per the limits otherwise install appropriate control devices • Continuous monitoring for meteorological data (wind speed and direction, temperature and relative humidity) is required and the Meteorological equipment may be installed in an open space on top of the administration building. Data logging system for the meteorology data will be linked to the Distributed Control System (DCS) • Stack emission testing, measuring air pollutants (including hexane) as well as PM_{10} should be conducted ensure compliance with the Iraqi Environmental limit and IFC guidelines Conducting fugitive emission testing as required by the Iraqi environmental authority.

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility		
Item No.	**Impact**	**Monitoring Measure**
	Emissions during start-up of units	• Monitoring of all accessible components (valves, pumps, etc) shall be carried out whenever is required. • Visual inspection of all instrumentation systems shall be carried out semi-annually. • Monitoring of all difficult to monitor components shall be carried out once in a year, unless the environmental local authority approves a less frequent schedule. ***Timing:*** During performance test and annually or whenever is required for boiler stacks and extraction vent and fugitive emission test as per Iraqi environmental authority. ***Responsibility:*** HSE Manager of the facility, coordination between governmental environmental authority and concerned departments in soybean oil project

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility

Item No.	Impact	Monitoring Measure
Terrestrial Land Environments (Landforms, Soil, Surface Water & Groundwater)		
TE1, TE2, TE3	Soil erosion and degradation of the soil and groundwater due to leakage and maintenance activities and wash down of equipment during construction and operation phases	***Monitoring Measures****:* • *Regular check for any hazardous material leakage during maintenance activities* • Periodic clean-up of surface water drainage channels. ***Timing:*** Regular checks for leakage from equipment, and check drainage channels after each storm event. ***Responsibility***: HSE Manager at the soybean oil facility
TE4 and TE10	Accidental release / spill of Fuel/Product related to Transport	***Monitoring Measures****:* • Regular checks on transport vehicles condition • Periodical check of each vehicle on-site. • Ensuring that refuelling of equipment and vehicles will be carried out in a designated area on hard standing ground to prevent seepage of any spills into the ground. ***Timing:*** Regular checks. At least one check per vehicle every three months. ***Responsibility***: HSE Manager at the soybean oil facility
	Accidental release / spill of Process Products from Storage Tanks.	***Monitoring Measures***: • Routine monitoring of tank condition • Periodical check of the material used in the retention and collection of spills, and training to all staff involved in oil management practices. • Installation of a network of monitoring wells is very advisable, including the implementation of a groundwater monitoring program. ***Timing*** Regular checks of tanks (implement a monitoring program). • Checking material used in the restraint and collection of spills at least once every 3 months. • Monitoring of wells at least once per 2 weeks for visually detecting the presence of free product and groundwater sampling + analysis at least once every year. • No. of GW wells is a minimum of 3 unless requested otherwise by Iraqi environmental authority ***Responsibility***: HSE Manager at the soybean oil facility

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility

Item No.	Impact	Monitoring Measure
	Accidental release / spill of material/effluents from pipes	***Monitoring Measures***: • Regular monitoring of pipelines to ensure appropriate status, including valves, pumps, etc. • Periodic check of retention and collection materials, and training to all staff. ***Timing*** • Regular checks of pipelines. • Checking material used for spill response once every 3 months. • Monitoring of wells at least once per month for visually detecting presence of free product and groundwater sampling + analysis at least once every year. ***Responsibility***: HSE Manager at the soybean oil facility
TE5, TE6, TE9	Potential environmental impacts associated with wastes generated at the soybean oil facility and on-site storage of wastes	***Monitoring Measures***: • Audit waste treatment facilities, waste transport contractors to ensure that wastes arising from the soybean oil facility are compliant with waste management guides • Maintain log of waste composition and Material Safety Data Sheets (MSDS). • Wastes sent for storage accompanied by identifying documentation. • Keep waste transfer documents, and generally follow all procedures established in the Iraqi environmental regulations and standards for transport and disposal of wastes. • Waste analysis is required for each batch of waste as part of waste management program. ***Timing***: Make monthly stock check of wastes in storage and analyses on wastes to a certain composition. ***Responsibility***: HSE Manager at the soybean oil facility

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility		
Item No.	**Impact**	**Monitoring Measure**
	Terrestrial Biological Resources	
TB1 and TB2	Removal of vegetation and potential foraging sites for nocturnal animals (habitat loss) Effects of noise on breeding, wintering and migrant birds offsite in protected areas	***Monitoring Measures**:* • Engage with the Iraqi environmental authority in marine life protection and implantation schemes • Sponsor conservation area rehabilitation programs • Suitable vegetation covers around the project site ***Timing**:* Prior to, and during site clearance activities and operation ***Responsibility**:* the soybean oil facility
TB3	Potential effects of light on nocturnal animals roaming and foraging offsite.	***Monitoring Measures**:* • Use of efficient lighting systems • Visual survey of lighting around sites perimeter to ensure that lights are shielded and canted, whilst complying with security constraints, to minimise disturbance to nocturnal animals offsite. ***Timing**:* During commissioning and then following routine maintenance activities on perimeter lighting. ***Responsibility**:* the soybean oil facility
	Noise & Vibration	
NV1, NV2, NV3 & NV4	Noise nuisance during all phases.	***Monitoring Measures***: • Monitor ambient noise at site boundaries to ensure compliance with the Iraqi environmental limit, confirm noise predictions at local sensitive receptors and document status of compliance with applicable standards. • At a minimum, Leq and L_{90} shall be measured, and two measurements conducted at each selected monitoring location approved by the Iraqi environmental authority. • Ensure generator is maintained as according to a maintenance schedule and housed in a noise-reducing insulator. • Ensure that machines and equipment are maintained in good working condition and inspected regularly. ***Timing***: Regular monitoring during construction phase. Annually during normal operations, daytime (6:00 to 19:00), evening (19:00-22:00) and night time (22:00 to 06:00) noise monitoring shall be performed. Minimum duration of each measurement shall be 15 minutes. ***Responsibility***: HSE Manager at soybean oil facility during operations and EPC during construction, commissioning and decommissioning phases.

<table>
<tr><th colspan="3">Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility</th></tr>
<tr><th>Item No.</th><th>Impact</th><th>Monitoring Measure</th></tr>
<tr><td colspan="3">Waste Management</td></tr>
<tr><td>WM1, WM2, and WM4</td><td>Hazardous and non-hazardous wastes handling during construction and operation phases</td><td>Monitoring Measures:
• Waste reduction practices as per Iraqi environmental authority and IFC requirements
• Effective management of wastes and within the requirements of applicable Iraqi regulations and IFC requirements
• Monitor waste management (including collection, handling, storage, transportation, treatment method, reuse, recycle, disposal, etc.) generated by soybean oil facility to ensure compliance with the Iraqi environmental requirements and document status of compliance with applicable standards. All required information (including type of waste, quantities, treatment method, disposal place at approved facility, etc) for preparing waste manifest and waste inventory should be recorded periodically.
Timing: Continuous.
Responsibility: HSE Manager at soybean oil facility during operations and EPC during construction, commissioning and decommissioning phases.</td></tr>
<tr><td colspan="3">Water Quality Management</td></tr>
<tr><td rowspan="2">WQ1, WQ2 and WQ3</td><td>On-site impact of treated ground water used for different purposes at the facility site</td><td>Monitoring Measures: The ground water treatment system should be observed and monitor continuously to ensure the treated water quality in compliance with the Iraqi standards and IFC guidelines at all times. The main parameters to be monitored are TDS and pH.
Timing: following commissioning.
Responsibility: the soybean oil facility</td></tr>
<tr><td>Off-site impact to marine life from – any discharges of treated wastewater effluents to the Arabian Gulf</td><td>Monitoring Measures:
• The industrial wastewater treatment system should be observed and monitor continuously to ensure the treated wastewater quality in compliance with the Iraqi standards and IFC guidelines at all times. The main parameters to be monitored are TDS, COD, BOD, Oil and Grease and pH
• Monitor the quality of treated wastewater at all times.
• Check condition of the Arabian Gulf at point of discharge as per the Iraqi environmental authority requirements
• Contribute to marine life monitoring and conservation schemes by Iraqi environmental authority
Timing: following commissioning.
Responsibility: the soybean oil facility</td></tr>
</table>

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility		
Item No.	**Impact**	**Monitoring Measure**
	Oceanography	
O1	Direct discharge (if any) to the marine environment of pre-treated wastewater during commissioning and operations period	***Monitoring Measures****:* • Ensure the discharged wastewater is in comply with the national and international limits • Monitor the water quality on outlet piping ***Timing****:* Pre-commissioning, continuous for monitors. Samples requiring laboratory analysis – at least once per 3 month for specified samples which will help control the wastewater quality, or at a frequency specified in the discharge consent conditions. ***Responsibility****:* the soybean oil facility
	Health and Safety	
HS3 and HS6	Increase in vehicle movement could result in a potential increase in road traffic accidents	***Monitoring Measures:*** Keep a record of vehicle accidents ***Timing***: During the lifetime of the project. ***Responsibility****:* EPC Contractor and HSE Manager at the soybean oil facility
HS1 and HS5	Detrimental affects to workers' health due to fugitive dust (PM_{10}) associated with construction and operation activities and exhaust emissions.	***Monitoring Measures****:* Inspections to ensure workers are using PPEs ***Timing***: During the lifetime of the project. ***Responsibility****:* EPC Contractor
H6, HS9 and HS10	Demand increased in health services and infrastructure by workers could potentially reduce local population's access to health care (peaking during construction phase).	***Monitoring Measures****:* Perform audits to ensure that there are sufficient on-site facilities providing health services for workers at any one time ***Timing***: One audit every six months during the lifetime of the project. ***Responsibility****:* HSE Manager at the soybean oil facility
HS8	Community health- communicable diseases that caused by viral bacterial, parasitic and fungal pathogens that are transmitted through an infected person, animal or environmental source	***Monitoring Measures****:* • Workforce training program to be compiled to include materials on communicable diseases (e.g. HOV and COVID-19), disease prevention, and treatment to raise awareness • Project areas, especially a construction site toilet, and eating facilities, should be kept clean and free from accumulation of wastes as well supplied with clean potable water. This include ensuring appropriate food preparation and monitoring measures are in place. ***Timing***: As per HSE plan ***Responsibility****:* EPC Contractor and HSE Manager at the soybean oil facility

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility		
Item No.	**Impact**	**Monitoring Measure**
HS4	Job-related Injuries	***Monitoring Measures:*** Perform Audits to evaluate the effectiveness of the HSE procedures implemented for the soybean oil facility and to take measures where necessary ***Timing***: As per HSE plan ***Responsibility****:* EPC Contractor and HSE Manager at the soybean oil facility
	The Workforce may be subject to poor labour and working conditions	***Monitoring Measures****:* • Adhering to labour and working condition in compliance wit Iraqi labour laws and in alignment with IFC PS 2 through awareness training and information provision, as necessary. • Ensure that performance with regards to worker management, worker rights and health and safety as outlined in Iraqi law and international standards will be managed and reported ***Timing****:* Regularly throughout construction and operation phases. ***Responsibility****: Contractor and* the soybean oil facility management

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility

Item No.	Impact	Monitoring Measure
General OHS Management	OHS Management	***Monitoring Measures:*** • Development of a site specific OHS risk assessment and management plan • Implementation of OHS Management Plan • Risk assessment study within the scope of every activity to be conducted for the project will be conducted before commencing the works. • Employees will be aware of any possible OHS risks and will be trained against them properly. • Ensuring immediate response to and timely reporting, analysis and communication of all incidents • All incidents shall be recorded in the approved incident reporting system, and be analyzed to a level commensurate with the actual consequence or potential risk rating, whichever is higher • Undertaking a medical assessment to all employees to ensure they are medically fit to perform their role before commencing the works and these controls will be repeated annually • Ensuring that health assessments are carried out in respect of all personnel who engage in specific tasks with the potential for occupational exposure • Acknowledge the risk associated with project area operations, and provides for the reporting and rectification of hazards • Where personnel are required to work alone, the activities and conditions shall be risk assessed and a safe system of work developed • Where a manual handling task is required a risk assessment shall be completed to identify the hazards. The risk of injury should be assessed for each hazard, and appropriate controls implemented, including manual handling training as appropriate • The Company must ensure commitment to monitoring and reporting of occupational health hazards and hazardous occupational environments, and implement controls to reduce risk in accordance with all applicable regulations and, wherever practicable, with regard to accepted best practices • Ensure the safe control of hazardous substances and reduce the level of exposure to personnel, property and the environment in accordance with the ESIA Requirements • Ensuring all personnel and visitors wear or use personal protective equipment provided if it is necessary to protect them from harm • Ensuring sufficient Safety Signs are posted in workplaces and travel ways to prevent incidents, identify hazards • Ensuring that all personnel undertaking activities where there is a risk of a person falling from one level to another do so in a controlled manner to reduce the risk of personal injury • Task specific hazard identification will be done for each activity. • Inspections of the project site should be carried out weekly. The company will undertake weekly inspections of the whole work site. ***Timing****:* Regularly throughout construction and operation phases. ***Responsibility****:* Contractor and the soybean oil facility management

Table 21-1 Summary of Potential Monitoring Measures for soybean oil facility		
Item No.	**Impact**	**Monitoring Measure**
Worker health & safety	Workers' Accommodations	***Monitoring Measures:*** • Providing adequate arrangements of drinking water, lighting, ventilation, bedding, bathing, laundry and other basic facilities in the workers' accommodation camps. • Providing separate toilet facilities for men and women at the workers' accommodation camps as well as at the project site. • Ensuring proper health-checkups of all laborers employed at the project site. • Facilitating healthcare services and medical care in case of sickness. ***Timing****:* Monthly during construction and operation phases. ***Responsibility****: Contractor and* the soybean oil facility management

22 ABBREVIATIONS & ACRONYMS

µg/l	Microgram per litre
$\mu g/m^3$	Microgram per cubic metre
$\mu N/m^2$	micro Newtons per square metre
µPa	micro Pascals
ΔT	Temperature Differential
AAQS	Ambient Air Quality Standards
API	American Petroleum Institute
AQG	Air Quality Guideline
AQL	Air Quality Limit
AQMS	Air Quality Monitoring Station
AQS	Air Quality Standards
ASTM	American Society for Testing and Materials
BACT	Best Available Control Technology
BAT	Best Available Techniques
BFD	Block Flow Diagram
BOD	Biological Oxygen Demand
BREF	BAT Reference Document
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
°C	Degree Celsius
CCD	Convention to Combat Desertification
CEDAW	Convention on the Elimination of all Forms of Discrimination Against Women
CFCs	Chlorofluorocarbons
IWTP	Industrial Wastewater Treatment Plant
CO	Carbon monoxide
CO_2	Carbon dioxide
COD	Chemical Oxygen Demand
CRC	Convention on the rights of the Child
dB	Decibel
dB(A)	A-weighting sound level in dB

EA	Each
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EC	Equivalent Carbon
EG	Environmental Guidelines
EIA	Environmental Impact Assessment
ESMMP	Environmental and Social Management Monitoring Plan
ESMS	Environmental and Social Management System
EPA	Environmental Protection Agency
EPC	Engineering, Procurement & Construction
EPID	Environment Protection and Improvement Directorate
EPFI	Equator Principles Financial Institution
EPRP	Emergency Preparedness Response Plan
ES	Environmental Standards
ESPs	Electrostatic Precipitation
EU	European Union
F	Frequency
ft	Feet
FEED	Front-End Engineering Design
FCC	Framework Convention on Climate Change
GCC	Gulf Cooperation Countries
GCPI	General Company for Ports of Iraq
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GOSI	General Organisation for Social Insurance
GPS	Global Positioning System
GIIP	Good International Industry Practices
GSC	General Statistics Center
ha	Hectare
HAP	Hazardous Air Pollutants
HAZID	Hazard Identification Study
HAZOP	Hazard And Operability Study
HGV	Heavy Goods Vehicles

HDPE	High Density Polyethylene
HIA	Health Impact Assessment
HIV	Human Immunodeficiency Virus
HOC	Halogenated Organic Compounds
HP	High Pressure
hrs	Hours
H_2S	Hydrogen Sulphide
HSE	Health, Safety & Environment
HSES	Health Safety Environment and Security
IBA	Important Bird Area
IBRD	International Bank for Reconstruction and Development
ICPPED	International Convention for the Protection of All Persons from Enforced Disappearance
ICC	International Criminal Court
ICAA	Iraqi Civil Aviation Authority
ICAO	International Civil Aviation Organization
ICCPR	International Covenant on Civil and Political Rights
ICSID	International Centre for Settlement of Investment Disputes
IDA	International Development Association
ID	Identification
IDLH	Immediately dangerous to life or health
IEA	International Energy Agency
IFC	International Finance Corporation
IHR	International Health Regulations
IMOE	Iraqi Ministry of Environment
INC	Incorporated
IPPC	Integrated Pollution Prevention & Control
IRR	Iraqi Republic Railroad
ISD	Industrial Security Department
ISO	International Standards Organization
ISU	Internet Services Unit
IUCN	International Union for Conservation of Nature & Natural Resources
IWDF	Internal Waste Documentation Form
IWTP	Industrial Wastewater Treatment Plant

kg/dscf	kilogram per deci standard cubic foot
kHz	Kilohertz
km	kilometer
kMTA	thousand metric tones per annum
KBA	Key Biodiversity Area
KPI	Key Performance Indicators
KPA	Kilo Pascal
KRI	Kurdistan Region of Iraq
kWh	Kilowatt per hour
lb	Pound
L_{10}	Sound level exceeded 10% of measurement period
L_{90}	Sound level exceeded 90% of measurement period
L_{eq}	Equivalent Noise Level
LDAR	Leak Detection and Repair
LDC	Less Developed Countries
L_{eq}	Equivalent Noise Level
LP	Low Pressure
m	metre
m/d	metre per day
m^2/d	Square metre per day
m^3/d	Cubic metres per day
m/s	metre per second
MBTU	Million British Thermal Unit
mg/dscf	milligram per deci standard cubic foot
mg/kg	Milligram per kilogram
mg/l	Milligram per litre
mg/m^3	Milligram per cubic metre
mg/Nm^3	Milligram per normal cubic metres
MIGA	Multilateral Investment Guarantee Agency
mm	millimetre
MMSCF	Million standard cubic feet
MMkcal/h	Million kilo calories per hour
MOH	Ministry of Health

IMOE	Iraqi Ministry of Environment
MS	Microsoft
MSDS	Material Safety Data Sheets
MT	Metric tones
MVA	Megavolt Ampere
MW	Megawatt
N	Nitrogen
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NESHAPS	National Emission Standards for Hazardous Air Pollutants (US)
NFPA	National Fire Protection Association
NM	Not Measured / Not Monitored
NMHC	Non Methane Hydrocarbon
Nm^3/hr	Normal cubic metres per hour
NO_2	Nitrogen Dioxide
NO_x	Nitrogen oxides
NSPS	New Source Performance Standards
NTU	Nephalometric Turbinity Unit
O_2	Oxygen
ODS	Ozone Depleting Substances
OPEC	Organization of the Petroleum Exporting Countries
PAH	Poly-aromatic Hydrocarbons
pH	Potential of Hydrogen
PLC	Programmable Logic Controller
PM_{10}	Particulate matter <10µm in size
ppb	Parts per billion
PPE	Personal protective equipment
ppm	Parts per million
ppmvd	Parts per million, volumetric dry
ppmw	parts per million by weight
ppt	Parts per thousand
psi	Pound per square inch
QA/QC	Quality Assurance / Quality Control

QRA	Quantitative Risk Assessment
RACT	Reasonably Available Control Technology
RECSO	Regional Cleanup Sea Organisation
RH	Relative Humidity
RO	Reverse Osmosis
ROPME	Regional Organisation for the Protection of the Marine Environment
RTA	Road Traffic Accident
SARPS	Standards and Recommended Practices
SCPI	State Company for Petrochemical Industries
sm	Square meter
SO_2	Sulphur dioxide
SEP	Stakeholder Engagement Plan
SWMP	Site Waste Management Plan
SWTP	Sanitary Wastewater Treatment Plant
TCEQ	Texas Commission of Environmental Quality
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
tph	tons per hour
TSP	Total suspended particulates
TSS	Total suspended solids
UAE	United Arab Emirates
UK	United Kingdom
ULNB	Ultra-low NOx Burners
ULSD	Ultra-Low Sulfur Diesel
UN	United Nations
UNCED	United Nations Conference on Environment & Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tanks
UTM	Universal Transverse Mercator

VOC	Volatile Organic Compounds
WB	World Bank
WC	World Commission
WHO	World Health Organization
WID	Waste Information Database
wt%	Weight percent
WMP	Waste Management Plan
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization
WWTP	Wastewater treatment plant

23 REFERENCES LIST

SECTION 1 – INTRODUCTION

- Cheng, M.H., 2017. Techno-economic analysis of soybean oilextruding-expelling process. In: Sustainability Analysis ofSoybean Refinery: Soybean Oil Extraction Process. Ph.D.Dissertation. Iowa State University, pp. 23–48.
- Erhan, S., Asadauskas, S., 2000. Lubricant basestocks from vegetable oils. Ind. Crop. Prod. 11, 277-282.

SECTION 2 – POLICY, LEGAL AND ADMINSTRATIVE FRAMEWORK

- World Bank (2007), Environmental, Health and Safety (EHS) Guidelines
- The IFC EHS Guidelines for Vegetable Oil Production and Processing, February 12, 2015
- The IFC EHS Guidelines for Food and Beverage Processing, April 2007

SECTION 3 – PROCESS DESCRIPTION

- Anderson, G., 2011. Solvent extraction: Edible oil processing. Retrieved from AOCS Lipid Library: http://lipidlibrary.aocs.org/OilsFats/content.cfm?ItemNumber=40337/ (accessed 16.11.15)
- Li, H., Pordesimo, L., Weiss, J., 2004. High intensity ultrasound-assisted extraction of oil from soybeans. Food Res. Int. 37, 731-738.
- Oetterer, M., Regitano-D'Arce, M. A. B., & Spoto, M. H. F. (2006). Fundamentos de Ciência e Tecnologia de Alimentos. Barueri, SP: Manole, 612.
- Oliveira, R., Barros, S., Gimenes, M., (2013). The extraction of passion fruit oil with green solvent. J. Food Eng. 117, 458-463.
- SoyStatsb, 2015. Retrieved from Internationla: World soybean production: http://soystats.com/international-world-soybean-production/
- Woerfel, J. (1995). Extraction. In D. Erickson, Practical Handbook of Soybean Processing and utilization (pp. 65-92). Urbana, IL: AOCS Press.

SECTION 4 – IMPACT ASSESSMENT CRITERIA AND METHODOLOGY

SECTION 5 – AIR QUALITY AND METEOROLOGY

- Al-Muhyi Abdul Haleem A., Faez Younis Khalil Aleedani, (2022): Impacts of Global Climate Change on Temperature and Precipitation in Basra City, Iraq. Bas J Sci 40(1) 215-230.
- Fatin Aqilah Binti Abdul Aziz, Norliza Abd. Rahman, and Jarinah Mohd Ali (2019). Tropospheric Ozone Formation Estimation in Urban City, Bangi, Using Artificial Neural Network (ANN). Research Article, Article ID 6252983. Tropospheric Ozone Formation Estimation in Urban City, Bangi, Using Artificial Neural Network (ANN) (hindawi.com).
- Fang, M.L., Chou, M.S., Chang, C.Y., Chang, H.Y., Chen, C.H., Lin, S.L. and Hsieh, Y.K. (2019). Chemical Adsorption of Nitrogen Dioxide with an Activated Carbon Adsorption System. Aerosol Air Qual. Res. 19: 2568-2575. https://doi.org/10.4209/aaqr.2019.09.0439.
- Khalil MAK, Butenhoff CL, Porter WC, Almazroui M, Alkhalaf A, Al-Sahafi MS (2016) Air quality in Yanbu, Saudi Arabia. J Air Waste Manag Assoc 66:341–355
- Kim KH, Kabir E, Kabir S (2015) A review on the human health impact of airborne particulate matter. Environ Int 74:136–143
- Surender and Pankila Khanna (2018). A review: On Carbon Monoxide Poisoning. Nternational Journal Of Information And Computing Science, Volume 5, Issue 8
- Tamminga, S. 1992. Gaseous pollutants by farm animal enterprises. In: C. Phillips and D. Piggins (Ed.) Farm Animals and the Environment. pp 345–357. CAB International, Wallingford, U.K
- US EPA, (2003), 40CFR Part 51, Revision to the Guideline on Air Quality models: Adoption of a preferred long range Transport Model and other Revisions; Final Rule.
- US EPA, 2005, 40CFR Part 51, Revision to the Guideline on Air Quality models: Adoption of a preferred long range Transport Model and other Revisions; Final Rule.

