MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE

Environmental and Social Impact Assessment

Ar Rass Solar Energy Park

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PROJECT 303011-00305 - EN-REP-102 – Environmental and Social Impact Assessment

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Executive Summary

Ar Rass Solar PV Park (hereinafter" the Project") is located in the Al Qassim Province of Saudi Arabia, about 24 km south-east of the city of Ar Rass. The total area of the Project is about 57.6 km^2.

The proposed Project will entail the installation and operation of eight (8) independent solar generating units (SGUs) with a combined projected output of approximately 2,620 MW and is expected to produce 7,006 GWh per year. This yearly production will supply energy to 345,000 households and reduce emission of greenhouse gases by 7 million tons of $CO_{2equivalent}$.

Chapter 1 of this report presents an overview of the Project and the study objectives. Chapter 2 presents the legal and regulatory framework. It covers both national and international requirements, IFC, World Bank, and Equator Principles.

Chapter 3 of this report presents a description of the Project lifecycle, namely construction, operation and decommissioning. The chapter presents main activities, components and anticipated wastes and emissions.

Chapter 4 presents the baseline data. The chapter covers natural environment and human environment. Environmental components such as climate, air quality, groundwater, soil and terrestrial ecology are presented in this chapter. In addition, surrounding land use and the current population status in terms of education and employment are presented in this chapter.

Penitential positive and negative impacts are assessed in Chapter 5. The assessment covers the construction phase, operation phase as well as potential impacts resulting from non-routine (accidental) events.

Chapter 6 presents the proposed mitigation measures during each phases of the project as well as impact significance evaluation after implementing the proposed mitigation measures.

Chapter 7 summarizes impacts before and after mitigation.

Chapter 8 provides a summary of the stakeholder engagement activity.

Regulatory Framework:

Environmental quality standards, in the Kingdom of Saudi Arabia, such as emission standards, are established by GAMEP. The EIA study adopts and complies with the most stringent environmental standards, both nationally and internationally.

Ecological Sensitivity:

According to Saudi Wildlife Authority, there are no protected or sensitive areas located within 10 km of the project area. The nearest protected area is designated as a recreational area, Hima al-Ghada, and is located about 20 km east of the proposed Project site. The general area is characterized by a dry desert plain with scattered vegetation and seasonal streams and drainage channels forming part of the wadi system of Wadi Ar Rummah.

Environmental Sensitivity:

Project area can be classified as medium sensitivity. The Project site is mostly flat comprised of sand with silt and some gravel plains.

Environmental Assessment:

An ESIA should assist in ensuring environmentally and socially sound management of the project during its entire lifetime (construction, operation, decommissioning); also, nun routine events during project phases. The methodology followed in this ESIA for the impact assessment is presented in the "European Union, EIA - Guidance on scoping, 2017". This methodology applies a multi-criteria analysis to evaluate impacts significance. It worth notice that the majority of impact significance are "Negligible "or "Minor".

Mitigation Measures:

specific mitigation recommendations for those impacts of Moderate significance are provided. Proposed technical, social and/or institutional mitigation measures for the expected impacts/ change during construction and operation of the proposed project were illustrated. Additional mitigation measures are presented as part of the Environmental Management Plan Framework and Monitoring Plan.

Stakeholder Engagement:

A summary of the most important stakeholder groups identified and a summary of the analysis of stakeholder significance are presented in this report. Furthermore, a summary of the Stakeholder Engagement activities is documented in this report.

Finally, the assessment team concludes based on the findings and recommendations of the environmental and social impact assessment for the proposed project, if mitigation measures are followed properly; the project shall be meeting all regulatory requirements without any tangible impact to the environment. In addition, Positive impact upon the local community through renewable energy generation and local employment created by the project during construction and operation.

Abbreviation List

ABD	Above Background Data
AC	Alternating current
BPEO	Best Practicable Environmental Option
ca.	Circa
CIRIA	Construction Industry Research and Information Association
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CR	Critically Endangered
CSP	concentrated solar power
dB	decibel
DC	Direct current
DEFRA	Department for Environment, Food and Rural Affairs
EBRD	European Bank for Reconstruction and Development
ECRA	Electricity Cogeneration Regulatory Authority
EHS	Environmental, Health, and Safety
EMC	Electromagnetic Compatibility
EME	electromagnetic emission
EMI	electromagnetic interference
EN	Endangered
EP	Equator Principles
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standards
FCC	Federal Communications Commission
GAMEP	The General Authority of Meteorology and Environmental Protection
GAOCMAO	Gulf Area Oil Companies Mutual Aid Organization
GAStat	General Authority of Statistics
GEF	Global Environment Facility
GHGs	greenhouse gases
GHI	Global Horizontal Irradiance
GIIP	Good International Industry Practice
GOSI	General Organization for Social Insurance
GWh	Gigawatt hours
HAP	hazardous air pollutants
HCIS	High Commission for Industrial Security
IBA	Important Bird Area
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
ILO	International Labour Organisation
ISCC	integrated solar combined cycle
IUCN	International Union for Conservation of Nature

KSA	Kingdom of Saudi Arabia
kV	kilovolt
LC	Least Concern
MCS	Ministry of Civil Service
MEWA	Ministry of Environment, Water and Agriculture
MLSD	Ministry of Labour and Social Development
MOCI	Ministry of Commerce and Investment
MOMRA	Ministry of Municipal and Rural Affairs
MSDS	Material safety datasheets
MW	Megawatt
NREL	US National Renewable Energy laboratory
NREP	National Renewable Energy Program
NT	Near Threatened
NWC	National Water Company
O&M	Operation and Maintenance
OECD	Organisation for Economic Cooperation and Development
OHLs	Overhead lines
PM	Particulate Matter
PME	Presidency of Meteorology and Environment
PV	Photovoltaic
RCJY	Royal Commission for Jubail and Yanbu
REPDO	Renewable Energy Project Development Office
RF	radiofrequency
SAGIA	Saudi Arabian General Investment Authority
SCTNH	Saudi Commission for Tourism and National Heritage
SEC	Saudi Electricity Company
SF_6	Sulphur hexafloride
SGUs	Solar generating units
SGV	Soil Guideline Values
SS	Switching Substation
SUS	Step-up Substation
SWA	Saudi Wildlife Authority
SWCC	Saline Water Conversion Corporation
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US EPA	United States Environmental Protection Agency
VOCs	volatile organic compounds
VU	Vulnerable
WB	World Bank
WHO	World Health Organization
WWF	World-Wide Fund for Nature

1. Introduction

This Environmental and Social Impact Assessment (ESIA) Report has been prepared for the proposed Ar Rass Solar PV Park project (hereinafter "the Project"), 24 km south-east of the city of Ar Rass in Al Qassim Province (Figure 1-1). The total area of the project is about 57.6 km^2. A copy of the Project land allocation official approval is presented in Appendix A.

The proposed Project will entail the installation and operation of eight (8) solar generating units (SGUs) and eight (8) step-up substations. The estimated power generation capacity will be approximately 2,620 MW which is equivalent to 7,006 GWh per year[1]. This yearly production will be equivalent to supplying energy to 345,000 households and will significantly reduce the emission of greenhouse gases by 7 million tons of CO_2 equivalent (Master Plan, Ar Rass Solar Energy Park, Worley, July 2019).

Figure 1-1 The Project Location

The ESIA report meets the requirements of the General Authority of Meteorology and Environmental Protection (GAMEP) Requirements, Equator Principles, International Finance Corporation (IFC) Performance Standards and World Bank Environmental, Health, and Safety (EHS) Guidelines.

[1] It should be noted that this capacity is the initially estimated capacity and should be confirmed or updated, as necessary as part of the detailed design of the Project.

More details on the objectives of the present study are presented in Section 1.1; whereas, detailed report structure is presented in Section 1.3.

1.1 Background, Significance and Necessity of the Project

The Renewable Energy Project Development Office (REPDO) is developing the Project as part of the National Renewable Energy Program.

1.2 Objectives and Scope of Work

The main objectives of the ESIA are:

- Identify and analyse sensitive components of the existing environment. Review the existing literature; document the regional and site-specific environmental baseline status. All media potentially affected shall be considered
- Determine the type, nature and significance of the potential environmental and/or social impacts during construction and operation phases
- Identify and recommend practical/ feasible mitigation measures early in the design process to eliminate, minimise, mitigate or avoid any negative environmental and/or social impacts resulting from the Project
- Recommend environmental and social management/monitoring plans for the project in order to eliminate and/or minimise the potential negative environmental and/or social impacts as identified above

1.3 Structure of the Report

The report structure is presented below:

- Chapter 1: Introduction and background of the Project. It also states the objectives of this report
- Chapter 2: Identifies and presents the applicable national regulatory requirements, governmental expectations, related to the environmental aspects for the proposed development. It also presents relevant international guidelines
- Chapter 3: Provides an overview of the project components and the process involved
- Chapter 4: Provides an overview of the environmental baseline of the project area
- Chapter 5: Presents an identification of the potential environmental and social impacts as well as alternatives considered
- Chapter 6: Presents proposed mitigation measures
- Chapter 7: Presents a summary and evaluation of the identified significant impacts
- Chapter 8: Presents an overview of the stakeholders' engagement process

1.4 Study Conducting Team

The present study was conducted by the following team:

- Nikolaos Moiras – ESIA Project Manager
- María Sánchez Sampedro, EMEA Region – Sustainability, Biodiversity and Climate Change Lead
- Ihab El-Sersy – ESIA Consultant / Country Manager, Egypt
- Daniela Zamfirescu – ESIA Consultant
- Yousra Zakaria – Senior ESIA Specialist
- Menna Megahed – Ecologist
- Abdelhalim Mahmoud – Environmental Consultant
- Khaled Ahmed – Environmental Specialist
- Francisco Peno – Senior GIS Cartographer

2. Policy, Legal, and Administrative Framework

2.1 National Administrative Framework

2.1.1 General Authority of Meteorology and Environmental Protection (GAMEP)

Overall, within the Kingdom of Saudi Arabia there are two authorities with the mandate to regulate environmental matters: The General Authority of Meteorology and Environmental Protection (GAMEP) and the Royal Commission for Jubail and Yanbu (RCJY).

Outside the designated boundaries of the RCJY and throughout the rest of the Kingdom, including this project, the primary regulating body is GAMEP.

The Kingdom, represented by the regulatory authority, the General Authority for Meteorology and Environment (GAMEP), former PME, essentially aims toward sustaining Article (32) of the Kingdom's Constitution, to “conserve, protect and develop the environment, and guard it from pollution".

2.1.2 Ministry of Energy

The Ministry of Energy has launched the National Renewable Energy Program (NREP). The Renewable Energy Project Development Office (REPDO) within the ministry was established in 2017 to drive the implementation of the NREP. REPDO brings unified leadership to the Kingdom’s capabilities in renewable energy research, measurement, data acquisition, regulation, predevelopment and tendering.

2.1.3 Ministry of Environment, Water and Agriculture (MEWA)

The Ministry of Environment, Water, and Agriculture (MEWA) is responsible for the regulation and implementation of all aspects of the country’s policies for environmental, water and agricultural sectors. The Ministry implements environmental, water production and agricultural plans and programs across the Kingdom with a focus on sustainability and value creation. It has widened its contribution to the national economy through numerous programs especially in the areas of food security, water preservation and environmental protection. There are various departments within the ministry that are responsible for environmental related tasks, including:

- Directorate of Environment
- Directorate of Water Affairs
- Directorate of Water Service
- Directorate of Agriculture
- Directorate of Land & Survey
- Directorate of Animal Resources
- Directorate of Planning & Budget

2.2 National Environmental Legislation Requirements

2.2.1 GAMEP Standards

The main objective of the project is to meet or surpass the relevant environmental legislative requirements and guidelines, set by the PME (currently GAMEP). The General Environmental Law was issued on 15 October 2001 (1422 AH). The main aims of this law included preservation, protection and development of the environment and safeguard it from pollution; protection of public health from activities that harm the environment; conservation and development of natural resources and rationalize their use and raising awareness of environmental issues.

The General Environmental Law entrusts the Competent Agency, GAMEP (formerly known as PME), with preserving and preventing the deterioration of the environment.

Article 5 of the General Environmental Law states that licensing agencies must verify that an environmental impact assessment is undertaken at the feasibility stage for projects that may have negative environmental effects.

Appendix 1 of the Rules for Implementation presents environmental protection standards for ambient air quality, air pollution sources, receptor water bodies, liquid discharges and pre-treatment processes. GAMEP (formerly known as PME) is declared the sole authority in determining the meaning and scope of the standards and may also grant exemptions.

Appendix 2 of the Rules for Implementation presents the standards for environmental impact assessments of industrial and development projects. Table 2-1 shows a summary of the national standards.

Table 2-1 National Standards

Standard	Effective date
Air Quality and Emissions	
Ambient Air Quality	02/03/2014
Control of Emissions to Air from Stationary Sources	03/24/2014
Standards on Emissions from Mobile Sources	03/24/2014
Water Environment	
Ambient Water Quality	02/03/2014
Wastewater Discharges	
Industrial and Municipal Wastewater Discharges	02/03/2014
Waste and Material Management and Transport (Hazardous and Non-hazardous)	
Prevention of Major Accidents	03/24/2012
Waste Classification	03/24/2012

Standard	Effective date
Waste Acceptance Criteria	03/24/2012
Material Recovery and Recycling of Waste	03/24/2012
Waste Regulatory Control and Compliance	03/24/2012
Waste Handling and Storage	03/24/2012
Waste Transportation	03/24/2012
Best Practice Environmental Options for Waste Disposal	03/24/2012
Noise	
Environmental Noise	02/03/2014

It should be noted that there are no national limits for soil quality. The assessment of soil quality may seek to adhere to the guidelines described in Section 1.8 'Contaminated Land' under the World Bank Environmental, Health, and Safety (EHS) Guidelines.

However, the Department for Environment, Food and Rural Affairs (DEFRA) and Construction Industry Research and Information Association (CIRIA) UK standards represent the most conservative methodology for assessing land contamination, owing to the range of assessment criteria and lower threshold limits. Therefore, the UK standards will be adopted for assessing soils contamination, as it represents the most comprehensive and robust approach.

2.2.1.1 Air

Ambient Air Quality

GAMEP Standards for ambient air quality are detailed in Table 2-2.

Table 2-2 PME 2014 Ambient Air quality Standards

Parameter	Unit (µg/Nm³)			Number of allowable exceedances[2]
	1 hour	24 hour	Annual	
PM_{10}		340	80	24 hour: 24 times per annum[3] Annual: N/A
$PM_{2.5}$		35	15	24 hour: 24 times per annum[4] Annual: N/A
Nitrogen Dioxide	660		100	1 hour: 2 times per 30 days Annual: N/A

[2] Violations will only be reportable where validated data is available for 98% of measurements

[3] The average 90th Percentile 24hour concentration must not exceed 340µg/Nm³

[4] The average 90th Percentile 24hour concentration must not exceed 35µg/Nm³

Parameter	Unit (µg/Nm³)			Number of allowable exceedances[2]
	1 hour	24 hour	Annual	
Sulphur Dioxide	730	365	80	1 hour: 2 times per annum 24 hour: 1 time per annum Annual: N/A
Ozone	235	157 (8hours		1 hour: 2 times per 30 days 24 hours: 2 times per 7 days
Carbon Monoxide	40,000	10,000 (8 hours)		None
Hydrogen Sulphide	150		40	1 hour: 10 times per annum Annual: N/A
Lead			0.5	N/A
Benzene			5	N/A

The GAMEP 2012 Environmental Standard, Standard Number 2 sets generic parameters and limit values for all mobile sources of air emissions such as non-road petrol engines, and non-road diesel engines such as generators, and forklifts. These limits are presented in Table 2-3 and Table 2-4.

Table 2-3 Air Emission Standards of Non-Road Petrol Engines (includes construction, agricultural, and industrial equipment)

Rated Power	CO (g/kW-hr)	HC (g/kW-hr)	NO_x (g/kW-hr)	PM (g/kW-hr)	Smoke (%)
50 ≤ hp < 100	N/A	N/A	9.25 (ABT)	N/A	20/15/50
100 ≤ hp <175	N/A	N/A	9.25 (ABT)	N/A	20/15/50
175 ≤ hp < 750	11.4	1.34	9.25 (ABT)	0.54	20/15/50
Hp = 750 +	11.4	1.34	9.25 (ABT)	0.54	20/15/50

Table 2-4 Air Emission Standards of Non-Road Diesel Engines (Spark-Ignition Engines)

Rated Power	CO (g/kW-hr)	HC (g/kW-hr)	NO_x (g/kW-hr)	HC + NO_x (g/kW-hr)
< 225cc (non-handheld)	518.97	N/A	N/A	N/A
≥ 225cc (non-handheld)	518.97	N/A	N/A	N/A
< 20cc (handheld)	804.6	295.02	5.36	0.54
≥ 20cc > 50 cc (handheld)	804.6	241.38	5.36	N/A
≥ 50 cc (handheld)	603.45	160.92	5.36	N/A

The GAMEP 2012 Environmental Standards set generic specific point source emission limit values for all industry and are tabulated in Table 2-5. Classes of substances in Table 2-5 are defined in the GAMEP Environmental Standard for Control of Emissions to Air from Stationary Sources in Appendix A of the standard.

Table 2-5 Emission Limit Values for Emissions to Air from Stationary Sources

Parameter	Emission Limit Values (µg/Nm³)		Threshold* (g/hr)	Comment
	Normal	Degraded Air Sheds		
Specific Air Pollutants				
Particulate matter (PM_{10})	150	100	500	Above background conditions
Particulate matter ($PM_{2.5}$)	50	25	100	Above background conditions
Dioxins and Furans	0.0001	0.0001		
SO_x	600	400	1000	
NO_x	500	350	1000	
Extremely toxic substances				
∑ Class I	0.05	0.05	0.02	
∑ Class I + II	0.1	0.1	0.5	
Carcinogenic substances				
∑ Class I	0.1	0.05	0.5	
∑ Class I + II	1	0.5	5	
∑ Class I + II + III	3	1	25	
Organic substances				
∑ Class I	40	20	25	
∑ Class I + II	150	100	100	
Inorganic substances (solid)				
∑ Class I	0.2	0.05	1	
∑ Class I + II	1	0.5	5	
∑ Class I + II + III	5	1	25	
Inorganic substances (gas/vapour)				
∑ Class I	3	0.5	10	
∑ Class II	15	3	50	
∑ Class III	100	30	300	
Volatile organic substances (VOCs)				
% of organic solvent lost in complete process through fugitive emissions	5%	3%	Thresholds apply	Refer to controls in Article V of the PME standard

*Where no threshold value is shown, the standard applies to all emission levels.

2.2.1.2 Water

Drinking Water

GAMEP provides standards for drinking water quality regardless of origin but does not apply to bottled mineral water. The list of parameters and guidelines is attached in Appendix B.

Sourcing Water

Water for this project will be provided from a low salinity water source such as water trucks by local suppliers. GAMEP 2014 provides relevant standards for water quality for surface water and ground water. According to JACOBS ZATE, the Ministry of Environment, Water, and Agriculture licenses the abstraction of groundwater and regulates the establishment of any wastewater treatment plant with regard to public health and environmental aspects. The Wastewater Treatment & Re-use Policy provides regulation and standards for the disposal and reuse of wastewater with a view to maximizing water efficiency while providing adequate protection of public health and the environment from pollution and infectious diseases.

Permits from the Ministry of Environment, Water, and Agriculture should be issued if recycled and treated wastewater is to be utilized. Licenses are also needed to use groundwater that lay within the range of urban cities and rural communities or groundwater that is of the same quality of wastewater conditioned that the beneficiary shall conduct analysis of groundwater in laboratories accredited by the Ministry of Environment, Water, and Agriculture. GAMEP Standards for groundwater are detailed on Table 2-6.

Table 2-6 GAMEP 2014 Standards for Groundwater Quality

Parameter	Unit	Max. Value
Chemical Indicators and nutrients		
Oil & Grease	mg/l	0
Phosphorus (total)	mg/l	0.03
Ammonia (free, as NH_3)	mg/l	0.3
Chloride (as Cl)	mg/l	Above Background Data (ABD)
Calcium ($CaCO_3$)	mg/l	ABD
Inorganic nitrogen (as Nitrite and Nitrate)	mg/l	30
Sodium	mg/l	150/250 (guide)
Sulfide	mg/l	0.002
Total Petroleum Hydrocarbons	mg/l	0.2
Heavy Metals		
Aluminium	mg/l	0.2
Arsenic	mg/l	0.005
Barium	mg/l	1
Cadmium	mg/l	0.005

Parameter	Unit	Max. Value
Chromium (total)	mg/l	0.1
Chromium (Hexavalent)	mg/l	0.005
Cobalt	mg/l	0.05
Copper	mg/l	0.05
Iron	mg/l	0.2
Lead	mg/l	0.005
Manganese	mg/l	0.1
Mercury	mg/l	0.001
Nickel	mg/l	0.02
Silver	mg/l	0.1
Zinc	mg/l	0.02
Organic and inorganic compounds		
Aldrin*	mg/l	2.2×10^{-6}
Benzene	mg/l	0.005
Carbon Tetrachloride*	mg/l	0.005
Chlordane*	mg/l	0.002
Hydrocarbons (Total)	mg/l	0.001
Cyanide (free)	mg/l	0.001
DDT (and metabolites)*	mg/l	1.7×10^{-5}
Dieldrin*	mg/l	4×10^{-6}
TCDD - Dioxin*	mg/l	3×10^{-8}
Endrin	mg/l	0.001
Fluoride	mg/l	0.2
Furans*	mg/l	1×10^{-6}
Helptachlor*	mg/l	0.0004
Hexachlorobenzene	mg/l	0.007
Lindane	mg/l	0.0002
Mirex*	mg/l	1×10^{-6}
MtBE	mg/l	0.02
Pentachlorophenol	mg/l	0.0005
PAH	mg/l	0.0002
PCBs (total)	mg/l	1.9×10^{-6}
Phenols (total)	mg/l	0.005
Toxaphene*	mg/l	0.002
1,1,1 Trichloroethane*	mg/l	0.001

Parameter	Unit	Max. Value
Toluene	mg/l	0.002
Vinyl chloride	mg/l	0.001
Xylenes	mg/l	0.005
Microbial		
Cyanobacteria	mg/l	5,000
E. Coli	Count/100 ml	<10
Intestinal enterococci	Count/100 ml	<5

*The concentrations of these chemical compounds are determined on a monthly average basis.

2.2.1.3 Noise

The Presidency for Meteorology and Environment (PME) has updated the National Environmental Noise Standard for the Kingdom of Saudi Arabia (KSA), effective in 2014, and established the permitted noise limits for industrial facilities, as listed in Table 2-7. This standard divides industrial facilities into the following five (5) categories, which are determined by the operator, but at the discretion of the Competent Agency:

A1 – Retail refers to areas that are entirely dominated by retail, dining and recreational properties.

A2 – Warehousing refers to areas where units predominantly store products or goods for distribution and there are no or very limited process activities.

A3 – Light Industrial refers to those areas which may be mixed with or adjacent to residential properties where minor manufacturing processes take place.

A4 – Medium Density Industrial areas are those with a range of manufacturing processes including combustion on small to medium size sites and there is absence of residential use.

A5 – High Density Industrial refers to designated industrial cities and industrial complexes where large scale manufacturing, refining and petrochemical processes exist. Cement manufacture is specifically included.

Table 2-7 GAMEP Maximum Permissible Free-field Noise for Industrial Facilities

Designation	LA_{eq} (dB(A))		
	Daytime (7am-7pm)	Evening (7pm-11pm)	Night time (11pm-7am)
A1 – Retail	55	50	45
A2 – Warehousing	55	50	45
A3 – Light Industrial	55	50	45
A4 – Medium Density Industrial	65	60	50
A5 – High Density Industrial	75	65	55

Notes:

a) For single noise emitting premises, the noise levels in Table 2-7 will pertain. As for industrial/commercial areas which are occupied by two separate significant noise emitting premises (actual or planned), the limits in Table 2-7 will be reduced by 3dB (A) for individual premises. For areas where more than two industrial/commercial premises exist or are planned, the limits in Table 2-7 will each be reduced by 5 dB (A) for individual premises.

b) Further to the permitted noise limits specified in Table 2-7 and in order to achieve a reasonable standard within habitable rooms at night, individual noise events during night-time (measured using fast time-weighting) should not exceed 70 dB LA_{max} at the façade of the nearest property.

c) In situations where general environmental noise is high (e.g., as the result of noise from extraneous sources, such as occasional passing cars), and when the noise being investigated is steady in nature, the specific noise may be assessed by measurement of the $LA_{90,T}$ background noise. For the specific noise to be suitable for assessment using the $LA_{90,T}$, it must be a constant and steady noise with no variation over the time period being assessed (i.e., day, evening or night). In this case, the measured specific noise using the $LA_{90,T}$ may be considered to be equivalent to the $LA_{eq,T}$ and the assessment can be made on this basis. That a measured $LA_{90,T}$ has been used rather than a measured $LA_{eq,T}$ must be noted in the measurement and assessment records (Art. II, (5) – PME Environmental Noise Standard).

d) Where the industrial noise is continuous, in a way that it is not possible to measure the ambient noise level, ambient noise measurements should be undertaken at a representative location that is not influenced by the industrial noise source under consideration. In such cases, the reason for assuming why location is representative should be presented.

e) For sensitive properties adjoining the premises at which the source is located (Art IV, (3) – PME Environmental Noise Standard).

The standards also list noise limits for construction activities at receiving environments and are found in Table 2-8. The receiving environments are classified as follows:

A – Quiet Areas refers to quiet areas because of its value being places of worship, important tourist attractions, recreational parks, neighbouring hospitals, schools, and natural areas sensitive to noise.

B – Sensitive Areas refers to areas which are dominated by residential buildings (including hotels and hostels) and can range from areas with small population density to areas on the outskirts of cities.

C – Mixed Areas refers to areas which are usually located within cities and include both residential and commercial areas. This classification also applies to retail areas.

D – Not Sensitive refers to industrialized areas with limited residential buildings and commercial buildings. This classification also applies to industrial cities and uninhabited lands in general.

It should be noted the area of the proposed project can be classified as Class D. More details on the project location and characterisation are presented in Chapter 4.

Table 2-8 GAMEP Maximum Permissible Noise for Construction Activities

Designation	$LA_{eq, 12h}$ (dB)		
	Daytime 5 meter	Evening 5 meter	Night time 5 meter
A, B, C	75	65	45
D	80	80	80

2.2.1.4 Waste

The Saudi GAMEP environmental standards of 2012 and 2014 provide a framework for developing integrated waste management systems in KSA which should provide improved control of environmental pollution, protect public health and welfare and minimise the impact of economic development. The project should comply with GAMEP requirements relevant for those generating, storing and handling wastes as outlined in the following standards:

Waste Acceptance Criteria (2012G) (PME Env. Std. 8):	The objective of this standard is to set a framework for the development of waste acceptance criteria for waste generators, and treatment, storage, and or disposal facilities (TSD facility) with the aim of reducing the environmental impact of landfills. Acceptance criteria determine the waste to be diverted from landfill, or categories of landfill, by establishing contaminant thresholds for hazardous and inert landfills to determine which wastes are acceptable for landfilling. The standard applies to all types of waste such including hazardous, non-hazardous, and inert waste.
Waste Classification (2012G) (PME Env. Std. 9):	This standard guides those generating, storing, and handling wastes in assessing their classification in terms of: The origin of the waste The physical form of the waste: liquid or solid The character of the waste: Hazardous or non-hazardous The type of hazardous waste This Standard defines and classifies waste to be managed in KSA with respect to the form of the waste material and its associated impact on human health or the environment.
Waste Regulatory Control and Compliance (2012G) (PME Env. Std. 12)	This standard offers a framework that includes a waste licensing regime for storage, treatment, and disposal facilities. This standard applies to all generators, transporters and TSD Facility (refers to a treatment, storage and/or disposal facility, including recycling facilities) operators in KSA, and extends to all waste types including hazardous, non-hazardous and inert waste.
Waste Handling and Storage (2012G) (PME Env. Std. 13)	This standard guides those handling and storing waste in good operating practices, in managing effective waste storage and segregation systems, and in detecting, containing and cleaning up any leaks that may occur. This standard applies to Waste Handlers who handle and store waste from the point of generation through to the storage of waste where it is held at a facility prior to its onward transfer for recycling, treatment or disposal. This Standard must therefore be read in conjunction with the specific requirements for dedicated storage facilities which are detailed further in the Waste Storage and Material Recycling Facilities – Design and Operation Standard.

Waste Training and Assessment of Technical Competence of Operators (2012G) (PME Env. Std. 14)	The objective of this standards is to establish the framework to ensure that efficient, nuisance-free and environmentally acceptable waste management procedures are practiced in KSA by outlining the minimum requirements for training, certification and assessment of persons participating in or responsible for the operation of treatment, storage and disposal facilities. This standard is to be applied by PME or other PME approved body with responsibility for assessing the technical competence of designated facility operators.
Waste Transportation (2012G) (PME Env. Std. 15)	This Standard utilizes the waste classification and definitions as stated in the provisions of the Waste Classification Standard and does not extend to provisions covering radioactive waste or explosives. This Standard does not apply to the on-site transportation of waste within a facility's property boundary.
Best Practicable Environmental Option (BPEO) for Waste Disposal (2012G) (PME Env. Std. 18)	The BPEO is the waste management system which achieves effective and affordable waste management with minimum cost and maximum benefit to the environment, society and the economy and is therefore one of the key principles to guide progress towards more sustainable waste management practice. The BPEO concept is thus clearly consistent with the objectives of sustainable development.
Industrial and Municipal Wastewater Discharges (PME 2014).	This environmental standard has been developed for quality control of direct discharge from installations and operators. The scope of this standard applies to drainage including any treated liquids or industrial water that cannot be classified as clean water or non-contaminated surface water discharge, including rainwater. This includes but not limited to: Detergents Cooling water Cleaning water

Liquid Waste

According to GAMEP Environmental Standard number 9 on Waste Classification, waste in liquid form is regarded as:

- Any waste that near instantaneously flows into an indentation void made in the surface of the waste; or
- Any waste load containing free draining liquid substance in excess of 250 litres or 10% of the load volume, whichever represents the lesser amount. "Free draining" means a liquid is defined irrespective of whether that liquid is in a container
- Another interpretation should be used where liquids are known to be present in small amounts in a generally solid waste

Liquid waste is classified into five groups:

- Water containing larger quantities of filterable or non-filterable solids
- Water containing larger quantities of dissolved chemical substances
- Water containing larger quantities of dissolved nutrients
- Non-aqueous liquids
- Combinations of two or more of the above groups

Environmental standards for industrial and municipal waste water should also be taken into consideration when considering discharged water. Table 2-9 lists limits for treated water before being discharged to a source of surface water. No limits are available for groundwater.

Table 2-9 Drainage Limits for Effluents Before Discharging to Surface Water (and Municipal Collection Systems)

Parameter*	Unit	Max. Value
Physio-chemical Properties		
Rough/Coarse Material		Not Permissible
Temperature	Δ Temperature from surrounding environment	5
pH		6.5-8.5
Turbidity	NTU	5
Total Suspended Solids	mg/l	10
Parameters		
Biological Oxygen Demand (BOD)	mg/l	10
Chemical Oxygen Demand (COD)	mg/l	50
Oil and Grease	mg/l	5
Total Organic Nitrogen	mg/l	5
Total Organic Carbon	mg/l	100
Total Phosphorus	mg/l	5
Phosphate (PO_4)	mg/l	1
Ammonia (NH_3)	mg/l	0.5
Chloride (Cl)	mg/l	1500
Inorganic nitrogen (as Nitrite NO_2 and Nitrate NO_3)	mg/l	15
Sodium	mg/l	800
Sulphates	mg/l	600
Sulphide	mg/l	0.2
Heavy Metals		
Aluminium	mg/l	5
Arsenic	mg/l	0.1
Barium	mg/l	1
Cadmium	mg/l	0.001
Chromium (total)	mg/l	0.01
Chromium (Hexavalent)	mg/l	0.05
Cobalt	mg/l	0.05
Copper	mg/l	0.2

Parameter*	Unit	Max. Value
Iron	mg/l	2
Lead	mg/l	0.1
Manganese	mg/l	0.2
Mercury	mg/l	0.001
Nickel	mg/l	0.2
Silver	mg/l	0.3
Zinc	mg/l	2
Organic and Inorganic Compounds		
Aldrin	mg/l	0.01
Benzene	mg/l	0.05
Carbon Tetrachloride	mg/l	0.02
Chlordane	mg/l	0.01
Chlorine (residual)	mg/l	0.3
Chlorinated Hydrocarbons (Total)	mg/l	0.1
Cyanide (free)	mg/l	0.05
DDT (and metabolites)	mg/l	0.01
Dieldrin	mg/l	0.01
TCDD - Dioxin	mg/l	0.01
Endrin	mg/l	0.002
Fluoride	mg/l	15
Furans	mg/l	0.01
Helptachlor	mg/l	0.01
Hexachlorobenzene	mg/l	0.01
Lindane	mg/l	0.01
Mirex	mg/l	0.01
MtBE	mg/l	0.01
Pentachlorophenol	mg/l	-
PAH	mg/l	0.01
PCBs (total)	mg/l	0.01
TPH		5
Toxaphene	mg/l	0.01
Vinyl chloride	mg/l	0.02

Parameter*	Unit	Max. Value
Xylenes	mg/l	0.05
Microbial		
Total Coliform	Count/100ml	2000

*Important note: substances not listed above may not be discharged at concentrations greater than 0.001mg/l unless agreed in advance with the competent authority or treatment plants.

Solid Waste

For waste to be considered solid, according to the GAMEP Environmental Standard number 9 on Waste Classification, the following criteria are met:

- Has an angle of repose of greater than five degrees (5°)
- Has no free liquids in excess of 10% of the load volume, when tested in accordance with the US EPA Paint Filter Liquids Test – Method 9095 (US EPA 1986)
- It emits no free liquids when transported
- It does not become free flowing at or below 60°C or when transported
- It is spadeable

Hazardous Waste

GAMEP has also defined hazardous waste, Environmental Standard number 9 on waste classification lists criteria for wastes to be considered hazardous. The waste is considered hazardous if:

- It is included in the Hazardous Waste List;
- It contains one of the hazardous constituents listed;
- It displays one of the hazardous properties listed;
- The waste is a mix of hazardous and non-hazardous materials; or
- If the competent agency decides to consider them specifically hazardous

Some properties of hazardous waste considered are ignitability, reactivity, toxicity, and corrosivity. A list of hazardous waste is found in Appendix B.

2.2.1.5 Labour

The labour law issued by Decree M/51, dated 23/8/1426H. Article 5 of this law lists provisions of the law that apply to the following:

- Each contract whereby a person undertakes to work for the account of the employer and under his management and supervision in consideration for a wage
- Workmen of the government and general organizations, including those involved with animal husbandry and agriculture
- Workmen of charitable organizations

- Workmen in agricultural and animal husbandry establishments which employ ten workmen and more
- Workmen in the agricultural establishments which process their own products
- Workmen who operate and repair on an ongoing basis the mechanical machinery necessary for agriculture
- The apprenticeship and training contracts with workmen other than those of the employer within the limits of the provisions set forth in this law.
- Part time workmen within the limits related to occupational safety and health and workmen injuries and the other categories designated by the Minister.

2.2.2 EIA Requirements

The main legal requirements, standards and regulations pertaining to environment assessment in the Kingdom of Saudi Arabia, and the requirement for Environmental Impact Assessments (EIAs), are established by the Rules for Implementation - General Environmental Regulations (2001) issued by the PME (currently known as GAMEP).

The emphasis on considering the environmental aspects in the planning phase for projects and programs as well as the requirements for conducting an EIA are specified within the General Environmental Regulations 2001 are as follows:

Article Ten: "Environmental aspects will be taken into consideration in planning for projects and programs, in the development plans of the various sectors and in the general development plan. These environmental aspects should be taken into consideration in a manner to achieve sustainable development objectives…"

Article Eleven: "A project owner or proprietor will conduct environmental studies to evaluate the environmental impacts of the project and comply with the outcome of the environmental impact assessment study in accordance with environmental standards and guidelines specified in the Rules for Implementation or any subsequent amendments and supplements."

Following Annex 2-1 of the Executive Regulations of the Saudi General Environmental Regulations, the Project (solar park) is classified as Third Category. Projects belonging to this Category require a comprehensive environmental impact assessment. GAMEP (formerly PME) determines the following procedures that should be accounted for within EIAs (Appendix 2.4 of the General Environmental Regulations, 2001):

- Presentation of the project
- Description of the project and its objectives
- Goals
- Need for the project
- Components of the project (onsite facilities attached to the project such as water treatment plants, water desalination plants, electrical power plants housing etc.)
- Project construction phases
- The workforce required for implementation of the project (minimum and maximum)

- The workforce required for operation of the project (minimum and maximum)
- Alternatives and options
- Status of surrounding environment including the following:
  - Air quality
  - Soil and topography
  - Surface and ground water
  - Land environment (fauna and flora)
  - Land use of selected site and its surroundings
  - Land ownership (original owner)
  - The environmental assessment includes the following:
  - Identification of the general potential impacts of the project and suggested alternatives; and
  - Identification and analysis of the key effects of the project on:
    - Air quality
    - Surface and underground water
    - Flora and fauna
    - Land use and urban development
    - Residential clusters
    - General scenic view (landscape)
    - Others
- Assessment of significant impacts:
  - Quantify and rate the significant impacts on natural resources
  - Estimate the relative damage to the area and the extent of its potential
  - Estimated lifespan of the facilities
  - Studies on the possible mitigation of anticipated impacts
  - Summary of the significant impacts after mitigation processes

2.3 International Legislation

2.3.1 Equator Principles

The Equator Principles have been adopted by the Equator Principles Financial Institutions (EPFIs) to provide a financial industry benchmark for determining, assessing and managing environmental and social risk in project financing.

They are created to ensure that the financed project is developed in a manner that is socially responsible and reflects sound environmental management practices. Accordingly, negative impacts on project-affected ecosystems and communities should be avoided where possible, and if these impacts are unavoidable, they should be reduced, mitigated and/or compensated for appropriately. Loans are provided to projects complying with the social and environmental policies and procedures and conforming to the Equator Principles (EP) III, effective from 4 June 2013, 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 Equator Principles Action Plan
- Principle 5: Stakeholder Engagement
- Principle 6: Grievance Mechanism
- Principle 7: Independent Review
- Principle 8: Covenants
- Principle 9: Independent Monitoring
- Principle 10: Reporting and Transparency

According to the Equator Principles, Saudi Arabia is a Non - Designated Country. Consequently, Equator Principle 3 requires the environmental assessment screening process to be carried out using the host country and the environmental standards and assessment criteria derived in compliance with the IFC Performance Standards and EHS Guidelines. The most stringent of all the appropriate regulations is to be applied during this assessment.

2.3.2 IFC Performance Standards on Social and Environmental Sustainability

The IFC Sustainability Framework promotes sound environmental and social practices, encourages transparency and accountability, and contributes to positive development impacts. The Sustainability Framework includes Performance Standards, which define clients' responsibilities for managing their environmental and social risks. The IFC Performance Standards have become globally recognized as a benchmark for environmental and social risk management in the private sector and are presented below:

- 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 People
- Performance Standard 8: Cultural Heritage

In addition, IFC has prepared a set of Guidance Notes, corresponding to the Performance Standards on Environmental and Social Sustainability. These Guidance Notes offer helpful guidance on the requirements contained in the Performance Standards, including reference materials, and on good sustainability practices to improve environmental performance.

In 2007, the IFC Environmental, Health, and Safety (EHS) Guidelines were released which replace World Bank Guidelines previously published in Part III of the Pollution Prevention and Abatement Handbook. The IFC EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards.

The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines, which provide guidance to users on EHS issues per industry sector. For complex projects, use of multiple industry-sector guidelines may be necessary. It should be noted that there are no industry specific guidelines for solar energy projects.

2.3.3 World Bank Environment and Social Framework

In August 2016, the World Bank released the "Environmental and Social Framework-Setting Environmental and Social Standards for Investment Project Financing" (The Framework). This Framework sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards with the aim of promoting shared prosperity. The framework comprises:

- A Vision for Sustainable Development
- The World Bank Environmental and Social Policy for Investment Project Financing
- The Environmental and Social Standards

Projects supported by the Bank through Investment Project Financing are required to meet the following Environmental and Social Standards (ESS), as applicable:

- ESS 1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS 2: Labour and Working Conditions
- ESS 3: Resource Efficiency and Pollution Prevention and Management
- ESS 4: Community Health and Safety
- ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

- ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities
- ESS 8: Cultural Heritage
- ESS 9: Financial Intermediaries
- ESS 10: Stakeholder Engagement and Information Disclosure

2.3.4 International Guidelines

2.3.4.1 Air

Given that KSA is a non-OECD country and Principle 3 of the EP states that the assessment for projects located in non-OECD countries will refer to the applicable IFC Performance Standards and the applicable Industry Specific EHS Guidelines, the assessment in this chapter will take into account the following guidelines: IFC Environmental, Health, and Safety General Guidelines (April 30, 2007) and specifically Air Emissions and Ambient Air Quality section and Construction section.

According to the Equator Principles, KSA is a Non-Designated Country. Consequently, Equator Principle 3 requires the environmental assessment screening process to be carried out using the host country and the environmental standards and assessment criteria derived in compliance with the IFC Performance Standards and EHS Guidelines. The most stringent of all the appropriate regulations is to be applied during the assessment.

The IFC EHS guidelines require implementation of the WHO Ambient air quality guidelines or the host country regulations, whichever is more stringent. Table 2-10 shows the ambient air quality guidelines.

Table 2-10 Ambient Air Quality Guidelines

Parameter	IFC/WB /WHO EHS	
	Averaging Period	Guideline value in µg/m³
Sulphur Dioxide (SO_2)	24-hour	125 (Interim target-1) 50 (Interim target-2)
	10 minute	20 (guideline) 500 (guideline)
Nitrogen Dioxide (NO_2)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM_{10}	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)

Parameter	IFC/WB /WHO EHS	
	Averaging Period	Guideline value in µg/m³
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily	160 (Interim target-1)
	maximum	100 (guideline)

2.3.4.2 Water

The IFC provides general standards for sanitary wastewater in the General EHS guidelines. Whist the standards do not specify a table of standards, the IFC guidelines require site specific standards to be developed based on local criteria and adapted on a project specific basis, and to include the following:

- Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or storm water to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality
- Receiving water use and assimilative capacity, taking other sources of discharges to the receiving water into consideration, should also influence the acceptable pollution loadings and effluent discharge quality
- Where data is unavailable on ambient water quality, US EPA nationally recommended water quality criteria should be used

2.3.4.3 Noise

In addition to the standards defined by the IFC, the EHS guidelines state that noise impacts from a project must not exceed a maximum increase of 3 dB above background levels at the nearest receptor located off-site. Identification of sensitive receptors and modelling of potential noise impacts must therefore be undertaken as part of the impact assessment and mitigation defined to ensure compliance with both the National and IFC requirements.

The General EHS Guidelines address impacts of noise beyond the boundary of the facilities. As stipulated in the Guidelines, noise emissions for industrial areas should not exceed 70 dBA (one-hour LAeq) during daytime (07:00-22:00) and night-time (22:00-07:00) or result in a maximum increase in background levels more than 3 dB at the nearest receptor location off-site.

Furthermore, the Guideline provides some noise reduction options that should be considered. These options include:

- Selecting equipment with lower sound power levels
- Installing silencers for fans
- Installing suitable mufflers on engine exhausts and compressor components
- Installing acoustic enclosures for equipment casing radiating noise
- Improving the acoustic performance of constructed buildings, apply sound insulation

The Guidelines state that noise monitoring may be carried out for the purposes of establishing the baseline ambient noise levels in the area of a proposed or existing facility, or for verifying operational noise levels. Noise monitoring programs should be designed and conducted by trained specialists. Typical monitoring periods should be sufficient for statistical analysis.

Construction Activities

According to the IFC's General EHS Guidelines noise impacts should not exceed the levels presented in Table 2-11. Further details on noise impacts are detailed in the IFC's General EHS Guidelines: Occupational Health and Safety and includes the following:

- 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. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB (A).
- Although hearing protection is preferred for any period of noise exposure in excess of 85 dB (A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB (A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.
- Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible.
- Periodic medical hearing checks should be performed on workers exposed to high noise levels.

The guideline also details different noise limits for a number of working environments detailed in Table 2-12.

Table 2-11 IFC Noise Level Guidelines

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime 07:00-22:00	Night time 22:00-07:00
Residential; industrial; educational	55	45
Industrial; commercial	70	70

Table 2-12 IFC Noise Limits for Working Environments

Location/Activity	Equivalent Level $LA_{eq,}8h$	Maximum LAmax,fast
Heavy industry (no demand for oral communication)	85	110
Light industry (decreasing demand for oral communication)	50 - 65	110
Open offices, control rooms, service counters and similar	45 - 50	-
Individual offices (no disturbing noise)	40 - 45	-
Classrooms, lecture halls	35 - 40	-
Hospitals	30 - 35	40

2.3.4.4 Wastewater

The Guidelines apply to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or stormwater to the environment.

As stipulated in the IFC General EHS Guidelines, discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria.

Furthermore, the Guidelines indicate that the quality of treated process wastewater, wastewater from utility operations or stormwater discharged on land, should be established based on local regulatory requirements.

2.3.4.5 Soil

As noted above, there are no national limits for soil quality. The assessment of soil quality seeks to adhere to the guidelines described in the UK standards will be adopted for assessing soils contamination, as it represents the most comprehensive and robust approach.

The UK standards represent the most conservative methodology for assessing land contamination, owing to the range of assessment criteria and lower threshold limits. The UK standards define Soil Guideline Values (SGVs) as “scientifically based generic assessment criteria that can be used to simplify the assessment of human health risks arising from long-term and on-site exposure to chemical contamination in soil.” The standards also decree that SGVs are generic assessment criteria and should be used as part of a Generic Quantitative Risk Assessment. Table 2-13 shows the SGVs for commercial or industrial soils.

Table 2-13 Soil Guideline Values (SGVs) by Environmental Agency

Substance	Soil Guideline Values (mg/kg Dry Weight) Commercial
Arsenic	640
Elemental Mercury	26
Inorganic Mercury	3,600
Methylmercury	410
Selenium	13,000
Cadmium	230
Benzene	95
Toluene	$4.4x10^3$
Ethylbenzene	$2.8x10^3$
o-xylene	$2.6x10^3$
m-xylene	$3.5 x10^3$
p-xylene	$3.2 x10^3$
Dioxins (PCDDs), Furans (PCDFs), and dioxin-like polychlorinated bi-phenyls (PCBs)	0.24
Phenol	3,200

2.3.4.6 Social

Two IFC Performance Standards are related to the social aspects of the proposed project, namely 2 (Labour and Working Conditions) and 4 (Community Health, Safety, and Security).

IFC Performance Standard 2 (Labour and Working Conditions): recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. The main objectives of this performance standard is to include promoting compliance with national employment and labour laws, protecting workers, including vulnerable categories of workers such as children and promoting safe and healthy working conditions.

IFC Performance Standard 4 (Community Health, Safety, and Security): addresses the project owner's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. One of the main objectives of this performance standard is 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.

In addition, IFC and the European Bank for Reconstruction and Development (EBRD) issued a guidance note regarding workers' accommodation. This guidance note addresses the processes and standards that should be applied to the provision of workers' accommodation in relation to projects funded by the IFC or EBRD.

Additionally, IFC released a number of guidance documents related to community development and stakeholders' engagement. In 2010, IFC (Environment Division) released Community Development Resource Guide for Companies, which aimed to serve as a resource guide to help IFC clients and other companies establish effective community development programs for communities located near or affected by their operations. It lays out general principles and methods and disseminates good practice to help develop an appropriate community development program.

The guideline included the key principles for community development that included building trust and managing expectations by clearly defining roles and responsibilities. Furthermore, IFC published "A Good Practice Handbook for Companies Doing Business in Emerging Markets" that presented the key concepts of Stakeholder Engagement such as identification and analysis and specific practices and approaches in implementing a successful stakeholder engagement process at each phase of the project cycle.

2.4 International Conventions

KSA has used the signing of international agreements and treaties as an extension to its regulations. KSA is party to various international environmental conventions or agreements; some of which include the following:

- Montreal Protocol on the Substances that Deplete the Ozone Layer (1987)
- Vienna Convention (and its protocol) on Protection of Ozone Layer (1988)
- Basel Convention on Trans-boundary Movement of Hazardous Waste (1989)
- UNEP Convention on the Conservation of Migratory Species of Wild Animals (1991)
- Convention on Biological Diversity (1992)
- Stockholm Convention on Persistent Organic Pollutants (POPs) (2001)
- Convention on the Conservation of Wildlife and their Natural Habitats in the Countries of the Gulf Cooperation Council (2001)

In addition to these guiding principles, KSA contributes to many regional and international organizations that are concerned with the protection of environment and conservation of natural resources, such as the United Nations Environment Program, World Health Organisation, United Nations Food and Agriculture Organization, World Meteorological Organization, UNESCO, the Regional Organization for Protection of Marine Environment, the relevant organizations working under the Arab League and the Gulf Cooperation Council as well as the Gulf Area Oil Companies Mutual Aid Organization (GAOCMAO).

KSA is a member of the International Labour Organisation (ILO). The ILO is devoted to advancing opportunities for women and men to obtain decent and productive work in conditions of freedom, equity, security and human dignity. Its main aims are to promote rights at work, encourage decent employment opportunities, enhance social protection and strengthen dialogue in handling work-related issues.

KSA is a signatory to the Kyoto protocol since January 2005, but as a developing country it would not be subject to emissions cuts under Kyoto, a requirement only binding 30 industrialised nations.

2.5 Legal Framework for Renewables Energy Generation Projects

2.5.1 National

Jacobs Zate was commissioned to provide an overview of the legal framework which applies for new renewable power generation projects in KSA. The report issued in 2017 presents relevant guidelines and recommends appropriate screening and assessment criteria for a wide range of renewable power generation technologies, including: concentrated solar power (CSP); solar photovoltaic; wind; geothermal; energy from waste; and integrated solar combined cycle (ISCC).

2.5.2 International

In 2015, IFC released Utility-Scale Solar Photovoltaic Power Plants – A Project Developer's Guide. The objective of this guide is to enhance the understanding of how to successfully develop, finance, construct, and operate utility-scale solar PV power plants. The guide focuses on aspects of project development that are specific to solar. From this perspective it covers all aspects of the overall project development process including site identification, plant design, energy yield, permits/licenses, contractual arrangements, and financing, giving sparser coverage to general project development basics that are not specific to solar.

3. Description of the Project

3.1 Project Location and Configuration

The proposed site for the Project is located approximately 24 km south-east of the city of Ar Rass in Al Qassim Province. The location is an undeveloped and unfenced area of approximately 57.6 km^2. The Project location is shown in Figure 1-1; whereas, Figure 3-1 shows the Project general layout (a higher resolution figure is presented in Appendix C) and Table 3-1 presents the coordinates of the site boundaries.

Table 3-1 Project Site Coordinates (WGS84 zone 38N)

Point	Easting	Northing
Pto-1	43.57155	25.61813
Pto-2	43.62129	25.61861
Pto-3	43.72329	25.62339
Pto-4	43.71212	25.59529
Pto-5	43.62175	25.57889
Pto-6	43.57202	25.57841

The Project installed capacity is 2,620 MW which is equivalent to generating approximately 7,006 GWh per year. It should be noted that this capacity is the initially estimated capacity and should be confirmed or updated, as necessary as part of the detailed design of the Project.

The total number of SGUs is eight (8). The capacity of the SGUs will be between 120-700 MW; one small unit with capacity 120 MW, six SGU have a capacity 300 MW and one (1) larger unit with capacity 700 MW., and each will have a dedicated 33/132 kV step-up substation (SGUS) that will connect to a central 132/380kV Switching Substation (SS) where it will collect the energy evacuated from SGUSs (Figure 3-1).

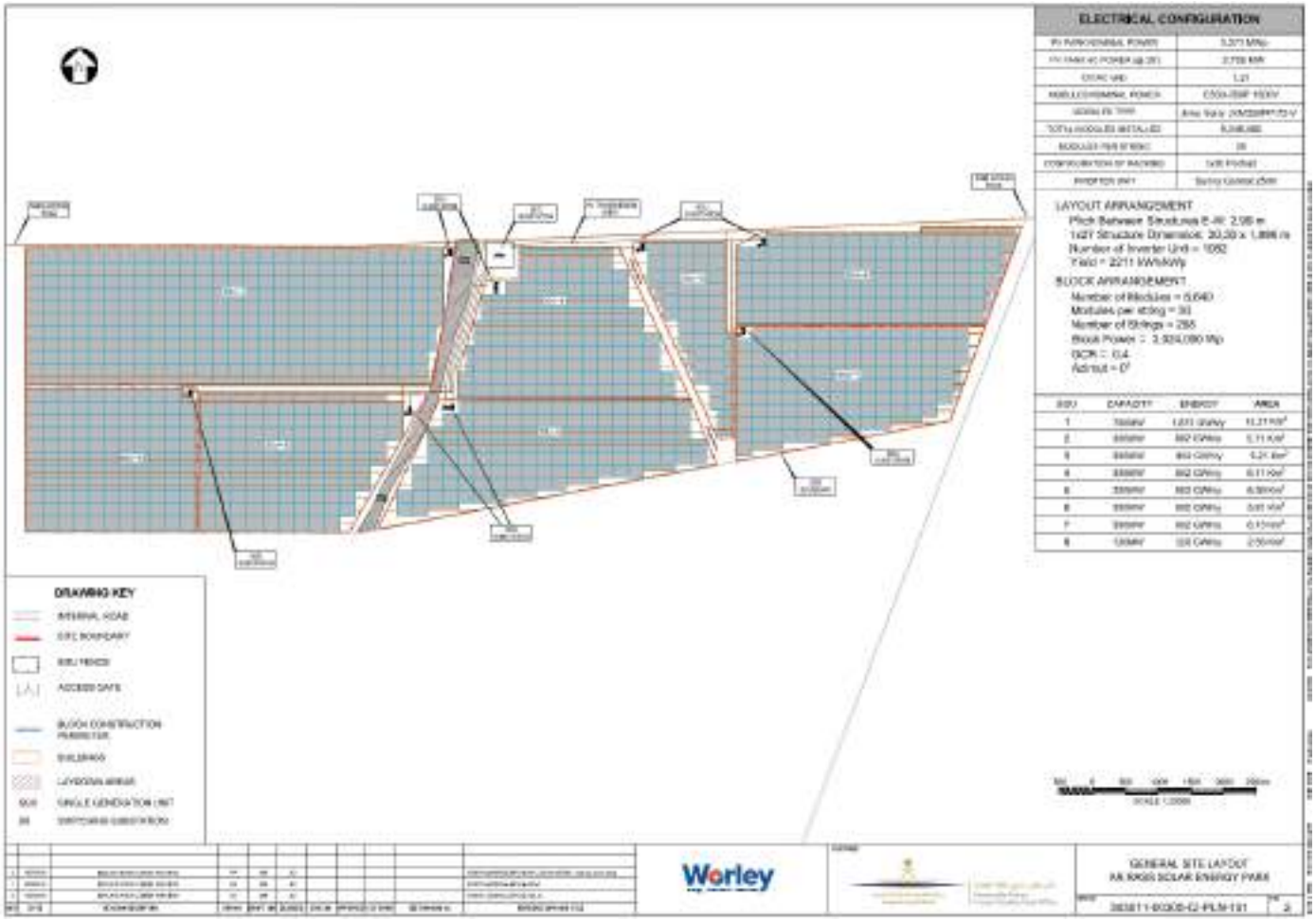

Figure 3-1 General Layout of the Project

The Substations, both the SS and SGUSs, will be Gas Insulated Substation type. Each SGUs will be connected to the SS through a 132 Kv Double circuit over-head line (OHL), as shown in Figure 3-2.

Figure 3-2 PV Plant and Transmission Over-head Line Example

3.2 Project Components

The main components of the proposed Project are as follows:

- PV modules
- 1,048 Inverter stations, including all MV components (transformers, MV switchgear, inverters, communications, control units and auxiliary services), as shown in Figure 3-3
- Cabling (DC, AC, LV and MV and HV) necessary for collecting and transporting energy will be selected and sized to withstand local conditions (e.g., temperature and radiation) and to minimize energy losses
- Earthing system
- Racking system, single-axis tracking
- A Fence will be installed around the site that complies with Saudi Arabian Standards
- Roads
- Security system and intruder detection system for each
- Instrumentation and control system, SCADA
- Interconnection with the Saudi Arabian Transmission System
- 380 kV overhead transmission line from the SS to the existing 380 kV lines
- Internal 132 kV high voltage evacuation lines from the SGU to the SS
- Eight (8) 33/110kV SGU substations (SGUSs)

- Buildings: interconnection cabin, Administration and Control building and associated facilities, storage and maintenance, and control access
- Infrastructure including:
  - Roads and access
  - Buildings
  - Water supply
  - Stormwater management

It should be noted that the Switching Substation is to be developed by SEC and thus outside the scope of the present study.

The main characteristics of the configuration of the Project are summarised in Table 3-2.

Figure 3-3 Typical Outdoor Inverter Station

Table 3-2 Characteristics of the Main Configuration of the Project

Project Configuration	
Number of SGU	8
Mounting System	Single-axis tracking
Power per SGU (MW)	700/300/120
Nominal Power (MWp)	3,168
AC Power (25°C) (MW)	2,620
DC/AC Ratio	1.21
PV Module	Canadian CS6U 350P 1500V
PV Modules Nominal Power (Wp)	350
Total PV Modules Installed	9,088,974
Number of PV Modules per String	30

Project Configuration	
Inverter power (kW)	2,500
Ground Coverage Ratio (GCR) (%)	0.4

The typical drawings of key equipment and the plant layout has been provided in Appendix C. The generalised drawings reflect the equipment and configurations selected in this report and could vary from the final installation. However, the design does reflect the most common types of systems and equipment. More details on some of the key components are presented below.

3.2.1 Polycrystalline PV Modules

The PV module Canadian CS6U 350P 1500V manufactured by Canadian Solar has been selected as the basis for the design and yield estimates. However, other PV panel types would be also suited for the proposed Project. The typical specifications are presented in Table 3-3.

Table 3-3 PV Module Specifications

Parameter	Value
Maximum Power (Pmax)	350 Wp
Power Tolerance	0-5 W
Maximum Power Voltage (Vmp)	38.1 V
Maximum Power Current (Imp)	9.21 A
Open-circuit Voltage (Voc)	46.2 V
Short-circuit Current (Isc)	9.79 A
Module Efficiency STC (%)	18
Maximum System Voltage (Vdc)	1500 Vdc
Operating Temperature (ºC)	-40ºC~+85ºC
Temperature Coefficients of V ºC	-0.29 %/ºC
Module Dimensions (mm^2)	1960 x 992

A typical Polycrystalline PV module is shown in Figure 3-4. In general, the PV panels are predominantly black in appearance – when viewed directly from the front. The front surface of a typical solar panel is toughened glass with an anti-reflective coating to maximise the light captured by the solar cells and reduce glare back towards the atmosphere.

Figure 3-4 Polycrystalline PV Module

3.2.2 Inverters

Each 300 MW SGU collects the energy from 120 inverter stations, 280 inverter stations for the 700 MW SGU and 48 inverter stations for the 120 MW SGU. The Project will be developed considering central inverters, because they are recommended for large commercial and utility-scale plants (> 100 MW) and have a long and proven track record. The inverter skid will comprise the inverter, the LV/MV transformer, the MV Switchgear and the associated auxiliary services electrical panels and communication panels.

The Sunny Central 2500-EV manufactured by SMA was selected as the basis for the design and yield estimates. This inverter is representative of the industry standard and is extremely common with a long and proven track record. However, a number of inverter types, sizes and manufacturers would be suitable for this Project. The inverter stations technical specifications of Sunny Central 2500-EV are included in Appendix E.

3.2.3 Interconnection

All interconnection components are designed according to SEC standards and specifications. Inside the Project area there are about 22 km of overhead 132 kV lines and about 793 m of underground 132 kV lines. The interconnection with the national grid will be made at the high voltage side of the Step-up transformer in the 132/380kV substations.

3.2.4 Infrastructure

3.2.4.1 Roads and Access

The Project will require the transport of materials and workers mainly during the construction phase. The construction of access road(s) to the site will be required to enable delivery of the main equipment. A temporary access road will be used during the construction stage until the permanent roads are completed.

A main access road, asphalted and 20 m in width, will be constructed to connect the Project with Highway 411 (as shown in Appendix C). The remainder internal roads will mostly be unpaved compacted access roads, with some paved roads to facilitate the access within the Project site for installation and maintenance purposes.

3.2.4.2 New Buildings

The proposed Project will require several onsite buildings to be constructed for the operational requirements:

- Administration and Control building in the Service Area
- Storage and Workshop building
- Substation buildings
- Security gate house and support building, in accordance with High Commission for Industrial Security (HCIS) SEC-03 requirements

3.2.4.3 Site Security

For health, safety and security reasons the Project site will be surrounded with a security fence. This will keep both the environs safe from possible accidents and keep the Project proponents' investment safe. It is furthermore recommended that closed circuit video-surveillance system will be fitted around the plant also for safety reasons.

3.2.4.4 Water Supply

A low salinity water source will be required for periodical cleaning of the PV panels during the operation phase. The water required for panel cleaning will be provided by water trucks from local suppliers. This will most likely be the optimum solution as overall water consumption will be limited and the water quality can be specified in the supply contract. Other water supply alternatives might be investigated at a later stage of the Project such as the utilization of a dedicated pipeline.

Steel water storage tanks will be constructed on site. These will be supplied by regular loads of water trucks. The tanks will be connected to the administration building; they will supply the cleaning trucks and will provide fire protection water to the Project.

3.2.4.5 Stormwater Management System

The Project site will be serviced by a stormwater management system which aims to separate clean from dirty surface water. All clean water will be directed away from the site, where as the contaminated water will be directed and collected within a stormwater management system. The aim of this system is to protect the health, welfare and safety of personnel, and to protect property from flood hazards by safely routing and discharging stormwater away from and within the site.

3.3 Construction Phase

3.3.1 Construction Activities Description

3.3.1.1 Civil Works

The main civil works are as follows:

- Rerouting existing underground services, such as piping, cabling and ducts, if necessary
- Civil works for discharging rainwater, if necessary
- General site filling, levelling and grading to the necessary lines and levels, and all other earthworks, where required, including access areas.
- Construction of new roads, pavements and parking areas as part of the required infrastructure;
- Security fence, lighting system and surveillance system in accordance with HCIS (class-3) SEC-02, SEC-04 and SEC-05 requirements.
- Security gate
- Solar array foundations/piling
- All civil works for the solar array of each SGU, which typically include the following works and systems:
  - Complete civil works for the solar field
  - Trenches
  - Service roads
  - Local infrastructure
- Any other outdoor civil works required inside the Project or as needed for interconnection to the grid.
- Civil works required for the administration and workshop building, the control building, the substations buildings, and the security gate house and support building.

Earthworks will be required during construction to remove loose sand and to reinforce unstable areas. In general, the site is designed with the aim of minimizing earthworks. Construction of the proposed Project and the associated infrastructure will require above ground buildings, installation of panels and construction of roads. Construction works will require temporary labour force, as well as vehicle movements and construction machinery.

3.3.2 Construction Schedule and Workforce

Due to the extremely large scale of the proposed Project, the Project will most likely be constructed in several phases. It is anticipated that, the construction of each 300 MW will take approximately 18 months. Depending on the intensity of the construction (timeline, parallel projects) there could be up to 600 people per each constructed 300 MW.

3.3.3 Construction Workers Accommodation

Construction workforce will be accommodated at Ar Rass city, as far as practical due to its relatively proximity to the Project site and the workers will be bussed in each day. In addition; and given the number of workers during the construction phase, the need for onsite accommodation camp is anticipated. The exact location of the onsite accommodation will be determined prior to the construction commencement; however, it will be within the area officially allocated for the Project. The camp will be designed in a manner that is fully compliant with the relevant national regulations; furthermore, IFC and EBRD guidelines on workers accommodation will be taken into consideration (for more details please refer to Section 2.3.4.6 and Appendix F).

3.3.4 Lay-down area

A laydown area within the boundaries of each of the eight SGUs is set aside for the temporary storage of materials during the construction activities as well as the assembly of PV modules. The laydown area is approximately 200 m X 200 m for each SGU. In addition, temporary construction offices will also be required. These offices will most likely be mobile offices and also of a temporary nature.

3.4 Operation Phase

Generally, the operation of the proposed Project entails the production of power by conversion of solar energy to electricity. The PV power generation process is primarily self-sufficient and is not in need of constant supervision. The resources required for operation include:

- Solar radiation;
- Water;
- Consumables, including but not limited to spare parts and equipment, detergents and fuel.

The outputs from the Project during routine operation include:

- Power
- Solid waste (hazardous and non-hazardous) and liquid effluents (non-hazardous)
- Waste water from washing off PV panels

3.4.1 Operation Activities Description

The two main activities during this phase are operation & maintenance as well as panel cleaning as further detailed below.

3.4.1.1 Operation & Maintenance

In general, the Project will be operated and maintained with the objective to maximise energy production at minimum costs, following SEC and Control Centre requirements. The main Operation and Maintenance (O&M) activities will include the following, as a minimum:

- Periodic supervision of equipment with the aim to reduce the number of failures and the need of corrective maintenance activities, thus maximizing energy generation

- Inspection and maintenance of equipment and installations according to the O&M manual, the manufacturers' recommendations, and good utility practice
- Repair breakdowns and failures of equipment under normal operating conditions according to the O&M manual, the manufacturers' recommendations, and good utility practice
- Cleaning PV modules (more details are presented in Section 3.4.1.2)
- Managing spare parts
- Monitoring and reporting
- Site Security

Furthermore, the operation of each SGU is based on the following:

- The PV modules are connected in series up to the rated voltage of the inverter, referred to as a string
- Strings are connected to electrical panels known as Combiner Boxes, which are in turn connected to the inverters
- The inverters transform the DC current into AC current, and the LV/MV transformers connected to the inverters step-up the voltage to a 33kV level. Transformers are protected by 33kV protection switchgears. The 33kV switchgears of the SGUs are connected by underground lines (feeders) to the 33kV switchgear in the step-up substation
- The step-up substation collects all feeders from the PV field and steps up the voltage from 33kV to 132 KV. Each 33kV feeder collects 15-20 MW
- A SCADA system is installed for the control, operation and monitoring of the SGU PV field and step-up substation
- The SGU Substations are connected by 132kV overhead lines (OHLs) to the switching substation (SS), where the voltage is stepped up to 380kV
- The Project will be connected to existing 380kV OHLs through which all of the energy generated by the Project will be evacuated to the existing electrical grid

3.4.1.2 Panels Cleaning

Two main cleaning systems will be considered:

- A semi-automated option that will consist of a truck/tractor configuration with customised cleaning equipment and large water tank. The cleaning mechanisms will be a combination of high-pressure water and spinning brushes
- A fully-automated cleaning rig which will run along the panels as a track and clean the panels. These systems have a very low consumption of water and require minimal labour input.

The preferred option will be determined prior to the initiation of the Project.

3.4.2 Design Life and Availability

The Project shall be designed for a 25-year lifecycle. Equipment shall be designed to withstand normal operation and conditions during this period. The availability of the Plant will be higher than 99%, which does not consider periods when the grid may be unavailable.

3.4.3 Operation Workforce

During operation phase, it is expected that a total of 300 workers will be required.

3.5 Materials Used During Construction and Operation

3.5.1 Water

In general, no water sources are available on site and all water has to be delivered by trucks and stored in large tanks on site.

The daily potable water consumption for the construction workers is estimated to be approximately 393 m^3/d. This number is based on the total number of workers at peak construction activities (i.e. 5,240 workers present at the same time as worst-case scenario)[5]. There is no available estimate for the construction activities water consumption at this early stage of the project; however, it should be determined prior to commencement of works.

During operation, annual water consumption quantity will depend on the frequency of cleaning and on the type of cleaning technology selected. Using standard cleaning technology and based on average soiling rates, the plant is expected to consume around 105,000 m^3 of water per year to ensure the performance of the panels is maintained. This preliminary figure for water consumption estimated during scoping has yet to be refined in the detailed design. Potable water is also required during the operation phase for the onsite workers. The potable water daily consumption for the operations workers is estimated to be approximately 22.50 m^3/d. This number is based on the total number of workers (i.e. 300 workers)[5]. During the operation phase, water will be supplied using trucks and stored onsite in large tanks, similar to the approach followed in the construction phase. Other water supply alternatives might be investigated at a later stage of the Project such as the utilization of a dedicated pipeline.

Depending on the quality of the selected water source, it may be necessary to construct a water treatment plant to obtain the required water quality for panels cleaning. The need for a water treatment plant, and consequently its specifications, will be determined at a later stage of the Project development.

3.5.2 Construction Materials

Materials required (aggregates, etc.) will be acquired from the local market. There is no available estimate of the quantities of these materials at this early stage of the project; however, they should be determined prior to construction commencement.

[5] Based on average consumption of 75 l/c/d

3.5.3 Hazardous Chemicals

There is no available estimate of the quantities of these materials at this early stage of the project; however, they should be determined prior to construction commencement. In general, it is anticipated that there will be a variety of chemicals stored and used during construction and operation of the Solar Power Plant, as listed in Table 3-4 below. In general, the different chemicals will be handled taking into consideration their properties and following the best practices.

Table 3-4 Hazardous Materials

Project Phase	Hazardous Materials
Construction	▪ Liquid fuels including diesel, petrol and gas (LPG) and lubricating and hydraulic oils will be used extensively by vehicles, pumps and generators; ▪ Cement and concrete admixture chemical will be used for the provision of concrete for substations, building bases and platforms; cement and concrete; ▪ Gases: oxygen, acetylene and nitrogen; ▪ Paints, coatings, grease and chemical cleaners for general use.
Operation	▪ Hydraulic and lubricating oils and greases contained within the synchronous condensers; ▪ Insulating oil contained in the inverter/transformers and substations; ▪ Gelled sulphuric acid electrolyte contained in batteries associated with the control room emergency power supply system; ▪ Small quantities of hydraulic and lubricating oils and greases, fuels (gas, petrol and diesel) ▪ Epoxy resins and hardeners (contained in fibreglass repair kits) ▪ Coolants, thread glues, paints, degreasers, ▪ Pesticides and herbicides associated with hygiene and maintenance activities; ▪ Gases such as oxygen, acetylene nitrogen; ▪ Sulphur hexafluoride (SF_6) gas contained within high voltage equipment.

3.6 Wastes and Emissions

3.6.1 Wastewater and Sewage

During construction, sanitary waste streams will be generated from the construction camp, and portable toilets. The wastewater will be appropriately collected in dedicated septic tanks and they will be emptied and serviced on a regular basis by an approved contractor.

The estimated daily wastewater generation during the construction phase is approximately 314.4 m^3/d. This is based on the assumption that wastewater represents approximately 80% of the domestic water demand indicated in Section 3.5.1[6].

[6] http://saudigazette.com.sa/article/527147, accessed in November 2019

During operation phase, wastewater generating from the panel cleaning is expected to generate. Furthermore, sanitary waste streams will be generated at both the administrative building and at the operations building and maintenance areas. Each area will have a kitchen as well as the requisite number of toilets and showers to support the staff active onsite. At these locations, a fully contained septic tank and leach field will be used to capture and treat the flows. As and when required, the septic tank (solids holding tank) will be cleaned out by a vacuum truck and the wastes will be trucked and disposed of at a licensed facility. The estimated daily domestic wastewater generation during the operation phase is approximately 18 m^3/d. This is based on the assumption that wastewater represents approximately 80% of the domestic water demand indicated in Section 3.5.1.

3.6.2 Solid Waste

Solid waste is expected to be generated during construction and operation. This will likely include construction waste (debris, discarded concrete, empty drums) and municipal solid waste (paper, cardboard, plastic and other packages, food waste). Municipal waste will be collected in dedicated places onsite and disposed of by a specialized contractor at the local municipal landfill site. Construction waste will be reused as much as possible in construction activities, or alternatively it will be disposed of at an authorised landfill site.

Another potential source of solid wastes is the damaged PV panels, if any during the installation. There are different management alternatives for the damaged panels, including return to supplier, offsite disposal at licensed facility and recycling at licensed facility, as far as practical. The final selection of the management approach shall be determined at the early start of the construction phase.

There will be limited production of wastes during the proposed Project operation; these will most probably include oil, oily rags, scrap metal, replaced machine components etc. which will be disposed offsite according to relevant national legislation. Another potential source of solid wastes during this phase is the damaged solar panels, if any. The management approach for the damaged panels, if any will be similar to those followed during the construction phase (e.g. return to supplier, etc.). The final selection of the management approach shall be determined at the early start of the operation phase.

3.6.3 Air Emissions

Dust and particulate generation are expected to occur during the construction phase. Furthermore, heavy equipment will produce exhaust emissions from diesel engines leading to temporary increase in SO_2, NOx, and CO_2 concentrations. The release of carbon monoxide (CO) occurs as a result of incomplete combustion of fuel in engines.

No air emissions are expected during the operation phase. Furthermore, the proposed Project is expected to significantly reduce the emission of CO_2 greenhouse gases by seven (7) million tons of $CO_{2\ equivalent}$.

3.6.4 Noise

The possible source of noise levels is the construction phase is equipment and machinery. Table 3-5 shows the maximum typical sound pressure levels for some of the construction equipment to be used in the proposed construction activities as per Defra[7] noise database for prediction of noise on construction and open sites.

Table 3-5 Typical Sound Pressure Levels for Construction Equipment

Equipment	A-weighted Sound Pressure Level, LAeq dB
Tracked excavator (loading dump truck)	85
Grader	86
Dump truck (tipping fill)	79

During operation, a potential noise sources are the substations, inverter stations and transformers. The noise level at 10m from the inverter (Sunny Central 2500-EV) is 64.3 dB(A). The noise levels vary depending on the specifications of the substation. The average noise level of the operating substation is 80 to 100 dBA (C. Chen et. al., 2014).

3.7 Decommissioning Phase

Decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. All construction material, equipment, temporary facilities, and waste will be removed from the site. Topsoil will be backfilled where required, including landscaping to achieve proper drainage. The majority of the semiconductor material and of the glass can be recovered and recycled. The remaining materials (e.g. glass fines, dust) are collected and properly disposed of according to local regulations. Rehabilitation works will ensure that the total area will be free draining, covered with topsoil.

No decommissioning plan is yet available; however, the following activities can be anticipated in association with the decommissioning phase:

- Existing buildings and structures demolished, rubble removed, and the area levelled;
- Remaining exposed excavated areas filled and levelled using overburden recovered from stockpiles;
- Stockpiles and tailings impoundments to be smoothed and contoured;
- Topsoil replaced using topsoil recovered from stockpiles

The following dust-generating activities may be expected during decommissioning:

- Smoothing of stockpiles by bulldozer
- Grading of sites
- Transport and dumping of overburden for filling
- Infrastructure demolition and piling of Infrastructure rubble

[7] Defra, Update of Noise Database for Prediction of noise on Construction and Open Sites, 2005

- Transport and dumping of building rubble
- Transport and dumping of topsoil
- Preparation of soil for re-vegetation

Of importance is the disposal of the PV panels at the end of the decommissioning phase because of their extremely large number exceeding 9 million pieces. In general, there are different management alternatives for the panels, including return to supplier, offsite disposal at licensed facility and recycling at licensed facility, as far as practical. The final selection of the management approach shall be determined at the early start of the decommissioning phase.

4. Status of Surrounding Environment

The present chapter of the report provides a general overview of the existing conditions at the Project site and wider area, as far as practical. Two approaches of data collection have been utilized in the receiving environment description, namely desktop research and site walkover. It should be noted that the proposed Project area was subject to a site visit and assessment were conducted by Worley team of experts in January 2019.

4.1 Natural Environment

This section presents the status of the environment in the project area. Data presented in this section is mostly derived from extensive desktop research and preliminary assessment conducted on site.

4.1.1 Topography and Landscape

Figure 4-1 shows Saudi Arabia altitudes in meters, most of the land has an altitude ranging between 0 to 1,000 m, including the project area. The main area of the project site is situated about 750 m ASL. The proposed Project location is in central Saudi Arabia in the Al Qassim Province, ca.330 km north west from Riyadh, 24 km south-east of Ar Rass, the largest city (by area) within the province and less than 85 km south-west from Buraydah, the capital of the region.

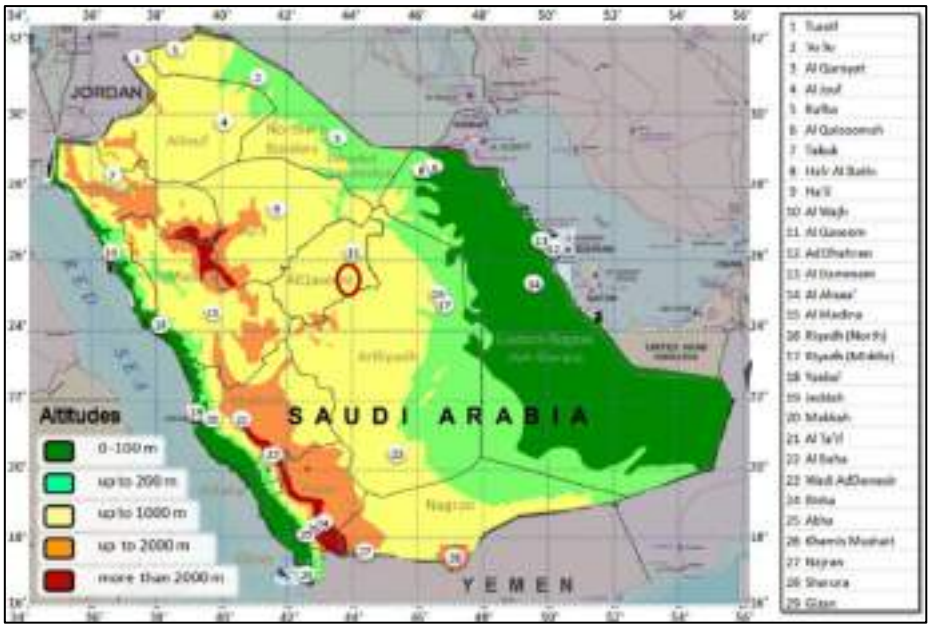

Figure 4-1 Saudi Arabia Altitudes (Source: Hussain, et.al., 2014)

The Project site has an area of ca. 57.6 km^2 and is situated at the eastern edge of the Najd Plateau. The Project site area is mainly covered by sand, gravel, and pebbles. The topography of the site is relatively flat (Figure 4-2), except an area of mounds (about 0.3 km^2) to the south. Two drainage channels are crossing the site from south to north; the east channel is wider and the western one is deeper.

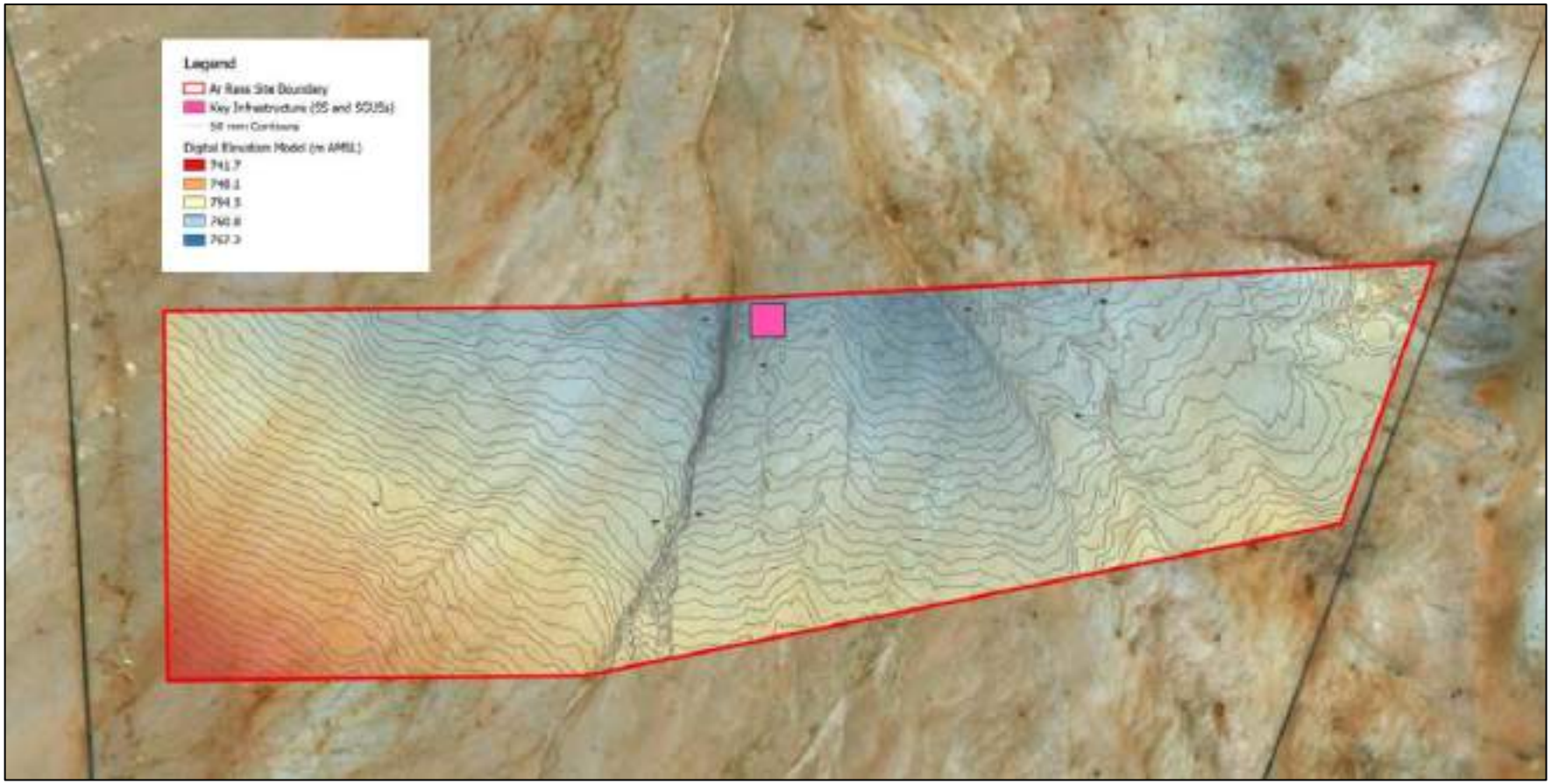

Figure 4-2 Ar Rass Project Site Topography

These drainage channels are tributary to Wadi Al-Rummah (Al-Rimmah) which crosses the Al Qassim region from south-west to north-east and passes just north of Ar Rass city. Al-Rummah (Ar-Rimmah. Ar-Rimah) is the longest valley in the whole Arabian Peninsula, stretching for about 600 km from near Medina, to the Thuayrat Dunes in the east, and farther northeast of the region.The typical site views recorded during the 2019 site visit are presented in (Figure 4-3).

Figure 4-3 Typical Site View

4.1.2 Climate and Meteorology

4.1.2.1 Climate

Ar Rass experiences a hot dry climate which is classified in the Köppen Climate Classification system (Köppen, 1884) as translated in (Volken & Bronnimann, 2011) as BWh which refers to a Hot Desert Climate. The climate is characterised by very hot summer periods, high sunshine hours and limited precipitation.

4.1.2.2 Temperature

Figure 4-4 shows that the annual seasonal pattern of temperature across the years 2010 to 2019 is relatively consistent in Buraydah, the capital of Al Qassim Province, where the proposed Project is located.

From Figure 4-5 it can be seen that July and August are the months of highest temperature, with hot days rising to over 40 °C and mean daily temperature in the mid 30's °C. The winter months of November through to March have mean daily temperatures around 20 °C with minimums down to 10°C in the region. Table 4-1 indicates the average temperature data in Ar Rass measured over a period of 19 years.

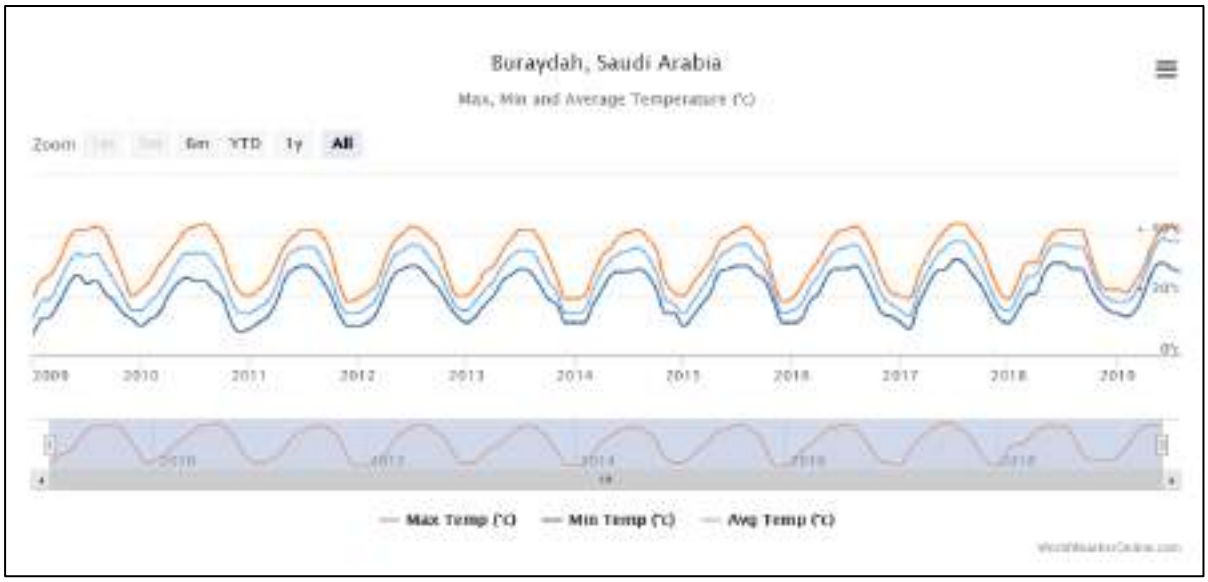

Figure 4-4 Monthly Annual Temperatures (°C)

Source: World Weather Online (https://www.worldweatheronline.com/buraydah-weather/al-qasim/sa.aspx)

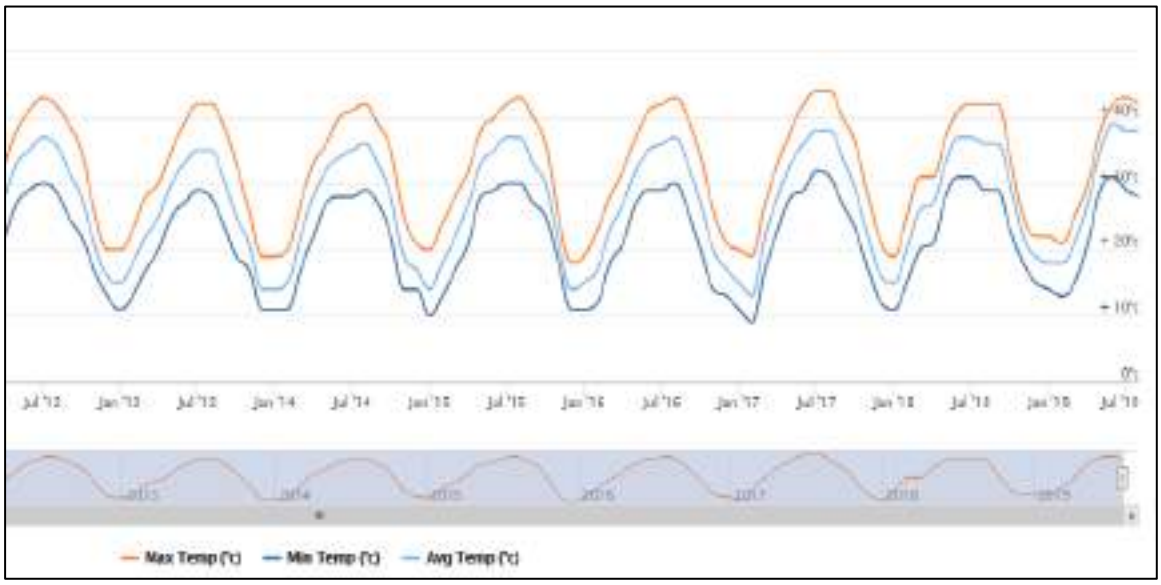

Figure 4-5 Mean, Maximum and Minimum Temperatures (°C) July 2012 to July 2019

Source: World Weather Online (https://www.worldweatheronline.com/buraydah-weather-averages/al-qasim/sa.aspx)

Table 4-1 Air Temperature Records in Ar Rass

Parameter	Yearly	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average Temperature (°C)	24.6	13.2	15.4	19.5	24.8	30.2	32.5	33.8	33.5	31.4	26.2	19.7	15

Source: http://www.weatherbase.com

4.1.2.3 Barometric Pressure

Long term mean pressure between 2010 and 2018 at Buraydah the capital of Al Qassim Province, where the proposed Project is located are shown in Figure 4-6. It should be noted that there is no publicly available information on Ar Rass city pressure.

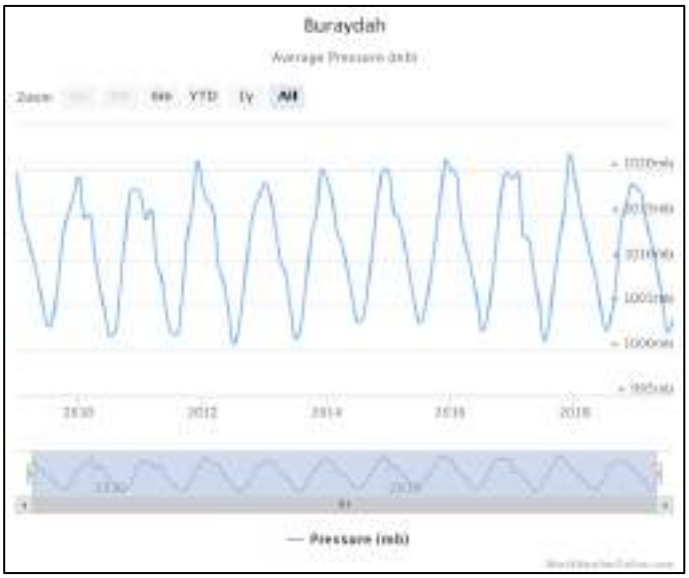

Figure 4-6 Average Pressure (mb) of Buraydah

Source: World Weather Online (https://www.worldweatheronline.com/buraydah-weather-averages/al-qasim/sa.aspx)

4.1.2.4 Wind

Figure 4-7 shows average wind speeds, and average wind gust speeds for Buraydah between 2010 and 2018. Wind speeds are not extreme with maximum gusts recorded being in the region reaching 27.8 kmph. It should be noted Buraydah is the capital of Al Qassim Province, where the proposed Project is located. Furthermore, according to the measurements recorded using a dedicated meteorological station at Ar Rass Site (Figure 4-8) and satellite data, the average wind speed at the Project site is about be 4.4 m/sec.

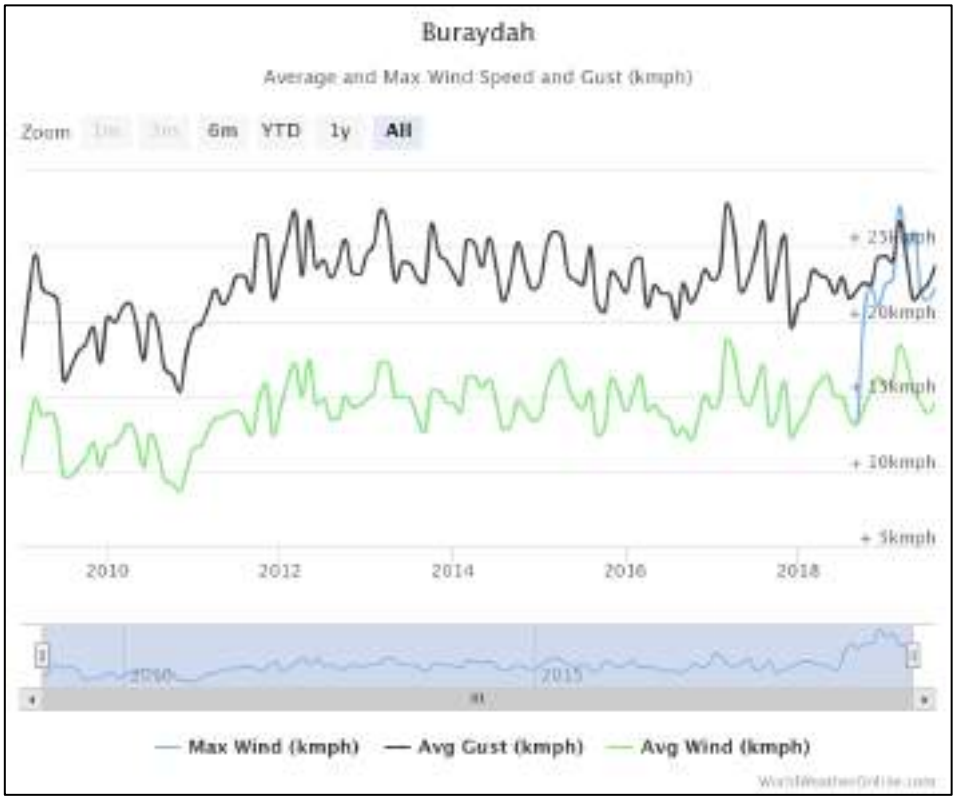

Figure 4-7 Buraydah Maximum and Average Wind Speeds (kmph), and Average Gust (2010-2018)

Source: World Weather Online (https://www.worldweatheronline.com/buraydah-weather-averages/al-qasim/sa.aspx)

Figure 4-8 Meteorological Station at Ar Rass Site

4.1.2.5 Rainfall

Rainfall over the peninsula and its coasts is extremely low, averaging 60 mm per year. The rain is mostly in the form of showers of short spells, often associated with thunderstorms and occasionally with dust storms. Figure 4-9 shows the precipitation mapping of Saudi Arabia. The scarcity of rainfall and no major source of fresh water results in the excess evaporation, as high as 205 cm per year and high salinity with minimal seasonal variation. Practically all precipitation statistics for the Kingdom of Saudi Arabia are influenced by extremes. The average amount of precipitation for the year in Ar Rass is 198.1 mm. The month with the most precipitation on average is March with 45.7 mm of precipitation. There is an average of 10.4 days of precipitation. Table 4-2 shows precipitation in mm recorded at Ar Rass.

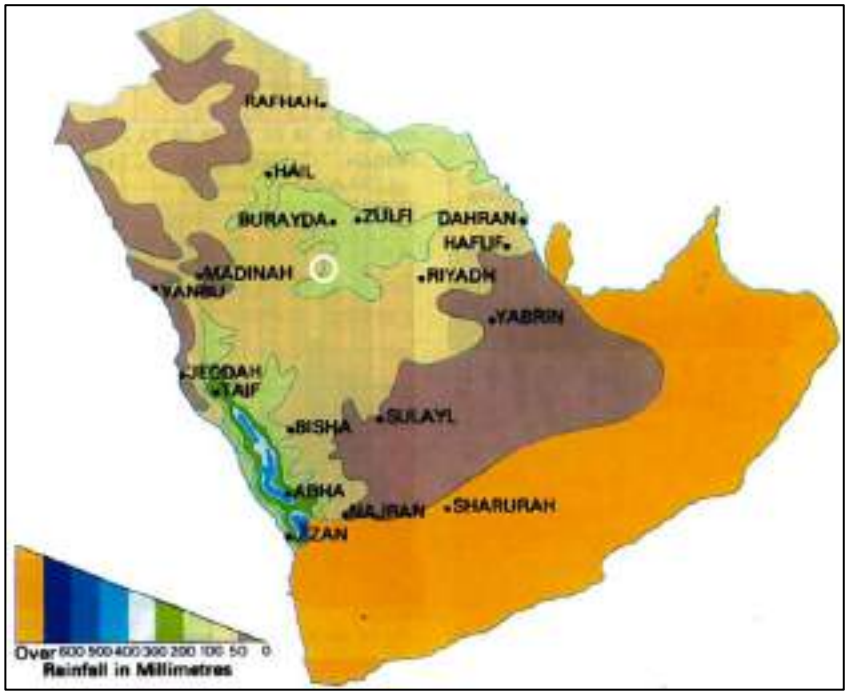

Figure 4-9 Precipitation Mapping of Saudi Arabia

Source: Hussain, et.al., 2014

Table 4-2 Precipitation in Ar Rass

Parameter	Yearly	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average Precipitation (mm)	61.5	10.4	1.9	5.9	17.6	1.54	0	0	0	0	2.04	17.3	4.8

Parameter	Yearly	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average Number of days with precipitation (Days)	8.9	1.6	0.33	0.88	2.37	0.62	0	0	0	0	0.37	1.8	0.92

Source: REPDO 2019

4.1.2.6 Relative Humidity

Table 4-3shows the average relative humidity measured in A Rass; whereas, Figure 4-10 shows the percentage of humidity and clouds at Buraydah area, from January 2009 to 2018. The highest percentage of humidity usually appear at winter season. It should be noted Buraydah is the capital of Al Qassim Province, where the proposed Project is located.

Table 4-3 Relative Humidity in Ar Rass

Parameter	Yearly	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average relative humidity (%)	28.4	0.2	40.9	33.7	30.3	19.7	12.6	13.7	14	16.4	23.8	38.8	47.2

Source:https://www.weatherbase.com/weather/weather.php3?s=604661&cityname=Ar-Rass-Al-Qassim-Saudi-Arabia&units=metric, Accessed April 2019

4.1.3 Air Quality

Air quality at Qassim is impacted by transportation, agriculture, and urban and commercial activities. According to the State of the Environment report produced by GAMEP in 2016, the main source of nitrogen oxides (NO_x), sulphur oxides (SO_x), and particulate matter ($PM_{2.5}$) in Al Qassim area is combustion from means of transportation. Figure 4-11 to Figure 4-14 shows the results in graphical forms.

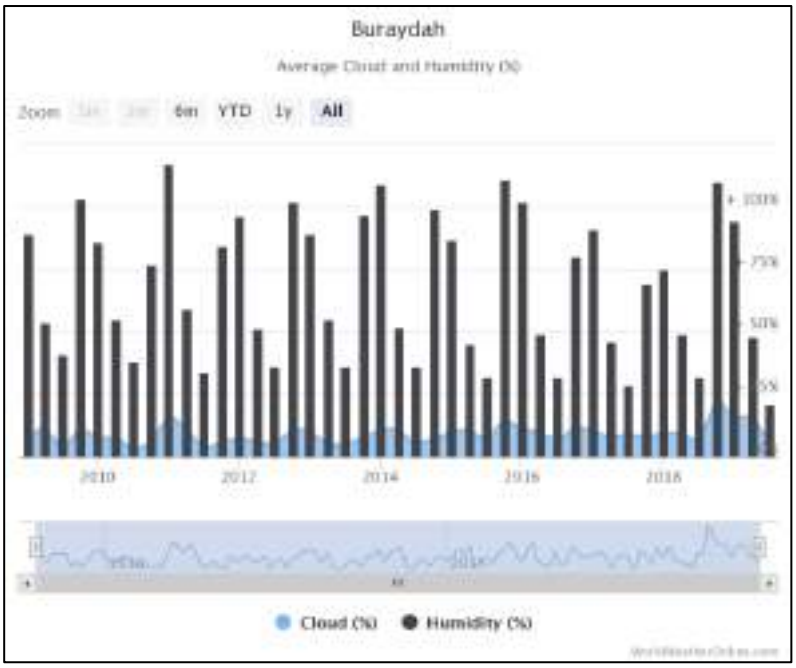

Figure 4-10 Average Cloud (%) and Humidity (%) from 2009 to 2018 at Buraydah

Source: World Weather Online (https://www.worldweatheronline.com/buraydah-weather-averages/al-qasim/sa.aspx)

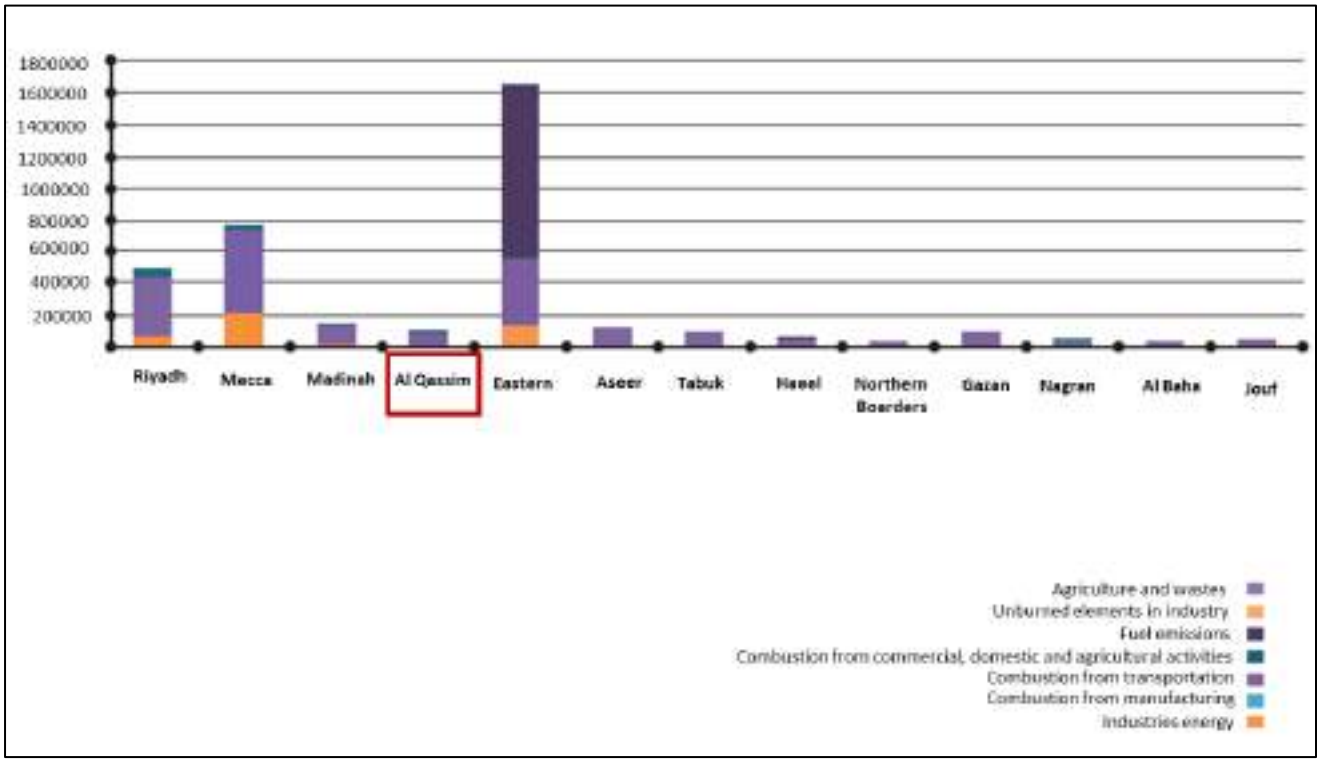

Figure 4-11 Geographical Distribution of NO_x Emissions in Saudi Arabia (tonnes)

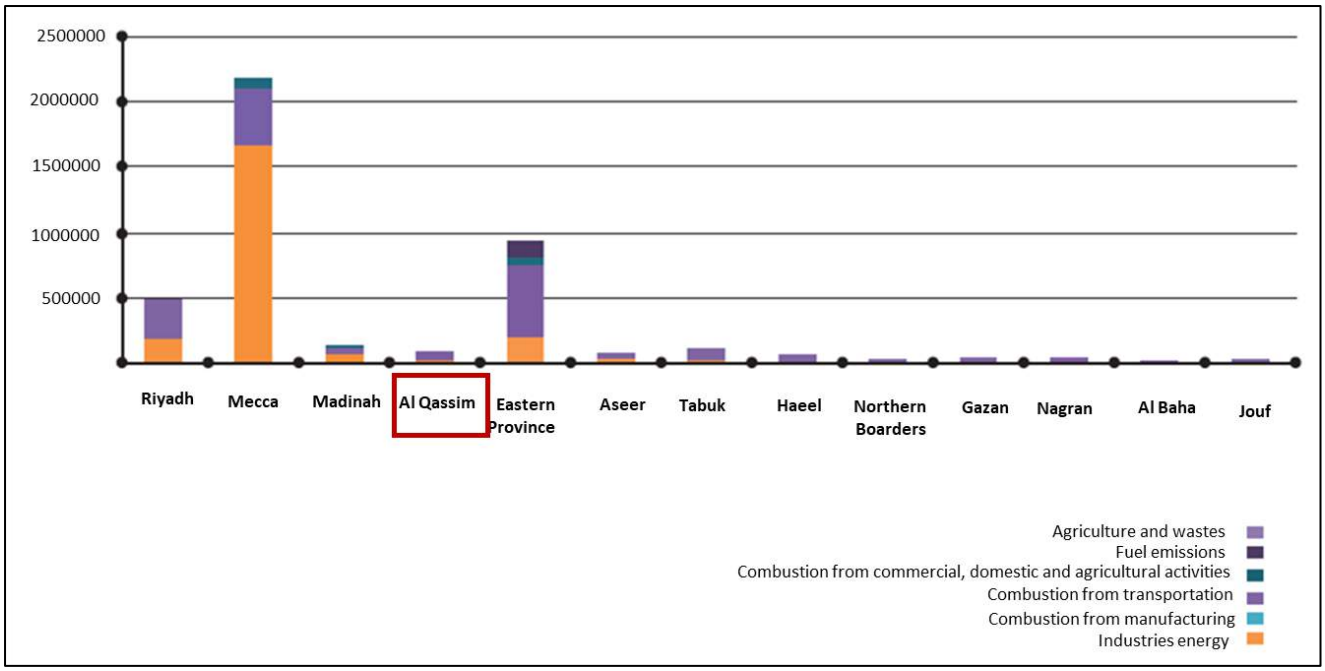

Figure 4-12 Geographical Distribution of SO_x Emissions in Saudi Arabia (tonnes)

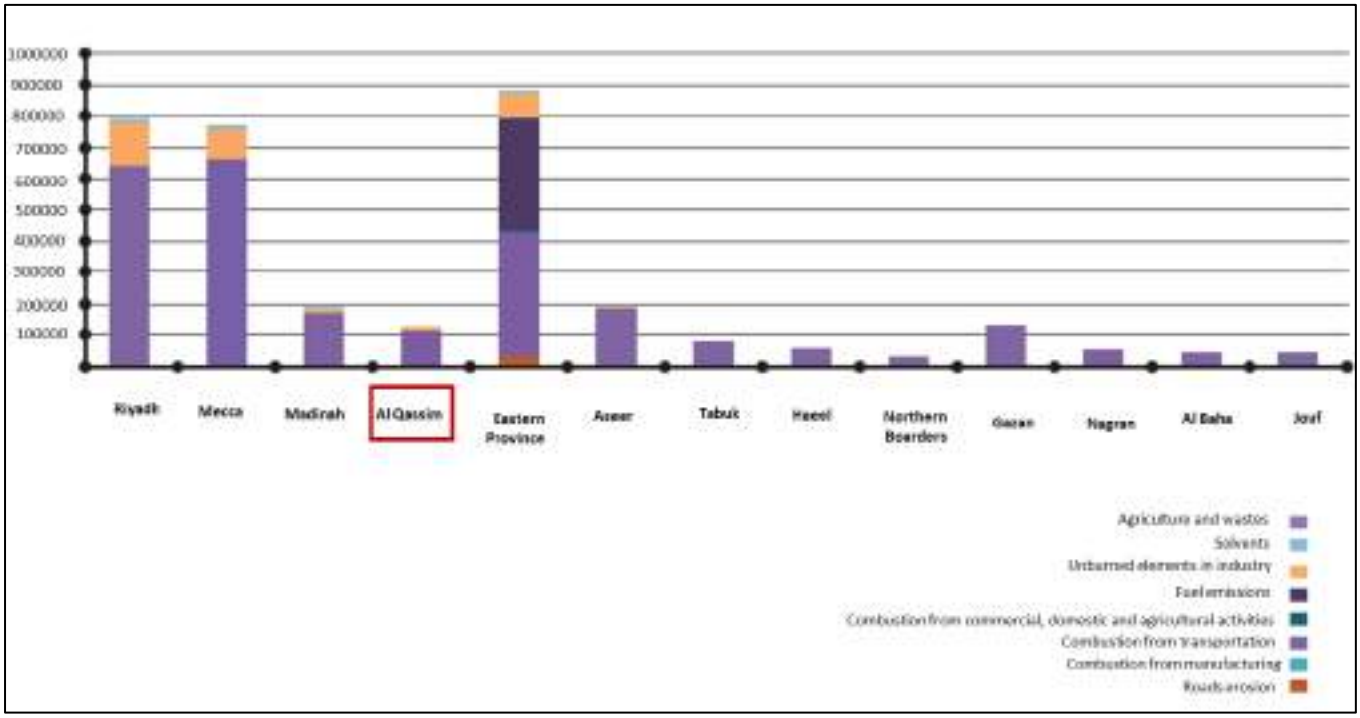

Figure 4-13 Geographical Distribution of VOCs Except Methane Emissions in Saudi Arabia (tonnes)

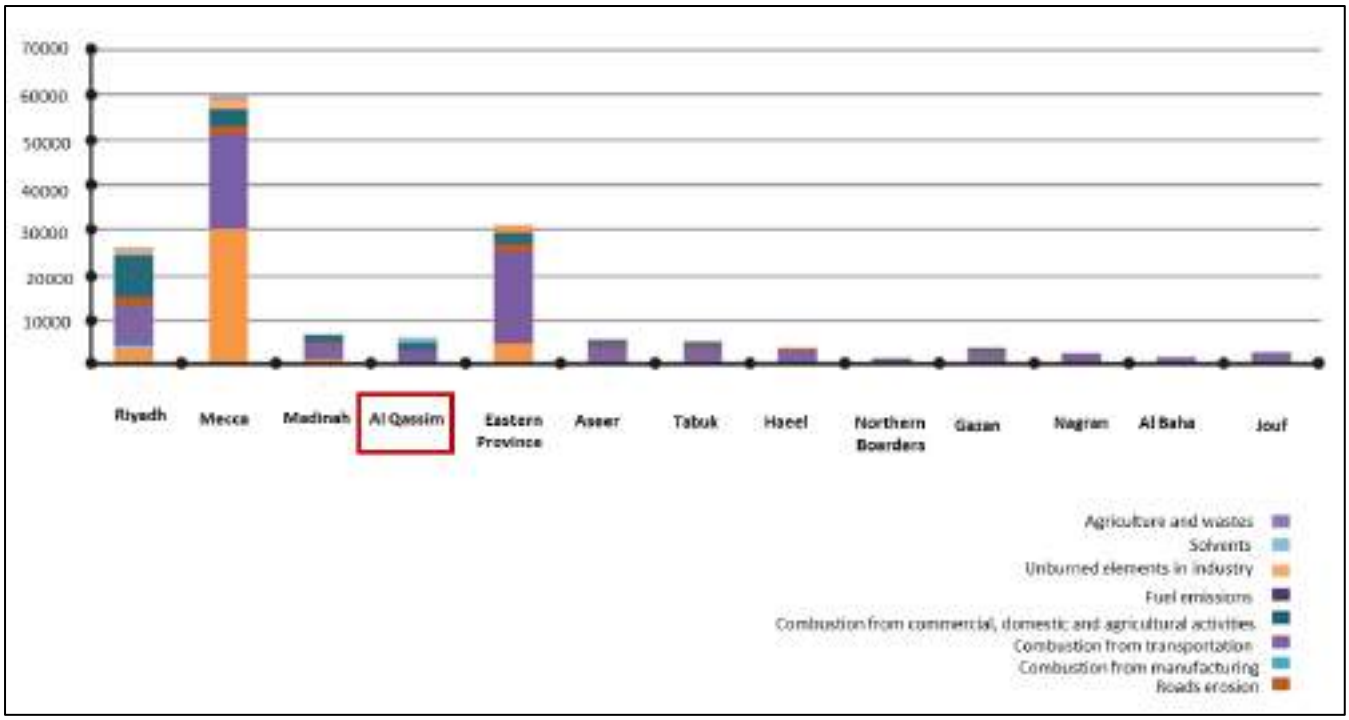

Figure 4-14 Geographical Distribution of $PM_{2.5}$ Emissions in Saudi Arabia (tonnes)

4.1.4 Solar Radiation

Data on solar radiation is crucial information for programs of deployment of solar energy technologies. The on-site meteorological station, equipped with solar and meteorological sensors, has measurements for a period of 12 months, from November 2017 to November 2018. The solar resources at the proposed Project site are strong with a total annual GHI of 2,288 kWh/m², which compares favourably to other regions with strong solar resources around the world, and a similar resource with the other locations in Saudi Arabia. Figure 4-15 shows Saudi Arabia average annual sum of GHI for the period from 1999 to 2018 in KWh/m^2 with the proposed project location indicated in black. Figure 4-16 shows the variation of the GHI during the year, with the peak in summer months and the lowest GHI in winter.

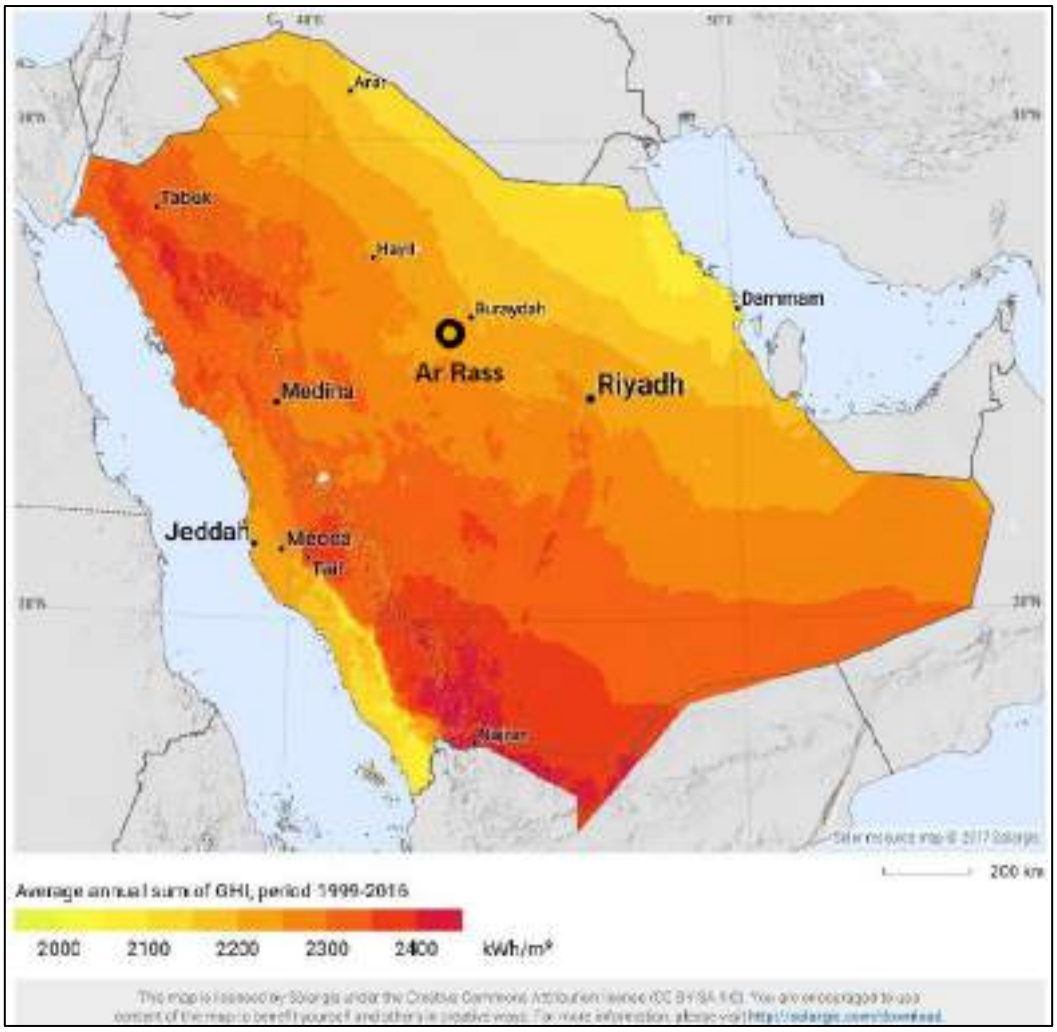

Figure 4-15 Saudia Arabia Solar Source

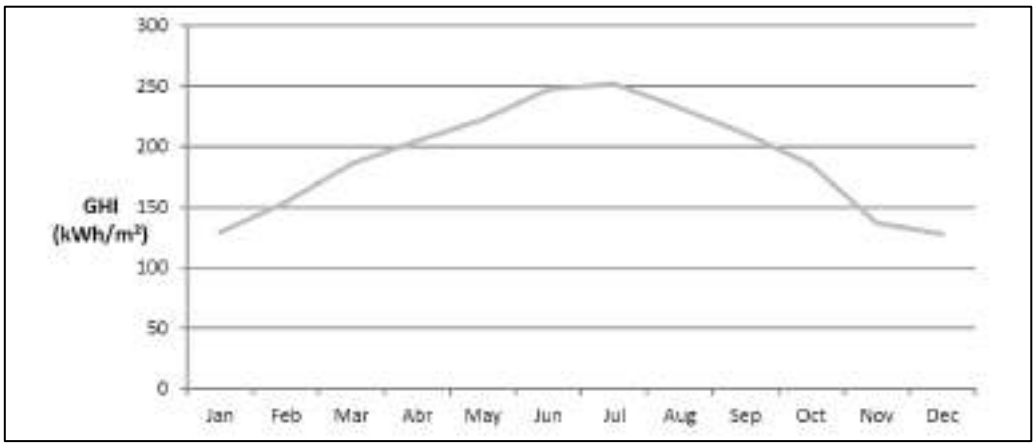

Figure 4-16 Monthly Sum of GHI

Source: Preliminary Site Assessment Report

4.1.5 Geology and Soils

The Arabian Peninsula is a huge crustal plate composed of ancient sedimentary and volcanic rocks, deformed, metamorphosed and injected by plutonic intrusions. The Arabian Peninsula consists of two major regions: Arabian Shield in the west and the Arabian Platform in the east. The Project site is located on the Arabian Shield, very close to the Arabian Platform. Figure 4-17 shows the simplified geologic map of the Arabian Peninsula, the distribution of the main rock sequences and the main tectonic elements (Rausch et al., 2014). The white circle indicates approximately the proposed Project location.

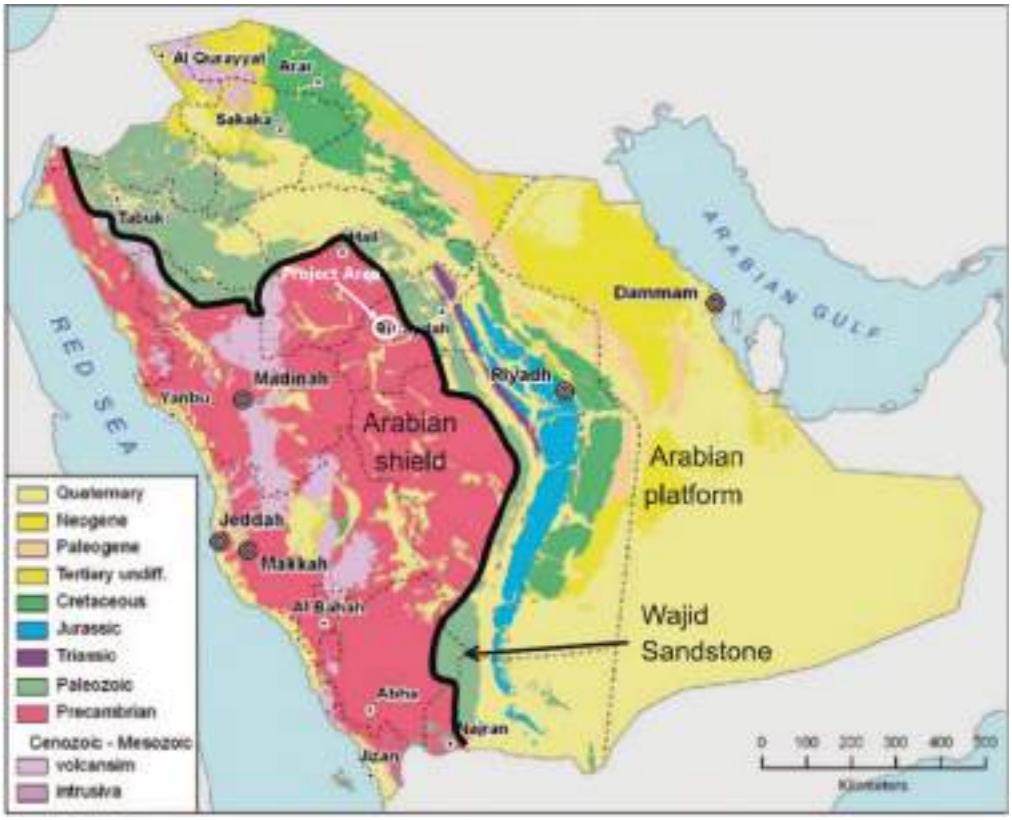

Figure 4-17 Simplified Geologic Map of the Arabian Peninsula

Figure 4-18[8] shows the geologic map of the discharge area of Wadi Ar-Rimah and Ar Rass area, generalized after U.S. Geol. Survey and Arabian American Oil Company (1963) (AI-Sayari and Zötl eds., 1978); the red mark indicates the approximate Project site location. The surroundings of Wadi Ar-Rimah in Ar Rass area consist of granites. The proposed Project site is located on a granite and granite gneiss platform covered by a relatively thin layer of Quaternary deposits (sands and gravels).

[8] 1 Precambrian metamorphic rocks, mainly schists; 2 Granite and granite gneiss; 3 Cambrian-Devonian sandstones; 4 Permian and Triassic sandstone, gypsiferous, and carbonate rocks; 5 Jurassic and Cretaceous carbonate rocks; 6 Eolian sand; 7 Alluvium and related surficial deposits; 8 Tertiary and Quaternary basalts; red mark: approximate Ar Rass solar park location

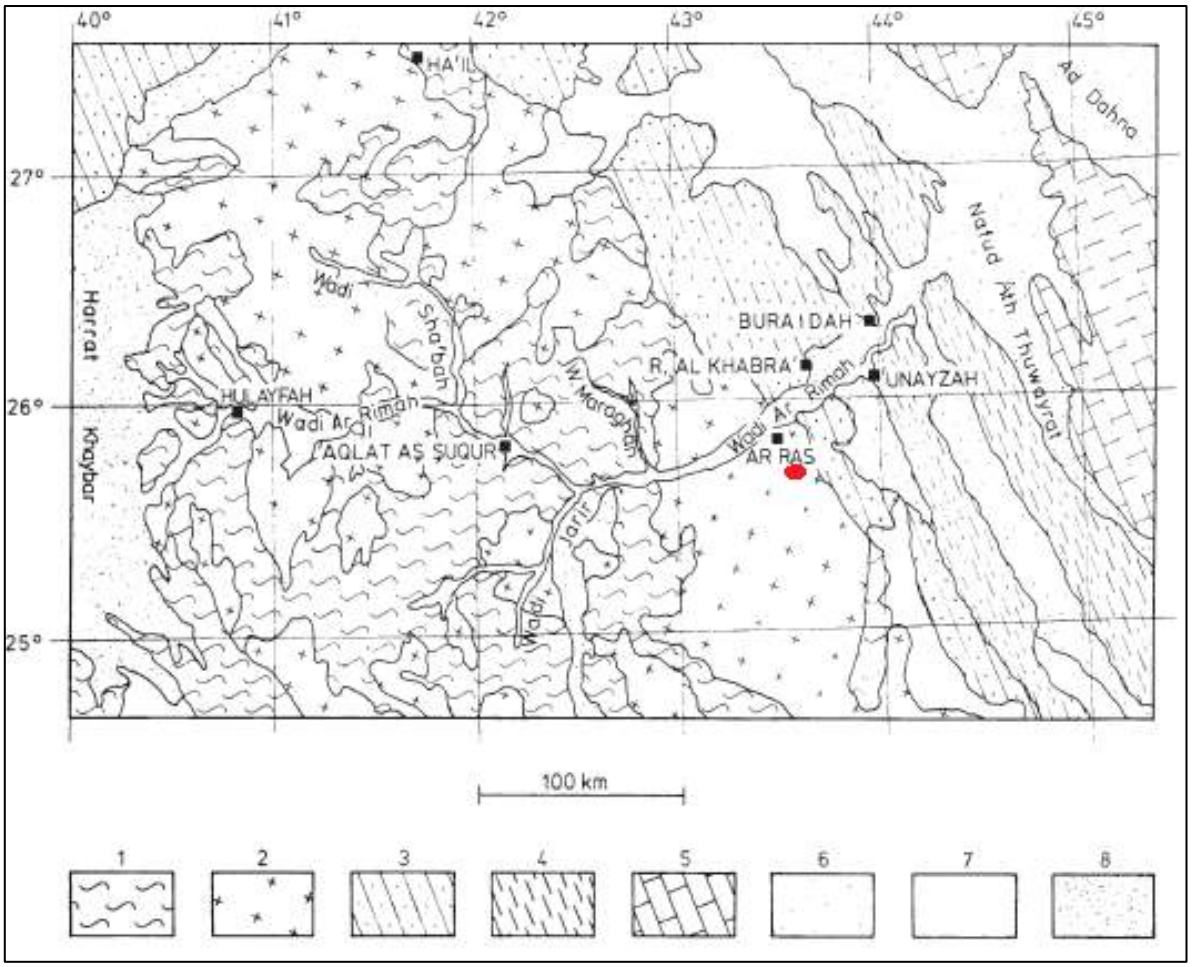

Figure 4-18 Geologic Map of Wadi Ar-Rimah and Ar Rass

4.1.6 Seismicity

The seismo-tectonic setting around Saudi Arabia suggests that large earthquakes can occur in areas very far from the project site, along the Red Sea rift zones and along the Gulf of Aden, along the Dead Sea transform fault system, and due to collision at the subduction zone along the Zagros Mountain belt. In the central and western part of the Arabian Shield, some of the Cenozoic volcanic areas are still potentially active, and some seismicity is associated with this low-level volcanism.

The Ar Rass solar park site is in an area of relatively low seismic risk of the Arabian Shelf (Figure 4-19). However, a study considering all earthquakes recorded since 1955 revealed an onset of intensified seismic activity and land deformation in northern and central KSA beginning from the early '80es which peaked in the '90es and early 2000s. Earthquakes and land deformation spatially and temporarily correlated with agricultural development and unsustainable groundwater extraction in central and northern KSA, especially in the intensively cultivated areas in the Qassim region around Buraydah, in a wide region north of Ar Rass city and to the east of the proposed site; in these regions agriculture relies on groundwater mined from the Saq aquifer.

Most of these earthquakes' epicentres (> 90%) are close to the cultivated lands within the Arabian Platform (Othman et al., 2018). None of these earthquakes had its epicentre on the Arabian Shelf (where the proposed project will be located). Epicentres' depths are shallow (< 10 km) and their magnitude is small. The earthquake closest to the site was at ca. 50 km north-east in the area of Wadi Al-Rimah at an unspecified date. Figure 4-19 shows the instrumental recorded earthquakes of the Arabian Plate from 1900 to 2015 (Deif et al., 2017). The Project is indicated by red circle.

The seismicity parameters for the Project site were determined according to AES A-112, June 2018 and Chapter 20 of ASCE-7-10, 2013. Cross-hole tests were completed and based on the results of these tests the site class was determined to be Class C (i.e. site characterized by very dense soil and soft rock) based on the classification provided in ASCE-7-10, 2013, Table 20.3-1 The main characteristics of the Project site area also include:

- Short period acceleration (Ss) in g%: 11.20
- Second period acceleration (S1) in g%: 3.20
- Peak ground acceleration (PGA) in g%: 2.0
- Site Coefficient FPGA: 1.3

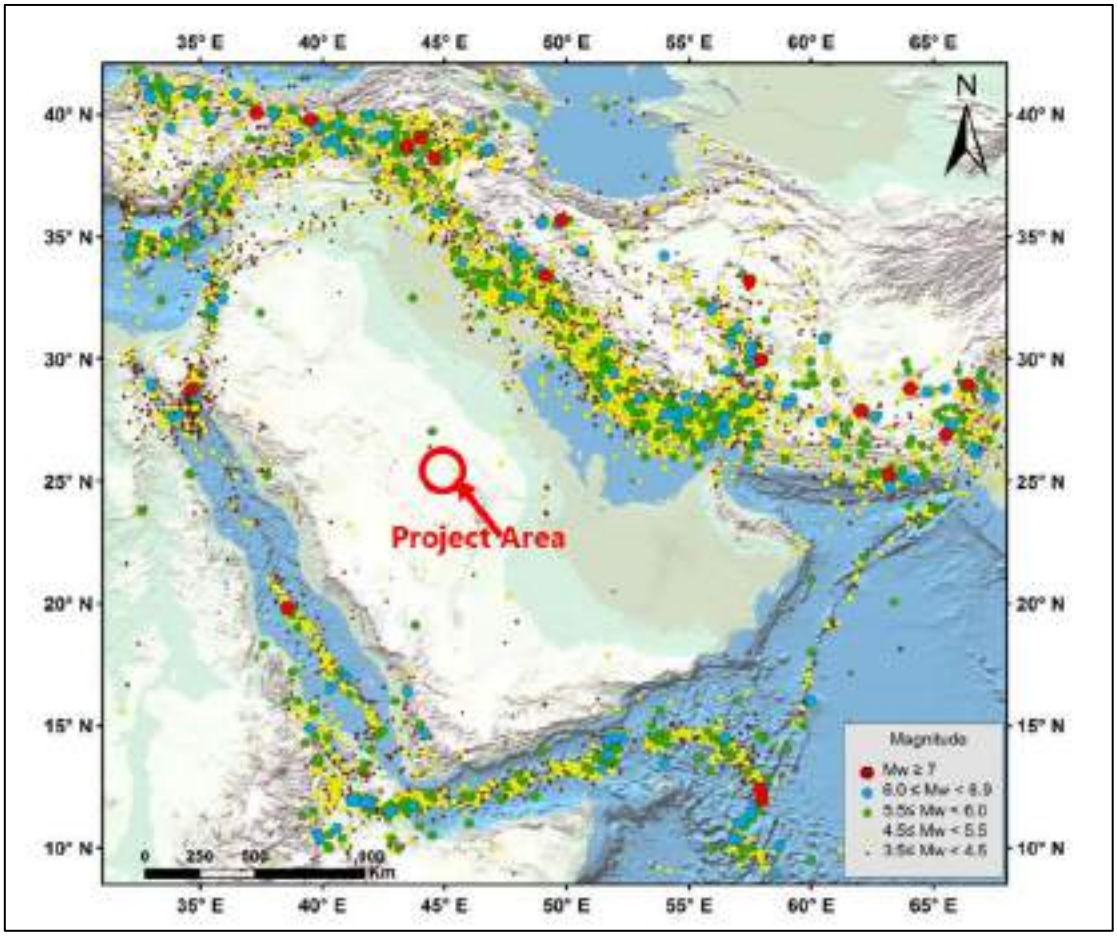

Figure 4-19 Instrumental Recorded Earthquakes of the Arabian Plate from 1900 to 2015

4.1.7 Hydrology and Water Resources

4.1.7.1 Surface water

There are no permanent surface water bodies in the project area and its surroundings. Wadi Ar-Rimah, the largest wadi of the Arabian Peninsula crosses from south-west to north-east just at the northern outskirts of Ar Rass city (Figure 4-18).

Hydrology in the wider area is dominated by Wadi Ar Rimah. The morphogeny of the wadi channel is of Pliocene and Quaternary age. The wadi originally was a broad trough valley with a flat cross-section and slopes of low gradient. The recent wadi channel, about 4 km wide, is the result of a young vertical and lateral erosion. In the granite area of Wadi Ar Rimah is ranging from the mouth of Wadi Maraghan to Ar Rass, fine surface sediments are composed of weathered granite.

The depth of Ar Rimah wadi channel increases downstream, i. e. from west to east. In Wadi Sha'bah it amounts to 4-6 meters, in Wadi Ar Rimah near Aqlat As Suqur, to 8 meters; east of the mouth of Wadi Maraghan, to 12-15 meters; and near Ar Rass to 15-20 meters. Since in recent times accumulation has dominated in Wadi Ar Rimah. the depth of erosion must reach below the recent wadi floor. There are no data available concerning the thickness of the wadi fill (deposits of sand and gravel) in the central part of Wadi Ar Rimah. In the marginal part of the wadi are some hand dug wells, showing a thickness of the young accumulation of 4 to 8 meters.

This agrees with the findings in the tributaries as described above. Episodic precipitation during late winter causes an episodic surface runoff, sometimes flowing through all the wadi channels upstream of Ar Rass. The low permeability of the fine sediments in the wadi floor is the reason for a low infiltration rate and a high percentage of surface runoff even after relatively short precipitation. Such rainfalls produce shallow ponds in larger flat sabkhah pans, as in the area between Riyadh Al Khabra and Ar Rass, or in many small basins scattered among small sediment hills (AI-Sayari and Zötl eds., 1978).

4.1.7.2 Groundwater

The water absorption ability of fine sediments in the area is high and capillary attraction produces a high soil humidity for many days, but there is no groundwater enrichment from precipitation. Local water supply around Wadi Ar-Rimah comes from groundwater in the transitional area at the wadi border towards higher terraces and plains and tributaries filled with fanglomerates of medium to coarse sizes; the aquifer is confined to the weathering zone, which in granite areas may be quite thick, down to more than 20 m bgl.

It was reported that in a well dug on the left bank of Wadi Ar Rimah across from Ar Rass, completely weathered granular granite was found down to a depth of about 20 m and compact granite below was encountered only gradually, transacted by open water-bearing joints.

The groundwater level was about 22 m below the surface and few litters per second could be pumped during few hours per day. Isotopic measurements carried out in water samples collected from the above mentioned well and from similar locations at Ar Rass revealed that the groundwater contains practically no tritium.

The conclusion therefore was that no recharge from present precipitations occurs because there is very little to no infiltration due to impermeable layers in the granite weathering mantle. This lower groundwater horizon flowing mainly through open joints in the transition zone of weathered to unweathered granite carries relatively old water. A distinct upper groundwater horizon with a recharge from precipitation flows to and along the channels of the tributaries for which Wadi Ar Rimah acts as local base level of erosion. The yield of this shallow groundwater body depends on the thickness of the accumulated material, the size of the recharge area and the seasonal distribution of rainfall.

It is highly probable that no significant groundwater source is available in the proposed Project site area; some water may be stored temporarily in the alluvial sediments of the draining channels crossing the site, but even if present, this is most probably not a sustainable groundwater source.

4.1.7.3 Site Specific Hydrology Study

A site-specific hydrology and flood protection study was conducted, with the purpose of assessing and analyzing the hydrological conditions surrounding the Project area. According to the study findings, there are two large drainage areas within the Project site boundary (Figure 4-20), which appear to drain water from south to north through the site. The majority of Project site has a low hazard rating for flooding (Figure 4-21), with the flows shallow and slow. This indicates low hazard to vehicles and people during the design storm event.

The simulated maximum velocity at the site is less than 0.75 m/s and would indicate low erosion and sediment transport potential. The hydrology study has indicated that the site is generally subject to low depth and velocity expansive flooding. The different onsite facilities can be protected relatively easily through minor ground raising and the installation of flood diversion bunds.

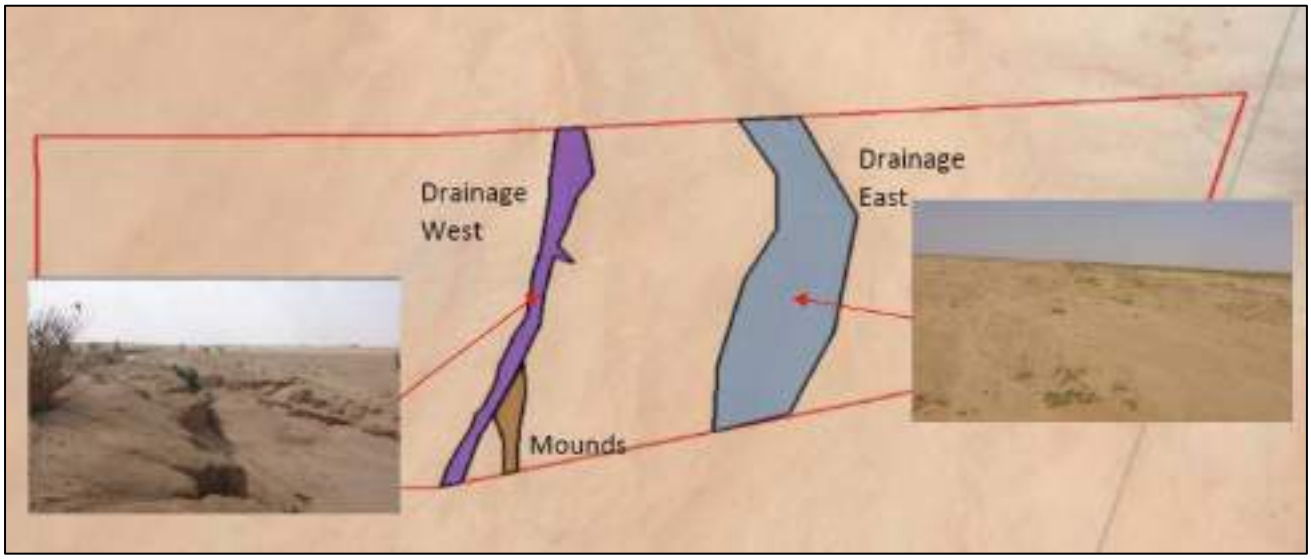

Figure 4-20 Drainage Feature Identified on Site

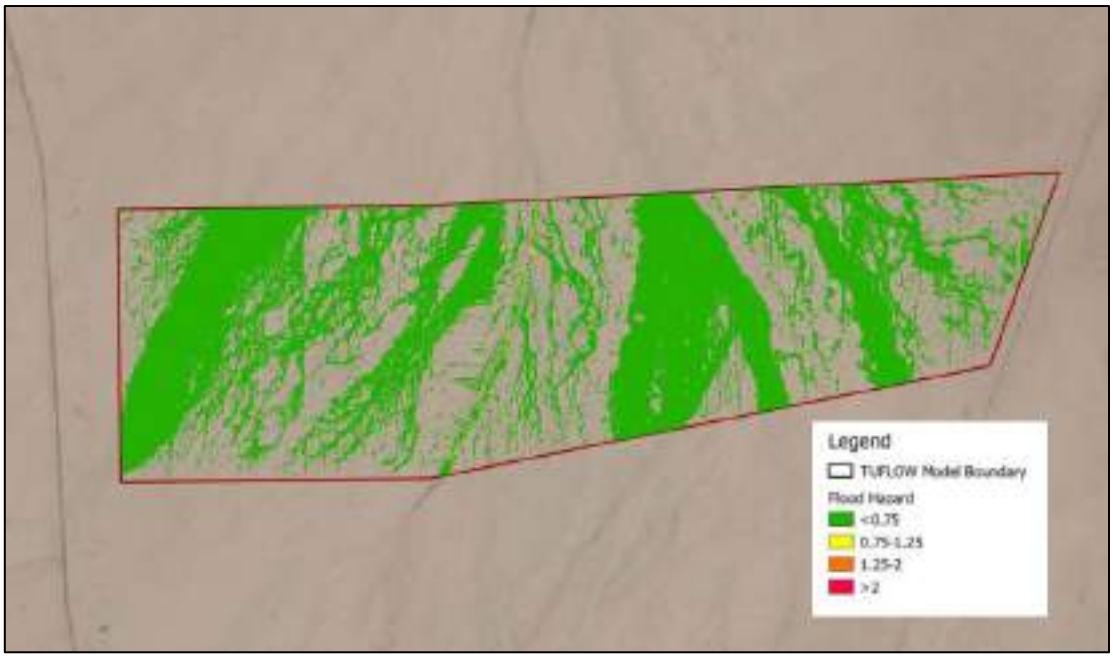

Figure 4-21 Flood Risk Mapping Results

4.1.8 Terrestrial Ecology

The following sections provide an overview of relevant site attributes (baseline conditions) and an appraisal of the function of the location of the proposed Project. The latter has used an Ecosystem Services approach as recommended in the IFC Performance Standards.

Vegetation of Saudi Arabia can generally be divided into five broad categories:

- Vegetation of the coastal plains and sabkhas
- Deserts and scarcely vegetated areas
- Dwarf shrub-lands
- Woodlands and xeromorphic shrub-lands of high-altitude areas
- Wadi communities

Figure 4-22 shows vegetation with the Project highlighted by a white circle. The Project area falls in an area within the Najd plateau which is dominated by a rocky landscape in the center of the Arabian Peninsula. The Project area can be dubbed under the eco-region “Arabian Desert and East Sahero Arabian xeric shrub lands” according to the classification of World-Wide Fund for Nature (WWF). Habitat types have been identified in the Project area during the site visit conducted in January 2019, according to IUCN classifications are presented below:

- 3.5 Subtropical / Tropical Dry Shrub Land
- 5.2 Seasonal / Intermittent / Irregular Rivers, Streams, Creeks

A habitat map is included in Appendix Appendix D.

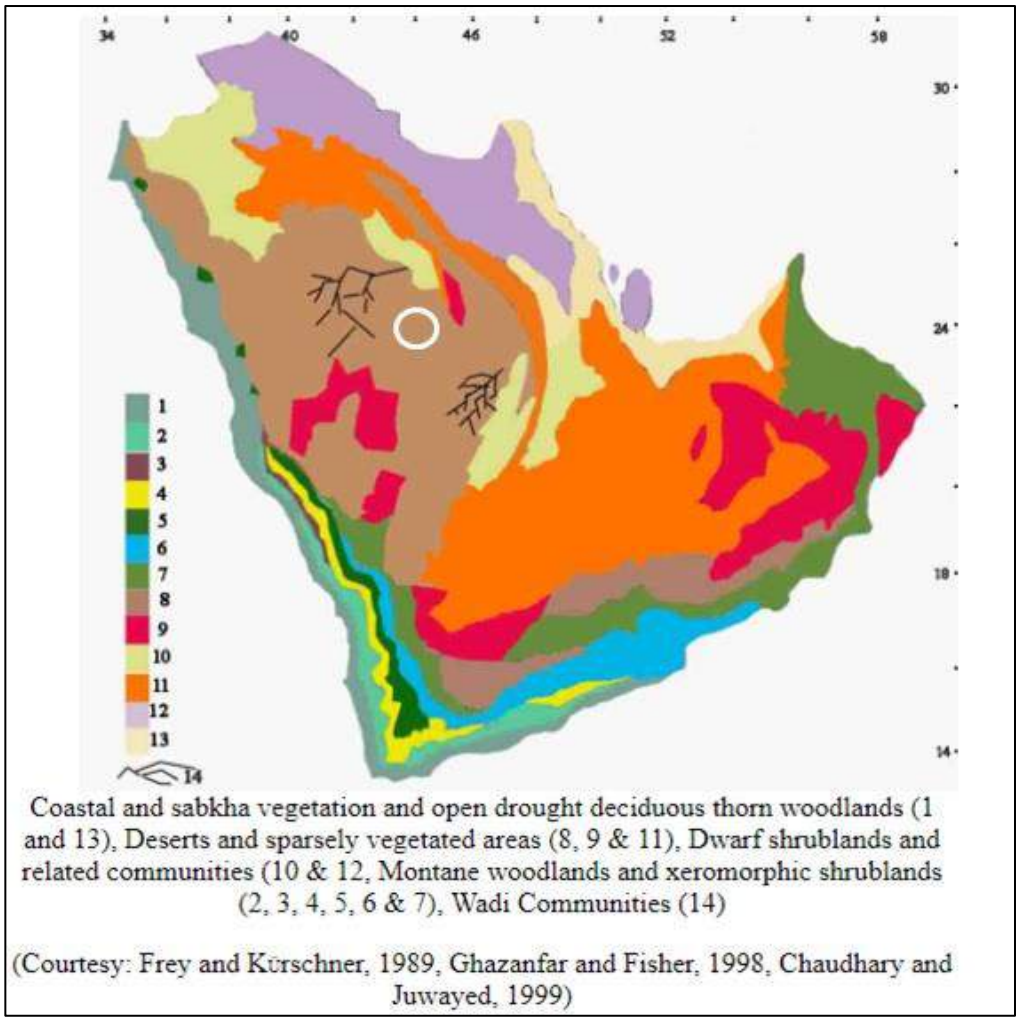

Figure 4-22 Vegetation Map of Saudi Arabia
Source: http://www.plantdiversityofsaudiarabia.info/biodiversity-saudi-arabia/Vegetation/Plant%20Communities%20and%20Plant%20Associations-Saudi%20Arabia.htm

4.1.8.1 Flora

The general area is characterized by a dry desert plain with scattered vegetation and seasonal streams and drainage channels forming part of the wadi system of Wadi Ar Rummah. *Widyan* or Wadis are one of the most important plant habitats in the Kingdom. Their floors are often filled with well-drained silts, sands and gravels which may hold considerable amounts of moisture. The major wadis of the Najd plateau in particular were important plant migration routes eastwards towards the Gulf as Tertiary and Quaternary sea levels fell. Wadi communities are categorized into three types; the first of which consists of the large wadis of central Saudi Arabia (including Wadi Ar Rummah). The dominant indicator species are scattered trees of Saharo-Sindian origin: *Acacia gerrardii*, *A. raddiana*, *A. tortilis*, with an under storey of *Astragalus spinosus*, *Chrysopogon plumulosus* and *Cymbopogon commutatus* as the main associates. Where *Acacia* has been cut down soil erosion is common, and the site invaded by *Calotropis procera* (Vincent, 2008).