SECTION 6 – TERRESTRIAL ENVIRONMENT

- Ahmed Srdah Al-Zubedi, 2022: Groundwater in Iraq, Published book in Baghdad, Iraq.
- Al-Warid, M., 1989. The History of Baghdad. Al-Nahdha Press, Baghdad, 372pp
- Al-Ansari, N. A. (2020). Topography and Climate of Iraq. Journal of Earth Sciences and Geotechnical Engineering, Vol. 11, No. 2, pp1-13
- Baban, Dler H. and Lawa, F.A., (2016). Palynological and Stratigraphical Evidences on the Age of the Outcropped Khabour Formation near Chalki Nasara Village, Kurdistan Region, Northern Iraq. Journal of Zankoy Sulaimani, Special Issue, GeoKurdistan II, pp.293-318
- Brown, G.F., Schmidt, D.L., and Huffman, A.C., 1989, Geology of the Arabian Peninsula: Shield area of western Saudi Arabia. U.S. Geological Survey Professional Paper 560-A, 188 p
- Bazuhair AS, Wood WW (1996) Chloride mass balance method for estimating groundwater recharge in arid areas: examples from western Saudi Arabia, J Hydrol 186:153–159
- Barzanji, A.F., 1973. gypsiferous soil of Iraq. Ph.D. Thesis, University of Ghent, Belgium.
- Clark AR, Walker BF, (1977): "A Proposed Scheme for the Classification and Nomenclature for use in the Engineering Description of Middle Eastern Sedimentary Rocks", Geotechnique, 27 (1), 93-99
- Fugro, (2021): Geophysical Investigation for Berth 4 Area, Geophysical Report, Umm Qasr Port, Basrah, Republic of Iraq
- Jassim, S.Z. and Buday, T.,(2006). Chapter fourth, pp.45-56: In Jassim and Goff, editors, Geology of Iraq 2006; Dolin, Prague and Moravian Museum, Brno, 341p.
- R. A. Mahmood, and A. A. Albadran, "Geotechnical classification and distribution of the Quaternary deposits in Basrah City, South of Iraq", Iraqi Journal of Earth Sciences, Special Issue, Part 1, pp. 6-16, 2002
- Sissakian, V.K., Fouad, S.F. and Tawfiq, F., 1992. Geological report on the areas affected by Harir Earthquake. GEOSURV, int. rep. no. 2077 (in Arabic).

SECTION 7 – TERRESTRIAL BIOLOGICAL RESOURCES

SECTION 8 – NOISE AND VIBRAITON

- BS 5228: 2009 - "Code of practice for noise and vibration control on construction and open sites" (Parts 1 and 2).
- Hong Kong Environmental Protection Department, 1996 "Technical Memorandum on Noise from Construction Work other than Percussive Pilling" 2nd ed
- The World Bank Group in collaboration with UNEP and UNIDO, 1998 "Pollution and Abatement Handbook".

SECTION 9 – WASTE & MANAGEMENT

SECTION 10 – WATER QUALITY MANAGEMENT

- Al-Ansari, N.A. (2013). Management of Water Resources in Iraq: Perspectives and Prognoses. J. Engineering, Vol.5, 8, pp.667-68
- Al-Ansari, N.A. (1998). Water resources in the Arab countries: Problems and possible solutions, UNESCO International conf. Water: a looming crisis, Paris, pp.367-376.
- Al-Qabas Oil Services Co, 2011: EIA for Basrah Upgrading FCC Project, section four: Description of the Existing Environment-Baseline Data.
- Chabuk, A., Al-Madhlom, Q., Al-Maliki, A., Al-Ansari, N., Hussain, M. and Laue, J. (2020). Water quality assessment along Tigris River (Iraq) using water quality index (WQI) and GIS software. Arabian Journal of Geosciences (2020) 13:654 https://doi.org/10.1007/s12517-020-05575-5.
- Krasny, J., Alsam, S. and Jassim, S.Z., Hydrology, in Jassim, S.Z. and Goff, J.C. (eds.). (2006). Geology of Iraq, Czechrepublic, Brno, pp.251-287.
- Sadik, A. and Barghouti, S. (1994). The water problems of the Arab World: Management of Scarce Resources, in Roger, R. and Lydon, P. (Ed.), Water in the Arab Word: Perspectives and Prognoses, Harvard University, pp.1-38.

- Saleh, S.A., Al-Ansari, N. and Abdullah, T. (2020). Groundwater Hydrology in Iraq. Journal of Earth Sciences and Geotechnical Engineering, Vol.10, No. 1, 2020, pp.155-197, ISSN: 1792-9040 (print version), 1792-9660 (online)
- World Bank (2006). Iraq: Country Water Resources, Assistance Strategy: Addressing Major Threats to People's Livelihoods, Report no. 36297-IQ, p.97.

SECTION 11 – MARINE ENVIRONMENT

- Al-Yamani Faiza Yousef (2021): Fathoming The Northwestern Arabian Gulf: Oceanography And Marine Biology, Kuwait Institute for Scientific Research, Kuwait.
- ROPME. (2010): ROPME Oceanographic Cruise - Winter 2006. Technical Report Series. No.6: Zooplankton in the ROPME Sea Area. ROPME/GC-14 7. Regional Organization for the Protection of the Marine Environment (ROPME), Kuwait. 13 pp.
- ROPME (2013): State of the Marine Environment Report- 2013. ROPME/ GC-16/1-ii Regional Organization for the Protection of the Marine Environment, Kuwait, 225 pp. http://www. Ropme.org/Uploads/Events/EBM/03-SOMER_2013.pdf.
- Polikarpov, I., M. Saburova, and F. Al-Yamani, (2016): Diversity and distribution of winter phytoplankton in the Arabian Gulf and the Sea of Oman. Continental Shelf Research 119: 85–99.
- Polikarpov, I., M. Saburova, and F. Al-Yamani, (2020): Decadal changes in diversity and occurrence of microalgal blooms in the NW Arabian/Persian Gulf. Deep Sea Research Part II: Topical Studies in Oceanography 179: 104810. DOI:10.1016/j.dsr2.2020.104810.

SECTION 12 – SOCIO-ECONOMIC ASPECTS

- Abood Abdullah N and Mohamed Abdul-Razak M (2020): The current status of inland fisheries in Basrah province, Iraq. International Journal of Fisheries and Aquatic Studies; 8(5): 120-127.
- Al-Hamoud Ali Taher, 2019, Behind Events in Basra: Problems and Possible Solutions, Published and translated by: Friedrich-Ebert-Stiftung, Amman Office.

- Coppola, P., & Silvestri, F. (2021). Gender Inequality in Safety and Security Perceptions in Railway Stations. Sustainability, 13(7), 4007. https://doi.org/10.3390/su13074007
- ILO, Iraq Employment Statistics for 2020, https://www.ilo.org/gateway/faces/home/statistics?_adf.ctrl-state=8bzlun6bn_4&locale=EN&countryCode=IRQ#
- Republic of Iraq, Ministry of Planning. National Development Plan 2018-2022. Baghdad, June, 2018. http://www.iraq-jccme.jp/pdf/archives/nationaldevelopmentplan2018_2022.pdf
- The World Bank, Iraq. https://data.worldbank.org/country/iraq
- United Nations Development Group Iraq Trust Fund. pp. 6, 7. Archived from the original (PDF) on July 28, 2011. Retrieved December 31, 2008.
- UN Inter-Agency Information and Analysis Unit. 2014. http://nina-iraq.com/wpcontent/uploads/2014/03/Women-In-Iraq-Fact-sheet-English.pdf
- World Economic Forum. (2021, March). Global Gender Gap Report.

SECTION 13 – ARCHAEOLOGY AND CULTURAL HERITAGE

SECTION 14 – HEALTH AND SAFETY

- Al-Qerem, W.; Jarab, A.; Hammad, A.; Alasmari, F.; Ling, J.; Alsajri, A.H.; Al-Hishma, S.W.; Abu Heshmeh, S.R. Iraqi Parents' Knowledge, Attitudes, and Practices towards Vaccinating Their Children: A Cross-Sectional Study. Vaccines 2022, 10, 820.
- Al-Jumaili, A.; Younus, M.; Kannan, Y.; Nooruldeen, Z.; Al-Nuseirat, A., (2021): Pharmaceutical regulations in Iraq: From medicine approval to post-marketing. East. Mediterr. Health J. 2021, 27, 1007–1015
- Duran, D.; Menon, R. (2020): Mitigating the Impact of COVID-19 and Strengthening Health Systems in the Middle East and North Africa; World Bank: Washington, DC, USA.

- KAPITA, (2021): Iraqi Healthcare Sector Overview, Baghdad, Iraq. Available at: http://kapita.iq/storage/app/media/Research/Health%20Sector%20 Overview-ENG.pdf

- IFC with the European Bank for Reconstruction and Development (EBRD)(2009): Guidance note: Worker's Accommodation: Process and Standards.

- IFC (2009): Workers Accommodation: Processes and Standards

- Government of Iraq. Iraqi Government Announces Preventative Measures in Response to Coronavirus. 2020.

- Langhause, K., 2020: Global Dose: Focus on Iraq, s.l.: s.n

- United Nations. Iraq Common Country Analysis (2022—Condensed Version); United Nations. 2022. Available online:https: //iraq.un.org/sites/default/files/2022-07/CCA%20Iraq%20-%20Condensed.pdf

- World Health Organisation (2012) http://www.undp.org.sa/sa/documents/mdg/nmdg2011.pdf http://www.who.int/nmh/countries/sau_en.pdf

- World Health Organisation (2022), Health System Strengthening https://www.emro.who.int/iraq/priority-areas/health-system-strengthening.html

- World Health Organization, (2022). The Global Health Observatory. Available online: https://www.who.int/data/gho/data/themes/t opics/indicator-groups/indicator-group-details/GHO/sdg-target-3.c-health-workforce.

- World Bank (2007), Environmental Assessment Sourcebook.

- World Bank (2007), Environmental, Health and Safety (EHS) Guidelines

SECTION 15 – TRAFFIC AND TRANSPORTATION INFRASTRUCTURE

SECTION 16 – SUSTAINABLE DEVELOPMENT

- United Nations World Commission on Environment and Development (UNWCED) (1987) Our Common Future, Brundtland Report, Oxford University Press.

- International Finance Corporation (2012) Policy on Environmental and Social Sustainability,available at http://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/ifc+sustainability/sustainability+framework/Sustainability+Framework+-+2012/# SustainabilityPolicy [Accessed on 18/06/2013].

- International Institute for Sustainable Development (1997), Assessing Sustainable Development, Principles in Practice, available at http://www.iisd.org/pdf/bellagio.pdf [Accessed on 18/06/13],

SECTION 17 – ANALYSIS OF ALTERNATIVES

- Barakat MA (2011) New trends in removing heavy metals from industrial wastewater. Arab J. Chem 4:361–377. https://doi.org/10.1016/j.arabjc.2010.07.019

- El-Hamidi and Zaher (2018): Production of vegetable oils in the world and in Egypt: an overview, Bulletin of the National Research Centre

- Environmental Technology Program for Industry (1999) The Edible Oil & Ghee Sector Environmental Report. The Federation of Pakistan Chambers of Commerce & industry, Pakistan. p. 1-24.

- Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control. Official Journal of the European Union 24, 29.1.2008, 8e29.

- Hammond EG, Johnson LA, Su C, Wang T, Pamela J, White PJ (2005) Soybean Oil. Ch. 13. In: Shahidi F (ed) Bailey's industrial oil and fat products. Sixth edition. Vol. 2. Edible oil and fat products: edible oils. Wiley, pp 577–653. https://onlinelibrary.wiley.com/doi/abs/10.1002/047167849X.bio041; https://ar.scribd.com/document/359538047/bailey-s-industrial-oil-and-fat-products-6-volume-set

- Mohammed Ali Musa and Syazwani Idrus, (2021): Physical and Biological Treatment Technologies of Slaughterhouse Wastewater: A Review, A Review. Sustainability 2021, 13, 4656. https://doi.org/ 10.3390/su13094656.

- Morin-Crini N, Crini G (eds) (2017) Eaux industrielles contaminées. PUFC, Besançon.

- Pratap A, Gupta SK, Kumar J, Mehandi S, Pandey VR (2016) Soybean. Ch. 12. In: Gupta SK (ed) Breeding oilseed crops for sustainable production opportunities and constraints. Academic Press is an Imprint of Elsevier, pp 293–315. https://doi.org/10.1016/B978-0-12-801309-0.00012-4

- Pratap A, Gupta SK, Kumar J, Solanki RK (2012) Soybean. In: Gupta SK (ed) Technological innovations in major world oil crops. Vol. I, breeding. Springer Science, New York, pp 293–321
- Rathore AK, Dhatwalia VK (eds) (2016) Toxicity and waste management using bioremediation. IGI Global, Hersh
- United States Department of Agriculture (USDA) Foreign Agricultural Service, (2021): Global Market Analysis, Oilseeds: World Markets and Trade.
- Yadava DK, Vasudev S, Singh N, Mohapatra T, Prabhu KV (2012) Breeding major oil crops: present status and future research needs. Ch. 2. In: Gupta SK (ed) Technological innovations in major world oil crops. Vol. 1: breeding. Springer Science+Business Media, LLC, pp 17–51. https://doi.org/10.1007/978-1-4614-0356-2_2; https://link. springer.com/content/pdf/10.1007/978-1-4614-0356-2_2.pdf

SECTION 18 – RISK ASSESSMENT

SECTION 19 – EQUIPMENT DESIGN SAFETY REQUIREMENTS

SECTION 20 – SUMMARY OF IMPACTS AND MITIGATION

SECTION 21 – ENVIRONMENTAL MANAGEMENT & MONITORING PLAN (EMMP)

APPENDIX (A)

APPLICABILITY AND COMPLIANCE OF THE PROJECT WITH THE IFC PS REQUIREMENTS

Appendix A: Applicability and compliance of the Project with the IFC PS requirements

PS #	Detailed Requirements of each IFC Performance Standard	Assessment/Applicability to the project
PS 1: Assessment and Management of Environmental and Social Risks and Impacts		**Mostly applicable**
1.1	**Policy**	**Applicable**
1.1.1	Establishing an overarching policy defining the environmental and social objectives and principles that guide the project to achieve sound environmental and social performance.	Applicable to this Project The project has Health, Safety and Environment Policy in place and will develop a site specific Environmental and Social Management System (ESMS) for the Project. Further, the project will comply with the applicable laws and regulations of the jurisdictions in which it is being undertaken, including those laws implementing host country obligations under international law
1.1.2	The policy shall be consistent with the other applicable internationally recognized standards, certification schemes, or codes of practice.	The certified Policy complies with ISO 45001 and ISO 14001 standards
1.2	**Identification of risks and impacts**	**Mostly Applicable**
1.2.1	Establishing and maintaining a process to assess the environmental and social impacts and risks of the project.	This ESIA study (including ESMP) has been prepared to assess environmental and social impacts
1.2.2	The risks and impacts assessment will be based on recent environmental and social baseline data at an appropriate level of detail.	Site visits by EnviroSOLTECH Team in Oct 2022 including stakeholder interviews; reports on groundwater quality and soil contamination at the site have been prepared and used in this ESIA study (section 6- Terrestrial Environment); measurements of background air quality and noise levels by EnviroSOLTECH Team for Air Dispersion Calculation and Noise Propagation Study as part of this study (ESIA)

1.2.3	All relevant environmental and social risks and impacts of the project, including the issues identified in PS 2 to 8, shall be considered.	All relevant impacts assessed in this ESIA study except PS 5 and PS 7 are not applicable to the Project
1.2.4	The risks and impacts associated with the emission of GHGs and climate change shall be considered.	This part has been covered in Section 5 of this ESIA study
1.2.5	Have potential transboundary effects been considered?	**Not Applicable, as this project has no transboundary implications**
1.2.6	Have the environmental and social risks and impacts been identified in the context of the project's area of influence?	Assessed Project Area including surrounding areas in the vicinity of the Soybean Oil plant
1.2.7	Have cumulative impacts that result from the incremental impact been conducted?	Cumulative impacts were assessed in two parts: Air Dispersion Calculation and Noise Study considering the existing background levels (see Section 5 of this ESIA study)
1.2.8	The identification of risks and impacts shall take into account the findings of applicable plans, studies and assessments prepared by relevant government authorities and other parties directly related to the project?	Reports from Ministry of Health and Statistical Center for planning in Basra and geological reports and other National reports have been used as baseline for preparing this ESIA study
1.2.10	Have disadvantaged or vulnerable groups been identified?	Yes, as part of the social impact analysis
1.3	**Management Programs**	**Applicable**
1.3.1	Establishing a program of mitigation and performance improvement measures that addresses the identified environmental and social risks and impacts of the project.	Environmental and Social Management Plans for construction and operation phases (ESMPs) of the Project will be developed and implemented by the EPC Contractor
1.3.2	The program shall take into account the engagement process with affected communities as appropriate.	Engagement process with affected communities is taken into account; Stakeholder Engagement Plan is part of this ESIA study
1.3.3	The program shall include estimates of the resources and responsibilities for implementation.	Sama AlManar has already allocated budgets for all costs (manpower and equipment) related to implementation of mitigation measures during construction and operation phases
1.3.4	The program shall include definition of the responsibilities for implementation.	Responsibilities and roles are defined in Section 21- EMMP

1.4	**Organizational Capacity and Competency**	**Applicable**
1.4.1	Establishing and maintaining an organizational structure that defines roles, responsibilities, and authority to implement the management program.	This part has been covered in EMMP Section 21 of this ESIA study.
1.4.2	Personnel within the client's organization with direct responsibility for implementing the management program will have the necessary knowledge, skills and experience to perform their work, including the applicable requirements of Performance Standards 1 through 8.	Sama AlManar has developed a Health, Safety and Environment Policy in place and hired a highly qualified HSE Manager for the Project
1.5	**Emergency Preparedness and Response**	**Applicable**
1.5.1	Are there emergency preparedness and response plans that are commensurate with the level of project risks?	EPC contractor will develop and implement Environmental Emergency Response Plans (EERPs) for construction and operational phases; these plans are part of the mitigation measures given in this ESIA study
1.5.2	In the event emergency preparedness and response requires participation of the potentially affected communities and the local governmental agencies, will they be involved?	Communities may not be involved but local government authorities (Umm Qasr Pot Authority) will be involved in those plans
1.6	**Monitoring and Review**	**Applicable**
1.6.1	Establishing procedures to monitor and measure the effectiveness of the management program, including the use of external experts and/or affected communities where appropriate.	Monitoring the implementation of mitigation measures is part of this ESIA study; Monitoring will be done by HSE Manager, environmental staff and a qualified auditor. Furthermore, representatives from Affected Communities could participate in monitoring activities if needed
1.6.2	Is the management program regularly updated based on the results of the monitoring?	Based on monitoring reports, the ESMP will be updated regularly whenever needed
1.6.3	Is periodic environmental and social performance information submitted internally to senior management?	The HSE Manager will report the monitoring results to senior management of the facility project management and the auditor
1.7	**Stakeholder Engagement**	**Partially Applicable**
1.7.1	Identifying stakeholders for the project	The stakeholders have been identified (Appendix C)

1.7.2	Developing and implementing a Stakeholder Engagement Plan that is scaled to the project risks and impacts and development stage	Stakeholder Engagement Plan has been established (Appendix C)
1.7.3	Has appropriate disclosure of relevant project information to, and consultation with, affected communities and other stakeholders been conducted?	Affected communities and other stakeholders have been informed during site visit of EnviroSOLTECH Team in October 2022; Draft ESIA will be disclosed to affected community and Public Consultation meeting will be performed to finalize the ESIA study
1.7.4	Has the disclosure and consultation process been effective: Timely (begin early in the process of identification of impacts); culturally appropriate (language, gender issues); transparent; objective, meaningful, free of external manipulation, interference, coercion, or intimidation and documented?	The Consultation and interview with stakeholders were prepared to meet with all these elements.
1.7.5	For projects with potentially significant adverse impacts on Affected Communities, has a process of Informed Consultation and Participation (ICP) been undertaken?	**Not Applicable** This project has very low environmental and risk impact on Umm Qasr community area
1.7.6	Are Indigenous Peoples engaged in a process of ICP (Informed Consultation and Participation)?	**Not Applicable** The project site does not have Indigenous Peoples
1.7.6	Was the Indigenous Peoples FPIC (Free, Prior and Informed Consent) obtained?	**Not Applicable** FPIC is not applicable to this project
1.8	**External Communications and Grievance Mechanisms**	**Applicable**
1.8.1	implementing and maintaining a procedure for receiving external communications, screening and assessing the issues raised and providing answers and adjustments to the management plan.	Grievance Mechanism is part of this ESIA study and of the Stakeholder Engagement Plan; Public Consultation Meeting will be performed to finalize ESIA study (please see Appendix C)
1.8.2	Are reports on the environmental and social sustainability of the project publicly available?	This ESIA study will be disclosed before Public Consultation meeting (please see Appendix C)
1.8.3	Has an effective grievance mechanism for affected communities been established?	Grievance Mechanism will be developed as part of Stakeholder Engagement Plan
1.9	**Ongoing reporting for affected communities**	**May not be Applicable**

1.9.1	Are regular reports provided to the affected communities describing the progress with the implementation of the Action Plans on issues involving risks to them and on those issues identified through the consultation/grievance mechanisms?	**May not be Applicable** Although this project has low environmental and risk impact on Umm Qasr community area, regular reports on risks to communities and grievance mechanisms may be developed and implemented if required.
PS 2: Labor and Working Conditions		**Applicable**
2.1	**Human Resource Policies and Procedures**	**Applicable**
2.1.1	Adopting and implementing human resources policies and procedures in accordance with all requirements of PS 2 and national law.	Sama AlManar has a Health, Safety and Environment Policy (2022) and will develop any other related plan as required by IFC and national law
2.1.2	Providing all workers with documented information regarding their rights related to hours of work, wages, overtime, compensation, and other benefits.	All workers will be informed about their rights as per national and international requirements.
2.2	**Working conditions and terms of employment**	**Applicable**
2.2.1	Establishing a collective bargaining agreement (negotiate contracts with employers to determine working conditions and terms of employment) between workers and workers' organizations.	Sama AlManar will respect and follow the national laws and international requirements when establishing a contract with all workers.
2.2.2	Migrant workers shall be engaged on substantially equivalent terms and conditions to the non-migrant workers carrying similar work.	Sama AlManar will treat its workers equally and fairly regardless their nationality or ethnicity.
2.2.3	Where accommodation services are provided to ensure compliance with the following: • Policies on the quality and management of the accommodations and basic services are implemented? • Principles of non-discrimination and equal opportunity guide the accommodation services? • The accommodation's arrangements do not restrict worker's freedom of movement or association?	Skilled workers (partly from abroad) will be accommodated in guesthouses at the project site or in hotels in Basra whereas unskilled workers will be accommodated in houses within the Umm Qasr area. Accommodations for both skilled and unskilled workers will be provided as per national and IFC requirements
2.3	**Workers' Organizations**	**Not Applicable to the Project**
2.3.1	Allowing workers to form and to join workers' organizations of their choosing without interference and to bargain collectively to express their grievances and protect their rights regarding working conditions and terms of employment.	Although this may not be applicable to this project, the national law allows workers to form and join workers' organizations. Furthermore,

		Sama AlManar will not restrict workers from expressing their grievances and will protect their rights regarding working conditions and terms of employment
2.3.2	If national law substantially restricts workers organizations, have there been restrictions imposed to workers to express their grievances and protect their rights organizations?	Sama AlManar will follow and respect international conventions and instruments, signed by the Iraqi government including those of the International Labor Organization (ILO) and the United Nations (UN).
2.4	**Non-discrimination and Equal Opportunity**	**Applicable**
2.4.1	It shall be ensured that employment decisions are not made on the basis of personal characteristics unrelated to job requirements.	Such subject is part of the ESMPs in this ESIA study
2.4.2	Aggressive pressure or intimidation and/or exploitation of workers, especially women and migrant workers, shall be avoided.	Sama AlManar will treat all workers equally regardless of their gender or nationality as defined in the ESMPs of this ESIA.
2.5	**Retrenchment (cutting of expenses)**	**Applicable**
2.5.1	If any collective dismissal (ends an employee's contract) was applied, an analysis of alternatives to retrenchment should be made.	Sama AlManar will follow the national law requirements and the contract signed with the employees with regard to end of contact for every worker.
2.5.2	If retrenchment of a significant number of employees is expected, a plan shall be developed to implement the retrenchment in compliance with all legal and contractual requirements.	
2.6	**Grievance Mechanism for workers**	**Applicable**
2.6.1	A grievance mechanism for workers shall be provided to raise workplace concerns related to easily accessible; understandable; transparent; allows anonymous complains.	Sama AlManar will establish and implement adequate grievance mechanisms for workers; this issue is also part of the ESMPs of this ESIA study.
2.7	**Child Labor**	**Applicable**
2.7.1	The project shall not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child’s education, or to be harmful to the child’s health or physical, mental, spiritual, moral, or social development.	Sama AlManar will not employee children of age less than 18 years and will follow the national law (see section 2- Regulatory Framework)
2.8	**Forced Labor**	**Not Applicable**

2.8.1	The project will not employ forced labor or trafficked persons.	Sama AlManar will follow the national law that does not allow forced labor
2.9	**Occupational Health & Safety (OHS)**	**Applicable**
2.9.1	The project shall provide the workers with a safe and healthy work environment.	Sama AlManar and the EPC Contractor will develop and implement an HSE Management System for construction and operation phases according to its certified HSE Policy and under supervision of the HSE Manager for the project. Further, Environmental Emergency response plan (EERP) will be developed and implemented for the Project. These topics are part of the ESMPs in this ESIA study
2.9.2	The project shall take all necessary steps to prevent accidents, injury, and disease.	
2.9.3	All workers shall be trained in occupational health and safety.	
2.9.4	Any occupational accidents, diseases, and incidents shall be documented and reported.	
2.10	**Workers Engaged by Third Parties**	**Applicable**
2.10.1	Estblishing policies and procedures for managing and monitoring the performance of third party employers in relation to the requirements of this PS.	If any third parties are engaged in this project, they will have to comply with the project's HSE Policy and site-specific HSEMS, including grievance mechanisms
2.10.2	All workers engaged by third parties shall have access to a grievance mechanism.	
2.11	**Supply Chain**	**Applicable**
2.11.1	Where there is a high risk of child or forced labor in the primary supply chain, these risks shall be identified and monitored, and the necessary steps shall be taken to remedy them.	Supply chain has to comply with Sama AlManar's HSE Policy and site-specific HSEMS
2.11.2	Where there is a high risk of significant safety issues related to supply chain workers, it shall be ensured that the primary suppliers are preventing these situations.	
2.11.3	In case of need and where remedy is not possible, the project will shift the project's primary supply chain over time to suppliers that can demonstrate that they are complying with this Performance Standard	
PS 3: Resource Efficiency and Pollution Prevention		**Mostly Applicable**
3.1	**Resource Efficiency**	**Applicable**
3.1.1	Implementing technically and financially feasible and cost effective measures for improving resource conservation and energy efficiency.	The Soybean Oil project will use highly efficient state-of the-art equipment to conserve raw materials, energy, and water.
3.1.2	Where GHG emissions exceed 25,000 tons CO2 annually annual quantification shall be undertaken.	Annual quantification of GHG emissions is given in section 5-Air Quality of this ESIA study. Sama

		AlManar will quantify the GHGs emission annually using IPCC methodologies.
3.1.3	In case the project is a potentially significant consumer of water, adopt measures that avoid or reduce water usage so that the project's water consumption does not have significant adverse impacts on others.	The project will work as closed cycle system to reduce the water consumption to the maximum extend (see section 10- Water Quality Management)
3.2	**Pollution Prevention**	**Applicable**
3.2.1	The Project shall avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release to air, water, and land.	Pollutants release will be minimized by using highly efficient technology like (1) closed system for hexane; (2) low-sulfur fuel and (3) wastewater treatment system. Air emissions and effluents will be monitored in order to fulfill all relevant national and IFC/WB standards (see section 5- air quality and meteorology; section 10-water quality management, Section 21 EMMP and other sections)
3.2.2	The following factors shall be included in the assessment of potential adverse project impacts such as: existing ambient conditions; the finite assimilative capacity of the environment; existing and future land use; the project's proximity to areas of importance to biodiversity; and the potential for cumulative impacts.	Most of these factors are included in this ESIA study; both exiting ambient conditions as well as assimilation were conducted for air and noise; land use, influence on biodiversity and potential for cumulative impacts have been assessed (see section 5, section 6, section 8 and others)
3.2.3	The following hierarchy for waste management shall be followed: avoidance, reduction, recovery, reusage, treatment, destruction and final environmentally sound disposal?	EPC Contractor will have to implement the Construction Waste Management Plan and Sama AlManar will develop and implement a waste management plan for operation phase; these issues are also part of the ESMPs in this ESIA study
3.2.4	Special provisions for hazardous waste disposal shall be considered.	Although the hazardous wastes from this project are negligible (see section 9), Sama AlManar will ensure that any hazardous waste will be stored in closed, roofed, ventilated, concreted and bunded storage areas for final disposal (for mode tails see section 21- EMMP)

3.2.5	Release of hazardous materials shall be avoided/minimized/controlled.	Release of hazardous materials (such as hexane) will be avoided or minimized or controlled using best international practices. However, if there is any release it will be in accordance with the IFC guidelines (WB/IFC General EHS guideline, 2007).
3.2.6	All hazardous materials which are subject to international bans shall be phase-out.	**Not Applicable** Sama AlManar will not use any internationally banned materials
3.2.7	If pesticides are used, their selection and management shall be consistent with good international industry practice and part of an integrated pest management and/or vector management strategy.	**Not Applicable** No pesticides will be used in this project for clearing of construction site or for maintenance during operation.
PS 4: Community Health, Safety, and Security		**Mostly Applicable**
4.1	**Community Health and Safety**	**Applicable**
4.1.1	Evaluating the risks and impacts to the health and safety of the Affected Communities during the project life-cycle.	Community health and safety impacts are assessed in this ESIA study (section 14- Health and Safety aspect) and mitigation measured presented in the EMMPs (section 21)
4.1.2	Establishing preventive and control measures consistent with GIIP such as in the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) or other internationally recognized sources.	This project will be constructed and operated in accordance with GIIP requirements (please see Section 21- EMMPs).
4.2	**Infrastructure and Equipment Design and Safety**	**Applicable**
4.2.1	The structural elements or components of the project shall be designed, constructed, operated and decommissioned in accordance with GIIP.	The project will be constructed and operated as state-of-the-art (please see section 19- Equipment Design Safety Requirements)
4.3	**Hazardous Materials Management and Safety**	**Applicable**
4.3.1	The potential for community exposure to hazardous materials and substances that may be released by the project shall be avoided or minimized.	Sama AlManar will develop and implement EERP and EEMP (section 21) and Risk Assessment (section 18) to minimize and potential for community exposure to any hazardous materials.

4.4	**Ecosystem Services**	**Not Applicable**
4.4.1	The impacts and risks on priority ecosystem services in use by the Affected Communities shall been identified.	Not Applicable
4.5	**Community Exposure to Disease**	**Not Applicable**
4.5.1	The project shall avoid or minimize the potential for community exposure to water-related and vector-borne diseases (such as malaria, dengue fever, yellow fever, and plague) caused by the project, including influx of labor.	**Not Applicable**
4.6	**Emergency Preparedness and Response**	**Applicable as indicated in PS 1**
4.7	**Security Personnel**	**Not Applicable** **As the project is located in a custom zone-highly secure place and no public is allowed to enter without proper justified permit**
PS 5: Land Acquisition and Involuntary Resettlement		**Not Applicable**
PS 5 is not applicable to this Project: The land allocated to this project is government property and Sama AlManar has signed a lease with the government authority (Umm Qasr Port) to have the land for at least 30 years for constructing and operating this project. No physical relocation. Existing access roads will be used		
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources		**Applicable**
6.1	General	**Applicable**
6.1.1	The significance of project impacts on biodiversity and ecosystem services shall be specifically addressed as part of the social and environmental assessment process.	The project impacts on biodiversity and ecosystem services have been addressed in section 7- Terrestrial Biological Resources and mitigation measures were given in Section 21-EMMP
6.2	**Protection and Conservation of Biodiversity**	**Not Applicable**
This part of PS 6 is not applicable to the Project as there is no conservation area or natural habitat areas within the area of influence of this project.		
PS 7: Indigenous Peoples		**Not Applicable**
PS 7 is not applicable to this Project as there are no indigenous people at the project site. The facility will be built in custom zone and no person will be allowed to enter the project site without an official permit from Umm Qasr Port authority.		
PS 8: Cultural Heritage		**Mostly not applicable**
8.1	Protection of Cultural Heritage in Project Design and Execution	**Mostly not applicable**

8.1.1	Cultural heritage shall be considered as part of the environmental and social assessment.	Impact of this project on Cultural Heritage has been addressed in section 13- Archaeology and Cultural Heritage
8.1.2	If the project is located in an area where cultural heritage is expected to be found, a Chance Find Procedure shall be established and implemented.	Although it is not expected to find any cultural heritage during construction phase, a Chance Find Procedure will be implemented, according to Section 21-EMMP.
8.1.3	The Affected Communities who use or have used the cultural heritage for long-standing cultural purposes shall be consulted.	**Not Applicable**
8.1.4	Is continued access allowed to the cultural site or is an alternative route provided, in case of affectation of sites used for long-standing cultural purposes?	**Not Applicable**
8.1.5	A hierarchy of avoidance, minimization, restoration in situ and restoration off site, and compensation shall be undertaken.	**Not Applicable**
8.1.6	If non-replicable cultural heritage needs to be removed, the following conditions of PS 8 shall be satisfied: no technically or financially feasible alternatives existed; the benefits of the projects outweighed the anticipated cultural heritage loss from removal; and removal was conducted by the best available technique.	**Not Applicable**
8.1.7	If critical heritage is removed, significantly altered, or damaged by the project, a process of ICP shall be undertaken with the Affected Communities.	**Not Applicable**
8.1.8	If the project is located in a legally protected area or a legally defined buffer zone, the following conditions of PS 8 shall be satisfied: compliance with defined regulations and the protected area management plans; consultation with the protected area sponsors and managers, local communities and other key stakeholders; implementation of additional programs as appropriate to promote and enhance the conservation aims of the protected area.	**Not Applicable**
8.2	**Project's use of cultural heritage**	**Not Applicable**
8.2.1	If the project will use cultural resources, knowledge, innovations, or practices of local communities embodying traditional lifestyles for commercial purposes, the project shall enter a process of ICP.	**Not Applicable**
8.2.2	Fair and equitable sharing of benefits shall be ensured.	**Not Applicable**

APPENDIX (B) AIR DISPERSION MODELLING

AB.1 Introduction & Objectives

This Appendix describes the methodology and results, air dispersion modelling of the emission sources of Soybean Oil Project and the potential impacts. Construction activities, commissioning, routine operations and abnormal operation are addressed.

AB.2 The objectives of this part are as follows:

- Predict the ambient concentrations and temporal extent of impacts from emissions to air from the Soybean Oil project;
- Evaluate impacts during construction (normal and abnormal) and operation (normal and abnormal) scenarios.

AB3. Model selection and setup

USEPA models were used for this study. The first model is AERMOD and the second is Tank model. The United States Environmental Protection Agency (US EPA) and the American Meteorological Society (AMS) formed the Regulatory model Improvement Committee (AERMIC) in 1991 in order to develop a state-of-the art regulatory dispersion model. The model resulting from this effort was AERMOD with PRIME algorithm (AERMOD). The PRIME downwash algorithm is an improvement to the earlier regulatory downwash algorithm and was developed with wind tunnel experiments. The PRIME algorithm allows the model to calculate impacts in the cavity region generated behind a building, which can be important in many industries.

In November 2005, after thorough evaluation of AERMOD, USEPA revised the "Guideline on Air Quality Models" (US EPA, 2005a) to replace ISCST3 and CTDMPLUS with AERMOD as the preferred refined dispersion modelling technique for simple and complex terrain for receptors within 50 km of a modeled source.

Since AERMOD is the USEPA-preferred model for short-range modelling, it was decided to use this model for this project. This model is the most advanced formulation of the steady-state Gaussian plume model. A software package that contains the US EPA model, AERMOD, called BREEZE AERMOD GIS Pro was applied in this modelling study.

For refined modelling, the Guideline on Air Quality Models (US EPA, 2005) recommends one year of one-site data or 5 years of off-site representative data. For this modelling, one year of meteorological data was used for this application. The raw data was processed with CALMET, the meteorological preprocessor for CALPUFF. The mixing height and stability classes were calculated based on the available data. The meteorological data for Basra station, located relatively close to the project site, was applied as surface data for this study.

Domain Size and Grid Resolution:

Selecting the spacing between grid points in a modelling work is a compromise option between computation time and the required resolution. If the number of receptors is doubled, the time required for each run will also be doubled. However, if the spacing is too large, the peak concentration may fall between receptor points and may not be captured in the final results. In this study, two types of receptors within the modelling domain were selected as shown in figure 5-8:

1. A fine Cartesian grid of receptors placed every 250meter in X-axis and every 250 meters in Y-axis and was used within 7.25km in X-axis and 4.75km in Y-axis of the facility. This grid has 600 receptors.

2. To provide a larger overview of how the concentration decreased with distance beyond 7km, a coarse Cartesian grid was used with receptors every 1000 m in x-axis and every 1000m in y-axis out to 20km from the facility. This grid has 240 receptors.

The topography of the domain is not very complicated with ground elevation varying between 0 and 4 above mean sea level. The terrain in Umm Qaser area is assumed flat as the average height of the buildings is fairly low (most buildings are lower than 15-20m) and as all terrain features are lower in elevation than the top of the stack of the sources.

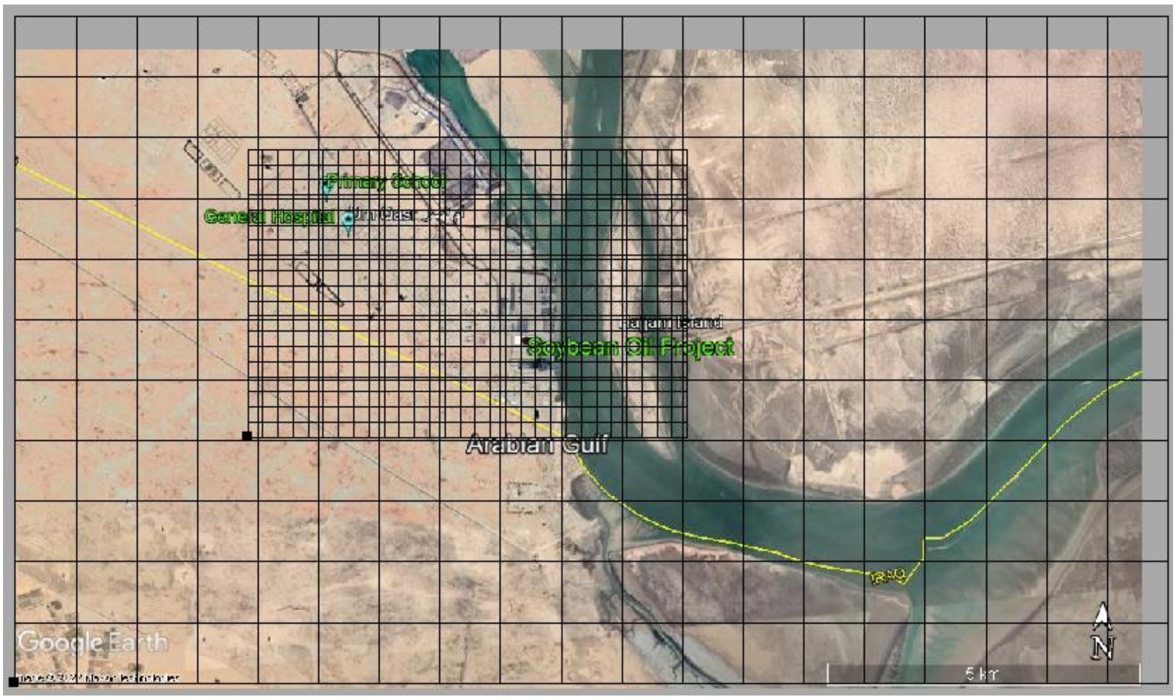


Figure 5-8: Cartesian Grids with a coarse grid (1000m x 1000m) covering a large area and a fine grid(250 m x 250m) over Umm Qasr Port Area

AB.4 Modelling Scenarios

Based on the submittals for the soybean oil project, there are several air pollution sources during operation and construction phases. During construction phase, the main air pollution sources are: (1) loading/unloading operation and bulldozer loading during construction phase and (2)Trucks movement on unpaved roads. During operation, there are sevral sources within the facility that will be discussed in the following subsection.

Sama AlManar requested EST consultant to identify the environmental impact of all defined sources on the ground level concentration during construction (loading and unloading raw materials and trucks movement on unpaved road) and operation phases (boilers and generators). In brief the differences between these phases are shown below.

A. Construction Phase:

Scenario 1 (Normal):

- Emission from loading/unloading operations and bulldozer operation and truck travel on unpaved road with control devices (68% efficiency).

Scenario 2 (Abnormal):

- Emission from loading/unloading operations and bulldozer operation and truck travel on unpaved road without control devices.

B. Operation Phase:

Scenario 1(Normal Operation):

The following sources will be in operation:

- Two boilers (20 MW for each) will use 40ton/day of Light Fuel Oil with 1% sulphur content
- Vent gas (hexane) at extraction plant

Scenario 2 (Abnormal):

- Three boilers (20 MW for each) will use 60ton/day of Light Fuel Oil with 1% sulphur content
- Five generators will use 20 litter/hour of diesel fuel with 10ppm sulphur content.

AB.5 Source Emission data

Construction Phase

As indicated earlier that there will be fugitive dust emission due to site development. Emissions of particle (PM_{10} and $PM_{2.5}$) during construction phase (normal and abnormal) were estimated using USEPA method.

The emission rates during the site preparation were developed for PM_{10} and $PM_{2.5}$ considering a nine-hour working day. It is assumed that the construction phase will continue for at least 12 month as maximum as indicated in the submittals by Sama AlManar. The emission rates were calculated based on the information provided by Sama AlManar company (total area of construction=50,000m^2) and on US EPA AP-42 emission factors.

There are three emission sources during construction phase: (1) Emissions from Bulldozing and material cutting and dumping and (2) emission from material handling (Truck loading/unloading) and (3) Emission from trucks travel on unpaved road. The PM_{10} and $PM_{2.5}$ emissions during construction phase due to loading/unloading operation and bulldozer operation were estimated using the following methods:

1- *Emission from raw material handling (truck loading / unloading):*

The fugitive dust emission associated with truck/loader loading and unloading operations are estimated based on Equation 1, section 13.2.4, US-EPA (AP-42) Compilation of Air Pollutant Emission Factor (AP-42), November.

PM10 Emissions (lb/ton) = $0.0011 \times (U/5)^{1.3} / (M/2)^{1.4}$

PM2.5 Emissions (lb/ton) = $0.00017 \times (U/5)^{1.3} / (M/2)^{1.4}$

where:

U = Mean wind speed (miles/hour)

M = Soil moisture (percent)

Source: Equation 1, Section 13.2.4, U.S. EPA Compilation of Air Pollutant Emission Factors (AP-42), November 2006.

2- *Emission from Bulldozing:*

Bulldozer fugitive dust emissions are estimated according to the following equations:

PM10 Emissions (lb/day) = $0.75 \times (s^{1.5} / M^{1.4}) \times N \times (1-CE_B/100)$

PM2.5 Emissions (lb/day) = $0.105 \times 5.7 \times (s^{1.2} / M^{1.3}) \times N \times (1-CE_B/100)$

where:

s = Soil silt content (percent)

M = Soil moisture content (percent)

N = Number of bulldozers/day

CE_B = Control efficiency (percent)

Source: Table 11.9-1, Section 11-9, US EPA Compilation of Air Pollutant Emission Factors (AP 42), July 1998.

3- Emission from Truck Travel on Unpaved Roads:

The fugitive dust emissions associated with truck travel on unpaved roads are estimated by means of the following equations:

PM10 Emissions (lb/VMT) = $1.5 \times (s/12)^{0.9} \times (W/3)^{0.45} \times T \times D \times (1-CE_{UR}/100)$

PM2.5 Emissions (lb/VMT) = $0.15 \times (s/12)^{0.9} \times (W/3)^{0.45} \times T \times D \times (1-CE_{UR}/100)$

where:

s = Soil silt content (percent)

W = Mean truck weight (tons)

T = Number of truck trips

D = Round trip distance (miles)

CE_B = Control efficiency (percent)

Source: Equation 1a, Section 13.2.2, U.S. EPA Compilation of Air Pollutant Emission Factors (AP-42), September 1998.

The following assumptions were made for our emission calculations:

- The control efficiency of water spray is >68%
- Raw Material moisture content ~ 9%
- Raw material Silt content = 10%
- Construction area: 50,000m^2

The emission rates of PM_{10} and $PM_{2.5}$ from each activity based on USEPA method are shown in table 5-20.

Table 5-20: Emission rate of PM_{10} and $PM_{2.5}$ during construction Phase

Activity	**PM_{10} (kg/hour)**	**$PM_{2.5}$ (kg/hour)**
Emissions from bulldozing and material cutting and dumping and material handling	Normal: 2.4 Abnormal: 7.5	Normal: 1.2 Abnormal: 3.7
Emission from raw material handling (truck loading / unloading)	Normal: 0.14	Normal: 0.020
Emission from Truck Travel on Unpaved Roads	Normal: 4.1 Abnormal: 27.3	Normal: 0.41 Abnormal: 2.7

These emission rates are considered as a fugitive emission and have been modelled as area sources covering the construction area.

Table 5-21: Soybean Oil Facility Emissions & Stack Parameters - Normal /Abnormal Operating Conditions (1)

	Emission Rates (g/sec)					UTM Grid			Stack Parameters			Flue Gas	
Emission Source	SO2	NOx	PM-10	CO		East (m)	North (m)		Height (m)	Diam. (m)		Temp (K)	Exit Vel. (m/sec)
Boiler 1	7.3	1.8	0.64	0.46		47°56'52.14"E	30° 1'23.57"N		30.0	1.1		403	4.82
Boiler 2	7.3	1.8	0.64	0.46		47°56'52.14"E	30° 1'23.57"N		30.0	1.1		403	4.82
Boiler 3	7.3	1.8	0.64	0.46		47°56'52.14"E	30° 1'23.57"N		30.0	1.1		403	4.82
Generator 1	0.0001	0.016	0.0016	0.004		47°56'50.72"E	30° 1'23.53"N		7.0	0.1		338	0.3

Generator 2	0.0001	0.016	0.002	0.004		47°56'50.72"E	30° 1'23.53"N		7.0	0.1		338	0.3
Generator 3	0.0001	0.016	0.002	0.004		47°56'52.66"E	30° 1'22.09"N		7.0	0.1		338	0.3
Generator 4	0.0001	0.016	0.002	0.004		47°56'52.66"E	30° 1'22.09"N		7.0	0.1		338	0.3
Generator 5	0.0001	0.016	0.002	0.004		47°56'52.66"E	30° 1'22.09"N		7.0	0.1		338	0.3
Vent from hexane Tanks And extraction Plant	Hexane emission= 0.00014g/sec					47°56'53.62"E	30° 1'23.24"N		24	0.1		313	0.1

(1) Normal Operation: Two boilers and four generators are in operation
Abnormal Operation: Three boilers and five generators are in operation

Interpretation of Modelled Data and reliability of modelling results

In order to determine the impact of Soybean Oil facility on ambient air quality of Umm Qasr area, the predicted concentrations from AERMOD are summed with the baseline values in section 5. Results of the dispersion model runs plus baseline concentrations are then compared with the Iraqi standards and WB guidelines.

The dispersion model predicts hourly averaged ground level concentrations at a series of specific receptor locations, for each hour of the year of meteorological data inputted. For each pollutant, the model was used to predict ground level concentrations for averaging periods that correspond to those of the Iraqi/WB standard. The baseline values, for the appropriate averaging period, are then added to the predicted concentrations of construction phase and compared with the standard.

The reliability of dispersion modelling needs to be considered during interpretation of the results. In general, it is agreed that

(1) Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations;

(2) models are reasonably reliable in estimating the magnitude of highest concentrations occurring on occasion somewhere within an area.

Errors in the highest estimated concentration are typically ±10-40% for flat terrain situations (U.S. Code of Federal Register 40 CFR Part 51, April 15, 2003). However, estimates of concentrations that occur at a specific time and site are poorly correlated with actually observed concentrations and are less reliable.

Modelling Results

Construction phase

The dispersion modelling has been used to predict ground level concentrations of SO_2, NO_x, CO and PM_{10} in normal and abnormal construction phase of Soybean Oil project for different averaging periods for the grid and discrete receptors established earlier section.

Graphical Representation of Modelling Results for Construction Phase

The model results from AERMOD were produced as contour plots of concentration. These plots were overlaid onto a satellite image of the area around the project within 20km domain. The resultant plots for the mentioned air pollutants for both scenarios are included in the below figures.

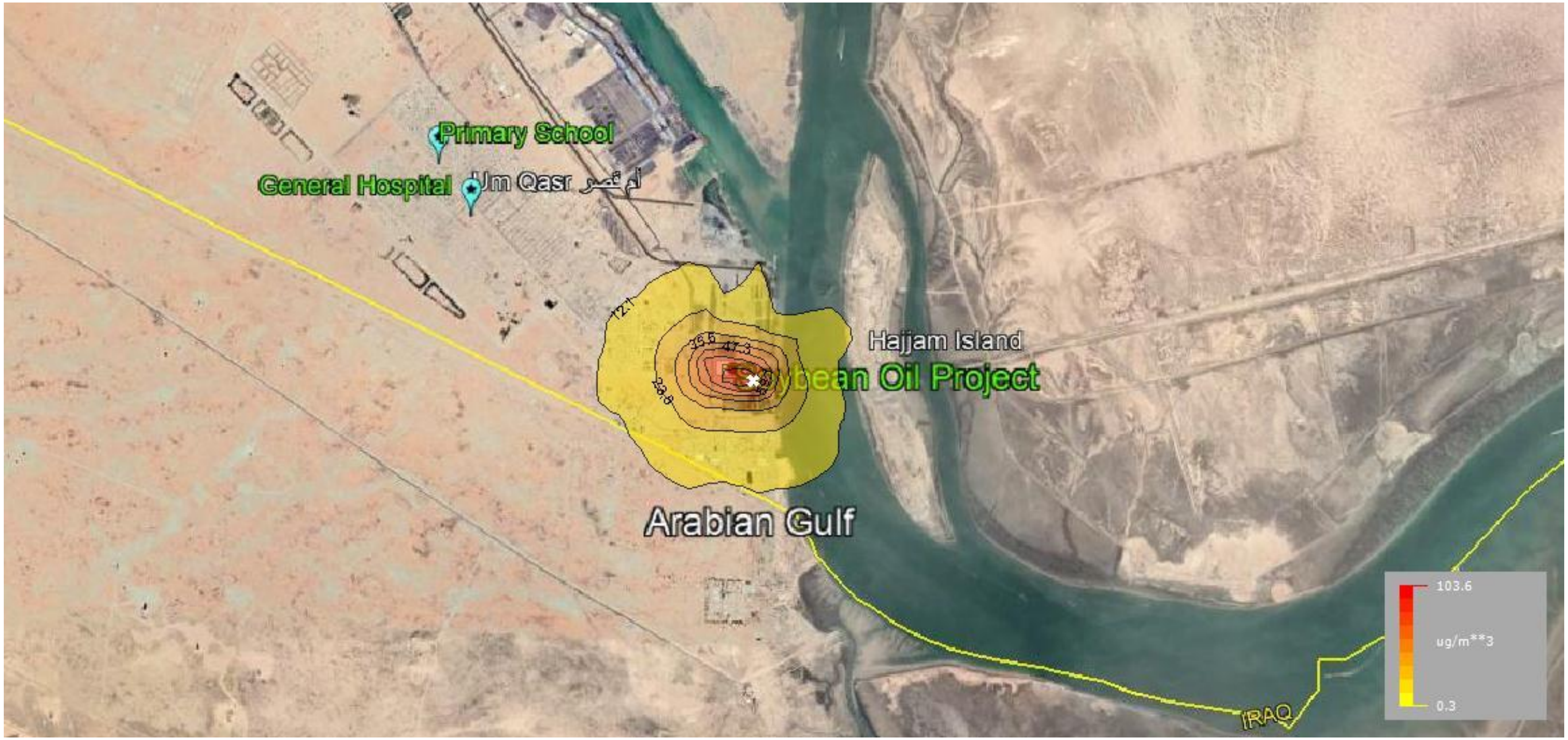


Figure 5-9: Predicted maximum 1-hour PM_{10} concentration ($\mu g/m^3$) during construction phase, Normal Scenario (No standard).