4.1.8.1.1 Project Site

According to preliminary site assessment report, various species of flora at varying densities, were recorded during the site visit as listed in Table 4-4 and can be seen in Figure 4-23. Both *Calotropis procera* and *Citrullus colocynthis* appeared near drainage channels. *Vachellia* (*Acacia*) *tortilis* was encountered towards the south boundary of the site where mount is the main feature.

Table 4-4 Trees and Shrubs Identified on Site

Common name / Arabic name	Family	Species	IUCN Conservation Status
Rimth	Amaranthaceae	*Haloxylon salicornicum*	Not assessed
Samar / Umbrella Thorn	Fabaceae	*Vachellia* (*Acacia*) *tortilis*	Not assessed
-	Xanthorrhoeaceae	*Asphodelus fistulosus*	Least Concern (LC)
Hawa	Asteraceae	*Launaea capitata*	Not assessed
Cheeseweed / Khubbez	Malvaceae	*Malva parviflora*	Not assessed
Apple of Sodom / 'Ushar	Apocynaceae	*Calotropis procera*	Not assessed
Bitter apple	Cucurbitaceae	*Citrullus colocynthis*	Not assessed


Figure 4-23 Vegetation as seen on Site

Ecosystem Services

The Project area is part of a wider ecosystem that provides provisioning services. Provisioning services are described as the material or energy outputs from ecosystems such as food (crops, meat, and dairy products, fish and honey); water (from rivers and groundwater); fibre (timber and wool); and fuel (wood and biofuels).

Plants are an integral part of the lives of people throughout the world. Plants satisfy basic human needs such as food, shelter, and health care. As such, plants found in Saudi Arabia have played an integral role in the culture of Bedouins and animals (Mandaville and Mandaville, 2011). Some of the plants found in the project area are considered somewhat toxic such as Bitter Apple (*Citrullus colocynthis*), and 'Ushar (*Calotropis procera*), however some have medicinal uses. For example, seeds from Bitter Apple (*Citrullus colocynthis*) are used as an effective laxative (Mandaville and Mandaville, 2011; Uphof, 1959).

An important plant for herders, especially camel herders, is Rimth (*Haloxylon salicornicum*), for this plant provides salt, which is a crucial supplement in camel diet.

Studies conducted in the Ta'if region recorded some of the plants found in the project area and have shown that these plants have at least one aspect of potential or actual economic use (Al-Sodany et al., 2013). The economic uses of plants identified in the project area are listed in Table 4-5.

Table 4-5 Economic Uses of Plants (Al-Sodany et al., 2013)

Species	Economic uses				
	Medicinal	Grazing	Edible	Fuel	Other
Vachellia (Acacia) tortilis	+	+		+	
Haloxylon salicornicum		+		+	
Calotropis procera	+	+		+	
Citrullus colocynthis	+	+			

4.1.8.2 Fauna

4.1.8.2.1 Mammals

According to the First Saudi Arabian National Report on the Convention on Biological Diversity published by the National Commission for Wildlife Conservation and Development, twelve mammalian taxa are considered endemic to Saudi Arabia including but not limited to Chiroptera (e.g. *Nycteris thebaica najdiya*), Lagomorpha (*Lepus capensis arabicus*), Rodentia (e.g. *Meriones rex*) among others.

The existence of small mammals expected in Al Qassim area according to their distribution maps and the habitats where they are encountered on IUCN Red List such as those listed in Table 4-6.

Table 4-6 Examples of Small Mammals Expected in Al Qassim

Common name	Species	Status on the IUCN Red List
Sundevall's Jird	*Meriones crassus*	LC
Libyan Jird	*Meriones libycus*	LC
Dwarf Gerbil	*Gerbillus nanus*	LC
Pygmy Gerbil	*Gerbillus henleyi*	LC
Cheesman's Gerbil	*Gerbillus cheesmani*	LC
Lesser Egyptian Jerboa	*Jaculus jaculus*	LC
Desert Hedgehog	*Paraechinus aethiopicus*	LC

The large mammals that once roamed the peninsula have greatly decreased in number for various reasons. Some examples include the Cheetah (*Acinonyx jubatus*), the Lion (*Panthera leo*), which are considered by the IUCN as regionally extinct in Saudi Arabia. Smaller carnivorous mammals may be present in Al Qassim area according to their distribution maps, and the habitats where they are encountered on IUCN Red List such as those listed in Table 4-7.

Table 4-7 Carnivorous Mammals Expected in Al Qassim

Common name	Species	Status on the IUCN Red List
Arabian Wolf[9]	*Canis lupus*	LC
Red Fox	*Vulpes vulpes*	LC
Rüppell's fox	*Vulpes rueppellii*	LC
Sand Cat	*Felis margarita*	LC
Wild Cat	*Felis silvestris*	LC
Honey Badger	*Mellivora capensis*	LC
Striped Hyaena	*Hyaena hyaena*	Near Threatened (NT), possibly extant in the wider area

Project Site

In general, the site is undeveloped and unfenced, which means that animals have access to the Project site. Burrows were observed in the sand and gravel areas. However, the burrowing animals were not identified.

4.1.8.2.2 Birds

The peninsula is home to a plethora of bird species and an important stopover site for many migratory species. Saudi Arabia is one of the most important north-south and east-west migratory pathways for a great number of birds.

According to the First Saudi Arabian National Report on the Convention on Biological Diversity, 432 species of birds are recorded in Saudi Arabia and about 180 species are known to breed in the country. The report also lists eleven endemic bird species and three near endemic species. There are some near threatened migratory and native species that are also found in Al Qassim, according to the IUCN Red List and Avibase (Figure 4-24) such as those listed in Table 4-8.

Table 4-8 List of Threatened Migratory and Native Birds found in Al Qassim (Avibase)

Common name	Species	Status on the IUCN Red List
Ferruginous Duck	*Aythya nyroca*	NT
European Turtle-Dove	*Streptopelia turtur*	VU
Asian Houbara	*Chlamydotis macqueenii*	VU
Eurasian Curlew	*Numenius arquata*	NT
Black-tailed Godwit	*Limosa limosa*	NT
Black-winged Pratincole	*Glareola nordmanni*	NT

[9] Recent studies show genetic evidence of the persistence of the Grey Wolf (*Canis lupus*) in the Ibex Reserve in central Saudi Arabia (Wronski et al., 2013)

Eurasian Curlew (*Numenius arquata*)

European Turtle Dove (*Streptopelia turtur*)

Source: arkive.org

Figure 4-24 Avifauna found in Saudi Arabia

Twice a year, birds migrate vast distances across the globe. Typically, these journeys follow a predominantly north-south axis, linking breeding grounds in arctic and temperate regions with non-breeding sites in temperate and tropical areas. Many species migrate along broadly similar, well-established routes known as flyways. Recent research has identified eight such pathways: The East Atlantic, the Mediterranean/Black Sea, the East Asia/East Africa, the Central Asia, the East Asia/Australasia, and three flyways in the Americas and the Neotropics. Figure 4-25 shows East Asia / East Africa birds' flyway, where the proposed project is indicated in red dot, according to BirdLife International.

Migration is the large-scale movement of a species to a different environment. There are many implications of migration; the food resources of some regions would not be adequately exploited without moving populations.

Saudi Arabia does not have an official list of protected species; however, it is a party in the Convention on the Conservation of Migratory Species of Wild Animals (CMS). The CMS text provides a list of endangered migratory species that should be protected by promoting, cooperating in, and supporting research relating to migratory species, providing immediate protection for the species listed, in addition to reaching agreements on covering the conservation and management of migratory species listed.

For this study, species listed in Appendix I are used as this list has species that are determined to be endangered and in need of protective and conservative actions from the participating countries. Table 4-9 shows species that are found in Saudi Arabia or pass over the peninsula during migration seasons. This list has been put together using the IUCN Red List and the Range States list published by CMS.

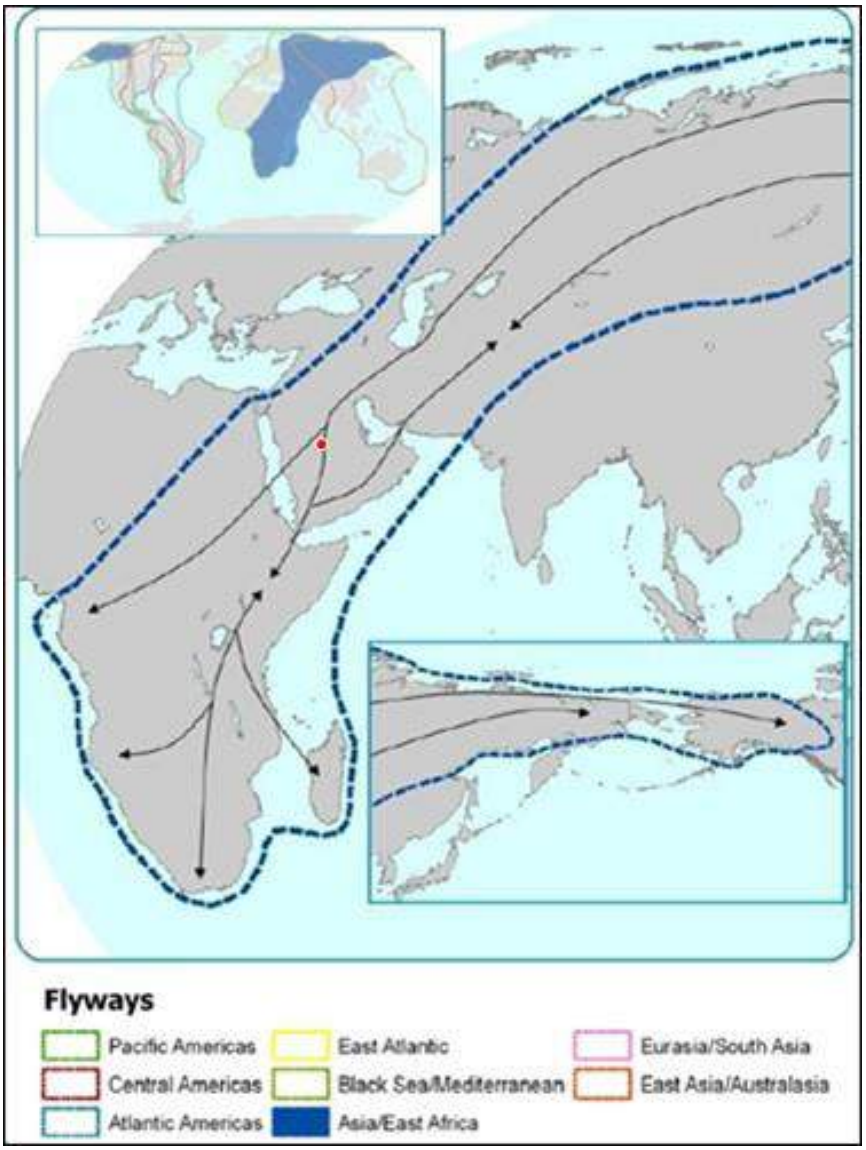

Figure 4-25 East Asia/East Africa Flyway

Table 4-9 A List of Migrant Animals Found and Protected in Saudi Arabia

Common name	Species	Status on the IUCN Red List	Status in Saudi Arabia (IUCN Red List)
Great White Pelican	*Pelecanus onocrotalus*	LC	Native
Dalmatian Pelican	*Pelecanus crispus*	NT	-
Northern Bald Ibis	*Geronticus eremita*	CR	Native
Ferruginous Duck	*Aythya nyroca*	NT	Native (found wintering)
White-headed Duck	*Oxyura leucocephala*	EN	Vagrant
Greater Spotted Eagle	*Clanga clanga*	VU	Native
Imperial Eagle	*Aquila heliaca*	VU	Native

Common name	Species	Status on the IUCN Red List	Status in Saudi Arabia (IUCN Red List)
Egyptian Vulture	*Neophron percnopterus*	EN	Native
Lesser Kestrel	*Falco naumanni*	LC	Native
Saker Falcon	*Falco cherrug*	EN	Native (Regular passage)
Red-footed Falcon	*Falco vespertinus*	NT	Vagrant
Sociable Plover	*Vanellus gregarius*	CR	Native
Slender-billed Curlew	*Numenius tenuirostris*	CR	Native
White-eyed Gull	*Larus leucophthalmus*	NT	Native
Basra Reed Warbler	*Acrocephalus griseldis*	EN	Native

Project Site

During the site visit conducted in January 2019, a pair of Desert Eagle Owls (*Bubo ascalaphus desertorum*) was observed and photographed as seen in Figure 4-26. It should be noted that this species is classified as Least Concern according to the IUCN Red List.

Figure 4-26 Eagle-Owl (Bubo ascalaphus desertorum) on Site

4.1.8.2.3 Reptiles and Amphibians

Reptiles and amphibians play important roles in any ecosystem. Reptiles control the populations of rodents and insects, and venomous snakes are important both medically and economically. Amphibians are usually indicator species for the health of a habitat.

The existence of reptiles is expected in the area according to their distribution maps and the habitats where they are encountered on IUCN Red List such as those listed in Table 4-10.

Table 4-10 Reptiles Expected in Al Qassim

Common name	Species	Status on the IUCN Red List
Arabian Horned Viper	*Cerastes gasperettii*	LC
Arabian Sand Boa	*Eryx jayakari*	LC
Schmidt's Fringe-toed Lizard	*Acanthodactylus schmidti*	LC
Zarudnyi's Worm Lizard	*Diplometopon zarudnyi*	LC
Common Leaf-nosed Snake	*Lytorhynchus diadema*	LC
Elegant Racer	*Platyceps elegantissimus*	LC
Egyptian Spiny-tailed lizard	*Uromastyx aegyptia*	VU
Horny-scaled Agama	*Trapelus ruderatus*	LC
Arabian Toad-headed Agama	*Phrynocephalus arabicus*	LC
Middle Eastern Short-fingered Gecko	*Stenodactylus doriae*	LC

Project Site

No reptilian species were encountered, during the site visit in January 2019. However, the presence of Desert Eagle Owls (*Bubo ascalaphus desertorum*) is a good indicator for the presence of small lizard species such as an Arnold's Fringe-fingered Lizard (*Acanthodactylus opheodurus*) and Schmidt's Fringe-toed Lizard (*Acanthodactylus schmidti*). Burrows were observed in the wider area; however, the burrowing animals were not identified.

4.1.8.3 Sensitive Areas

According to Protected Planet and the Integrated Biodiversity Assessment Tool (IBAT), there are no protected or sensitive areas located within 10 km of the Project area. The nearest protected area is designated as a recreational area, Hima al-Ghada, and is located about 20 km east of the proposed Project site. There are two other protected areas as well; Jabal Tukhfah is about 80 km south west of the proposed Project area, and Nafud al-'Urayq about 90 km west of the Project area as is seen in Figure 4-27. More details on the closest sensitive areas to the Project area, namely Hima al-Ghada and Jabal Tukhfah are presented below.

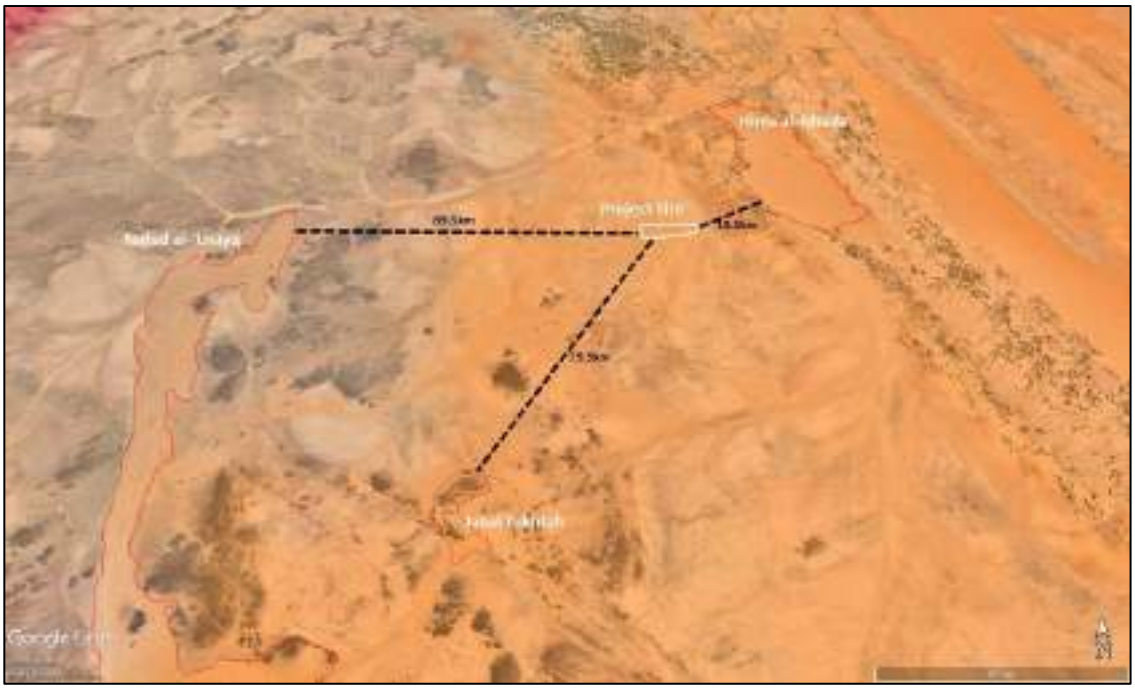

Figure 4-27 Nearest Protected Areas to Project Location

Hima al-Ghada

The reserve has an area of about 1,186.22 km^2 and is designated as a category VI: Protected area with sustainable use of natural resources according to the IUCN Protected Area Categories. This protected area is managed through the Human Integrated Management Approach (HIMA) which is a community-based natural resources management and conservation system which is aimed at protecting areas of land by encouraging local participation that integrates social and environmental priorities (Khalil et al, 2016). The main purpose of this protected area is the conservation of the plant *Haloxylon persicum*, which is able to stabilize sandy soils due to its extensive root system making it an important plant in this desert environment.

Jabal Tukhfah

The reserve has an area of about 147.32 km^2 and is designated as a category IV: Habitat/Species Management Area according to the IUCN Protected Area Categories. The jabal is a series of hills of varying sizes made of limestone surrounded by red sand plains, contrasting against the lush green colour of Acacia trees and other desert shrubs. Information on the area and its management is very limited.

4.2 Human Environment

This section presents an overview of the human environment found in Al Qassim Province and Ar Rass Governorate as applicable. Figure 4-28 shows the project area at Al Qassim Province. It should be noted that there are no known areas of archaeological value within the Project footprint or immediate surrounding area.

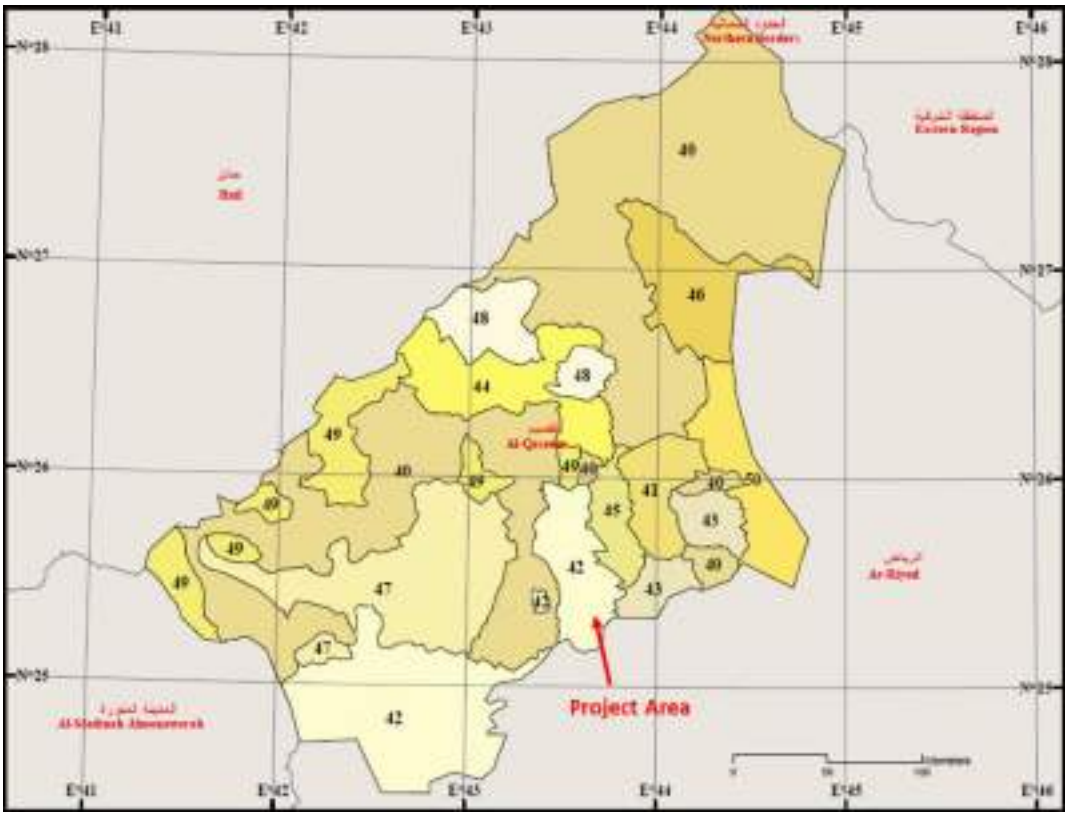

Figure 4-28 Proposed Project Site at Al Qassim Province

4.2.1 Population

The project is in Al Qassim Province of Saudi Arabia. The province covers an area of about 70.300 km², Buraidah City being the capital of province, Ar Rass is the third city of the Province and consider one of the largest cities in the province. According to Al Qassim province[10], the total population in Al Qassim is 1,016,756 (including Saudi and foreign nationalities). According to the population census of 2010 (1431 Hijri), the population of Ar Rass governorate is approximately 58,000 people. GAStat has developed distribution maps of the population in Saudi Arabia and for each province separately, Figure 4-29 shows the total population in the province and the density, in each governorate, while Figure 4-30 shows the distribution of males and females in each governorate.

[10] http://www.alqassim.gov.sa/Ar/ProvincesAndLocalities/Bereeda/Pages/default.aspx; accessed in April 2019

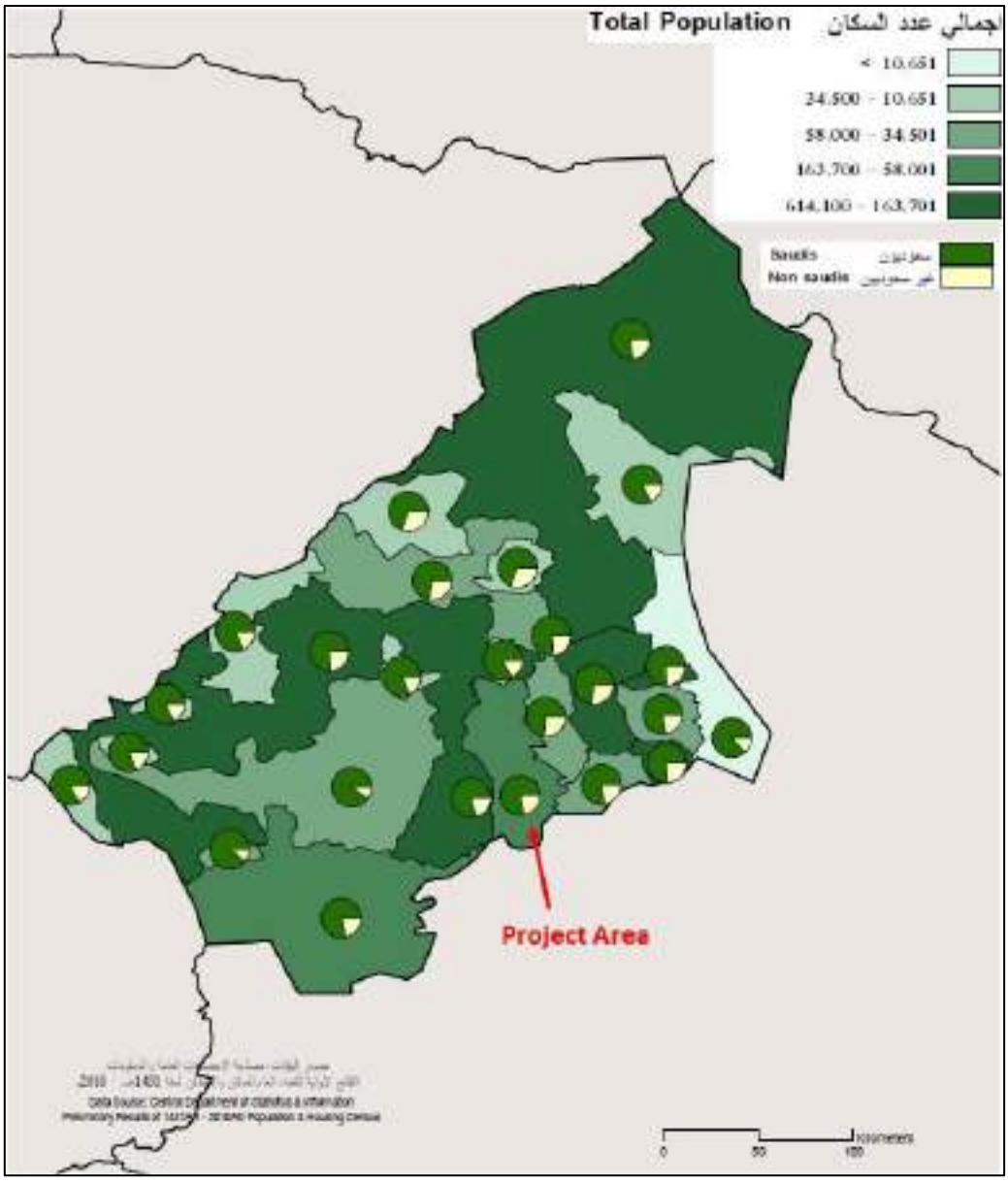

Figure 4-29 Total Population of Al Qassim Province by Governorate

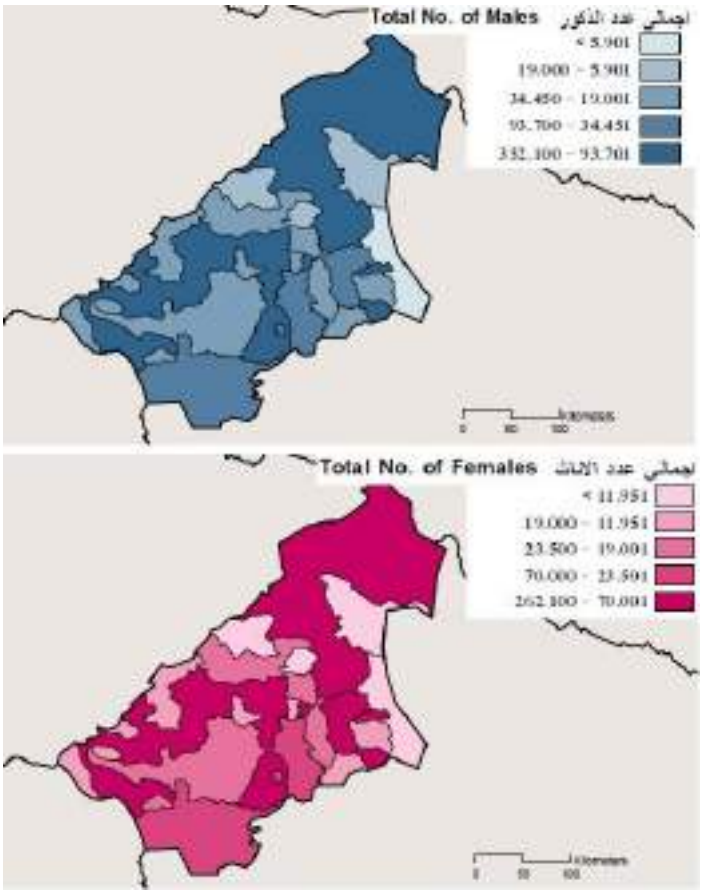

Figure 4-30 Total Population by Genders in Al Qassim Province by Governorate

4.2.2 Employment

According to the General Organization for Social Insurance (GOSI), Ministry of Civil Service (MCS), and Ministry of Labour and Social Development (MLSD), there are a total of 472,468 employees in Al Qassim province. Table 4-11 shows how this number is broken down by gender and nationality during the first quarter of 2018. These numbers exclude employees in the military, security sectors, and outside enterprises.

Table 4-11 Total Number of Employees by Gender and Nationality in Al Qassim province

Nationality	Gender	Employees No.	Total
Saudi	Male	71,179	114,069
	Female	42,890	
Non-Saudi	Male	348,716	358,399
	Female	9,683	
Total	Male	419,895	472,468
	Female	52,573	

Source: labour market report for 1Q/2018

4.2.3 Residential Areas

The Project is located within a low populated area within Al Qassim Province. The closest main city is Ar Rass which is about 24 km of the site. A substation is located approximately 25 km north of the site. Some agricultural activities located approximately 7 km to the south of the site and also at a distance of approximately 14 km to the east of the site were recorded during the site visit (Worley Preliminary Site Assessment Report, March 2019) in January 2019 (Figure 4-31).

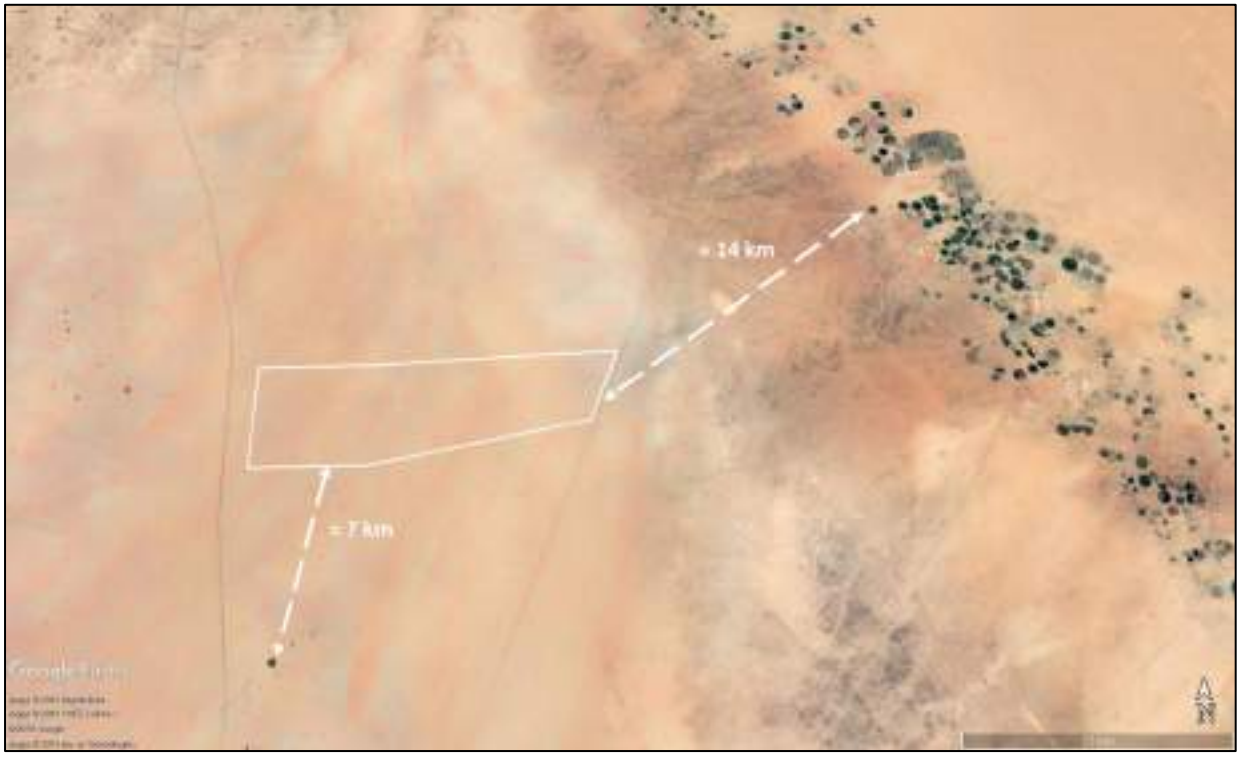

Figure 4-31 Agricultural Activities Locations (indicated in green colour)

4.2.4 Cultural and Archaeological Sites

Al Qassim province is home to a few culture heritage sites such as Al Shanana Tower, Al Bassam House, Al Musawkaf Traditional and Al Khobara Heritage; also, some museum exists in the province such as Buraydah Museum and Al Shamasiyah Heritage. However, according to the 2019 site visit findings, there are no known areas of archaeological value within the project footprint or immediate surrounding area; in general, the site is disturbed through human use, including vehicle movements. A walk over survey highlighted no evidence of archaeological or cultural heritage features within the site boundary or surrounding areas.

4.2.5 Transport Infrastructure

The site is accessible by highway 7399 which is single-lane in good condition and it runs parallel to east boundary of project site to Al Ahamadeya centre. Highway 411, which is a split double-lane national highway in good condition, runs parallel to the west of project site. The highway is less than 1 km west of the western border of the proposed site, and connects Ar Rass city with Al Bijadyah city, which is in Riyadh province. Figure 4-32 shows the drive from Prince Nayef bin Abdulaziz International Airport (formerly Al Qassim International Airport) to Ar Rass city requires about 1 hour by car. Another airport in the wider area of the proposed Project is Gassim, which is located at a distance of about 74 km to north.

In general, the drive from Ar Rass to the site requires about 20 minutes by car. There are a few informal roads crossing the site which are in reasonable conditions, but it will require more development due to a height level difference at the south of the proposed Project site and presence of two drainage across the site.

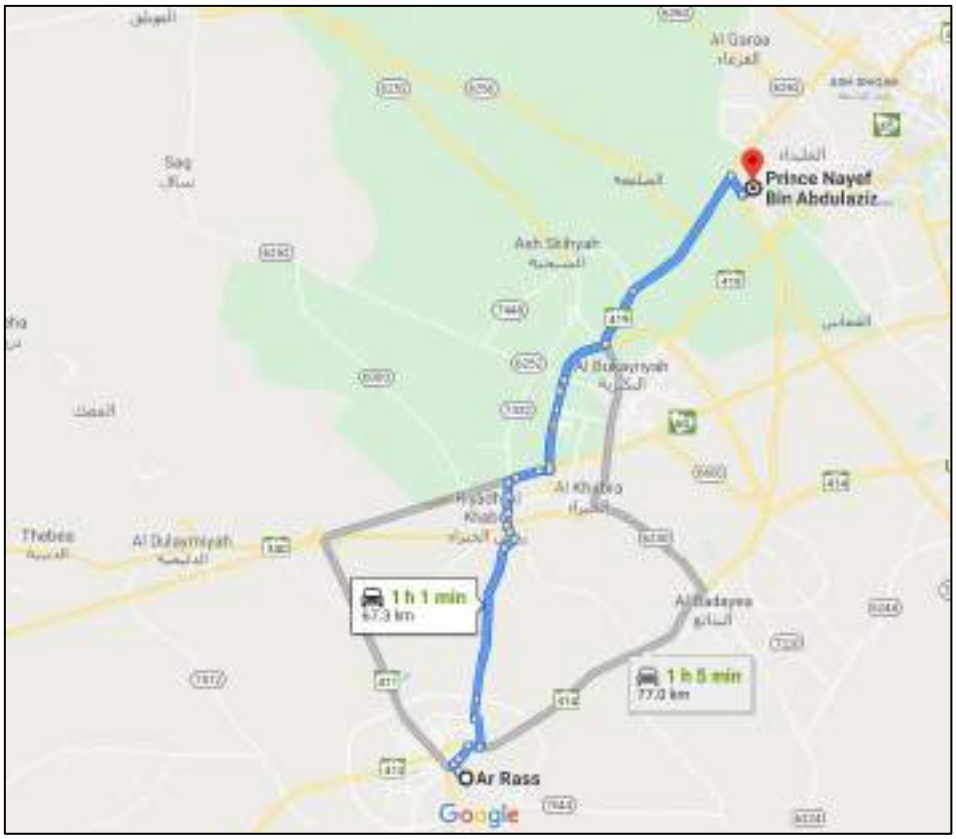

Figure 4-32 Distance from Airport to Ar Rass City

4.3 Existing Pressures

Current sources of noise at the Project site consist of:

- Natural sources of environmental noise (e.g. wind); and
- Man-made sources of noise inside the project boundary such as overhead power lines and vehicle operation.

Environmental noise outside the site boundary is caused mainly by vehicular traffic. The site is situated between Highway 411, which extends along the west boundary, and Highway 7399, which extends along east boundary; both highways serve medium-to-low traffic flow.

At present the Project site has two major drainages across the site both run from south to north (Figure 4-20). The eastern drainage serves a much larger area, with a cross section of up to 100 m and has shallow area channel. The western drainage area is more significant as it appears to drain large quantities of water through the site. It is characterized by a narrow and deep channel, it has approximately 10-20 m wide only and 2 m. deep. There are several smaller channels that protrude from the main western drainage that are narrower and shallower.

4.4 Overall Project Area Sensitivity

As detailed in the previous sections, there are no protected or sensitive areas located within 10 km of the Project area. Vegetation in the Project area is scattered, and one bird species was encountered during the site visit which is classified of Least Concern according to the IUCN. The Project is located within a low populated area within Al Qassim Province. The closet town to the Project site is Ar Rass which is about 24 km away. There are no known areas of archaeological value within the Project footprint or immediate surrounding area.

5. Suggested Alternatives and Potential Impacts

5.1 Suggested Alternatives

5.1.1 No Action Alternative

The “No-Action” alternative (not constructing the proposed Project) is not a feasible alternative, as it would lead to loss of investment and expected employment as well as power generation.

This project is part of the National Renewable Energy Program. The proposed Project development projected output of approximately 2,620 MW. This capacity corresponds to a power generation of up to 7,006 GWh per year. This output will power about 345,000 households and result in significantly reducing the emission of greenhouse gases by 7 million tons of $CO_{2equivalent}$.

Hence, carrying out the proposed project can importantly have high positive impacts to country. In simple words, the "no-action" alternative means the loss of opportunity for development and opportunity to contemplate power resources in Saudi Arabia.

5.1.2 Mounting System

The structure upon which the PV modules are mounted is a critical component in the proposed Project as it impacts on generation output and profile, as well as on capital and operational costs. For a fixed-tilt mounting system, the PV modules remain in a fixed position, typically tilted at an optimal angle, with the rows oriented in a West-East direction. For the same rated capacity, the annual generation is generally higher with a single-axis tracking system compared to fixed-tilt mounting and thus was selected for the proposed Project. Figure 5-1 shows mounting systems examples.

Fixed-tilt mounting system

Single-axis tracking system

Figure 5-1 Mounting Systems Examples

5.1.3 Panels Cleaning System

The solar PV modules are generally employed in dusty environments. The dust gets accumulated on the front surface of the module and blocks the incident light from the sun and consequently reduces the power generation capacity of the module. Two main cleaning systems are typically considered in similar projects, namely semi-automated and fully-automated. More details on each option are presented in Section 3.4.1.2. The semi-automated option is one of the commonly used cleaning alternatives (Sahar Bouaddi, et.al., 2018); however, the fully-automated alternative is more efficient in terms of water consumption and labour requirements. The preferred option will be determined prior to the initiation of the Project.

5.1.4 Solar Panel Type

There are different types of solar panels such as silicon based (Polycrystalline) and thin film. The key advantages of the polycrystalline solar panels include cost-effectiveness; whereas, the thin film panels perform well under high temperature. However, polycrystalline solar panels have higher durability than thin film panels. For the proposed Project, polycrystalline solar panels are selected.

5.2 Potential Impacts Assessment

The main objective of the ESIA is to examine, analyse and assess the planned project activities' effects on the baseline conditions described in Chapter 4. A detailed description of the proposed project activities and components is presented in Chapter 3.

An ESIA should assist in ensuring environmentally and socially sound management of the project during its entire lifetime (construction, operation, decommissioning).

The impact assessment process starts with a focusing procedure to identify the key environmental and social features from the baseline information detailed in Chapter 4 of this report. This focusing identifies the key biological, physical and human components of the proposed project area of influence. The potential positive and negative changes resulting from the defined project activities presented in Chapter 3 are then projected for the entire lifecycle of the project. These predicted changes (impacts) are then evaluated using a ''significance'' ranking process.

An outline of the impact assessment procedure is as follows:

- Identification of the Receptors/Valued Receptors (VRs)
- Identification of the key activities of the project
- Impact evaluation
- Significance ranking

Figure 5-2 shows an overview of the impact assessment process.

5.2.1 Identification of Significant Effects (Impacts)

The matrix below (Table 5-1) has been created to summarize the potential impacts resulting from the routine activities of the proposed Project. The sensitive receptors are listed in columns and the impact-generating project activities (environmental aspects) are shown in rows. Activities likely to generate an impact on the environment are identified and classified as negative (*Blue*) or positive (*Green*).

It should be noted that the purpose of the below table is to give a general overview of the link between the relevant Project activities and the potentially affected valued receptors and it does not indicate the magnitude / severity of the potential impacts. The detailed impact assessment during the different phases is presented in the relevant following sections (e.g. Section 5.2.4.1 etc.).

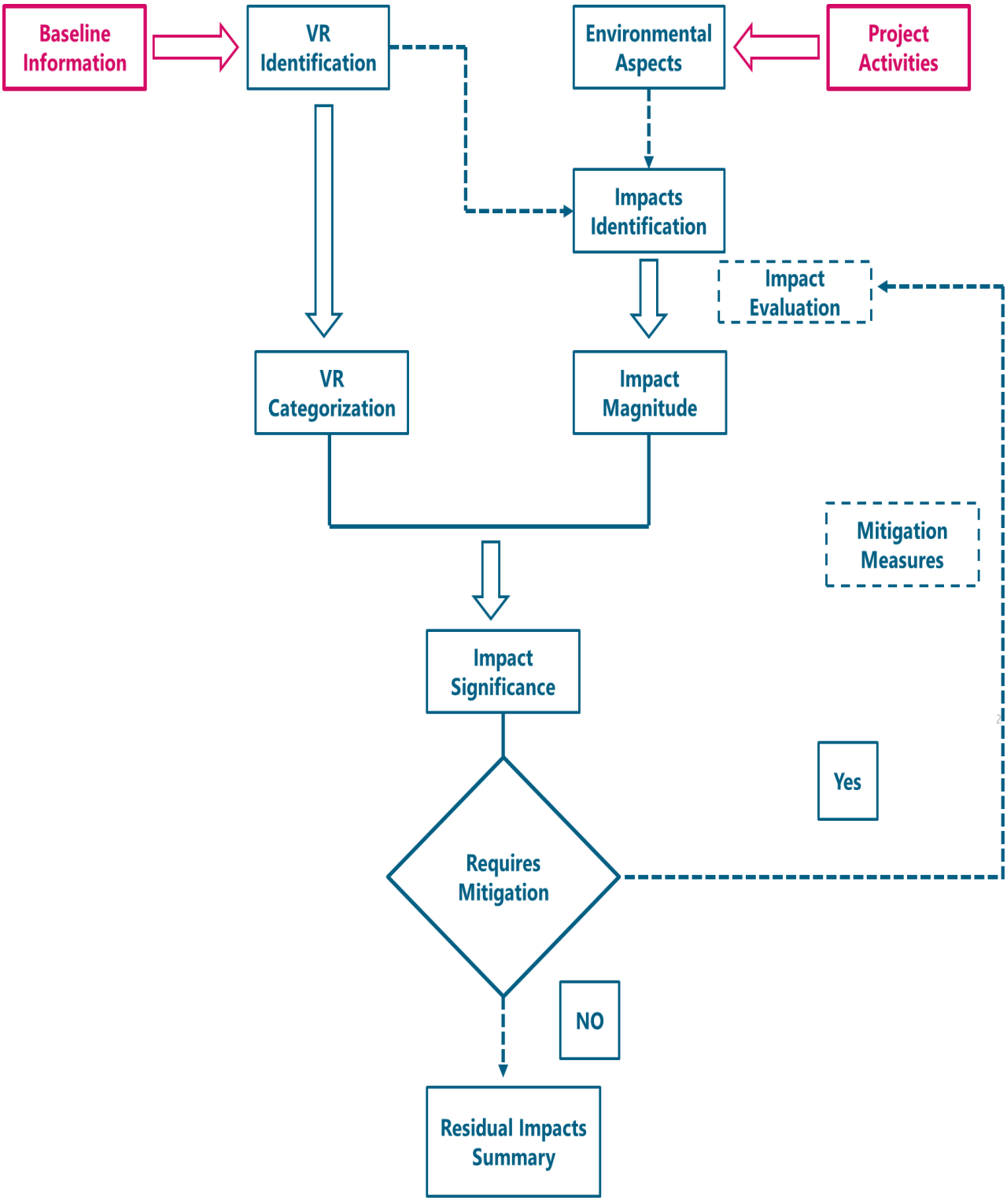

Figure 5-2 Impact Assessment Methodology Summary

Table 5-1 Impacts Identification Matrix

		Physical environment				Biotic environment			Socioeconomic environment			
PHASES	**Actions/Activities**	Climate and Air quality	Noise	Soil	Water Resources	Flora	Avifauna	Reptiles and Mammals	Population	Onsite workers	Economic activities & Infrastructures	Visual receptors
Construction	Purchase of supplies, services and job opportunities								√	√	√	
	Clearing and earthworks	√	√	√		√	√	√		√		
	Mobilization/demobilization (trucks, busses, construction vehicles, etc.)	√	√							√		
	Construction activities: foundations, civil construction, electrical, etc.	√	√							√	√	
Operation	Project presence											√
	Equipment operations		√	√	√				√	√		
	Purchase of supplies, services and job opportunities								√	√	√	
	Power generation	√							√			

Key:
Positive Impact √
Negative Impact √

5.2.2 Impact Evaluation Methodology

The methodology followed in this ESIA for the impact assessment is presented in the "European Union, EIA - Guidance on scoping, 2017". This methodology applies a multi-criteria analysis to evaluate impacts significance based on:

1. **Magnitude** of the predicted effect
2. **Sensitivity** of the receiving environment

The impacts magnitude considers the following characteristics which could affect the target receptor as a result of the proposed project:

Intensity and direction: Intensity describes the physical dimension of a development and direction specifies whether the impact is negative or positive. Depending on the type of impact, intensity can often be measured with various physical units and compared to reference values

Spatial extent (geographical area): Spatial extent describes the geographical reach of an impact area or the range within which an effect is observable

Duration (reversibility, timing, periodicity and regularity): Duration describes the length of time during which an impact is observable, and it also takes into account timing and periodicity

Impacts magnitude and sensitivity of the receiving environment are scaled according to the categories listed in Table 5-2 and Table 5-3 and are then weighted in the matrix of shown in

Table 5-4 to determine impacts significance category "High", "Moderate" or "Minor".

Table 5-2 Scale of sensitivity of the Receiving Environment

High	High importance and rarity, national scale, limited potential for substitution and low capacity to accommodate proposed form of change
Medium	Medium importance and rarity, national scale and limited potential for substitution. The receiving environment has some tolerance of the proposed change subject to design and mitigation
Low	Low or medium importance and rarity, local scale. The receiving environment is tolerant of the proposed change subject to design and mitigation

Table 5-3 Scale of Magnitude of the Impact

Major	Loss of resource and/or quality and integrity of resource over a significant area; Severe change/damage to key characteristics, features or elements for more than 2 years
Moderate	Loss of resource, but not adversely affecting the integrity over a significant area; Partial loss of/damage to key characteristics, features or elements, for more than 6 months but less than 2 years
Minor	Some measurable change in attributes, quality or vulnerability; Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements

Table 5-4 Impacts Significance

Impact Magnitude	Environmental Sensitivity		
	High	***Medium***	***Low***
Major	High	High	Moderate
Moderate	High	Moderate	Minor
Minor	Moderate	Minor	Negligible

For impacts of Moderate and High significance, technical, social, and/or institutional measures are proposed to mitigate anticipated changes and consequential impacts during project implementation and operation.

5.2.3 Environmental Sensitivity

Sensitivity is defined as the sensitivity of the receiving environment to change, including its capacity to accommodate the changes the project may bring about.

Sensitive receptors are defined herein as any component of the receiving environment or society that is considered important by the developer, operator, general public, or any non-governmental or governmental organisation involved in the assessment process. Importance is determined on the basis of cultural values and/or scientific and public concern. The sensitive receptors are selected depending on the identification of pathways linking important environmental components with the totality of the project's activities.

Each receptor is categorised in terms of its perceived environmental and social value, taking into account local, national or international designations and legal protection status, if appropriate. Based on these considerations, the receptors sensitivity is categorised as “Low”, “Medium” or “High”:

Based on the assessment of the environmental and social conditions in the study area, the sensitive receptors identified for this project are listed by category in Table 5-5.

Table 5-5 Importance and Sensitivity of Receptors

Category	Environmental Receptor	Importance	Sensitivity
Air and Climate	Air Quality	The site is in a desert area, far from main population centres (Ar Rass at 24 km). Good air quality is required for the health of population.	Low
	Global Climate	Contribution to global warming by GHG emissions.	Medium
Physical Environment	Land	Land use: the site will change from undeveloped to industrial area.	Low
	Soil	Soil Quality	Low

Category	Environmental Receptor	Importance	Sensitivity
	Groundwater	Groundwater table was not encountered at a depth of 10 m. Consequently, groundwater is not considered vulnerable to direct contamination trough infiltration from ground surface.	Low
Biological Environment	Flora	The area is characterized by a dry desert plain with scattered vegetation and seasonal streams and drainage channels forming part of the wadi system.	Low
	Avifauna	The only documented species during the site visit of the Project area is classified as Least Concern by the IUCN as detailed in Section 4.1.8.2.2; however, according to the Migratory Soaring Bird Sensitivity Mapping Tool, a small number of soaring bird records exist within the defined project area (plus a 20 km buffer area). In addition, the Project area is located along a migration route.	Medium
	Reptiles and Mammals	No reptile species was documented during the site visit of the Project area. No mammals were documented during the site visit as detailed in Section 4.1.8.2.1	Low
Socio-economic Environment	Population (local community members)	The closest populated area to the Project is area is at a distance of about 24 km (Ar Rass Town).	Low
	Population (Onsite workers)	Onsite workers will be present onsite during the construction and operation phase and consequently might be affected by some project activities	Low
	Visual receptors (road traffic and aviation)	Commuters on the roads/highway and aviation may be affected by glint and glare from the Project site.	Low
	Local economy	Potential purchasing activities are expected, especially during the construction phase	High
	Acoustic environment	Increasing the ambient noise levels and nuisance to population and effects on fauna	Low
	Electromagnetic emissions	Potential increase in electromagnetic emissions during the operation phase is expected	Low

5.2.4 Impacts Assessment

5.2.4.1 Assessment of Impacts during Construction

The potentially affected receptors include but not limited to air quality and biological environment. A summary of the impact assessment is presented in Table 5-10. More details are presented in the following sections.

5.2.4.1.1 Air Quality

Construction activities would involve a number of separate operations, including mobilization, land clearing (grubbing and vegetation removal), on-site burning of cleared biomass, topsoil stripping, cut-and-fill operations (i.e., earthmoving), ground excavation, foundation treatment, building/structure erection, electrical and mechanical installation, access road establishment, pipeline(s) laying and landscaping. Construction would, in large part, be divided into two phases: site preparation and construction. The site preparation phase would be of relatively short duration and would be followed by a much longer construction phase.

Major heavy equipment used in the site preparation would include chainsaws, chippers, dozers, scrapers, end loaders, trucks, cranes, equipment for blasting operations if required. The major equipment used in the construction phase would include cranes, end loaders, backhoes, dozers, trucks, and a temporary concrete batch plant if substantial amounts of concrete are needed and/or premixed concrete is unavailable from nearby vendors.

At present it is not known where the wastes will be transferred to or what route they will take or the number of trucks to be utilized for this purpose. However, such activities (wastes transport) will lead to additional exhaust gases emissions due to the waste transport trucks movements. Fugitive dust from soil disturbances and engine exhaust from heavy equipment and commuter/delivery/support vehicular traffic within and around the facility would contribute to air emissions of criteria pollutants, volatile organic compounds (VOCs), greenhouse gases (GHGs; e.g., CO_2), and small amounts of hazardous air pollutants (HAPs) (e.g., benzene). Typically, potential impacts of fugitive dust emissions on ambient air quality would be higher than those of engine exhaust emissions.

Soil disturbance during site preparation and access road establishment, which involves the intense use of heavy equipment over a short time period, has the greatest potential for air emissions and adverse air quality impacts (through the release of large amounts of fugitive dust). In addition, soil disturbance from heavy equipment used for access road construction and/or re-contouring of land results in a greater potential for emissions and adverse air quality impacts. Under unfavourable dispersion conditions, concentrations of PM_{10} or $PM_{2.5}$ could exceed the standards at the site boundaries. However, given the long distances to inhabited areas, construction activities would probably contribute minimally to concentrations of air pollutants at the nearest human receptors.

Fugitive dust emissions would be caused by site preparation, access road establishment, pipeline(s) laying, construction activities, and wind erosion and would cause unavoidable localized impacts. Construction activities would probably be limited to a portion of the site at any time. However, the large total area disturbed during construction could be exposed to wind erosion and dust resuspension. Stabilizing soils in an area at the completion of construction would reduce these emissions. However, given that stabilization is never fully effective and disturbed soils sometimes cannot be stabilized, wind erosion from disturbed areas could continue throughout the remainder of the construction period and beyond into the operation phase.

Impacts on air quality during construction are *Moderate*. Given the *Low* sensitivity of air as receptor, impacts on air quality during construction are **Minor**.

5.2.4.1.2 Soil

Construction of the proposed Project could result in significant impacts on soil over an area that may include but not necessarily limited to the sum of the footprints of all structures and related infrastructure (e.g., on-site roads, access road, pipeline(s), parking areas, and fencing). Soil-related impacts during construction may extend beyond the site boundary as a result of increased erosion by wind or water. Ground-disturbing activities would include vegetation clearing and grubbing; excavating for foundations, footings, and trenches for buried electrical connections and pipelines; pile driving (foundations); stockpiling excavated material for backfilling; drilling rock to set foundations and footings; grading for roads and staging and laydown areas. The construction of other facilities, such as the central control building, electrical substation, concrete batching plant, sanitary facilities and temporary offices, and an area for minor maintenance and storage of equipment and parts also would have the potential to result in adverse impacts on soil resources, because they involve some degree of ground disturbance.

Direct adverse impacts of construction activities relate mainly to the increased potential for soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff. Soil contamination could also result from the release of contaminants related to the use of machinery, from improper storage and handling, and from the application of chemical stabilizers to control fugitive dust emissions.

During construction works, cross contamination is the transfer of contaminated soils from one location to another, thereby exacerbating an eventually existing environmental problem through poor management. In addition, if contaminated soil is dispersed through dust generation as a result of construction activities like ground excavation, further spreading of contaminants will occur. Impacts to soil quality during construction may also result from limited leaks from the wastewater collection system for the sanitation facilities available at the worker accommodation camp.

Potential impacts on soil, a receptor of *Low* sensitivity, during the construction phase are considered of *Moderate* magnitude; hence the impact significance is assessed as **Minor**.

5.2.4.1.3 Biological Environment

Dust deposition during construction would increase due to movement of trucks, site excavation, access road establishment, pipeline(s) laying and all other construction works. Also, increased truck movement to the site is expected for fill material transportation. It is highly likely that most bird species will vacate the area for the duration of these activities. Scarce vegetation will be removed. In general, faunal and floral diversity is considered to be limited as noted in the site walk-over conducted in 2019 (Worley Preliminary Site Assessment Report, 2019).

The impact magnitude can be classified as *Moderate* and the effect of construction activities on flora, reptiles and mammals will be of **Minor** significance due to their *Low* sensitivity. *Medium* sensitivity of avifauna classifies significance of construction impacts on avifauna as **Moderate**.

5.2.4.1.4 Impacts on the Human Environment

Visual Impacts

Construction activities will cause noise and disruptions from vehicles and machinery. These activities will alter the existing land use patterns on the site from currently vacant to construction related activities which have a visual impact. The construction phase will result in a total transformation from the current setting and landscape of the proposed sites. It is inevitable that visual impact during construction will occur from dust, etc. Potential visual impacts caused by construction activities will include the visual changes caused by clearance of vegetation, ancillary buildings and laydown areas; visual disturbance caused by construction of roads, buildings, energy collectors, increased traffic (and number of large vehicles), worker presence, and dust emissions.

No permanent residents are present within several kilometres from the site and consequently the most concerned viewers are commuters on the adjacent roads; their sensitivity is rated as **Low** and the visual impacts during construction are considered of **Minor** significance.

Acoustic Environment

Construction activities likely to take place on the site will include the following:

- Site preparation - Site preparation may involve back-filling, levelling and grading and the removal of made ground in areas where foundations are to be installed. It is assumed that these activities will require the use of dozers, excavators and lorries
- Construction and Installation - This phase of works is assumed to involve the casting of reinforced concrete slabs 'in-situ', block work, steel/scaffold erection and the installation of plant etc. It is assumed that these works will require the use of concrete truck mixers, compressors, generators, heavy lifting equipment (including cranes) and hand tools
- Drainage and road paving - This stage of the works will comprise of several operations that will likely include excavation for and laying of drainage pipes and road surfacing

Acoustic pollution concerns undesirable sounds that usually are undesirable because they happen at an inappropriate place, at an inappropriate time. As an environmental disturbance, the noise is undesirable because it mingles with the speech and the hearing or it is so loud that could damage the hearing. In detail, noise is defined as a sound that is undesirable due to its impacts to human, and to constructions, to which it could cause fatigue or other disorder, and because it could inhibit the perception and understanding of other sounds (McGraw-Hill, Dictionary of Scientific and Technical Terms, 1984).

Sound consists of mechanical energy that is transferred by vibrating bodies under the form of condensing and thinning-out of the molecules of gas, liquid and solid materials. The frequency of the sound is equal to the number of these condensing and thinning-out movements, which occur within a time unit, and is calculated in Hertz (Hz).

Normally, the measurement of the noise is based on the pressure caused by the movement of the acoustic waves on the air. This pressure varies between 20 $\mu N/m^2$ (minimum value) and 100 $\mu N/m^2$ (feeling of pain). For practical reasons, the measurement of noise is made in decibel (relative scale). One decibel (db) is defined as ten times the decimal logarithm of the quotient of the square of the measured pressure (P1) to the square of the reference pressure (Po), as follows:

$$db=10*\log (P1/Po^2)$$

The introduction of db converts the above-mentioned scale of pressures, to a scale of 0-134 db (Tsochos, Environmental road construction, chapter 8). The higher noise level that could be transferred by the atmospheric air is 194 dB (Anastasakis, 1989). For the best representation of all frequencies that the human ear could hear, instead of the simple dB unit, the so-called A-weighted unit is measured. This unit is expressed in dBA and equals to the balanced average of the low, medium and high frequencies. For a better understanding of this scale, some standard values in dBA are presented in Table 5-6 below. In this table, equivalent acoustic pressure values are selected.

Table 5-6 Indicative noise levels in db(A)

Activity	db(A)
Audibility threshold	0
Leaf rustle, breath	10
Whisper	20
Quiet rural area (night)	30
Very quiet room (library)	40
Quiet urban area (day)	50
Normal talking	60
Vacuum cleaner, television, road traffic at 30m	70
Car at 6m	74
Washing machine, standard factory, small truck at 6m	80

Activity	db(A)
Subway at 6m	90
Loud motorcycle at 6m	110
Power saw	120
Jet aircraft at 6m	140

The noise sources are distinguished into:

- Point sources
- Line sources
- Area sources

The main source of noise during construction of the project is the operation of the work-sites. The noise level during construction phase of a project is affected by:

- The type of works (excavation etc.)
- The size and number of machinery and equipment
- The moving speed of the machinery
- Local conditions, as the topography, the distance from access roads, etc.

Even though significant improvements have been achieved during the last years, towards minimization of noise production at source (the work-site machinery), noise pollution from construction-sites still remains a possible issue, concerning mainly neighbouring settlements.

The methodology for the estimation of noise level during the operation of the work-sites of the suggested project is based on the British standard «British Standard BS 5228 Volume 1: Control of noise during construction at outdoor sites», which refers to the necessity of protection to the people that live and work near work-sites. The specifications define a calculation frame for the noise produced at work-sites and include a guide for the noise level data L_{wa} and L_{Aeq} at 10 m from standard work-site machinery.

The methodology for the estimation of noise is based upon the following data:

- Source characteristics
  - Level of acoustic energy, Lw
  - Acoustic level equivalent on energy terns to the time-frame, thus Lax=Leq+10 logT
- Propagation
- Diffraction

The decrease of sound due to the sound diffraction by obstacles (dykes, piles of material etc.) is very difficult to calculate in advance at a work-site, because the location of deposition of material or the position of machinery etc., are not known a priori.

- Meteorological conditions

The absorption of sound by the atmosphere is significant for sources of low frequency and for distances larger than 50-100m. The direction and force of the wind, the temperature and the humidity of the atmosphere could cause diversion of the acoustic level up to 20 dB(A).

- Type of soil

The decrease of sound depends on the type of soil (road paving, cultivated earth etc.) and is estimated by the empirical models of Delany and Bazley. The noise estimation methodology, according to the British specifications, depends on the type of source (steady source, moving source inside the work-site, moving source at a large distance and at a defined path).

For the present case, it is considered that the operation of the work-sites constitutes a steady noise source, consisting of the sum of noises produced by the work-site machinery. The admission that the operation of a work-site constitutes a steady noise source results from the fact that the sites of interest for the estimation of the noise level equivalent (settlements) are situated at a long distance from the work-site. The worst-case scenario is considered, which includes the operation of all work-site machinery at the same time, as presented below:

Estimation of the noise level during construction of the project

At the present stage, the composition of the work-site of the project is not yet known. Thus, an accurate calculation of the noise level during construction cannot be accurately calculated. However, an approximating estimation of the expected noise level, based on a standard work-site composition for similar projects, could be assessed. The L_{db}(A) operation level of a hypothetical construction site scenario, according to British specifications BS5228 ''Code of practice for noise and vibration control on construction and open sites'', was estimated and is presented below in Table 5-7.

Table 5-7 Hypothetical composition of machinery for the estimation of noise

	Average Scenario
Muffed air-compressor 7 m^3/min with 2 pneumatic drills 14 kg	1
loader 50 KW	2
dozer 109 KW with average moving speed 10 km/h	1
dump tracks 35 t during loading with engines in hold or with moving speed 5-10 km/h inside work-site	2
track excavator 45 KW	1

For the estimation of noise, the worse-case scenario is considered, which includes simultaneous operation of all machinery, the presence of a truck inside the work-site and operation of one out of the two existing loaders at the same time. The noise levels from operation of the above machinery are presented in Table 5-8 below.

Table 5-8 Noise Level of Work-site Machinery

	Laeq, dB(A) at 10 m
Air-compressor with 2 drills	72
Track excavator	80
Loader 50 KW	104
Dump truck 35 t	106
dozer 109 KW	113

Considering the above data an applying BS228 guidelines, result in the following equivalent noise levels, proportionally to the distance from the work-site (Table 5-9).

Table 5-9 Equivalent Noise levels and distance from the work-site, according to BS 5228 standard

Distance from work-site (m)	Noise estimation db(A)
20	77.203
40	71.18
80	65.16
100	63.23
150	59.70
200	57.20
250	55.27
300	53.68
350	52.34
400	51.18
450	50.16
500	49.25
600	47.66

The estimated noise levels, per distance from the border of the work-site, are also presented below in Figure 5-3. The above estimations constitute a worst-case scenario of noise estimation, because the sound decrease due to diffraction caused by the vegetation and the topography (altitude difference between the source and the receiver), are not taken into consideration. The U.S. Environmental Protection Agency (U.S. EPA) has compiled data regarding the noise generating characteristics of specific types of construction equipment. Noise levels generated by heavy construction equipment at a distance of 50 feet can range from 60 dBA for a small tractor up to 100 dBA for rock breakers. According to the GAMEP standard, the combined noise effect at the facility fence from noise sources during construction may not at any time exceed 80 dB(A).

Where, through the EIA process for a project, it has been predicted that the GAMEP construction noise limits are likely to be breached, a construction noise permit is required.

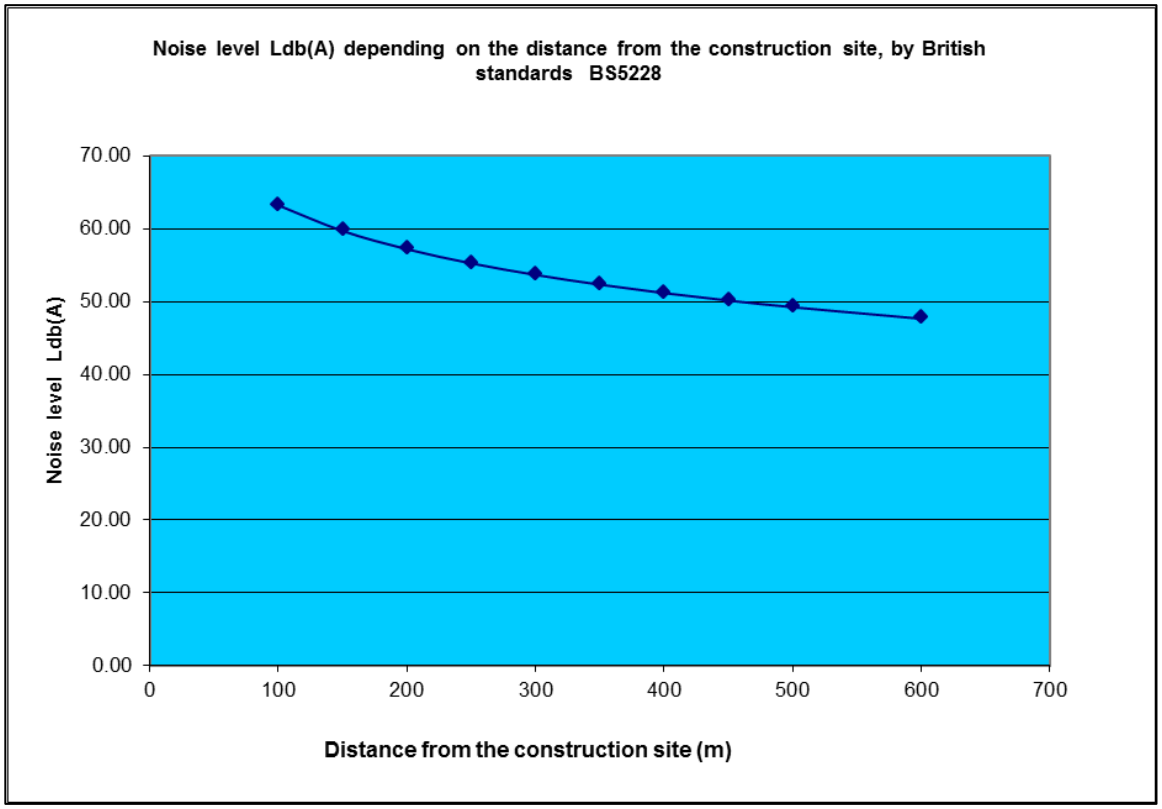

Figure 5-3 Noise level estimation at work-site, in relation with the distance, according to the BS5228 standard

As demonstrated above with regards to the ambient noise levels, since noise is attenuated by distance and no human settlements are present within several km from the site perimeter, the construction activities on site are unlikely to affect the offsite ambient noise levels significantly especially considering that they fall under the limit of 80db at a very close distance. Based on the *Low* sensitivity of the acoustic environment and the assumed *Moderate* impact magnitude, significance of noise impacts during construction is **Minor**.

Socio-economic Impacts

As indicated in the previous sections, during the construction phase, there will be a number of machinery and heavy equipment operating at the site which will increase the noise level in the Project area and impact the surrounding population, both public (if present) and onsite workers. Increased traffic and ambient noise levels are expected during these activities. Furthermore, air quality might be reduced during this phase of the Project due to dust and gaseous emissions generation. The following are the main impacts expected to result from the generation of air emissions in general:

- nuisance and disturbance
- loss of visual amenity through deposition
- impacts on the health of onsite workers (i.e. increase in allergies, respiratory stress)

The impact is expected to be of **Minor** significance on the onsite workers and **Negligible** on the local community members, if present during the construction phase.

The primary economic impact during construction is likely to result from local employment creation and the use of local businesses/services during this phase. Given the significant unemployment levels within Saudi Arabia, any creation of jobs is likely to be welcomed and is a net **Positive** social impact. As well as the direct monetary uplift to the families of those employed, money paid to local workers will also stimulate the local economy via the multiplier effect, whereby money earned on the project expended locally will re-circulate within the local economy.

Supplies of goods, food and some materials from local suppliers could be a benefit for local communities and should be maximized. A further secondary impact is likely to arise from spending on local goods during the construction process. This will result in a **Positive** impact upon the local economy.

Table 5-10 Impact Assessment – Construction Phase (Before Mitigation)

VR	Receptors Sensitivity	Magnitude	Impact Significance
Air quality	Low	Moderate	**Minor**
Soil	Low	Moderate	**Minor**
Flora	Low	Moderate	**Minor**
Avifauna	Medium	Moderate	**Moderate**
Reptiles and Mammals	Low	Moderate	**Minor**
Commuters	Low	Minor	**Minor**
Acoustic environment	Low	Moderate	**Minor**
Population (onsite workers)	Low	Moderate	**Minor**
Population (local community members)	Low	Minor	**Negligible**
Local economy	**Positive**		

5.2.4.2 Assessment of impacts during Operation

The potentially affected receptors include but not limited to climate and biological environment. A summary of the impact assessment is presented in Table 5-13. More details are presented in the following sections.

5.2.4.2.1 Climate and Air Quality

There are no air emissions expected during operation. The impact of the project operation to air quality will be Positive as presented below.

CO_2 reduction

Being a renewable energy generation project, the planned Project has a **Positive** effect on the environment as it contributes to reduce climate change compared to the case in which the same amount of electricity would be produced through conventional power generation methods based on combustion of fossil fuels. The expected CO_2 greenhouse gases reduction is estimated to be approximately 7 million tons.

Sulphur hexafluoride (SF_6)

The substation at the Project will be SF_6 - insulated. In 1997, the Kyoto Protocol (Global Warming Treaty) listed SF_6 as one of the six greenhouse gases that should be controlled by reducing emission or eliminating use. For high voltage switchgear (circuit breakers and gas insulated substation) there are no practical substitutes, so continued use is necessary for the near future. SF_6 gas has the highest global warming potential, 23,900 times that of CO_2; in other words, 1 kg of SF_6 vented into the atmosphere corresponds to roughly 24 tonnes of CO_2. It is also very persistent in the atmosphere, with a lifetime of 3,200 years. The U.S. Environmental Protection Agency (EPA) requires that owners and operators of electric power transmission and distribution equipment report emissions of SF_6 and/or perfluorocarbons (PFC) for systems that have a total nameplate capacity exceeding 17,820 lbs. (7,838 kg) of those gases.

The SF_6 gas systems at the Project will comprise several sealed gas compartments and are designed to avoid in as much as possible SF_6 leaks during normal operation. The SF_6 amount contained in these pieces of equipment is not specified but is assumed to be less than 50 kg per piece, which is typical for modern circuit breakers.

Even during normal operation, SF_6 emissions can't be completely ruled out. Studies on SF_6 from circuit breakers in the U.S. report SF_6 losses in the range of 0.5 – 2 % per year; given the operating conditions at Ar Rass area (hot, desert climate), routine SF_6 losses are expected rather at the higher limit of this range, amounting to about 11 kg SF_6 routinely emitted per year (equiv. 263 t CO_2/year), or a total of 275 kg SF_6 lost to the atmosphere during 25 years of operation. SF6 losses during routine operation must be compensated by refilling from pressure containers.

Potential sources of SF_6 emissions occur from: 1) losses through poor gas handling practices during equipment installation and maintenance; and 2) leakage from SF_6-containing equipment. The operation and maintenance of SF_6 gas carts which are used to remove, store, clean, and re-fill SF_6 gas to high-voltage equipment are a major source of handling-related losses. Equipment leakage, on the other hand, is the result of the deterioration of SF_6-containing equipment fittings and materials with time and use through chemical, hardening, and corrosion effects. In general, the SF_6 gas carts operation and maintenance activities will be carefully planned and executed; furthermore, leak detection devices will be installed as needed and immediately handle the source of leakage in an appropriate manner. As a result the impact magnitude of SF_6 releases during operation is considered *Minor*. Given the *Medium* sensitivity of climate as a receptor, the impact significance of routine SF_6 releases is **Minor**.

Heat-island Effect

A growing concern that remains understudied is whether or not PV installations cause a "heat island". Large PV power plants induce a landscape change that reduces albedo so that the modified landscape is darker and, therefore, less reflective. Lowering the terrestrial albedo from ~20% in natural deserts to ~5% over PV panels alters the energy balance of absorption, storage, and release of short- and longwave radiation. A PV heat island effect would be the result of a detectable increase in sensible heat flux (atmospheric warming) resulting from an alteration in the balance of incoming and outgoing energy fluxes due to landscape transformation. Due to modified albedo, the solar arrays influence local and regional wind patterns and boundary layer height.