Figure 5-10: Predicted maximum 24-hour PM_{10} concentration (μg/m³) during construction phase, Normal Scenario (Iraq standard=150ug μg /m³ and WB guideline=50 μg /m³).

Figure 5-11: Predicted annual PM_{10} concentration ($\mu g/m^3$) during construction phase, Normal Scenario (WB guideline=20 $\mu g/m^3$).

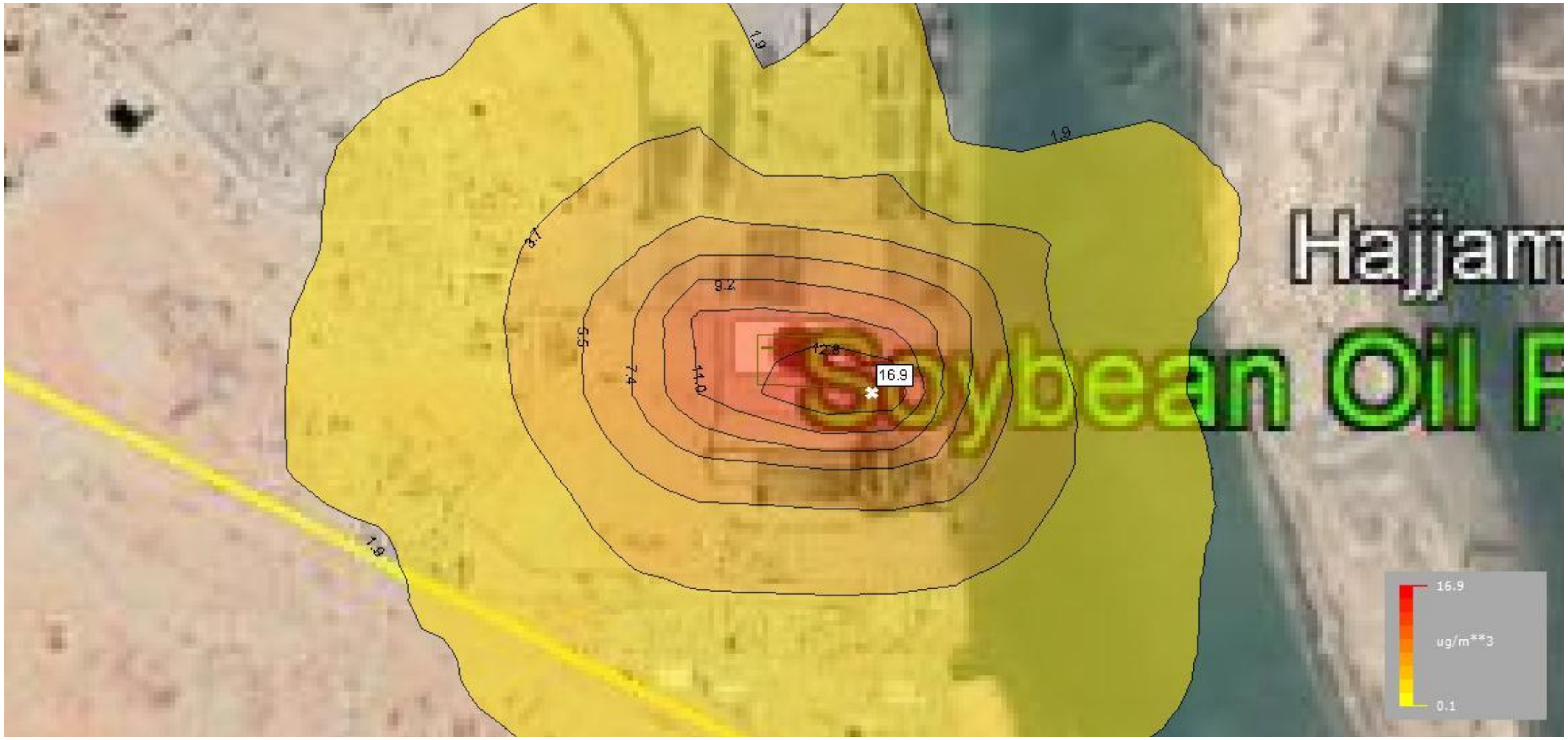


Figure 5-12: Predicted maximum 1-hour $PM_{2.5}$ concentration (µg/m³) during construction phase, Normal Scenario (No standard).

Figure 5-13: Predicted maximum 24-hour $PM_{2.5}$ concentration (μg/m³) during construction phase, Normal Scenario (Iraq standard=65 μg /m³ and WB guideline=25 μg /m³).

Figure 5-14: Predicted annual $PM_{2.5}$ concentration (μg/m^3) during construction phase, Normal Scenario (Iraq standard=15 μg /m^3 and WB guideline=10 μg /m^3).

Figure 5-15: Predicted maximum 1-hour PM_{10} concentration (µg/m^3) during construction phase, Abnormal Scenario (No standard).

Figure 5-16: Predicted max 24-hour PM_{10} concentration ($\mu g/m^3$) during construction phase, Abnormal Scenario (Iraq standard=150 $\mu g/m^3$ and WB guideline=50 $\mu g/m^3$).

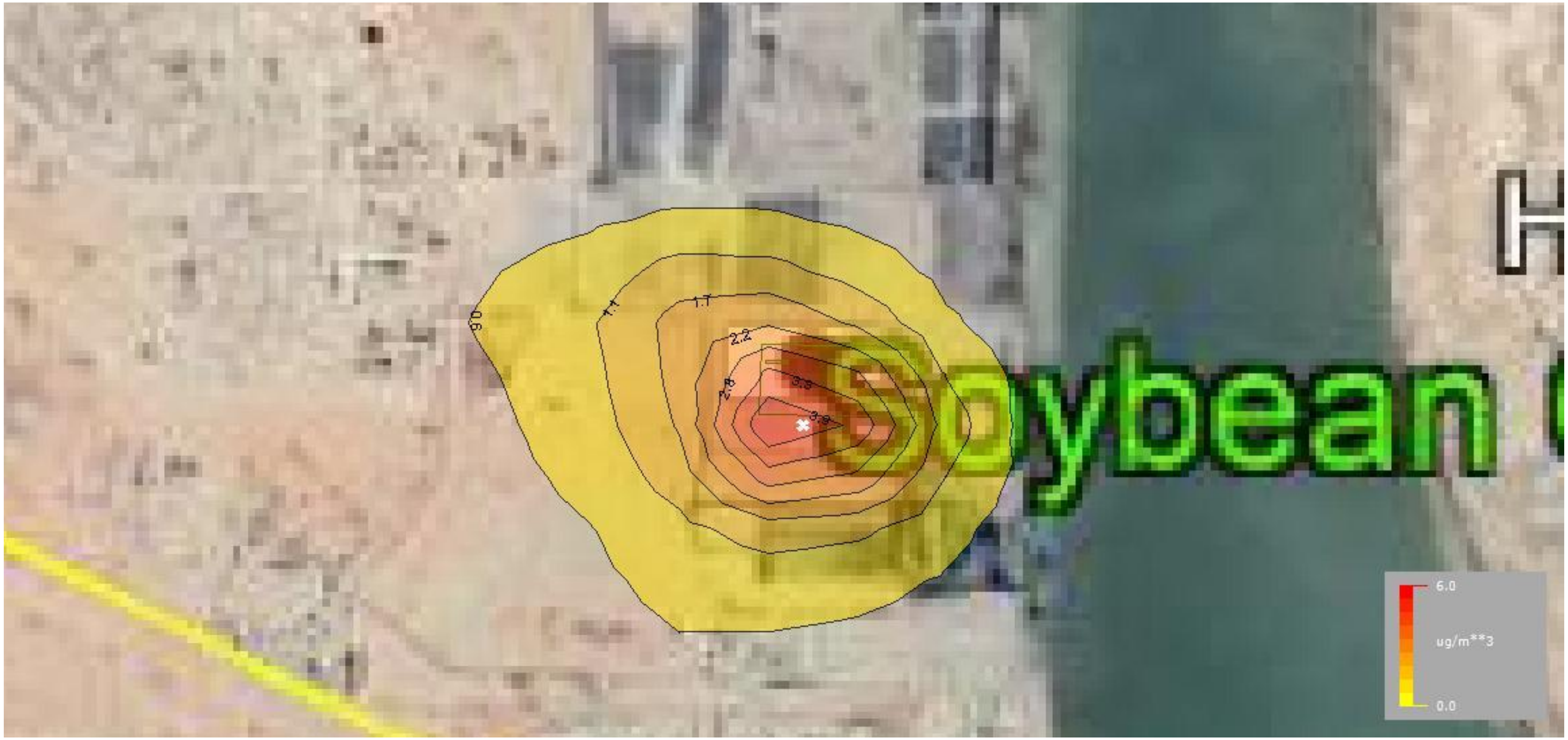


Figure 5-17: Predicted annual PM_{10} concentration ($\mu g/m^3$) during construction phase, Abnormal Scenario (WB guideline=20 $\mu g/m^3$)

Figure 5-18: Predicted maximum 1-hour PM2.5 concentration (μg/m³) during construction phase, Abnormal Scenario (No standard).

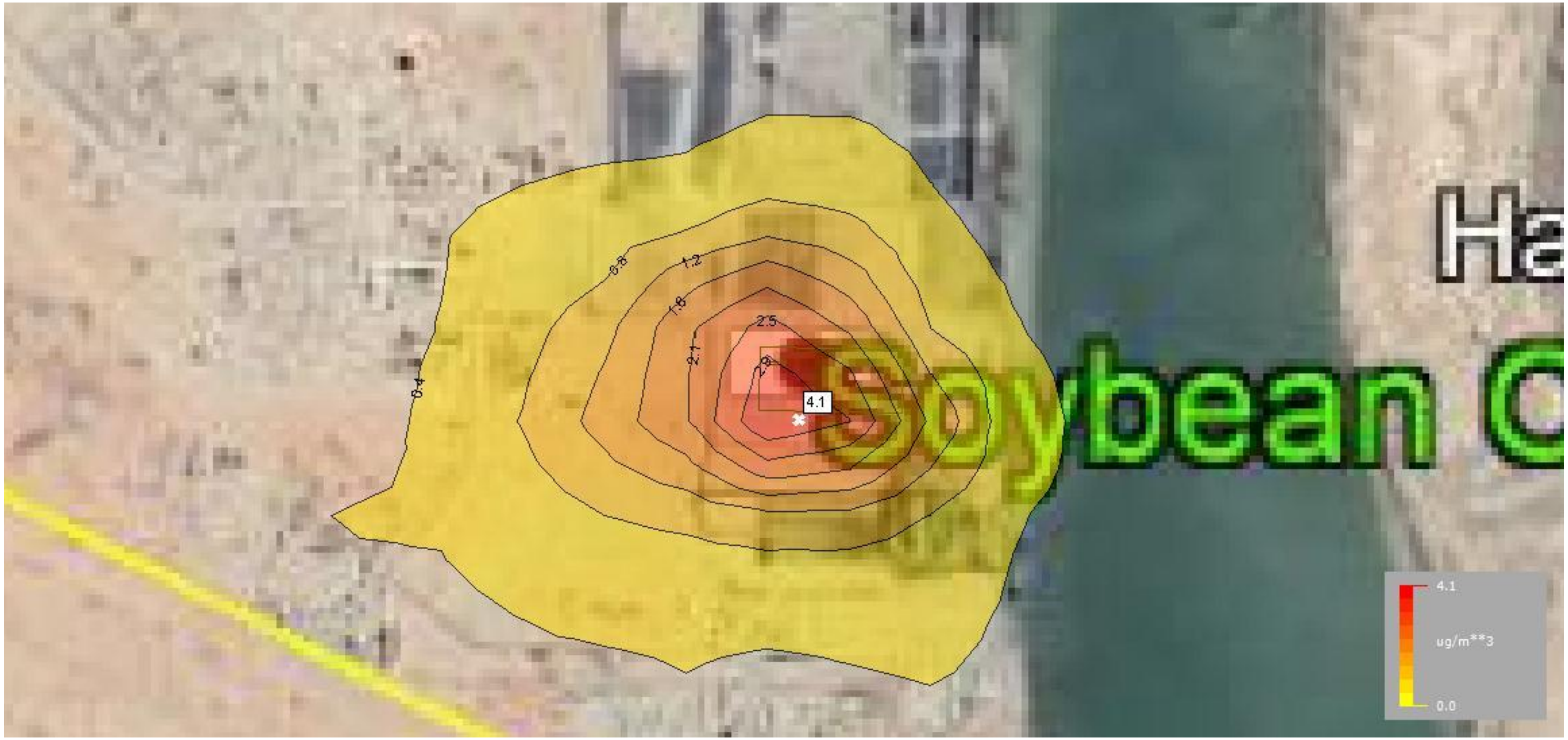


Figure 5-19: Predicted 24-Hr $PM_{2.5}$ concentration (μg/m³) during construction phase, Abnormal Scenario (Iraq standard=65 μg /m³ and WB guideline=25 μg /m³).

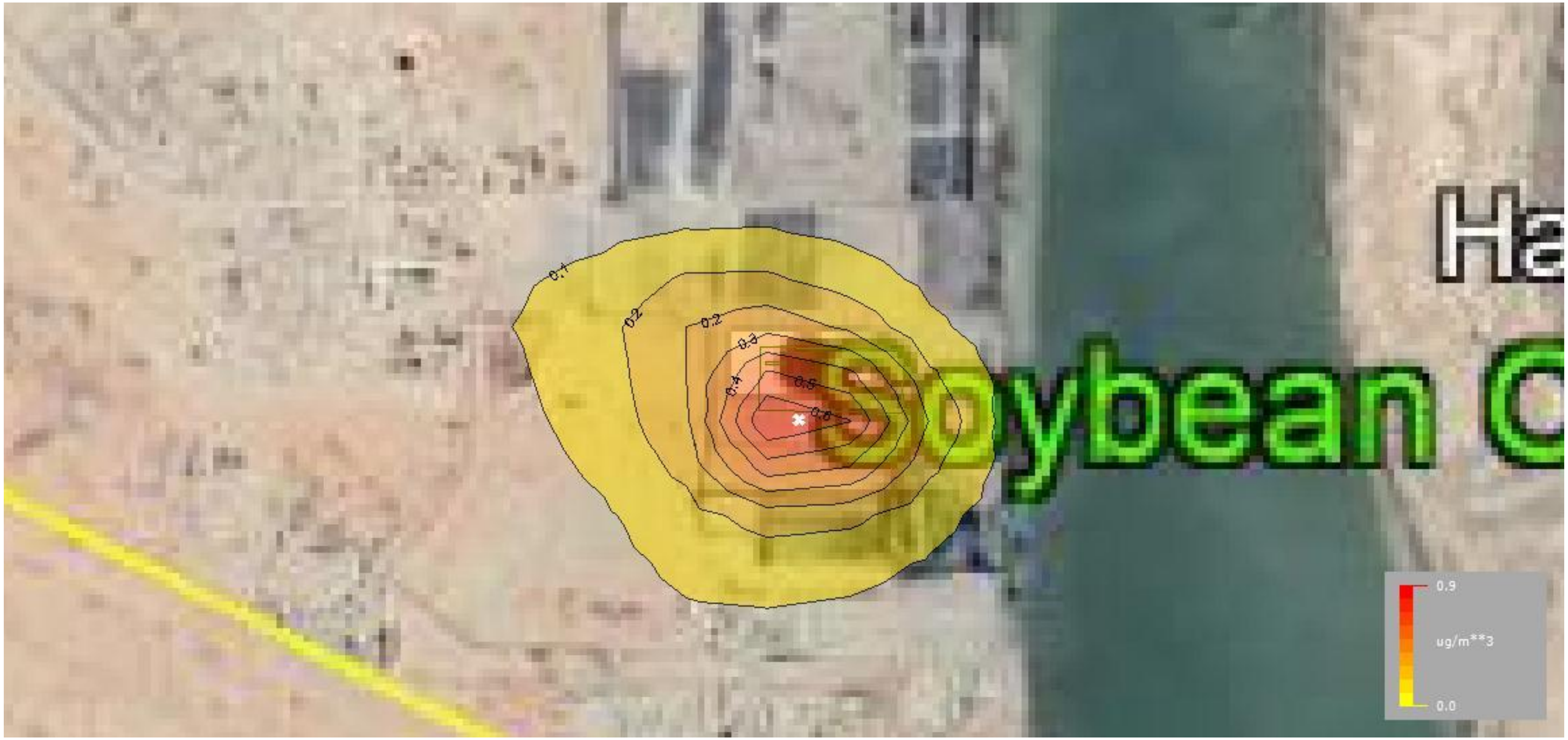


Figure 5-20: Predicted annual $PM_{2.5}$ concentration (μg/m^3) during construction phase, Abnormal Scenario (Iraq standard=15 μg /m^3 and WB guideline=10 μg /m^3).

Operation phase

AERMOD Model has been used to predict ground level concentrations of NO_2, SO_2, CO, PM10 and hexane during normal and abnormal operation phases of Soybean Oil facility for different averaging periods for the grid and discrete receptors established earlier in this section.

Normal Operation

The normal scenario (two boilers and four generators are in operation) was run for the following pollutants: SO_2, NOx, CO and PM_{10} from stacks and emissions of hexane from vent. The model results from AERMOD during normal scenario were made as contour plots of concentration produced. These plots were overlaid onto a google earth image of the area around the Soybean Oil project within 20km domain. The resultant plots for the mentioned air pollutants for normal scenario are included in the below figures.

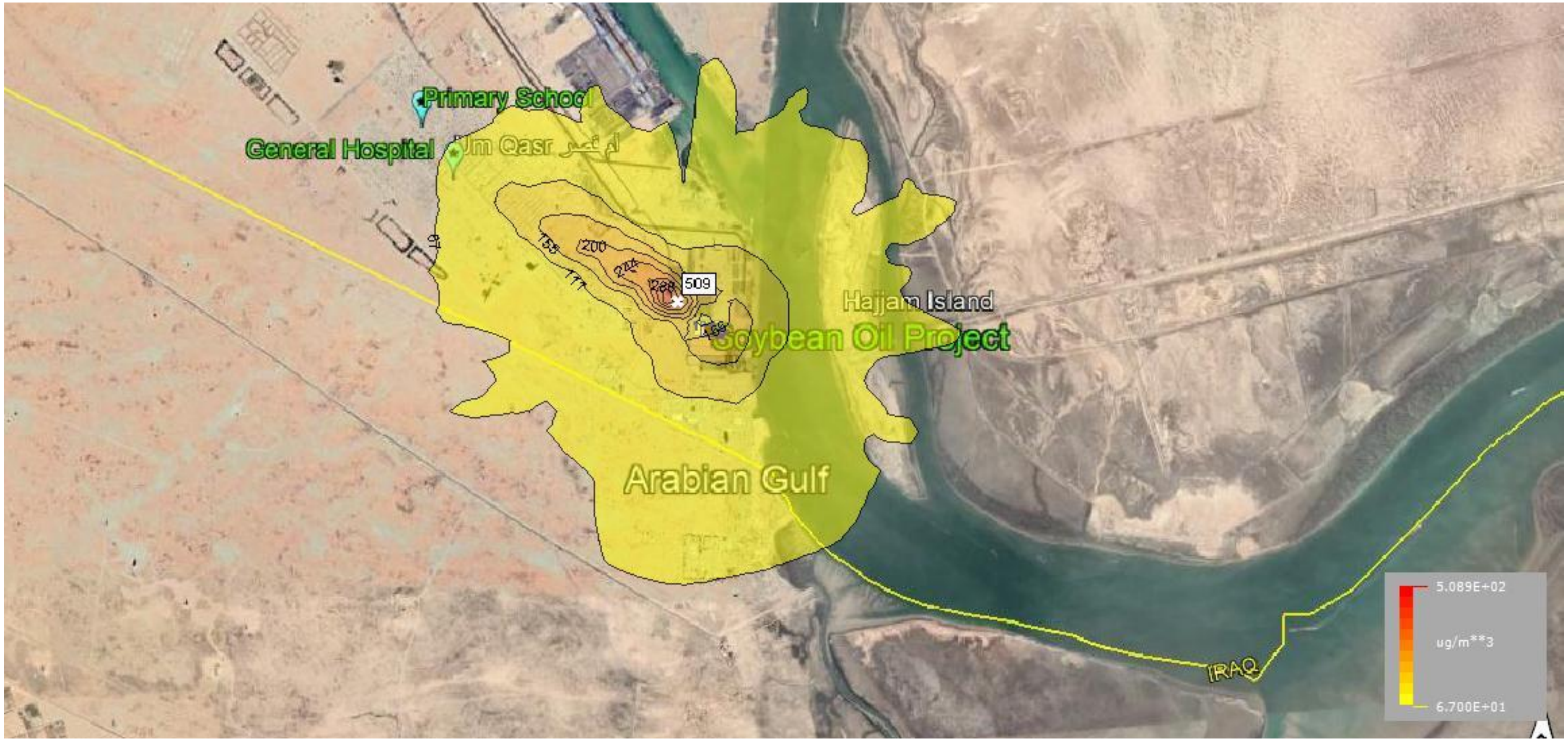


Figure 5-21: Predicted maximum 1-hour SO2 concentration (μg/m³) during operation phase, Normal Scenario (Iraqi standard= 262 μg /m³ and WB Guideline=500 μg /m³).

Figure 5-22: Predicted maximum 24-hour SO2 concentration (μg/m³) during operation phase, Normal Scenario (Iraqi standard= 104 μg /m³).

Figure 5-23: Predicted Annual SO_2 concentration (µg/m^3) during operation phase, Normal Scenario (Iraqi standard= 47 µg /m^3).

Figure 5-24: Predicted maximum 1-hour NOx concentration (μg/m³) during operation phase, Normal Scenario (Iraqi standard= 188g/m³ and WB Guideline=200 μg /m³).

Figure 5-25: Predicted Annual NOx concentration (μg/m³) during operation phase, Normal Scenario (Iraqi standard= 75g/m³ and WB Guideline=40 μg /m³).

Figure 5-26: Predicted maximum 1-hour CO concentration (μg/m^3) during operation phase, Normal Scenario (Iraqi standard= 40,000 μg /m^3 and WB Guideline=28,500 μg /m^3).

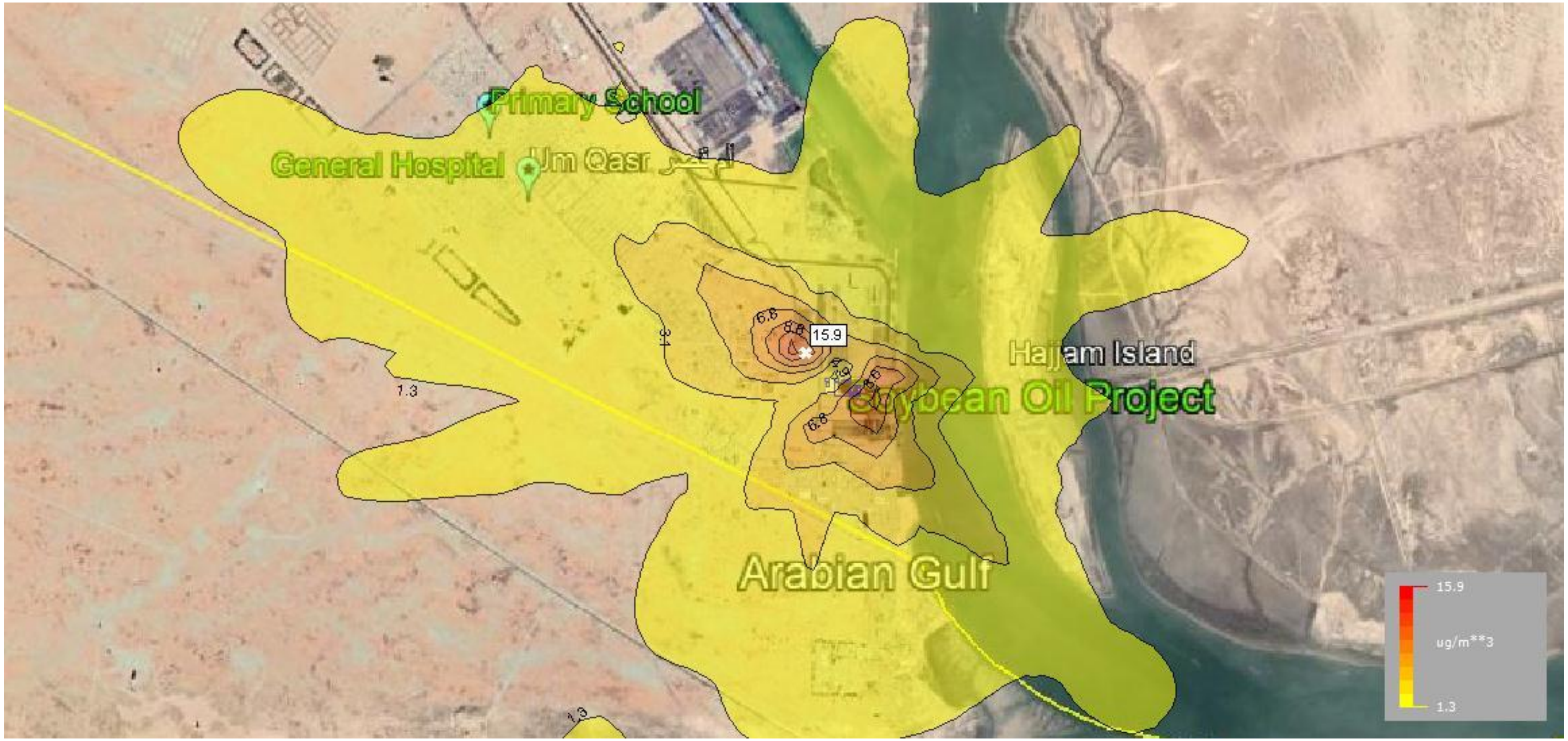


Figure 5-27: Predicted maximum 8-hour CO concentration (μg/m³) during operation phase, Normal Scenario (Iraqi standard= 11,400 μg /m³ and WB Guideline=10,000 μg /m³).

Figure 5-28: Predicted maximum Annual CO concentration (μg/m³) during operation phase, Normal Scenario (No Standard).

Figure 5-29: Predicted maximum 1-hour PM10 concentration (μg/m³) during operation phase, Normal Scenario (No standard).

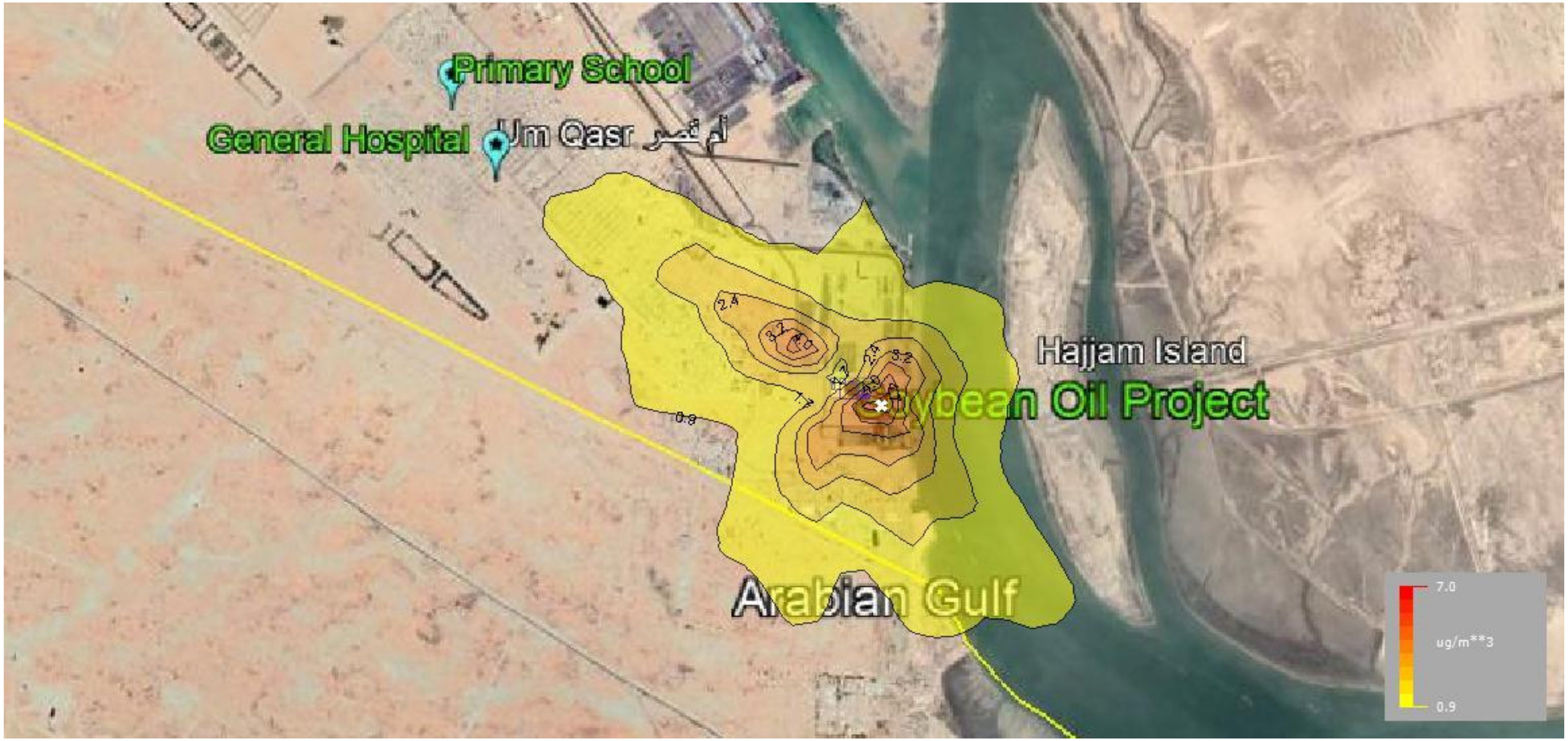


Figure 5-30: Predicted maximum 24-hour PM10 concentration (µg/m³) during operation phase, Normal Scenario (Iraqi standard= 150g/m³ and WB Guideline=50 µg/m³).

Figure 5-31: Predicted Annual PM_{10} concentration (µg/m^3) during operation phase, Normal Scenario (WB Guideline= 20 µg/m^3).

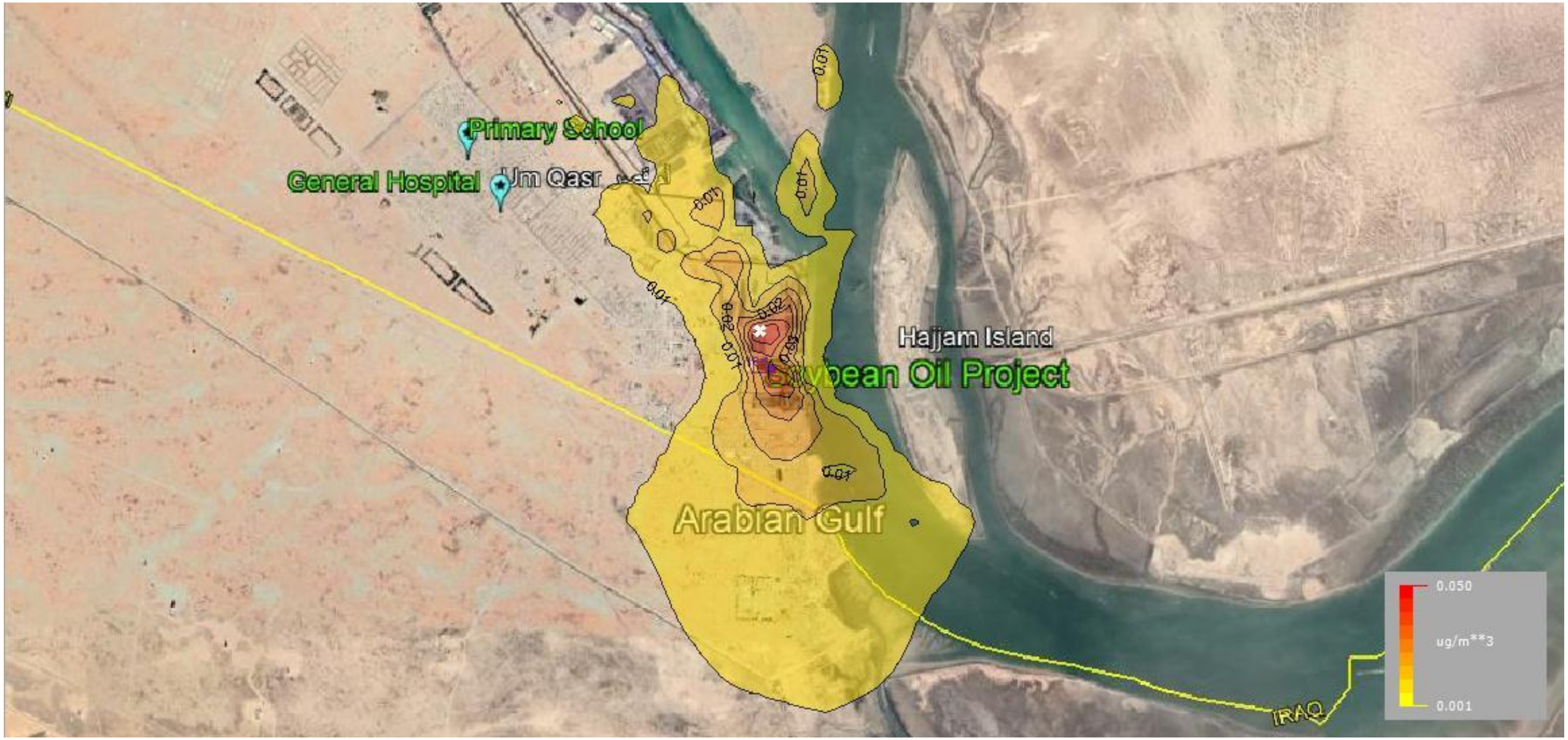


Figure 5-32: Predicted 1-Hour Hexane concentration (μ μg/m³) during operation phase, Normal Scenario (No standard).

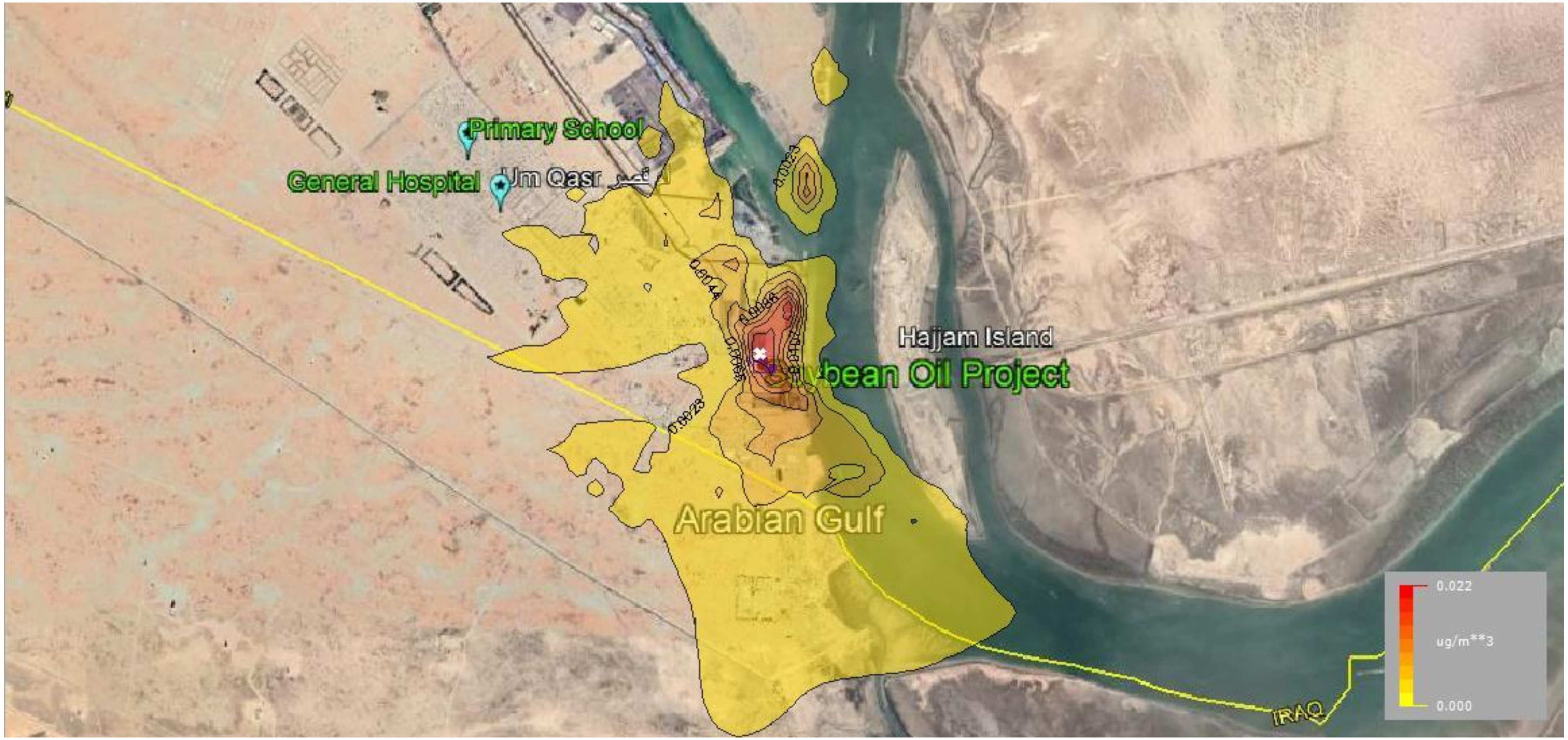


Figure 5-33: Predicted 3-Hour Hexane concentration (μg/m³) during operation phase, Normal Scenario (No Iraqi/WB standard).

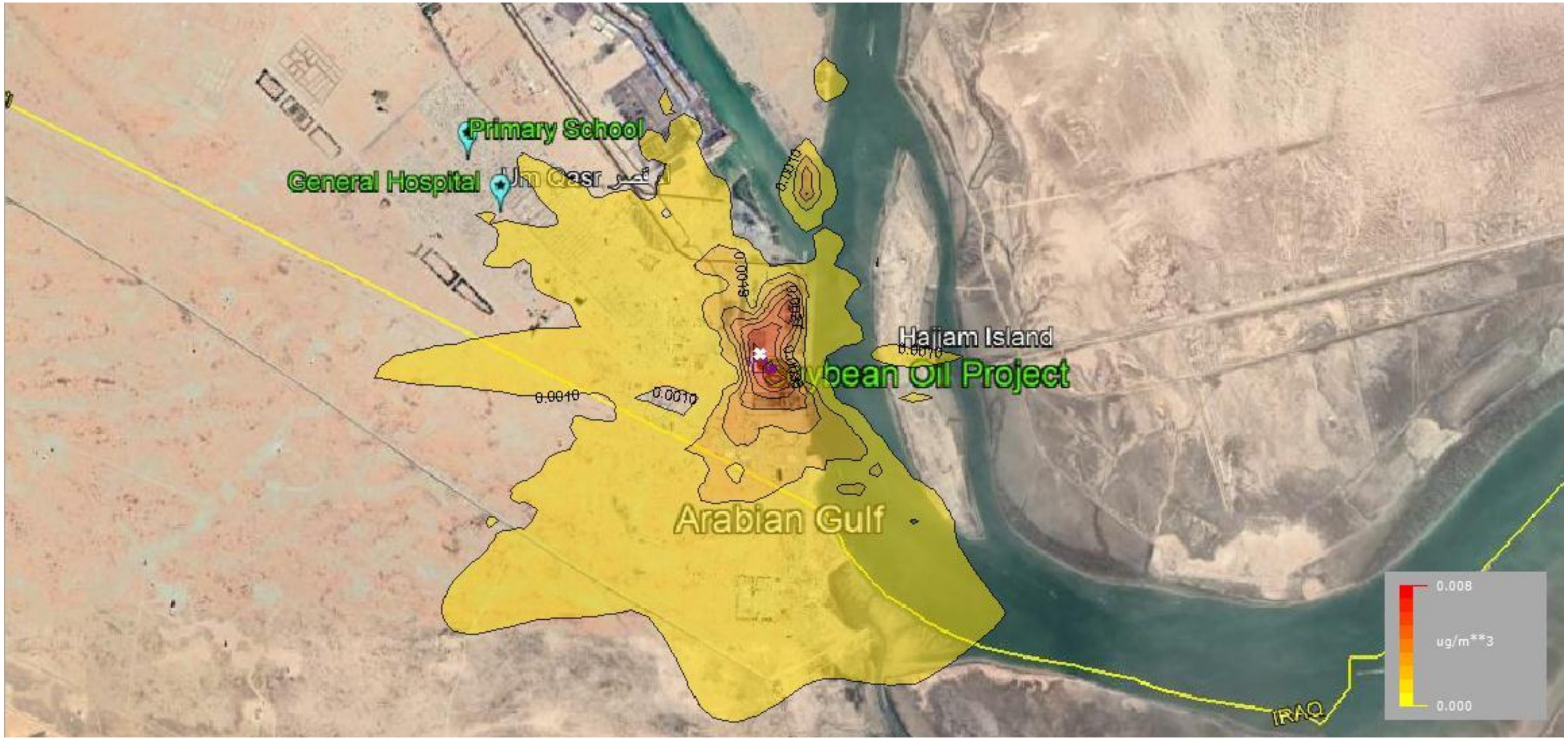


Figure 5-34: Predicted 8-Hour Hexane concentration (µg/m³) during operation phase, Normal Scenario (No Iraqi/WB standard).

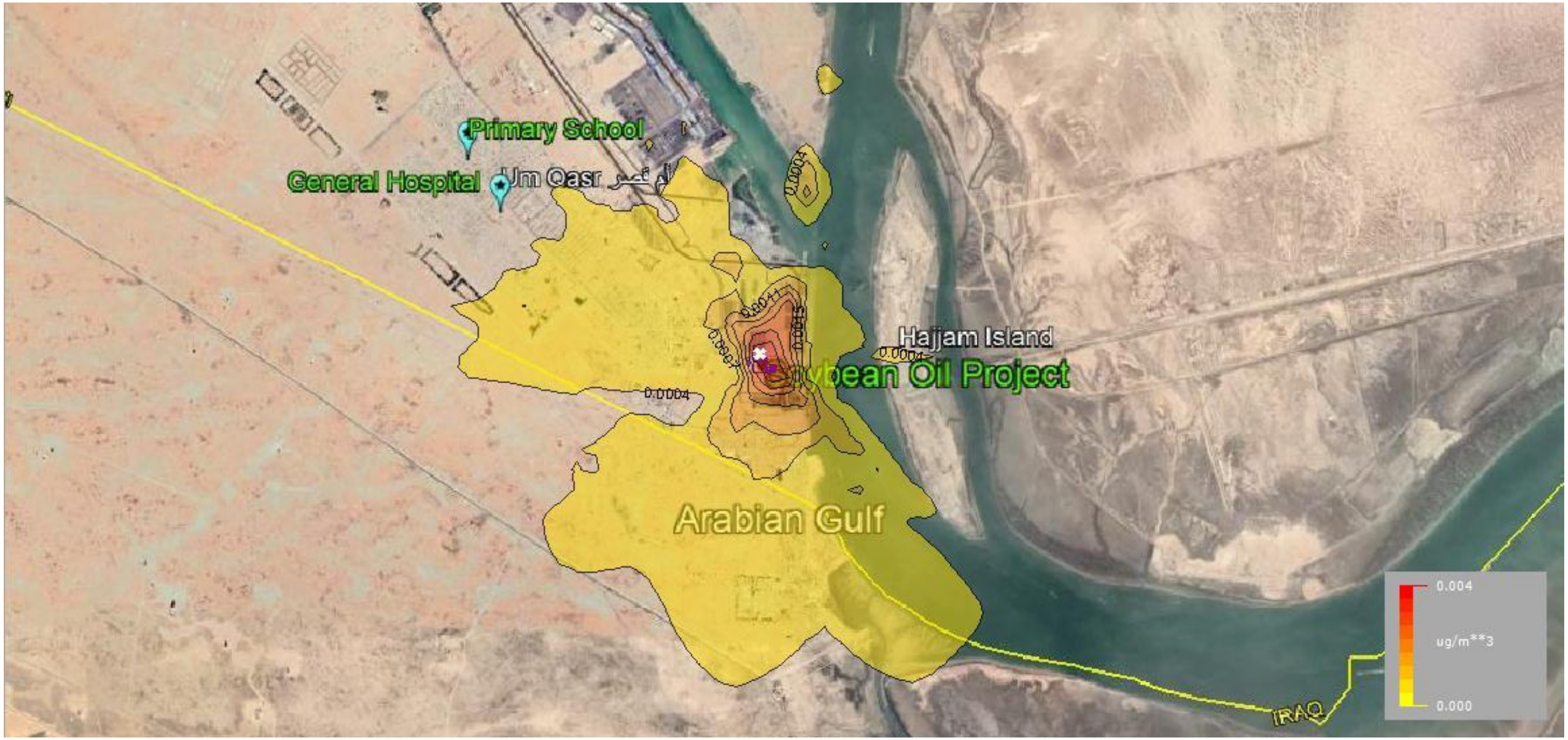


Figure 5-35: Predicted 24-Hour Hexane concentration (μg/m³) during operation phase, Normal Scenario (No Iraqi/WB standard).

Figure 5-36: Predicted Annual average Hexane concentration (μ μg/m³) during operation phase, Normal Scenario (No Iraqi/WB standard).

Abnormal Operation

The dispersion modelling has been used to predict ground level concentrations during abnormal operation scenario for different averaging periods for the grid receptors established earlier in section.

During abnormal operation scenario, it is assumed three boilers and five generators are in operation. The resultant plots for the SO_2, NO_x, CO and PM_{10} were considered for this scenario and are provided in the below figures.

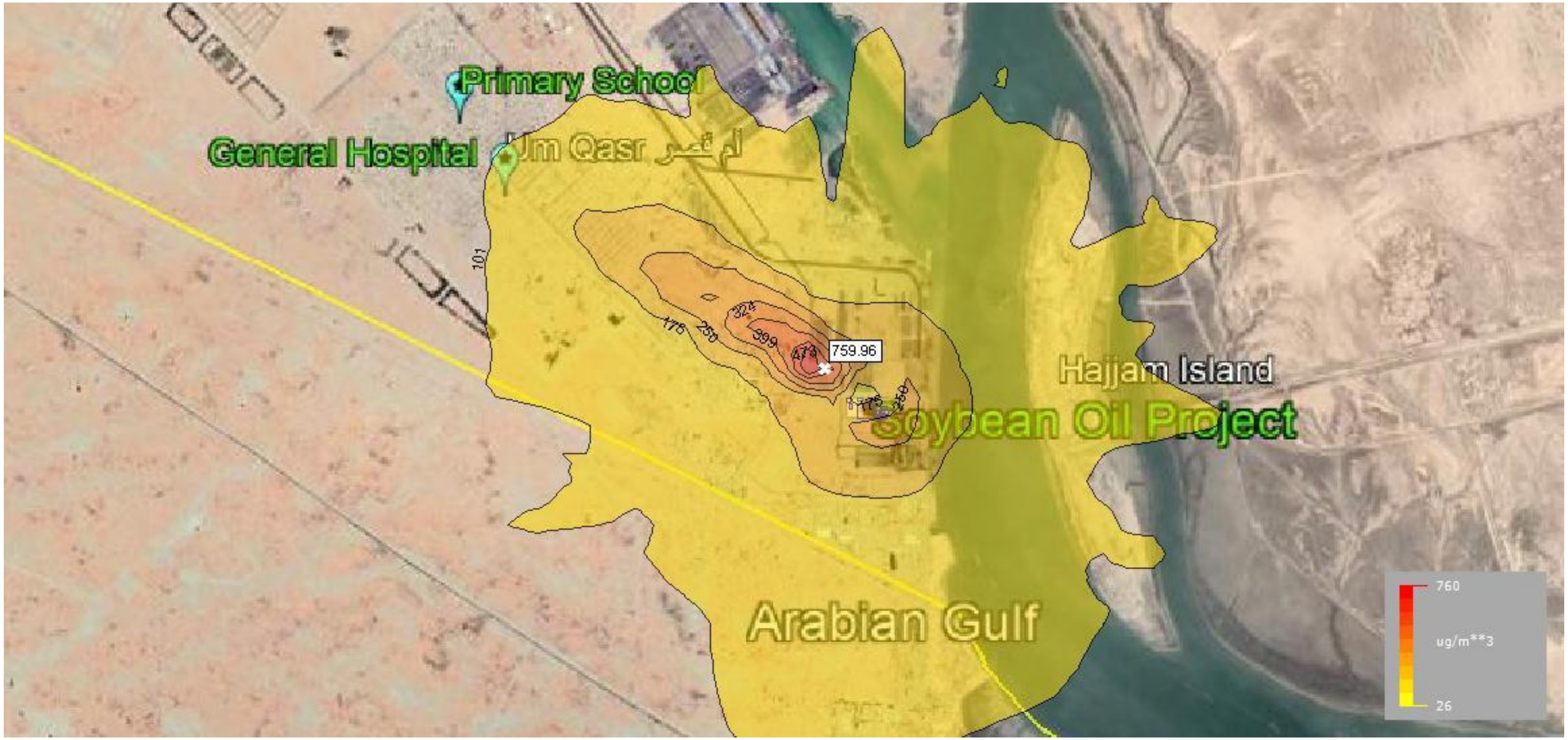


Figure 5-37: Predicted maximum 1-hour SO2 concentration (μg/m³) during operation phase, Abnormal Scenario (Iraqi standard= 262 μg/m³and WB Guideline=500u μg/m³).