The magnitude of these effects is hard to predict and could only be assessed trough monitoring once the Project becomes operational, combined with a fully coupled regional climate model to investigate feedbacks between surface albedo changes, surface temperature, precipitation and average cloud cover.

5.2.4.2.2 Soil

Similar as during construction, direct adverse impacts on soils during operation may include soil erosion and deposition by wind, soil erosion by water and surface runoff. Potential impacts on soil, a receptor of *Low* sensitivity, during the operation phase are considered of *Minor* magnitude; hence the impact significance is assessed as **Negligible**.

5.2.4.2.3 Groundwater

During operation, the PV panels will have to be routinely cleaned. This would generally be done with high-pressure water sprayed from trucks during evening hours. From typical consumption data from similar plants, it seems that, if the spraying system is operating correctly, most water sprayed on the mirrors would probably evaporate quickly before reaching the ground. A well designed and optimally functioning panels cleaning system which consumes minimum water quantities is essential. Given the depth of the groundwater table of at more than 10 m, it is assumed that no significant amounts of panels wash water will infiltrate and reach the groundwater. The significance of the potential impact of panels wash water on groundwater is considered **Negligible**.

5.2.4.2.4 Biological Environment

The impact on plant and animal life is a major hurdle for permitting the construction of solar power plants. Solar projects in the United States generate controversy regarding their disruption to wildlife and habitat, and environmental impact statements have estimated impacts to wildlife that require extensive mitigation efforts. Large areas of desert land in certain areas in the United States such as California may be excluded from solar energy development due partly to concerns for wildlife.

Very few measurements of ecological impacts, or mitigation efforts, from large-scale solar projects are published. Impacts on wildlife are difficult to assess in absence of a detailed ecological site survey.

The impact to wildlife will be correlated to the biodiversity (species density) of the land on which the power plant is built. The loss of habitat and habitat fragmentation are potential negative direct impacts.

The light at the solar power plant may attract multiple insect species. The increased presence of insects may lead to the attraction of insectivorous birds and bats and land-based predators that feed on them if they were fatally injured. In this way, solar plants may behave like ecological traps especially for insects and birds. However, this effect is less significant at facilities employing PV panels, such as the proposed Project, compared to solar thermal facilities.

The full spectrum of impacts of solar facilities on birds is only now starting to emerge from compliance reports at solar facilities. These can be summarized as follows:

- Collisions with the PV panels
- Permanent displacement due to habitat transformation
- Collisions with the associated power lines resulting in mortality

It is hard to tell how significant the impact on birds' moving along the migration route will be. Collision with PV panels is a relatively low risk as long as these are absorbing light and are not mistaken by birds for the sky or a water body. It is hard to tell whether this will actually happen until post-construction monitoring reveals actual birds' mortality at the site. Some species of birds may collide with panels because they are attracted to shaded areas, particularly if panels are located in previously undisturbed areas as is the case of the Project.

The most affected candidates by collision mortality on the power lines are medium to large terrestrial species (birds).

Overall, the impacts of the proposed Project operation will be low compared to other anthropogenic sources of bird and insect fatality.

In addition, the use of non-organic herbicides and pesticides for landscaping may be toxic to birds and also impact on the local vegetation if present, thereby increasing the secondary poisoning of non-targeted species.

The impacts on biodiversity during operation will be persistent for two and a half decades; however, since it is expected that, as time will pass, some adaptation of species to the presence of the Project and operational noise would occur, so that the initial impacts magnitude would decrease with increasing operation time and could be considered overall Moderate. Impacts significance will depend on receptors sensitivity: it will be **Moderate** for avifauna and **Minor** for species of lower sensitivity such as reptiles and mammals.

5.2.4.2.5 Impacts on Human Environment

Visual Impacts

This section discusses visual impacts on human receptors. Impacts on avifauna are discussed in Section 5.2.4.2.4. The large size, strong regular geometry of solar facilities, and the use of glass panels with metal supporting structures, may result in high visual contrast that is visible for long distances in many instances. The appearance varies substantially, depending on the horizontal and vertical viewing angle and distance as well as on the time of the day, and it may change dramatically as the observer moves or as even short time elapsed.

In favourable, but not uncommon viewing conditions, the large facilities observed in other studies at sites with similar geomorphology as the Project were easily visible at distances of tens of km. When viewed from long distances, the facility may not be recognizable as solar facilities. Depending on the projects' layouts and contrast, in some cases they may appear to be natural features (e.g. large bodies of water). Furthermore, the presence of the overhead transmission lines may be considered as intruding on the view of a landscape.

Human receptors with respect to visual impacts from the Project are:

- Civil and military aviation
- Residents

Since the closest airports are very far from the Project site (in the range of 70 km and more), no regular low altitude flights (as e.g. during take-off and landing) are taking place over the site area, so the visual impact on aviation is considered to be limited. Impacts may be more significant for low altitude occasional flights such as those for entertainment, emergency air transport (e.g. airborne traffic monitoring, rescue flights, etc.) when reflexion on the panels in form of glare may be observed from the cockpit. However, the panels are expected to have very low reflection and this impact is considered of **Minor** significance.

Impact on road commutes is expected to be of relatively *Moderate* magnitude due to the relatively low height of solar PV panels and associated infrastructure and the relatively low reflectivity; due to the *Low* receptors' sensitivity, this impact is considered of **Minor** significance.

The visual impacts of the facility including eventual glint and glare should be re-assessed and mitigation measures be refined by the EPC based on final design as well as after start of operation.

Electromagnetic Interference

An often-neglected aspect t of PV interaction is electromagnetic interference (EMI). Typically, this refers to mean radiofrequency (RF) emissions, emanating from PV systems, which can impact nearby radio receivers. This can also include any blocking or attenuation of nearby radar or communications by the PV system.

Although the risk of EMI from PV systems is typically very low, it does merit evaluation, if only to improve the confidence of site owners and other stakeholders. This particularly is the case for a solar park of the size of the proposed Project which will cover a very large area and will employ 1048 inverters.

Grid-connected or grid-tied systems must meet utility power quality requirements. Large PV plants are generally exempt from Electromagnetic Compatibility (EMC) standards, but their internal control systems and inverters must meet industrial EMC standards in order to provide adequate operating reliability. Inverters employ high-power switching circuitry, which can generate radiated and conducted interference unless adequately shielded and filtered. Other pieces of PV systems equipment, such as step-up transformers, are not a source of electromagnetic interference because of their low-frequency (60 Hz) operation.

The International Electrotechnical Commission's (IEC) Technical Committee 82 prepares International Standards for systems of PV conversion of solar energy into electrical energy and for all the elements in the entire PV energy system. In this context, the concept "PV energy system" includes the entire field from light input to a solar cell to, and including, the interface with the electrical system(s) to which energy is supplied.

CISPR 22 is a widely used standard for electromagnetic compatibility within Europe for Information Technology Equipment, ITE. CISPR 22 is maintained by CISPR: International Special Committee on Radio Interference. The Federal Communications Commission (FCC) CFR Title 47, Part 15 regulates RF emissions from commercial products. Compliance with Part 15 is not a requirement for large-scale power generation equipment, but many PV inverter manufacturers do qualify their residential or utility scale equipment to this standard and it is easily validated when procuring equipment.

A review conducted by the US National Renewable Energy laboratory (NREL) on behalf of NFEC showed that several case studies have indicated that EMI from PV installations are low risk. Research and field investigations of electromagnetic emission (EME) from Solar PV arrays concluded that they produce extremely low frequency EME similar to electrical appliances and wiring. At a distance of 150 feet from the inverters, EM fields dropped back to very low levels of 0.5 mG or less, and in many cases to much less than background levels (<0.2 mG).

To illustrate the relative emissions for FCC-compliant equipment, the following plot shows field strength vs. distance for a transmitting cell phone, and the maximum output of a FCC-compliant inverter (Figure 5-4). Comparing the field strength of both devices, the maximum expected field strength for a compliant inverter at a distance of 100 feet is comparable to the field strength of a cell phone a mile away. This is likely to be indistinguishable from background noise.

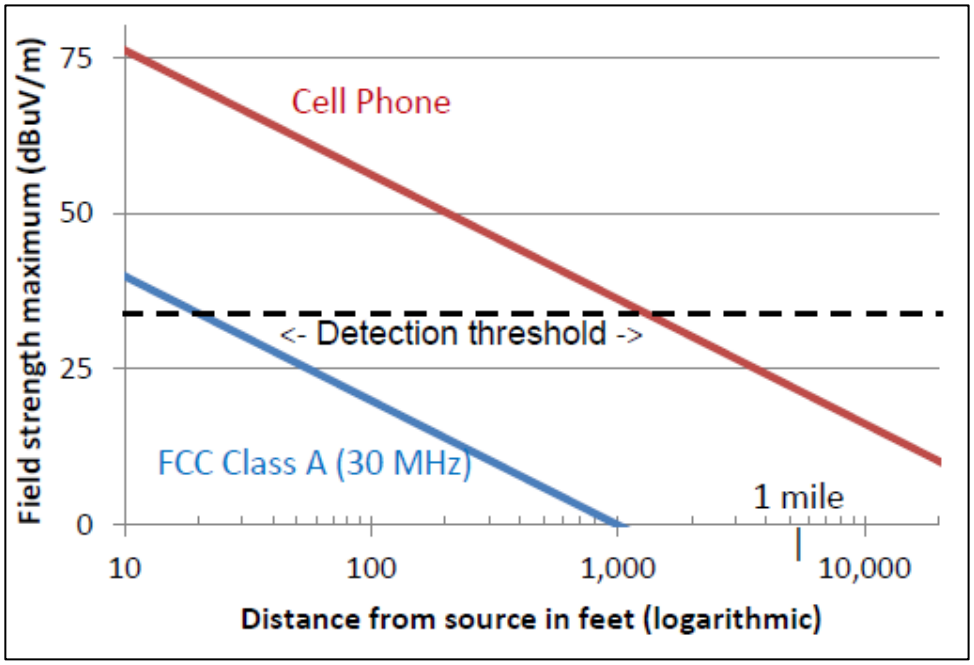

Figure 5-4 Measured transmit signal power (logarithmic dBuV/m) for a typical cell phone (red) and maximum allowed FCC class 'A' emission at 30 MHz (Source:NREL)

In some cases where PV systems were deployed near existing radar equipment, a setback distance of 250–500 feet were implemented to minimize the physical blocking or reflection of the radar signals by the PV system. A similar 250-foot setback near any other critical communication equipment could be considered in order to attenuate any low-frequency emitted radiation that may be produced by the PV system. With diligent procurement and siting of PV systems, including specifications for FCC Part 15 Class A compliant equipment and a 250-foot setback from communication equipment, NREL anticipates little to no EMI impact on nearby communications or telemetry equipment. The Sunny Central 2500-EV manufactured by SMA was selected as basis of design for the proposed Project. The data sheet for a similar inverter type from this series (2200 US) is included in Appendix E. It should be noted that these specifications are used only for guidance for the purpose of impacts assessment. The final specifications of the inverters are to be determined at a later stage of the project. The datasheet mentions "EMC standards", classification "EN 55011:2011-4, IEC / EN 61000-6-2, EN 55022, CISPR 22:2008 modified class A, FCC Part 15 Class A".

At the planned Project, assuming that the 120 inverters are evenly distributed over the area of each 300 MW SGU, 48 inverters are evenly distributed over the area of the 120 MW SGU and 280 inverters are evenly distributed over the area of the 700 MW SGU, it follows that the area allocated to one inverter varies from 47,676.0 to 55,128.7 m^2 (Table 5-11), and the distance between neighbouring inverters will be approx. 246.4 to 264.92 m. This is greater than 250 ft (approx. 76 m) mentioned above, i.e. a safe distance at which the EM emissions from inverters are attenuated below background. This means that for an even arrangement of the inverters over the SGU areas, there is no cumulative effect of EM emissions from neighbouring inverters.

Table 5-11 SGUs Areas and Areas allocated for One Inverter

Solar Generation Unit	Area (m^2)	Area per inverter (m^2)	Equivalent Radius (m)
SGU-1	1,3349,278.5	47,676.0	123.2
SGU-2	5,722,139.0	47,684.5	123.2
SGU-3	6,099,447.2	50,828.7	127.2
SGU-4	6,099,447.2	50,828.7	127.2
SGU-5	6,554,606.1	54,621.7	131.85
SGU-6	5,838,508.4	48,654.2	124.44
SGU-7	6,1363,97.0	51,136.6	127.58
SGU-8	2,646,180.4	55,128.7	132.46

Given the above considerations, if FCC Part 15 Class A classification is confirmed and the inverters are located at not less than 250 ft from each other, the impact magnitude of electromagnetic emissions from the site can be considered *Minor*.

The site is at a remote location with nearest human receptors at several km distance. No airports are present within 30 km radius and no radar communication facilities are known to be present.

Following these considerations**,** as long as the proposed Project is using FCC Part 15 Class A equipment (or equivalent), the environmental sensitivity to EM emissions is *Low* and the resulting impact significance is **Negligible**.

Acoustic Environment

The Project will consist of eight independent Solar Generating Units (SGUs). One SGU will have a capacity of 700 MW, six SGUs will have a capacity of 300 MW and one SGU will have a capacity of 120 MW. Each SGU will have a dedicated 33/132kV step-up substation (SGUS) that will connect to a central 132/380kV Switching Substation (SS).

Furthermore, the Project will also include transmission lines which may produce sizzles sounds that occur during periods of high humidity. Though this noise is audible to those very close to the transmission lines, it quickly dissipates with distance and is easily drowned out by typical background noises and thus not considered as a significant noise source. Another potential noise source is the water treatment plant that might be utilized for panels cleaning water treatment. However, the need for the water treatment plant is yet to be determined at a later stage of the Project and thus the specifications of the treatment plant is not available at this stage and consequently not further assessed in this study.

An overview of the main noise sources and estimated levels on the Project site during operation is given in Table 5-12. It should be noted that only sources in the vicinity of the Northern fence have been considered in the noise estimates due to their close proximity to the fence. Noise levels are estimated at the perimeter fence, where the maximum permitted noise levels for industrial sites in Table 2-7 should apply. The locations of noise sources and distances to the nearest perimeter fence are shown on the drawings in Appendix C. Maximum noise levels of the HV transformers according to E.ON Elnät Sverige AB[11] are equal to 82 dB(A) for 33/132kV 120 MVA, respectively 84 dB(A) for 33/132kV 175 MVA.

Table 5-12 Noise Levels Estimation from Noise Emitting Equipment During Operation

Equipment	Location	Approx. distance from the façade to the nearest perimeter fence (m)	Estimated combined sound pressure at the source (dB(A))	Estimated combined sound pressure at the nearest fence (dB(A))
Transformers				
Five (5) HV step-up transformers 33/132kV 175MVA	SUS-1	140 (to the north)	89	43
Two (2) HV step-up transformers 33/132kV 175MVA	SUS-4	750 (to the north)	85	27.5
Two (2) HV step-up transformers 33/132kV 175MVA	SUS-6	180 (to the north)	85	39.9
One (1) HV step-up transformers 33/132kV 120MVA	SUS-8	180 (to the north)	82	36.9
Inverters				

[11] E.ON Elnät Sverige AB: Technical Requirements for Power Transformers. Standard Operating Procedures. NUT-091103-027/ D10-0015669/11.0 valid from 2017-06-07. Table 13, page 21.

Equipment	Location	Approx. distance from the façade to the nearest perimeter fence (m)	Estimated combined sound pressure at the source (dB(A))	Estimated combined sound pressure at the nearest fence (dB(A))
1048 Inverters	Locations are not specified. Assumed equally spaced inverters all over the SGSs areas; distance between adjacent inverters is approx. 252 m (Table 5-11). Sound pressure level at 10m from one inverter is 64.3 dB (A) (Appendix E).			
Effect from one inverter at 252 m (distance to every neighbour inverter and assumed minimum distance to the nearest fence)				16
Combined effect from one inverter and its neighbours at each location where there is an inverter				64.3
Combined effect from inverters along the facility fence assuming that all inverters are at minimum 250m from the fence				16
Combined effect of inverters and transformers at the northern fence				**43**

Noise from transformers

The highest noise impact from transformers will be at the northern fence of the proposed Project site which is impacted by SUS1, SUS4, SUS6 and SUS8.

Noise from inverters

From Appendix E, the noise level of a Sunny Central 2500-EV inverter is equal to 64.3 dB(A) at 10m distance. It should be noted that the specifications indicated in this appendix are used only for guidance for the purpose of impacts assessment. The final specifications of the inverters are to be determined at a later stage of the project.

Locations of the inverters are not specified, but for the purpose of this assessment, similarly as for the EM emissions above, it is assumed that they are evenly distributed over the area. This would result in a distance between every two inverters of approx. 252 m. The noise level of 64.3 dB(A) attenuates at this distance to ca. 5 dB(A). This means that at each location where there is an inverter, the combined noise level from one inverter and the other neighbouring inverters (at ca. 252m each) is 64.5 dB(A) (no cumulative noise impact from the neighbouring inverters). Assuming that the minimum distance between any inverter and the facility fence is 252m, it follows that the maximum effect of inverters at the fence line is ca. 5 dB(A).

This noise level due to inverters would add to the level caused by the transformers. The maximum combined noise level from inverters and transformers is 43 dB(A) which complies with GAMEP maximum permitted noise levels at the facility fence line for high density industrial sites with multiple emission sources.

The conservative approach above is only based on the inverse square law for sound propagation, without any consideration of other factors contributing to sound propagation (e.g. wind, presence of the solar panels, other physical obstacles, elevation, terrain, etc.). Also the sound emission levels of transformers used in this estimation are the maximum values for their specifications (E.ON “Technical Requirements for Power Transformers”) and are not confirmed by the actual design. This assessment considers no mitigation measures for any of the noise emitting equipment.

Given the above considerations, the worst-case noise impact at the facility fence is considered of *Minor* magnitude.

Given the *Low* sensitivity of the acoustic environment and absence of potential noise receptors in the site proximity (absence of settlements in the site proximity and no permanent personnel on site during operation), with the above assumptions, the significance of noise impacts without mitigation is considered to be **Negligible.**

5.2.4.2.6 Socio-economic Impacts

At a strategic level, the operation of the proposed Project offers potential to support the continued growth of the local and national economy, through the ability to provide an important source of electrical energy to the Saudi Arabian grid.

As indicated in the previous sections, during the operation phase, ambient noise levels are expected to increase as a result of the operation of the proposed Project. However, these noise levels will be in full compliance with the applicable regulations. Some increased traffic during this phase is expected due to panels cleaning water trucking. Consequently, the potential impact is expected to be **Minor** on the onsite workers during this phase.

It should be noted that the different components of the proposed Project (e.g. transmission lines, etc.) will be located within the allocated project area and thus no economic / physical displacement of the local community is expected.

On the other hand; and similar to the construction phase, a **Positive** economic impact during operation will result from any local employment created by the project. Whilst the likely nature of these impacts is largely unchanged from the construction phase, they are likely to be less significant due to a minimum number of personnel required for operation; this effect is to some extent compensated by the greater time scales involved in the operation of the site compared to construction.

Table 5-13 Impact Assessment – Operation Phase (Before Mitigation)

Receptor	Sensitivity	Magnitude	Impact Significance
Climate – CO_2 reduction	**Positive**		
Climate – SF_6 release	Medium	Minor	**Minor**
Soil	Low	Minor	**Negligible**
Groundwater	Low	Minor	**Negligible**
Flora	Low	Moderate	**Minor**
Avifauna	Medium	Moderate	**Moderate**
Reptiles and Mammals	Low	Moderate	**Minor**

Receptor	Sensitivity	Magnitude	Impact Significance
Visual receptors	Low	Moderate	**Minor**
Population (local community members)	Low	Minor	**Negligible**
Population (onsite workers)	Low	Moderate	**Minor**
Electromagnetic emissions	Low	Minor	**Negligible**
Acoustic environment	Low	Minor	**Negligible**
Local economy	**Positive**		

5.2.4.3 Impacts during Decommissioning

The lifetime of this facility is planned to be 25 years, at the end of which it will have to be decommissioned and the site restored at or close to its initial conditions. No decommissioning plan is yet available; this section highlights decommissioning aspects considered to be most relevant for a PV power plant.

5.2.4.3.1 Closure plan

Following the operational life of the project, the project owner shall perform site closure activities to meet federal, state and local requirements for the rehabilitation and revegetation of the project site after decommissioning. The project owner shall prepare a Closure, Revegetation, and Rehabilitation Plan and submit it to obtain the necessary permits. Under this plan, all aboveground structures and facilities are removed to a depth of three feet below grade and taken offsite for recycling or disposal. Concrete, piping, and other materials existing below three feet in depth may be left in place. Areas that had been graded are restored to original contours unless it can be shown that there is a community benefit for the grading to remain as altered. Plant species native to the area will be replanted.

5.2.4.3.2 PV panels end-of-life management

This section is based on information provided in IRENA and IEA-PVPS (2016): “End-of-Life Management: Solar Photovoltaic Panels,” International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems. Based on installations existing in 2016 and future annual installations, IRENA provided an estimation of panel waste by country by 2050. Projections for Saudi Arabia without consideration of early losses are given in Table 5-14.

PV panels create unique waste-management challenges along with this increasing waste streams forecast. By weight, typical c-Si PV panels today contain about 76% glass (panel surface), 10% polymer (encapsulant and backsheet foil), 8% aluminium (mostly the frame), 5% silicon (solar cells), 1% copper (interconnectors) and less than 0.1% silver (contact lines) and other metals (mostly tin and lead).

It follows that typically, more than 90% of their mass is composed of glass, polymer and aluminium, which can be classified as non-hazardous waste. However, smaller constituents of c-Si panels can present recycling difficulties since they contain silicon, silver and traces of elements such as tin and lead (together accounting for around 4% of the mass).

Table 5-14 Modelled results of cumulative waste volumes of end-of-life PV panels for KSA, in tonnes

Year	2020	2030	2040	2050
End-of-life waste PV panels in tonnes (no early losses)	300	3,500	70,000	450,000

From a regulatory point of view, end-of-life management requirements for PV panels still largely falls under the general waste classification rather than dedicated to PV. The EU is the only jurisdiction that has developed specific regulations and policies addressing the end-of-life management of PV. The waste management and classification for PV panels in the EU is regulated by the WEEE Directive in addition to other related waste legislation (e.g. Waste Framework Directive 2008/98/EC). This comprehensive legal framework also ensures that potential environmental and human health risks associated with the management and treatment of waste are dealt with appropriately.

The responsibility for end-of-life waste-management activities downstream (waste generation, collection, transport, treatment and disposal) are typically covered by the following three main stakeholders:

- Society. End-of-life management is supported by society, with government organisations controlling and managing operations, financed by taxation which could create revenue for municipalities;
- Consumers. The consumer that produces panel waste is responsible for end-of-life management, including the proper treatment and disposal of the panel;
- Producers. End-of-life management is based on the extended-producer-responsibility (EPR) principle. This holds producers physically and financially responsible for the environmental impact of their products through to end-of-life and provides incentives for the development of greener products with lower environmental impacts.

The legislation currently in place in KSA requires that PV panels' disposal after decommissioning follows PME/GAMEP legislation for waste classification, waste management and disposal and waste transportation. Decommissioning the Project which will employ more than 9 million modules will generate very large amounts of different types of waste and could be an important impact that should be thoroughly assessed at a later stage of the project. A detailed decommissioning plan will ensure that all legal guidelines are implemented, and all waste will be disposed safely, which will reduce the impacts significance below concern.

5.2.4.3.3 SF_6 end-of-life recycling for HV and MV equipment

Although not a PV plant specific issue, when MV and HV electrical equipment insulation or breaker component materials contain SF_6 and the equipment is near end-of-life, special care must be taken in the recycling process. SF_6, at the time of disposal, is recognized by numerous government organizations as hazardous waste.

Owners of power equipment technologies that contain SF_6 should involve knowledgeable, legitimate partners when retiring obsolete electrical equipment. Electrical equipment manufacturers around the globe have put in place a detailed end-of-life program to help support customers who are confronted with SF_6 equipment end-of-life recycling issues. When electrical equipment reaches the end of its useful life, the equipment usually contains gaseous and solid SF_6 decomposition by-products which are toxic and corrosive.

The main potential gaseous decomposition by-products are HF, SO_2, SO_2F_2 and SOF_2. Their respective concentration can range from a very few parts per billion to a few percentage points of the volume of the SF_6. The existence of molecular sieves placed inside SF_6 equipment compartments help to absorb most of these gaseous decomposition by-products during the lifecycle of the electrical equipment. The by-products result from partial discharges or the process of breaking load during the lifecycle of the electrical equipment.

Sometimes, some solid powder by-product (a few grams) can also accumulate inside the enclosure containing the gas during the equipment's lifecycle. Special care must be taken by the operators extracting the gas in order to prevent the breathing-in or touching of this powder. European Union Directive 305/2008 states that all personnel handling SF_6 gas must be trained and certified by authorized certification bodies.

The SF_6 technology imbedded in electrical equipment represents no threat as long as the SF_6 is properly handled, recovered, recycled and re-used in a closed cycle. The launching of a SF6 disposal initiative begins with an audit of equipment that is near end-of-life. Once the quantity of equipment has been identified, a plan can then be developed with the appropriate partner to begin the formal disposal and recycling process.

SF_6 recycling is highly regulated at the national and international level. SF_6 is considered a hazardous waste at the moment of its end-of-life by a majority of countries. Therefore, only licensed or authorized hazardous waste managers are allowed to handle, transport, recycle, or destroy the gas according to national or regional regulations and standards. The hazardous waste will subcontract the end-of-life process to licensed waste managers.

SF_6 gas transported inside spent electrical equipment is subject to United Nations (UN) code 3164. SF_6 gas contained within a bottle is subject to UN code 3163 regulations. Labelling and packaging should therefore adhere to ADR regulation requirements. UN hazardous waste codes concerning the transportation of waste include UN code 16 05 04* [* = hazardous waste] when the SF_6 is contained inside a bottle and UN code 160213* [* = hazardous waste] when SF6 is contained inside electrical equipment.

When the electrical equipment begins to be dismantled, copper, aluminium, and iron components (which make up most of the spent electrical equipment) need to be segregated and stored in different, separate containers. The envelope / enclosure containing the SF_6 should also be carefully set aside. This separation of materials facilitates the processing work and improves the efficiency rate of the recycling. A recycling rate of up to 98% can be achieved under the best conditions.

The magnitude of SF_6 releases during decommissioning is hard to quantify. However, since climate is considered a moderate sensitive receptor subjected to change (Table 5-5), the impact significance of SF6 release on this receptor will be at least **Moderate** even for a **Minor** impact magnitude**.**

5.2.4.4 Impacts due to Accidental (Non-routine) Events throughout the Project Phases

Non-routine events include a range of unintended activities and accidental events (e.g. spills). These non-routine events could negatively impact a number of receptors, mainly including air and soil quality. The non-routine events that could occur during the different project phases are listed below:

- Leaks and Spills
- Inappropriate waste disposal
- Explosion and fire
- Vehicles accidents

The assessment of significance of impacts for the accidental (non-routine) events throughout the project phases is detailed in

Table 5-4. Assessment of significance of impacts for the accidental (non-routine) events throughout the project phases detailed below was based on the most conservative approach and did not take into consideration the probability of occurrence of the accident. In general, accidental events are typically characterised by low probability of occurrence (Vrouwenvelder, 2005).

A summary of the impact assessment is presented in Table 5-15. More details are presented in the following sections.

5.2.4.4.1 Air Quality

Air quality can be potentially affected as a result of explosion and fire. Considerable concentration of various air pollutants (e.g. SO_2, particulates) results from the fire and/or explosion. The type of the released air pollutants is dependent on the composition of the flammable material as well as the temperature.

The impact of fire and explosion on ambient air quality is highly dependent on different factors such as the type and volume of the flammable material and the duration of the fire. In case of large fire and given the *Low* sensitivity of the potentially affected receptor the impact is expected to be **Moderate**.

5.2.4.4.2 Groundwater

Groundwater quality may be impacted by spillages during construction. This may occur due to inadequate management and leak of polluting construction materials (e.g. paints) and fuel that may reach the groundwater resulting in pollution. Hazardous and non-hazardous materials used in construction are likely to include fuel, engine oil, paints, solvents and other chemicals. Poor handling of those materials and their inappropriate storage may result in poor containment and ultimately potential leaks.

Impacts to groundwater quality during construction may also result from limited spills at maintenance locations/workshops for construction equipment or leaks from the wastewater collection system for the available sanitation facilities. Such limited leaks could result in introducing organic matter, hydrocarbons (oils), coliforms or heavy metals if reached the groundwater. Inappropriate waste disposal may have also impact on the groundwater quality.

Hazardous materials stored and used during operation on the site may have the potential for spillage and may contaminate groundwater. In general, groundwater is not very vulnerable to direct contamination trough infiltration from the ground surface. This is due to the potential high depth of the groundwater table (Section 4.1.7.2). Additionally, some of contaminants may be trapped in the soil matrix and may act over decades as long-term contaminants source, causing extended dissolved plumes. Given that the groundwater was not encountered in the drilled boreholes (depth of 10 m) during the geotechnical investigation (Section 4.1.7.2), it is assumed that no significant amounts of spills and leaks will infiltrate and reach the groundwater. Consequently, the overall impact on groundwater quality due to the different non-routine events can be classified as **Minor**.

5.2.4.4.3 Soil Characteristics

During construction and commissioning, potentially contaminating materials including fuels, engine oil, paints, solvents, chemical additives are expected to be stored and handled at the construction sites. Accidental spills may reach the soil, resulting in contamination. Inappropriate waste management can have similar consequences. Inappropriate sanitation facilities during the construction phase may cause soil contamination.

Soil quality could be impacted due to the failure of containment systems for chemicals, raw materials, and wastewater, such as tanks, pipe work, etc. Accidental impacts on soils are **Minor**, due to the Low sensitivity of the receptor.

5.2.4.4.4 Biological Environment

Biological environment may be affected during any accidental events. Impacts could result from the following accidental (non-routine) events:

- Fire and explosion
- Leaks and spills
- Inappropriate waste disposal

Apart from animals present at the immediate location where the fire starts that could be killed when the fire start, animals are expected to escape the area very shortly due to the heat radiation. The significance of the potential impact is classified as **Minor**.

Spill and leaks may negatively affect the terrestrial ecology and biodiversity. The extent and magnitude of the impact is highly dependent on the material/chemical released in terms of composition and quantity. Given that the sensitivity of the potentially affected environmental receptors, flora and reptiles is Low, the significance of the direct impact is classified as **Negligible**. On the other hand, due to the Medium sensitivity of the avifauna the impact significance is classified as **Minor.**

Accidental release of solid wastes from vehicles may occur during the transport of those wastes for disposal which may have impacts on the well-being of existing biodiversity if not immediately contained. Due to the low sensitivity of the VR, the potential impact is expected to be **Negligible**.

5.2.4.4.5 Human Environment

Impacts on human environment (both the local community and onsite workers) could result from the following accidental (non-routine) events:

- Fire and explosion
- Vehicle accidents

Fire and explosion may affect surrounding population, if present as well as the onsite workers. In general, fire due to flammable material may occur which will cause disturbance to inhabitants in the area surrounding the proposed project which may result in change of their behaviour; however, such changes are expected to be limited to a short period of time. In general, it is expected that the onsite workers will be more impacted than the local community members in case of fire; however, the number of onsite workers is limited. Consequently, the impact is expected to be of **Minor** significance on the onsite workers; whereas, it is expected to be **Negligible** on the local community members. Vehicle collision and accidents during construction vehicle movement may result in injuries or loss of lives and the impact is expected to be of **Minor** significance.

Table 5-15 Impact Assessment – Accidental Events (Before Mitigation)

Receptor	Sensitivity	Magnitude	Impact Significance
Leaks and spills			
Soil	Low	Moderate	**Minor**
Groundwater	Low	Minor	**Minor**
Flora	Low	Minor	**Negligible**
Avifauna	Medium	Minor	**Minor**
Reptiles and Mammals	Low	Minor	**Negligible**
Inappropriate waste disposal			
Groundwater	Low	Minor	**Negligible**
Soil	Low	Moderate	**Minor**
Flora	Low	Minor	**Negligible**
Reptiles and Mammals	Low	Minor	**Negligible**
Fire and explosion			
Air	Low	Major	**Moderate**
Flora	Low	Moderate	**Minor**
Avifauna	Medium	Minor	**Minor**

Receptor	Sensitivity	Magnitude	Impact Significance
Reptiles and Mammals	Low	Moderate	**Minor**
Population (onsite workers)	Low	Moderate	**Minor**
Population (local community members)	Low	Minor	**Negligible**
Vehicles accidents			
Population (both onsite workers and local community members)	Low	Moderate	**Minor**

6. Proposed Mitigation Measures

The following mitigation hierarchy shall be followed as applicable (Figure 6-1):

- Evaluating the mitigation measures to put in place to avoid the direct and indirect impacts
- Evaluating the mitigation measures to put in place to reduce these impacts
- Evaluating the mitigation measures to put in place to restore the environment
- Evaluating the mitigation measures to put in place to compensate the residual impacts

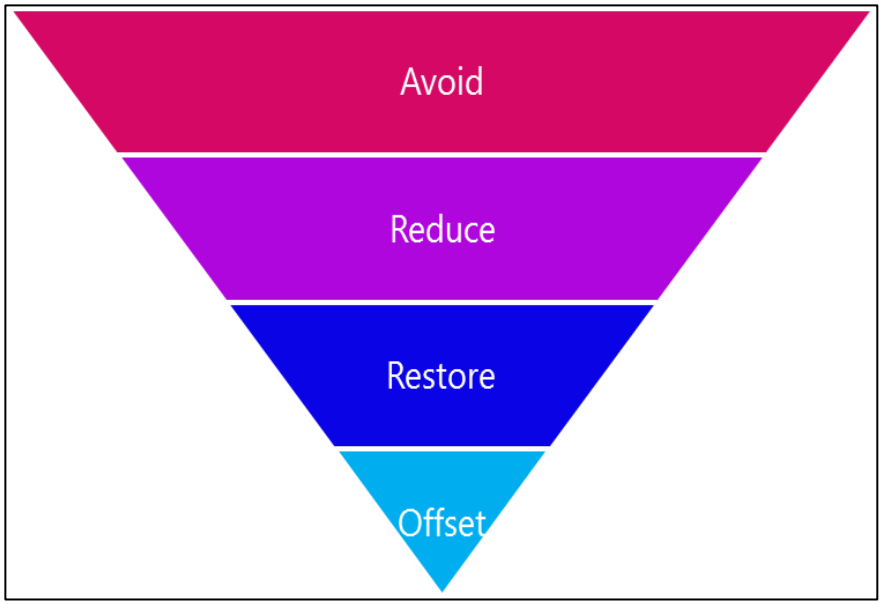

Figure 6-1 Mitigation Measures Implementation Hierarchy

Recommended mitigation measures/procedures for the expected impacts are presented below; specific mitigation recommendations for those impacts of Moderate significance are provided. Additional mitigation measures are presented as part of the Environmental Management Plan Framework and Monitoring Plan presented in Appendix F of this report. The residual impacts after implementing the below proposed mitigation measures are summarized in Chapter 7.

6.1 Mitigation of Impacts during Construction

During construction, the contractor should ensure that no encroachment to the nearby land occurs and should follow the clearly defined transportation routes. Transport routes will be identified, and training will emphasize that employees should keep to the designated routes in order to protect the environment and reduce encroachment on adjacent land, reduce dust fall across the site due to the movement of trucks on undesignated sand tracks and also protect the visual aesthetics of the landscape. Construction activities should be limited to demarcated areas.

The following mitigation measures are also recommended:

- Transportation on and to/from the site will be minimized through efficient transport management in order to minimize noise and vehicle pollution. Machinery will be maintained on a regular basis to ensure smooth efficient running to control emissions and leakages
- Signage and diligent supervision of contractors should be implemented across the site
- Hazardous materials used during the construction stage should be adequately managed, in order to minimize the potential risk of spillage
- In addition, any labour accommodation facilities should promote fair labour practices in the construction industry. The provision of facilities should include dedicated areas for food preparation, personal hygiene, and healthcare and also provide suitable waste management facilities, sewage collection and removal facilities and health, safety and security programs. Inspection schedules should also be included in the independent audits to ensure that standards are achieved and maintained
- Proper organic waste management practices should minimize temporary negative effects during construction
- Light generation during night periods should be minimized, to avoid attracting fauna and potential deviations from migrating routes
- Wastes will be appropriately collected, classified and transported to a licensed facility for treatment/final disposal

6.2 Mitigation of Impacts during Operation

Although the terrestrial ecology on the site is not of high ecological value, it remains important to consider ways to minimize the impact on the site and surrounding area during operations.

An avifauna survey and monitoring should be undertaken by an ornithologist during the first year of operation of the Project, to assess the impacts from the project on the bird population in the area, assess behaviour and eventual mortality and, based on the outcome, to adapt mitigation measures as necessary.

Landscaping on the site should include indigenous/native plants that have minimum water and fertilizer requirements. An integrated pest management plan should be developed which uses organic pest management products in preference to large-scale pesticides.

Transport routes on site and training will emphasize that vehicles and employees should keep to the designated routes in order to prevent unnecessary land encroachment, thus protecting the natural resources and reducing dust emissions, limit speeds in areas eventually known to be occupied by special status species and minimize foot traffic in undisturbed areas.

An efficient waste management plan will prevent inert waste from polluting the Project site and adjacent areas and will also provide options for sustainable management of waste. Recycling facilities should be provided for staff/residents in order to maximize the re-use and recycling of materials and waste. Appropriate storage of hazardous materials, should be designed in accordance with the IFC and World Bank guidelines, preventing any major spillages on the site.

Since human activities attracts pests and has a large impact on birds, consideration should be given to developing a plan to manage pests. Further mitigation measures that can be implemented are:

- To the extent possible, minimize the number of areas where wildlife could hide or be trapped.
- Use avian deterrence techniques, including: facility habitat management; prey control; anti-perching technology; nest-proofing or other enclosures
- Regularly monitor the solar field, access roads, and ancillary facilities for invasive non-native plant species establishment. Initiate control measures immediately upon evidence of invasive species introduction or spread
- Limit vegetation management and use mechanical controls in preference to herbicides/pesticides. Where required, limit herbicide/pesticide use to non-persistent, immobile herbicides/pesticides and apply only in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications
- Address spills immediately per the appropriate spill management plan, and initiate soil clean-up and soil removal if needed
- Turn off all unnecessary lighting at night to avoid disturbance of migratory birds
- Conduct seasonally appropriate inspections by a qualified biologist or team of biologists to ensure that important or sensitive species or habitats are not present in or near project areas. If birds' collisions are found to be frequent, the borders of the panels could be painted in white to increase mirrors visibility
- To protect large birds, it is recommended that transmission lines be separated by at least the wingspan of the birds to avoid short circuiting during perching and take-off from transmission line towers. Further, the project should consider mitigation by underground powerlines or birdlife diverters

6.3 Accidental (non-routine) Events

The different accidental (non-routine) events may affect different receptors. The following general management and control measures are recommended to minimise accidental impacts that may occur during the different phases of the project:

- Ensure regular inspection and maintenance of electrical equipment and fittings to avoid their damage and risk of fire
- Prohibit smoking in all storage areas and display prominent NO SMOKING notices.
- Material safety datasheets (MSDS) and safety instructions should be clearly displayed in the storage area
- Implement training systems to ensure that personnel onsite respond in a timely manner to incidents that could result in soil and groundwater contamination
- For all potential accidental events, an emergency response plan must be put in place

- Employees should be fully trained to implement the relevant emergency response plans in the event of emergency
- Different preventative concepts shall be applied (e.g. proper documentation of standard procedures, work permitting rules and procedures effective management of processes)
- Implement Environmental Emergency Plan (Appendix G)
- Vehicles and other equipment shall be subjected to regular maintenance to avoid spills and leakage of fuels and lubricants
- Environmental register should be used to register all waste management activities including quantities and types of waste handled
- All employees should be educated through trainings to deposit all wastes in the appropriate containers without throwing out carelessly
- Good housekeeping should always be maintained
- Operational controls, maintenance procedures and comprehensive response planning
- Train employees to promptly contain, report and/or clean up any hazardous material spills as well as emergency events
- An emergency notification system should be implemented to inform nearby industries and residential communities of an emergency
- Emergency alarm systems are both audible and visible
- Qualified first-aid shall be provided at all times for all the employees. Appropriately equipped first-aid stations will be easily accessible throughout the place of work
- Ensure driver safety training are provided and verify driver qualifications
- Driving safety –this will include compliance with local law, specific company required speed limits, night driving, incident procedures, acceptable journey times, mobile phone/radio usage, etc.
- Traffic plan should be appropriate to cover all transport arrangements
- Availability of first aid kit and safety equipment requirements for vehicles
- Portable fire extinguishers are intended as the first line of defence to fight fires of limited size
- Mobile fire-fighting equipment shall be available on site. For major fire, external support may be required as per the Emergency Response Plan
- Firefighting products shall be considered with the least hazard and lowest potential environmental and/or health impact
- Coordination with local fire services and providing specific information on the facility, as necessary, so that the most effective firefighting methods can be determined
- All employees are responsible to contribute to the prevention of fire and will be trained on fire-fighting techniques and the use of fire extinguishers regularly

- Grievance Mechanism shall be in place and appropriately implemented
- Addressing any compliant received from the local community and onsite workers promptly as far as practical
- The standards for workers accommodation stated in IFC and EBRD Guidance Note for workers' accommodation will be followed as far as practical

7. Summary of Significant Impacts after Mitigation

Table 7-1 gives an overview of impacts significance before and after mitigation.

Table 7-1 Impacts significance before and after mitigation

Receptor	Significance before mitigation	Mitigation Measures	Significance after mitigation
Construction Phase			
Avifauna	**Moderate**	Refer to Section 6.1 and Appendix F	**Minor**
Operation Phase			
Avifauna	**Moderate**	Refer to Section 6.2 and Appendix F	**Minor**
Accidental Events			
Air – Fire and explosion	**Moderate**	Refer to Section 6.3 and Appendix G	**Minor**

A monitoring plan which is designed to control and ensure compliance with the proposed mitigation measures is presented in Appendix F.

8. Stakeholder Engagement and Public Consultation

8.1 Stakeholder Mapping

A Stakeholder Mapping Report had been put together during the screening and scoping phase of the project. This section gives a summary of the most important stakeholder groups identified and a summary of the analysis of stakeholder significance. This section will also provide a summary of the Stakeholder Engagement Action Plan. The detailed report is presented in Appendix H.

8.1.1 Stakeholder Identification

The report identified parties and/or individuals who might have an interest in the proposed project and who might influence or be influenced by the proposed project.

The identified stakeholder group included regulatory bodies and competent authorities, including but not limited to:

- Ar Rass Municipality and Ar Rass Governorate
- Qassim Province
- Ministry of Municipal and Rural Affairs (MOMRA)
- General Authority of Meteorology and Environmental Protection (GAMEP)
- Ministry of Environment, Water, and Agriculture (MEWA)
- Ministry of Energy
- Electricity Cogeneration Regulatory Authority (ECRA)
- Saudi Electricity Company (SEC)
- Saudi Aramco
- High Commission for Industrial Security (HCIS)
- Ministry of Commerce and Investment (MOCI)
- Saudi Arabian General Investment Authority (SAGIA)
- General Directorate of Civil Defense
- Saudi Wildlife Authority (SWA)
- Saudi Commission for Tourism and National Heritage (SCTNH)

Other stakeholder groups identified include intergovernmental groups, specifically project lenders who set environmental and social requirements that must be met for loans to be approved. In addition, there are businesses and community representatives such as local residents of Ar Rass. Other groups include the media organizations such as local newspaper and radio media groups.

8.1.2 Stakeholder Analysis

This section provides a quick overview of the significance of stakeholder groups identified in the previous section according to the impact, interest, and influence of said stakeholder on the proposed Project. Table 8-1 details the criteria used to determine the significance of each stakeholder group previously identified. The appropriate level of engagement of each stakeholder was also determined based on the criteria identified using the engagement matrix shown in Figure 8-1.

Table 8-1 Criteria Used to Determine the Significance of Each Stakeholder Group

Significance	Impact	Interest	Influence
Low	Stakeholder will experience very few impacts as a result of the project	The project has limited relevance to the stakeholder's field of interest and/or responsibilities	Stakeholder has very little control over the project
Moderate	Stakeholder will experience a moderate degree of impact as a result of the project. These impacts can be managed and mitigated	The project has some relevance to the stakeholder's field of interest and/or responsibilities	Stakeholder can influence the scope and schedule of the project
High	Stakeholder will experience a high degree of impact as a result of the project	The project is directly related to the stakeholder's field of interest and/or responsibilities	Stakeholder has decision making powers regarding the project

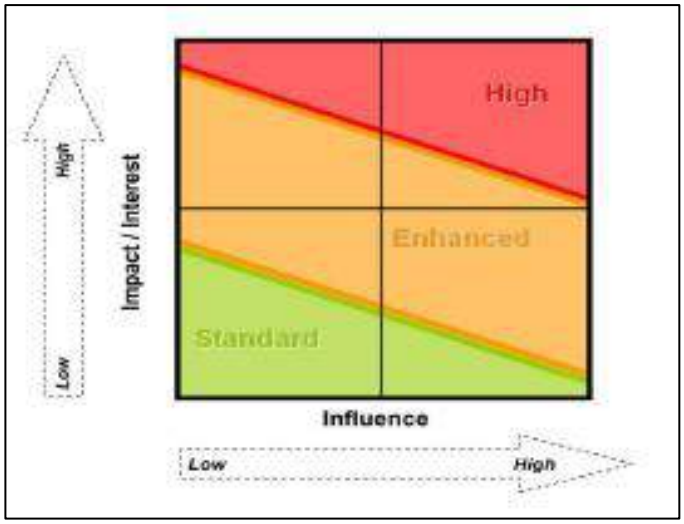

Figure 8-1 Levels of Engagement Matrix

As might be expected, regulatory bodies and competent authorities, as well as project lenders have Moderate to High significance in regard to the proposed Project and Enhanced to High levels of engagement. While local businesses and communities have Low to Moderate significance and Enhanced levels of engagement in regard to the proposed project. While the media has Low significance and standard level of engagement.

8.1.3 Stakeholder Engagement Action Plan

This plan will provide all identified stakeholder groups and interested factions with a channel of communications between the stakeholder groups and the project developer. The approach generally uses the different levels of engagement to provide more focused activities based on the level of significance of each stakeholder groups. For example, a Standard level of engagement can be achieved using disclosure, while a Moderate level can be achieved via consultation and engagement, and focused engagement can achieve a High level of engagement.

The action plan included various engagement methods for the different proposed activities. Table 8-2 shows examples of the engagement methods for some of the activities included in the report.

Table 8-2 Stakeholder Engagement Action Plan Example

Activity	Stakeholders	Engagement method
Scoping	All	Focused engagement, Consultation and Disclosure
ESIA report	All	Disclosure
Implement EMP	All	Disclosure

The action plan also details some proposed grievance mechanisms for the project developer in order to monitor grievances and identify any recurrent issues, or escalating conflicts. Including but not limited to the following:

- Implementing a grievance mechanism and ensure the responsiveness of this mechanisms to concerns and complaints
- Receiving and logging all comments and complaints associated with the project
- Responding to such complaints and comments wither verbally or in writing

Lastly, the report emphasizes the importance of monitoring stakeholder engagement activities in order to ensure that the consultation and disclosure efforts are sufficient and effective throughout the process.

8.2 Public Consultation

A public consultation session took place in August 2019. During the session, the different Project aspects were discussed including but not limited to components as well as the potential positive and negative impacts of the Project. The relevant documentations of the session are presented in Appendix H.

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Appendix A. Project Land Allocation Official Approval

1. Waste Classification

1.1 Hazardous Waste List

Y1	Clinical wastes from medical care in hospitals, medical centres and clinics
Y2	Wastes from the production and preparation of pharmaceutical products, drugs and medications
Y3	Wastes from the production, formulation and use of biocides and phyto-pharmaceuticals
Y4	Wastes from the manufacture, formulation and use of wood preserving chemicals
Y5	Wastes from the production, formulation and use of organic solvents
Y6	Wastes from heat treatment and steel tempering operations containing cyanides
Y7	Waste mineral oils unfit for their originally intended use
Y8	Waste oils/water, hydrocarbons/water mixtures, emulsions
Y9	Waste substances and articles containing (greater than 50 ppm) polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)
Y10	Waste tarry residues arising from refining, distillation and any pyrolysis treatment
Y11	Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
Y12	Wastes from production, formulation and use of resins, latex, plasticizers, glues and adhesives
Y13	Waste chemical substances arising from research and development or teaching activities which are not known and are new and whose effects on human health and the environment are not yet known
Y14	Wastes of an explosive nature not subject to other regulations or standards
Y15	Wastes from production, formulation and use of photographic chemicals and processing materials
Y16	Wastes resulting from surface treatment of metals and plastics
Y17	Residues arising from industrial waste disposal operations
Y18	Petroleum refinery wastewater treatment sludges

1.2 Hazardous Waste Constituents

Y19	Metal carbonyls
Y20	Beryllium and beryllium compounds
Y21	Hexavalent chromium compounds
Y22	Copper compounds
Y23	Zinc compounds
Y24	Arsenic and arsenic compounds
Y25	Selenium and selenium compounds
Y26	Cadmium and cadmium compounds
Y27	Antimony and antimony compounds
Y28	Tellurium and tellurium compounds
Y29	Mercury and mercury compounds
Y30	Lead and lead compounds
Y31	Inorganic fluorine compounds excluding calcium fluoride
Y32	Inorganic cyanides
Y33	Acidic solutions or acids in solid form
Y34	Basic solutions or bases in solid form
Y35	Asbestos (dust and fibres)
Y36	Organic phosphorus compounds
Y37	Organic cyanide compounds
Y38	Phenols and phenol compounds, including chlorophenol compounds
Y39	Ether compounds
Y40	Halogenated organic solvents
Y41	Organic solvents other than halogenated solvents
Y42	Any congener of polychlorinated dibenzo-furan
Y43	Any congener of polychlorinated dibenzo-p-dioxin
Y44	Organic halogen compounds other than substances referred to in this Table

1.3 Hazardous Property List

H1 Explosive	Substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene
H2 Oxidising	Substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances
H3 Highly Flammable	(a) liquid substances and preparations having a flashpoint below 21°C (b) substances and preparations which may become hot and finally catch fire in contact with air at ambient temperatures without any application of energy (c) solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition (d) gaseous substances and preparations which are flammable in air at normal pressure (e) substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities
H3B Flammable	Liquid substances and preparations having a flashpoint >=21°C and <=55°C
H4 Irritant	Non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation
H5 Harmful	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks
H6 Toxic	Substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death
H7 Carcinogenic	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence
H8 Corrosive	Substances and preparations which can readily corrode or dissolve flesh, metal or other materials
H9 Infectious	Substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or living organisms
H10 Toxic for Reproduction	Substances or preparations which, if they are inhaled or ingested or if they penetrate the skin, may produce or increase the incidence of non-heritable adverse effects in the progeny and/or of male or female reproductive functions or capacity
H11 Mutagenic	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence
H12 Toxic Gas Release	Substances or preparations which release toxic or very toxic gases in contact with water, air or an acid
H13 Ecotoxic	Substances or preparations which present or may present immediate or delayed risks for one or more sectors of the environment
H14	Substances and preparations capable by any means, after disposal, of yielding another substance, for example leachate, which possesses any of the characteristics H1 to H13

1.4 Toxicity Property Leaching Procedure Regulatory Levels

Contaminant	Concentration (mg/l)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon Tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol*	200.0
m-Cresol*	200.0
p-Cresol*	200.0
Total Cresols	200.0
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichlorobenzene	0.5
1,1-Dichlorobenzene	0.7
2,4-Dichlorobenzene	0.13
Endrin	0.02
Heptachlor (and its epoxide)	0.0008
Hexachlorobenzene	0.13
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lidane	0.4
Mercury	0.2
Methoxychlor	10.0

Contaminant	Concentration (mg/l)
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl Chloride	0.2

* If o-, m- and p- cresols cannot be individually measured, the level for total cresols is used.

2. Drinking Water

Prescribed concentrations and values

Parameter	Units	Value (Health)	Value (Acceptability)	Indicator
Physical chemistry				
pH	pH units	No health criteria specified	6.5 -8	
Colour	Hazen units	No health criteria specified	15	Yes
Conductivity	µS/cm at 20 ^{0}C	2,500		Yes
Taste and Odour	n/a	No health criteria specified	Unobjectionable	Yes
TDS	mg/l		1500	
Turbidity	NTU	5	1	Yes
Gross Alpha activity	Bq/l	0.1		
Gross Beta activity	Bq/l	1		
Radioactivity (excl. potassium -40)[4]	mSv/(annual RDL[5])	0.1		
$CaCO_3$	mg/l	300		
DO	%	No health criteria specified	>85	
Nitrate (as NO_3)	mg/l	50		Yes
Nitrite (as NO_2)	mg/l	1		Yes
Organic and Inorganic chemical pollutants				
Acrylimade	µg/l	0.5		
Alachlor	µg/l	20		
Aldicarb	µg/l	10		
Aldrin and Dieldrin	µg/l	0.03		
Aluminium	µg/l		200	
Antimony	µg/l	20		
Asbestos	Million fibres/L	7		
Arsenic	µg/l	10		
Atrizine	µg/l	2		

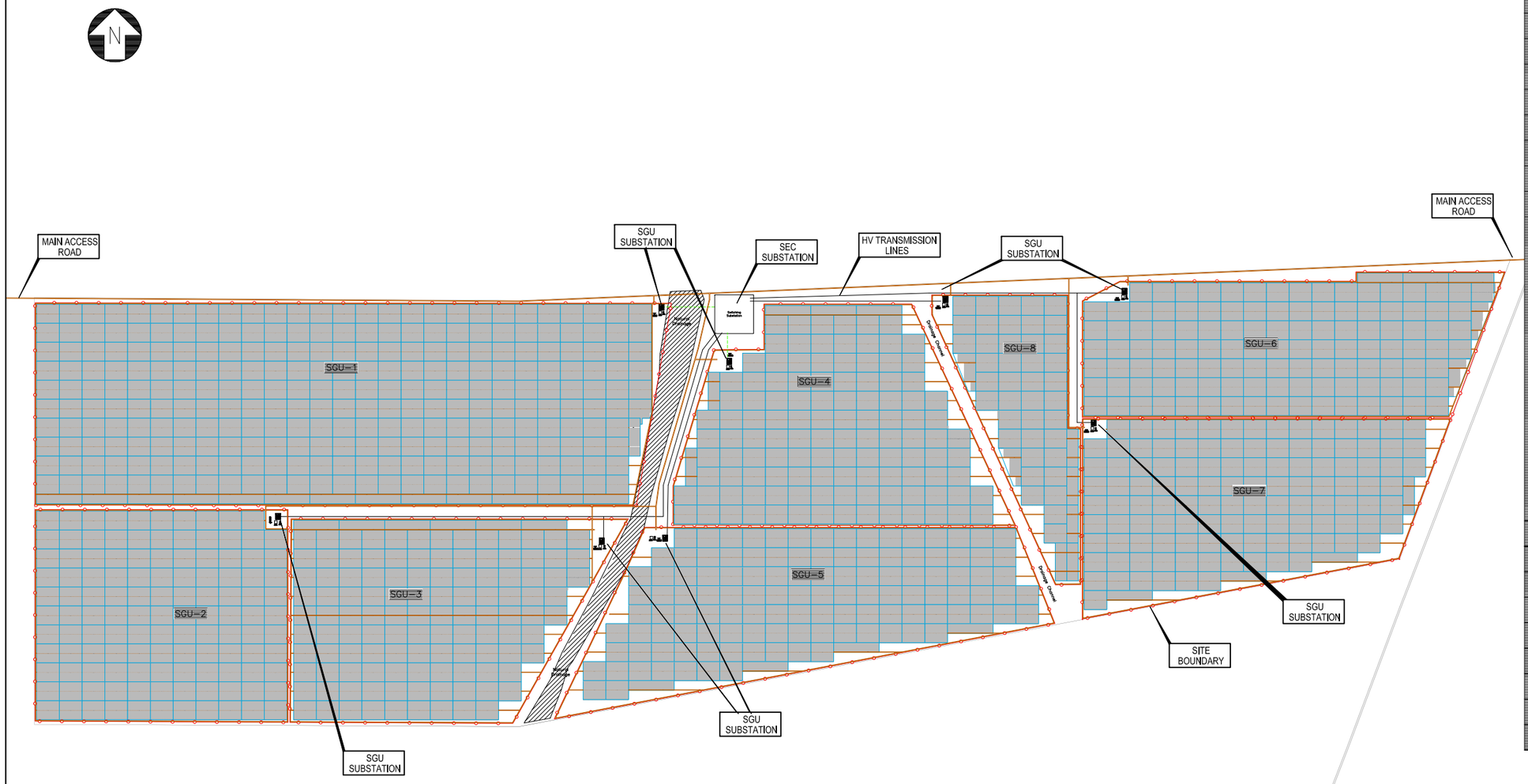
Parameter	Units	Value (Health)	Value (Acceptability)	Indicator
Barium	µg/l	700		
Beryllium	µg/l	200		
Benzene	µg/l	10		
Benzo(a)pyrene	µg/l	0.01		
Boron	µg/l	1000		
Bromate	µg/l	10		
Bromodichloromethane (BDCM)	µg/l	60		
Bromoform	µg/l	100		
Cadmium	µg/l	3		
Carbofurans	µg/l	7		
Carbon Tetrachloride	µg/l	2		
Chloral Hydrate	µg/l	10		
Chlordane	µg/l	0.2		
Chlorate	µg/l	700		
Chlorine residual	µg/l	500		
Chloride	µg/l	No health criteria specified	250,000	
Chlorite	µg/l	700		
Chlorophenol (2,4,6,T)	µg/l	200		
Chloroform	µg/l	200		
Chromium	µg/l	50		
Copper	µg/l	2		
Cyanide	µg/l	70		
Cynazine	µg/l	6		
2,4 -D (2,4-dichlorophenoxyacetic acid)[6]	µg/l	30		
DDT and Metabolites	µg/l	1		
Dibromoacetonitrile	µg/l	70		
Dibromochloromethane (DBCM)	µg/l	100		
Dibromo-3-chloropropane 1,2 (DBCP)	µg/l	1		
Dibromoethane 1,2	µg/l	0.4		

Parameter	Units	Value (Health)	Value (Acceptability)	Indicator
Dichloroacetonitrile	µg/l	20		
Dichlorobenzene, 1,2-	µg/l	1000		
Dichlorobenzene, 1,4-	µg/l	300		
Dichloroethane, 1,2-	µg/l	30		
Dichloroethene, 1,1-	µg/l	30		
Dichloroethene, 1,2-	µg/l	50		
Dichloromethane	µg/l	20		
Dichloropropane 1,2 (1,2-DCP)	µg/l	40		
Dichloropropene 1,3	µg/l	20		
Dichlorprop (2,4 DP)	µg/l	100		
Edetic acid (EDTA)	µg/l	600		
Endrin	µg/l	0.6		
Ethylbenzene	µg/l	300		
Fenoprop (2,4,5 T)	µg/l	9		
Fluoride	µg/l	1500		
Formaldehyde	µg/l	60		
Haloacetic acids (HAA5)	µg/l		900	
Hexachlorobutadiene (HCBD)	µg/l	0.6		
Isoproturon	µg/l	9		
Iron	µg/l		300	
Lead	µg/l	10		
Lindane	µg/l	2		
Manganese	µg/l		400	
Mercury (inorganic)	µg/l	1		
Methoxychlor	µg/l	200		
Metolachlor	µg/l	10		
Microcystin-LR	µg/l	1		
Molybdenum	µg/l	70		
Monochloramine	µg/l	3000		

Parameter	Units	Value (Health)	Value (Acceptability)	Indicator
MTBE	µg/l	No health criteria specified	15	
Nickel	µg/l	20		
PAH (sum total)	µg/l	0.1		
Pentachlorophenol (PCP)	µg/l	9		
Pesticides (total)	µg/l	0.5		
Selenium	µg/l	10		
Sodium	µg/l	No health criteria specified	200,000	
Styrene	µg/l	20		
Sulphate	µg/l	500,00	250,000	
Tetrachloroethene	µg/l	40		
Toluene	µg/l	700		
TCBs (Total)	µg/l	No health criteria specified	5	
Trihalomethanes (THM total)	µg/l	100		
Trichloroethene, 1,1,1	µg/l	70		
Uranium	µg/l	15		
Vinyl chloride	µg/l	0.3		
Xylenes	µg/l	500		
Zinc	µg/l	No health criteria specified	3000	
Microbial				
Cryptosporidium	Count/100ml		-	
E. coli	Count/100ml	0		Yes
Total Coliform Bacteria	Count/100ml	0		Yes

Appendix B. Guidelines

Appendix C. Drawings and Layouts



ELECTRICAL CONFIGURATION

PV PARK NOMINAL POWER	3,271 MWp
PV PARK AC POWER (@ 25°)	2,705 MW
DC/AC ratio	1.21
MODULES NOMINAL POWER	C530-350P 1500V
MODULES TYPE	Jinko Solar JKM350PP-72-V
TOTAL MODULES INSTALLED	9,348,480
MODULES PER STRING	30
CONFIGURATION OF RACKING	1x30 Portrait
INVERTER UNIT	Sunny Central 2500

LAYOUT ARRANGEMENT

Pitch Between Structures E-W: 2.99 m
1x27 Structure Dimension: 30.30 x 1.996 m
Number of Inverter Unit = 1082
Yield = 2211 kWh/kWp

BLOCK ARRANGEMENT

Number of Modules = 8,640
Modules per string = 30
Number of Strings = 288
Block Power = 3,024,000 Wp
GCR = 0.4
Azimut = 0°

SGU	CAPACITY	ENERGY	AREA
1	700MW	1,873 GWh/y	13,27 Km^2
2	300MW	802 GWh/y	5,71 Km^2
3	300MW	802 GWh/y	6,21 Km^2
4	300MW	802 GWh/y	6,11 Km^2
5	300MW	802 GWh/y	6,59 Km^2
6	300MW	802 GWh/y	5,81 Km^2
7	300MW	802 GWh/y	6,13 Km^2
8	120MW	320 GWh/y	2,55 Km^2

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU — SINGLE GENERATION UNIT
- SS — SWITCHING SUBSTATION

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CUSTOMER

Renewable Energy Project Development Office

GENERAL SITE LAYOUT
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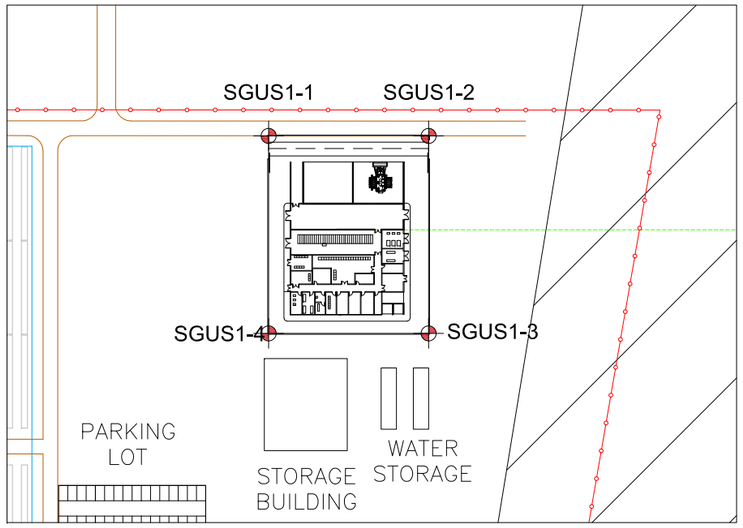

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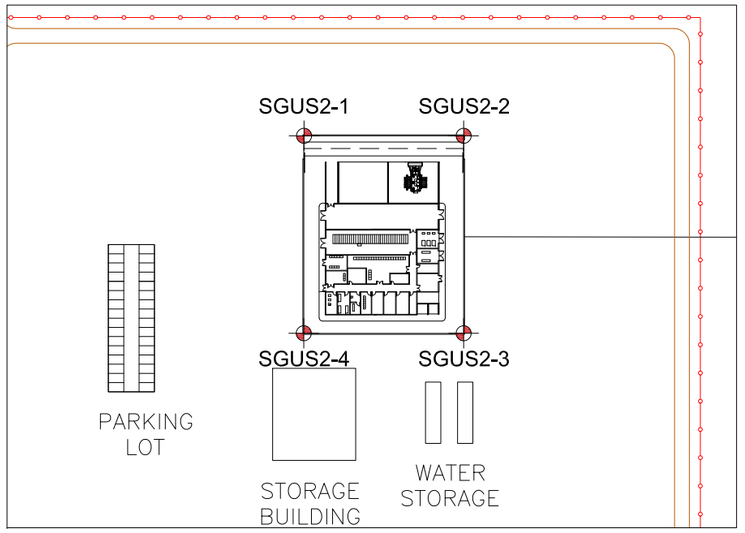

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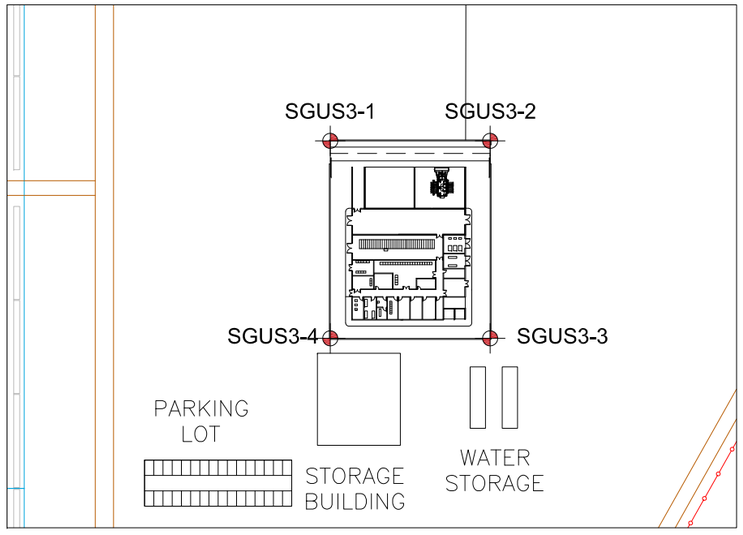

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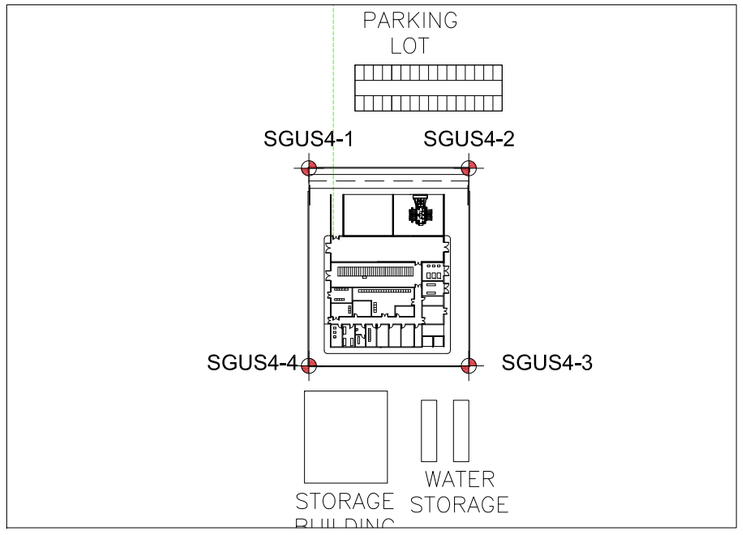

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energy | chemicals | resources

CUSTOMER

Renewable Energy Project Development Office

SGU SUBSTATION LAYOUT
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-102 (1 of 2)

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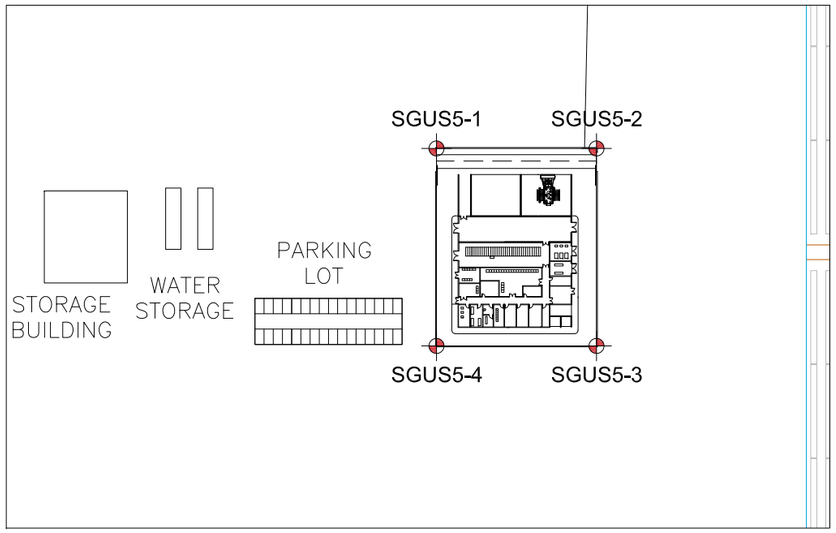

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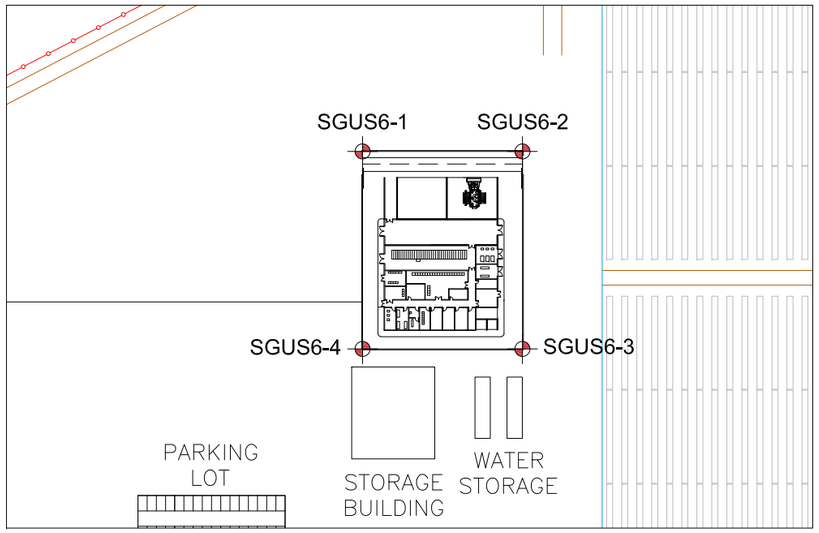

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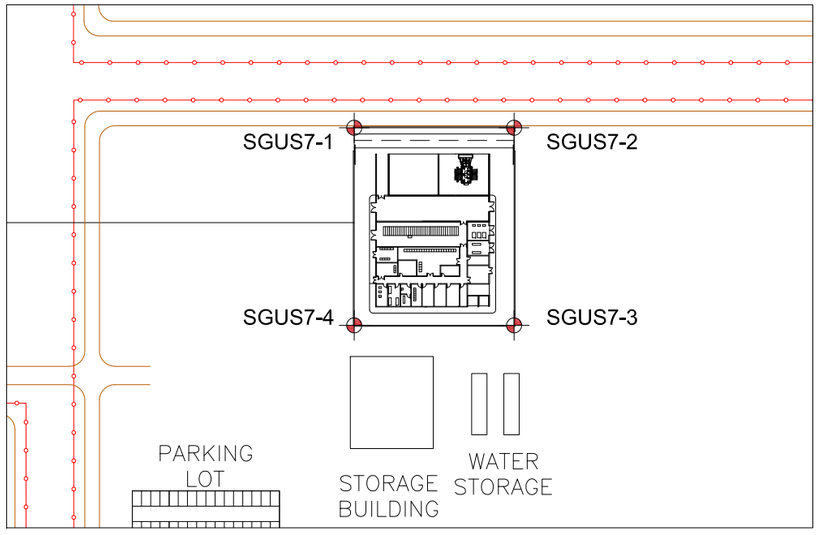

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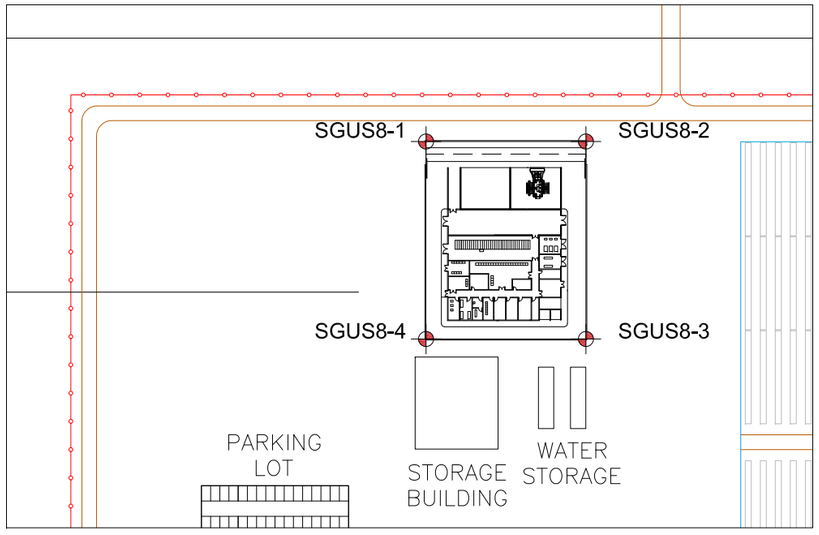