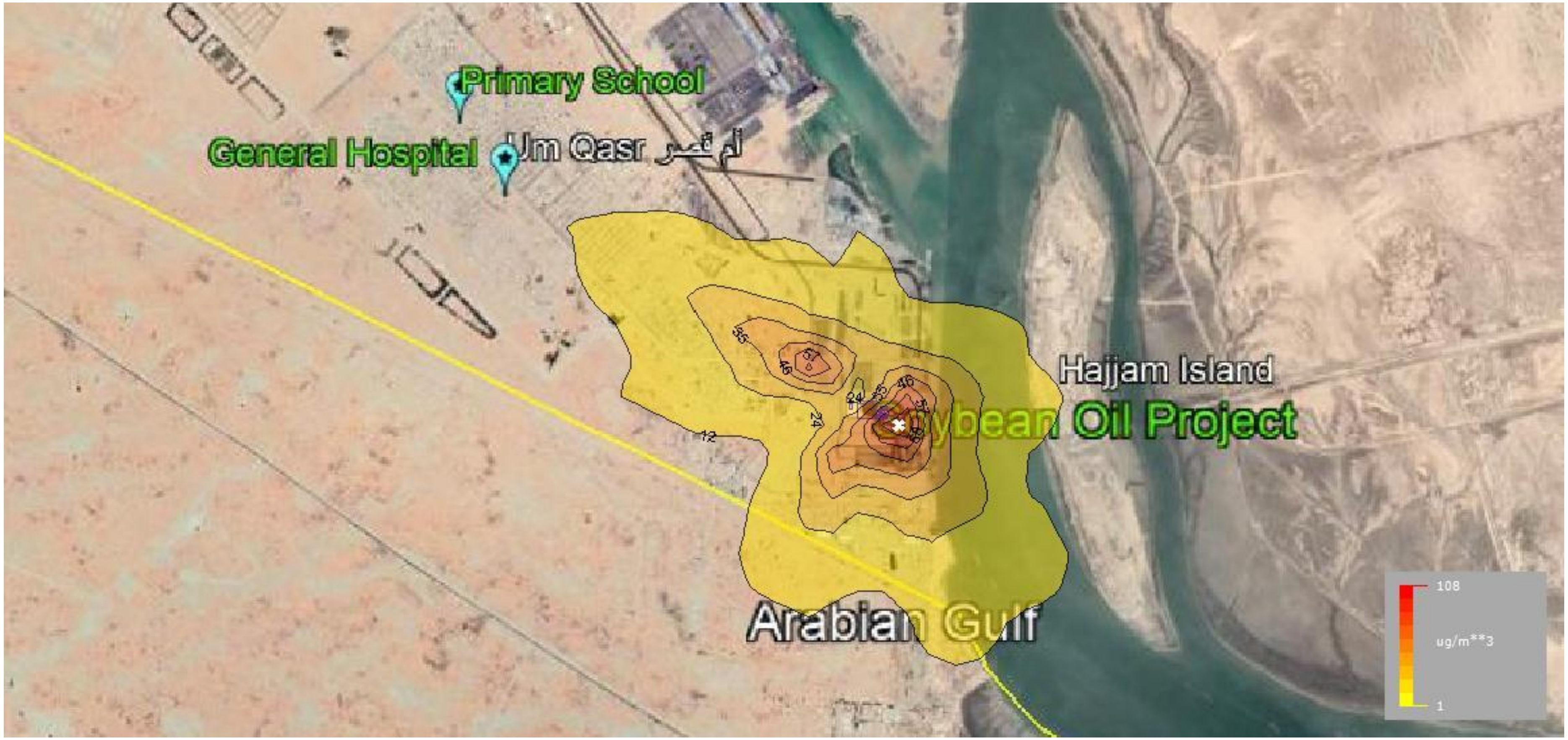


Figure 5-38: Predicted maximum 24-hour SO2 concentration (µg/m³) during operation phase, Abnormal Scenario (Iraqi standard= 104 µg/m³).

Figure 5-39: Predicted Annual SO2 concentration (μg/m³) during operation phase, Abnormal Scenario (Iraqi standard= 47 μg/m³).

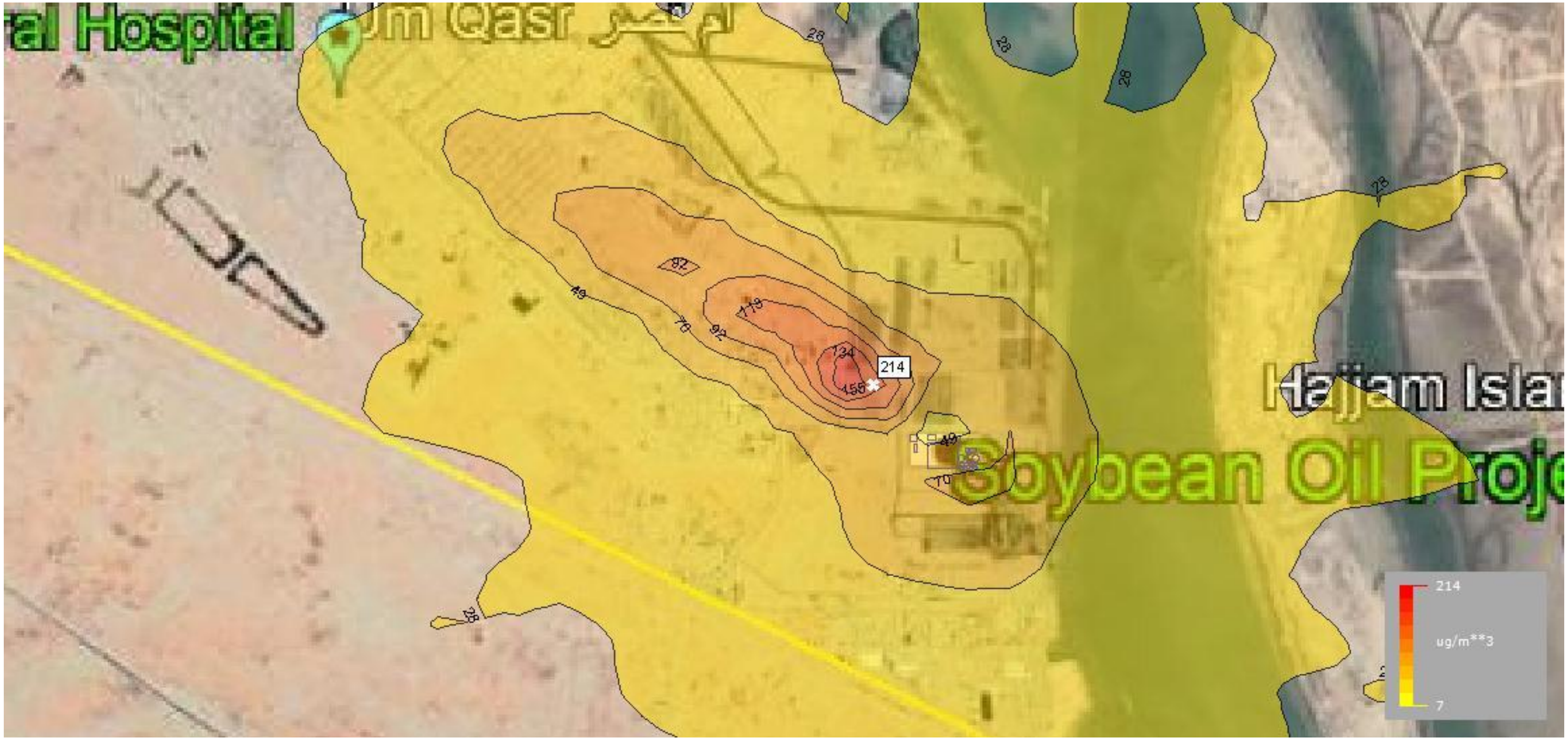


Figure 5-40: Predicted maximum 1-hour NOx concentration (μg/m³) during operation phase, Abnormal Scenario (Iraqi standard= 188g/m³ and WB Guideline=200 μg/m³).

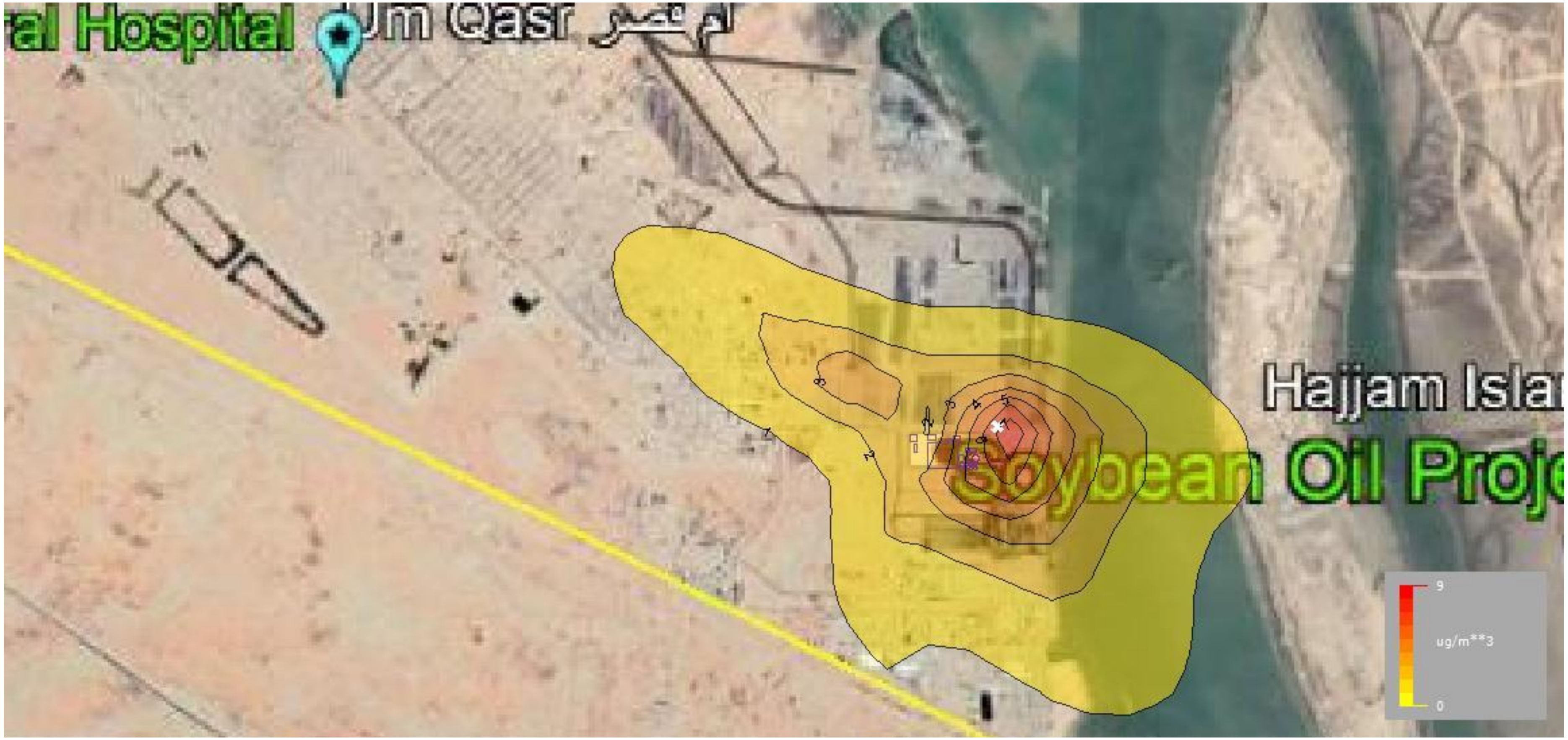


Figure 5-41: Predicted Annual NOx concentration (µg/m³) during operation phase, Abnormal Scenario (Iraqi standard= 75g/m³ and WB Guideline=40 µg/m³).

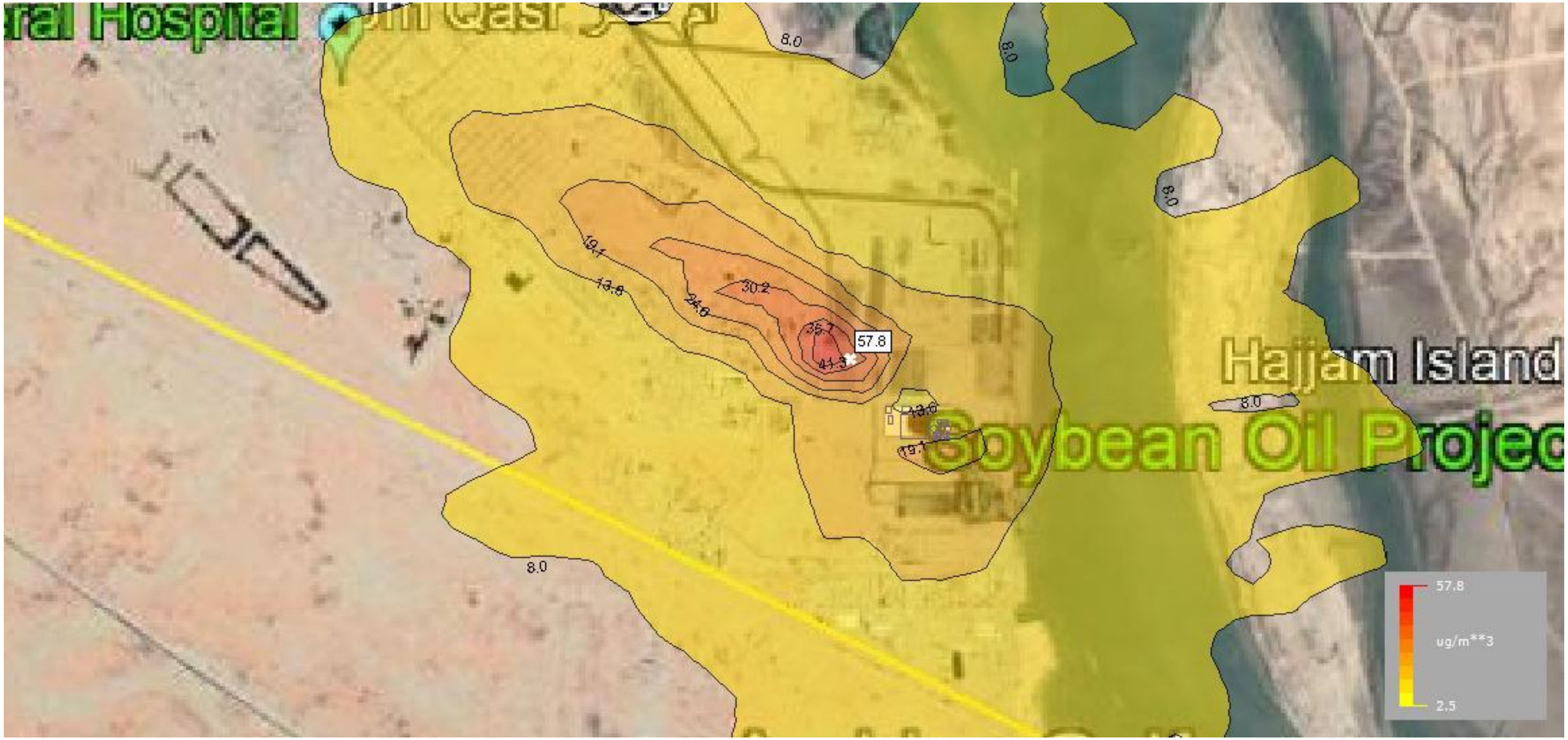


Figure 5-42: Predicted 1-Hour CO concentration (μg/m³) during operation phase, Abnormal Scenario (Iraqi standard= 40,000g/m³ and WB Guideline=28,500 μg/m³).

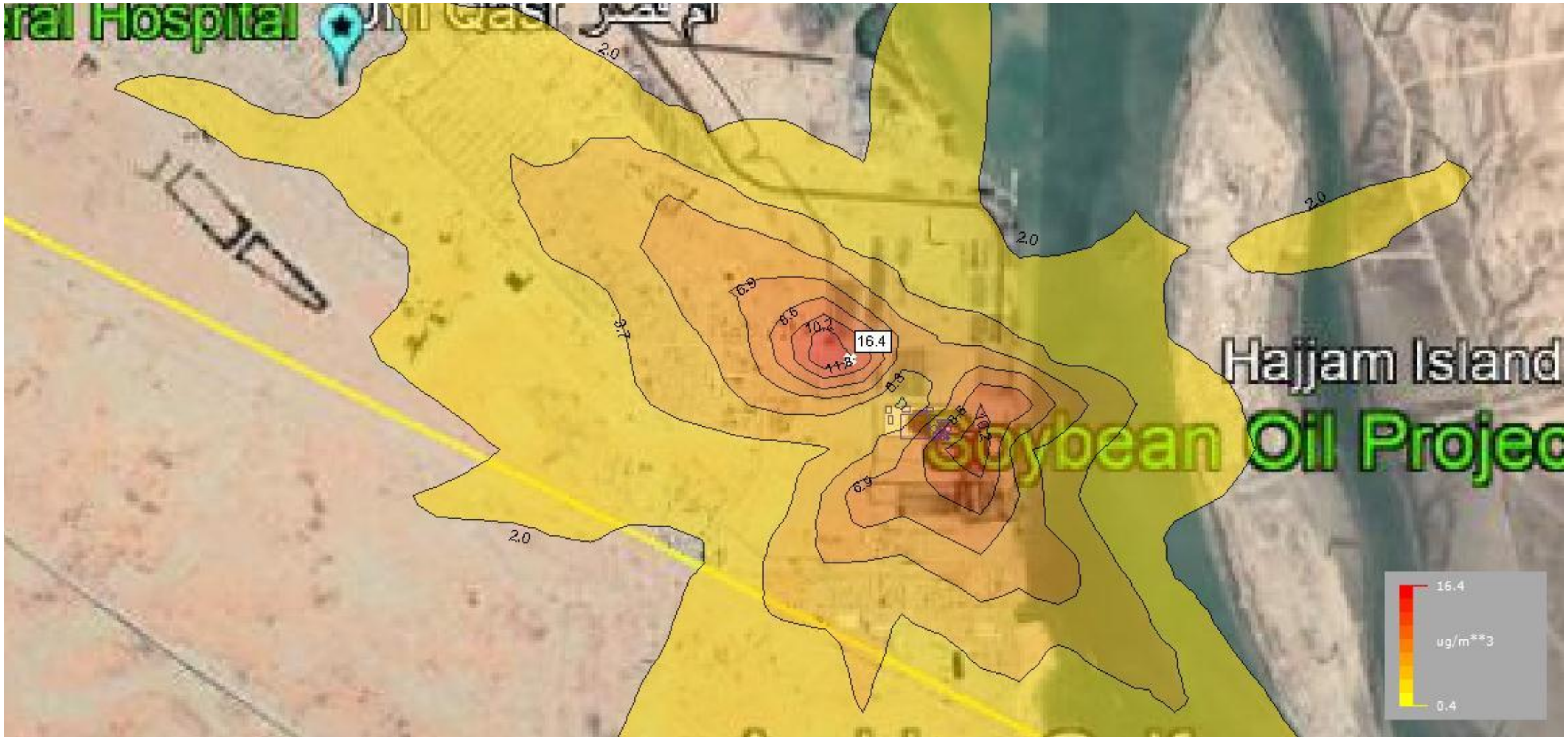


Figure 5-43: Predicted 8-Hour CO concentration (µg/m³) during operation phase, Abnormal Scenario (Iraqi standard= 11,400g/m3 and WB Guideline=10,000 µg/m³).

Figure 5-44: Predicted Annual CO concentration (μg/m³) during operation phase, Abnormal Scenario (No standard).

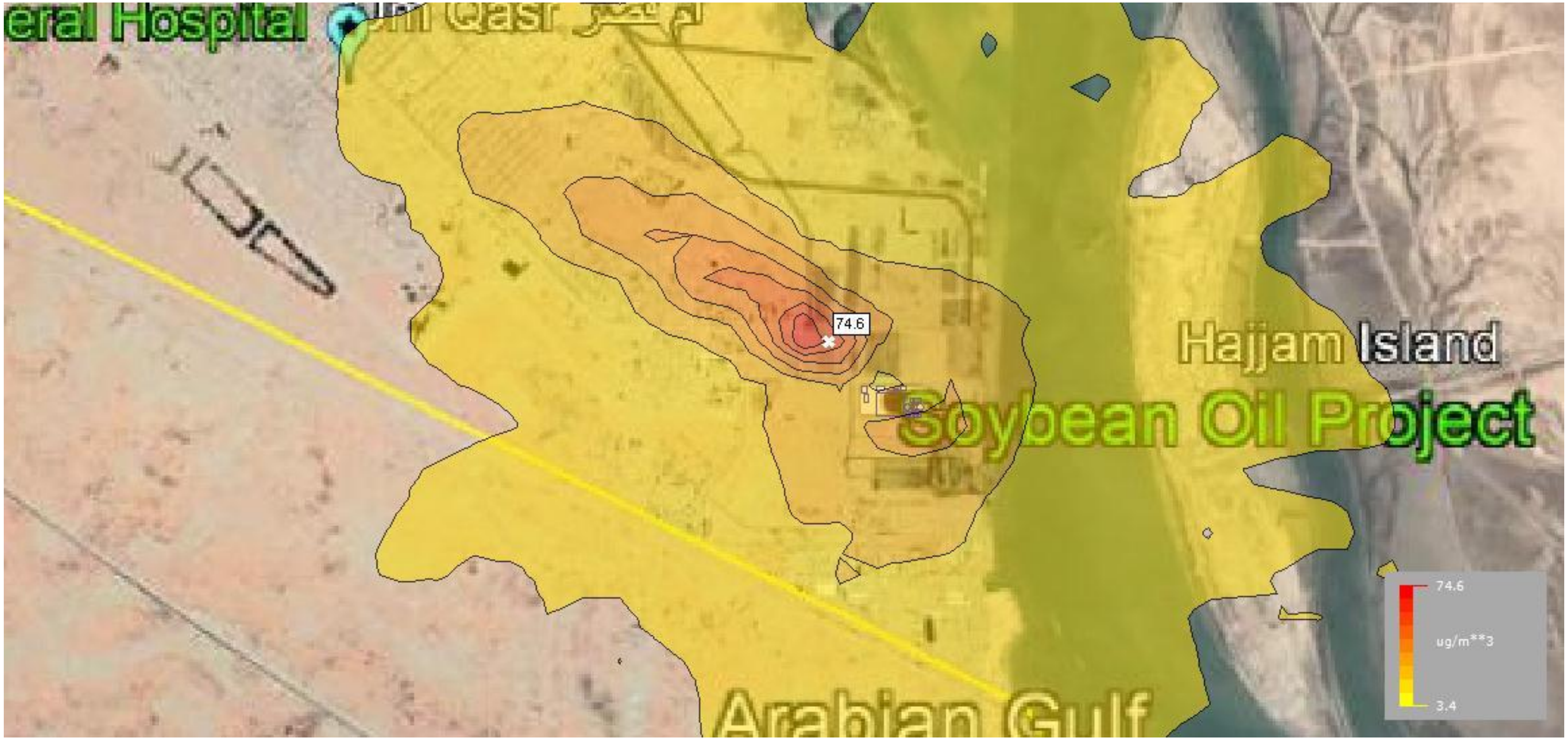


Figure 5-45: Predicted maximum 1-hour PM10 concentration (µg/m^3) during operation phase, Abnormal Scenario (No standard).

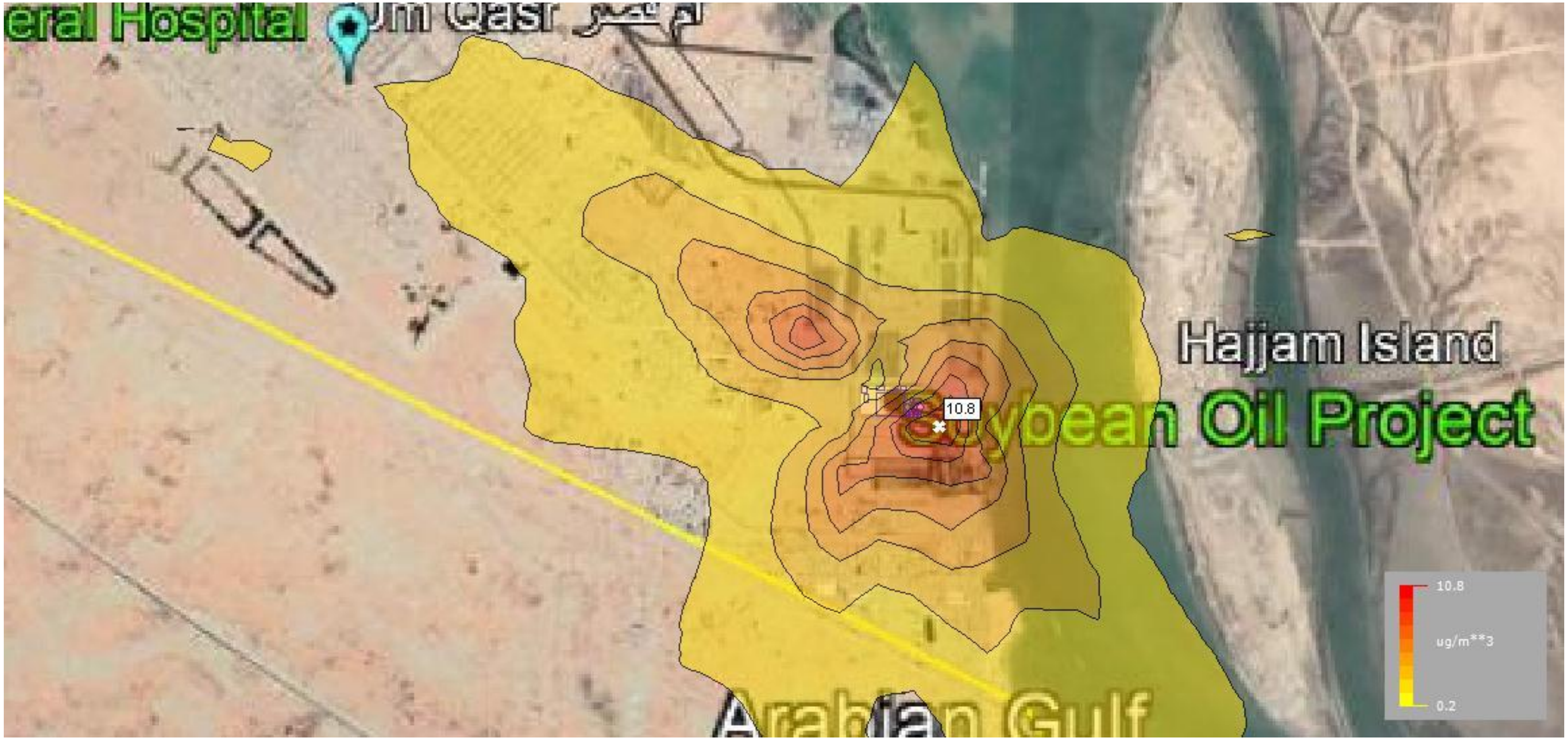


Figure 5-46: Predicted maximum 24-hour PM10 concentration (µg/m³) during operation phase, Normal Scenario (Iraqi standard= 150g/m³ and WB Guideline=50 µg/m³).