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0	26/04/2019	ISSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-CI-PLN-102-0

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energy | chemicals | resources

CUSTOMER

Renewable Energy Project Development Office

SGU SUBSTATION LAYOUT
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-102 (2 of 2)

REV 1

DATE & TIME: 19/07/2019 06:10:27 PM
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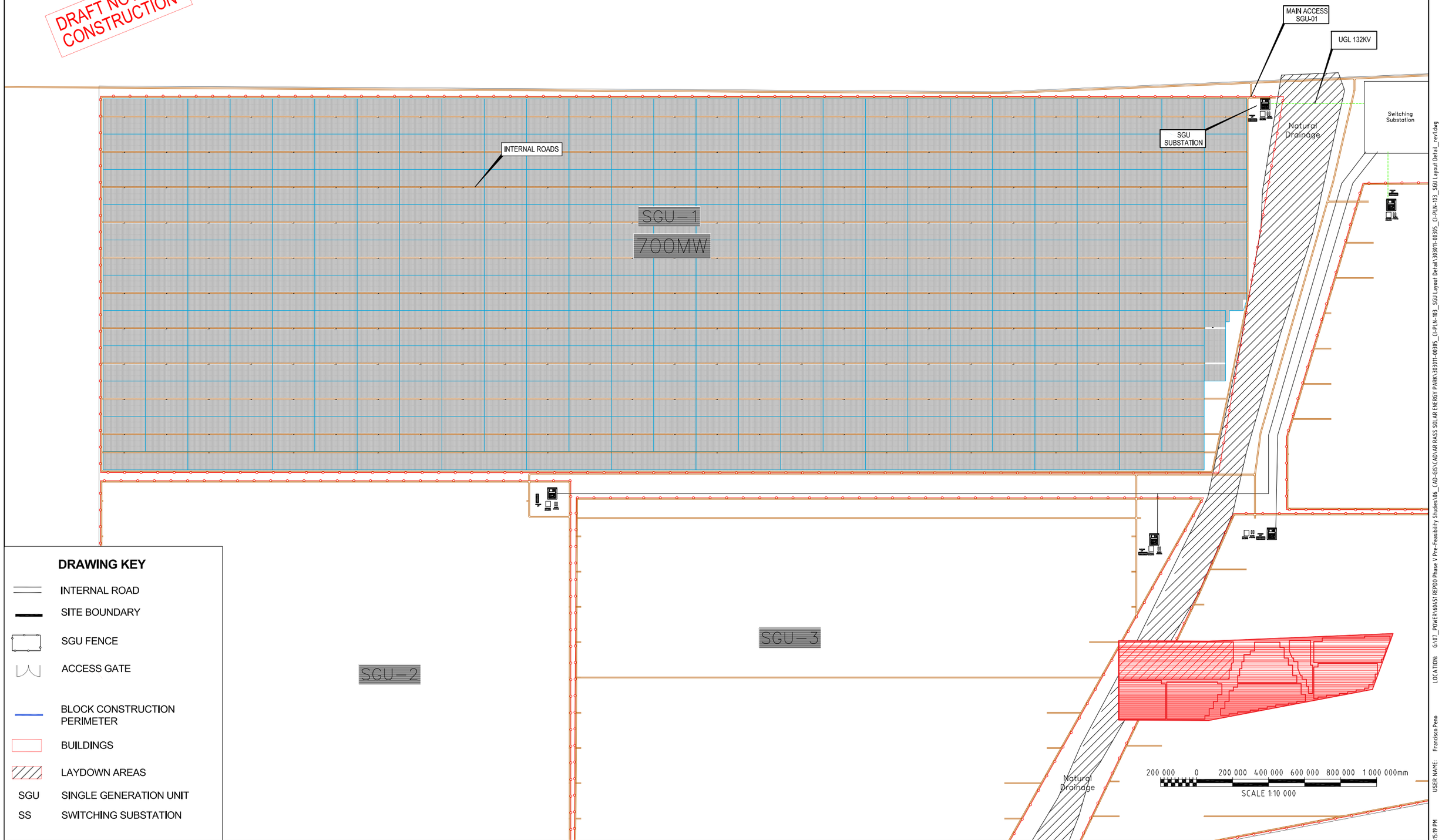

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU SINGLE GENERATION UNIT
- SS SWITCHING SUBSTATION

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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0	26/04/2019	ISSUED FOR CLIENT REVIW	IG	MB	JO					303011-00305-CI-PLN-103-0

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Renewable Energy Project Development Office

SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (1 of 8)

REV 1

DATE & TIME: 19/07/2019 04:15:19 PM
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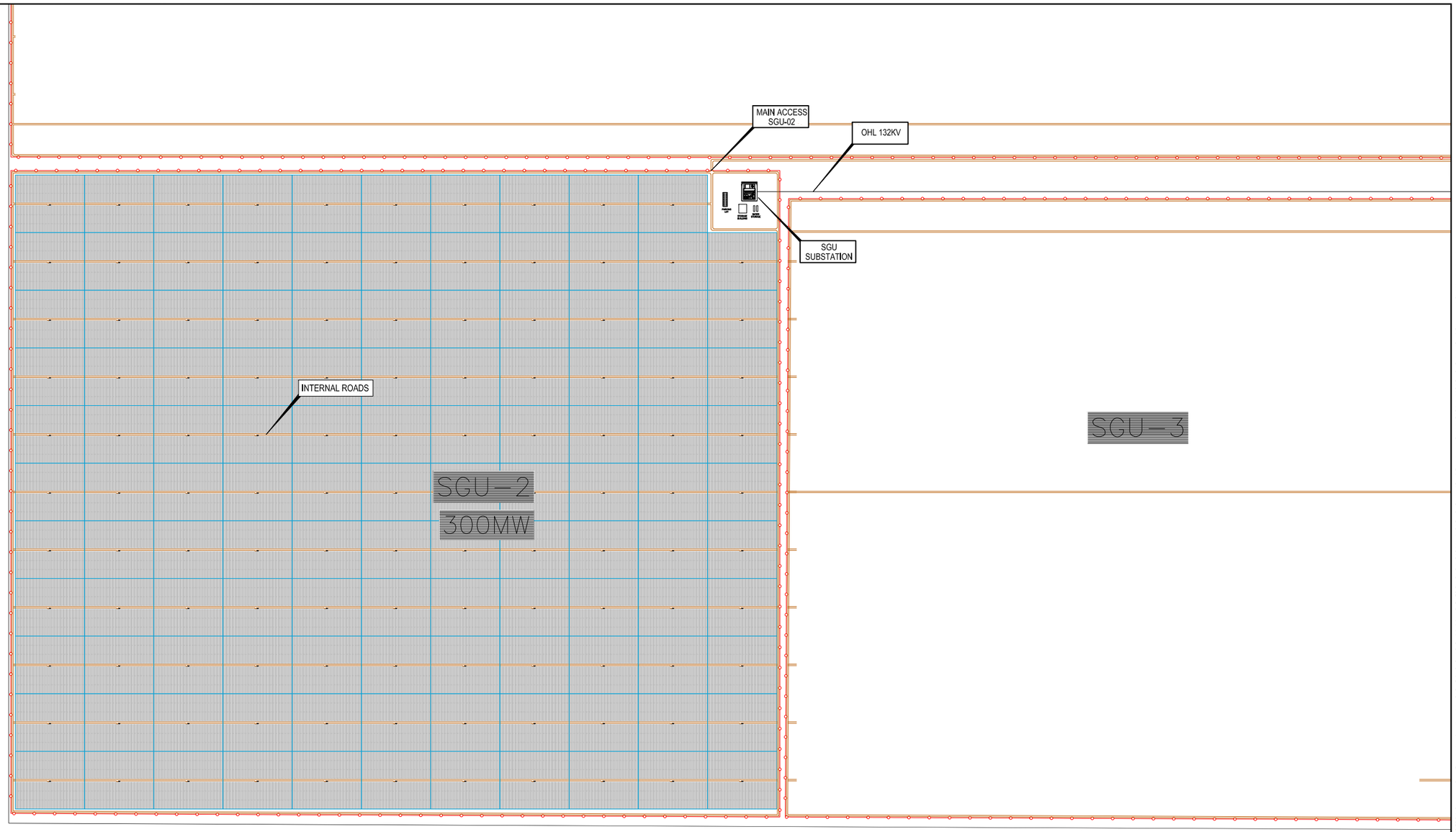
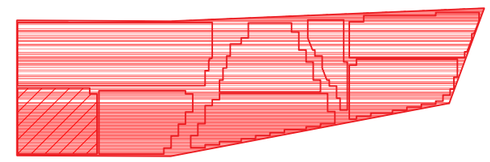


DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU — SINGLE GENERATION UNIT
- SS — SWITCHING SUBSTATION



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SCALE 1:7500

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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0	26/04/2019	ISSUED FOR CLIENT REVIW	IG	MB	JO					303011-00305-CI-PLN-103-0

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Renewable Energy Project Development Office

SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (2 of 8)

REV 1

DATE & TIME: 19/07/2019 06:17:32 PM
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DRAFT NOT FOR CONSTRUCTION

MAIN ACCESS SGU-03

OHL 132KV

SGU SUBSTATION

INTERNAL ROADS

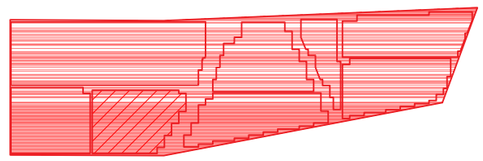
SGU–3
300MW

SGU–2

Natural Drainage

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU SINGLE GENERATION UNIT
- SS SWITCHING SUBSTATION



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SCALE 1:7500

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Renewable Energy Project Development Office

SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (3 of 8)

REV 1

DATE & TIME: 19/07/2019 06:19:38 PM USER NAME: Francisco.Pena LOCATION: G:\07_POWER\60451REPDO Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305_CI-PLN-103_SGU Layout Detail\303011-00305_CI-PLN-103_SGU Layout Detail_rev1.dwg

DRAFT NOT FOR CONSTRUCTION

Natural Drainage

Switching Substation

SGU SUBSTATION

UGL 132KV

INTERNAL ROADS

MAIN ACCESS SGU-04

Drainage Channel

SGU-8

SGU-4

300MW

SGU-5

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU SINGLE GENERATION UNIT
- SS SWITCHING SUBSTATION

150 0 150 300 450 600 750m

SCALE 1:7500

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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Renewable Energy Project Development Office

SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (4 of 8)

REV 1

DATE & TIME: 19/07/2019 06:23:14 PM USER NAME: Francisco.Pena LOCATION: G:\07_POWER\60451REPDD Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305_CI-PLN-103_SGU Layout Detail_rev1.dwg

DRAFT NOT FOR CONSTRUCTION

OHL 132KV

MAIN ACCESS SGU-05

SGU SUBSTATION

INTERNAL ROADS

SGU-5

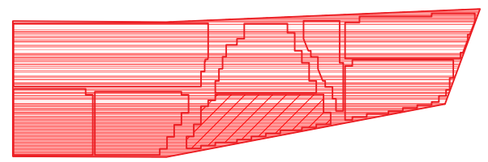
300MW

Natural Drainage

Drainage Channel

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU SINGLE GENERATION UNIT
- SS SWITCHING SUBSTATION



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SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (5 of 8)

REV 1

DATE & TIME: 19/07/2019 06:25:38 PM
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MAIN ACCESS SGU-06

SGU SUBSTATION

OHL 132KV

INTERNAL ROADS

DRAFT NOT FOR CONSTRUCTION

SGU-8

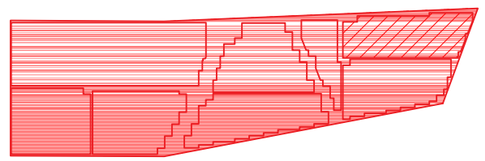
SGU-6

300MW

SGU-7

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU SINGLE GENERATION UNIT
- SS SWITCHING SUBSTATION



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Renewable Energy Project Development Office

SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (6 of 8)

REV 1

DATE & TIME: 19/07/2019 06:27:09 PM
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SGU-8

OHL 132KV

SGU SUBSTATION

MAIN ACCESS SGU-07

INTERNAL ROADS

SGU-7

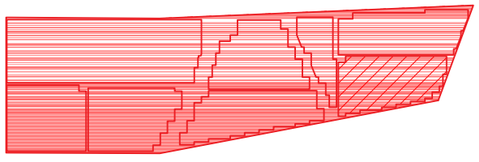
300MW

DRAFT NOT FOR CONSTRUCTION

Drainage Channel

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU — SINGLE GENERATION UNIT
- SS — SWITCHING SUBSTATION



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SCALE 1:7500

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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Renewable Energy Project Development Office

SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (7 of 8)

REV 1

DATE & TIME: 19/07/2019 06:29:24 PM USER NAME: Francisco.Pena LOCATION: G:\07_POWER\60451\REPDD Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY P

DRAFT NOT FOR CONSTRUCTION

MAIN ACCESS SGU-08

OHL 132KV

SGU SUBSTATION

INTERNAL ROADS

Drainage Channel

SGU-8

120MW

SGU-4

SGU-6

SGU-7

Drainage Channel

DRAWING KEY

- INTERNAL ROAD
- SITE BOUNDARY
- SGU FENCE
- ACCESS GATE
- BLOCK CONSTRUCTION PERIMETER
- BUILDINGS
- LAYDOWN AREAS
- SGU SINGLE GENERATION UNIT
- SS SWITCHING SUBSTATION

150 0 150 300 450 600 750m

SCALE 1:7500

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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Worley energy | chemicals | resources

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Renewable Energy Project Development Office

SGU LAYOUT DETAIL
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-103 (8 of 8)

REV 1

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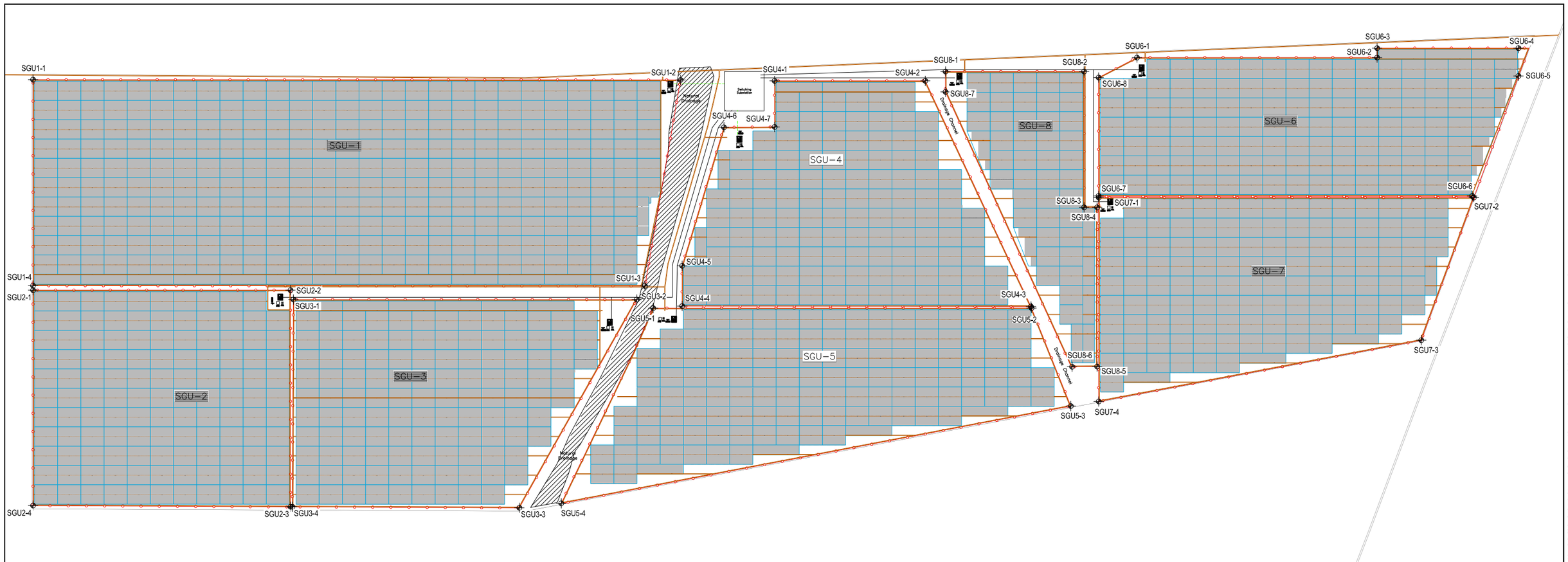

SGU-1 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-1-1	356594.45	2834107.60
SGU-1-2	363164.71	2834104.65
SGU-1-3	362803.86	2832015.62
SGU-1-4	356594.45	2832018.51

SGU-2 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-2-1	356594.45	2831972.78
SGU-2-2	359206.80	2831972.78
SGU-2-3	359206.80	2829776.19
SGU-2-4	356594.45	2829788.54

SGU-3 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-3-1	359236.59	2831877.57
SGU-3-2	362720.65	2831877.57
SGU-3-3	361528.93	2829765.76
SGU-4-4	359225.15	2829776.19

SGU-4 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-4-1	364119.50	2834095.50
SGU-4-2	365648.71	2834095.50
SGU-4-3	366720.87	2831807.50
SGU-4-4	363181.50	2831812.00
SGU-4-5	363181.50	2832219.50
SGU-4-6	363605.35	2833624.18
SGU-4-7	364119.94	2833628.00

SGU-5 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-5-1	362887.20	2831790.58
SGU-5-2	366726.62	2831791.42
SGU-5-3	367125.39	2830797.09
SGU-5-4	361954.73	2829810.61

SGU-6 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-6-1	367797.00	2834331.50
SGU-6-2	370233.50	2834331.50
SGU-6-3	370233.50	2834427.00
SGU-6-4	371668.00	2834427.00
SGU-6-5	371668.00	2834145.50
SGU-6-6	371198.45	2832928.56
SGU-6-7	367408.17	2832928.56
SGU-6-8	367408.00	2834129.00

SGU-7 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-7-1	367408.24	2832911.29
SGU-7-2	371215.04	2832911.29
SGU-7-3	370681.32	2831465.14
SGU-7-4	367408.50	2830843.53

SGU-8 AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SGU-8-1	365853.69	2834190.16
SGU-8-2	367260.18	2834190.16
SGU-8-3	367260.18	2832812.50
SGU-8-4	367392.68	2832812.50
SGU-8-5	367392.68	2831198.21
SGU-8-6	367129.87	2831196.54
SGU-8-7	365853.69	2833983.31

400 0 400 800 1200 1600 2000m

SCALE 1:20000

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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0	18/03/2019	ISSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-CI-PLN-105-0

Worley energy | chemicals | resources

CUSTOMER

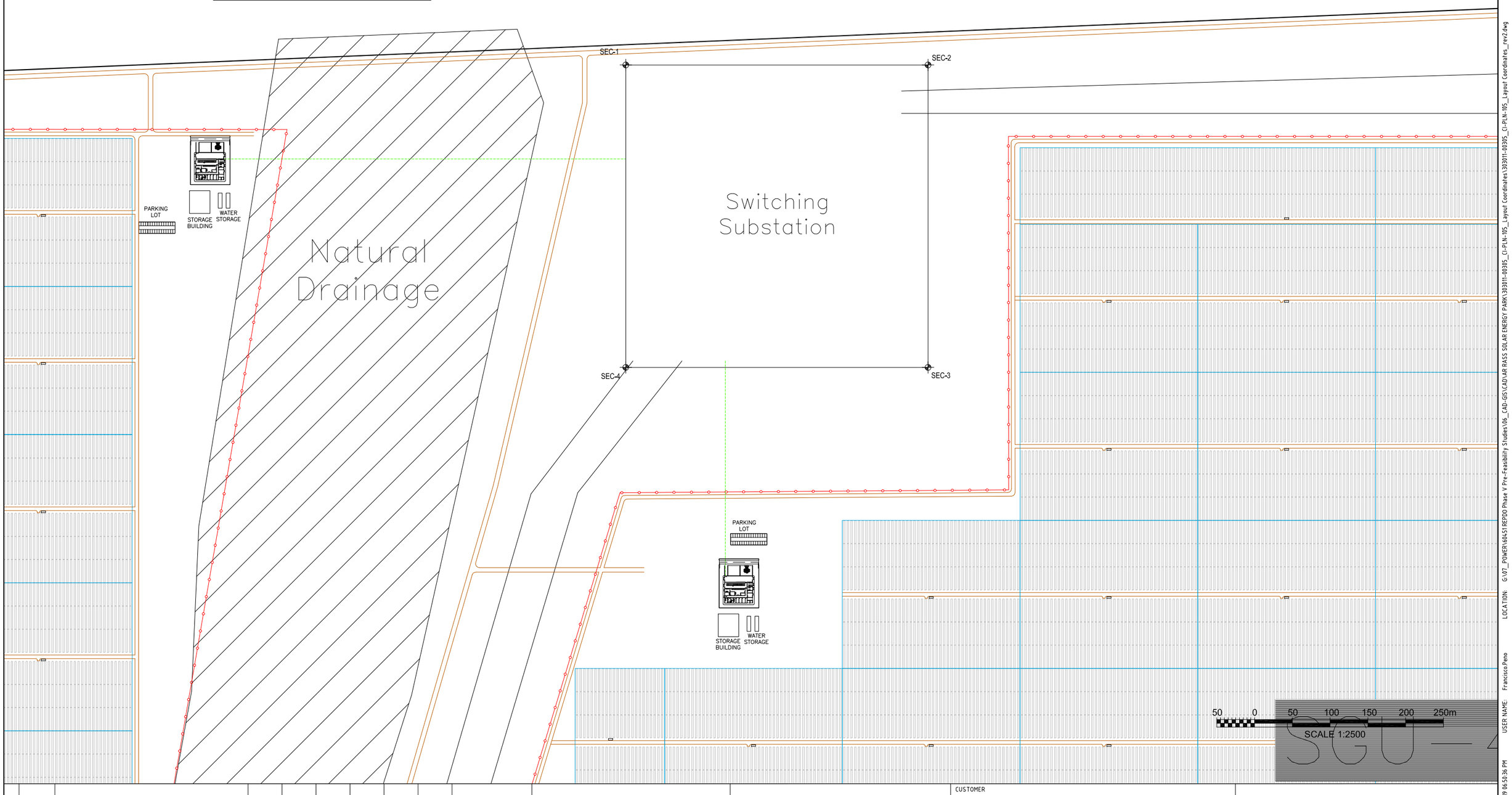
Renewable Energy Project Development Office

GENERAL SITE LAYOUT COORDINATES AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-105 (1of3) | REV 2

DATE & TIME: 19/07/2019 06:46:11 PM USER NAME: Francisco.Pena LOCATION: G:\07_POWER\60451REPDD Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305_CI-PLN-105_Layout Coordinates\303011-00305_CI-PLN-105_Layout Coordinates_rev2.dwg

SEC SUBSTATION AREA COORDINATES (WGS84 38North)		
POINT	X	Y
SEC-1	363613.10	2834189.91
SEC-2	364013.10	2834189.91
SEC-3	364013.10	2833789.91
SEC-4	363613.10	2833789.91



REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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0	14/06/2019	ISSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-CI-PLN-105-0

Worley energy | chemicals | resources

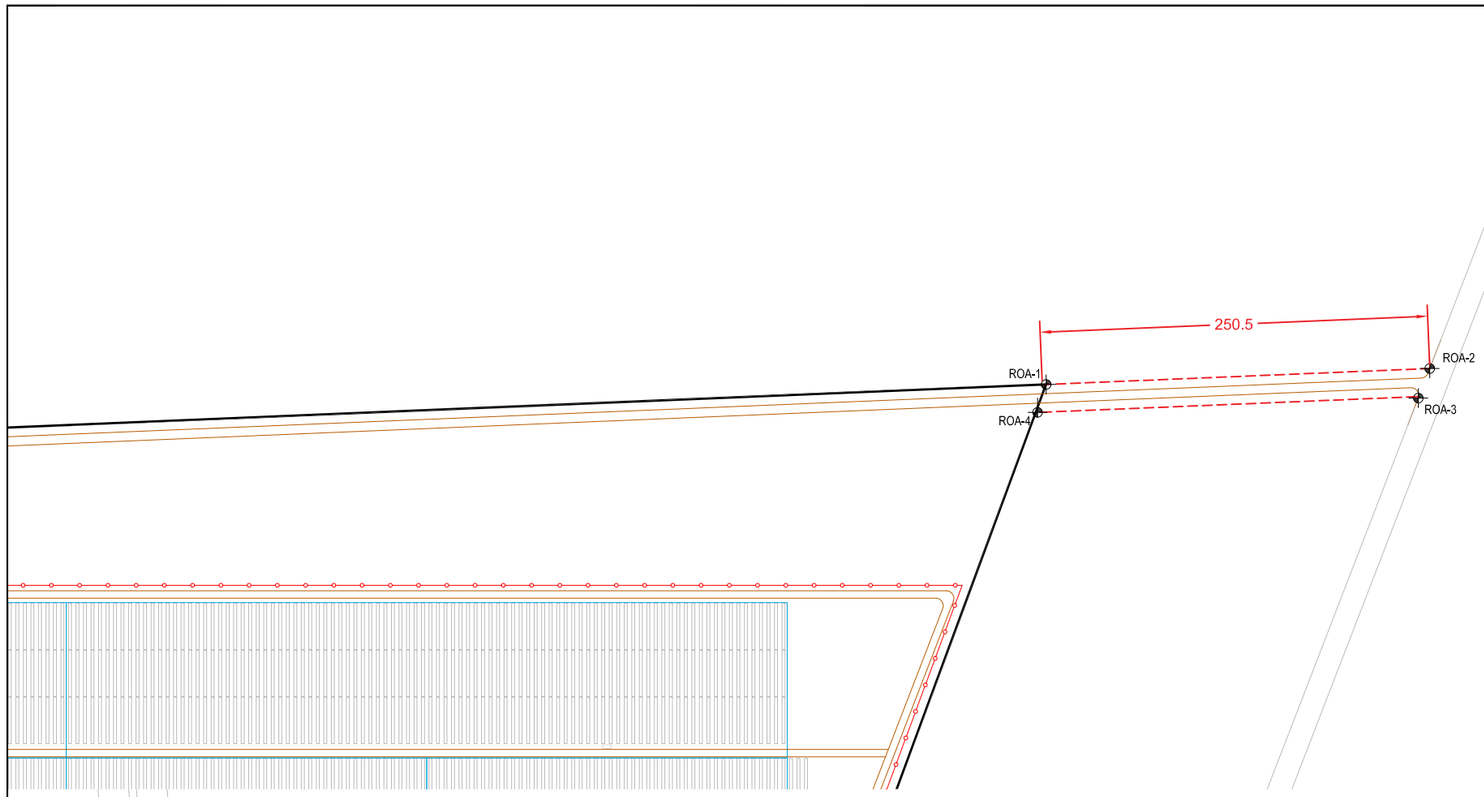
CUSTOMER

Renewable Energy Project Development Office

SEC SUBSTATION COORDINATES
AR RASS SOLAR ENERGY PARK

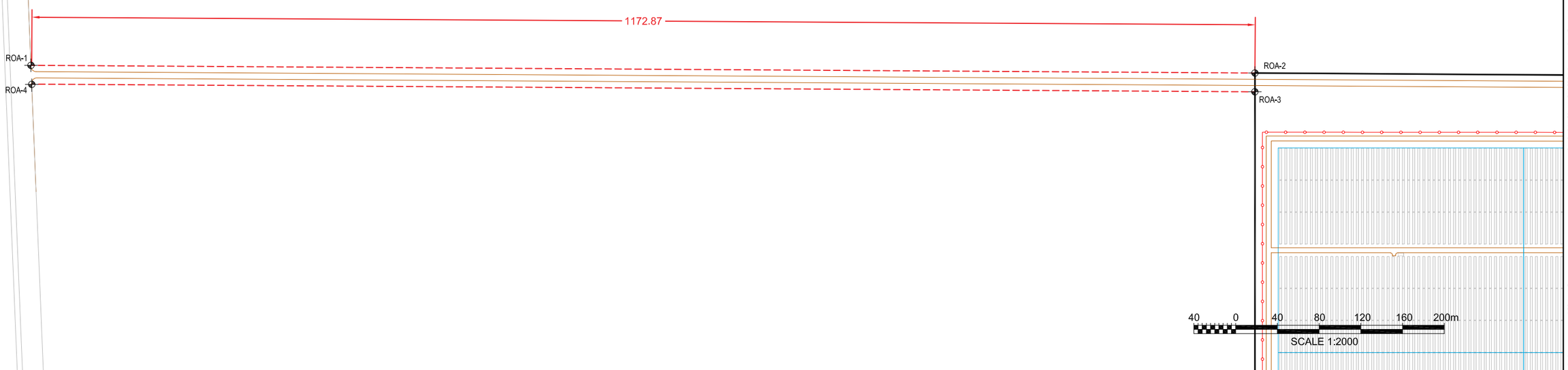
DRG No 303011-00305-CI-PLN-105 (2of3) REV 2

DATE & TIME: 19/07/2019 06:50:36 PM USER NAME: Francisco.Pena LOCATION: G:\07_POWER\60451 REPDD Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305_CI-PLN-105_Layout Coordinates\303011-00305_CI-PLN-105_Layout Coordinates_rev2.dwg



ROAD EAST ACCESS COORDINATES (WGS84 38North)		
POINT	X	Y
ROA-1	371829.18	2834557.96
ROA-2	372079.47	2834568.35
ROA-3	372072.28	2834550.04
ROA-4	371822.13	2834539.77

ROAD WEST ACCESS COORDINATES (WGS84 38North)		
POINT	X	Y
ROA-1	355414.35	2834171.64
ROA-2	356587.23	2834164.26
ROA-3	356587.15	2834146.26
ROA-4	355415.08	2834153.63



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Worley
energy | chemicals | resources

CUSTOMER

Renewable Energy Project Development Office

ACCESS ROAD EAST & WEST COORDINATES
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-105 (3de3)

REV 1

DATE & TIME: 19/07/2019 07:14:59 PM
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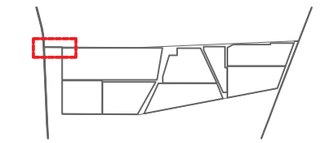
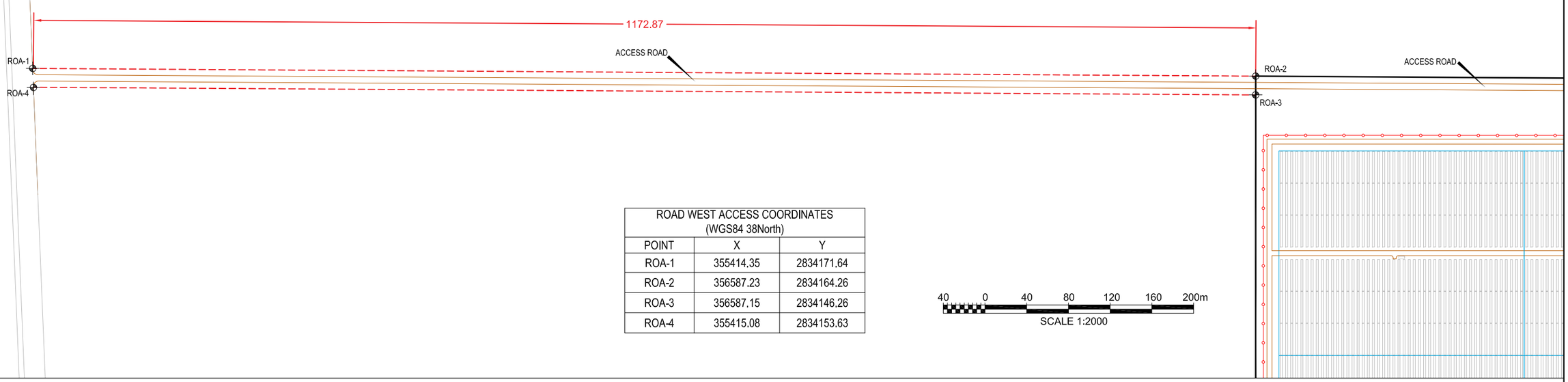
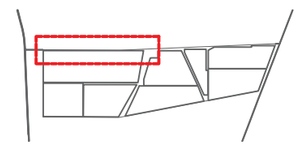
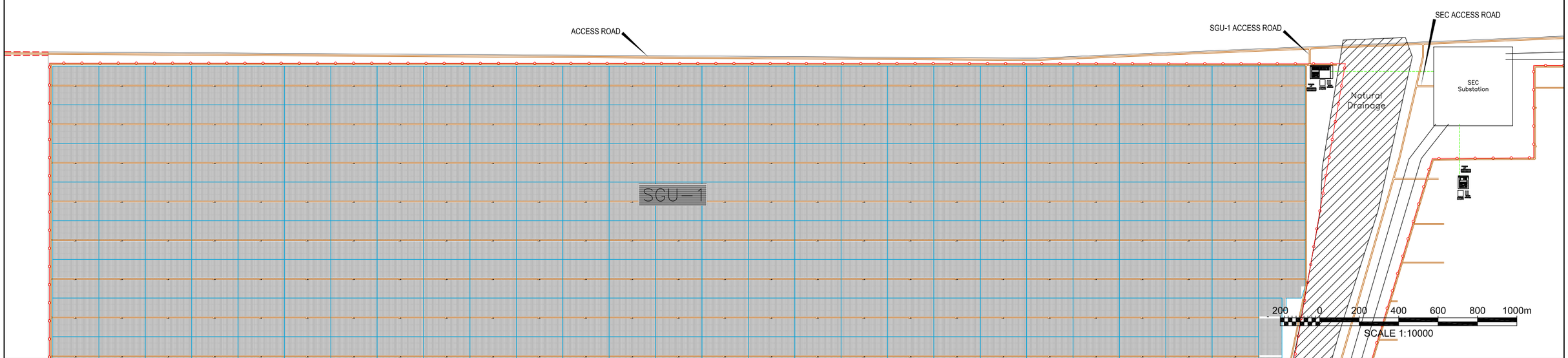




ROAD WEST ACCESS COORDINATES (WGS84 38North)		
POINT	X	Y
ROA-1	355414.35	2834171.64
ROA-2	356587.23	2834164.26
ROA-3	356587.15	2834146.26
ROA-4	355415.08	2834153.63





REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
0	24/10/2019	ISSUED FOR CLIENT REVIEW	FP	JO	JO				WP7	303011-00305-CI-PLN-105_Layout SGU1 Coordinates.dwg

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Renewable Energy Project Development Office

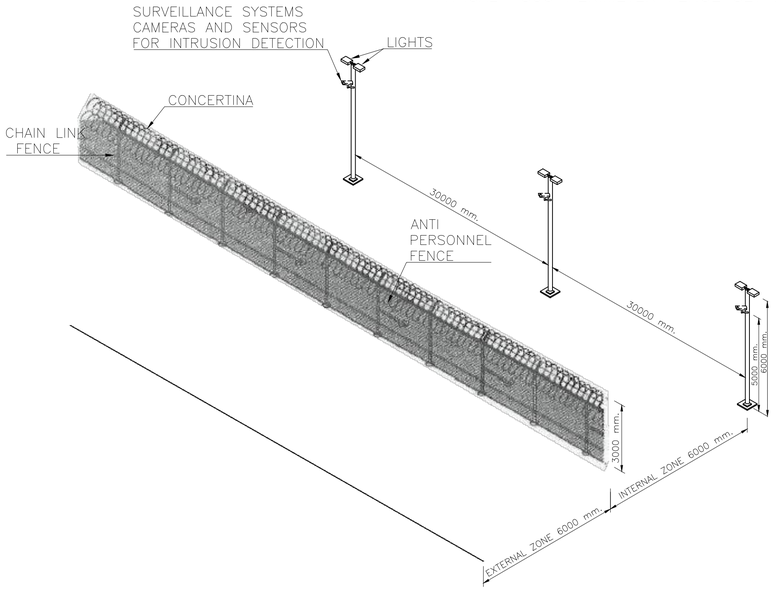
ACCESS ROAD EAST & WEST COORDINATES AR RASS SOLAR ENERGY PARK

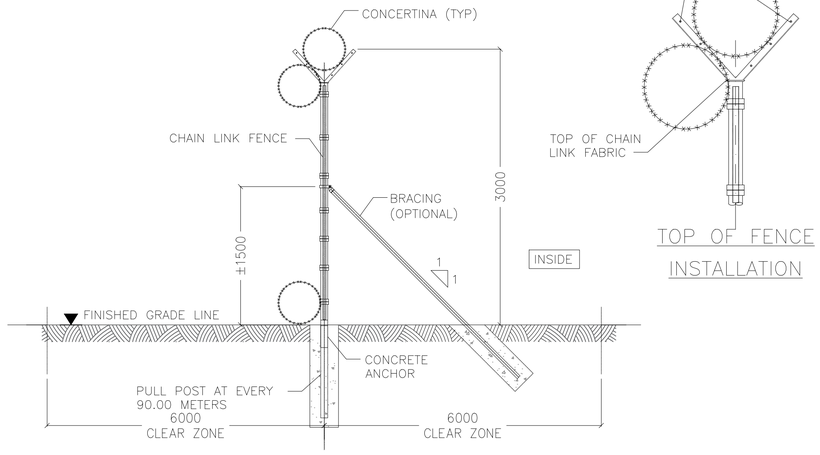
DRG No 303011-00305-CI-PLN-109 (3 of 3)

REV 2

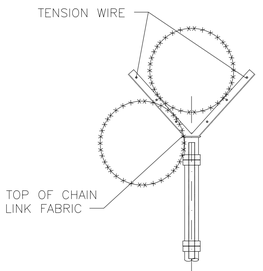
DATE & TIME: 24/10/2019 04:26:21 PM
USER NAME: Francisco.Pena
LOCATION: G:\07_POWER\60451\REPDD Phase 1 Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305_CI-PLN-109_Layout SGU1 Coordinates.dwg

TYPICAL SGU PERIMETER FENCE SET BACK





SECTION A-A'



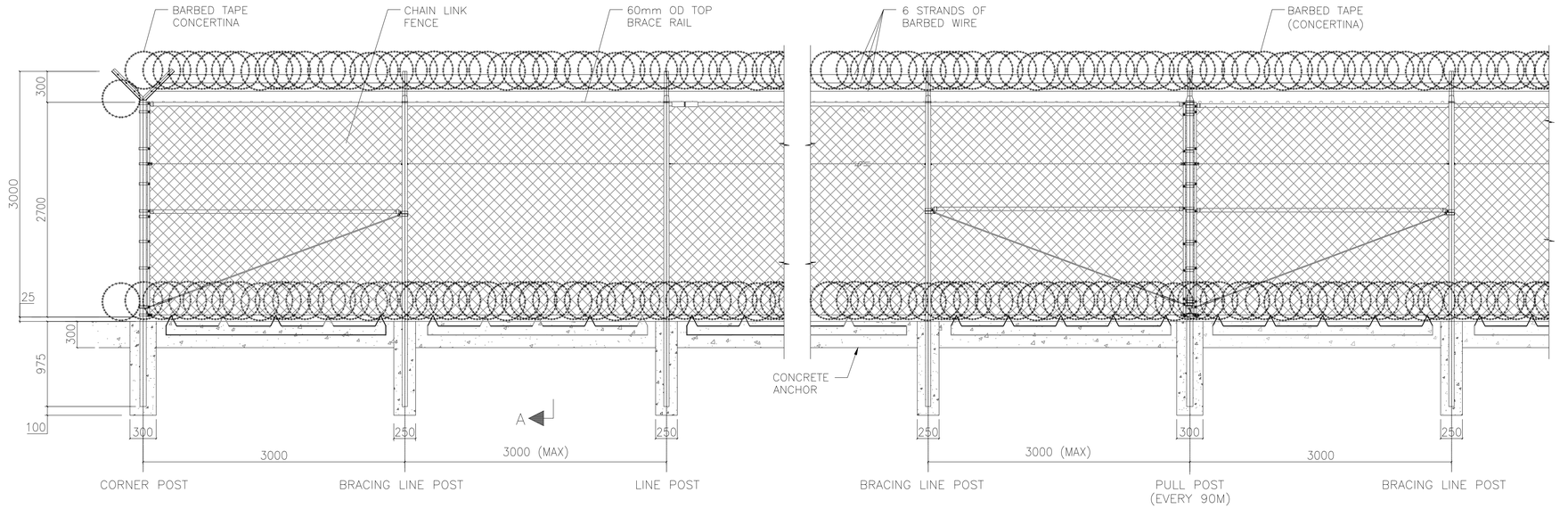
TOP OF FENCE INSTALLATION

NOTES:

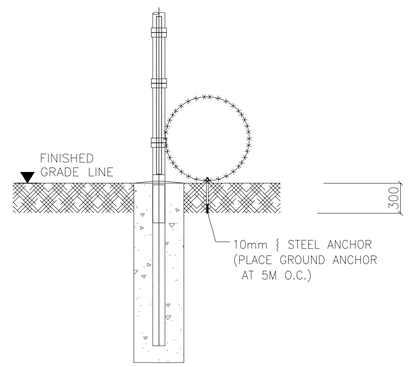
1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. TOP OF THE FENCE SHALL FOLLOW THE PROFILE OF THE GROUND.
3. FOUNDATION WORK SHALL BE IN ACCORDANCE WITH APPLICABLE INDUSTRY CODES, STANDARD AND PROCEDURE.
4. FOUNDATION CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE INDUSTRY CODES, STANDARD, SPECIFICATION AND PROCEDURE.
5. ALL BOLT THREADS SHALL BE BURRED AFTER FASTENING TO PREVENT REMOVAL.
6. BRACING POSTS SHALL BE PROVIDED AT ALL ENDS, CORNERS AND ACUTE VARIATIONS IN LEVELS. THE DISTANCE BETWEEN STRAINING POSTS SHALL NOT EXCEED 90 METERS. LINE POSTS SHALL BE AT 3000mm MAXIMUM SPACING.
7. FENCE POSTS AND BRACES SHALL BE IN ACCORDANCE WITH ASTM F1083 GROUP 1A SCHEDULE 80 PVC COATED.
8. FABRIC SHALL BE VINYL COATED CHAIN LINK AND FUSION BONDED AS PER ASTM F668, CLASS 2B, WITH A 50mm DIAMOND MESH AND A HEIGHT OF 2700mm.
9. REFERENCES HCIS, SECURITY DIRECTIVE FOR INDUSTRIAL FACILITIES (2017), SEC-02 SECURITY FENCING, SECTION 5.5 CATEGORY 3 FENCING SYSTEM.

LEGEND:

℄	–	CENTERLINE
MAX	–	MAXIMUM
M	–	METER
mm	–	MILLIMETERS
OC	–	ON CENTER
OD	–	OUTER DIAMETER
TYP	–	TYPICAL



GENERAL LAYOUT - CLASS 3 CHAIN LINK SECURITY FENCE



BOTTOM OF FENCE INSTALLATION

DRAFT NOT FOR CONSTRUCTION

FENCE
SCALE N/S

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
1	19/07/2019	INSSUED FOR CLIENT REVIEW	FP	MB	JO					303011-00305-CI-PLN-106_HCIS Fencing Details_rev1.dwg
0	26/04/2019	INSSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-CI-PLN-106. DWG

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المملكة العربية السعودية

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Renewable Energy Project Development Office

HCIS FENCING DETAILS
AR RASS SOLAR ENERGY PARK

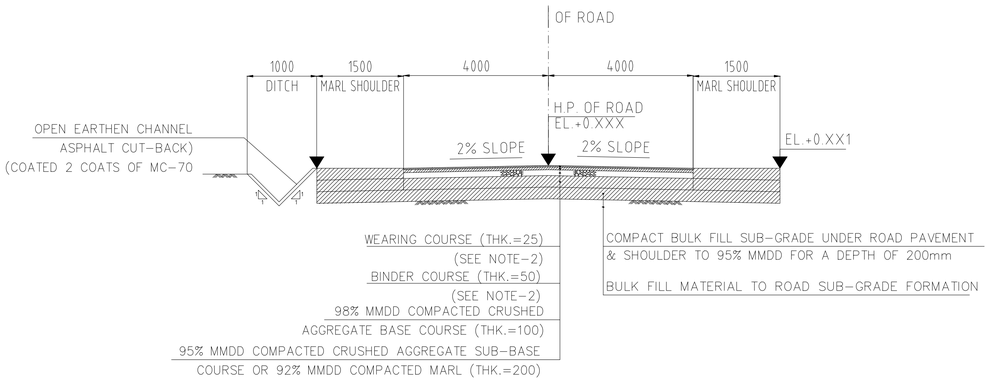
DRG No 303011-00305-CI-PLN-106

REV 1

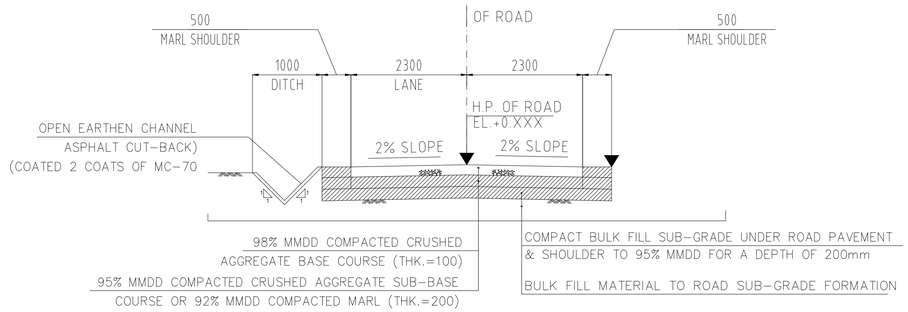
DATE & TIME: 19/07/2019 10:48:55 AM
USER NAME: Francisco Pena
LOCATION: G:\07_POWER\60452_ScaTecSolar_Detail_Eng_PV_117MW\07_CAD\REPDO V\AR RASS SOLAR ENERGY PARK\303011-00305_CI-PLN-106_HCIS Fencing Details_rev1.dwg

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS AND ELEVATIONS ARE IN METERS UNLESS OTHERWISE NOTED.
2. ASPHALT PAVING FOR BINDER AND WEARING COURSES SHALL BE A MIXTURE OF ASPHALT CEMENT, COARSE AGGREGATES, FINE AGGREGATES AND IF REQUIRED, MINERAL FILLER.
3. REFERENCE SAUDI ARAMCO PLANT LAYOUT REQUIREMENTS SAES-B-055 FOR PRIMARY AND SECONDARY ROADS. REFERENCE SEC-02 SECURITY FENCING, SECTION 4.5 CATEGORY 3 FENCING SYSTEM FOR PATROL ROADS.

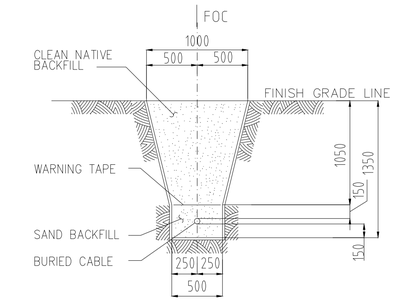


1 / - PRIMARY ROAD



2 / - PATROL ROAD

DRAFT NOT FOR CONSTRUCTION



3 / - CABLE TRENCH DETAIL

SECTIONS & DETAILS
SCALE N/S

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
1	19/07/2019	INSSUED FOR CLIENT REVIEW	NF	MB	JO					303011-00305-CI-PLN-107 Roads, Drainage Cable Trench typical Details_rev1.dwg
0	26/04/2019	INSSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-CI-PLN-107. DWG

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Renewable Energy Project Development Office

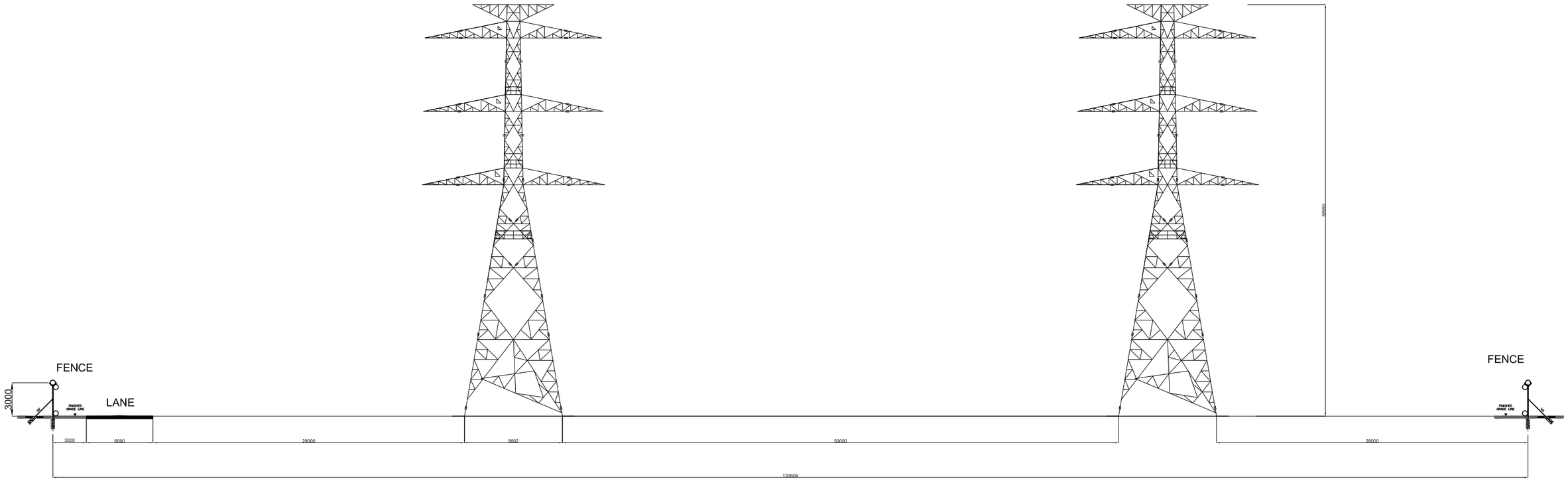
ROADS, DRAINAGE & CABLE TRENCH TYPICAL DETAILS
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-CI-PLN-107
REV 1

DATE & TIME 19/07/2019 11:22:48 AM USER NAME NatividadFurelos LOCATION G:\07 POWER\64\52 Scale\Solar Detail End PV 117MW\07 CAD\REPDD V\AR RASS SOLAR ENERGY PARK\303011-00305-CI-PLN-107 Roads, Drainage Cable Trench typical Details_rev1.dwg

NOTES:

1. REFERENCE TO TRANSMISSION ENGINEERING STANDARD, TES-P-122.09 REV.0, TABLE 09.16



DRAFT NOT FOR CONSTRUCTION

SECTION 1
SCALE N/S

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
2	19/07/2019	ISSUED FOR CLIENT REVIEW	NF	MB	JO					303011-00305-EL-PLN-101_Type Sections_rev2. dwg
1	26/04/2019	ISSUED FOR CLIENT REVIEW	RM	BM	JO					-

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Renewable Energy Project Development Office

SECTION 01 HV-SINGLE LINE A 110kV
AR RASS SOLAR ENERGY PARK

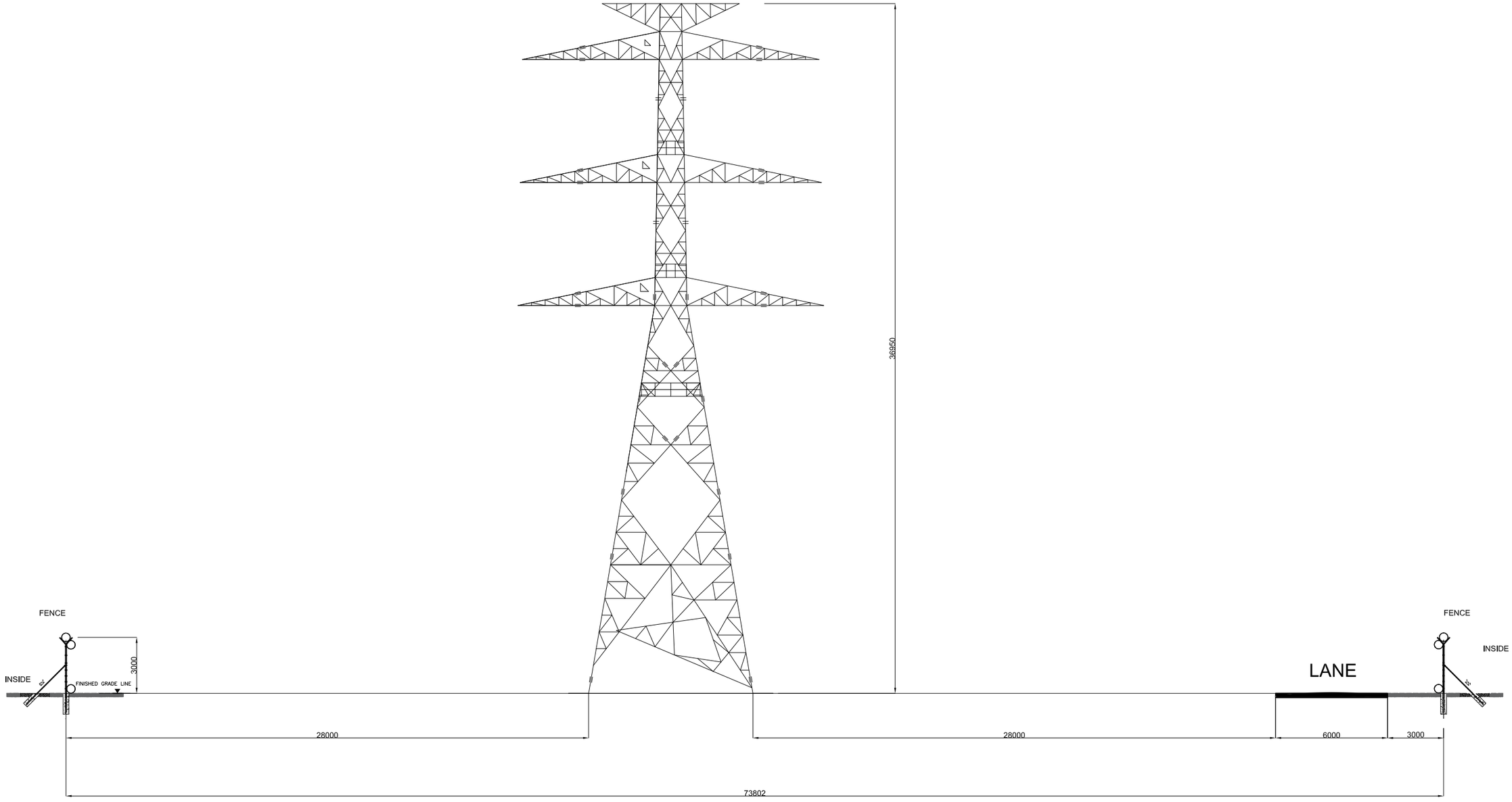
DRG No 303011-00305-EL-PLN-101 (1 of 2)

REV 2

DATE & TIME: 19/07/2019 03:56:17 PM USER NAME: Francisco.Pena LOCATION: G:\07_POWER\60451 REPDD Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305-EL-PLN-101_Type Sections_rev2.dwg

NOTES:

1. REFERENCE TO TRANSMISSION ENGINEERING STANDARD, TES-P-122.09 REV.0, TABLE 09.16



DRAFT NOT FOR CONSTRUCTION

SECTION 2
SCALE N/S

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
2	19/07/2019	ISSUED FOR CLIENT REVIEW	NF	MB	JO					303011-00305-EL-PLN-101_Type Sections_rev2. dwg
1	26/04/2019	ISSUED FOR CLIENT REVIEW	RM	BM	JO					-

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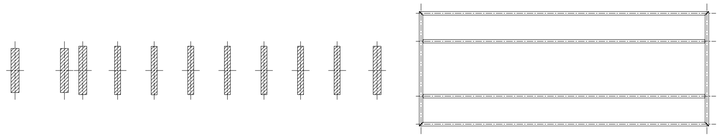
SECTION 01 HV-SINGLE LINE A 110kV
AR RASS SOLAR ENERGY PARK

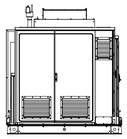
DRG No 303011-00305-EL-PLN-101 (2 of 2)

REV 2

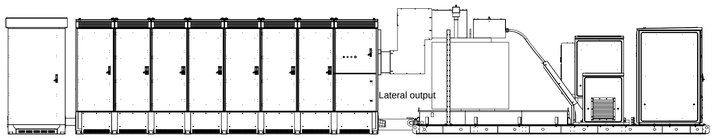
DATE & TIME: 19/07/2019 03:57:13 PM USER NAME: Francisco.Pena LOCATION: G:\07_POWER\60451REPDD Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305-EL-PLN-101_Type Sections_rev2.dwg



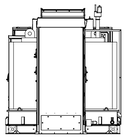
INVERTER FOUNDATIONS TOP VIEW

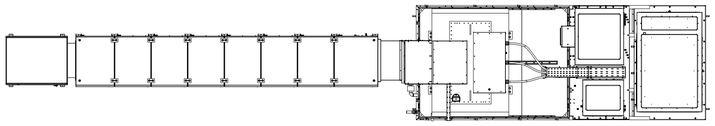


SIDE VIEW

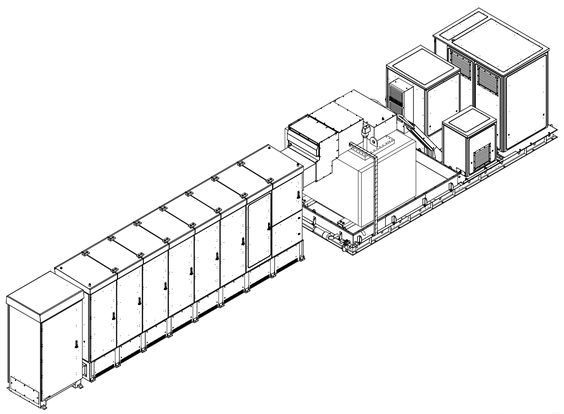


FRONTVIEW



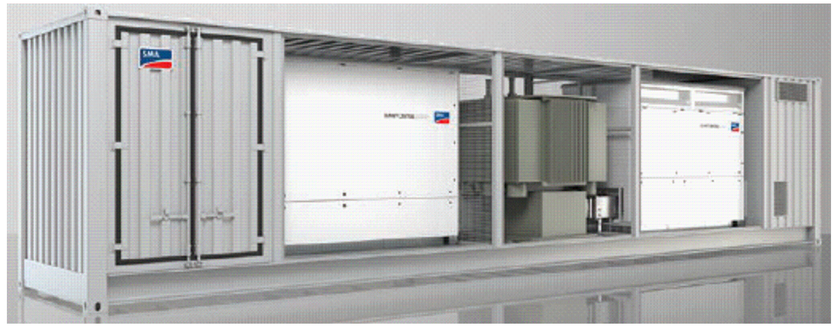


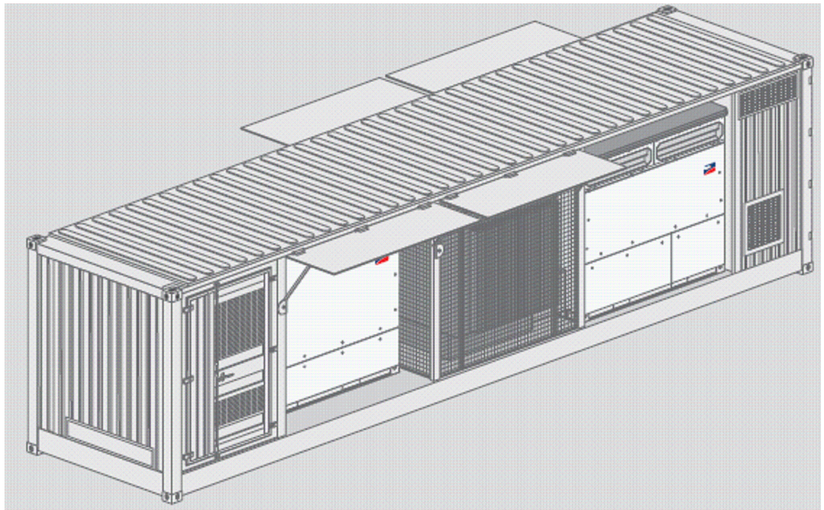
TOP VIEW

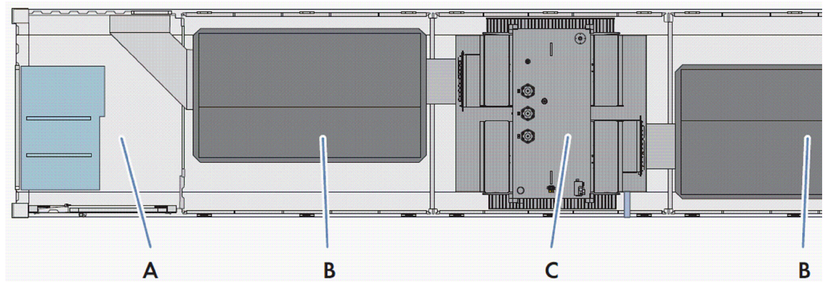


POWER ELECTRONIC
INVERTER SKID
EXAMPLE 1

DRAFT NOT FOR CONSTRUCTION







A–MV Switchgear
B–Inverters
C–MV Transformer
D–LV Room

SMA
INVERTER STATION
EXAMPLE 2

INVERTER STATION
SCALE N/S

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
1	19/07/2019	INSSUED FOR CLIENT REVIEW	NF	MB	JO					303011-00305-EL-PLN-102.Typical Inverter Station_rev1. dwg
0	xxxxx	INSSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-EL-PLN-102. DWG

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TYPICAL INVERTER STATION
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-EL-PLN-102

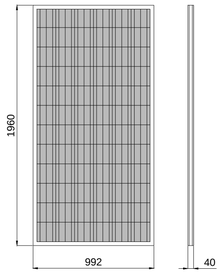
REV 1

DATE & TIME 19/07/2019 11:30:12 AM USER NAME Nathvidad.Furelos LOCATION: G:\07_POWER\60452_ScatecSolar_Detail_Eng_PV_117MW\07_CAD\REPDO\ VVAR RASS SOLAR ENERGY PARK\303011-00305_EL-PLN-102_Typical Inverter Station_rev1.dwg

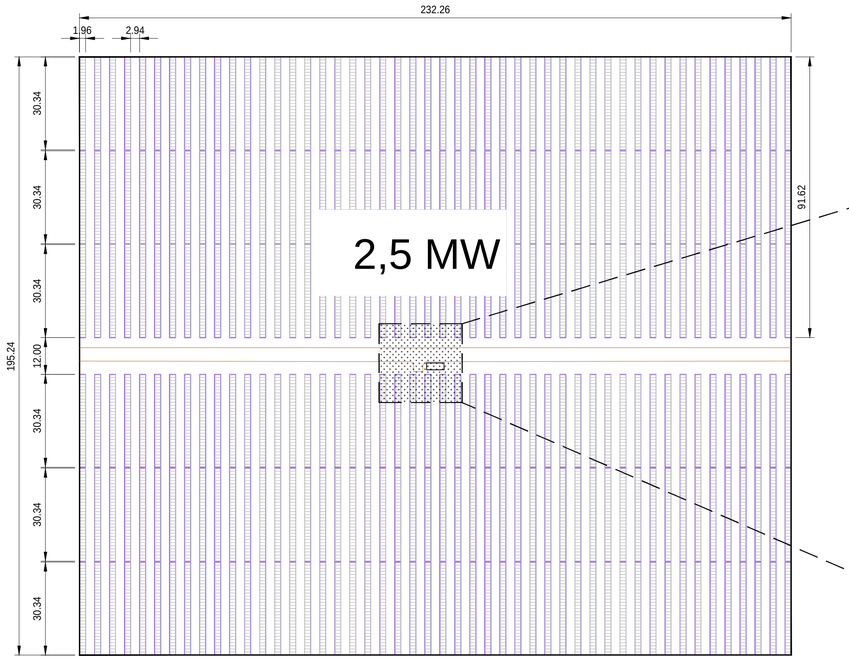
BLOCK ARRANGEMENT

- Number of Modules = 8,640
- Modules per string = 30
- Number of Strings = 288
- Block Power = 3,024,000 kWp
- Inverter Power = 2500 kWp
- DC/AC ratio = 1.21
- GCR = 0.4
- Azimut = 0°
- Pitch Between Structures E-W: 2.94 m
- 1x30 Structure Dimension: 30.34 x 1.96 m
- Number of tracking structures = 288
- Module Power = 350W

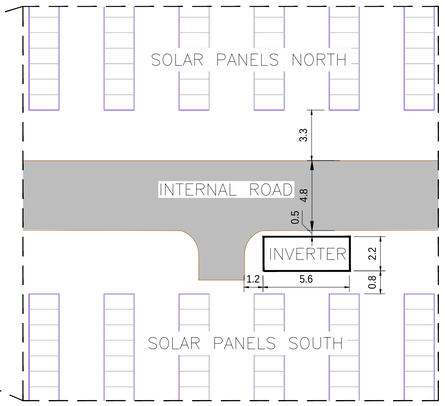
DRAFT NOT FOR CONSTRUCTION



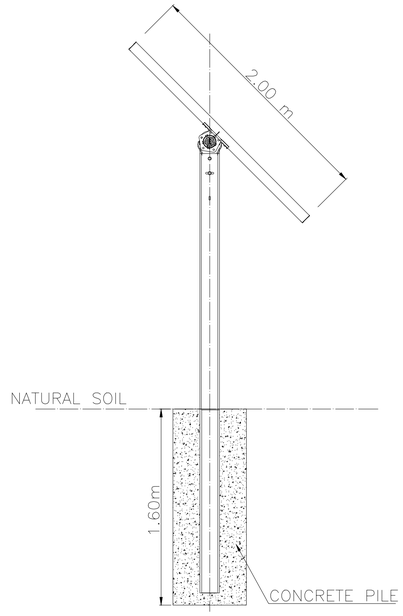
SOLAR PANEL
SCALE 1:25



TYPICAL SOLAR MODULE
SCALE 1:1000



LOCATION INVERTER DETAIL (TYP)
SCALE 1:200



SOLAR SINGLE AXIS TRACKER
SCALE 1:25

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
1	19/07/2019	INSSUED FOR CLIENT REVIEW	NF	MB	JO					303011-00305-EL-PLN-103.Typical Array Layout & Support Structure_rev1.dwg
0	26/04/2019	INSSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-EL-PLN-103. DWG

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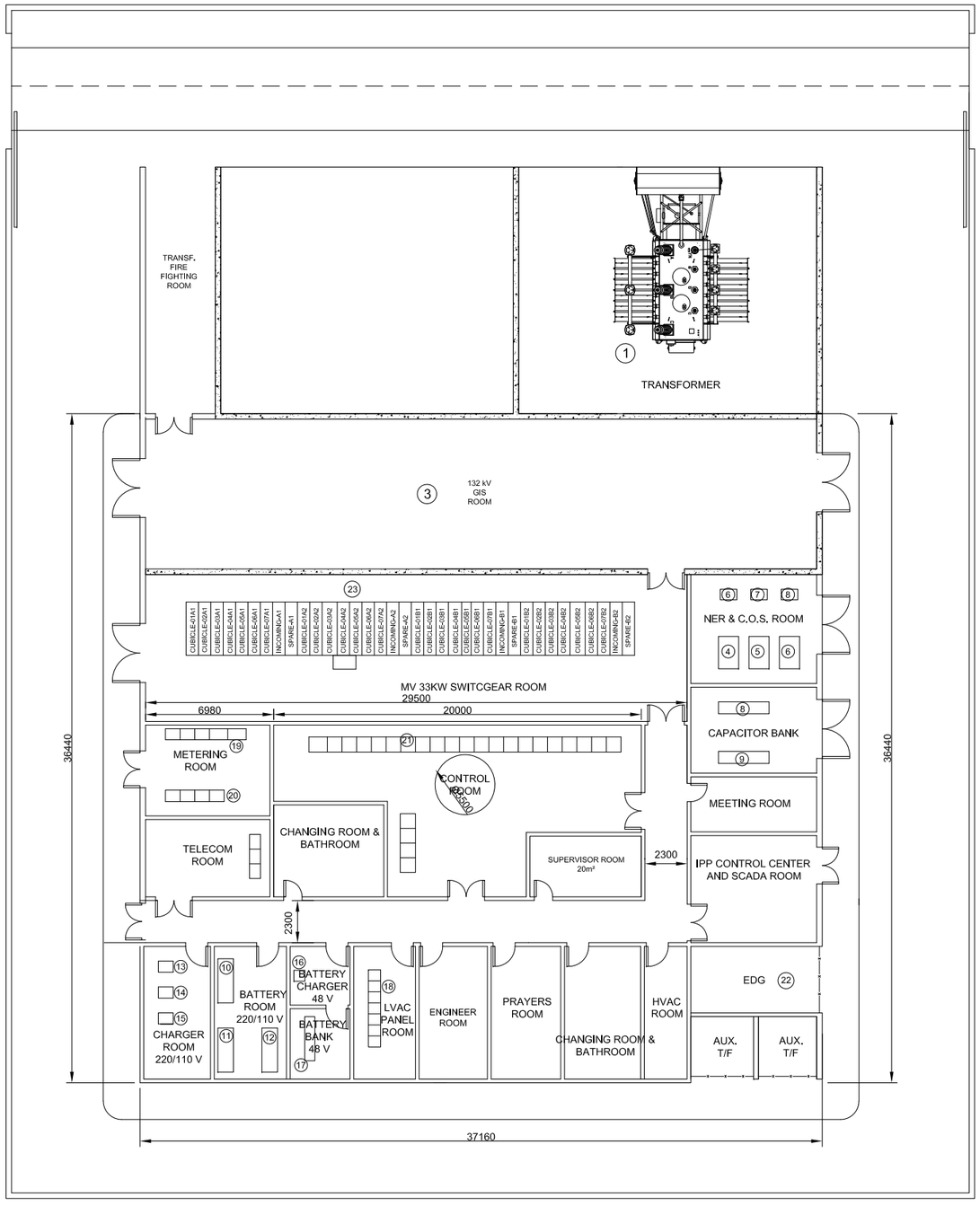
TYPICAL ARRAY LAYOUT & SUPPORT STRUCTURE
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-EL-PLN-103

REV 1

DATE & TIME: 19/07/2019 12:43:16 PM
USER NAME: Natividad Furelos
LOCATION: G:\07_POWER\60452_ScaTecSolar_Detail_Eng_PV_117MW\07_CAD\REPDO V\AR RASS SOLAR ENERGY PARK\303011-00305_EL-PLN-103_Typical Array Layout & Support Structure_rev1.dwg



IPP SUBESTATION

ESCALE 1:150

EQUIPMENT LIST	
TAG Nº	DESCRIPTION
1	High voltage power transformer 320/305 MVA - 1
2	-
3	132kV Gis Room
4	Neutral resistor - 1
5	Neutral resistor - 2
6	Change over switch - 1
7	Change over switch - 2
8	Capacitor bank - 1
9	Capacitor bank - 2
10	Battery bank for control 220 V
11	Battery bank for tripping 220 V
12	Battery bank for emer. lighting 110 V
13	Battery charger for control 220 V
14	Battery charger for tripping 220 V
15	Battery charger for light 110 V
16	Battery charger 48 V
17	Battery bank 48 V
18	LVAC panel
19	Main and check metering panel busbar A
20	Main and check metering panel busbar B
21	33 kV Control and relay panel
22	Emergency Diesel Generator
23	33 kV Switchgear

DRAFT NOT FOR CONSTRUCTION

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
1	19/07/2019	INSSUED FOR CLIENT REVIEW	NF	MB	JO					303011-00305-EL-PLN-104.Typical SGU Substation Layout_rev1
0	26/04/2019	INSSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-EL-PLN-104. DWG

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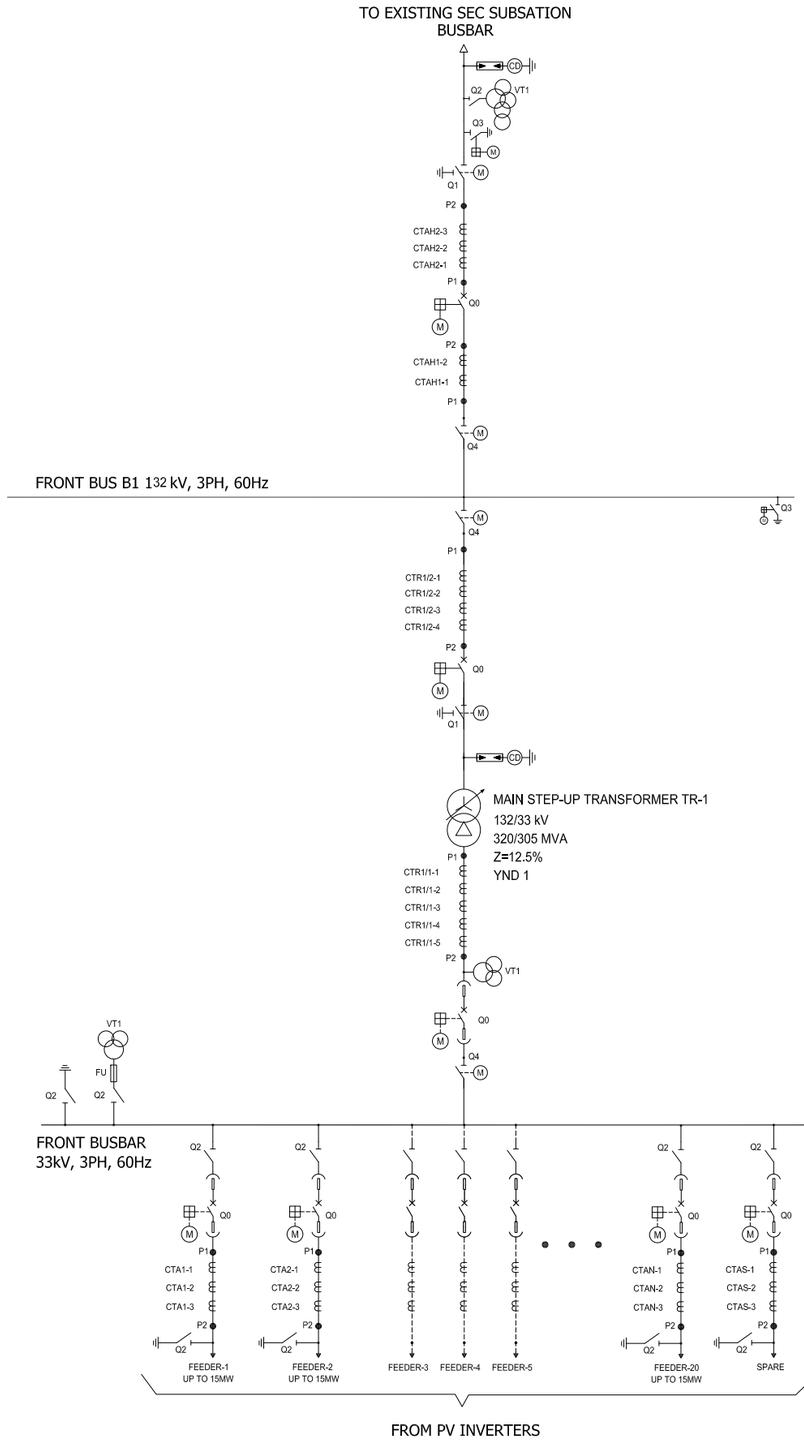
TYPICAL SGU SUBSTATION LAYOUT
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-EL-PLN-104

REV 1

DATE & TIME: 19/07/2019 03:49:44 PM
USER NAME: Francisco Peno
LOCATION: G:\07_POWER\60451 REPDO Phase V Pre-Feasibility Studies\06_CAD-GIS\CAD\AR RASS SOLAR ENERGY PARK\303011-00305_EL-PLN-104_Typical SGU Substation Layout_rev1.dwg



LEGEND:

[redacted]

LEGEND:

NUMBER	SYMBOL	DESCRIPTION
Q0		CIRCUIT BREAKER WITH MOTOR OPERATED SPRING MECHANISM
Q1		3 POSITION SWITCH WITH MOTOR OPERATED (ISOLATOR + WORK IN PROGRESS EARTH SWITCH)
Q2		ISOLATOR / DISCONNECTOR INCORPORATED WITH VT (MANUAL OPERATION)
Q3		HIGH SPEED EARTHING SWITCH WITH MOTOR OPERATING
Q4		SWITCH WITH MOTOR OPERATED
FU		FUSE
VT1		VOLTAGE TRANSFORMER WITH TWO OR THREE SECONDARY WINDINGS
VT		VOLTAGE TRANSFORMER WITH ONE SECONDARY WINDING
CT		CURRENT TRANSFORMER (P1 & P2 - PRIMARY OF CT)
-		SURGE ARRESTER
-		COUNTER DISCHARGE
-		EARTHING POINT
-		380/33 kV BUS BAR
-		110/33 kV CABLE
-		CABLE SEALING END
-		MAIN STEP UP TRANSFORMER

[redacted]

DRAFT NOT FOR CONSTRUCTION

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
2	19/07/2019	ISSUED FOR CLIENT REVIEW	NF	MB	JO					303011-00305-EL-PLN-105.General_Single_Diagram_rev2. dwg
1	14/06/2019	ISSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-EL-PLN-105-1
0	26/04/2019	ISSUED FOR CLIENT REVIEW	IG	MB	JO					303011-00305-EL-PLN-105-0

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GENERAL SINGLE LINE DIAGRAM
300 MW SGU
AR RASS SOLAR ENERGY PARK

DRG No 303011-00305-EL-PLN-105 (2 of 3)

REV 2

DATE & TIME: 19/07/2019 03:33:42 PM
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Appendix D. Maps

356000 360000 364000 368000 372000

2836000 2832000 2828000

Legend

Ar Rass Solar Energy Park

Habitats

Hot Desert

1:50.000

0 0,5 1 2 3 Km.