Figure 5-47: Predicted Annual PM_{10} concentration ($\mu g/m^3$) during operation phase, Abnormal Scenario (WB Guideline= 20 $\mu g/m^3$).

Ground level concentration at sensitive receptors

The dispersion modelling has been used to predict ground level concentrations in normal operations for different averaging periods at certain discrete receptors as shown in table 5-15. Discrete receptors were selected at different sensitive places within Umm Qasr residential area. The discrete receptor coordinates are given in the below table and shown in (figure 5-48). The concentration at sensitive receptors were assumed as same values recorded at the nearest air quality station although this assumption may not be valid at all receptors.

Table 5-15: Discrete Receptor Coordinates

Receptor	E Coordinate	N Coordinate
Umm Qr General Hospital	47°55'2.65"E	30° 2'10.12"N
AlSuwais Primary School	47°54'48.64"E	30° 2'27.92"N

Figure 5-48: Sensitive locations (Receptors) within Umm Qasr Residential Area

Nitrogen Oxides

The baseline is due to NOx emissions from all exiting sources (including traffic) but the modelling results are due to NOx emission from Soybean Oil Project alone at some sensitive receptors as given in the below table. It is clear that all predicted values at sensitive receptors due to the project alone are within the Iraqi ambient standards and WB guideline for both 1-hour maximum and annual average. The highest contribution from the project alone for 1-hour maximum of NOx represent about 10% of the Iraqi ambient standard. The baseline (all exiting sources including both industries and traffic) represent about 120% of the iraqi standard for 1-hour maximum (188 **µg/m³**). This high percentage is caused by already high concentration of exiting baseline.

As for the annual average the contribution of the project alone is less than 2.5% of the annual standard of 40ug/m3 at all sensitive receptors. The exiting baseline is about 175% of the WB standard of 40ug/m3.

Table 5-22: Summary of Impact Predictions for NOx (in µg/m³) Compared with Iraqi/WB Standard (Maximum Allowable Concentrations "Ceiling") Under Normal Operation

Location	Baseline (All exiting sources)	Model only (Project's Contribution)	Model only the Project as % Standard	Baseline as % Standard
1-Hour Average (Iraqi Standard: 188 µg/m3 and WB guideline: 200 **µg/m³**)				
Umm Qr General Hospital	207	19	10%	110%
AlSuwais Primary School	225	19	10%	120%
Annual Average (Iraqi Standard: 75 µg/m3 and WB guideline: 40 **µg/m³**)				
Umm Qr General Hospital	70.5	1.0	2.5%	175%
AlSuwais Primary School	70.5	1.0	2.5%	175%

The predicted modeled concentrations of NOx for 1-hour and annual average at two sensitive receptors (defined earlier) have been compared with the 25% of the available increment. The available increment is defined as the difference between the baseline and the ambient air quality standard, as outlined in the IFC/WB Guidelines (World Bank, 2007). As clear from below table that The predicted modeled concentrations of Nox for 1-Hour maximum and annual average could not be compared with the 25% of the available increment because the available increment (the different between baseline and RC standards) will not be valid (negative value) since the baseline at all receptors are above the corresponding standards.

Table 5-23: Summary of Impact Predictions for NOx (in µg/m³) Compared with 25% Available Increment (Maximum Allowable Increase) Under Normal Operation

Location	Baseline	Standard	Available Increment	25% of available increment	Maximum Modelling Results
1-Hour Average (Iraqi Standard: 188 **µg/m³** and WB guideline: 200 **µg/m³**)					
Umm Qr General Hospital	207	188	NV	NV	19
AlSuwais Primary School	225	188	NV	NV	19
Annual Average (Iraqi Standard: 75 **µg/m³** and WB guideline: 40 **µg/m³**)					
Umm Qr General Hospital	70.5	40	NV	NV	1.0
AlSuwais Primary School	70.5	40	NV	NV	1.0

Note: NV means not valid because the baseline value is above the corresponding standard

Sulphur Dioxide

The existing baseline of SO2 is due to emissions from all existing sources (including umm Qasr power plant, traffic and etc) while the modelling results is due to emissions from Soybean Oil Project alone at two sensitive receptors as given in the below table. It is clear that all predicted values at sensitive receptors due to Soybean Oil Project alone are within the Iraqi ambient standards and WB guideline for 1-hour maximum (262ug/m3 and 500ug/m3 respectively), 24-hour average (104µg/m3 and 52ug/m3 respectively) and annual average (47µg/m3). The highest contributions from the project alone for 1-hour maximum of SO2 represent about 67.7% of Iraqi ambient standard. Further, the exiting baseline (all exiting sources) is exceeding the Iraqi standard of 262ug/m3 at both sensitive receptors representing about 141% to 187% of Iraqi standard for 1-hour maximum (262ug/m3).

The daily average of SO2 due to both cases (all sources and Project alone) are within the Iraqi standard and WB guideline at both sensitive receptors. The contribution of the project alone to the daily average of SO2 is about 16.2% of the WB standard of 52ug/m3 at both receptors. The exiting baseline is 40.4% of the WB guideline of 52ug/m3.

As for the annual average the contribution of the project alone is about 4.8% of the annual standard of 47ug/m3 at both receptors. The exiting baseline is about 28.9% of the Iraqi standard of 47ug/m3.

Table 5-24: Summary of Impact Predictions for SO2 (in µg/m³) Compared with Ambient Standard (Maximum Allowable Concentrations "Ceiling") Under Normal Operations

Location	Baseline (All Exiting sources)	Model only (Project's Contribution)	Model only Project as % Standard	Baseline as % Standard
1-Hour Average (**Iraqi standard: 262** and WB guideline: 500 **µg/m³**)				
Umm Qr General Hospital	26.2	67.7	25.8	141.0
AlSuwais Primary School	26.2	67.7	25.8	187.0
24-Hour Average (Iraqi standard: 104 and WB guideline: **52 µg/m3**)				
Umm Qr General Hospital	21.0	8.4	16.2	40.4
AlSuwais Primary School	21.0	8.4	16.2	40.4
Annual Average (Iraqi Standard: 47 µg/m3)				
Umm Qr General Hospital	13.6	2.3	4.8	28.9
AlSuwais Primary School	13.6	2.3	4.8	28.9

The predicted modeled concentrations of SO2 for 1-hour, 24-Hour Average and annual average at two sensitive receptors have been compared with the 25% of the available increment. As clear from below table that the 1-hour maximum and daily average of SO2 concentrations exceed the 25% of the available increment. However, the annual average of SO2 concentrations at both receptors are below the Allowable Increment Level.

Table 5-25: Summary of Impact Predictions for SO2 (in µg/m³) Compared with 25% Available Increment (Maximum Allowable Increase) Under Normal Operations

Location	Baseline	Standard	Available Increment	25% of Available Increment	Modelling Results (Only Project)
1-Hour Average (**Iraqi standard: 262** and WB guideline: 500 **µg/m³**)					
Umm Qr General Hospital	26.2	262	235.8	59.0	67.7
AlSuwais Primary School	26.2	262	235.8	59.0	67.7
24-Hour Average (Iraqi standard: 104 and WB guideline: **52 µg/m³**)					
Umm Qr General Hospital	21.0	52	31.0	7.8	8.4
AlSuwais Primary School	21.0	52	31.0	7.8	8.4
Annual Average (Iraqi Standard: 47 **µg/m³**)					
Umm Qr General Hospital	13.6	47	33.4	8.4	2.3
AlSuwais Primary School	13.6	47	33.4	8.4	2.3

Particulate Matter (PM10)

The baseline due to PM_{10} emissions from all existing sources and the modelling results due to PM_{10} emission from Soybean Oil Project alone at two sensitive receptors are given in the below table. It is clear that all predicted values at sensitive receptors due to the Project alone are far below the WB guidelines for both daily maximum (50µg/m3) and annual average (20µg/m3). However, the baselines of PM_{10} at sensitive receptors are above the daily maximum standard and annual average standard. The contributions from the project alone to daily maximum of PM_{10} represent about 1.8% of WB ambient guideline. The baseline (all existing sources including natural sources) represents about 158% to 218% of WB guideline for 24-hour average (50µg/m3).

As for the annual average the contribution of the project alone is 1% of the annual standard of 20µg/m3 at both receptors. The exiting baseline is 425% of the WB guideline of 20µg/m3.

Table 5-26: Summary of Impact Predictions for PM_{10} (in µg/m³) Compared with Ambient Standard (Maximum Allowable Concentrations "Ceiling") Under Normal Operation

Location	Baseline (All existing sources)	Model only (Project's Contribution)	Model only as % Standard	Baseline only as % Standard
24-Hour Average (Iraqi standard: 150 and **WB guideline: 50 µg/m³**)				
Umm Qr General Hospital	79	0.9	1.8	158

Location	Baseline (All existing sources)	Model only (Project's Contribution)	Model only as % Standard	Baseline only as % Standard
AlSuwais Primary School	109	0.9	1.8	218
Annual Average (WB Standard 20 **μg/m³**)				
Umm Qr General Hospital	85	0.2	1.0	425
AlSuwais Primary School	85	0.2	1.0	425

The predicted modelled concentrations of PM_{10} for 24-Hour Average and annual average could not be compared with the 25% of the available increment because the available increment (the different between baseline and corresponding standards) will not be valid since the baseline at both receptors are above the standards as clear from below table.

Table 5-27: Summary of Impact Predictions for PM_{10} (in μg/m³) compared with 25% Available Increment (Maximum Allowable Increase) Under Normal Operation

Location	Baseline	Standard	Available Increment	25% of Available Increment	Maximum Modelling Results (only the Project)
24-Hour Average (Iraqi standard: 150 and **WB guideline: 50 μg/m³**)					
Umm Qr General Hospital	79	50	NV	NV	0.9
AlSuwais Primary School	109	50	NV	NV	0.9
Annual Average (WB guideline 20 **μg/m³**)					
Umm Qr General Hospital	85	20	NV	NV	0.2
AlSuwais Primary School	85	20	NV	NV	0.2

APPENDIX (C): STAKEHOLDER IDENTIFICATION, PUBLIC DISCLOSURE AND CONSULTATION

AC. STAKEHOLDER ENGAGEMENT

AC.1 Introduction

Stakeholder engagement is a requirement of IFC Performance Standard 1 as it is recognised that failure to engage stakeholders can create significant risks to development of a project. Accordingly, Sama AlManar is planning to have good relations between the Project management and its surrounding communities and relevant stakeholders which eventually will lead to the Project to maintain a social license to operate. Stakeholder engagement provides an important mechanism for receiving community feedback on project-related concerns and also disseminating project related information back to the community.

The objectives of the consultation process with the stakeholders for this ESIA study are:

- ensuring that clear/transparent, timely and accurate information about this project is provided to the stakeholders;
- providing sufficient opportunity to stakeholders to express their opinions and concerns, and to ensure that these concerns are taken into account by project management and influence Project decisions; and
- establishing a relationship and form of communication between the project management, government authority (mainly Umm Qasr Port), affected surrounding communities and other interested parties for the lifetime of the Project.

This part of the study provides the stakeholder identification and analysis as well as the grievance mechanism that are recommended for this Project in line with the International Finance Corporation (IFC) Performance Standards. An overview of the stakeholder's views and potential concerns raised during these consultations is also provided.

AC.2 Stakeholder Consultation and Disclosure

A brief overview of the requirements of public disclosure and stakeholder consultation as per IFC PS 1 ((Assessment and Management of Environmental and Social Risks and Impacts) is provided below.

- Community engagement to be undertaken with the affected communities and be free of external manipulation, interference, or coercion. In situations where an affected community may be subject to risks or adverse impacts from a project, the project management shall undertake a process of consultation so as to provide the affected communities with an opportunity to express their views on the project risks, impacts, and mitigation measures, as well as allow the project management to consider and respond to them.

- As part of consultation process, the project management should also establish a Grievance Redressal Mechanism, which will allow the affected communities to express their views and concerns and grievances about the project proponent's environmental and social performance and allow for steps to be taken to resolve such concerns and complains.

- The project management shall identify and engage with stakeholders that are not directly affected by the project but those that have established relationships with local communities and/or interest in the project – local government authorities – and establish a dialogue.

As for the disclosure process, according to the IFC requirements, the Final Draft ESIA will be disclosed to the public in English and in the local language. Affected and interested stakeholders shall have real access to this study, which shall therefore not only be posted on Sama AlManar's website, but shall also be delivered in printed copies to the local government offices (i.e., Umm Qasr Port authority and possibly Umm Qasr Municipality). The disclosure period is 7 days although it can be extended longer if required. After disclosure of the ESIA report, public consultation meeting(s) on the Final Draft ESIA will be held by the consultant (EnviroSOLTECH) and Sama AlManar to explain and interpret the main findings of the study to the main stakeholders in Umm Qasr (mainly municipality, Umm Qasr port authority, schools teachers and princiPles, Umm Qasr general hospital staff, and others) and seeking their feedback and concerns, which will then be considered in the revision of the Final Draft ESIA report.

AC.3 Stakeholder Characterisation, Identification and Mapping

Stakeholders can be defined as *"… persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community, or other businesses"* IFC (2007).

The stakeholders have been identified below:

- Affected parties`: Local Umm Qasr Community, project employees, Contractual Labourers, Government Bodies (Regulatory Authorities) such as Municipality of Umm Qasr, Environmental Directorate, Umm Qasr General Hospitals, etc.

- Other interested parties: Other government Bodies (Regulatory Authorities) such as Ministry of Health and nearby projects.

Project stakeholders identified in the above categories are presented below:

- Umm Qasr community area (Affected Party)
- AlZubair and Basra Community areas
- Umm Qasr schools (Affected Party)
- Umm Qasr General Hospital (Affected Party)
- Municipality of Umm Qasr (Affected Party)
- Umm Qasr Port Authority (Affected Party)
- Municipality of Basrah, Engr. Iman Hameed Majeed (Interested Party)
- The municipalities of the province of Basra Directorate, Engr. Asad Saleh (Affected Party)
- Directorate of Environment in Basra, Dr. Karim Ghanim and Mr. Amer Hussain (Affected Party)
- Directorate of Health in Basra, Dr. Nihad Qasim Mohamed (Interested Party)
- Directorate of Basra Planning; Engr. Shahdi Abdul Ameer Majed (Interested Party)

Mapping of stakeholders for this project is shown in Table AA1. This table maps the key stakeholders to enable the planning of engagement activities based on EnviroSOLTECH's evaluation: a) their interest in the Project; and b) their ability to influence the Project in terms of permitting, financing, implementation and operation.

Table AA1: Interest and Influence of Stakeholders

Stakeholder name	Interest	Influence	potential areas of interest/expectation from stakeholders
Umm Qasr community area	High	Medium	Very interested in the project/ their expectationon on positive impact is medium
AlZubair and Basra Community areas	Medium	Low	Interested in the project/ their expectationon on positive impact is medium

Umm Qasr schools (primary and secondary education)	Medium	Low	Very interested in the project/their expectationon on positive impact is medium
Basra University	High	Medium	Interested in the project/their expectationon on positive impact is medium
Umm Qasr General Hospital	Medium	Medium	Interested in the project/their expectationon on positive impact is medium
Umm Qasr Port Authority	High	High	Very interested in the project/their expectationon on positive impact is high
Manarat Umm Qasr*	High	High	Very interested in the project/their expectationon on positive impact is high
Municipality of Umm Qasr	High	Medium	Very interested in the project/their expectationon on positive impact is medium
Municipality of Basrah	Medium	Low	Interested in the project/their expectationon on positive impact is low
The municipalities of the province of Basra Directorate	High	Medium	Interested in the project/their expectationon on positive impact is medium
Directorate of Environment in Basra	High	Low	Interested in the project/their expectationon on positive impact is medium
Directorate of Health in Basra	High	Low	Interested in the project/their

			expectationon on positive impact is low
Directorate of Basra Planning	Medium	Low	Very interested in the project/their expectationon on positive impact is medium
Directorate of Labour and Social Affairs	High	Low	Very interested in the project/their expectationon on positive impact is medium
Fishing communities even though they are not expected to be impacted**	Low	Low	Interested in the project/their expectationon on positive impact is low

*Manart Umm Qasr is the current operator of berth No. 4 and provides all needed all services and equipment at this berth

**More details on fishing location are given in section 12-Socio-Economy

Umm Qasr Port Authority is the most significant stakeholder party, both in terms of interest in and influence on the Project, followed by Umm Qasr community and Municipality of Umm Qasr that have high interest in and medium influence on the project. As for the remaining stakeholders, they have either medium or high interest in potential economic benefits associated with the Project, but their influence is low to medium. Since the development of the soybean Oil Project, Sama AlManar has recognised that maintaining appropriate communication and a harmonious relationship with its stakeholders are keys to maintaining a social license to operate for the project.

AC.4 Grievance Redress Mechanism

IFC PS 1 requires that a Grievance Redress Mechanism (GM) is developed for the projects to provide a systematic way of receiving, investigating and responding to community complaints or concerns associated with a Project's activities. When a Grievance Redress Mechanism is carefully designed, properly implemented and embedded in an effective community engagement program, the mechanism shall provide significant benefits to both the Project and communities in which it operates. The grievance mechanism should also allow submission of anonymous complaints.

All project affected stakeholders will be notified about the Grievance Redress Mechanism of the Soybean Oil Project during the Public Consultation meetings, as well as through the disclosed project information leaflets. Project-affected people will be notified orally or in a written form about their rights and the procedure of filing complaints.

Sama AlManar management will carry out the following to meet the grievance requirements:

- Nominate a person of staff responsible for grievance procedure coordination, hereby referred to as Grievance Coordinator;
- Provide a telephone number, e-mail address and contact name of Grievance Coordinator on project boards and website of the company;
- Liaise with the complainant on behalf of the company and coordinate relevant departments to provide a solution to the complainant;;
- Liaise with courts if needed;
- Keep grievances confidential and staff and contractors will be in no way penalized for providing their feedback,
- Keeping the grievances log updated with the status of all grievances raised.

In most cases, a grievance or complaint will be submitted by a stakeholder or local resident by phone, in writing or by speaking with the company grievance coordinator or one of the company's project representative officers. However, the affected stakeholders are recommended to follow the typical steps of a grievance mechanism below for submitting their complaints:

a) Contact the company's designated grievance coordinator in the following way: in person via designated telephone number, via email, via regular mail.

b) Each complaint shall be registered, and a reference number will be assigned to it. A resolution to the grievance has to be taken within 15 days.

c) Agree with the company management on mitigation measure.

d) Sign if the mitigation measure has been implemented as agreed .

e) In case of failure of the grievance redress system, the project-affected stakeholders can submit their case to the appropriate court of law.

The above suggested grievance mechanism is designed to avoid lengthy court procedures. The EPC Contractor and the operator of Soybean Oil Project are requested to implement an independent grievance management system to enable the workers (and their organizations, where they exist) to raise reasonable workplace complaint or concerns. The workers' grievance mechanism shall follow the same principles as the one created for the general public:

- complaints must be answered in a timely and effective manner without fear of retribution;
- the mechanism should allow for anonymous submissions;

- the access to the grievance mechanism shall not replace or impede the subsequent access to other redress mechanisms;
- the promoter will inform workers of the grievance mechanism at the time of hire and make it accessible to them.

AC.4.1 Monitoring and Reporting Of Grievances

It will be important to monitor and report on all stakeholder engagement activities and any complaint, or concern raised by the affected parties to ensure that the desired outcomes are being achieved, and to maintain a comprehensive record of engagement activities and any complaint raised. The monitoring and reporting shall be undertaken on a regular basis. The scope of the monitoring shall cover the following aspects:

- Continually assessing the effectiveness of the grievance mechanism procedure;
- Identifying the need for any improvement on the procedures and the implementation;
- Evaluating the progress of resolution implementation and identify intervention needs from the Project management to manage overdue or outstanding cases or recurring grievances; and
- Periodic monthly reporting will be prepared by the company grievance coordinator and these reports to be submitted to the site manager and distributed to other relevant parties as required to identify the need for organisational and procedure improvement.

The content of the regular reports should contain at least the following information:

- Summarise the grievances received from affected stakeholders and classification based on the grievance type within the timeframe;
- Overall resolution status – number of complaints resolved, pending of implementation and unresolved, along with challenges in implementing the resolutions, and timeframe for resolving the remaining unresolved grievances;
- Results of monitoring and the status of implementation of the proposed recommendations; and
- Identify all critical grievances occurring regularly or overdue cases.

AC.4.2 Disclosure of Grievance Mechanism

The disclosure and communication of the grievance mechanism will begin early in the Project lifecycle and continue on an on-going basis as grievances arise. It will be disclosed in a culturally appropriate manner in the local language and format that is understandable to all project-affected peoples.

The following information is recommended to be disclosed (internally and externally):

• Steps to be taken by the company for resolving the complaint based on Project-based Grievance Mechanism;

• Indicating the affected community;

• Indicating where, when, and how affected party can submit their complaints;

• Indicating the person who is responsible for receiving and responding to complaints, and if any external parties can receive complaints from communities; and

• Indicating what type of responses complainants can expect from the Project including timing of response.

In regard to disclosing the mechanism in the company website, Project management will undertake communication in group discussions and community meetings, as well as by using other communication tools. It is essential that the local government and all contractors also fully understand the mechanism to enable them to communicate the step-by-step process to the project-affected people, particularly in the case where the grievances are submitted to them for resolution.

AC.5 Project Stakeholder Engagement Activities Undertaken To Date

Community and Government consultations were undertaken in October 2022 as part of ESIA development process during the construction phase of the Project. The main topics of discussion with stakeholders were:

(a) Attitude of the community towards the upcoming project;

(b) Expected positive and negative impacts of the project;

(c) The main environmental and socio-economic impacts from the project on the surrounding project area;

(d) Existence of environmental, social and historical places around the project area;

(e) Community benefits during construction and operation phases of the project;

(f) Views and fears of the community on the project implementation during construction and operation phases.

Tables below present the outputs of surveys undertaken during Oct 2022 with the main stakeholders during the Soybean Oil construction phase. These surveys/consultations were undertaken with various stakeholders including the following: Umm Qasr community residents, Umm Qasr general hospital, Umm Qasr schools, Umm Qasr Municipality, Basra general municipality, general statistical center, and others.