WGS 84 UTM Zone 38N
Source:
Basemap licensed by ESRI- Bing Maps for ArcGIS Desktop Users
Service Agreement. See http://www.esri.com/legal/licensing/third-party-data.html

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0	2019/08/26	ISSUED FOR CLIENT REVIEW	FP	YZ	JO					60451-01-Land Use Ar Rass_rev0.mxd

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HABITATS MAP
Ar Rass Solar Energy Park

CODE **306014-15818-1-ENV-02** Rev.0

356000 360000 364000 368000 372000

2836000

2832000

2828000

N

Legend

Ar Rass Solar Energy Park

Land Use

Open land

Roads

1:50.000

0 0,5 1 2 3 Km.

WGS 84 UTM Zone 38N
Source:
Basemap licensed by ESRI- Bing Maps for ArcGIS Desktop Users
Service Agreement. See http://www.esri.com/legal/licensing/third-party-data.html

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REV	DATE	REVISION DESCRIPTION	DRAW	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
0	2019/08/26	ISSUED FOR CLIENT REVIEW	FP	YZ	JO					60451-01-Land Use Ar Rass_rev0.mxd

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LAND USE MAP
Ar Rass Solar Energy Park

CODE **306014-15818-1-ENV-01** Rev.0

356000 360000 364000 368000 372000

Appendix E. Inverters Typical Technical Specifications

SC-2200-10 / SC-2500-EV-10 / SC-2750-EV-10

Efficient

- More power per cubic meter
- Up to 4 inverters can be transported in one standard shipping container
- DC/AC Over-dimensioning up to 250%*

Robust

- Proven high-precision air-cooling system for intelligent, effective cooling
- Can be installed outdoors anywhere in the world in any ambient condition

Flexible

- Conforms to all known grid requirements worldwide
- Provides Q on demand
- Available as a stand-alone or turn-key solution with medium-voltage block

Easy to Use

- Improved DC connection area
- Bay for connecting customer equipment
- Integrated voltage supply for internal consumption and external loads

SUNNY CENTRAL 2200 / 2500-EV / 2750-EV

The new Sunny Central: maximum power density and integration

With an output of up to 2750 kVA and system voltage of 1000 volts DC or 1500 volts DC, SMA's central inverters allow for more efficient system design. An integrated transformer and additional space is available for the installation of customer equipment. The Sunny Central has been optimized for outdoor installation. The air cooling system OptiCool™ ensures smooth operation, even in extreme ambient temperatures. Sand and dust particles are effectively kept away. The Sunny Central is the central component of SMA Utility Power Systems. In combination with the medium-voltage block, DC technology, power plant controlling system and SMA Service, it is also available as compact platform solution.

*depending on location and module technology (1000 Vdc to 200%)

SUNNY CENTRAL 1000 V

Technical Data	Sunny Central 2200
Input (DC)	
MPP voltage range V_{DC} (at 25 °C / at 50 °C)	570 to 950 V / 850 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	545 V / 645 V
Max. input voltage $V_{DC, max}$	1100 V
Max. input current $I_{DC, max}$ (at 25°C / at 50°C)	3960 A / 3600 A
Max. short-circuit current $I_{DC, sc}$	6400 A
Number of DC inputs	32
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²
Integrated zone monitoring	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A
Output (AC)	
Nominal AC power at cos φ =1 (at 25°C / at 40°C / at 50°C)	2200 kVA / 2080 kVA / 2000 kVA
Nominal AC power at cos φ =0.8 (at 25°C / at 40°C / at 50°C)	1760 kW / 1664 kW / 1600 kW
Nominal AC current $I_{AC, nom}$ = Max. output current $I_{AC, max}$	3300 A
Max. total harmonic distortion	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 7)]	385 V / 308 V to 462 V
AC power frequency / range	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz
Min. short-circuit ratio at the AC terminals	> 2
Power factor at rated power / displacement power factor adjustable[7)]	1 / 0.8 overexcited to 0.8 underexcited[8)]
Efficiency	
Max. efficiency / European efficiency / CEC efficiency[2)]	98.6% / 98.4% / 98.0%
Protective Devices	
Input-side disconnection point	DC load break switch
Output-side disconnection point	AC circuit breaker
DC overvoltage protection	Surge arrester, type I
AC overvoltage protection (optional)	Surge arrester, class I
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III
Ground-fault monitoring / remote ground-fault monitoring	○ / ○
Insulation monitoring	○
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34
General Data	
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)
Weight	< 3400 kg / < 7496 lb
Self-consumption (max.[3)] / partial load[4)] / average[5)])	< 8100 W / < 1800 W / < 2000 W
Self-consumption (standby)	< 300 W
Internal auxiliary power supply	Integrated 8.4 kVA transformer
Operating temperature range[7)]	–25°C to 60°C / –13°F to 140°F
Noise emission[6)]	66.4 dB(A)
Temperature range (standby)	–40°C to 60°C / –40°F to 140°F
Temperature range (storage)	–40°C to 70°C / –40°F to 158°F
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%
Maximum operating altitude above MSL[7)] 2000 m / 3000 m / 4000 m	● / ○ / ○ (earlier temperature-dependent derating)
Fresh air consumption	6500 m³/h
Features	
DC connection	Terminal lug on each input (without fuse)
AC connection	With busbar system (three busbars, one per line conductor)
Communication	Ethernet, Modbus Master, Modbus Slave
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)
Enclosure / roof color	RAL 9016 / RAL 7004
Display	● Identicator lights / ○ HMI touchscreen (10.1")
Supply transformer for external loads	○ (2.5 kVA)
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, UL1741, BDEW-MSRL, IEEE1547, UL 840 Cat. IV, Arrêté du 23/04/08
EMC standards	IEC / EN 61000-6-4, IEC / EN 61000-6-2, EN 55022, CISPR 22:2008 modified class A, FCC Part 15 Class A
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001
● Standard features ○ Optional	
Type designation	SC-2200-10

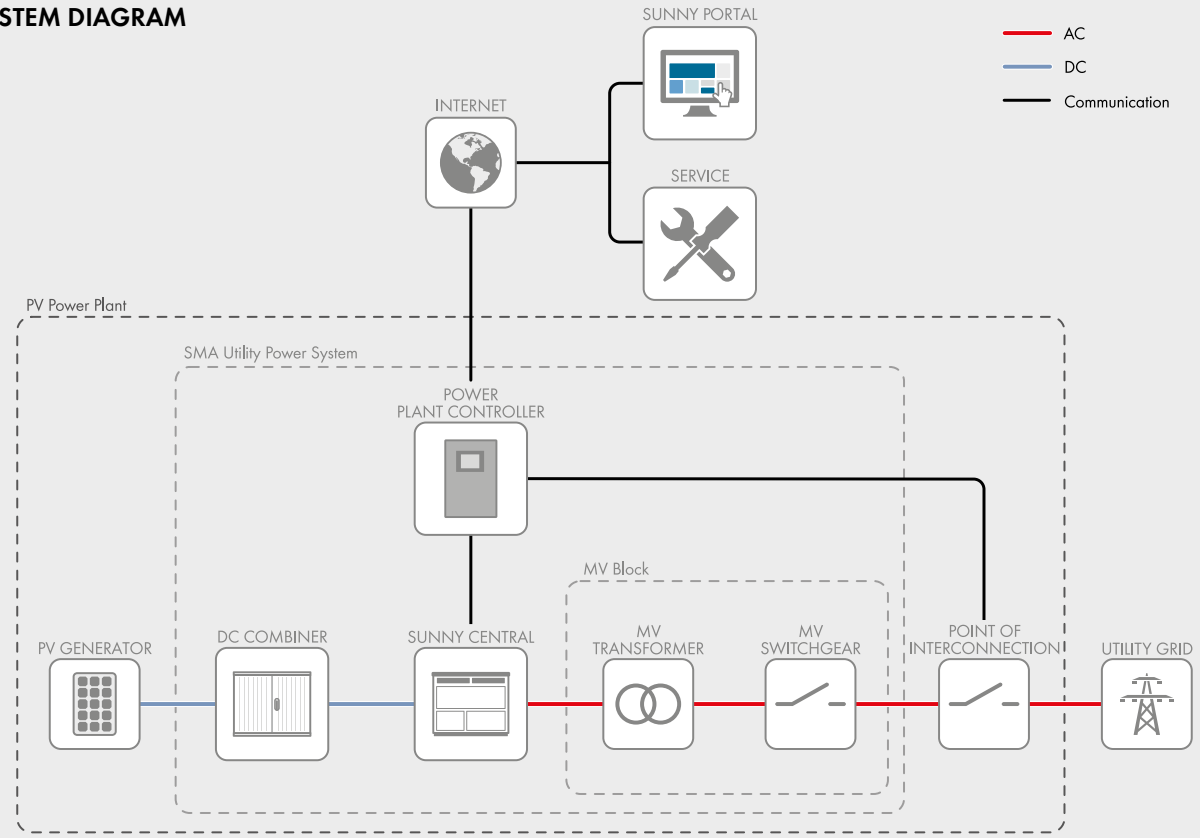
1) At nominal AC voltage < 385 V, nominal AC power decreases in the same proportion
2) Efficiency measured with internal power supply
3) Self-consumption at rated operation
4) Self-consumption at < 75% Pn at 25°C
5) Self-consumption averaged out from 5% to 100% Pn at 25°C
6) Sound pressure level at a distance of 10 m
7) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
8) Depending on the DC voltage

SUNNY CENTRAL 1500 V

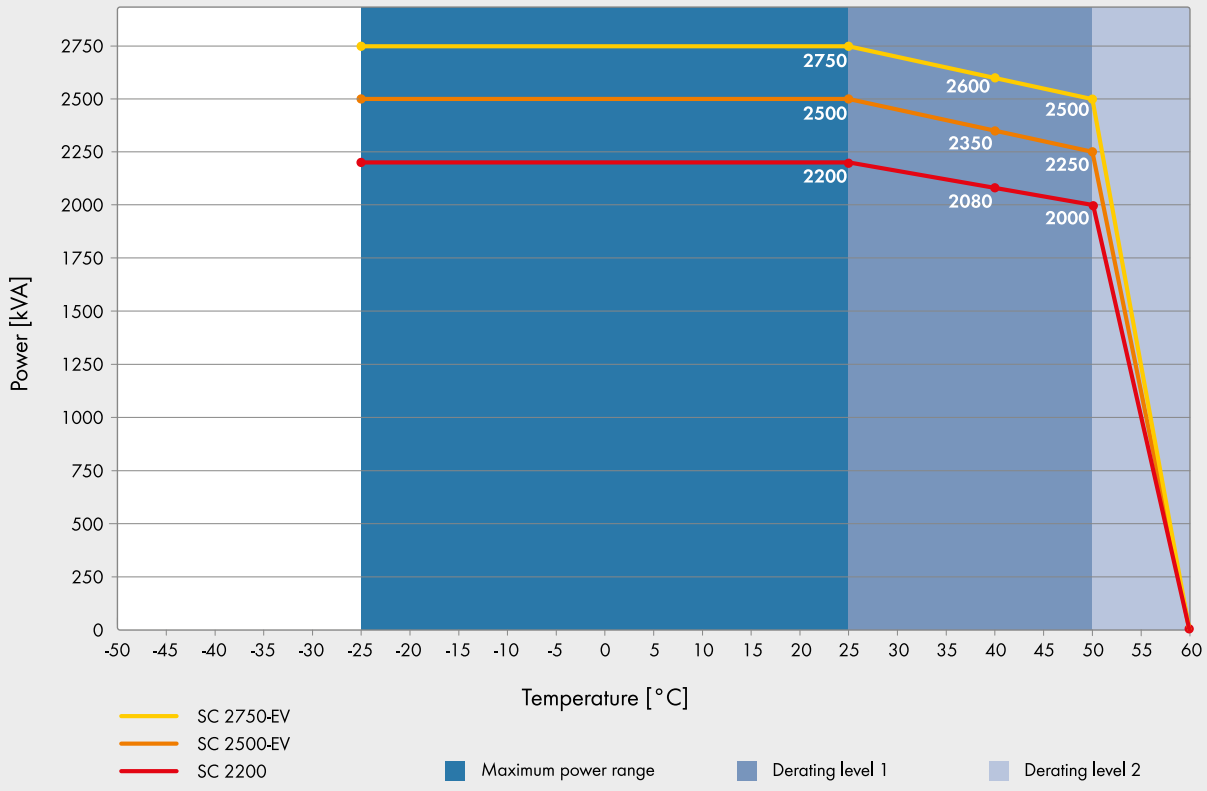
Technical Data	Sunny Central 2500-EV	Sunny Central 2750-EV
Input (DC)		
MPP voltage range V_{DC} (at 25°C / at 50°C)	800 V to 1425 V / 778 V to 1275 V	877 V to 1425 V / 849 V to 1275 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	778 V / 928 V	849 V / 999 V
Max. input voltage $V_{DC, max}$	1500 V	1500 V
Max. input current $I_{DC, max}$ (at 25°C / at 50°C)	3200 A / 2956 A	3200 A / 2956 A
Max. short-circuit current rating	6400 A	6400 A
Number of DC inputs	32	32
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	2 x 800 kcmil, 2 x 400 mm²
Integrated zone monitoring	○	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A	
Output (AC)		
Nominal AC power at cos φ =1 (at 25°C / at 40°C / at 50°C)	2500 kVA / 2350 kVA / 2250 kVA	2750 kVA / 2600 kVA / 2500 kVA
Nominal AC power at cos φ =0.8 (at 25°C / at 40°C / at 50°C)	2000 kW / 1880 kW / 1800 kW	2200 kW / 2080 kW / 2000 kW
Nominal AC current $I_{AC, nom}$ = Max. output current $I_{AC, max}$	2646 A	2674 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 8)]	550 V / 440 V to 660 V	600 V / 480 V to 690 V
AC power frequency	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz
Min. short-circuit ratio at the AC terminals	> 2	> 2[9)]
Power factor at rated power / displacement power factor adjustable[8)]	● 1 / 0.8 overexcited to 0.8 underexcited[10)] ○ 1 / 0.0 overexcited to 0.0 underexcited[10)]	
Efficiency		
Max. efficiency[2)] / European efficiency[2)] / CEC efficiency[3)]	98.6% / 98.3% / 98.0%	98.7% / 98.5% / 98.5%
Protective Devices		
Input-side disconnection point	DC load-break switch	
Output-side disconnection point	AC circuit breaker	
DC overvoltage protection	Surge arrester, type I	
AC overvoltage protection (optional)	Surge arrester, class I	
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III	
Ground-fault monitoring / remote ground-fault monitoring	○ / ○	
Insulation monitoring	○	
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34	
General Data		
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)	
Weight	< 3400 kg / < 7496 lb	
Self-consumption (max.[4)] / partial load[5)] / average[6)])	< 8100 W / < 1800 W / < 2000 W	
Self-consumption (standby)	< 370 W	
Internal auxiliary power supply	Integrated 8.4 kVA transformer	
Operating temperature range[8)]	−25 to 60°C / −13 to 140°F	
Noise emission[7)]	64,3 dB(A)	
Temperature range (standby)	−40 to 60°C / −40 to 140°F	
Temperature range (storage)	−40 to 70°C / −40 to 158°F	
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month / year) / 0 % to 95%	
Maximum operating altitude above MSL[8)] 1000 m / 2000 m / 3000 m	● / ○ / ○ (earlier temperature-dependent derating)	
Fresh air consumption	6500 m³/h	
Features		
DC connection	Terminal lug on each input (without fuse)	
AC connection	With busbar system (three busbars, one per line conductor)	
Communication	Ethernet, Modbus Master, Modbus Slave	
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)	
Enclosure / roof color	RAL 9016 / RAL 7004	
Display	● Identicator lights / ○ HMI touchscreen (10.1")	
Supply transformer for external loads	○ (2.5 kVA)	
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, Arrêté du 23/04/08	
EMC standards	EN 55011:2011-4, IEC / EN 61000-6-2, EN 55022, CISPR 22:2008 modified class A, FCC Part 15 Class A	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001	
● Standard features ○ Optional		
Type designation	SC-2500-EV-10	SC-2750-EV-10

1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
3) Efficiency measured with internal power supply
4) Self-consumption at rated operation
5) Self-consumption at < 75% Pn at 25°C
6) Self-consumption averaged out from 5% to 100% Pn at 25°C
7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) A short-circuit ratio of < 2 requires a special approval from SMA
10) Depending on the DC voltage

SYSTEM DIAGRAM



TEMPERATURE BEHAVIOR (at cos φ =1)



Appendix F. Environmental Management Plan Framework and Monitoring Plan

MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE

Environmental Management Plan Framework and Monitoring Plan

Ar Rass Solar PV Park

Document No 303011-00305 - EMP-REP-102

14 Nov 2019

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EcoNomics

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PROJECT 303011-00305 - EMP-REP-102 – Environmental Management Plan Framework and Monitoring Plan

Rev	Description	Original	Review	WorleyParsons Approval	Date	Customer Approval	Date
A	Issued for Review	Daniela Zamfirescu, Yousra Zakaria, Khaled Ahmed, Menna Megahed, Ayman Naguib and Ihab El-Sersy	Nikos Moiras and María Sánchez Sampedro	Jonathan O'Toole	14 Nov 2019	N/A	

Contents

1. Environment Management Plan Framework

1.1 Introduction

The environmental management plan (EMP) consists of the set of mitigation, monitoring, and institutional measures to be taken during project construction, operation and decommissioning to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures.

The purpose of this section is to provide a framework that gathers the recommended mitigation measures, to enable the preparation of a comprehensive environmental management plan that can be used during the construction and operation activities to ensure impacts to the environment are kept to an absolute minimum.

The EPC Contractor will provide with the bid a complete EMP and will update it after award. The project environmental management plan will be based on the ISO 14001 standard. The EMP will be a central document for identifying and controlling all environmental management system (EMS) related information and material based on the ISO 14001 standard, and will provide reference to all supporting documents. The following outline is based on the general requirements of an environmental management plan that would satisfy ISO 14001 requirements and would address:

1. Environmental policy
2. Planning

2.1 Environmental aspects

2.2 Legal and other requirements

2.3 Objectives and targets

2.4 Environmental management programs

3. Implementation and operation

3.1 Structure and responsibility

3.2 Training, awareness and competence

3.3 Communication

3.4 Environment management system documentation

3.5 Document control

3.6 Operational control

3.7 Emergency preparedness and response

4. Checking and corrective action

4.1 Monitoring and measurement

4.2 Non-conformance and corrective and preventative action

4.3 Records

4.4 Environmental management system audit

5. Management review

Once an approval for the proposed development has been granted, a detailed environmental management plan will be prepared, including all legal and regulatory requirements, specific performance targets, measurement systems and reporting requirements.

1.2 Key Principles

Environmental excellence is a primary management objective and the responsibility of every team member. The project team should commit to achieving environmental excellence in all of its business practices and operations through the key principles outlined below:

- Commitment - Management at all levels will be actively committed to the achievement of environmental excellence in the conduct of our business. Through communication with the project team members, the commitment to environmental excellence should be reflected in the day to day work.
- Organization - A project team wide organizational structure and culture will be established that recognizes and encourages the full and active participation of all employees in the systematic identification, assessment and management of environmental issues.
- Accountability - Responsibility for the protection of the environment is a matter of corporate policy and is a matter of law, with potentially severe consequences for failure to comply. Management at all levels is responsible for ensuring that operations are conducted in accordance with this policy and that appropriate environmental programs, procedures and systems of work have been developed and implemented for the project.
- Management Systems and Standards – The project team should develop, implement and continuously improve the project environmental management systems and develop environmental management standards using company documented standards where available, ensuring that they reflect best industry practices.
- Risk Management – The project team will ensure that potential environmental risks associated with all our designs and activities are assessed as early as is practicable in order to minimize and manage adverse effects and to identify opportunities for improvement.
- Legislative Compliance – The project team should operate to standards that will comply with the requirements of applicable local and appropriate national and international legislation and codes of practice and will strive beyond compliance and recognize these principles as a valued way of life.

- Training - Health, safety, and environmental managers and staff should be qualified by reason of education or experience to discharge their responsibilities and should participate in a program of continuing professional development. In addition, the project team is committed to provide training and development on environmental matters that is appropriate to each employee's job duties and responsibilities. The project team should be proactive in the management of third-party contractors to ensure they are fully aware of the environmental issues and to ensure that their actions are aligned with project environmental standards.
- Environmental Aspects – The project team should continuously evaluate the environmental aspects of the project activities through all of its phases. The goal will be to develop and provide products and services, as applicable that have minimal environmental impact and are safe in their intended use, efficient in their consumption of energy and natural resources and can be recycled, reused or disposed of safely.
- Continuous Improvement – The project team should be committed to continuous improvement of environmental management practices.
- Monitor, Audit and Review - Effective management requires on-going assessment and review, accordingly, an on-going assessment, self-evaluation and audit program will be implemented and maintained for the project activities.

1.3 EMP Objectives

This EMP seeks to manage and keep to a minimum the negative impacts of the project and at the same time, enhance the positive and beneficial impacts.

The objectives of the EMP are to:

- Identify the legislative and regulatory requirements governing environmental matters
- Summarise the project environmental management structure and processes to be implemented by the EPC Contractor
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts
- Identify measures that could optimize beneficial impacts
- Establish a method of monitoring and auditing environmental management practices during all phases of development
- Ensure compliance with the safety recommendations
- Propose mechanisms for monitoring compliance with the EMP and reporting thereon
- Specify time periods within which the measures must be implemented, where appropriate
- Rectify impacts through rehabilitation, restoration, etc. of the affected environment
- Minimise impacts by optimising design features

The EMP is a legally binding document that all parties involved in the project must be made aware of.

1.4 Project Responsibilities

The most important members of the construction team from an environmental perspective are the Project Manager (PM), the EPC Contractor (EPCC), the EPC Contractor's Environmental Control Officer (ECO), and the Project Owner.

The PM is responsible for the implementation of the EMP on the site during the pre-construction and construction phases of the project.

The ECO is responsible for monitoring the implementation of the EMP during the design, pre-construction and construction phases of the project.

The EPCC is responsible for abiding by the mitigation measures of the EMP which are to be implemented by the PM during the construction phase.

The Project Owner is responsible for the implementation of the EMP during the operational and decommissioning phases of the project. Decommissioning will however entail the appointment of a new professional team and responsibilities will be similar to those during the design, pre-construction and construction phases.

An independent auditor will conduct an environmental audit quarterly during the construction phase of the project (quarterly audits are needed for the duration of the construction phase) according to the provisions of the EMP.

1.5 Environmental Management Plan

The EPC Contractor will develop an environmental management plan to, (a) identify the set of responses to potentially adverse impacts; (b) determine requirements for ensuring that those responses are made effectively and in a timely manner; and (c) describe the means for meeting those requirements.

More specifically, the EMP should address the following:

1.5.1 Description of the Proposed Activity(s)

This section will describe the technical detail pertaining to the project. Details on the location of the project and a description of the proposed works during all project phases will be provided.

1.5.2 Description of the Existing Environment

A summary of the existing environment of the Development footprint will be provided which generally covers the following areas:

- physical environment
- biological environment
- socio-economic environment
- particular values and sensitivities

1.5.3 Identification and Assessment of Environmental Effects and Risks

The environmental assessments will include:

- Air emissions
- Waste characterization and inventory
- Consumption of chemicals, and other raw materials
- Labour and social issues

The aspect, source, potential and predicted impact, management measures and residual risk will be detailed covering the following activities:

- Environmental Objectives, Standards and Criteria
- Environmental Management Techniques

1.5.4 Compliance with Laws/Regulations

Approvals / permits / consents / licenses relating to the environment will be in place prior to construction and operational phases and will be stored in a location which is easily accessible to appropriate staff. The approvals / permits / licenses will include – but not limited to – the following:

- Planning permission
- Construction noise permit (as applicable)
- Environmental approvals (discharge to air, transport of waste, etc.)
- Contract with special and approved contractor for transport of hazardous material

Should any other approvals or permits be required for new activities, these will be obtained prior to the commencement of the activities. The project will comply with relevant legislation.

1.5.5 Setting Environmental Objectives and Targets

One of the most important components of the environmental management systems is the Environmental Performance Review.

This creates a number of specific environmental objectives that relate to the construction and operation of the project. As such, in terms of key environmental objectives, the Owner and its contractors in compliance to the KSA environmental laws. Owner's health and safety regulations will strictly apply the following measures:

- Design, construct and operate activities in a manner that protects human health and minimizes the impact of its operations on the environment
- Strive for an injury-free work force and minimize environmental impact through implementation of programmes in its project area that reduce risks to employees and the environment
- Encourage and promote waste minimization, the sustainable use of natural resources, recycling, energy efficiency, resource conservation and resource recovery

- Actively participate with the governmental agencies and other appropriate groups to ensure that the development and implementation of environmental policies, laws, regulations and practices serving the public interest based on sound scientific judgment
- Direct all employees to work in a safe manner, comply with the company's environmental policies and procedures and be environmentally responsible
- Comply with all applicable environmental laws and regulations of KSA. Where existing laws and regulations are deemed inadequate, the contractors and/ or the Owner will adopt its own Environmental Standards
- Each component will develop and maintain written safety policies and programmes to address known hazards in the project workplace
- Safe behaviour and judgment to be considered as essential measures of performance at all levels;
- Determine frequency of audits based on the complexity of the activities and the potential environmental risk
- When an audit is completed, report the findings to the site environmental management team and in case of any deficiencies found, develop corrective action plans
- Facilitate for the Saudi government and local environmental agencies to perform inspections of the project area to determine compliance with environmental regulations and permits
- The project team will recognize and respond to the community's questions about its operations
- Follow the waste disposal management plan to ensure that all kinds of wastes are properly managed and recycled
- In case of hazardous solid wastes\ specialized waste streams following the same type of waste management, wastes are sent to third-party leading to proper treatment before final disposal.

Environmental performance at the site will be monitored regularly by the Owner and regulatory agencies (GAMEP).

1.5.6 Roles and Responsibilities

Key roles and responsibilities of personnel with respect to meeting environmental management and performance objectives during the works will be identified.

1.5.7 Environmental Monitoring Program

A monitoring program should be implemented for the duration of all phases of the project.

Monthly audits will be conducted by the Environmental Control Officer for the duration of the construction phase. These audits can be conducted randomly and do not require prior arrangement with the Project Manager.

An audit report will be prepared to address the rating of the compliance with the EMP. This report will be submitted to the Owner and to the relevant environmental authorities.

The Contractor will be held liable for all unnecessary damage to the environment. A register will be kept of all complaints from the authorities and / or the local community. All complaints / claims will be handled immediately to ensure timely rectification by the responsible party.

Environmental monitoring during project implementation provides information about key environmental aspects of the project, particularly the environmental impacts and the effectiveness of mitigation measures. Such information enables evaluating the success of mitigation as part of project supervision, and allows corrective action to be taken when needed. Therefore, the EMP identifies monitoring objectives and specifies the type of monitoring. Specifically, the monitoring section of the EMP provides:

- a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions
- monitoring and reporting procedures to:
  - ensure early detection of conditions that necessitate particular mitigation measures
  - provide information on the progress and results of mitigation

A formal monitoring protocol will be included within the revised EMP once the detailed design is available and once recommendations and conditions from the decision-making authority have been received.

More details on the monitoring requirements are presented in Section 1.7.

1.5.8 Compliance with the EMP

A copy of the EMP must be kept on site during the construction period at all times. The EMP will be made binding on all contractors operating on the site and must be included as contractual clauses in any contractual agreement between the Owner and the EPC Contractor.

All persons employed by the Contractor or his sub-contractors will abide by the requirements of the EMP.

Contract conditions will include measures to be taken in the event of a construction workforce found to be in breach of any of the specifications contained within the EMP.

The Contractor will not direct a person to undertake any activity which would place them in contravention of the specifications contained within the EMP.

Should the Contractor be in breach of any of the specifications contained in the EMP, the Project Manager will, in writing, instruct the Contractor responsible for the incident of non-compliance regarding corrective and/or remedial action required, specify a timeframe for implementation of these actions and/or indicate that work could be suspended should non-compliance continue.

Should non-compliance continue, further written notification will be forwarded to the Contractor responsible for the incident of non-compliance outlining the required corrective and/or remedial action, the timeframe for implementation, penalties and/or work could be suspended as specified previously.

An appropriate reporting schedule for frequent reporting (of compliance with the EIA/EMP) to the Owner and the relevant Authorities will be developed.

Departmental officials will be given access to the property referred to in the EIA authorisation for the purpose of assessing and/or monitoring compliance with the conditions contained in the EMP at all reasonable times.

1.5.9 Non-Conformance and Corrective Action

The Contractor is deemed not to have complied with the EMP if:

- Within the boundaries of the site, site extensions and haul/ access roads there is evidence of contravention of clauses
- Environmental damage ensues due to negligence
- Failure to comply with corrective or other instructions within a specified time
- Failure to respond adequately to complaints from the public

The Owner is deemed not to have complied with the EMP if:

- Within the boundaries of the site there is evidence of contravention of clauses
- If environmental damage ensues due to negligence
- Failure to respond adequately to complaints from the public

1.5.10 Environmental Management Programs

Specific environmental management programs and procedures will be in place prior to the commencement of construction or operation activities. Procedures may include:

- Safety Management for operations
- Solid Waste Management Programme (disposal and reuse procedures)
- Emergency Response Procedures
- Environmental and Security Management
- Effluents and Emissions Monitoring Procedures
- Air Emission Monitoring Procedures

The programmes are reviewed according to the frequency specified in the document control system, or on an as-required basis following an incident, or non-compliance.

1.5.11 Mitigation

To meet the requirements of government agencies and regulatory authorities, the management of environmental issues will be carried out in such a way that all stakeholders will be left with no doubt that hazards to the environment have been identified and appropriately managed.

The EMP should provide detailed prevention, minimisation and mitigation strategies or action programs (including design standards) for controlling environmental impacts at the site. The EMP will identify feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels. The plan will include compensatory measures if mitigation measures are not feasible, cost-effective, or sufficient.

1.5.12 Capacity Development and Training

To support timely and effective implementation of environmental project components and mitigation measures, the EMP provides a specific description of institutional arrangements that is responsible for carrying out the mitigation 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 agencies responsible for implementation, the EMP should cover the following additional topics: (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes.

1.5.13 Emergency Events and Contingency Planning:

The implementation strategy will establish and provide for maintenance of an up-to-date emergency response manual with detailed response arrangements. It will be recommended that contingency plans must be approved before work can commence.

1.5.14 Implementation Schedule

For all three aspects (mitigation, monitoring, and capacity development), the EMP should provide (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (b) the capital and recurrent cost estimates for implementing the EMP.

1.5.15 Integration of EMP with Project

The EMP should be specific in its description of the individual mitigation and monitoring measures and its assignment of institutional responsibilities, and it must be integrated into the project's overall planning, design, budget, and implementation. Such integration is achieved by establishing the EMP within the project so that the plan will receive funding and supervision along with the other components.

1.5.16 Documentation and Reporting

The following documentation must be kept on site in order to record compliance with the EMP:

- Record of Complaints
- Monitoring Results
- Notification of Emergencies and Incidents

1.5.17 Environmental Register

The Contractor will:

- Report incidents involving contractor employees and/or the public that could potentially cause negative sentiment and perception towards the project
- Report environmental complaints and correspondence
- Record and report incidents that cause harm or may cause harm to the environment
- Record all hazardous materials used on site

- Maintain a record of all waste disposal manifests detailing the nature of the waste disposed of, the waste classification and the location of the site to which such waste was sent

1.5.18 Public Communication and Liaison with Interested and Affected Parties

Clear and effective communications are maintained between contractors, consultants, regulators and Owner.

The adjacent land/business owners should be kept informed and updated throughout the construction and operational phases.

Sufficient signage should be erected around the site (including at the entrance), informing the public of the construction activities taking place.

1.5.19 Distribution of the EMP

The plan will be distributed to Owner, consultant, government agencies, relevant Project subcontractor companies, the PM, the HSE manager and or the Environmental Control Officer (ECO), and will be freely available to all Project Team members and Subcontractors.

1.6 Layout of the EMP

The EMP framework is separated into four phases. Each phase has specific issues unique to that period of the development and operation of the proposed project.

The impact is identified and given a brief description. The four phases of the development are identified as below:

- Pre-Construction Phase
- Construction Phase and associated rehabilitation of affected environment
- Operational Phase (Post-Construction)
- Closure and Decommissioning

1.6.1 EMP for Pre-construction

Important requirements for the pre-construction phase are:

- Proper timely communication and continuous liaison to ensure all parties are appropriately informed always
- The Contractor must adhere to all conditions of contract including the Environmental Management Programme and landowner special conditions
- Adequate planning of the construction program to allow for disruptions due to rain and wet conditions
- Where existing roads are in a bad state of repair, such roads' condition will be documented before they are used for construction purposes
- All manmade as well as natural (vegetation) structures outside the boundary of the servitude will be protected against damage always and any damage will be rectified immediately

- Proper documentation and record keeping of all complaints and actions taken
- Regular site inspections by the ECO and good control over the construction process throughout the construction period
- Appointment of an ECO on behalf of the Contractor to implement the EMP
- Independent Environmental Audits to be performed during and upon completion of construction
- A formal communications protocol should be set up during this phase. The aim of the protocol should be to ensure that effective communication on key issues that may arise during construction be maintained between key parties. The protocol should also ensure that concerns / issues raised are formally recorded and considered and where necessary acted upon. The communications protocol should be maintained throughout the construction phase

Table 1-1 Pre-construction Phase

IMPACT	PRE-CONSTRUCTION PHASE (This section deals with the preparation of the site and actions that need to be implemented before construction commences)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**PRE – CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• Appoint an Environmental Control Officer (ECO) • Before construction begins, all areas to be developed must be clearly demarcated with fencing • The Contractor must ensure compliance with conditions described in the PME • Records of compliance / non-compliance with the conditions of the authorization must be kept and be available on request • Records of all environmental incidents must be maintained and a copy of these records be made available on request throughout the project execution • Confirm with Owner suitable sites for the storage areas for materials, if applicable • All construction equipment must be stored within the site and all associated oil changes etc. (no servicing) must take place within the site, if applicable • Skilled laborers should be drawn from the local market • Training of site staff • Environmental awareness training for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (e.g. groundwater), air pollution		

IMPACT	PRE-CONSTRUCTION PHASE (This section deals with the preparation of the site and actions that need to be implemented before construction commences)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**PRE – CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	and litter control • Project Manager will ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks • Staff operating equipment (such as excavators, loaders, etc.) will be adequately trained and to any potential hazards associated with their tasks • No operator will be permitted to operate critical items of mechanical equipment without having been trained by the Contractor and certified competent by the Project Manager • Staff should be educated as to the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training		

1.6.2 EMP for Construction

The boundaries of the construction site will be clearly identified on site during the construction process. The method of identification will be permanent fencing, temporary fencing or construction / safety barricades or high visibility tape. Where existing or new permanent fencing is used to identify construction boundaries high visibility warning tape will be interwoven in the fence. All works and storage of materials and equipment will be restricted to this area during the construction phase.

1.6.2.1 Site Clearing

Site clearing must take place in phased matter, as and when required. Areas which are not to be constructed on within two months of time must not be cleared to reduce erosion risks. The area to be cleared must be clearly demarcated and this footprint strictly maintained. Spoil that is removed from the site must be removed to an approved spoil site / licensed landfill site.

The necessary silt fences and erosion control measures must be implemented in areas where these risks are more prevalent. These include steep areas.

1.6.2.2 Site Establishment

Site establishment will take place in an orderly manner and all required amenities will be installed at site, if applicable before the main workforce move onto site. The site will have the necessary ablution facilities with chemical toilets at commencement of construction. The Contractor will inform all site staff to make use of supplied ablution facilities and under no circumstances will indiscriminate sanitary activities be allowed other than in supplied facilities.

The Contractor will supply waste collection bins where such is not available and all solid waste collected will be disposed of at a registered landfill. A certificate of disposal will be obtained by the Contractor and kept on file. Where a registered waste site is not available close to the construction site, the Contractor will provide a method statement with regard to waste management. The disposal of waste will be in accordance with all relevant legislation. Under no circumstances should solid waste be burnt on site.

Table 1-2 Construction traffic and access

IMPACT	CONSTRUCTION TRAFFIC AND ACCESS (This section deals with the impact that construction traffic and access has on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Construction traffic*** • Construction routes must be clearly defined • Delivery of equipment must be undertaken with the minimum amount of trips • Access of all construction and material delivery vehicles should be strictly controlled, especially during wet weather to avoid compaction and damage to the topsoil structure • Planning of site delivery hours must be scheduled to avoid peak hour traffic, weekends and evenings • Wheel washing and damping down of un-surfaced roads must be implemented to reduce dust • Vehicles and equipment will be serviced regularly to avoid the contamination of soil from oil and hydraulic fluid leaks etc. • Servicing must be done off-site • Oil changes must take place on a concrete platform or on a drip tray • Soils compacted by construction will be deep ripped to loosen compacted layers and re-graded to even running levels		

IMPACT	CONSTRUCTION TRAFFIC AND ACCESS (This section deals with the impact that construction traffic and access has on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	Access • Temporary access roads that might be required must be rehabilitated prior to the contractor leaving the site • Strategic positioning of entry and exit points to ensure as little effect as possible on the traffic • The main routes to the site must be clearly signposted and printed delivery maps must be issued to all suppliers and Sub- Contractors • Planning of temporary access routes to the site for construction purposes, if needed will be done in conjunction between the Contractor, Owner and the Landowner. All agreements reached should be documented and no verbal agreements should be made. The Contractor will properly mark all access roads. Roads not to be used will be marked with a "NO ENTRY" sign • Where new access roads are constructed, this must be done according to design and contract specifications. Drainage channels will be suitably designed to ensure erosion does not occur, especially at the outflow points. The new access road will be designed to allow for the natural flow of water where required. Crossing of eroded areas on access routes to new sites will be thoroughly planned and installed according to design and contract specifications. All areas susceptible to erosion will be protected with suitable erosion control measures from the onset of the project. Prevention is the ultimate aim, as restoration is normally very difficult and costly.		

IMPACT	CONSTRUCTION TRAFFIC AND ACCESS (This section deals with the impact that construction traffic and access has on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	Road maintenance • Where necessary suitable measures will be taken to rehabilitate damaged areas. In the event of rehabilitation work being required on private roads, such work will be done to the original specifications of the private road • Contractors should ensure that access roads are maintained in good condition by attending to potholes, corrugations and stormwater damage as soon as these develop • The Contractor will meet the safety requirements under all circumstances. All equipment transported will be clearly labelled as to their potential hazards according to specifications. All the required safety labelling on the containers and trucks used will be in place ***General*** • The Contractor will ensure that all the necessary precautions against damage to the environment and injury to persons are taken in the event of an accident • Due precautions, including the monitoring of traffic speeds by all suppliers and sub-contractors where required, should be undertaken to prevent accidents leading to injury to persons on access roads and to minimise the likelihood of injury to wildlife		

Table 1-3 Construction Camp, if applicable

IMPACT	STORAGE AREAS (This section deals with the impacts relating to the storage areas i.e. storage of materials)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Storage of materials (including hazardous materials)*** • Choice of location for storage areas must take into account prevailing winds, distances to water bodies, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary • Storage areas must be designated, demarcated and fenced • Storage areas should be secure so as to minimize the risk of crime. They should also be safe from access by animals etc. • Fire prevention facilities must be present at all storage facilities • Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s). These pollution prevention measures for storage should include a bund wall high enough to contain at least 110% of any stored volume, and this should be sited away from drainage lines in a site with the approval of the Owner • Any water that collects in the bund must not be allowed to stand and must be removed immediately and the		

IMPACT	STORAGE AREAS (This section deals with the impacts relating to the storage areas i.e. storage of materials)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Weekly
ENVIRONMENTAL MANAGEMENT PLAN			
	hydrocarbon digestion agent within must be replenished • All legal compliance requirements with respect to Fuel storage and dispensing must be met • All fuel storage tanks (temporary or permanent) and associated facilities must be designed and installed in accordance with the relevant oil industry standards, codes and other relevant requirements • Areas for storage of fuels and other flammable materials must comply with standard fire safety regulations and may require the approval of the Municipal Fire Prevention Officer • Flammable fuel and gas must be well separated from all welding workshops, assembly plants and loading bays where ignition of gas by an accidental spark may cause an explosion or fire • The tank must be erected at a safe distance from buildings, boundaries, welding sites and workshops and any other combustible or flammable materials • Symbolic safety signs depicting “No Smoking”, “No Naked Flames” and “Danger” are to be prominently displayed in and around the fuel storage area • The capacity of the tank must be clearly displayed and the product contained within the tank clearly identified • There must be adequate fire-fighting equipment at the fuel storage and dispensing area or areas • The storage tank must be removed on completion of the construction phase of the project		

IMPACT	STORAGE AREAS (This section deals with the impacts relating to the storage areas i.e. storage of materials)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	• All such tanks to be designed and constructed in accordance with a recognised code (international standard) • The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage • Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks must be sealed and stored in an area where the ground has been protected • Any electrical or petrol-driven pump must be equipped and positioned so as not to cause any danger of ignition • If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used • The drum must not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank must be stored in a waterproof container when not in use • All waste fuel and chemical impregnated rags must be stored in leak-proof containers and disposed of at an approved hazardous waste site • The amounts of fuel and chemicals stored on site will be minimised • Storage sites will be provided with bunds to contain any spilled liquids and materials • These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local		

IMPACT	STORAGE AREAS (This section deals with the impacts relating to the storage areas i.e. storage of materials)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	soil or water resources • Clear signage must be placed at all storage areas containing hazardous substances / materials • Material Safety Data Sheets (MSDSs) will be readily available on site for all chemicals and hazardous substances to be used on site. Where possible the available MSDSs should additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes • Storage areas containing hazardous substances/materials must be clearly signed • Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures • A suitable Waste Disposal Contractor must be employed to remove waste oil. These wastes should only be disposed of at licensed landfill sites designed to handle hazardous wastes • The contractor must ensure that its staff is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training • All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site • Any spillage, which may occur, will be investigated and immediate action must be taken. This occurrence must also be reported to the Owner, as well as local authorities if so required		

IMPACT	STORAGE AREAS (This section deals with the impacts relating to the storage areas i.e. storage of materials)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	End of construction • Once construction has been completed on site and all excess material has been removed, the storage area will be rehabilitated. If the area was badly damaged, re-seeding will be done and fencing in of the area will be considered if livestock/faunal species specific to the area may subsequently have access to such an area • Such areas will be rehabilitated to their natural state. Any spilled concrete will be removed and soil compacted during construction will be ripped, levelled and re-vegetated • Only designated areas must be used for storage of construction materials, soil stockpiles, machinery and other equipment • Specific areas must be designated for cement batching plants. Sufficient drainage for these plants must be in place to ensure that soils do not become contaminated • The storage areas must be kept clear of litter at all times • Spillages within the storage areas need to be cleaned up correct disposal • No open fires are allowed within the storage areas and no wood from surrounding vegetation may be used to create a fire		

Table 1-4 Repair, Maintenance and Cleaning

IMPACT	REPAIR, MAINTENANCE AND CLEANING (This section deals with the repair, maintenance and cleaning that may be required during construction)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• No vehicle maintenance and repairs will be undertaken within a 30m radius of any drainage lines. Any facilities susceptible to oil, petrol and diesel spillage will be located a minimum of 30m and preferably 50m from the drainage line • Repair yards, batching plants and stationary machines will be provided with sumps, and spilled fluids and runoff will be kept in a conservancy tank until removed from the site in terms of the relevant legislative requirements • Adequate collection facilities such as diversion mounds, ditches, drains, oil separation sumps and sedimentation ponds will be constructed at each location with a pollution potential • All repair work away from bunded areas will make use of drip trays • Regular inspections will be carried out to detect leaks and spillages. These facilities will be maintained as regularly as is necessary to ensure they meet the original specification		

Table 1-5 Environmental Education and Training

IMPACT	ENVIRONMENTAL EDUCATION AND TRAINING (This section deals with the environmental training of construction employees)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Environmental training*** • Ensure that all site personnel have a basic level of environmental awareness training. The Contractor must submit a proposal for this training to the Owner for approval. • It is the Contractor's responsibility to provide the site foreman with environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff • Training should be provided to the staff members in the use of the appropriate fire-fighting equipment. Translators are to be used where necessary • Use should be made of environmental awareness posters on site • The need for a "clean site" policy also needs to be explained to the workers • Staff operating equipment (such as excavators, loaders, etc.) will be adequately trained to deal with any potential hazards associated with their tasks ***Monitoring of environmental training*** • The Contractor must monitor the performance of construction workers to ensure that the aspects have been properly understood and are being followed. If necessary, the ECO and / or a translator should further explain aspects of environmental or social behaviour that are unclear. Toolbox talks are recommended		

Table 1-6 Borrow Pits

IMPACT	BORROW PITS (This section deals with the impact that construction traffic and access has on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			

MITIGATION	***Location of borrow pits***
	• Borrow pit localities must be negotiated with the relevant municipality to ensure consensus of their location
	• The Contractor is required to comply with the requirements of the relevant regulation
	
	Management of borrow pits
	• The Contractor must also compile an information document which states the methods which will be utilised when creating borrow pits. This document must include, but not be limited to the following:
	  ◦ Plans which detail the expected quantity of excavation that will be required
	  ◦ Temporary and permanent stormwater control
	  ◦ The final contouring of the borrow pit and the proposed method of rehabilitation
	  ◦ The current status and land use of the borrow pit
	  ◦ Topsoil management strategy (preservation of topsoil for reinstatement)
	  ◦ Proposed management of dangerous conditions (e.g. Steep slopes, loose and unstable material, holes)		

Table 1-7 Soils

IMPACT	SOILS (This section deals with the impact that the proposed development will have on soils)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION / METHOD STATEMENT	***Topsoil*** • The Contractor should, prior to the commencement of earthworks determine the average depth of topsoil, and agree on this with the Owner. The full depth of topsoil should be stripped from areas affected by construction and related activities prior to the commencement of major earthworks. This should include the building footprints, working areas and storage areas. Topsoil must be reused where possible to rehabilitate disturbed areas • Care must be taken not to mix topsoil and subsoil during stripping • Should any topsoil become polluted the Contractor must remove the polluted soil to the full depth of pollution and replace it at his own expense with approved topsoil which should be at least equal to approved topsoil specifications • Removed topsoil should be transported to a licensed landfill site or used onsite for landscaping as required ***Soil Stripping*** • No soil stripping must take place on areas within the site that the contractor does not require for construction works or areas of retained vegetation • Subsoil and overburden should, in all construction and lay down areas, be stockpiled separately to be returned for		

IMPACT	SOILS (This section deals with the impact that the proposed development will have on soils)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Monthly
ENVIRONMENTAL MANAGEMENT PLAN			
	backfilling in the correct soil horizon order • Construction vehicles must only be allowed to utilise existing tracks or pre-planned access routes ***Stockpiles*** • Stockpiles should not be situated such that they obstruct natural water pathways • Stockpiles should not exceed 2m in height unless otherwise permitted by the Owner • If stockpiles are exposed to windy conditions or heavy rain, they should be covered either by vegetation or cloth, depending on the duration of the project. Stockpiles may further be protected by the construction of berms or low brick walls around their bases • Stockpiles should be kept clear of weeds and alien vegetation growth by regular weeding • Where contamination of soil is expected, analysis must be done prior to disposal of excess soil to determine the appropriate disposal route. Proof from an applicable waste disposal site where contaminated soils are dumped if and when a spillage/leakage occurs should be forwarded to the Owner. ***Fuel storage*** • Topsoil and subsoil to be protected from contamination • Fuel and material storage must be away from stockpiles		

IMPACT	SOILS (This section deals with the impact that the proposed development will have on soils)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Cement, concrete and chemicals must be mixed on an impermeable surface and provisions should be made to contain spillages or overflows into the soil • Any storage tanks containing hazardous materials must be placed in bunted containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material • Contaminated soil must be contained and disposed of off-site at an approved landfill site ***Cement mixing*** • Concrete mixing must be contained within a bunded area • Cement mixing must only take place within designated areas • Ready mixed concrete must be utilised where possible • No vehicles transporting concrete to the site may be washed on site • If a batching plant is necessary, run-off should be managed effectively to avoid contamination of other areas of the site. Run- off from the batch plant must not be allowed to get into the storm water system or any streams, wetlands or existing erosion channels / dongas		

IMPACT	SOILS (This section deals with the impact that the proposed development will have on soils)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			
	Earthworks • All earthworks and borrow pits must be adequately controlled and managed • Soils compacted during construction should be deeply ripped to loose compacted layers and re-graded to even running levels. Topsoil should be re-spread over landscaped areas. According to specifications by the Owner's Landscape Architect / Ecologist the area should be re-vegetated upon completion of construction activities • It is very important that the foundation excavations for the proposed structures be inspected by an engineering geologist or geotechnical engineer prior to the placing of steel reinforcement or concrete in order to determine that the structure is being founded upon the correct material, and also to detect whether any active layers have been exposed by the foundation excavation • Contaminated soil must be contained and disposed of off-site at an approved landfill site ***Herbicides / pesticides*** • Fertilisers should not be used excessively and slow release fertilizers and organic products should be used in preference to highly soluble and inorganic fertilizers • The use of herbicides and pesticides and other horticultural chemicals should be carefully controlled wherever these are used. Where feasible, 'environmentally friendly' products should be utilised		

Table 1-8 Erosion control

IMPACT	EROSION CONTROL (This section deals with the impact that the proposed development will have with regards to potential erosion)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Bi-Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• Wind screening and stormwater control should be undertaken to prevent soil loss from the site • The use of silt fences and sand bags must be implemented in areas that are susceptible to erosion • Sensitive areas, if any need to be identified prior to construction so that the necessary precautions can be implemented • All erosion control mechanisms need to be regularly maintained • Retention of vegetation where possible to avoid soil erosion • Vegetation clearance should be phased to ensure that the minimum area of soil is exposed to potential erosion at any one time • Where possible re-vegetation of disturbed surfaces should occur immediately after construction activities are completed • Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion		

Table 1-9 Groundwater pollution

IMPACT	GROUNDWATER POLLUTION (This section deals with the impact that the construction and operation of the development could have on groundwater pollution)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION / METHOD STATEMENT	***Sanitation*** • Adequate sanitary facilities and ablutions must be provided for construction workers (1 toilet per every 15 workers) • The facilities must be regularly serviced to reduce the risk of groundwater pollution ***Hazardous materials*** • Controlled use and or storage of materials, fuels and chemicals which could potentially leak into the ground • All storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material • Contaminated wastewater must be managed by the Site Manager to ensure existing water resources on the site are not contaminated. All wastewater from general activities in the site will be collected and removed from the site for appropriate disposal at a licensed commercial facility ***Cement mixing*** • Cement contaminated water must not enter the ground as this disturbs the natural acidity of the soil and affects plant growth		

IMPACT	GROUNDWATER POLLUTION (This section deals with the impact that the construction and operation of the development could have on groundwater pollution)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	Public areas • Food preparation areas, if any should be provided with adequate washing facilities and food refuse should be stored in sealed refuse bins which should be removed from site on a regular basis • The Contractor should take steps to ensure that littering by construction workers does not occur and persons should be employed on site to collect litter from the site and immediate surroundings, including litter accumulating at fence lines • No washing or servicing of vehicles on site ***Water resources*** • Water sources/taps available for drinking water etc. must be pointed out by the ECO. It is not advisable that a contractor makes use of or collects water from any other source other than those pointed out to them as being suitable for use • Treated raw water should be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting, etc • The Owner as well as other emergency contact numbers provided by the Municipality should be contacted in order to deal with spillages and contamination of environments • Ensure that surface/storm water is diverted away from excavations		

IMPACT	GROUNDWATER POLLUTION (This section deals with the impact that the construction and operation of the development could have on groundwater pollution)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Ensure that contaminants are safely stored and away from construction site		
	• Sufficient cleaning of pipeline before decommissioning and dismantling		
	Water Flows Across Construction Sites • The quantity of uncontaminated stormwater entering cleared areas will be minimised by appropriate site design and by installation of control structures and drains which direct such flows away from cleared areas and slopes to stable (vegetated) areas or effective treatment installations • Site drainage lines will be identified and control measures installed to handle predicted stormwater		

Table 1-10 Air Quality

IMPACT	AIR POLLUTION (This section deals with the impact from air pollution)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• All activities on-site must comply with the requirements of the PME/GAMEP's Air Quality Standard ***Dust control*** • Retention of vegetation where possible will reduce dust travel • Excavations and other clearing activities must only be done during agreed working times and permitting weather conditions to avoid drifting of sand and dust into neighbouring areas • Damping down of all exposed soil surfaces with a water bowser or sprinklers when necessary to reduce dust • The Contractor will be responsible for dust control on site to ensure no nuisance is caused to the land owners in the surrounding areas, if any • A speed limit of 30km/h must not be exceeded • Any complaints or claims emanating from the lack of dust control will be attended to immediately by the Contractor		

IMPACT	AIR POLLUTION (This section deals with the impact from air pollution)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Spoil dumps will be positioned such that they are not vulnerable to wind erosion		
	Odour control • Regular servicing vehicles in order to limit gaseous emissions (To be done off-site). • Regular servicing of on-site toilets to avoid potential odours • Allocated cooking areas must be provided • The Contractor must make alternative arrangements (other than fires) for cooking. Liquid Petroleum Gas cookers may be used provided that all safety regulations are followed • Waste must be disposed, as soon as possible at a municipal transfer station, skip or on a permitted landfill site. Waste must not be allowed to stand on site to decay, resulting in malodours and attracting vermin ***Rehabilitation*** • The Contractor should commence rehabilitation of exposed soil surfaces as soon as practical after completion of earthworks		

IMPACT	AIR POLLUTION (This section deals with the impact from air pollution)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
	Fire prevention • Burning of materials including wood, grass and refuse which emit visible smoke will not be permitted on construction sites • The Contractor must ensure that any grass left in a natural state during construction should be cut in order to prevent veld fires, especially during the dry months • No open fires will be allowed on site under any circumstance. All cooking will be done in demarcated areas that are safe and cannot cause runaway fires • The Contractor will have operational fire-fighting equipment available on site		

Table 1-11 Noise

IMPACT	NOISE (This section deals with the impact of increased noise)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• Construction site yards and any noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development site. Once the final layout, and power line alignments are made available by the Contractor, the sites must be evaluated in detail and specific measures designed into the system • All construction vehicles and equipment are to be kept in good repair • Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20 dBA. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators) • Construction activities, and particularly the noisy ones, are to be contained to reasonable hours during the day and early evening • Machines in intermittent use should be shut down in the intervening periods between works or throttled down to a minimum • In general, operations should meet the noise standard requirements of the Health and Safety requirements • Construction staff working in areas where the 8-hrs ambient noise levels exceed 75 dBA should wear ear protection equipment.		

IMPACT	NOISE (This section deals with the impact of increased noise)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Noise levels must be kept within acceptable limits. All noise and sounds generated must adhere to specifications for maximum allowable noise levels for construction • Noisy operations should be combined so that they occur where possible at the same time • Noise from labourers must be controlled • Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order and where appropriate fitted with silencers which are kept in good working order. Should the vehicles or equipment not be in good working order, the contractor may be instructed to remove the offending vehicle or machinery from the site • The contractor must take measures to discourage labourers from loitering in the area and causing noise disturbance. Where possible labour will be transported to and from the site by the contractor or his Sub-Contractors by the contractors' own transport • Construction activities are to be contained to reasonable hours during the day and early evening		

Table 1-12 Fauna

IMPACT	FAUNA (This section deals with the impact that the development will have on fauna in the area)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION / METHOD STATEMENT	• No disturbing, injuring or killing of any fauna (including snakes) for any purposes • No feeding of wildlife • Hunting or hurting of local fauna is prohibited • No domestic animals are to be brought onto the site • The construction site, if applicable will be kept clean and tidy and free from rubbish which would attract animal pest species • Use of appropriate construction techniques • The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase • Construction activities must be planned carefully so as not to interfere with the calving and lambing season for most animal species, as far as practical • The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners • The Contractor will under no circumstances interfere with livestock without the Landowner being present • Wild animals and arachnids and scorpions may exist around the site and thus safety measures must be		

IMPACT	FAUNA (This section deals with the impact that the development will have on fauna in the area)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	implemented to ensure the safety of the contractors and sub-contractors • Care should be taken when removing stumps, logs or rock material. Any scorpions encountered on the site should be left alone and allowed free access away from the activity or safely removed from the area. No scorpions should be intentionally killed • Fauna species should not be harmed or killed and allowed free movement away from the area. Safety precaution measure must be implemented especially during the vegetation clearance phase • All necessary mitigation measures must be implemented to minimise impacts		
SITE SPECIFIC MITIGATION			
	• No animal may be hunted, trapped or killed for any purpose whatsoever • Ensure proper substrate anchorage, provide 'dummy pole' for power lines in order to prevent damage/ injury of mammals as a result of direct contact with pole structures • In the event that animals are present that may pose a risk to human safety, a suitable animal handler must be requested to remove the animal in an environmentally responsible manner This requirement specifically refers to snakes and scorpions. • The Contractor will, as soon as reasonably possible, but within 24 hours of becoming aware of a complaint relating to wildlife interaction, respond to the complaint and register the complaint in the Environmental Register. In addition, the complaint must be reported to the Owner as soon as possible such that the incident can		

IMPACT	FAUNA (This section deals with the impact that the development will have on fauna in the area)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	be investigated by the Owner or Contractor		

Table 1-13 Waste Management

IMPACT	WASTE MANAGEMENT (This section deals with the impact from waste produced by the development)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Construction rubble*** • All rubble from demolition activities must either be used on site as part of the existing development, or must be taken off and disposed of at an approved site • Rubble must not be dumped on site but must be placed within a skip bin for regular removal • Construction rubble will be disposed of in pre–agreed, demarcated spoil dumps that have been approved by the relevant Municipality ***Litter management*** • Refuse bins must be placed at strategic positions to ensure that litter does not accumulate within the construction site • A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site		

IMPACT	WASTE MANAGEMENT (This section deals with the impact from waste produced by the development)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Waste disposal will need to take place in terms of requirements of GAMEP • If possible and feasible, all waste generated on site must be separated into glass, plastic, paper, metal and wood and recycled. An independent contractor can be appointed to conduct this recycling • Littering by the employees of the Contractor will not be allowed under any circumstances. The ECO will monitor the neatness of the work sites, if applicable • Skip waste containers should be maintained on site. These should be kept covered and arrangements made for them to be collected regularly form the site by the local council or a private waste contractor • All waste must be removed from the site and transported to a landfill site as approved by the relevant Municipality • Waybills providing disposal at each site will be provided to the Owner's inspection ***Hazardous waste*** • All waste hazardous materials must be carefully stored as advised by the Owner, and then disposed of off-site at a licensed landfill site • Contaminants to be stored safely to avoid spillage		

IMPACT	WASTE MANAGEMENT (This section deals with the impact from waste produced by the development)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Machinery must be properly maintained to keep oil leaks in check ***Sanitation*** • The Contractor will install mobile chemical toilets on the site • The exact location of the toilets must be approved by the SHE Officer/ECO prior to establishment • All temporary/portable toilets must be secured to the ground to prevent them from toppling due to wind or any other cause • The Contractor will ensure that the entrances to toilets are adequately screened from public view • Suitable toilets will be provided for the staff at all points at which workmen are carrying out duties under the contract • The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied • Staff will be sensitised to the fact that they should use these facilities at all times. No indiscriminate sanitary activities on site will be allowed • All ablution activities must take place in these facilities, and the waste material must be stored and		

IMPACT	WASTE MANAGEMENT (This section deals with the impact from waste produced by the development)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	disposed of at the registered waste disposal site or collected by a suitable waste contractor on a regular basis • Ablution facilities will be within 100m from workplaces but not closer than 150m from any watercourses or boreholes. There should be enough toilets available to accommodate the workforce • Toilets will be serviced regularly and the ECO will inspect toilets regularly • Toilets should be no closer than 150m or above the 1:100 year flood line from any watercourse or alternatively located in a place approved of by the Owner • Under no circumstances may open areas, neighbours fences or the surrounding bush be used as a toilet facility • The construction of "Long Drop" toilets is not allowed • Potable water must be provided for all construction staff ***Remedial actions*** • Depending on the nature and extent of the spill, contaminated soil must be either excavated or treated on-site		

IMPACT	WASTE MANAGEMENT (This section deals with the impact from waste produced by the development)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Excavation of contaminated soil must involve careful removal of soil using appropriate tools/machinery to storage containers until treated or disposed of at a licensed hazardous landfill site • The ECO must determine the precise method of treatment of polluted soil. This could involve the application of soil absorbent materials as well as oil-digestive powders to the contaminated soil • If a spill occurs on an impermeable surface such as cement or concrete, the surface spill must be contained using oil absorbent pads • If necessary, oil absorbent sheets or pads must be attached to leaky machinery or infrastructure. • Materials used for the remediation of petrochemical spills must be used according to product specifications and guidance for use • Contaminated remediation materials must be carefully removed from the area of the spill so as to prevent further release of petrochemicals to the environment, and stored in adequate containers until appropriate disposal		

Table 1-14 Health and Safety

IMPACT	HEALTH AND SAFETY (This section deals with the safety of workers and the public exposed to construction hazards)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/ Owner**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Worker safety*** • Implementation of safety measures, work procedures and first aid must be implemented on site • A health and safety plan must be drawn up to ensure worker safety • Workers should be thoroughly trained in using potentially dangerous equipment • Contractors must ensure that all equipment is maintained in a safe operating condition • A safety officer must be appointed • A record of health and safety incidents must be kept on site • Any health and safety incidents must be reported to the project manager immediately • First aid facilities must be available on site at all times • Workers have the right to refuse work in unsafe conditions • The Contractor will take all the necessary precautions against the spreading of disease • A record will be kept of drugs administered or precautions taken and the time and dates when this was done. This can then be used as evidence in court should any claims be instituted against the Owner or the Contractor • Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury		

IMPACT	HEALTH AND SAFETY (This section deals with the safety of workers and the public exposed to construction hazards)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/ Owner**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
	to site workers/local residents ***Worker facilities*** • Eating areas should be regularly serviced and cleaned to ensure the highest possible standards of hygiene and cleanliness Fires are not to be allowed ***Protective gear*** • Personal Protective Equipment (PPE) must be made available to all construction staff and their usage must be compulsory. Hard hats and safety shoes must be worn at all times and other PPE worn were necessary i.e. dust masks, ear plugs etc. • No person is to enter the site without the necessary PPE • Standards and specifications governing dangerous processes such as welding and radiographic testing of welds must be strictly applied, with a view to proper protection of the public and workers ***Site safety*** • Potentially hazardous areas such as trenches, if any are to be demarcated and clearly marked • Adequate warning signs of hazardous working areas • Uncovered manholes and excavations must be clearly demarcated • Emergency numbers for local police and fire department etc. must be placed in a prominent area		

IMPACT	HEALTH AND SAFETY (This section deals with the safety of workers and the public exposed to construction hazards)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/ Owner**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Firefighting equipment must be placed in prominent positions across the site where it is easily accessible. This includes fire extinguishers, a fire blanket as well as a water tank • Suitable conspicuous warning signs in Arabic, English and all other applicable languages must be placed at all entrances to the site • All speed limits must be adhered to on site ***Construction equipment safety*** • All equipment used for construction, including drills, TLB's must be in good working order with up to date maintenance records ***Hazardous Material Storage*** • Staff that will be handling hazardous materials must be trained to do so • Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor • All storage tanks containing hazardous materials must be placed in bunted containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored hazardous material • Material Safety Data Sheets (MSDS) which contain the necessary information pertaining to a specific hazardous substance must be present for all hazardous materials stored on the site		

IMPACT	HEALTH AND SAFETY (This section deals with the safety of workers and the public exposed to construction hazards)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/ Owner**	**Daily**
ENVIRONMENTAL MANAGEMENT PLAN			
	• The bund walls for the transformer oil containers must be in place before the installation of these containers ***Procedure in the event of a petrochemical spill*** • The individual responsible for or who discovers the petrochemical spill must report the incident to the Owner. • The problem must be assessed and the necessary actions required will be undertaken. • The immediate response must be to contain the spill. • The source of the spill must be identified, controlled, treated or removed wherever possible. ***Fire management*** • A Fire Management Strategy must be compiled and implemented • All construction personnel will receive training on fire hazards and techniques to extinguish any fire that may be initiated on the site • They must also be made aware of the added risks during the dry summer months, as well as of the Fire Management Strategy to be implemented during construction • Firefighting equipment should be present on site at all times as per OHSA • All construction staff must be trained in fire hazard control and firefighting techniques • All flammable substances must be stored in dry areas which do not pose an ignition risk to the said substances		

Table 1-15 Security

IMPACT	SECURITY (This section deals with issues of security during construction for workers and surrounding land users)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• Access to the construction site should be strictly controlled by a security company • 24-hour security on-site • Labour should be transported to and from the site to discourage loitering in adjacent areas and possible increase in crime or disturbance • Unsocial activities on site should be banned. Any persons found to be engaged in such activities should receive disciplinary or criminal action taken against them • The site will be fenced to prevent any loss or injury to persons or livestock during the construction phase • If any fencing interferes with the construction process, such fencing will be deviated until construction is completed. The deviation of fences will be negotiated and agreed with the landowner in writing • No alcohol / drugs to be present on site • No firearms allowed on site or in vehicles transporting staff to /from site (unless used by security personnel) • Construction staff is to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bus as a toilet facility are forbidden) • Driving under the influence of alcohol is prohibited		

IMPACT	SECURITY (This section deals with issues of security during construction for workers and surrounding land users)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	• All employees must undergo the necessary safety training and wear the necessary protective clothing • Secure the site in order to reduce the opportunity for criminal activity in the locality of the construction site		

Table 1-16 Visual Impact

IMPACT	VISUAL IMPACT (This section deals with the visual impact that the new development will have on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• Fencing of the site will also aid in reducing the visual impact of construction • Cluster construction activities on site. Storage facilities, elevated tanks and other temporary structures on site should be located such that they have as little visual impact as possible • Material chosen to blend in with the surrounding environment • Unwanted material and litter should be removed on a frequent basis • Cordon off construction site with shade-cloth if necessary • Lighting must be subtle and not disturb passing motorists and surrounding residents • Lighting should be inward and downward facing • The site will be kept visually and aesthetically pleasing. The ECO will regularly inspect the site to ensure that it is neat and clean • The exterior design in terms of buildings, fences and landscaping be planned in such a way that it will not distract travellers from visiting the site • An information centre is advisable which could explain the technology		

IMPACT	VISUAL IMPACT (This section deals with the visual impact that the new development will have on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
ENVIRONMENTAL MANAGEMENT PLAN			
SITE SPECIFIC MITIGATION			
	• Reduce the construction period through careful planning and productive implementation of resources • Restrict the activities and movement of construction workers and vehicles to the immediate construction site • Ensure that the general appearance of construction activities and lay-down areas are maintained by means of the timely removal of rubble and disused construction materials • Restrict construction activities to daylight hours (where possible) in order to negate or reduce the visual impacts associated with lighting		

1.6.3 EMP for Operation

Table 1-17 Construction site restore

IMPACT	CONSTRUCTION SITE DECOMMISSIONING	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**EPC Contractor/ Owner**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Removal of equipment*** • All structures comprising the storage areas, if applicable are to be removed from site • The area that previously housed the storage areas, if applicable is to be checked for spills of substances such as oil, paint, etc., and these should be cleaned up • All hardened surfaces within the storage areas area should be ripped, all imported materials removed, and the area will be top soiled and regressed ***Temporary services*** • The Contractor must arrange the cancellation of all temporary services • Copies of all certificates from waste disposed are to be presented to the Owner • Temporary roads must be closed and access across these blocked • All areas where temporary services were installed are to be rehabilitated to the satisfaction of the Owner		

IMPACT	CONSTRUCTION SITE DECOMMISSIONING	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**EPC Contractor/ Owner**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	Associated infrastructure • Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the Owner • All surfaces hardened due to construction activities are to be ripped and imported material thereon removed • All rubble is to be removed from the site to an approved disposal site as approved by the Owner. Burying of rubble on site is prohibited • The site is to be cleared of all litter • The Contractor is to check that all watercourses are free from building rubble, spoil materials and waste materials • Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Owner • All residual stockpiles must be removed to spoil or spread on site as directed by the Owner • All leftover building materials must be returned to the depot or removed from the site • The Contractor must repair any damage that the construction works have caused to neighbouring properties, specifically, but not limited to, damage caused by poor storm water management		

IMPACT	CONSTRUCTION SITE DECOMMISSIONING	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**EPC Contractor/ Owner**	**Weekly**
ENVIRONMENTAL MANAGEMENT PLAN			
	Borrow pits • Borrow pits are to be closed and rehabilitated.		

Table 1-18 Water Management

IMPACT	WATER MANAGEMENT	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Bi-Annually**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION / METHOD STATEMENT	***Management*** • Management must ensure that solid waste collection and sanitation is managed effectively in order to avoid any chances of ground and surface water pollution • All runoff water from fuel deposits, workshops, vehicles washing areas and other equipment must be collected and disposed of • All water discharged from the works including effluent from wash water and stormwater from workshops and refuelling areas, as well as all runoff from areas with pollution potential will comply with national effluent standards • All chemical/hydrocarbon storage areas must be bunded. This bund water must be removed from site by a licensed contractor • All chemical usage areas, if any must be paved • Potentially contaminated water must be directed to an oil/water separator. Oily water must be removed from the site by a licensed contractor • Any run-off that is discharged from the site must be uncontaminated • All vehicle transfers of materials must be conducted within a bunded area to minimise the potential for spills to enter the stormwater		

IMPACT	WATER MANAGEMENT	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Bi-Annually**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Spills of potential contaminants must be immediately cleaned up and neutralised. Such spills must be handled with consideration to health and safety considerations • The use of water to clean up spills must be avoided except where necessary • Movement of vehicles on and off site is to be through approved access points only • Spill kits must be made available on site for the clean-up of spills and leaks of contaminants • Spill response procedures to include removal/disposal of potentially contaminated water and any used absorbent materials • In the event of a major spill or leak of contaminants, the administering authority must be contacted immediately as per incident reporting procedures • No groundwater must be polluted by any activities on site ***Monitoring and Reporting*** • A formal monitoring and reporting strategy/protocol should be developed for monitoring the integrity of the different water resources likely to be affected by the plant. This should include any ongoing rehabilitation measures initiated in the construction phase • Monitoring should include fixed-point photographs at specific intervals and after large flood events • Specific activities that should be monitored include: ◦ Erosion potential (specifically in and around roads and storm-water discharge points)		

IMPACT	WATER MANAGEMENT	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Bi-Annually**
ENVIRONMENTAL MANAGEMENT PLAN			
	• Stormwater management and design • Identified problem areas		

Table 1-19 Air Quality

IMPACT	AIR QUALITY	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Annually**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Dust management*** • Dust control mechanisms must be utilised to reduce the amount of dust being released • Any dirt roads that are utilised by the contractor to access the site must be regularly maintained to ensure that dust levels are controlled • The plant's equipment must be performance tested during the commissioning phase to ensure that the manufacturer's standard has been delivered in respect of air emissions		

Table 1-20 Fauna

IMPACT	FAUNA		
PHASE	**OPERATION**	**Owner**	**Annually**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Fauna management*** • Hunting or hurting of local fauna is prohibited • The owner must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase • A monitoring programme must be developed to monitor the impacts of the construction of the plant on Avifauna. This monitoring programme should be set up in conjunction with GAMEP • Monitor the movement of small and medium size mammals through fences. In the event that an animal becomes trapped within the facility, procedures need to be developed in order to facilitate their removal		

Table 1-21 Noise

IMPACT	NOISE	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Annually**
ENVIRONMENTAL MANAGEMENT PLAN			

MITIGATION	***Noise from the plant***
	• The design of the plant is to incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous daytime rating level, namely a noise level of 70 dBA (just inside the property projection plane, namely the property boundary). At the property fence and at potential receptors outside the facility, noise levels should comply with GAMEP standards
	• The latest technology incorporating maximum noise mitigating measures for the plant components should be designed into the system
	• The design process is to consider, inter alia, the following aspects:
	  ◦ The position and orientation of buildings on the site
	  ◦ The enclosure of noisy plant in buildings where possible and practical
	  ◦ The design of the buildings to minimise the transmission of noise from the inside to the outdoors
	  ◦ The insulation of particularly noisy plant and equipment
	• All plant and equipment, including vehicles, must be properly maintained in order to minimise noise		

IMPACT	NOISE	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Annually**
ENVIRONMENTAL MANAGEMENT PLAN			
	generation • Observation of on-site noise levels by Safety, Health and Environment Officer • A complaints register must be held, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon • Corrective action is required to be undertaken immediately after a complaint is made or non-conformance is identified • Any complaints regarding noise must be investigated, sources identified and mitigation measures implemented. Feedback on resolution of the issue must be provided to the complainant • The Safety, Health and Environment Officer will maintain an incident reporting system to record non-conformances		

Table 1-22 Biodiversity

IMPACT	BIODIVERSITY (FAUNA AND FLORA)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Quarterly**
ENVIRONMENTAL MANAGEMENT PLAN			

MITIGATION / METHOD STATEMENT	• Indigenous vegetation, if any must be maintained.
	• The active control of all alien invasive species, if any by means of manual removal, ring-barking, chemical control or a combination of these methods
	• The use of herbicides will be in compliance with the GAMEP regulations
	• The Operator will:
	  ◦ Ensure that a registered pest control operator applies or supervises the application of all herbicides
	  ◦ Ensure that all herbicides are stored in a well-ventilated demarcated storage area
	  ◦ Ensure that a register of all contents of the storage area is kept and updated on a regular basis
	  ◦ Ensure that a daily register of all relevant details of herbicide usage is kept, and that such a register is maintained by the Owner
	  ◦ All emergent seedlings must be removed by hand and re- sprouting from existing rootstock must be chemically treated in a continual monitoring and follow-up programme
	  ◦ Implementation of a rehabilitation and landscaping program for the site		

IMPACT	BIODIVERSITY (FAUNA AND FLORA)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	OPERATION	Owner	Quarterly
ENVIRONMENTAL MANAGEMENT PLAN			
	• Where possible re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction • No faunal species must be harmed by maintenance staff during any routine maintenance at the site • Appropriate mitigation of bird collisions with PV panels needs to be determined on an ad hoc basis through regular monitoring once the plant is operational • Develop and implement an avifauna impact monitoring programme • Marking the relevant sections of the power line with appropriate marking devices.		

Table 1-23 Biodiversity

IMPACT	WASTE MANAGEMENT	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Monthly when conduction / and or maintenance is required**
ENVIRONMENTAL MANAGEMENT PLAN			

MITIGATION	***Waste management (if this is required on the site)***
	• Solid waste separation and recycling should take place for the entire duration of the operational phase for the project
	• All structures and/or components replaced during maintenance activities are appropriately disposed of at an appropriate licensed waste disposal site or sold to a recycling merchant for recycling
	• Ensure that care is taken that spillage of oils and other hazardous substances are limited during maintenance. Should any accidental spillage take place, it must be cleaned up according to specified standards
	• Waste handling, collection and disposal operations are managed and controlled by a waste management contractor
	• Wastewater:
	  ◦ Water from bunds and oily water from oil/water separator must be removed by a licensed contractor.
	• Waste – Leaked oil and chemicals:
	  ◦ Appropriate disposal must be arranged with a licensed facility		

IMPACT	WASTE MANAGEMENT	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Monthly when conduction / and or maintenance is required**
ENVIRONMENTAL MANAGEMENT PLAN			

	• Waste must be stored and handled according to the relevant legislation and regulations
	• General Waste:
	  • Recycled where possible or disposed of properly to an appropriate landfill facility
	• Hazardous Waste:
	  • Separate hazardous and general waste and dispose hazardous waste to an appropriate hazardous waste disposal site
	• Uncontaminated waste must be removed at least monthly for disposal
	• Contaminated or regular wastes must be disposed of as necessary and in accordance with legislation
	• An incident/complaint register must be established and maintained
	• Visual inspection of the site must be carried out daily for evidence of litter or waste material that has been inappropriately disposed of by site personnel
	• Waste collection must be monitored on a regular basis
	• Waste documentation must be completed and available for inspection on request		

IMPACT	WASTE MANAGEMENT	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Monthly when conduction / and or maintenance is required**
ENVIRONMENTAL MANAGEMENT PLAN			
	• A complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, resolved • Weekly and monthly reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor and monitored by the Safety, Health and Environment Officer. All appropriate waste disposal certificates accompany the monthly reports		

Table 1-24 Visual Impact

IMPACT	VISUAL IMPACT	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**OPERATION**	**Owner**	**Annually**
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• The exterior design in terms of buildings, fences and landscaping is planned in such a way to reduce the visual impact • All lighting where practical, must be "down" to minimise the visual impact of the facility at night. Lighting must be directed towards the areas they are supposed to illuminate • Use of light fixtures and the fitment of covers and shields designed to contain rather than spread light where practical. The minimum amount of lighting must be used • If a visually intrusive component of the site is identified, the procedures must be altered or updated to ensure effective management • An incident reporting system will record and manage follow up of resolution of non-conformances		

1.7 Layout of the SMP

This section is divided into three main parts. The first part and the second part address the Social Management Plan (SMP) for the construction and operations, respectively, and the third presents the grievance mechanism to be applied throughout the construction and operation phase of the Project.

This section is based on IFC Performance Standard 2, which recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by due recognition of the rights of workers. Its objectives include the promotion of fair treatment, non-discrimination and equal opportunity, and the maintenance and improvement of worker-management relationships.

Requirements in terms of Performance Standard 2 include the following:

- Human Resource Policies and Procedures:
  - Adopt and implement the appropriate human resource policies
  - Provide workers with clear understandable documentation explaining worker's rights
- Working Conditions and Terms of Employment:
  - Respect collective bargaining agreements with workers organisations
  - Identify and ensure substantially equivalent terms and conditions for migrant workers
  - Develop and implement policies on the quality and management of accommodation and provision of basic services
- Workers Organisations: Not to restrict or prevent workers from forming and / join workers organisations
- Non-Discrimination and Equal Opportunity:
  - Employment decision will not be made on the basis of personal characteristics unrelated to inherent job requirements
  - Promote equal opportunity, fair treatment and non-discrimination.
  - Take measures to prevent and address harassment, intimidation and / or exploitation
- Retrenchment: Develop a Retrenchment Plan to address issues as it relates to legal and contractual requirements
- Grievance Mechanism: Provide grievance mechanism for workers to raise workplace concerns
- Protecting the Work Force:
  - Persons under the age of 18 will not be employed
  - Forced labour will not be employed
- Occupational Health and Safety:
  - Provide safe and healthy work environment
  - Take steps to prevent accidents, injury and disease

- Apply good international industry practice to assess risk and potential hazards to workers, provide preventative and protective measures, training, monitoring and reporting, emergency preparedness and response procedures

- Workers engaged by Third Parties: Take reasonable action to ascertain compliance with the Performance Standard
- Supply Chain: Take reasonable action to ascertain compliance with the Performance Standard

The value of compliance with these requirements includes:

- Improved well-being and welfare of workers
- Improving the efficiency and effectiveness of the Project operations
- Maintenance of a positive corporate image

The site earmarked for the proposed facility is in a designated industrial area that is currently unoccupied. Thus, the project will not necessitate any relocation or resettlement. The project owner is recommended to set up and publicly disclose a cut-off date for eligibility to avoid encroachment in the area with the sole purpose of obtaining benefits from the project. The project will, however, have some negative impacts of the surrounding social environment; these mainly relate to nuisance impacts, increased noise levels, and reduced air quality due to emissions. However, the project will also have various positive socio-economic impacts, including benefits for the local economy, the creation of indirect business opportunities, etc.

Effective management of relations with neighbouring communities and other local stakeholders is important, not only to inform them of likely negative impacts, but also to manage expectations concerning the magnitude and extent of positive impacts. The IFC Performance Standard 1 confirms the importance of effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them. According to PS1, Stakeholder engagement is an ongoing process that may involve consultation and participation. The process of consultation should be undertaken in a manner that provides the stakeholders with opportunities to express their views on project impacts and mitigation measures, and allows the project owner to consider and respond to them.

Additionally, Principle 5 of the Equator Principles is focused on stakeholder engagement. According to this principle, an informed consultation and participation process should be conducted and should be free from external manipulation and intimidation. The results of the stakeholder engagement process should be documented and any actions agreed resulting from such process should be taken into consideration by the project owner.

1.7.1 SMP for Construction

Table 1-25 Social Environment

IMPACT	SOCIAL ENVIRONMENT (This section deals with the social impacts that the new development will have on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/Owner**	**Bi-Monthly**
SOCIAL MANAGEMENT PLAN			
MITIGATION	• All contact with the affected parties will be courteous at all times. The rights of the affected parties will be respected at all times • A complaints register should be kept on site. Details of complaints should be incorporated into the audits as part of the monitoring process. This should be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the Contractor. This register is to be tabled during monthly site meetings • During the setup phase of the project the Contractor needs to make contact with those people that are interested in or affected by the development. The contractor will notify adjacent neighbours and inform them of the intended development. He will also inform neighbours that a complaints register will be available on site • No interruptions other than those negotiated will be allowed to any essential services. Damage to infrastructure will not be tolerated and any damage will be rectified immediately by the Contractor. A record of any damage and remedial actions will be kept on site • Speed limits will be enforced and all drivers will be sensitised to this effect		

IMPACT	SOCIAL ENVIRONMENT (This section deals with the social impacts that the new development will have on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/Owner**	**Bi-Monthly**
SOCIAL MANAGEMENT PLAN			
	• Any possible disruptions to essential services must be kept to a minimum and should be well advertised and communicated		
SITE SPECIFIC MITIGATION			
Roads	• Road rehabilitation should take place during and once construction is completed • Construction traffic should only make use of an approved route • Traffic signs should warn construction vehicles of the presence of pedestrians along the road • General road rules should be enforced		
Influx of construction workers	• Raise awareness amongst construction workers about local traditions and practices		
Influx of job seekers	• Ensure that employment procedures/policies are communicated to local stakeholders • Have clear rules and regulations for access to the site office to control loitering • Construction workers should be clearly identifiable by wearing proper construction uniforms displaying the logo of the construction company. Construction workers could also be issued with identification tags		
Direct formal employment opportunities for local	• Unskilled job opportunities should be afforded to local community members		

IMPACT	SOCIAL ENVIRONMENT (This section deals with the social impacts that the new development will have on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/Owner**	**Bi-Monthly**
SOCIAL MANAGEMENT PLAN			
individuals	• Equal opportunities for employment should be created • Payment should comply with applicable Labour Law legislation in terms of minimum wages		
Indirect formal and/or informal employment opportunities for local individuals	• Develop a procurement policy that is easy to understand and ensure that local subcontractors also comply with the procurement policy and any other applicable policies • Ensure that local subcontractors receive the necessary support in terms of resources • Encourage construction workers to use local services		
Disaster Management Plan	• Develop and implement a disaster management plan for implementation during the construction phase • Maintain risk-specific safety infrastructure and plans – such as major accidents involving roads		
Sanitation	• Adequate water facilities should be provided • Sufficient portable chemical toilets on site		
Sense of place	• Sufficient and transparent information should be supplied to neighbouring properties		
Physical splintering	• Fence off the construction site to prohibited unauthorised access • Community awareness on the safety mechanisms of the plant and related infrastructure, and the potential dangers		

IMPACT	SOCIAL ENVIRONMENT (This section deals with the social impacts that the new development will have on the site and surrounds)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor/Owner**	**Bi-Monthly**
SOCIAL MANAGEMENT PLAN			
	• A clear emergency evacuation plan should be developed in close co-operation with the affected local municipalities		

Table 1-26 Workers Accommodation

IMPACT	Workers Accommodation	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**CONSTRUCTION**	**EPC Contractor**	**Monthly**
SOCIAL MANAGEMENT PLAN			
MITIGATION	• Ensure design and construction of the accommodation camp complies with all the applicable national laws, standards and building code and the requirements of IFC/EBRD Guidance on Workers' Accommodation (2009), including but not limited to the following: • The camp is located to avoid flood risk and other natural hazards • Living facilities must be situated within reasonable distance from the worksite • The camp is adequately drained to avoid the accumulation of stagnant water • Air-conditioning and ventilation is appropriate for the local climatic conditions. It is recommended that the window area represents not less than 5% to 10% of the floor area • Both natural and artificial lighting are provided and maintained in living facilities. Emergency lighting must be provided • Wastewater, sewage food and any other waste materials are adequately discharged in compliance with local or World Bank standards, whichever is more stringent. Containers for solid waste collection must be provided and emptied on a regular basis • Ensure adequate space is provided for workers' rooms and dormitory facilities range from 10 to 12.5 cubic		

IMPACT	Workers Accommodation	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Monthly
SOCIAL MANAGEMENT PLAN			
	meters minimal volume per resident or 4 to 5.5 square meters of minimal floor space per resident, with a minimum celling height of 2.10 m • Pest and vector control as well as disinfection must be carried out in compliance with the applicable legal requirements and / or good practice • Adequate sanitary and washing facilities as well as cooking and storage facilities must be provided • Rest and recreation facilities must be provided • Basic healthcare and emergency health response must be provided • Living facilities must allow for sufficient privacy • Ensure administration and maintenance of accommodation facilities comply with all applicable standards in terms of: • Fire-fighting equipment must be provided at appropriate locations, and must be regularly maintained as per manufacturer's instructions • Access to an adequate and convenient supply of free potable water is always available for workers. Depending on climate, weather conditions and accommodation standards, 80 to 180 litres per person per day must be made available. Drinking water must meet local or WHO drinking water standard, whichever is more stringent and water quality must be monitored regularly		

IMPACT	Workers Accommodation	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Monthly
SOCIAL MANAGEMENT PLAN			
	• Living facilities must be kept in good repair and must be kept clean		

Table 1-27 Labour and Working Conditions

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Monthly
SOCIAL MANAGEMENT PLAN			
MITIGATION	• Assess/ review HR policies to ensure that obligations under national and international labour and human rights laws are adequately addressed, including: • Non-discrimination & equal opportunity • Prohibition of child labour and forced labour • Remuneration and benefits • Deductions, hours of work, breaks and rest days		

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Monthly
SOCIAL MANAGEMENT PLAN			
	• Overtime arrangements and compensation • Medical insurance and pension • Leave for illness, vacation, maternity or holiday • Implement measures to enforce and monitor compliance with HR policies • Provide awareness training to all project workers prior to commencing work on the project's HR policies and their rights under national and international labour and human rights laws (including the right to join workers' organisations and enter into collective bargaining agreements) • Give preference to local workers in hiring process, wherever feasible and provided that candidates have the right skills and background • Working Conditions and Terms of Employment • Issue all workers with a contract which describes the employment relationship. The contract must be provided as part of the hiring process and shall describe all policies and procedures related to working conditions. • Assess the employment relationship with vulnerable groups, including women workers, young workers, migrant workers and workers with disabilities to mitigate discrimination. • Ensure that HR policies and procedures (discussed above) cover all workers, including direct, contracted and supply		

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Monthly
SOCIAL MANAGEMENT PLAN			
	chain workers. • Where collective bargaining agreements are in place, verify that these meet the requirements of the applicable legislation. • In the event that some employees are covered by collective bargaining agreements and others are not, ensure that the terms and conditions of employment as well as benefits of all employees in similar positions are equivalent.		

Table 1-28 Employment

IMPACT	EMPLOYMENT (This section deals with the impact that increased employment from the development will have on the area)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Weekly
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	• Training of labour to benefit individuals beyond completion of the project		

IMPACT	EMPLOYMENT (This section deals with the impact that increased employment from the development will have on the area)	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	CONSTRUCTION	EPC Contractor	Weekly
ENVIRONMENTAL MANAGEMENT PLAN			
	• Labour to be sourced from the local community where possible • Local suppliers to be used where possible • The Project Manager must ensure that all staff working on the proposed project must be in possession of a KSA work permit		

1.7.2 SMP for Operation

Table 1-29 Social Environment

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**Operation**	**Owner**	**Annual**
SOCIAL MANAGEMENT PLAN			
MITIGATION	• Update the stakeholders database developed during the construction phase as needed • Provide appropriate training on cultural aspects for any foreign worker • Monitor implementation and effectiveness of SEP implementation • Minimising Negative Impacts on Host Communities • Restricting working hours for particularly loud or intrusive activities • Minimising machinery operation and vehicle movements • Minimising night time vehicle movement • Regular monitoring of the ambient air quality and noise levels at the boundaries of the facility as well as the nearest receptor(s) • Audit the grievance mechanisms utilised to ensure their adequacy. • Monitor local community attitude towards the project • Coordinate with nearby facilities and communities in case of non-routine events that might affect them		

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	Operation	Owner	Annual
SOCIAL MANAGEMENT PLAN			
	• Identify and utilise opportunities to improve environmental conditions which affects the surrounding communities • Surveillance programmes to screen the health of workers and minimise risk of introducing of new or highly resistant diseases into host communities • Education and training programmes for contractors to prevent the transmission of communicable diseases • Collaboration with local authorities to enhance access of workers' families and the community to public health services, immunisation facilities, etc. • Ensure communities and other stakeholders have access to information necessary to understand the nature of possible effects of an accident • Ensure communities and other stakeholders have adequate opportunity to contribute effectively, as appropriate, to decisions concerning the development of community emergency preparedness and response plans • Prohibit trespassing of workers onto neighbouring properties • Establish appropriate disciplinary action must be taken in the event of transgression • Implement public awareness programmes to identify areas of particular risk and approaches to reduce risk		

Table 1-30 Labour and Working Conditions

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	**Operation**	**Owner**	**Quarterly**
SOCIAL MANAGEMENT PLAN			
MITIGATION	• Assess/ review HR policies to ensure that obligations under national and international labour and human rights laws are adequately addressed • Provide awareness training to all project workers on the project's HR policies and their rights under national and international labour and human rights laws (including the right to join workers' organisations and enter into collective bargaining agreements) • Give preference to local workers in hiring process, wherever feasible and provided that candidates have the right skills and background • Issue all new operational workers with a contract which describes the employment relationship. The contract must be provided as part of the hiring process and shall describe all policies and procedures related to working conditions. • Assess the employment relationship with vulnerable groups, including women workers, young workers, migrant workers and workers with disabilities to mitigate discrimination. • Ensure that HR policies and procedures (discussed above) cover all workers, including direct, contracted and supply chain workers. • Where collective bargaining agreements are in place, verify that these meet the requirements of the applicable legislation.		

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	Operation	Owner	Quarterly
SOCIAL MANAGEMENT PLAN			
	• In the event that some employees are covered by collective bargaining agreements and others are not, ensure that the terms and conditions of employment as well as benefits of all employees in similar positions are equivalent. • Areas in plant whereas sound pressure levels exceed 85dBA need to be designated as “Restricted area”, and personnel hearing protection is mandatory • Areas where hazardous materials are utilized will be designated as “Restricted area”, and the appropriate PPE is mandatory • Ways of lowering noise levels from the different noise sources such as generators and pumps should be examined and implemented. • Design and implement a hearing conservation program for all project personnel. • Provision of the appropriate safety clothes to all workers. • Provide employees operating noisy equipment with appropriate noise protection (e.g. ear defenders, ear plugs) to protect them from hearing damage • Conduct medical check to all employees • Regular monitoring of noise levels will be conducted at the facility during operations phase. Should noise emissions exceed acceptable limits, additional mitigation measures shall be investigated; • Routine maintenance of equipment and vehicles based on manufacturer’s recommendation will ensure that		

IMPACT	Labour and Working Conditions	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	Operation	Owner	Quarterly
SOCIAL MANAGEMENT PLAN			
	equipment are operating efficiently and not generating excessive noise or emissions. • Throttle down or switch off noise generating equipment when not in use. • In case of any near-miss or accident, prompt thorough investigation should be conducted and corrective measures should be taken as necessary		

Table 1-31 Health and Safety

IMPACT	HEALTH AND SAFETY	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	OPERATION	Owner	Daily
ENVIRONMENTAL MANAGEMENT PLAN			
MITIGATION	***Emergency evacuation plan*** • Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the staff and surrounding land users in the case of an emergency		

IMPACT	HEALTH AND SAFETY	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	OPERATION	Owner	Daily
ENVIRONMENTAL MANAGEMENT PLAN			
	• All permanent staff must undergo safety training ***Maintenance*** • The power lines are to be regularly maintained. A maintenance schedule must be drawn up and records of all maintenance kept ***Fire safety*** • Firefighting equipment in the form of fire hydrants or fire extinguishers must be available on the site. These must be regularly maintained by an appropriate company ***Storage and handling and management of hazardous materials*** • Management strategies/operational procedures for the routine monitoring and inspection of fuel tanks, and other fuel related equipment will be compiled and implemented • The storage of flammable and combustible liquids such as oils will comply with the relevant legislation • The storage and handling of corrosive substances must be in accordance with the relevant legislation • The minimum amount of fuel required for efficient operation of the facility must be stored on site • Any spills will be rendered harmless and arrangements made for appropriate collection and disposal, including cleaning materials, absorbents and contaminated solid		

IMPACT	HEALTH AND SAFETY	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	OPERATION	Owner	Daily
ENVIRONMENTAL MANAGEMENT PLAN			
	• Ensure that spill kits are available on site to clean up spills and leaks • Obtain any permits and approvals necessary and comply with the conditions attached to such permits and approvals • Transport of all hazardous substances must be in accordance with the relevant legislation • Identify and maintain a register of all activities that involve the handling of potentially hazardous substances, as well as devise and supervise the implementation of protocols for the handling of these substances. This will include all fuels, oils, lubricants and grease • Ensure that all hazardous substances are handled in accordance with the manufacturer's specifications and relevant legal requirements • Arrange and supervise the implementation of clean-up operations and proper disposal of contaminated materials at a licensed hazardous waste disposal site • Keep written records detailing the type of spill, the corrective and remedial measures implemented in the stopping or reduction of the spill, and the clean-up. Such progress reporting is important for monitoring and auditing purposes and the written reports may afterwards be used for training purposes in an effort to prevent similar future occurrences • Tanks to be designed and constructed in accordance with a recognised code (international standard) • The rated capacity of tanks must provide sufficient capacity to permit expansion of the product contained therein by		

IMPACT	HEALTH AND SAFETY	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	OPERATION	Owner	Daily
ENVIRONMENTAL MANAGEMENT PLAN			
	the rise in temperature during storage • Tanks must be situated in a bunded area the volume of which must be at least 110% of the proposed volume of the tank • The floor of the bunded area must be smooth and impermeable constructed of concrete or plastic sheeting with impermeable joints with a layer of sand over to prevent perishing. The floor of the bunted area will be sloped towards an oil trap or sump to enable any spilled fuel and/or fuel–soaked water to be removed • The fuel delivery area, if any must be bunded and an interceptor system or similar structure must be installed, with all drainage directed to an oil water separator. This approach will allow for the removal of free product from any surface run-off or spillages. The interceptor system must contain a holding tank that is used to contain any free product recovered. Free product must be removed from this separator, stored in a holding tank, and recycled or disposed of in an appropriate manner • Internationally approved non-corrosive pipework systems must be installed (approved codes) • Ant flash nozzles must be installed at the end of the vent pipes and provisions must be made for overfill protection devices in the tank filling pipes to prevent tank overfills during filling operations • Fuel must be dispensed via a system that has suitable leak detectors linked to the fuel lines if and where required. These leak detectors must form an integral part of the pumping system and allow for automatic cut-off the fuel supply must a leak be detected		

IMPACT	HEALTH AND SAFETY	RESPONSIBILITY	FREQUENCY / MONITORING REQUIREMENTS
PHASE	OPERATION	Owner	Daily
ENVIRONMENTAL MANAGEMENT PLAN			
	• Any water that collects in the bund must not be allowed to stand and must be removed and the hydrocarbon digestion agent within must be replenished • Spill and emergency response equipment must be accessible at chemical transfer/unloading points and refuelling locations • Bunds and storage facilities must be maintained to ensure design capacity is available • Water which ponds within the bunded areas must be pumped to the oil/water separator as soon as possible after rain events cease • Observation and supervision of chemical storage and handling practices and vehicle maintenance by the Safety, Health and Environment Officer throughout the plant's operational phase • Inspection of bunding integrity, stability and function ***Hazard and Risk*** • All monitoring will occur according to the risk management and emergency response plan, guidelines and license conditions • A complaints register must be maintained, in which any complaints from the community must be logged. Complaints must be investigated and, if appropriate, acted upon		

1.7.3 Grievance Mechanism Framework

According to Equator Principle 6, a grievance mechanism should be established that is designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. Furthermore, the grievance mechanism should be accessible both to the public and on-site workers. IFC Performance Standard 1 also provides for the establishment of a mechanism to address community grievances. In addition, IFC PS 2 on Labour and Working Conditions mentions that it is good practice to establish a grievance mechanism to deal with workers' claims.

The grievance mechanism should be scaled to the risks and impacts of the Project. It provides a formal and ongoing avenue for stakeholders (including on-site workers) to engage with the project proponent, whilst the monitoring of grievances provides signals of any escalating conflicts or disputes. In general, identifying and responding to grievances supports the development of positive relationships between the project proponent and the communities, and other stakeholders.

An effective and equitable grievance mechanism, whether it is intended for us by workers or the public, has the following positive attributes:

- Accessibility: All intended users are aware of the grievance mechanism, and are informed about how it operates. Moreover, the relevant grievance mechanism (be it intended for workers or the public) is accessible to all potentially-affected persons, individual workers (including employees of Sub-contractors) and the organisations representing those workers. The mechanism should be clear and understandable, and available to all intended users at no cost.
- Transparency of the process: Workers and community members are aware of whom they can turn to in the event of a grievance, and of the support and sources of advice that are available to them. All relevant personnel within the organisation (including line and senior managers and the community relations team) must be familiar with their organization's grievance procedure.
- Cultural appropriateness: The mechanism is designed to take into account culturally appropriate ways of handling community and worker concerns.
- Confidentiality and non-retribution: The process will ensure that, where required, a complaint is dealt with confidentially. Moreover, the worker or community member making the complaint will not be subject to reprisal or retribution, and will not be prevented access to other remedies.
- Reasonable timescales: While sufficient time is allowed to investigate grievances fully, the process aims for swift resolutions. Time limits are set for each stage of the process, for example, a maximum time between a grievance being raised and the setting up of a meeting to investigate it.

In the context of this Project, a Grievance Mechanism must be developed in accordance with national law and IFC Performance Standards. The Grievance Mechanism will have two aspects: one dealing with Project workers, and the other dealing with community/ stakeholder complaints. A framework for developing each of these two components is provided in the following sub-sections.

1.7.3.1 On-Site Workers

The worker's grievance mechanism must have the following characteristics:

- Workers will be made aware to whom they can turn in the event of a grievance and the support and sources of advice that are available to them. All line and senior managers must be familiar with their organization's grievance procedure.
- Complaints can be filed through the following means, including mail, email, or in person by meeting the relevant line manager or HR manager.
- The Grievance Mechanisms shall be accessible to individual workers as well as to the organisations employing/ representing them.
- Anonymous complaints are allowed. The process will ensure that a complaint is dealt with confidentially. While procedures may specify that complaints should first be made to the workers' line manager, there should also be the option of raising a grievance first with an alternative manager, for example, a human resource (personnel) manager.
- Any worker raising a complaint will not be subject to any reprisal.
- Sufficient time will be allowed to investigate grievances fully, but the process will aim for swift resolutions. Time limits should be set for each stage of the process, for example, a maximum time between a grievance being raised and the setting up of a meeting to investigate it.
- A worker will have the right to appeal to a higher level of management if he or she is not happy with the initial finding.
- In any meetings or hearings, the worker will have the right to be accompanied by a colleague, friend or union representative.
- Written records will be kept at all stages. The initial complaint should be in writing if possible, along with the response, notes of any meetings and the findings and the reasons for the findings.
- As per IFC PS2, the mechanism should not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

1.7.3.2 Public

To ensure that the grievance mechanism is accepted within the affected communities, it shall conform to the following principles (Figure 1-1):[1]

- Principle 1. Proportionality: Scaled to risk and adverse impact on affected communities
- Principle 2. Cultural Appropriateness: Designed to take into account culturally appropriate ways of handling community concerns
- Principle 3. Accessibility: A clear and understandable mechanism that is accessible to all segments of the affected communities at no cost

[1] Source: IFC Good Practice Note Addressing Grievances from Project-Affected Communities, 2009

- Principle 4. Transparency and Accountability to All Stakeholders: The affected community:
  - Know who in the organization is responsible for handling complaints and communicating outcomes, and who is in charge of the mechanism oversight;
  - Have input into its development;
  - Possess sufficient information on how to access it; and
  - Have power to ensure that the process is adhered to by those directly responsible for managing it.
- Principle 5. Appropriate Protection: A mechanism that prevents retribution and does not impede access to other remedies

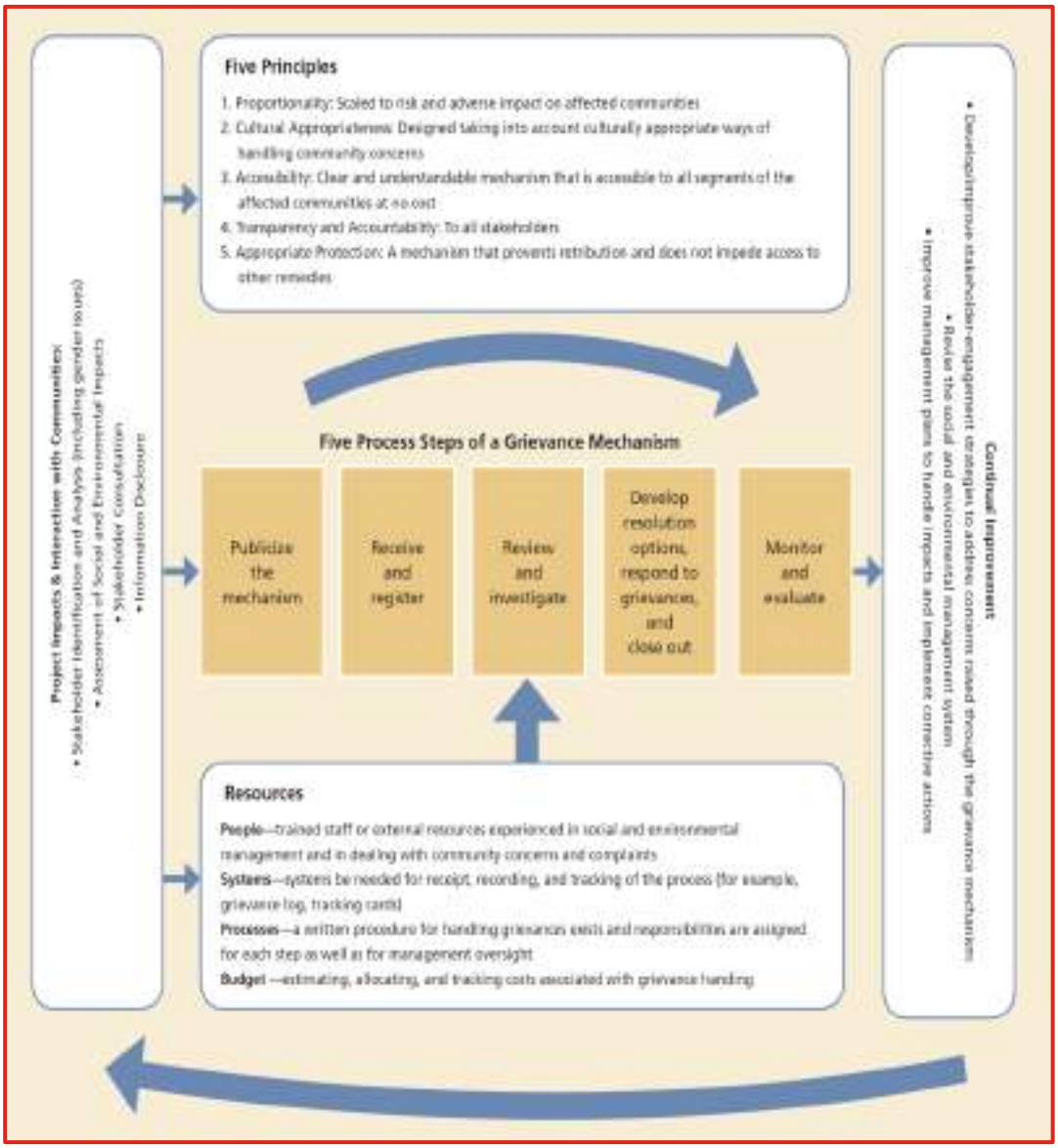

Figure 1-1 Grievance Mechanism Basic Design Elements

2. Environmental Monitoring Plan

This section provides a monitoring plan which is designed to control and ensure compliance with the proposed mitigation measures. It is recommended to assign an Environmental Fieldwork Supervisor (EFS) to ensure that the monitoring program/requirements are fulfilled and properly implemented. The EFS should understand the Monitoring Plan, and will be provided all necessary assistance from personnel in the field to fulfil it. He/she will have a sufficient and appropriate environmental, sampling/analyses and environmental management background.

2.1 Monitoring Categories

The proposed monitoring program is composed of three separate monitoring categories. These are:

- Environmental monitoring
- Socio-economic monitoring
- Operational and management performance monitoring.

Corrective actions will be implemented in cases of non-conformance.

It should be noted that given that the groundwater table is at depth of more than 10 m and the nature of the proposed Project activities, groundwater quality it is not likely to be impacted due to the Project implementation and thus not considered in this monitoring plan at this stage of the Project.

2.1.1 Environmental Monitoring during Construction

During the construction phase of the solar park, an environmental monitoring program will be implemented, and will include:

- Visual inspection
- Water resources
  - Potable water
- Air emissions
- Noise levels
- Solid and hazardous waste
- Incoming and outgoing chemicals
- Trucking and machinery use
- Workspace monitoring
- Site access and internal roads

In the early phases (construction and operation start-up), the environmental monitoring program will include all regulated parameters. Subsequently the list of parameters can be re-examined according to their significance for the project and to the specific site conditions.

2.1.1.1 VISUAL INSPECTION OF SPECIFIC LOCATIONS

Certain locations will require weekly visual inspection to ensure that construction work proceeds in an environmentally sound manner. These may include:

- Storage areas sites and workshops, if applicable
- Waste collection locations and wastewater storage tank locations
- Construction material storage locations

2.1.1.2 POTABLE WATER

Potable water will be regularly monitored prior to the point of supply to ensure compliance with health standards. Results will comply with the local standards for drinking water quality.

2.1.1.3 AIR EMISSIONS

During the construction phase, ambient air quality will be monitored quarterly by active sampling for $PM_{2.5}$, PM_{10}, SO_2, and NOx at the same locations as one monitoring round before construction and will be compared to these values considered as baseline. The measured concentrations should comply with relevant legislation.

2.1.1.4 NOISE MONITORING

Noise levels at the project site during construction must comply with the GAMEP standard for construction noise. In areas with direct equipment usage, noise levels are to be checked at least quarterly. Ambient noise will be monitored twice a year at the site boundaries and also at two locations closest to the nearest residential area, if any. At these locations the noise level will be recorded by 24-hour noise measurement divided into two intervals (day and night) using a Type 1 sound level meter (precision grade) at least once a year to ensure compliance with relevant legislation.

2.1.1.5 SOLID AND HAZARDOUS WASTE MONITORING

A logbook will be kept and maintained to record the amounts of produced wastes and excavated material, transportation routes and reuse or final disposal. During construction, wastes will be handled according to a waste management plan. Monitoring is required to ensure proper implementation of the management plan. Records of the frequency of solid waste collection at site will be documented and the documents kept along with records of waste transportation to disposal sites.

Hazardous waste types and quantities, including paint and oil containers, aerosol cans, and batteries, will be recorded along with documentation to support proper handling (by specialized contractors) and disposal.

2.1.1.6 INCOMING AND OUTGOING CHEMICALS

A logbook will be kept and maintained to record the types and amounts of all incoming and outgoing hazardous chemicals. This book will be reviewed regularly to check the chemicals consumption. An inventory of material safety data sheets for all chemicals on the site will also be kept. Moreover, any new chemical proposed for purchase for the first time must be approved by the site's Environmental Officer prior to purchase.

2.1.1.7 TRUCKING AND MACHINERY USE

Trucking and machinery use will be continuously monitored, machinery operational conditions recorded, and regular or necessary maintenance performed to avoid increases in exhaust emission and fuel consumption levels. This will ensure that air mitigation measures to avoid dust and emissions have been applied during the construction phase. Road and truck related accidents will be recorded.

2.1.1.8 WORKSPACE MONITORING

During the construction phase occupational noise levels in the vicinity of operational heavy machinery and inside closed workplaces will be monitored weekly using Type 2 noise equipment. Dust levels should be visually monitored during construction to ensure that the visibility on the adjacent highway is not affected.

Air quality monitoring will be conducted twice weekly to measure concentrations of CO and PM10.

2.1.2 Environmental Monitoring during Operation

During the operation phase, an environmental monitoring program will be implemented that will include:

- Water resources
  - Potable water
- Air emissions
- Noise levels
- Solid and hazardous waste
- Incoming and outgoing chemicals
- Trucking and machinery use
- Workspace monitoring

2.1.2.1 Potable Water

Potable water will be regularly monitored prior to the point of supply to the plant's potable water supply network to ensure compliance with health standards. Quarterly monitoring will take place during construction. The results will comply with the relevant local standards.

2.1.2.2 Ambient Air Quality

During the operation phase, ambient air quality will be monitored quarterly by active sampling and the measurements for $PM_{2.5}$, PM_{10}, SO_2, CO and NO_x (as NO_2). The measured concentrations will comply with relevant legislation (Section 2 of the ESIA).

2.1.2.3 Noise Monitoring

During the operation phase, ambient noise will be monitored twice annually at the site boundaries in addition to two locations on the public road closest to the nearest residential area if any. At these locations, the noise levels will be recorded on a 24-hour noise measurement basis divided into two intervals (day and night) using Type 1 sound level meter (precision grade) at least once a year to ensure compliance with relevant legislation.

2.1.2.4 Solid and Hazardous Waste Monitoring

The volume, collection frequency, means of transportation and locations of disposal of generated municipal solid waste during the operation phase will be recorded in a logbook and addressed in the waste management plan. This information will be kept in the power plant's environmental records for inspection.

2.1.2.5 Incoming and Outgoing Chemicals

A logbook will be kept and maintained to record the types, amounts and transportation routes of all incoming and outgoing hazardous chemicals. This book will be reviewed regularly to check the chemicals consumption. An inventory of material safety data sheets for all chemicals on the site will also be kept. In addition, any new chemical proposed for purchase for the first time must be approved by the site's Environmental Officer prior to purchase.

2.1.2.6 Trucking and Machinery Use

Trucking and machinery use will be continuously monitored and machinery operational conditions recorded. Regular maintenance will be performed to avoid increases in exhaust emission and fuel consumption levels. Road and truck related accidents will be recorded.

2.1.2.7 Workspace Monitoring

Noise levels in the vicinity of operational machinery and inside closed workplaces will be continuously using Type 2 noise equipment. Temperatures inside all workplaces will be recorded during the operation phase. Air quality monitoring will be monitored continuously in the work place for concentrations of CO, VOCs, and PM_{10}.

2.1.3 Socio-economic Monitoring

A survey will be undertaken annually starting the first year of construction and continuing for the first two years of operation, then undertaken every 2-4 years thereafter. Key elements to be monitored may include numbers of temporary and long-term jobs created during the project construction and operation, change of income, job availability, internal transportation costs, etc.

2.1.4 Operational and Management Performance Monitoring

Operational and management performance monitoring will involve checking that all data are documented and interpreted and that corrective actions are followed up and implemented.

2.1.4.1 Documentation

The documentation system (including logbooks, internal/external communication documentation, etc.) and environmental register will be quarterly checked and daily updated. Monitoring results will be available to be presented to responsible authorities as required. Upon the identification of any data gaps, correction actions will be made and documented.

2.1.4.2 Corrective/Preventive Action Results and Follow-up

Forms will be available for corrective action requirements. Similarly, other forms will be made for corrective action follow-ups. Corrective action will be followed up regularly until they are finalised. Any such documentation system will be structured so as to be ISO 9000: 2000 certification-capable. Wherever possible, the documentation will be electronic.

2.2 Monitoring Work Plan

This section describes the tasks required to fulfil the monitoring requirements.

2.2.1 List of Tasks

- Review the monitoring plan
- Set a start date; adjust all following dates to fit the monitoring schedule
- Keep copies of the monitoring plan in areas relevant to sampling locations
- Review locations, lists of monitoring parameters and activities (sampling, analysis, etc.)
- Clearly mark the monitoring locations onsite plans
- Conduct or supervise the required sampling and analysis
- Record any site remarks observed while sampling and analysing
- Based onsite remarks and data interpretation, determine non-conformances and requirements for corrective actions, if any
- In case non-conformances are detected, propose, document, and follow up on corrective actions (weekly)
- For each monitoring round, prepare a report including:
  - findings of the monitoring program and data interpretation
  - status of corrective and preventative actions
  - remarks and recommendations
  - Monitoring activities and dates for the coming round

- During each monitoring round, examine previous monitoring results and decide on any future additions or reductions in the monitoring parameters and the frequencies of sampling accordingly

2.2.2 General Recommendations

It is advised that qualified individuals implement the monitoring program and train local representatives. It is recommended that analysis of samples be conducted by third-party accredited laboratories to ensure that impartial objective data are produced. It is also recommended that all locations be accurately geo-referenced.

Appendix G. Environmental Emergency Response Plan (EERP)

MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE

Environmental Emergency Response Plan (EERP)

Ar Rass Solar PV Park

Document No 303011-00305 - ERP-REP-102

16 Sep 2019

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EcoNomics

Synopsis

[This is the synopsis text. It is used for reports. In formal reports, the synopsis text should be no more than about ten lines. It can contain paragraph breaks if desired.]

Disclaimer

PROJECT 303011-00305 - ERP-REP-102 – Environmental Emergency Response Plan (EERP)

Rev	Description	Original	Review	WorleyParsons Approval	Date	Customer Approval	Date
A	Issued for Internal Review	Khaled Ahmed	Nikos Moiras and María Sánchez Sampedro	Jonathan O'Toole	16 Sep 2019	N/A	

Contents

Document Control Procedures

The Environmental Emergency Response Plan (EERP) is a controlled document. All EERP Recipients, detailed within the distribution list, will receive a copy of EERP. This document will be subject to review on a three-monthly basis and updated as necessary by HSE Department to comply with current and best industry practice, to reflect audit recommendations and incorporate current contact details.

It is the responsibility of the EERP copy holder; Chief Executive Officer (CEO), to maintain the accuracy of this document. All updates should be promptly inserted and acknowledged according to MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE Management Procedures. The amendments to EERP will be maintained and approved by the CEO. The following table will be used to record detail amendments (reviews).

Revision Number	Page(s) / Section(s) Amended or Added	Amended by	Date

Distribution List

S.N.	EERP Recipients	Date

1. Introduction

1.1 Purpose

This plan outlines procedures for emergency awareness, preparation, and response with the purpose of preventing, minimizing and/or mitigating environmental impacts. The procedures listed provide a framework for proper response to emergency situations that occur and may have environmental impacts.

1.2 Scope

This procedure applies to Ar Rass Solar PV Park of MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE for which potential accidents and emergency situations may arise. The procedures for preventing and mitigating the following emergency situations are described:

- Personnel Injury
- Site Evacuation
- Fire or Explosion
- Floods
- Chemical Spillage
- High Winds and Dust

1.3 Objectives

The EERP core objectives are to:

- Preserve life and ensure the safety of people
- Minimise the impact on the environment
- Minimise damage to property
- Minimise the impact on business continuity and reputation
- Minimise the impact on neighbouring industry and community, if any

1.4 Project Overview

The proposed project is approximately 24 km south-east of the city of Ar Rass in Al Qassim Province. The location is an undeveloped and unfenced area of approximately 57.6 km^2. The Project location is shown in Figure 1-1.

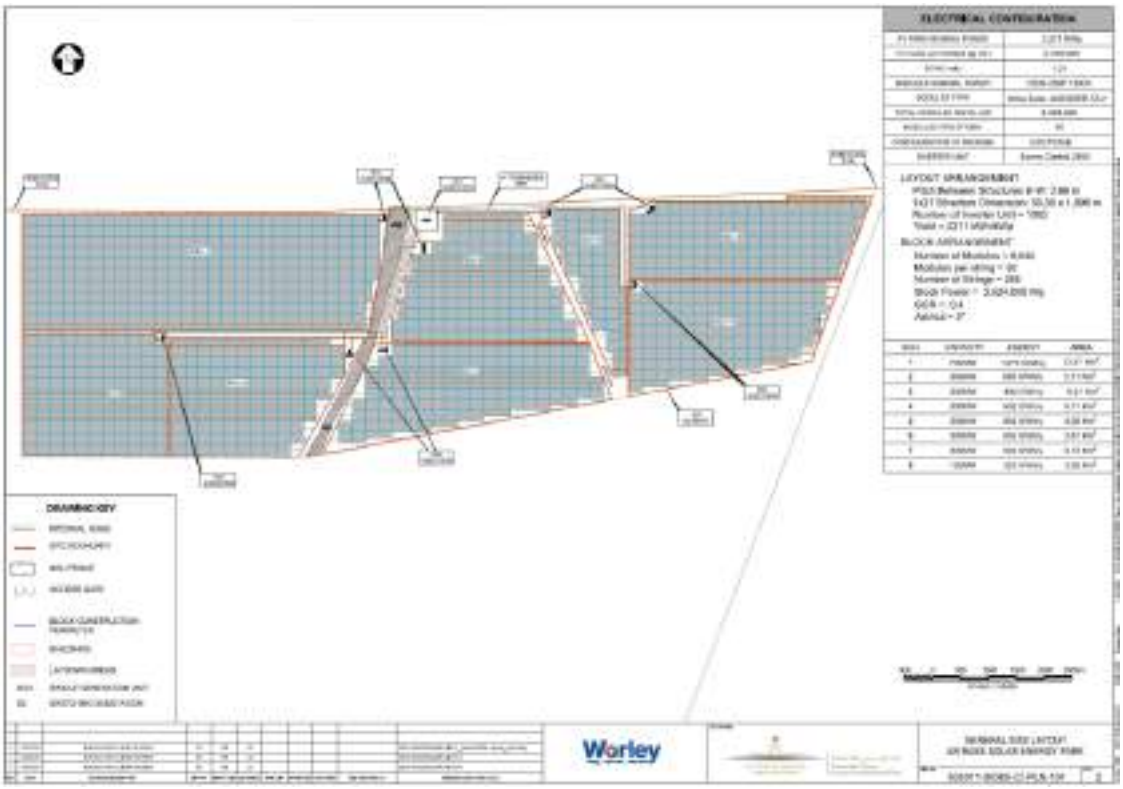

Figure 1-1 General Layout of the Project

Generally, the operation of the photovoltaic (PV) plant entails the production of power by conversion of solar energy to electricity. The PV power generation process is primarily self-sufficient and is not in need of constant supervision. The resources required for PV plant operation include:

- Solar radiation
- Water
- Consumables, including but not limited to spare parts and equipment, detergents and fuel

The outputs from the PV plant during routine operation include:

- Power
- Solid waste (hazardous and non-hazardous) and liquid effluents (non-hazardous)

Waste water from washing off PV panels

1.5 Definitions

Accident	An incident which has resulted in actual injury or illness and/or damage (loss) to assets, the environment or third party(ies)
Causal Factor	An event or condition that results in an effect. Anything that shapes or influences the outcome.

Fatality	A death results from a work-related injury or occupational illness
First Aid Case	Any one-time treatment and any follow-up visit for the purpose of observation of minor scratches, cuts, burns, splinters and so forth, which do not ordinarily require medical care. Such a one-time treatment and the follow-up visit for the purpose of observation are considered first aid although provided by a physician or registered medical professional.
Hours of Exposure	The total number of hours worked by all employees and contractors during the reporting period.
Incident	An unplanned, undesired event that can result in physical harm and/or property damage.
Medical Treatment Case	Is an occupational injury/illness, which is not classified as a lost time injury, but which results in loss of consciousness or medical treatment other than first aid. Example, loss of consciousness due to lack of oxygen/ high temperatures /electrocution /head injury, penetrating eye injury, chemical or hot burns, fracture not resulting from lost time injury, etc.
Near Miss	Incidents with no injury, property or environmental damage, but having the potential to cause it. This could include an unsafe act.
Occupational Illness	Any work-related abnormal condition or disorder, other than an injury, which is mainly caused by exposure to environmental factors associated with employment. It includes acute and chronic illness or diseases which may be caused by inhalation, absorption, ingestion or direct contact. Whether a case involves a work-related injury or occupational illness is determined by the nature of the original event or exposure which caused the case, not by the resulting condition of the affected employee. An injury results from a single event. Cases resulting from anything other than a single event are considered occupational illnesses.
Property damage	Damage to any assets including buildings, equipment, and/or vehicles.
Root Causes	One of multiple factors (events, conditions or organizational factors) that contributed to or created the direct cause and subsequent undesired outcome and, if eliminated, or modified would have prevented the undesired outcome. Typically, multiple root causes contribute to an undesired outcome
Work-Related Injury	An injury to a person arising out of or in the course of work being done for or on behalf of the Company. It includes injury to Company employees whilst on company duties and injury to an employee of a company approved contractor whilst engaged in work for or on behalf of the Company.

2. Emergency Response Team

The Emergency Response Team (ERT) will report through the normal, internal management chain-of-command. The response teams are organized in a manner consistent with the principles of the Incident Commander System (ICS). The ICS is a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure, designed to enable effective and efficient domestic incident management.

2.1 Emergency Response Team

2.1.1 Emergency Response Team during Construction

Prior to construction, MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE will establish the ERT that may include some or all of the positions outlined below.

Emergency Response Room - Duty Manager – 24 hrs
Construction Manager (Incident Commander):
Engineering Project Manager (Deputy Incident Commander):
HSE Manager (Planning Lead):
Contractor Safety Manager (Operations Lead):
Contractor Safety Coordinator (ERT Lead):
Contractor Logistics Coordinator (Logistics Lead):
Contractor Finance and Administration Manager (Financial Lead):

2.1.2 Emergency Response Team during Operations

MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE will update the EERP with the names and phone numbers of the ERT which may include some or all of the positions outlined below.

Emergency Response Room - Duty Manager – 24 hrs	
Incident Commander:	
Deputy Incident Commander:	
Operations Lead:	
Environment and Planning Lead:	
Logistics Lead:	
Finance and Administration Lead:	
Health and Safety Advisor:	
Safety Coordinator:	
Legal Manager:	
Security Manager:	
Media Relations Manager:	

2.2 Notification Procedure

The following 7-step Emergency Notification Procedure should be used during construction and operations:

2.2.1 Notify the Duty Manager (Emergency Response Room)

All emergency situations should immediately be reported to the Duty Manager (Emergency Response Room). The duty Manager shall immediately notify the Incident Commander to decide upon appropriate course of actions.

2.2.2 Describe

Describe the emergency situation. Typically, the categories below can be used:

- Fatality;
- Major illness (heart attack, not breathing, unconscious, etc.);
- Major injury (broken bone, loss of limb, severe cuts/bleeding, etc.);
- Minor injury (twisted ankle, foreign body in eyes, minor cuts, etc.);
- Bite/sting (snake, scorpion, etc.);
- Weather effect (effects of heat, sun, cold, wind chill, lightning strike, etc.); and/or:
- Incident type (fall, crush, vehicle crash, fire, electric shock, etc.).

2.2.3 Location

Give the Duty Manager (Emergency Response Room) the location of the emergency, by referring to the nearest structure or road junction.

2.2.4 Call Emergency Services/Statuary Bodies

The Incident Commander will arrange for the required emergency service/statuary bodies to respond. For non-urgent medical attention. The Incident Commander should arrange for site transport to take the injured to hospital, and notify the hospital that they are on their way.

2.2.5 Notify ERT Leaders

The Incident Commander will contact the ERT Leaders, who will assist at the location of the emergency. Jointly, the ERT Leaders will arrange for trained emergency responders to attend the scene of the emergency, if required. The names of all emergency responders (e.g. first aiders) should be made available to all the site personnel – first aiders should be identified by a badge on their hard hat.

2.2.6 Coordinate

The ERT Leaders will send an employee to the nearest site access point to meet the emergency services, and escort them to the location of the emergency.

2.2.7 Accompany

The ERT Leaders will continue to assist with the situation on site, and Safety Coordinator will accompany any injured personnel to the hospital. The employer can later require the injured to make an appointment to see the MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE Doctor if confirmation of the extent or nature of injuries, treatment or disability is required.

3. Prevention

The key method employed to prevent the occurrence of incidents is the planned and controlled execution of work processes. In summary, preventative measures include:

- Ensuring that adequate planning is undertaken including appropriate risk assessment;
- Ensuring that appropriate control measures are implemented and maintained;
- Complying with all legislative and industry requirements;
- Complying with all applicable internal system procedures;
- Complying with the requirements of the Environmental Management Plan (EMP) and its related sub-plans and procedures;
- Complying with the requirements of the Health and Safety Plan; and
- Complying with the requirements of this EERP

3.1 RISK ASSESSMENT

3.1.1 Hazard Identification

There are a number of ways of identifying potential sources of injury or disease. Selection of the appropriate procedure will depend on the type of work processes and hazards involved. Procedures may range from a simple checklist for a specific piece of equipment or substance to a more open-ended appraisal of a group of related work processes. A combination of methods may provide the most effective results.

Methods of identifying workplace hazards may include:

- reviewing information from designers or manufacturers (work method statement);
- analysing incident and injury data;
- analysing work processes;
- consulting with employees;
- developing a hazard checklist;
- conducting walk-through audit/surveys;
- examining and considering material safety data sheets or product labels; and
- seeking advice from specialist practitioner or representatives.

When determining hazards associated with the task the hazard types below should be considered:

- Physical hazards, e.g. fall from height, manual handling falling objects, noise, plant related hazards etc.
- Electrical hazards, e.g. direct electrocution, contact with overhead or underground cables

- Chemical hazards, e.g. inhalation, skin contact with chemical, ingestion of chemicals
- Radiation hazards, e.g. UV light, lasers
- Biological hazards, e.g. infection, handling of waste

3.1.2 Risk Assessment

The purpose of risk assessment is to identify potential hazards associated with site activities, evaluate the degree of risk by quantitative assessment of the "likelihood" and "consequence" and then to determine corresponding control measures required.

For ongoing identification of hazardous tasks that require risk assessment, the HSE Department shall review the major site progress of the upcoming three months to identify the need for a risk assessment update.

3.1.2.1 Purpose of Risk Assessment

The purpose and function of a risk assessment can be expressed as follows:

1. To identify operations, tasks and processes which may foreseeably cause harm to employees and/or others on the site (hazards).
2. To identify the potential for the hazard to be realized, and the potential consequences which might then occur (risk).
3. To enable a risk assessment to be developed which will assist in eliminating or reducing the exposure of the workers and others to the risk.

Risk evaluation is considered based on the principles of prevention and protection of all workers, client, consultants and all visitors. The principles, in summary, are to:

1. Avoid risk;
2. Combat risk at source;
3. Change the method of work to suit the individual;
4. Make use of technological developments;
5. Incorporate control measures into procedures within an overall planned structure to reduce risks;
6. Give precedence to controls, which cover the whole workforce or activity; and
7. Provide information and training to all workers involved.

3.1.2.2 Definition of Hazard and Risk

Hazard: The potential to cause harm, including ill-health, physical injury, damage to plant, equipment, property or the environment.

Risk: The likelihood that a specified undesired event will occur due to the realization of a hazard by or during work activities, or by products and services created by work activities.

3.1.2.3 Risk Evaluation

Figure 3-1 shows an example of a risk evaluation matrix.

		Hazard Severity				
		Negligible A	**Slight/low B**	**Medium C**	**High D**	**Very High E**
Probability of Occurrence	**Improbable 1**	Low	Low	Low	Low	Low
	Remote 2	Low	Low	Low	Medium	Medium
	Probable 3	Low	Low	Medium	Medium	High
	Occasional 4	Low	Medium	Medium	High	High
	Frequent 5	Medium	Medium	High	High	High

Figure 3-1 Risk Evaluation Matrix Example

Likelihood

5. Frequent Like to occur frequently
4. Occasional May occur occasionally
3. Probable Unlikely but possible to occur
2. Remote So unlikely that occurrence may not be experienced
1. Improbable Occurrence is rare

Risk Rating and Action criteria

Low (L)	Acceptable, however review to see if risk can be reduced further.
Medium (M)	Task should only proceed with appropriate management authorization after consultation with specialist teams. Efforts must be made to reduce the risk; the cost of prevention should be measured. Risk reduction measures should be implemented within a defined time period. Where a medium risk is linked with extremely harmful consequences, further assessment may be necessary to establish more precisely the likelihood of harm to determine the need for improved control measures.
High (H)	Task must not proceed. It should be redefined, or further control measures put in place to reduce risks. Work should not be started until the risk has been reduced. Considerable resources may be required to reduce the risk. Where work is in progress, urgent action should be taken. If it's not possible to reduce the risk, work has to remain prohibited.

3.1.2.4 Risk Control

The following criteria shall be put into consideration while establishing control measures to mitigate the risks. Preferred orders of control are as follows:

- **Elimination** – removing the hazard or hazardous work practice from the workplace;
- **Substitution** – substituting or replacing a hazardous or hazardous work practice with a less hazardous one;
- **Isolation** - isolating or separating the hazard or hazardous work practice from people not involved in the work or the general work areas from the hazard. This can be done by installing screen or barriers; or making of hazardous areas;
- **Engineering Control** – if the hazard cannot be eliminated, substituted or isolated, an engineering control is the next preferred measure. This may include modifications to tools or equipment, providing guarding to machinery or equipment;
- **Administrative control** – includes introducing works practices that reduce the risk. This could include limiting the amount of time a person is exposed to a particular hazard, control access into hazardous area by implementing of permit to work system; and
- **Personal protective equipment** – should be considered only when other control measures are not practicable or to increase protection.

3.1.2.5 Procedure

1. Break down the identified job into individual processes;
2. Identify potential hazards associated with each process;
3. Evaluate the risk level arising from each hazard based on the likelihood of occurrence and consequences of the harm by the risk matrix;
4. Determine control measures to eliminate the hazards or to further reduce the risk level;
5. Identify risk controllers;
6. Complete the risk assessment report and pass it to the HSE manager for approval and endorsement. Communicate the risk assessment report to the identified risk controllers, relevant subcontractors and concerned parties;
7. Implement the control measures mentioned in the risk assessment reports;
8. The safety Coordinator to carry out periodical inspections to ensure the risk control measure are being implemented properly; and
9. The Safety Coordinator to review the risk assessments wherever required.

3.1.2.6 Record & Review

Records of the risk assessments should be properly maintained. A register of risk assessment shall be prepared for ease of reference. The risk assessments shall be reviewed when:

- There is a significant change in the working method;
- New technology, plant, equipment or material is applied;
- Major accident or high potential incident has occurred;
- There is a change in applicable legislation;
- An industrial summons, suspension notice, or improvement notice has been received; and
- Any other reason exists to suspect that the original assessment is no longer valid or could be improved.

4. Preparedness

The Site must be prepared for potential incidents or emergencies by:

- developing and implementing HSE and emergency procedures;
- providing adequate and ongoing training for site personnel;
- conducting drills and exercises;
- regular auditing of site activities;
- ongoing and effective communication;
- ongoing liaison with emergency service agencies;
- identifying resources and equipment required for effective emergency response;
- identifying roles and responsibilities of individuals;
- identifying key personnel and reliable means of contacting them; and
- maintaining documentation so potential incidents or emergencies can be properly managed.

4.1 Training

4.1.1 Objective

In order to enhance employees' safety & environment protection awareness and knowledge in accident prevention, adequate training will be provided to all employees including sub-contractors' employees.

4.1.2 Orientation Training

All new or transferred employees, including subcontractors' employees, shall attend an orientation training provided by HSE Department, within seven days of their arrival on site. The content of the orientation training shall include an introduction to this EERP and special arrangement for emergency.

4.1.3 Training Program

Training schedule of in-house training is presented in Table 4-1.

Table 4-1 Schedule of In-House Training

Training Details	Conducted by	Participants	Target Dates
Emergency procedure and application of (EERP)	HSE In-Charge	All Staff	Once a quarter
Fire Evacuation Drill	HSE In-Charge	Concerned Staff	Once a half year

4.2 Exercise and Drill

Only through a structured drill and exercise program can ensure the effectiveness and readiness of the emergency resources (responders or equipment). Drill and exercise will be tailored to suit the nature of site activities and will include, but not be limited to, the following emergency situations:

- Fire/Evacuation;
- First Aid; and
- Spill response drills.

There are various methods employed to periodically test the response capability, including:

4.2.1 Tabletop Exercise (Every 3 Months)

A tabletop exercise is a facilitated discussion or activity conducted in a conference room setting involving discussion of a scenario by the response team. The primary characteristic of a tabletop exercise is that it involves a verbal "walk through" of a response to an incident. Tabletop exercises are also:

- Used for establishing policies, providing input to planning, developing procedures, clarifying roles and confirming knowledge;
- Conducted in a non-threatening learning environment; and
- Conducted by trained personnel to facilitate discussion and evaluate performance.
- The purpose a tabletop exercise is to have participants practice problem solving skills, resolve questions of coordination, and assign responsibilities in a non-threatening environment, under minimum stress. A tabletop exercise can be used in preparation for a functional or full-scale exercise.

4.2.2 Functional Exercise (Every 6 Months)

A functional exercise is more extensive than a tabletop exercise in that activities are conducted beyond a conference room atmosphere. This type of exercise is often referred to as a "drill," and focuses on a single response function. Functional exercises (drills) are characterized by:

- Scenario-driven response activities;
- Simulation of non-participating parties;
- Limited mobilization of personnel and resources;
- Limited scope;
- Trained personnel to serve as controllers, evaluators and simulators; and
- Hands-on experiential learning.

The purpose of a functional exercise (drill) is to exercise a specific function or a limited range of functions of a response plan. Functional exercises (drills) enable those involved to validate key functions/objectives and demonstrate individual and team knowledge, skills and capabilities.

4.2.3 Functional Exercise (Annually)

A full-scale exercise is used to evaluate a response of the total, integrated, operational capabilities, involving all levels of management and could involve all aspects of a response operation (e.g., notification, assessment, initial response, recovery, disposal, etc.).

Full-scale exercises are designed to mirror real-life incidents as closely as possible. This type of activity enables the validation of a multitude of functions and teams, as well as to evaluate the interaction and coordination among the participants. Exercises involve:

- scenario-driven response activities;
- variation in the number or type of participants;
- simulation of non-participating parties;
- arrangement of personnel and resource mobilization;
- participation of multiple teams/management levels in integrated response;
- extensive testing of interaction and coordination within a system;
- extensive realism; and
- Trained personnel to serve as controllers and evaluators.

The purpose of a full-scale exercise is to exercise the range of response functions in EERP to the maximum extent practical. A full-scale exercise will incorporate a high degree of realism, extensive involvement of personnel and resources, and an increased level of stress on player participants.

4.2.4 Lessons Learned

MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE will develop a comprehensive management system to address all lessons learned from drills and real-life incidents together with near misses. The lessons learned should be incorporated into an action plan for measurement and focus on key issues.

4.3 Resources

Resources and equipment are readily located on-site to enable prompt response and effective management of incidents or emergencies. Such resources and equipment include:

4.3.1 Adequately Trained Emergency Teams

MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE will assign the following trained and qualified Emergency Teams to be available and ready onsite in the event of any emergencies:

- Rescue Team;
- Fire Fighting Team;
- Security Team;
- Administration Team;
- First Aid Team; and
- Engineering Team

4.3.2 Equipment

4.3.2.1 Fire Extinguishers

Enough number of fire extinguishers will be made available in appropriate places with the following specifications:

- A fire extinguisher rated not less than 2A shall be provided for each 3,000 square feet of building area and in each yard storage area. Travel distance to any fire extinguisher shall not exceed 100 feet from any protected area.
- One or more extinguishers rated not less than 2A shall be located on each floor of a multi-storied building. At least one 2A-rated extinguisher shall be located adjacent to each stairway in a multi-storied building. Extinguishers rated not less than 10B will be provided between 25 feet and 75 feet of any area in which more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are used or stored.
- Extinguishers shall be conspicuously located where they will be readily accessible and immediately available in case of a fire. Their locations shall be conspicuously marked. Extinguishers shall be installed on hangers or in the brackets provided and shall not be more than 5 feet from the floor. Extinguishers weighing more than 40 pounds shall be installed so that the top is not more than 3½ feet from the floor.

4.3.2.2 First Aid Box

Enough number of First Aid Boxes will be made available in appropriate places. The basic first aid box contents are:

- 6 Triangular Bandages
- 2 Crepe Roller Bandages 2”
- 2 Crepe Roller Bandages 3”
- 24 Adhesive Dressing – Band-aid Style
- 1 Roll Surgical Adhesive Tape ½” – 1”
- 1 Packet individually wrapped Sterile Wound dressing (50 Nos)
- 2 Packet cotton Balls
- 20 Swab Sticks (in plastic container)
- 1 Bottle Antiseptic Liquid (250ml)
- 1 Tube Antiseptic Cream (30 gm)
- 2 Bottle Eye Pads
- Sterile Eye Pads
- 2 Small Towels
- 12 Safety Pins
- 1 Pair Scissors
- 1 Pair Forceps
- 1 Pair Tweezers
- 1 Kidney Dish Plastic (small)
- 1 Pocket disposable Gloves

4.3.2.3 First Aid Room

Apart from enough number of First Aid Boxes; a suitable and equipped First Aid Room shall be provided on site and it will be maintained as listed below:

- A Stretcher
- Wheel Chair
- A sink with cold and hot running water
- Drinking water
- Paper Towels, soap and nail brushers
- Clean garments for use by First Aiders
- Clinical Thermometer

- A cough with pillow and blankets frequently cleaned
- Dressing trolley
- Kidney tray;
- Splints of different size
- Oxygen Tank
- Sphygmomanometer
- Stethoscope
- Other necessary surgical items

4.3.2.4 MSDS

Material Safety Data Sheet (MSDS) file on all substances used on site will be placed at easily and readily accessible locations and regularly updated.

4.3.2.5 Oil and Chemical Spill Containment Equipment

Oil spill containment equipment and spill kits will be easily made accessible at pertinent locations throughout the site.

5. Emergency Response Activities

5.1 Emergency Response Procedures

In the event of an emergency, the following procedures will be implemented to ensure an effective response.

- Immediate Reactions (Initial Response);
- Alerts and Notifications;
- Assess Situation;
- Initiate appropriate Environmental Emergency Response Plans (EERPs);
- Report to Concerned Authorities/Parties; and
- Response Deactivation and Debriefing.

5.1.1 Immediate Reactions (Initial Response)

Any person involved in or witnessing an incident must initiate appropriate action to ensure the safety and immediate treatment of injured personnel and to prevent consequential injury or loss at the incident site. In addition, Safety Coordinator must be notified to command and continue the initial response activities. The priorities of initial response are to:

1. Ensure human health and safety;
2. In the event of an injury to any persons:
    - Stabilize injured person(s). If able to move, injured persons shall be moved to the site First Aid Room as early as possible, irrespective of whether First aid is given or not. If unable to move, call the First Aid Team. First Aid should be administered by approved first aiders or medical staff;
    - HSE Manager/Incident Commander should be notified immediately.
3. In the event of a fire, immediate actions shall be taken to:
    - Stop all hot work activities;
    - Shut down all electrical and fuel sources, if necessary;
    - Assess the size of the fire and the resources available to suppress it;
    - If the fire is small enough, extinguish it;
    - Notify others in the area;
    - Notify your immediate Supervisor/ Foreman and the site designated Fire Marshal;
    - Local fire department, if necessary, to be called by the designated employee;
    - Conduct a head count; and
    - Evacuate the area, if necessary.

4. Preserve the environment;
5. In the event of a spill, immediate actions shall be taken to contain or clean up the spill using sand, suitable absorbent material.
6. Minimize or prevent property damage;
7. Minimize or prevent equipment damage;
8. Secure the area/scene;
9. Immediate notification:
    - The type of accidents (indicative) that require immediate notification to the relevant local authorities and the Ambulance service are as follows:
        - Fatality
        - Any fracture other than finger, thumbs or toes
        - Any amputations and dislocations of shoulder, hip, knee or spine
        - Loss of sight (temporary or permanent)
        - A chemical or hot metal burn to the eye
        - Penetrating eye injury
        - An injury resulting from an electric shock which causes unconsciousness
        - An injury resulting from an electric shock which requires resuscitation
        - An injury resulting from an electric shock which requires hospital admittance for more than 24 Hours
        - An injury that result in unconsciousness or the casualty needing resuscitation
        - An injury resulting in the casualty being admitted to hospital for more than 24 Hours

5.1.2 Alerts and Notifications

Safety Coordinator shall broadcast an alarm requiring all onsite personnel to gather at the predetermined gathering place/ assembly point to receive further instructions.

An alarm or an emergency notification system will be established as part of the Emergency Preparedness to alert all employees at the site in the event of an emergency. According to site practical conditions, the alarm or notification system could include lights, horns, sirens, or other appropriate devices or operational forms to ensure that every employee is aware of site emergencies.