Overview of the feedback that was received during these consultations:

- Most stackholders request to create job opportunities for the people in Umm Qasr area
- Some stakeholders (Umm Qasr general hospital, directorate of health and Environmental directorate at Basra) emphasize the importance of compliance of the project with all Iraqi environmental regulation and standards.
- All stakeholders believe that the project will not affect their future access to water resources since they have not faced any water shortages so far.
- All stakeholders believe that the project will not affect any nearby archaeological, cultural and heritage sites.
- All stackeholders do not have any concerns about the soybean oil project

Some pictures showing meetings with local residents in Umm Qasr residential area to obtain their opinion and concerns on the project

Results of Questionnaire for local residents

	General Questions			
1	Gender	**Male**	**Female**	
		69.56%	**30.4%**	
2	Are you aware of the proposed soybean project?	**Yes**	**NO**	
		52.2%	**37.8%**	
3	Do you believe it will have a positive or negative effect on the local community?	**Positive**	**Negative**	
		82.6%	**17.4**	
4	Do you have any concerns about the soybean oil project?	**Yes**	**NO**	
		17.4%	**82.6%**	
	Demographic Questions			
5	How many people live in your household?	**2-5**	**> 5**	
		26.1%	**73.9%**	
6	Age of residents	**< 20**	**20-30**	**> 30**
		4%	**35%**	**61%**
7	Educational level of family members	**Not educated**	**High school**	**University**
		13%	**52%**	**35%**
8	Economic status of residents	**High**	**Moderate**	**Poor**
		4%	**83%**	**13%**
	Government Services Questions			
9	Do you have water and sewer network in your area?	**Yes**	**No**	
		91.3%	**8.7%**	
10	Does the municipality collect the garbage regularly?	**Yes**	**No**	
		91.3%	**8.7%**	
11	Do you have a fire Department in your area	**Yes**	**No**	
		69.6%	**30.4%**	
12	Do you have a Police Department in your area	**Yes**	**No**	
		100%	**0%**	
	Employment and local manpower			
13	Are you or your household currently employed?	**Yes**	**No**	
		39.1%	**60.9%**	
14	Do you have an education and/or training for these positions?	**Yes**	**No**	
		34.8%	**65.2%**	
15	What are your monthly wages based on your skill level?	**< 1000$**	**1000-2000 $**	**> 2000 $**
		74%	**22%**	**4%**
16	Are you interested in working for the Soybean oil project?	**Yes**	**No**	
		82.6%	**17.4%**	
17	Do you own a business or work for a local business that could provide supplies and/or services to the soybean project?	**Yes**	**No**	
		39.1%	**60.9%**	
	Land Use and Natural Resources Questions			
18	Do you, your family or your neighbors currently use land in the area of the soybean oil project?	**Yes**	**No**	

		0%	**100%**	
19	Do you believe the proposed project will affect your current and/or future use of the lands?	**Yes**	**No**	
		56.5%	**43.5%**	
20	Do you use water resources (groundwater and/or surface water) from the area of the project?	**Yes**	**No**	
		0%	**100%**	
21	If yes, select as appropriate	**Drinking**	**Irrigation**	**Others**
22	Is groundwater and/or surface water scarce in the vicinity of the project area?	**Yes**	**No**	
		69.6%	**30.4%**	
23	Do you believe the project will affect your future access to water resources?	**Yes**	**No**	
		0%	**100%**	
	Archaeological, Cultural and Heritage Sites Questions			
24	Do you know of any archaeological, cultural and heritage sites that are located in the soybean oil project area and its vicinity?	**Yes**	**No**	
		0%	**100%**	
25	If yes, do you believe that the project will affect these archaeological, cultural and heritage sites?	**Yes**	**No**	




Some pictures showing meeting with local government representatives in Umm Qasr residential area to obtain their opinion on the project

Statistical results of questionnaire for local Government Representatives

General Questions							
1	Gender	**Male**		**Female**			
		50%		**50%**			
2	Are you aware of the proposed soybean oil project?	**Yes**		**No**			
		75%		**25%**			
3	Do you believe it will have a positive or negative effect on the local community? Please Explain your response.	**Positive**		**Negative**			
		100%		**0%**			
4	Do you have any concerns about the soybean oil project?	**Yes**		**No**			
		0%		**100%**			
5	If yes, Explain………………………………………………………………………………………						
	Demographic Questions						
6	What is the population of the area?	**< 50,000**		**50,000-100,000**		**> 100,000**	
		0%		**100%**		**0%**	
7	What is the demographic make-up of the area?	**Age of residents**		**Educational level**		**Occupation of residents**	
		< 20	**0%**	None educated	**0%**	Employed	**50%**
		20-30	**100%**	High school	**50%**	Non-Employed	**50%**
		> 30	**0%**	University	**50%**	Others	**0%**
8	Are there any government or academic reports available about the demographics and the population of the area?	**Yes**		**No**			
		0%		**100%**			
9	If yes, can we access to these documents?						
	Government Services Questions						
10	How many schools are in the affected area?	**Answer**		**10**			
11	How many students are enrolled in these schools?	**Answer**		**4000-5000**			
12	Is there additional capacity in the schools if additional employees are moved to area to work for the soybean oil company?	**Yes**		**No**			
		100%		**0%**			
13	What social services are provided to local residents currently?	**Status**	**Health care**	**Hospitals**	**Family services**	**Food banks**	**Others services**
		Yes	**50%**	**50%**	**75%**	**100%**	
		No	**50%**	**50%**	**25%**	**0%**	
14	What municipal services are currently provided to residents of the area?	**Status**	**Sewer**	**Water**	**Garbage collection**	**Police department**	**Fire dept**
		Yes	**100%**	• **100%**	• **100%**	• **100%**	**100%**
		No	• **0%**	• **0%**	• **0%**	• **0%**	• **0%**
	Employment and Local Manpower Questions						
15	How are local residents currently employed?	**Goverment**		**Non-Government**		**Own business**	
		25%		0%		75%	
16	What are current monthly wages/ salaries in the area based on required skill levels?	**< 1000$**		**1000-2000 $**		**> 2000 $**	
		75%		**25%**		**0%**	

<table>
<tr><td rowspan="2">17</td><td rowspan="2">What is the level of unemployment in the area?</td><td><10%</td><td colspan="2">10-20%</td><td colspan="3">> 20%</td></tr>
<tr><td>0%</td><td colspan="2">75%</td><td colspan="3">25%</td></tr>
<tr><td rowspan="2">18</td><td rowspan="2">Are raw materials, supplies and services required by the project available locally?</td><td>Yes</td><td colspan="5">No</td></tr>
<tr><td>0%</td><td colspan="5">100%</td></tr>
<tr><td>19</td><td>If yes, give details</td><td colspan="6">……………………………………………………………………………………</td></tr>
<tr><td rowspan="2">20</td><td colspan="2" rowspan="2">Will local businesses in the community be able to benefit from selling goods and materials to the Soybean oil project?</td><td>Yes</td><td colspan="4">No</td></tr>
<tr><td>100%</td><td colspan="4">0%</td></tr>
<tr><td colspan="8">Land Use and Natural Resources Questions</td></tr>
<tr><td rowspan="3">21</td><td rowspan="3">How is land currently used in the area of the project?</td><td>Status</td><td>Grazing area</td><td colspan="2">Agriculture</td><td>Industry</td><td>None</td></tr>
<tr><td>Yes</td><td>0%</td><td colspan="2">0%</td><td>0%</td><td>0%</td></tr>
<tr><td>No</td><td>100%</td><td colspan="2">100%</td><td>100%</td><td>100%</td></tr>
<tr><td rowspan="2">22</td><td colspan="2" rowspan="2">Are the natural resources available? (e.g., grazing area and agriculture)</td><td>Yes</td><td colspan="4">No</td></tr>
<tr><td>0%</td><td colspan="4">100%</td></tr>
<tr><td colspan="8">Archaeological, Cultural and Heritage Sites Questions</td></tr>
<tr><td rowspan="2">23</td><td colspan="2" rowspan="2">Are there any local cultural and heritage sites located in the soybean oil project area and its vicinity?</td><td>Yes</td><td colspan="4">No</td></tr>
<tr><td>0%</td><td colspan="4">100%</td></tr>
<tr><td>24</td><td>If yes, how are these currently used and/or protected?</td><td colspan="6"></td></tr>
<tr><td>25</td><td>And how these cultural and heritage sites affected?</td><td colspan="6"></td></tr>
</table>

APPENDIX (D) MAIN ARCHAEOLOGY AND CULTURAL SITE IN IRAQ

AD 1. Major archaeological sites

Major archaeological sites in Iraq are given hereunder:

- Hatra was an ancient city in Upper Mesopotamia located in present-day eastern Nineveh Governorate in northern Iraq. The city lies 290 km northwest of Baghdad. City of the Sun, Hatra was the first, and for a long time, the only UNESCO-listed site in Iraq, listed at the 9th Session of the World Heritage Committee, held in Paris, France in 1985. ***This archaeological site is extremely far (about 760km) from the project site, located in Nineveh Governorate, northwest Iraq.***

Figure 13-1: Hatra site in Nineveh Governorate, northwest Iraq

- Babylon was the capital city of the ancient Babylonian Empire, which itself is a term referring to either of two separate empires in the Mesopotamian area in antiquity. These two empires achieved regional dominance between the 19th and 15th centuries BC, and again between the 7th and 6th centuries BC. Babylon was added to UNESCO's List in 2019. ***This archaeological site is far (>400km) from the project site located in Babil or Babylon Province, central Iraq.***

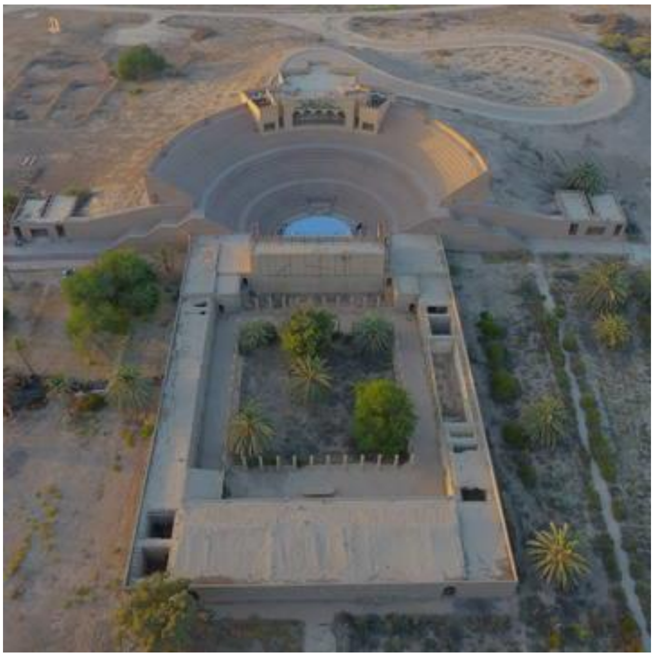


Figure 13-2: Babylon site in Babil Governorate, Central Iraq

- Nineveh was an ancient Assyrian city of Upper Mesopotamia, located in the modern-day city of Mosul in northern Iraq. It is located on the eastern bank of the Tigris River and was the capital and largest city of the Neo-Assyrian Empire, as well as the largest city in the world for several decades. In the 6th century BC, Nineveh was one of the most important in ancient Mesopotamia and was the capital of Assyria. The walls of Nineveh were built around A.D. 700 to protect the Assyrian capital, at the time probably the largest city in the world. ***This archaeological site is far (860km) from the project site and located in Mosul province, northwest of Iraq.***

Figure 13-3: Nineveh site in Mosul province, northwest of Iraq

- Nimrud is an ancient Assyrian city located 30 kilometres south of the city of Mosul, in the Nineveh Plains in Upper Mesopotamia. It was a major Assyrian city between approximately 1350 BC and 610 BC. Nimrud was the capital of Assyria in the 9th century BC, and was the first Assyrian capital, founded 3,200 years ago. Its rich decoration reflected the empire's power and wealth. ***This archaeological site is far (860km) from the project site and located in Mosul province, northwest of Iraq.***

Figure 13-4: Nimrud site in Mosul province, northwest of Iraq

- Assur, also known as Ashur and Qal'at Sherqat, was the capital of the Old Assyrian State, the Middle Assyrian Empire, and for a time, of the Neo-Assyrian Empire. Ashur dates back to the third millennium. ***This archaeological site is far (750km) from the project site and located in Saladin province, north of Baghdad, Iraq.***

Figure 13-5: Assur site in Saladin province, north of Baghdad Iraq

- Eridu ranks as ‘the oldest city in the world’. Interestingly Eridu is explicitly described by ancient writers as ‘standing upon the shores of the sea’ and Ur, situated only a few miles away, ‘had quays at which ocean-going vessels discharged their cargoes’. The Eridu site was inscribed as a UNESCO World Heritage Site as part of the Ahwar of Southern Iraq in 2016. Ur is city of the fabled moon god Nanna and the home of Abraham. Known in the Bible as Ur of the Chaldees, the Chaldeans inhabited the city in 10th Century BC. Excavated in the 1920’s and 30’s by Leonard Woolley, great treasures were seized including gold, silver and clay tablets telling the poem of Gilgamesh. Eridu is situated about 12 kilometres south-southwest of Ur. ***Both sites (Eridu and Ur) are far (200km) from the project site and located in Dhi Qar province, Southern Iraq.***

Figure 13-6: Eridu (Left) and Ur (right) sites in Dhi Qar Province, Southern Iraq

AD 2. Cultural Islamic Heritage

The Republic of Iraq is home to many famous sacred places in Islam including the following:

- Imam Ali Shrine, also known as Masjid of Ali in Najaf, is one of the holiest sites in Iraq. This shrine contains the tomb of Ali ibn Abi Talib, a cousin, son-in-law and companion of the Islamic prophet Muhammad.

  The Soybean Oil project is located at a distance of 405km from this location and no effects are anticipated.

- The Great Mosque of Kufa ,or Masjid al-Kufa, is located in Kufa, Iraq and is one of the earliest and holiest surviving mosques in the world. The mosque, built in the 7th century, was home to Ali ibn Abi Talib, the 4th Rashidun caliph; and contains the holy shrine of Muslim ibn Aqeel, his companion Hani ibn Urwa; and the revolutionary, Al-Mukhtar.

The Soybean Oil project is located at a distance of 410km from this location and no effects are anticipated.

- The Imam Hussain Shrine is the mosque and burial site of Hussain ibn Ali, the third Imam of Shia Islam, in the city of Karbala, Iraq. It stands on the site of the Mausoleum of Hussain, who was a grandson of Prophet Muhammad, peace be upon him, near the place where he embraced martyrdom during the Battle of Karbala in 680 CE. The tomb of Hussain is one of the holiest sites in Shia Islam, on a par with Mecca and Medina, and many make pilgrimages to the site. Every year, millions of pilgrims visit the city to observe Ashura, which marks the commemoration of Hussain's death for all Muslims

The Soybean Oil project is located at a distance of 465km from this location and no effects are anticipated.

- The Mausoleum of Abdul-Qadir Gilani, also known as Al-Ḥaḍrat Al-Qadiriyyah, is an Islamic religious complex dedicated to Abdul Qadir Gilani, the founder of the Qadiriyya Sufi order, located in Baghdad, Iraq.

The Soybean Oil project is located at a distance of about 500km from this location and no effects are anticipated.

- The Abu Hanifa Mosque is one of the most prominent Sunni mosques in Baghdad, Iraq. It is built around the tomb of Abu Hanifah An-Nu'man, the founder of the Hanafi madhhab or school of Islamic religious jurisprudence. It is in the al-Adhamiyah district of northern Baghdad, which is named after Abu Hanifa's reverential epithet Al-Imam Al-Azam ("The Great Leader").

The Soybean Oil project is located at a distance of about 500km from this location and no effects are anticipated.

- Al-Kadhimiya Mosque or Al-Kadhimayn Shrine is a Shi'ite Islamic mosque and shrine located in the Kadhimay suburb of Baghdad, Iraq. It contains the tombs of the seventh and ninth Twelver Shii Imams, respectively Musa al-Kaẓim and his grandson Muhammad al-Jawad. The mosque is built on the site of the Qureish cemetery, which was created within the original Round City of Baghdad in 762 AD.

The Soybean Oil project is located at a distance of about 500km from this location and no effects are anticipated,

- Al-Askari Shrine, or the Al-Askari Mosque, is a Shia Muslim mosque and mausoleum in the Iraqi city of Samarra 125 km (78 mi) from Baghdad. It is one of the most important Shia shrines in the world. It was built in 944. The dome was destroyed in a bombing by terrorist attack in February 2006 and its two remaining minarets were destroyed in another bombing in June 2007, causing widespread anger among Shias. The dome and minarets were repaired and the mosque reopened in April 2009. The

10th and 11th Shiite Imams, Ali al-Hadi and his son Hasan Al-Askarī, known as Al-Askariyyayn are buried in the shrine.

The Soybean Oil project is located at a distance of about 600km from this location and no effects are anticipated.

- There are many other historical mosques within the Republic of Iraq, such as the following:
    - Baghdad: Al-Ahmadiya Mosque, Al-Asifyah Mosque, Al-Khulafa Mosque, Al-Rahman Mosque, Imam Ahmad Bin Hanbal Shrine, Umm al-Qura Mosque.
    - Mosul: Great Mosque of Al-Nuri, Mosul Grand Mosque, Mosque of the Prophet Jonah, Mosque of the Prophet Seth, Mausoleum of Yahya Abu al-Qasim
    - Najaf: Al-Hannanah Mosque and Al-Sahlah Mosque
    - Samarra: Abu Dulaf Mosque, Great Mosque of Samarra

The Soybean Oil project is located at a distance of any such locations and no effects are anticipated.


Figure 12-9: Imam Ali Shrine (left) and Masjid al-Kufa (right) in Najaf, Iraq

Figure 12-10: Imam Hussain Shrine (left) and Al-Askari Shrine (right) in Karbala and Samarra respectively, Iraq

APPENDIX (E) SOCIAL MANAGEMENT PLANS

Human Resources Policy

Sama AlManar accepts and promotes the following principles:

- Fully commitment to the Iraqi labor law along with its decrees and decisions.
- Develop an appropriate framework of labor relations and of agreed mechanisms to bring the organization into line with corporate and social requirements and to promot the objectives of competitiveness and business improvement.
- Develop a strategy that favors the selection, hiring, promotion and retention of talent, consisting of competitive remuneration and a working environment that promotes the professional growth of the Group's employees, based on equal opportunity, the commitment to the Purpose and Values of the group and the business enterprise of the Group, and reconciliation between personal and professional life.
- Ensuring on-going development of consistent human resources processes that progress in the implementation of a talent culture in all countries.
- Ensuring to implement a strategic objective of the conduct of labor relations based on equality of opportunity, particularly between genders, non-discrimination, respect for diversity and no forced labor.
- Develop measures to achieve a favorable environment that facilitates reconciliation of personal and working life, complying with the applicable law and following best international practices.
- Develop and implement a remuneration system that allows for the attraction and retention of the best professionals and the objectives of which are aligned with Sama AlManar's objective and HR policy.
- Recognize and appreciation of the contribution of all professionals to Sama AlManar's creation of value and to its growth.
- Recognize and value family and personal connections among the professionals of the Sama AlManar company, and establish specific measures ensuring that employees with such connection are not favored or discriminated against in hiring and promotion processes, nor is there any violation of the principle of equal opportunity.
- The process of selecting, hiring and promoting professionals of Sama AlManar shall ensure that all of its professionals are persons who are respectable and appropriate, aligned with the provisions of the Purpose and Values of the company and with the principles contained in the Code of Ethics, assessing their history and

rejecting those who lack the required appropriateness due to the background thereof.

Recruitment and Selection Policy

Sama AlManar accepts and promotes the following basic principles:

- Develop and implement a program for standardizing the recruiting and hiring procedures of the company, so that they:
    - Comply with applicable Iraqi labor laws regarding recruitment and selection.
    - Respect equal opportunities and promote non-discrimination with respect of race, color, age, gender, marital status, ideology, political opinion, nationality, religion, or any other personal, physical, or social condition..
    - Select all professionals who have the required competency profile, without exclusions of any kind that could limit the effectiveness of the selection process.
    - Ensuring that the identification and assessment of the ideal candidates are made in according to the knowledge, attitudes, abilities, and competences required for the different job positions.
    - Ensure that selection shall be carried out based on merit and capability, guaranteeing that all candidates are treated equally throughout the process without any kind of discrimination and with no forced labor.
    - Protect the confidentiality to all candidates, in accordance with personal data protection laws and regulations.
- Priority of recruitment shall be given to the inhabitant of the surrounding areas of the project (within Basra Province).
- Sama AlManar shall promote the hiring of its professionals using stable and permanent contracts.
- Provide candidates with a competitive offer that favors the recruitment and hiring of the best professionals.

- Sama AlManar's offer must be based on equal opportunity, business enterprise, a balance between personal and professional life, and reconciliation thereof.
- Ensuring that selection and hiring processes are objective and impartial and do not influence the hiring of family members of Sama AlManar professionals or persons with a similar connection, avoiding the participation of the professionals with which they are connected in their selection process.

WORKERS' GRIEVANCE MECHANISM

Objective: To receive and facilitate resolution of Project workers' concerns and grievances about the Project. The grievance mechanism seeks to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate and readily accessible.

Roles and Responsibilities: The Human Resources Manager is responsible for management of this workers' grievance mechanism, with the involvement of additional key staff if needed.

Various channels for Project workers' to vocalize their grievances formally include:

- Complaint register form (workers can fill the forms that will be distributed to them in advance to voice their grievances)
- Face-to-face meetings with the Human Resources Manager, the worker's manager and/or other relevant Project representatives;
- Written communication (e.g. email, letter) directed to the Human Resources Manager, the worker's manager and/or relevant Project representative; and
- Telephone (worker can call HR officer and/or a relevant Project representative and request to speak to him); and
- Anonymous grievances may also be submitted on-line at the company website to the Human Resources Manager.

All grievances would be kept in a grievance log in the Workers' Grievance database. The grievance log record could include a summary of the grievance, the resolution or agreement reached between the company and the complainant, and monitoring actions taken in response to the grievance.

The key steps of the Process that can be followed for implementing worker's grievance mechanism are as follows:

- Identification of grievances. This could be by depositing a grievance in a suggestion box, or in person, by phone, letter, or email.
- Grievance is recorded in a 'grievance log' (written and electronic) within 2-3 days of receipt. The grievance log will be held in the Human Resources Department.
- Grievance is acknowledged through a personal meeting, phone call, or letter as appropriate, with the complainant. If the grievance is not well understood or if additional information is required, clarification should be sought from the complainant.
- The Project Manager or Human Resources Manager will support the Direct Supervisor and the Site Manager in deciding who should deal with the grievance and determine whether additional support is required to respond to the complainant. Grievances may also be submitted directly to the Human Resources Manager.
- The Direct Supervisor delegates the grievance to the relevant departments(s)/personnel to develop a response and if needed, a corrective/preventive measure.
- A response is developed by the Direct Supervisor within defined period after acknowledging the grievance, if the complainant is not anonymous, with input from the relevant Project personnel and others, as necessary.
- Communication of the response should be carefully coordinated. The Human Resources Manager will ensure that an approach to communicating the response is agreed and implemented, taking into consideration cultural sensitivities and implementation of any preventive/corrective measure.
- Record the response received from the complainant to help assess whether the grievance is closed or whether further action is needed. The Direct Supervisor or Site Manager should use appropriate communication channels (such as telephone or face to face meeting) to confirm whether the complainant has understood and is satisfied with the response. The complainant's response should be recorded in the grievance log.
- Close the grievance with sign-off from the Human Resources Manager. The Human Resources Manager will assess whether a grievance can be closed or whether further attention is required. If further attention is required, the Direct Supervisor should re-assess the grievance.

Once the Human Resources Manager has assessed whether the grievance can be closed, he/she will sign off or seek agreement from the Project Manager, to approve closure of the grievance.

The grievance management process enables complaints to be lodged anonymously. Complainants are not required to provide their name when lodging a grievance. This is reflected in the grievance log and close-out template). All grievances will be archived into the Workers' Grievance Database. All grievances will be recorded, investigated and closed-out in the same manner – as described above.

APPENDIX (F) OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT PLAN (OHSMP)

Objectives

The objective of OHSMP is to prevent occupational risks for all workers at the Project site and to guarantee the health and safety of the workers during the construction and operation phases.

Risk identification and analysis

HSE Manager shall assure that the project site has a description for the risk identification and followed by evaluation for each risk. The risk shall be sorted according to its severity and probability levels, with specific controls being defined for those risks that are considered significant in order to reduce the risk to an acceptable level. Based on this, the highest risks with the greatest severity rating and the greatest probability of occurring are managed first, and lower risks with lower probability of occurrence and lower severity rating are handled in descending order of importance. The project managment shall implement preventive measures in accordance with the following hierarchy:

- Elimination of risk;
- Minimization and control of risk factors, with the adoption of collective protective measures or with the adoption of administrative measures or work organization; and
- Adoption of individual protection measures, Personal Protective Equipment (PPE).

High risk activities

High risk activities are those with more likely to result in failure, harm or injury, so, to ensure that these types of activities are carried out in a correct way through developing a work permit process. Some examples of high risk activities are: working on confined spaces; working at heights; hot works; electrical work; and lifting activities.

The aim of work permit is to assure that the worker and its supervisor are aware of the risks of the activity, and to assure that all the measures are applied to minimize the risk. The work permit may contain at least the following information:

- The names of the employee and its direct supervisor;
- The starting date and time of the activities, and the expected time of completion;
- The type of work to be carried out and the name of area where the activity will be carried out;
- The security measures applied in accordance with the results of the risk analysis for each activity, and
- Permit to be signed by all concerned personals (workers carrying out the activity and the EHS Supervisor and job supervisor)

The work permit must be prepared by the worker who intends to carry out the activity and reviewed by their direct supervisors, to ensure that they know the activity risks, PPE required, required emergency procedures and emergency equipment.

Personal protective equipment (PPE)

The PPE must be selected according to the hazards and risks identified in the risk analysis and work permit. The PPE shall be used to protect the body part exposed to the risks identified, the below is a list of the most common PPE used for the activities:

- Head – helmet (against impact, dielectric, hood);
- Respiratory system – respirators (against particles, gases or vapors), disposable mask, autonomous respiratory equipment;
- Eyes and face - protective glasses, goggles, face screen, welding helmet, welding glasses;
- Ears – earplugs, earshells;
- Gloves (against chemical substances, dielectric, against extreme temperatures), sleeves;
- Apron (against extreme temperatures, against chemical substances) overall, coat, clothing against chemical substances;

- Occupational footwear, footwear against impacts, conductive footwear, dielectric footwear, spats, waterproof boots;
- Protection against falls equipment; and
- Firefighting equipment.

Personnel health

The HSE manager shall ensure the health care of personnel, by ensuring that the basic documents and facilities are provided including the following:

- Environmental Risk Prevention Plan;
- Medical and Occupational Health Control Plan;
- Toilet facilities;
- Clean and potable water supply;
- Appropriate working hours;
- Medical Service (i.e. medical stations, first aid kits, nurse/doctor); and
- Continuous medical check-up.

Safety instructions for access to the work

All visitors and workers who access the site for the first time shall follow the below instructions and each person who receives these instructions must sign a receipt, which will be guarded by the HSE Manager. Safety instructions for access to the work:

- All visitors and workers who access this workplace shall comply at all times with the instructions of the HSE section;
- Use all applicable PPE (such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, etc) based on the type of risk;
- Pay attention when walking through the site, avoid going through areas with obstacles or mud and stepping on sharp objects;
- Do not approach, or interfere with, construction machinery or vehicles;
- Avoid getting close to slab edges, decking edges, etc. unless they are fully protected; and

- In an emergency, remain calm and follow the orders of those responsible for the work at all times.

Go to the designated safe place (assembly point) and remain there until the end of the emergency.