5.1.3 Assess the Situation

Safety Coordinator shall assess the situation and then establish contact with Incident Commander to decide upon course of action and appropriate emergency response stagey/method.

5.1.4 Initiate appropriate Environmental Emergency Response Plans (EERPs)

The Incident Commander shall decide to initiate one of the following Emergency Response Plans (EERPs):

- Personnel Injury
- Site Evacuation
- Fire or Explosion
- Floods
- Chemical Spillage
- High Winds and Dust

5.1.5 Report to Concerned Authorities/Parties

The degree of reporting required in the event of an accident is determined by both the outcome and severity of the same. Reporting of low potential incidents, including First Aid cases and Medical treatment cases of low potential severity is limited within the Site Safety Department through the Site First Aid Room. All other incidents require full incident report in addition to the first information given to the First Aid Room. Any accidents resulting in fatality, fire or preventing the person from duty more than 3 days will be reported to concerned authorities by telephonic message or by fax immediately following the accident and a more comprehensive report will be prepared and submitted to the authorities within twenty-four hours.

The procedure to be followed in accident reporting is as follows:

1. Injured persons shall be moved to the site First Aid room as early as possible, irrespective of whether First aid is given or not.
2. Inform the Supervisor, Safety Department and Incident Commander.
3. Inform the authorities, if required.
4. Detailed Investigation Report will be prepared by the safety Department and submitted to the Incident Commander.
5. The Incident Commander will submit the report to the authorities concerned.
6. It is the responsibility of the supervisor to submit the preliminary report to the Safety Department. The Safety Coordinator shall in turn investigate the incident and furnish the detailed report to the Incident Commander.

During the accident investigation time, witness statements, the contributing causes and root causes will be analysed, and they will also arrange to educate all employees on the Learning Points arising out of the incident for future guidance to others.

A Safety Summary Report will be prepared on a monthly basis incorporating all data related to any type of accidents. The Initial accident report will be issued within 48 hours and the final Close out report within 7 to 14 days.

5.1.6 Response Deactivation and Debriefing

Once the incident has been declared over, the Incident Commander chair the debriefing activities and notify appropriate organisations of de-brief meeting time and location.

5.2 Environmental Emergency Response Plans (EERPs)

5.2.1 Personnel Injury

The following actions will be taken for personnel injuries:

- The Site Safety Coordinator or site designee, will be notified of the injury(s) by the employee(s) on the scene;
- A qualified First Aid Attendant will be summoned immediately to administer first aid until medical assistance arrives;
- The Incident Commander or designee, will notify local emergency services for Ambulance and other relevant emergency services, if required;
- All key Supervisors will be paged or called and advised of the injury;
- For off-site assistance, the HSE Manager designee, will meet the emergency responders at a pre-arranged gate and direct them to the location of the emergency;
- Should an employee require emergency off-site medical transportation, they will be accompanied by a site representative such as First Aid Attendant/ Nurse to give pertinent information needed;
- As soon as possible, HSE Department will carry out an accident investigation to the root cause(s) so corrective measures can be taken;
- Once the root causes of the “accident” have been identified, an incident briefing to all concerned employees should be conducted by Management Team; and
- All necessary documentations regarding the accident should be filled out and sent to HSE Department.

5.2.2 Site Evacuation

In the case of severe weather events, a potential threat to the site property or workers such as a bomb threat, the site area may have to be evacuated. Once a decision is taken by the Incident Commander to evacuate, the following procedures/ actions must be taken:

- All employees will evacuate to predetermined area(s) unless the evacuation area is in danger;
- The Site Safety Coordinator or designee will broadcast via all means available, such as two-way short band radio and over cell phones, a predetermined alarm and convey the specific egress and gathering area instructions and the nature of the emergency. Acknowledgement from each on-site team leader and their crews will be required;
- The Site Incident Commander or designee, will notify the concerned authorities;
- All visitors and vendors/subcontractors will be guided by their key on-site contact;

- Site ERT will proceed to the assembly area, perform a head count and provide further instructions to evacuated personnel; and
- After all employees are accounted for, the employees must await instruction prior to leaving the area or going back to work.

5.2.3 Fire or Explosion

- All on-site employees are responsible for fire prevention and will be trained on firefighting techniques and the use of fire extinguishers regularly in addition to the orientation training they receive upon arriving to the site;
- There is potential for an accidental fire to be caused by construction materials/ waste or by sparks thrown from cigarette smoking, welding or cutting torch;
- There is also a risk associated with the use and storage of small quantities of flammable liquids and compressed gases, including equipment fuels, paints, and cleaning solvents. Hazards associated with these materials will be mitigated by following safety requirements found in "MSDS/Health and Safety Specific Plan"; and
- MINISTRY OF ENERGY, RENEWABLE ENERGY DEVELOPMENT OFFICE will have fire extinguishers (F.E) onsite to address any small fire that can be extinguished in its infancy Stages. For larger fires, firefighting services will be notified and mobilized to the site.

Upon discovering the fire, the following actions will be taken:

- Safety Coordinator to assess the size of the fire and the areas affected by it;
- Determine the cause of the fire and apply corrective measures;
- Prepare documentation in accordance with incident reporting requirements; and
- Notify the Incident Commander.

5.2.4 Floods

The following list of actions shall be performed in the event of flooding:

- Site Safety Coordinator or designee will consult with concerned authorities to determine the severity of local flooding;
- Construction materials that can be damaged by water or pollute waters if submerged will be moved to either enclosed areas or elevated areas above the short-term local sheet flooding to remain dry; and
- If the flooding is severe, site will be shut down and evacuated, if required.

5.2.5 Chemical Spillage

General emergency response procedures in the event of spillages incidents:

- Identify the drum/can which has leaked or punctured.
- Cordon off the area of spillage;

- Use appropriate P.P.E (Gloves, Googles, Boots, etc);
- If the chemical is coming out as a jet, then immediately shift the material from the affected area. The workmen should wear the necessary P.P.E. while doing so;
- Drain off the punctured drum into an appropriate container;
- After the drum is drained off completely, dispose of the drum appropriately. Wash off the floor with water. (If required use saw dust).
- Contaminated spill material shall be collected in a separate bin and disposed of by an approved waste disposal contractor; and
- All concerned staff shall be trained in the procedures for handling spills and shall be made aware of Federal and local regulations.

5.2.6 High Winds and Dust

- When high wind creates a hazard to craftsmen or work being performed i.e. instability in elevated areas, limited visibility due to dust or particles in the air, unmanageable materials, etc., supervisors will stop work activities, reassign work and area, properly store and secure material which might blow away, injure someone or damage equipment, lower/tie down crane booms and obtain further instruction from site Management;
- Appropriate material should be available and stored on the site to facilitate the securing of Site property, materials, and equipment, i.e. rope, wire, boards / plywood; and
- Although the storm has passed, hazards may still exist because of unstable structures or other hazardous conditions. Therefore, a safety and property damage loss assessment inspection shall be conducted on the site by supervisors and reported to the Safety team for planned clean-up prior to start-up or normal site activities.

Appendix H. Stakeholder Mapping Report (SMR) and Public Consultation Documentation

MINISTRY OF ENERGY, RENEWABLE ENERGY PROJECT DEVELOPMENT OFFICE

Stakeholder Mapping Report

Ar Rass Solar PV Park

Document No 403014-14897- SMR-REP-102

30 May 2019

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Disclaimer

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PROJECT 403014-14897- SMR-REP-102 – Stakeholder Mapping Report

Rev	Description	Original	Review	Worley Approval	Date	Customer Approval	Date
0	Draft	M. Abdelhalim				N/A	

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Abbreviation List

BP	Bank Procedures
CITC	Communications and Information Technology Commission
EIA	Environmental Impact Assessment
EP	Equator Principles
ECRA	Electricity and Cogeneration Regulatory Authority
EPFI	Equator Principles Financial Institution
ESIA	Environmental and Social Impact Assessment
GACA	General Authority of Civil Aviation
GAMEP	General Authority of Meteorology and Environmental Protection
GER	General Environmental Regulations
GW	Gigawatt
HCIS	High Commission for Industrial Security
IBRD	International Bank for Reconstruction and Development
ICSID	International Centre for Settlement of Investment Disputes
IDA	International Development Association
IFC	International Finance Corporation
KACST	King AbdulAziz City for Science and Technology
MEPA	Meteorological and Environmental Protection Agency
MEWA	Ministry of Environment, Water, and Agriculture
MIGA	Multilateral Investment Guarantee Agency
MOCI	Ministry of Commerce and Investment
MOMRA	Ministry of Municipal and Rural Affairs
NREP	National Renewable Energy Program
OP	Operational Policy

PIF	Public Investment Fund
PME	Presidency of Meteorology and Environmental Protection
PV	Photovoltaic
REPDO	Renewable Energy Development Office
SAGIA	Saudi Arabian General Investment Authority
SCTNH	Saudi Commission for Tourism and National Heritage
SEC	Saudi Electricity Company
SWA	Saudi Wildlife Authority

1. Introduction

1.1 Background

The proposed Ar Rass Solar Energy Park will be part of the National Renewable Energy Program (NREP), launched by the Ministry of Energy. The NREP aims to maximize the potential of renewable energy in Saudi Arabia. The proposed project will comprise the installation of solar photovoltaic (PV) technology at the project location. As part of the project, an Environmental and Social Impact Assessment (ESIA) will be conducted in accordance with applicable national and international requirements.

1.2 Project Location

The proposed Ar Rass Solar Energy Park is located 30 km south of the city of Ar Rass, in Qassim Province. The location is mostly undeveloped with an area of approximately 57.6 km². The site sits between Highway 411, running parallel with the west boundary, and Highway 7399, which runs parallel to east boundary. Both highways offer a suitable and safe access to the site and are in very good condition with a medium to low flow of traffic.

The area is utilized as a rangeland for camels, sheep, and goats by local herders. Overall, the site is bordered from the east by Road 7399 and from the west by Road 411. Open lands exist to the north and south of the site. Agricultural activity is located approximately 7 km to the south of the site, and also at a distance of approximately 14 km to the east of the site.

A map showing the regional project location is shown in Figure 1-1. A map of the proposed project location is shown in Figure 1-2.

Figure 1-1 Regional Project Location

Figure 1-2 *View of the Proposed Project Location*

2. Policy, Legal, and Administrative Framework

This section describes the policy, legal, and administrative framework within which the ESIA will be prepared. The main objective of this ESIA will be to meet or surpass the relevant environmental legislative requirements and guidelines, including but not limited to:

- National KSA Legislation – General Authority of Meteorology and Environmental Protection (GAMEP); and
- International Legislation - World Bank/IFC Guidelines

Both the national and international legislations requirements show a level of overlap. However, the international legislation (i.e. the Equator Principles Financial Institutions "EPFC" Requirements) goes further than national requirements and expectations for the ESIA. The National KSA Legislation does not currently include public involvement within the EIA process, nor are the results shared for public review. This approach differs significantly from the EP requirements.

The proposed ESIA process is expected to adopt, where relevant, best practice and implement the requirements of the EPFIs. In this sense, it is considered that the national legislation will also be fully met.

2.1 Policy on Renewable Energy Development and Process

The following section provides an overview of Saudi Arabia's developing policy with respect to renewable energy:

2.1.1 National Renewable Energy Program (NREP)

Saudi Arabia's National Renewable Energy Program (NREP) is a strategic initiative under Vision 2030 and the King Salman Renewable Energy Initiative. The program aims to maximize the potential of renewable energy in Saudi Arabia. The program sets out an organized and specific road map to diversify local energy sources, stimulate economic development and provide sustainable economic stability to the Kingdom in light of the goals set for Vision 2030, which include establishing the renewable energy industry and supporting the advancement of this promising sector while working to fulfill the Kingdom's commitments to reducing carbon dioxide emissions.

2.1.2 Program Ownership

The NREP is overseen by the Ministry of Energy. The office responsible for the program delivery is the Ministry's Renewable Energy Project Development Office (REPDO). The REPDO was established in 2017 in order to deliver the goals of the NREP in line with Vision 2030. The REPDO reports to a committee chaired by the minister of the Ministry of Energy, which is tasked with overseeing the delivery of the NREP. The committee brings together and include the country's energy sector stakeholders, including the Electricity and Cogeneration Regulatory Authority (ECRA) and the Saudi Electricity Company (SEC).

2.2 National Legal and Administrative Framework

Article 32 of Saudi Arabia's Basic Law of Governance, issued by Royal Order No. A/91 on 1/3/1992, establishes the requirement for the country to preserve, protect, and improve the environment. Article 32 establishes that "*The state works for the preservation, protection, and improvement of the environment, and for the prevention of pollution*."

The first comprehensive Saudi Arabia national environmental legislation was enacted on September 24th, 2001 in the form of the General Environmental Regulations (GER), Council of Ministers Resolution No. 193. It entered the force on October 31, 2002, and their Implementing Rules were published on September 30, 2003. The main objectives of the GER include preservation, protection, development of the environment, safeguarding the environment from pollution; protection of public health from activities and acts that harm the environment; conservation and development of natural resources and rationalizing their use and raising awareness of environmental issues. The GER entrusts the General Authority of Meteorology and Environmental Protection (GAMEP), formerly known as the Meteorological and Environmental Protection Administration (MEPA) and more recently as the Presidency of Meteorology and Environmental Protection (PME), with preserving and preventing the deterioration of the environment.

The legislation establishes a number of prohibitions of pollution and contamination of air, land and water, with particular reference to all parties involved in services, industry or other economic activities. Proponents of projects which may have an impact on the environment are required to comply with existing and future environmental specifications, standards, measurements and guidelines as promulgated by GAMEP and set out in the appendices of the Implementing Rules. Moreover, prior to the setting up of a project, an environmental evaluation study must be completed and approved by GAMEP. The detail of the legislation is contained in the appendices of the Implementing Rules, as follows:

- Appendix 1: Environmental Protection Standards
- Appendix 2: Procedures for the Assessment of Environmental Effects of Industrial and Development Projects
- Appendix 3: Manual of Environmental Qualification Procedures
- Appendix 4: Rules and Procedures for the Control of Hazardous Waste
- Appendix 5: National Contingency Plan for Combatting Pollution by Oil and other Harmful Substances of the Marine Environment in Emergency Cases
- Appendix 6: Violations and Fines

The following articles from the GER are worth noting:

Article 4 states that any public entity has to take measures to adhere to the provisions of the GER for all projects it executes, supervises, or licenses; and ensure that regulations and environmental standards in the Implementing Rules are adhered with. Any public entity responsible for issuing standards or specifications related to activities affecting the environment has to consult with GAMEP before issuing them.

Article 5 states that licensing agencies must verify that an environmental impact assessment (EIA) is undertaken at the feasibility stage for projects that may have negative environmental effects.

Article 6 states that an entity responsible for carrying out new projects or major modifications to existing projects has to use best available technologies, which are suitable for the local environment and least polluting to the environment.

Article 10 states that environmental considerations should be incorporated in the process of planning for development projects, programs, and development plans for various sectors and the general development plan.

Article 11 states the following:

Any person responsible for designing or operating any project or activity must commit to ensure that the design and operation of the project are in conformity with the regulations and standards in force.

Any person involved in a work which may result in negative impact on the environment must take all appropriate steps to limit the effects or decrease their potential occurrences.

Article 12 states the following:

Who ever performs excavation, demolition, construction work, or the transportation of wastes and soils resulting from these activities has to take necessary precaution measures during the storage and safe transport and treatment of these materials using suitable manners.

Article 13 of the General Environmental Law calls for ensuring that various activities do not contribute to the contamination of surface water, groundwater, or coastal water directly or indirectly via liquid or solid wastes.

In 2012 and 2014, the GAMEP developed a number of supplementary Environmental Standards revising in part the General Standards for the environment issued in Appendix 1 to the General Environmental Regulations and Rules for Implementation.

In addition to the GER, national environmental legislative framework includes the following:

- Forests and Rangelands Act (1979);
- Water Resources Conservation Act (1980);
- Act establishing the National Commission for Wildlife Conservation (1986);
- Act on Fishing and Protection of Living Aquatic Resources in the Territorial Waters of Saudi Arabia (1987);
- Wildlife Protected Areas Act (1995);
- Wild Animals and Birds Hunting Act (1999); and
- Act on Trade in Endangered Wildlife Species and their Products (2000)

The GAMEP is the authority in charge of environmental performance for developments across the Kingdom of Saudi Arabia, with the exception of designated industrial cities.

The General Environmental Regulations and Rules for Implementation, along with the Supplementary Environmental Standards, establish the regulatory basis for the control of the environmental aspects of the project.

2.2.1 National Environmental Impact Assessment (EIA) Requirements

EIA is a process for identifying the likely significant environmental effects (beneficial or adverse) of proposed developments before development consent is granted. Article 5 of the GER states that "*The agency in charge of implementation of the project shall be responsible for conducting the environmental assessment studies in accordance with the environmental basics and standards determined by the competent agency in the rules for implementation*." In accordance with the industrial and development project classification guide, appendix no. 2.1 of the GER 2001: Guidelines for Classification of Industrial and Development Projects, issued by GAMEP, projects are classified into three categories in terms of the level of environmental impact assessment required for that project. Three categories of EIAs are utilized. Category 1 has the least requirements, while Category 3 requires a full assessment of the effects of a project. The GER provides guidance on the categorization of projects and a list of likely projects which fall into each of the three categories. The GER provides four principles on which to base the decision of characterization. These are:

- The nature and magnitude of the intended activity and the existence of similar projects at the site or similar sites;
- The extent of depletion of natural resources by the installation predicted for agricultural lands and mineral resources;
- The location of the installation and the nature of the surrounding environment and nearby residential areas, and;
- The type of power used.
- In accordance with the Guidelines for Classification of Industrial and Development Projects, solar power plants have been classified as Category 3. Hence, the proposed project will be classified as Category 3. The regulations specify that the EIA for a Category 3 project should include:
- Presentation of the project;
- Description of the project and its objectives;
- Status of the surrounding environment;
- Identification of the general potential project impacts and suggested alternatives;
- Identification and analysis of key effects of the project on air quality, marine and coastal environment, surface and groundwater, flora and fauna, land use and urban development, residential clusters, and generic scenic view;
- Assessment of significant impacts; and
- Summary of significant impacts after mitigation processes.

2.2.2 Relevant National Ministries and Regulatory Bodies

2.2.2.1 General Authority of Meteorology and Environmental Protection

The General Authority of Meteorology and Environmental Protection (GAMEP), formerly known as the Presidency of Meteorology and Environmental Protection "PME", is the primary agency responsible for environmental matters in the Kingdom of Saudi Arabia. GAMEP is responsible for the general regulatory framework for the development and enforcement of environmental rules and regulations. The responsibilities of GAMEP include but are not limited to the following:

- Conducting environmental surveys and pollution assessment and control;
- Establishment of environmental standards and regulations;
- Recommendations on practical measures for emergency situations;
- Keeping up to date with environmental developments internationally; and
- Preparing and issuing climatological, environmental, and meteorological analyses, forecasts, and bulletins.

2.2.2.2 Ministry of Environment, Water, and Agriculture

The Ministry of Environment, Water, and Agriculture (MEWA) is responsible for the regulation and implementation of all aspects of the country's policies for the environmental, water, and agricultural sectors. The ministry implements environmental, water production, and agricultural plans and programs across the Kingdom with a focus on sustainability and value creation. The Ministry of Environment was established by virtue of the Royal Decree no. (A/133), dated 30/07/1437 H, upon which the name of the Ministry of Agriculture (MOA) was changed to the Ministry of Environment, Water and Agriculture (MEWA), and assigned the environment-related tasks to it. The establishment of the Undersecretariat of Environment was approved by the Ministerial Resolution no. 115/1/1438, dated 16/02/1438 H. Some of the tasks and responsibilities of the Directorate of Environment include mapping out national strategies and environmental and meteorological objectives and goals and coordinating and cooperating with the local, regional and international entities, and following up developments and updates in the fields of environment and meteorology.

2.2.2.3 Ministry of Energy

The Ministry of Energy is the central energy authority in Saudi Arabia. The ministry was formerly known as the Ministry of Petroleum and Mineral Resources. However, in 2019 the name of the Ministry was amended to its current name via a Royal Decree.

The Ministry of Energy manages and executes Saudi Arabia's National Renewable Energy Program (NREP), which is a long-term, multi-faceted renewable energy program designed to balance the domestic power mix, whilst working towards carbon reduction commitments. The Ministry of Energy directly supports the National Transformation Program (NTP) and Saudi Arabia's Vision 2030. The office responsible for the delivery of the NREP is the Renewable Energy Project Development Office (REPDO). The NREP aims to substantially increase the share of renewable energy in the total energy mix, targeting the generation of 3.45 gigawatts (GW) of renewable energy by 2020 under the National Transformation Program (NTP), and 9.5GW by 2023, towards Vision 2030.

2.2.2.4 Electricity and Cogeneration Regulatory Authority

The Electricity and Cogeneration Regulatory Authority (ECRA) is the entity which regulates the electricity and water desalination industry in the Kingdom of Saudi Arabia. ECRA monitors the performance of service providers within a regulatory framework in accordance with government laws, regulations, policies and standards, as well as international best practices in order to guarantee the provision of safe, reliable, reasonably priced, and efficient electric power and desalinated water to the consumers of Saudi Arabia. ECRA has been designed several responsibilities which are delineated in the Electricity Law and ECRA's Charter. These responsibilities cover the following areas:

- Supply Matters: issuing licenses for generation, transmission, distribution, retailing and trading of electricity and cogeneration services as well as production, trading, and transportation of desalinated water; monitoring licensees' compliance with their license requirements and conditions; development of unified regulatory accounting and reporting procedures for electricity, cogeneration and desalination providers; coordination of the infrastructure of the electricity and water desalination industry and development of the expansion plans of these industries;
- Consumer Issues: assessment of tariffs charged for supply of electricity, cogeneration, and water desalination services, periodic review of these tariffs, proposing (as needed) new tariffs to the government, protecting interests of stakeholders in the industry, investigating and resolving complaints by involved parties, and improving industry performance;
- Technical Issues: developing and issuing best practice codes and standards, ensuring adequacy of the research and development (R&D) activities of the electricity and water desalination industry, promoting energy conservation measures in coordination with relevant authorities; and
- Organizational and Administrative Tasks: defining public interest with regard to the electricity and water desalination industry, development of regulations for expansion of the infrastructure of the industry, encouraging private sector participation and investments, and issuing periodic reports to the Council of Ministers on costs and tariffs of electricity, cogeneration and desalination services.

2.2.2.5 Saudi Electricity Company

Saudi Electricity Company (SEC) is a Saudi electric utility company, which enjoys a monopoly on the generation, transmission, and distribution of electric power in Saudi Arabia through a number of power generation plants in the country. The company was formed in 2000 by Order of the Council of Ministers through a merger of existing regional electricity companies around the country into a single joint stock company. The company, in coordination with governmental organizations, takes part in various activities aimed at the preservation of the environment in the Kingdom through the following:

- Participating in the development of national indicators for the environment and sustainable development;
- Participating in formulating and updating national plans for responding to radiological and nuclear emergencies;
- Continuously coordinating with GAMEP with respect to the protection of the environment;
- Preparing quarterly environmental reports and forwarding them to GAMEP;
- Participating and sponsoring environmental conferences and events locally and internationally; and
- Participating and sponsoring national campaigns for cleaning up cities and provinces of the Kingdom.

2.2.2.6 Saudi Arabian Oil Company

Saudi Arabian Oil Company “Saudi Aramco”, the national oil company in Saudi Arabia, has environmental responsibilities with respect to project design, environmental monitoring, and compliance with applicable environmental standards. As part of its commitment to the environment, Saudi Aramco has developed a number of internal standards and procedures. Saudi Aramco is a key stakeholder in the National Renewable Energy Program (NREP).

2.2.2.7 Ministry of Municipal and Rural Affairs

The Ministry of Municipal and Rural Affairs (MOMRA) is the primary governmental organization in charge of the supervision and regulations of municipalities across cities, towns, and villages of the Kingdom of Saudi Arabia. MOMRA is currently leading the development of the municipal sector through the 4-year Municipal Transformation Program (MTP), which is a sector-wide, across-the-board overhauling and upgrading of municipal performance nationwide. The MTP ultimately aims for sustainable cities and communities that ensure developmental equilibrium between the economy, communities, and the environment, and which form the essential urban foundation and platform to enable the implementation of the whole-of-government National Transformation Program (NTP) toward the realization of Saudi Arabia’s Vision 2030.

2.2.2.8 Emirate of Qassim Province

The Law of Regions, promulgated by Royal Decree No. A/92 and amended by Royal Decree No. A/21, administratively divides Saudi Arabia into 13 provinces. Each province consists of a number of governorates (of "Class A" or "Class B"), districts and centers (of "Class A" or "Class B"). Each province is headed by an Emir, with the rank of a minister. The Emir of the province shall be answerable to the Interior Minister. Every emir shall assume the administration of the region according to the general policy of the State in compliance with provisions of the Law of Regions and other laws and regulations. Some of the duties of the Emir include:

- Maintaining security, order, and stability, and take necessary measures in accordance with the Law of Regions and other laws and regulations;
- Working for social and economic development and public works of the province;
- Administering governorates, districts and centers, and supervising governors, directors and districts and heads of centers, and ascertaining their capabilities to perform assigned duties; and
- Protecting state property and assets and prevent their usurpation.

2.2.2.9 Ar Rass Governorate

Governorates are the second level of regional administration in Saudi Arabia. Each of the thirteen provinces of Saudi Arabia is sub-divided into governorates. Governorates, in turn, are further subdivided into sub-governorates (or centers "Marakiz"). However, some sub-governorates may report directly to the provincial capital rather than to one of the governorates. Regional capitals are not included within any governorate but are governed by municipalities "Amanah" instead. Governorates in Saudi Arabia can be either "Category A" or "Category B", depending on population size. Each governorate is headed by a governor, appointed by an order from the council of ministers, and holds the highest executive authority in the governorate. Some of the duties of governors include:

- Maintaining order and security in the governorate in accordance with applicable laws and regulations;
- Working for the urban, social, and economic development of the governorate and its centers; and
- Developing the public services in the government and its centers and improving their efficiency.

Qassim Region is administratively divided into 13 governorates. The proposed Ar Rass Solar Energy Park will be located 30 km south of the city of Ar Rass within Ar Rass Governorate. Ar Rass Governorate is classified as a Category A Governorate and consists of 6 centers (Marakiz).

2.2.2.10 Ar Rass Municipality

The Municipalities and Village Law, promulgated by Royal Decree No. M/5, provides a framework for the function of municipalities in Saudi Arabia. Each municipality comprises a municipal council, which practices the authority of monitoring and reporting. Each municipality is headed by a mayor "Amin" who holds the executive authority and is supported by various administrations. The head of the municipality shall be answerable to the Urban and Rural Affairs Minister. Some of the functions of the municipality include the following:

- Regulation, and maintenance of the municipality in accordance with an official masterplan;
- Issuance of permits with respect to construction and buildings as well as public and private works extensions and their monitoring;
- Maintaining the cleanliness of the municipality, and creation of public parks and swimming pools and their regulation;
- Protecting public health and preventing the risks of floods;
- Establishing markets and retail outlets; and
- Establishing the locations for hawkers and regulating their activities.

2.2.2.11 Ministry of the Interior

The Ministry of the Interior is the national authority responsible for national security, naturalization, immigration, and customs in Saudi Arabia. The Ministry was founded in 1951 after the combined ministerial body covering financial and interior affairs was separated.

2.2.2.12 High Commission for Industrial Security

The High Commission for Industrial Security (HCIS) was formed via Royal Decree No. 8/439 in order to protect facilities and oversee areas of security, safety, and fire protection. The commission is headed by the Interior Minister and provides strategic supervision and oversight to 12 main sectors including the electricity sector.

Some of the responsibilities of the HCIS include:

- Executing all commission decisions;
- Coordinating among different facilities (Petroleum, Industrial, Services) and the different security agencies to the effectively implement all security, industrial safety and fire protection requirements;
- Conducting comprehensive onsite surveys of all Sectors under HCIS Oversight to follow up and insure implementation of all security, industrial safety and fire protection requirements; and
- Preparing technical, engineering, administrative, and regulatory procedures for all sectors under HCIS oversight covering safety, security and fire protection and updating them regularly.

2.2.2.13 General Directorate of Civil Defense

The General Directorate of Civil Defense is an authority associated with the Ministry of Interior. The General Directorate of the Civil Defense has taken on its own responsibility the issues of security and safety for the protection of residents, public and private properties from the risks of fire, catastrophes, wars, and accidents.

2.2.2.14 Ministry of Defense

The Ministry of Defense is responsible for the protection of national security, interests, and sovereignty of the country from external threats as well as working with all ministries of the state to achieve national security and stability. The Ministry includes five armed forces; The Royal Saudi Land Forces, The Royal Saudi Air Forces, The Royal Saudi Naval Forces, The Royal Saudi Air Defense Forces, and The Royal Saudi Strategic Missiles Force.

2.2.2.15 General Authority of Civil Aviation

The General Authority of Civil Aviation (GACA) is the national authority which administers all aviation industry matters in the Kingdom of Saudi Arabia. GACA owns and several domestic and international airports in Saudi Arabia and is responsible for all air traffic control, safety, operations and development matters in the country.

2.2.2.16 Ministry of Economy and Planning

The Ministry of Economy and Planning oversees the economic system in Saudi Arabia including strategy development, planning research, legislation and economic laws. The Ministry has the function of developing and implementing five-year plans which reflect the long-term economic targets for the country.

2.2.2.17 Saudi Wildlife Authority

The Saudi Wildlife Authority (SWA) was established by the Royal Decree no. 22/M with a mandate to prepare and implement plans to sustain terrestrial and marine wildlife and rehabilitate rare and threatened species and their habitats. The ultimate goal of SWA is getting back the natural environmental balance.

2.2.2.18 Saudi Commission for Tourism and National Heritage

The Saudi Commission for Tourism and National Heritage (SCTNH) is the government authority concerned with tourism and national heritage of the Kingdom of Saudi Arabia. One of the objectives of the SCTNH is preservation, development and maintenance of antiquities and activation of tourism's contribution to cultural and economic development.

2.2.2.19 Ministry of Housing

The mission of the Ministry of Housing is to organize and facilitate a balanced and sustainable housing environment through the establishment and development of programs to stimulate the private and public sectors through cooperation and partnership in organizing, planning, and control to facilitate housing for all community segments at reasonable price and quality.

2.2.2.20 Ministry of Transport

The Ministry of Transport plays the role of the legislator for the daily land, maritime, and air transport services planning and implementation. The Ministry has a mission of achieving integration between all transport sectors, land, maritime, and air, in order to meet the needs of the Kingdom by raising the levels of safety, energy rationalization, and to enhance the operation and performance efficiency to provide efficient services to all beneficiaries.

2.2.2.21 Ministry of Commerce and Investment

The Ministry of Commerce and Investment (MOCI) aims to achieve a leading position for both Saudi trade as well as Investment sectors, under a fair and stimulating environment. It aims to enhance both trade and Investment sectors' capacities and maintaining beneficiaries' interests, through developing and implementing effective and efficient policies and mechanisms, which may contribute in achieving sustainable economic development. Some of the tasks that the Ministry of Commerce and Investment (MOCI) carry include the following:

- To develop the national economy needs, and enhance the commercial and economic relations with the world's states;
- To increase the effectiveness of the private sector role, encourage it to raise the economic efficiency for its facilities, and expand the fields of its commercial activities in the local and world markets;
- To develop the national labor hand in terms of the commercial activities and qualify it and have it replaced the non-Saudi labor hand. To improve the efficiency of the commercial sector performance with regard to providing the needs of the local markets in terms of commodities and services, in line with the Saudi and international standards; and
- To make sure that the consumer has obtained the appropriate amount and with the appropriate price. To develop the sector of work services and organize it and develop financing activities in cooperation with the concerned bodies.

2.2.2.22 Saudi Arabian General Investment Authority

Saudi Arabian General Investment Authority (SAGIA) is the foreign investment license provided in Saudi Arabia. SAGIA was created in 2000 via a Council of Ministers resolution. The main objective of SAGIA is to oversee investment affairs in Saudi Arabia, including foreign investment.

2.2.2.23 Communications and Information Technology Commission

The Communications and Information Technology Commission (CITC) is the national communications authority. It was first established under the name "Saudi Communications Commission" in accordance with the decision of the Council of Ministers. The name was later changed after the commission was assigned new tasks related to information technology. CITC is responsible for regulating the information and communications technology sector in the Kingdom of Saudi Arabia. The Telecommunications Act, issued by Royal Decree No. M/12, dated 5/3/1422H and its Bylaws, issued in 1423 H, provides the legal framework for organizing this sector. This Act involves a number of objectives such as: Providing advanced and adequate telecommunication services with affordable prices, creating an appropriate atmosphere to encourage fair competition, using frequencies effectively, localization of telecommunication technology and managing recent advancements, clarity and transparency in procedures, equality and neutrality, protection of the public interest as well as the interest of users and investors.

2.2.2.24 King Abdulaziz City for Science and Technology

King Abdulaziz City for Science and Technology (KACST) is a scientific government institution that supports and enhances scientific applied research. The institution coordinates the activities of government institutions and scientific research centres in accordance with the requirements of the development of the Kingdom. It also cooperates with the relevant authorities in identifying national priorities and policies in technology and science so as to build a scientific and technological basis that serves development in agriculture, industry, mining, etc. It also aims at developing national competences and recruiting highly qualified specialists to help develop and control modern technology in order to serve development in the Kingdom. KACST comprises all the requirements of scientific research, such as laboratories, means of communications, information sources and all necessary facilities.

2.2.2.25 Public Investment Fund

The Public Investment Fund (PIF) is a sovereign wealth fund owned by Saudi Arabia. The PIF has been a leading economic player and has contributed to the development of national investment entities constituting the foundation for overall development, while contributing to the establishment of many of the largest companies in the Kingdom. Throughout the years, the PIF has financed many key projects and companies and provided financial support for projects of strategic importance to the national economy. The PIF invests in the fields of telecoms, aerospace, energy, green technologies, and security, seeking a focus on housing finance, renewable energy, and information technology.

2.2.3 Permits

A number of permits are typically required to construct and operate the proposed project Table 2-1 indicates the type of permits required for the construction and operation of the proposed project and associated facilities (e.g. utilities connections). Such permits set out and regulate the standards to which the proposed project must be in compliance with.

Table 2-1 Permitting Requirements for Ar Rass Solar Energy Park

Permit Type	Permitting Authority	Law	Project Phase	
			Construction	Operation
Land Allocation Permit	Ar Rass Municipality/MOMRA	Municipalities and Villages Law	Yes	No
Building Construction Permit	Ar Rass Municipality/MOMRA	Municipalities and Villages Law	Yes	No
Safety License	General Directorate of Civil Defense	Civil Defense System and Executive Lists	Yes	Yes
Industrial License/Investment License	Ministry of Commerce and Investment/SAGIA	Laws of the Legal Guide for Investors provided by SAGIA, such as: ■ Basic Law of Governance ■ Implementing Regulations of the Foreign Investment Act ■ Gas Suppliers Law ■ Labor Law ■ Income Tax Law ■ Social Insurance Law ■ Company Laws ■ Capital Market Law ■ Code of Law Practice ■ Copyright Law ■ Law of Patents ■ Law of Arbitration	Yes	Yes
Environmental Permit to Construct/Operate	GAMEP	General Environmental Regulations and Rules for Implementation Council of Ministers Resolution No. 429 dated 8/8/1439H	Yes	Yes
Permit to Connect to Water Infrastructure	Ministry of Environment, Water and Agriculture	Public Utilities Protection Regulation	Yes	Yes

Permit Type	Permitting Authority	Law	Project Phase	
			Construction	Operation
Permit to Connect to Saudi Electricity Company Utilities	Saudi Electricity Company	Public Utilities Protection Regulation, Electricity Law and Its Executive Regulations	Yes	Yes
Generation License	Electricity and Cogeneration Regulatory Authority	Electricity Law and Its Executive Regulations	Yes	Yes
Transmission License	Electricity and Cogeneration Regulatory Authority	Electricity Law and Its Executive Regulations	Yes	Yes
Distribution and Retail License	Electricity and Cogeneration Regulatory Authority	Electricity Law and Its Executive Regulations	Yes	Yes
Industrial Security License	High Commission for Industrial Security	Security Directive (No. 3870)	Yes	No
Industrial Safety License	High Commission for Industrial Security	Safety Directive (No. 3871)	Yes	No

2.2.4 International Conventions

Saudi Arabia has used the signing of international agreements and treaties as an extension to its regulations. Saudi Arabia is party to various international environmental conventions or agreements; some of which include the following:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
- Vienna Convention of 1985 for the Protection of the Ozone Layer;
- Montreal Protocol of 1989 on Substances that deplete the Ozone Layer;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal;
- Rio Declaration on Environment and Development;
- United Nations Framework Convention on Climate Change;
- Convention on Biological Diversity, Rio De Janeiro;
- United Nations Convention to Combat Desertification;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora;
- The Kyoto Protocol to the UN Framework Convention on Climate Change; and

- The Paris Convention on Climate Change.

2.3 International Legal and Administrative Framework

2.3.1 World Bank Group and International Finance Corporation

The World Bank Group is a family of five international organizations that make leveraged loans. These include:

- 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)

The proposed project is likely to attract private sector finance. Hence, it is assumed that the EIA would need to assess the environmental impacts in accordance with the International Finance Corporation (IFC) Performance Standards. The IFC 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. The IFC have developed their Performance Standards on Social and Environmental Responsibility as a means of managing the social and environmental risks and impacts on projects. 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 eight Performance Standards collectively have subsequently been adopted by other institutions and protocols (such as the EPs) and are currently widely regarded as the *defacto* international standard for securing social and environmental sustainability in the planning and life time execution of major infrastructure developments. The eight performance standards are itemized as follows:

- Performance Standard PS1: Social and Environmental Assessment and Management Systems;
- Performance Standard PS2: Labor and Working Conditions;
- Performance Standard PS3: Pollution Prevention and Abatement;
- Performance Standard PS4: Community Health, Safety and Security;
- Performance Standard PS5: Land Acquisition and Involuntary Resettlement;
- Performance Standard PS6: Biodiversity Conservation and Sustainable Natural Resource Management;
- Performance Standard PS7: Indigenous Peoples; and
- Performance Standard PS8: Cultural Heritage.

The applicability of these performance standards to Ar Rass Solar PV Park EIA study will be assessed in more detail in the scoping report.

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. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. In 2007, IFC EHS Guidelines were released which replaced World Bank Guidelines previously published in Part III of the Pollution Prevention and Abatement Handbook. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.

2.3.1.1 World Bank Operation Manual

The World Bank Environmental Assessment requirements pertaining to stakeholder engagement for a Project such as Ar Rass Solar Project are provided in Operational Policy (OP) 4.01 and Bank Procedures (BP) 4.01. Guidance is included in the OP to allow "burrower decision makers and Bank operational staff" to ensure that the project options under consideration are environmental sound and sustainable. BP 4.01 explains how the World Bank representatives implement the policies stipulated in OP 4.01, and clarifies the procedures and documentation required. The World Bank provides practical guidance for designing sustainable World Bank-assisted projects by way of a Sourcebook. The following Sourcebook chapters and Updates have been reviewed as most relevance to the Stakeholder Engagement Plan:

- Chapter 7: Community involvement and the role of nongovernmental organizations in environmental assessment.
- Update No. 26: Public Consultation in the EA Process: A Strategic Approach.

2.3.2 Equator Principles (EPs)

The EPs are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects. The ten principles are:

Principle 1: Review and Categorisation:

This EP requires all projects considered for financing to be categorized according to the degree of environmental and/or social risk they present. Projects with minimal environmental or social impacts require no further analysis under the EPs; those with attributable impacts are potentially subject to meeting the requirements of the remaining Principles.

Principle 2: Environmental and Social Assessment:

This EP mandates a project specific environmental and social impact assessment (ESIA) and provides an illustrative list of potential environmental and social issues to be addressed in the assessment;

Principle 3: Applicable Environmental and Social Standards:

This EP concerns the environmental and social standards that the project must adhere to during its construction, operation and decommissioning;

Principle 4: Environmental and Social Management System and Equator Principles Action Plan:

This EP addresses requirements for a comprehensive ESMP which needs to be implemented within a structured management system to ensure that the provisions of the remaining EPs are effectively implemented;

Principle 5: Stakeholder Engagement:

This EP covers the requirements for consultation as well as the public disclosure of key project documentation and information:

Principle 6: Grievance Mechanism:

This EP concerns requirements for a structured grievance mechanism to be put in place to enable project-affected communities (including workers engaged on the project and workers at neighboring sites) to express any concerns or grievances they may have concerning the development;

Principle 7: Independent Review:

This EP provides for the possible requirement for an independent review of EP compliance in order to assist the Equator Principle Financial Institution (EPFI)'s due diligence;

Principle 8: Covenants:

This EP provides for the incorporation of covenants linked to EP compliance to be included in the project financing agreements;

Principle 9: Independent Monitoring and Reporting:

This EP deals with the possible requirement for independent verification of monitoring carried out by the project sponsors; an

Principle 10: Reporting and Transparency:

This EP commits each EPFI to report publicly at least annually about its EP implementation processes.

The Equator Principles (EP) III became effective from 4 June 2013.

With respect to stakeholder engagement, Equator Principle 5 (Stakeholder Engagement) and Equator Principle 6 (Grievance Mechanism) are of most relevance. Per EP5, an effective stakeholder engagement should be demonstrated on an ongoing basis in a structured and culturally appropriate manner with affected communities and other stakeholders. Per EP6, a requirement exists for the client to establish a grievance mechanism designed to facilitate the communication and resolution of concerns and grievances about the environmental and social performance of the project.

Saudi Arabia is classed as a Non Designated country by the EP and therefore the ESIA process evaluates compliance with the Applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

2.3.3 ESIA Requirements

Equator Principles Financial Institutions (EPFIs) require burrowers to comply with the Equator Principles, to ensure that the project has been developed in a manner that is socially responsible and reflects sound environmental management practices. The first principle deals with the categorization of the project on the basis of its potential risks and impacts. The screening is undertaken using the following categorization scheme of the IFC:

- Category A: Projects with potential significant adverse environmental social risks and/or impacts which 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;
- Category C: Projects with minimal or no adverse environmental and social impacts/risks.

The proposed project is considered a Category B Project: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.

3. Project Stakeholders

Stakeholders refer to parties or individuals who have an interest in the project and who can potentially influence, or be influenced by the construction, operation, and/or decommissioning of the project. Stakeholders of consideration may include public and private bodies, groups and individuals, including local authorities, utilities/power companies, and public stakeholders. A proposed stakeholder group relevant to the project are included in the Table 3-1.

Table 3-1 Proposed Stakeholder Group

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
Regulatory Bodies/ Competent Authorities	Ar Rass Municipality	Local municipality of the project site	Consulted as appropriate during the scoping and assessment stages	Issuing land allocation and building permits, general interest in the progress of the project	No direct role, general interest in the operation of the facility
	Ar Rass Governorate	Governorate of the project location including the governor or his representatives	Consulted as appropriate during the scoping and assessment stages	No direct role, general interest in the progress of the project - retain on stakeholders groups for receipt of communication in relation to the project and construction activities	No direct role, general interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility
	Emirate of Qassim Province	Provincial area of the project site	Consulted as appropriate during the scoping and assessment stages	No direct role, general interest in the progress of the project - retain on stakeholders groups for receipt of communication in relation to the project and construction activities	No direct role, general interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	Ministry of Municipal and Rural Affairs (MOMRA)	Competent authority responsible for the supervision and regulation of municipalities across Saudi Arabia	Provision of advice and concerns regarding project development. Attend consultation meetings	Issuing land allocation and building permits, general interest in the progress of the project	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility
	General Authority of Meteorology and Environmental Protection (GAMEP)	Competent agency responsible for environmental regulation permitting	National Environmental Regulator	GAMEP has overall responsibility for environmental protection in KSA. It functions as an enforcement institution for the application of environmental laws including environmental licensing.	GAMEP has overall responsibility for environmental protection in KSA. It functions as an enforcement institution for the application of environmental laws including environmental licensing and auditing.
	Ministry of Environment, Water, and Agriculture (MEWA)	Governmental authority responsible for the regulation and implementation of all aspects of the country's policies for the environmental, water, and agricultural sectors	Consulted as appropriate during the scoping and assessment stages	Permit to connect to existing water utilities infrastructure	General interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	Ministry of Energy	Project proponent. Central authority for energy projects in Saudi Arabia. Key stakeholder in the National Renewable Energy Program.	Monitoring performance. Lead in communication to interested governmental agencies/ministries as required	Monitoring performance. Lead in communication to interested governmental agencies/ministries as required	Monitoring performance. Lead in communication to interested governmental agencies/ministries as required
	Electricity and Cogeneration Regulatory Authority (ECRA)	Competent authority with respect to the regulation and supervision of the electricity and desalination industry. Key stakeholder in the National Renewable Energy Program	Provision of advice and concerns regarding project development. Attend consultation meetings	Granting Generation license, Transmission License, Distribution and Retail licenses, consulted as appropriate in the construction phase	Renewal of relevant licenses, and Monitoring performance
	Saudi Electricity Company (SEC)	Responsible for the transmission of produced electricity through an overhead transmission line/management, and operation, and maintenance of the grid. Key stakeholder in the National Renewable Energy Program	Provision of advice and concerns regarding project development. Attend consultation meetings	Respond directly on issues relating to project interaction with SEC assets	Ongoing role related to the operation of the facility and energy supply to the grid

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	Saudi Aramco	The national oil company in Saudi Arabia and is a key stakeholder in the National Renewable Energy Program	Provision of advice and concerns regarding project development. Attend consultation meetings	Respond directly on issues relating to project interaction with Saudi Aramco assets	Monitoring performance
	High Commission for Industrial Security (HCIS)	Regulatory authority with responsibility for the development and implementation of security, safety, and fire protection strategies across the country. The authority provides strategic supervision and oversight for various sectors including the electricity sector	Consulted as appropriate during the scoping and assessment stages	Granting Industrial Security and Safety Approvals prior to construction. Interest in adherence to security directives	Oversight and follow up and to ensure implementation of all security, industrial safety and fire protection requirements
	Ministry of Commerce and Investment (MOCI)	Regulating authority in charge of setting commercial systems and regulations	Consulted as appropriate during the scoping and assessment stages	Granting of Industrial License	General interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	Saudi Arabia General Investment Authority (SAGIA)	Competent authority in charge of foreign investment affairs	Consulted as appropriate during the scoping and assessment stages	Granting of Industrial Investment License (foreign investment)	General interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility
	General Directorate of Civil Defense	Governmental authority associated with the Ministry of Interior concerned with the protection of residents and public and private properties	Consulted as appropriate during the scoping and assessment stages	Issuing safety license prior to operations	General interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility
	Saudi Wildlife Authority (SWA)	Regulating authority whose objective is to conserve biological diversity in Saudi Arabia	Stakeholder for the EIA interested in ensuring the protection of biological diversity in the Kingdom	Ensure that all measures included in the EIA for the protection of biological diversity are followed	General interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	Saudi Commission for Tourism and National Heritage (SCTNH)	Governmental authority concerned with tourism and conservation of the country's national heritage	Stakeholder for the EIA as the sole body authorized to provide licensing and perform intrusive archaeological investigations, maybe invited to consultation meetings, may provide information of use to the project	Potential supervision during the construction process to ensure archaeological findings are not overlooked.	General interest in the facility -retain on stakeholders groups for receipt of communication in relation to the facility
	Ministry of Interior	The national authority responsible for national security, naturalization, immigration, and customs in Saudi Arabia	Consulted as appropriate during the scoping and assessment stages	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility
	Ministry of Defense	National authority responsible for the protection of national security, interests, and sovereignty of the country	Consulted as appropriate during the scoping and assessment stages; need to confirm if the Ministry does not have any associated facilities or future plans in the area	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	Ministry of Transport	National legislator for the daily land, maritime, and air transport services planning and implementation	Consulted as appropriate during the scoping and assessment stages; Need to confirm if the Ministry has any future plans in the area that could be affected by the project	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility
	Ministry of Housing	National authority responsible for housing developments	Consulted as appropriate during the scoping and assessment stages; Need to confirm if the Ministry has any future plans in the area that could be affected by the project	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility
	General Authority of Civil Aviation	National authority which administers all aviation industry matters in the Kingdom of Saudi Arabia.	Consulted as appropriate during the scoping and assessment stages; Need to confirm if there are any air corridors to be affected by the project	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	Public Investment Fund	Sovereign wealth fund owned by the Kingdom, investing in a variety of projects on behalf of the Kingdom	Consulted as appropriate during the scoping and assessment stages; Need to confirm if there are any plans to be affected by the project	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility
	Ministry of Economy and Planning	National authority supervising the economic system in Saudi Arabia	Consulted as appropriate during the scoping and assessment stages; Need to confirm if there are any plans to be affected by the project	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility
	Communications and Information Technology Commission	National communications authority	Consulted as appropriate during the scoping and assessment stages; Need to confirm if there is any associated infrastructure to be affected by the project	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
	King Abdulaziz City for Science and Technology	Scientific government institution that supports and enhances scientific applied research and is involved in some solar projects in the Kingdom	Consulted as appropriate during the scoping and assessment stages	No direct role. Retain on stakeholder groups for receipt of communications in relation to project and construction activities	No direct role. Retain on stakeholder groups for receipt of communications in relation to facility
Businesses and Community Representatives	Local residents of Ar Rass	May include local receptors or persons with general interest in local development	Consulted as appropriate during the scoping and assessment stages	No role. Potential to form part of project affected persons group and/or have general local interest in construction phase activities	No role. Potential to form part of project affected persons group and/or have general local interest in operation activities
	Local herders	Temporary users of the area	Consulted as appropriate during the scoping and assessment stages	No role. Potential to form part of project affected persons group and/or have general local interest in construction phase activities	No role. Potential to form part of project affected persons group and/or have general local interest in operation activities

Type	Name	Description	Role in EIA Stage	Role in Construction	Role in Operation
Media	Various	Local newspaper and radio media groups	None specific – may be involved in the dissemination of information in relation to the project, including consultation meetings	None specific – may be involved in the dissemination of information in relation to the project, including consultation meetings	None specific – may be involved in the dissemination of information in relation to the project including consultation meetings, news features of facility completion / start of operations.

A preliminary analysis has been undertaken to determine the potential level of impact, interest, and/or influence of a stakeholder group as it relates to the group's relationship with the project. The significance of the group's relationship with the project may be classified as Low, Moderate, or High. Table 3-2 provides the criteria used to determine the significance of each stakeholder group:

Table 3-2 Criteria Used to Determine the Significance of Each Stakeholder Group

Significance	Impact	Interest	Influence
Low	Stakeholder will experience very few impacts as a result of the project	The project has limited relevance to the stakeholder's field of interest and/or responsibilities	Stakeholder has very little control over the project
Moderate	Stakeholder will experience a moderate degree of impact as a result of the project. These impacts can be managed and mitigated	The project has some relevance to the stakeholder's field of interest and/or responsibilities	Stakeholder can influence the scope and schedule of the project
High	Stakeholder will experience a high degree of impact as a result of the project	The project is directly related to the stakeholder's field of interest and/or responsibilities	Stakeholder has decision making powers regarding the project

On the basis of the criteria in Table 3-2, appropriate level of engagement for each stakeholder group is determined. Three levels of engagement have been defined as Standard, Enhanced, and High. The level of engagement for each stakeholder group will be used to design targeted group-specific engagement activities. Figure 3-1 shows the levels of engagement matrix.

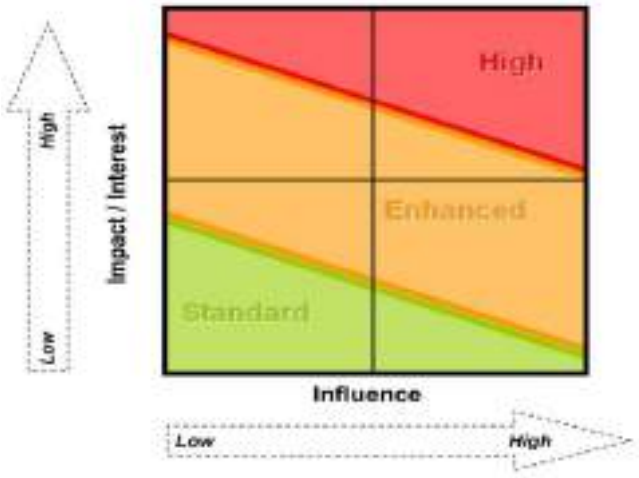


Figure 3-1 Levels of Engagement Matrix

Table 3-3 provides the level of significance and engagement identified for each stakeholder group identified in Table 3-1. Stakeholders can move from one level of engagement to another throughout the project. The mapping and analysis of stakeholder groups is an ongoing process and will be revisited throughout the project.

Table 3-3 Stakeholder Levels of Significance and Engagement

Stakeholder Group	Stakeholder	Significance	Level of Engagement
	Ar Rass Municipality	Moderate	Enhanced
	Ar Rass Governorate	Moderate	Enhanced
	Emirate of Qassim Province	Moderate	Enhanced
Regulatory Bodies/Competent Authorities	General Authority of Meteorology and Environmental Protection (GAMEP)	High	High
	Ministry of Environment, Water, and Agriculture (MEWA)	Moderate	Enhanced
	Ministry of Energy,	High	High

Stakeholder Group	Stakeholder	Significance	Level of Engagement
	Electricity and Cogeneration Regulatory Authority (ECRA)	High	High
	Ministry of Municipal and Rural Affairs (MOMRA)	Moderate	Enhanced
	Saudi Electricity Company (SEC)	High	High
	Saudi Aramco	High	High
	High Commission for Industrial Security (HCIS)	Moderate	Enhanced
	Ministry of Commerce and Investment (MOCI)	Moderate	Enhanced
	General Directorate of Civil Defense	Moderate	Enhanced
	Saudi Wildlife Authority	Moderate	Enhanced
	Saudi Commission for Tourism and National Heritage	Moderate	Enhanced
	Ministry of Interior	Moderate	Enhanced
	Ministry of Defense	Moderate	Enhanced
	Ministry of Transport	Moderate	Enhanced

Stakeholder Group	Stakeholder	Significance	Level of Engagement
	Ministry of Housing	Moderate	Enhanced
	General Authority of Civil Aviation	Moderate	Enhanced
	Public Investment Fund	Moderate	Enhanced
	Ministry of Economy and Planning	Moderate	Enhanced
	Communications and Information Technology Commission	Moderate	Enhanced
	King Abdulaziz City for Science and Technology	Moderate	Enhanced
Businesses and Community Representatives	Local residents of Ar Rass	Low-Moderate	Enhanced
	Local herders	Low-Moderate	Enhanced
Media	Various Media Outlets	Low	Standard

4. Stakeholder Engagement Action Plan

4.1 Approach

The Stakeholder Engagement Plan will allow a range of stakeholders and interested parties to be identified and engaged. This will include regulatory stakeholders who are of high importance/influence and stakeholders of lesser importance who require to be kept informed through less intensive engagement processes. As shown in Figure 3-1, three levels of engagement are proposed (Standard, Enhanced, and High). These levels of engagement will be used to focus stakeholder activities based on the level of impact/interest or influence identified for each stakeholder group.

A Standard level of engagement can be achieved using disclosure/information dissemination. The objectives of this approach include:

- To ensure the timely communication of relevant project information; and
- To relay information in a manner that is both understandable and accessible to the groups being consulted.

Disclosure/information dissemination mechanisms can include the following:

- Email updates;
- Website content;
- Newsletters; and
- Status updates and reporting;

An Enhanced level of engagement can be achieved via consultation and engagement. The objectives of this approach include:

- To provide the platform to stakeholders to present their interests, views, and concerns; and
- To disclose information prior to consultations in a manner that is both understandable and accessible to the groups being consulted.

Consultation and engagement mechanisms can include the following:

- Questionnaires;
- E-mail request for information, or no objection letters;
- Feedback and grievance mechanisms; and
- Public meetings.

A High level of engagement can be achieved using focused engagement. The objectives of this approach include:

- To achieve effective participation and engagement, in turn, influencing the project process; and

- To help manage and mitigate impacts to enable stakeholders, where possible, to maximize the benefits proposed by the project.
- Focused engagement mechanisms can include the following:
- Workshops;
- Steering group and individual meetings; and
- Participatory monitoring and evaluation.

4.2 Stakeholder Engagement Action Plan

Table 4-1 provides a Stakeholder Engagement Action Plan. The plan must be continuously reviewed and updated to maintain a record of all communication and engagement activities.

Table 4-1 Stakeholder Engagement Action Plan

Activity	Stakeholders	Objectives	Communication Method	Responsibility	Timing
Scoping	All	Disclose project information: Summary of the proposed project's objectives, description, and potential impacts Determine stakeholders concerns for consideration in the scope of work/terms of reference	**Focused Engagement, Consultation, Disclosure** Targeted briefings with businesses and community representatives including surveys and questionnaires Newsletters, website updates	MEIM/Worley support	Prior to the finalization of the scoping report

Activity	Stakeholders	Objectives	Communication Method	Responsibility	Timing
	Government authorities	Identify and discuss key issues, including any potential conflicts Determine stakeholder concerns for consideration in scope of work/terms of reference	**Focused Engagement, Consultation, Disclosure** Workshops, presentations	Worley/MEIM	Prior to the finalization of the scoping report
Environmental Assessment and Production of Draft ESIA	All	Disclose information on study methods and findings	**Disclosure** Newsletters, website and E-mail updates	Worley/MEIM	Following the finalization of the scoping report and preparation of the draft ESIA Report
	All	Establish if stakeholder concerns have been addressed	**Consultation** Record of Consultation	Worley	Following the finalization of the scoping report and preparation of the draft ESIA Report

Activity	Stakeholders	Objectives	Communication Method	Responsibility	Timing
Final ESIA Report	All	World Bank OP. 4.01: Summary of EA conclusions in a form and language meaningful to the groups being consulted for review and comment. Summary of the ESIA to be accessible online per Equator Principle 10	**Disclosure** Non-technical summary including mitigation plan as appropriate distributed via E-mail to key stakeholders and accessible online as appropriate	Worley/MEIM	During the finalization of the ESIA Report
	MEIM, Lender	Agree mechanism for any ongoing consultation	**Focused Engagement** Meeting	Worley/Lender	During the finalization of the ESIA report

Activity	Stakeholders	Objectives	Communication Method	Responsibility	Timing
	MEIM, Lender	ESIA report officially submitted to lender	**Disclosure** The report is made accessible online	Worley/Lender	Following the finalization of the ESIA report
Implement Environmental Management Plan	Local communities of the project area	Inform communities/industries of any potentially disruptive work/activities	**Disclosure**	Project owner	During the construction phase of the project
	All	Disclose results of environmental monitoring	**Disclosure**	Project owner	During the construction phase of the project
Grievance Mechanism	All	Set up a mechanism for stakeholders to raise concerns and grievances about the project	Stakeholder database	Worley/MEIM	Throughout the project, early in the project cycle

Activity	Stakeholders	Objectives	Communication Method	Responsibility	Timing
Project Implementation	Lender	World Bank Group Guidance requires a report which demonstrates: ■ Compliance with measures agreed on the basis of the findings and results of the EA, including the implementation of any Environmental management plan; ■ Status of mitigation measures; and the findings of the monitoring program	**Disclosure** Report to the lender	Project owner	During the operation phase of the project

4.3 Grievance Mechanisms

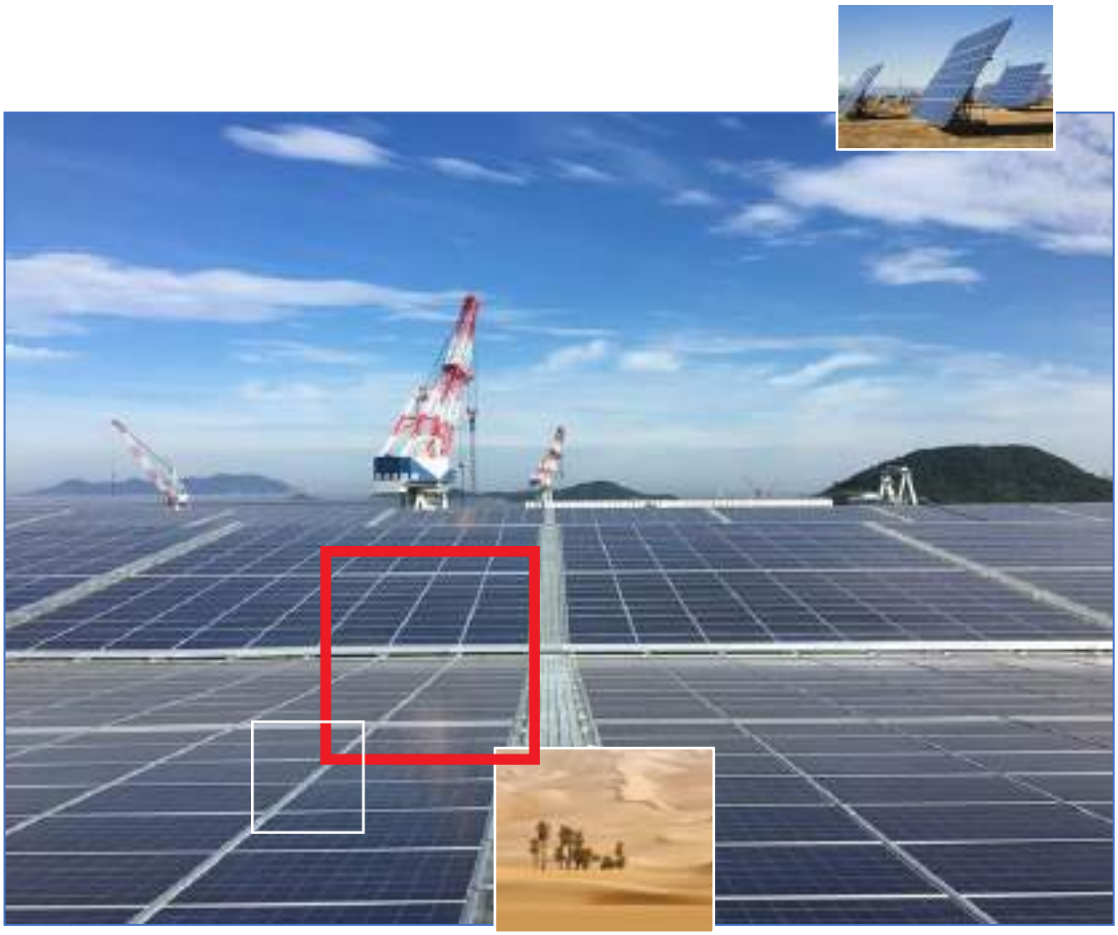
The management of grievances is a vital component of stakeholder engagement and an important aspect of risk management for a project. Grievances can be an indication of growing stakeholder concerns (real and perceived) and can escalate if not identified and resolved. Identifying and responding to grievances supports the development of positive relationships between projects, communities and other stakeholders. Monitoring of grievances will signal any recurrent issues, or escalating conflicts and disputes.

The project developer should implement a Grievance Mechanism to ensure that it is responsive to any concerns and complaints particularly from affected stakeholders and communities. The Developer will accept all comments and complaints associated with the Project and individuals who submit their comments or grievances have the right to request that their name be kept confidential.

RENEWABLE ENERGY DEVELOPMENT OFFICE

Summary

Ar Rass Solar PV Park



Al-Yaum Tower
Dammam-Al-Khobar Highway Near Chamber of Commerce
Al Khobar 31952
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Project Summary

Ar Rass Solar PV Park (hereinafter 'the Project") is located in the Al Qassim Province of Saudi Arabia, about 24 km south-east of the city of Ar Rass. The total area of the project is about 57.6 km^2.

The proposed Project will entail the installation and operation of eight (8) independent solar generating units (SGUs) with a combined projected output of approximately 2,620 MW, which is equivalent to approximately 7,006 GWh per year. This yearly production will be equivalent to supplying energy to 345,000 households and result in significantly reducing the emission of greenhouse gases by 7 million tons of CO_2 equivalent.

The site proposed for the Project is located approximately 24 km south-east of the city of Ar Rass in Al Qassim Province. The location is an undeveloped and unfenced area.

Table 01 Project Site Coordinates (WGS84 zone 38N)

Point	X	Y
Pto-1	43.57155	25.61813
Pto-2	43.62129	25.61861
Pto-3	43.72329	25.62339
Pto-4	43.71212	25.59529
Pto-5	43.62175	25.57889
Pto-6	43.57202	25.57841

The site will have an Interconnection Cabin for the collection of the feeders from the inverter stations and for interconnection with the national grid, as well as an Administration and Control building and associated facilities.

The results of the yield assessment conducted shows that the Solar Energy Park will be able to generate up to 7,006 GWh, considering the proposed plant design and the available solar resources of the site.

The study defines the Basis of Design, assessing the available solar resources, and conducting preliminary design and yield assessments for the plant. Several small optimization studies were conducted to confirm some of the key design parameters: The PV modules will be aligned in a north-south orientation in a single-axis tracking system and turn on a single axis (+60°/-60°) to follow the sun from east to west. For an optimum GCR[1] of 0.4 %. The remaining design parameters were selected considering industry trends and proven equipment The main characteristics of the configuration of the Project are summarised in the table bellow:

The main components of the proposed Project are as follows:

- PV modules
- 1,048 Inverter stations, including all MV components (transformers, MV switchgear, inverters, communications, control units and auxiliary services),.
- Cabling (DC, AC, LV and MV and HV) necessary for collecting and transporting energy will be selected and sized to withstand local conditions (e.g., temperature and radiation) and to minimize energy losses
- Earthing system
- Racking system, single-axis tracking
- A Fence will be installed around the site that complies with Saudi Arabian Standards
- Roads
- Security system and intruder detection system for each
- Instrumentation and control system, SCADA
- Interconnection with the Saudi Arabian Transmission System
- 380 kV overhead transmission line from the SS to the existing 380 kV lines
- Internal 132 kV high voltage evacuation lines from the SGU to the SS
- Eight (8) 33/110kV SGU substations (SGUSs)
- Buildings: interconnection cabin, Administration and Control building and associated facilities, storage and maintenance, and control access
- Infrastructure including:
  - Roads and access
  - Buildings
  - Water supply
  - Stormwater management

[1] The Ground Covering Ratio (GCR) is the length of the module divided by the distance from the front edge of a module to the front edge of a neighbouring module.

Project Location

Regulatory Framework:

Environmental quality standards, in the Kingdom of Saudi Arabia, such as emission standards are established by GAMEP.

The EIA study adopts and complies with the most stringent environmental standards, both nationally and internationally.

Ecological Sensitivity:

According to Protected Planet and the Integrated Biodiversity Assessment Tool (IBAT), there are no protected or sensitive areas located within 10 km of the project area. The nearest protected area is designated as a recreational area, Hima al-Ghada, and is located about 20 km east of the proposed project site. There are two other protected areas as well; Jabal Tukhfah is about 80 km south west of the proposed project area, and Nafud al-'Urayq about 90 km west of the Project area

Summary of Significant Impacts after Mitigation

The following table provides an overview of impacts significance before and after mitigation.

Impacts significance before and after mitigation

Receptor	Significance before mitigation	Significance after mitigation
Avifauna	**Moderate**	**Minor**
Avifauna	**Moderate**	**Minor**
Air – Fire and explosion	**Moderate**	**Minor**

A monitoring plan which is designed to control and ensure compliance with the proposed mitigation measures is presented in the ESIA.

Stakeholder comments

Stakeholder name:

Comments:

Attendees

	Name	Stakeholders
1.	م. عبدالعزيز حمد الخضيري – مدير عام التخطيط والتميز المؤسسي	وزارة النقل
	م. سالم جبران القحطاني – مدير عام تخطيط الطرق	
2.	أحمد بن سليم العتيبي	وزارة الإسكان
3.	عبدالله بن مسعود الرشيدي	
4.	محمد بن حجاج الحجاج	الهيئة العامة للاستثمار
5.	هشام بن عبدالله الفوزان	
6.	سلطان بن عبدالله الضويحي	هيئة الاتصالات وتقنية المعلومات
7.	عبدالله سالم الدوسري	وزارة التجارة والاستثمار
8.	خالد محمد التميمي	الهيئة العامة للنقل
9.	ياسر بن عبدالعزيز الجربوع	وحدة التحول الرقمي
10.	العقيد الركن أحمد العبدالكريم النصرالله	وزارة الدفاع
11.	عبدالعزيز بن عبدالله الفراج	الهيئة العامة للسياحة و التراث الوطني
12.	فيصل بن عبدالله الفايز	
13.	إبراهيم الدايل	

	Name	Stakeholders
14.	العقيد الدكتور / نايف محمد الحازمي	وزارة الداخلية
15.	الرائد المهندس / عبدالله بن صالح العوفي	
16.	حسن بن مرزوق الفهادي	
17.	الملازم أول المهندس / ياسر بن حمد العتيبي	
18.	م علي بن سعيد الغامدي	وزارة البيئة والمياه والزراعة – الإدارة العامة للتشريعات والأداء البيئي
19.	أحمد بن محمد سليمان	وزارة البيئة والمياه والزراعة – نائب مدير الإدارة العامة لموارد المياه
20.	أحمد بن سعيد باجحلان	وزارة البيئة والمياه والزراعة – نائب مدير الإدارة العامة للتشريعات والأداء البيئي
21.	سعد الدين أبو زهرة	وزارة البيئة والمياه والزراعة – أخصائي بيئي وكالة الوزارة للبيئة
22.	قاسم بن أنور الهلال	وزارة البيئة والمياه والزراعة – مهندس بيئي وكالة الوزارة للبيئة
23.	أنور بن مبخوت النهدي	الهيئة العامة للأرصاد وحماية البيئة – مدير إدارة التراخيص
24.	راكان بن عبدالله الغامدي	الهيئة العامة للأرصاد وحماية البيئة – مدير إدارة التأهيل البيئي
25.	أرجان بن عمر زميريق	الهيئة العامة للأرصاد وحماية البيئة – نائب مدير عام خدمات المناخ
26.	حمزة بن عبدالعزيز كومي	الهيئة العامة للأرصاد وحماية البيئة – نائب مدير عام الإدارة العامة للتوقعات

	Name	Stakeholders
27.	محمد بن يسلم شبراق	المشرف العام على مركز سعود الفيصل لحماية الحياة الفطرية
28.	علي بن عبدالعزيز العساف	الهيئة السعودية للحياة الفطرية – مدير مركز المعلومات البيئية
29.	فواز بن محمد البارودي	الهيئة السعودية للحياة الفطرية – مدير الدراسات والأبحاث البرية
30.	سلطان الناباسي	صندوق الاستثمارات العامة
31.	فارس الحارثي	ارامكو
32.	سالم الثبيتي	وزارة الشئون البلدية و القروية
33.	هاني تطواني	الهيئة السعودية لحماية الحياة الفطرية – نائب الرئيس
34.	د. سامي الصريصري	هيئة الطيران المدني
35.	مالك المزروع	مدن
36.	فيصل الجندل	وزارة الاقتصاد والتخطيط
37.	Mawani	المؤسسة العامة للموانئ
38.	SEC	الشركة السعودية للكهرباء

	MINUTES OF MEETING					
	Project/Dep't. Doc #	*Phase IV Solar Energy Parks*	Rev.	*<Rev>*	Date	*21-08-2019*
	Project/Dep't. #/Name	*Renewable energy*	*Solar*			
	Client Name	*Renewable Energy Project Development Office (REPDO)*				

Meeting Title / Purpose:	Stakeholder Meeting	**Location:**	Riyadh
Meeting Leader:	*REPDO*	**Meeting Time:**	9:00
Issued by:	Worley		**X** A.M. ☐ P.M.
Issued for Information to:	*REPDO*		

Topic No.	Minutes	Action By	Action Due Date
01	REPDO representative welcomed the attendees to the Stakeholder Meeting, which provides a presentation of four (4) Phase IV Solar Energy Parks Projects at four (4) locations; Ar Rass, Saad, Wadi Ad Dawasir, and Layla.	Inf.	
02	REPDO presented a video on MEIM's objectives with respect to the development of renewable energy projects and the vision of KSA's National Renewable Energy Program (NREP) in line with Saudi Vision 2030.	Inf.	
03	The team of Worley presented the agenda for the meeting and an overview of the four (4) Solar Energy Parks Projects in Ar Rass, Saad, Wadi Ad Dawasir, and Layla, highlighting the studies conducted as part of the projects including the ESIA studies.	Inf.	
04	An attendee highlighted the need to protect biodiversity during the development of the projects, and noted that migratory birds have different migration patterns. In light of this, he asked on the proposed mitigation measures for the anticipated impacts and whether these will cover all phases of the projects. Mr. Nikolaos of Worley answered that the ESIA studies include a framework for Environmental Management Plans (EMPs) and Environmental Monitoring Plans to ensure compliance with proposed mitigation measures covering all phases of the projects such as construction and operation phases.	Inf.	
05	Mr. Nayef Al Hazmi of the Ministry of Interior asked on whether there are other renewable energy projects in other parts of the Kingdom. Eng. Asem of REPDO answered that the selected locations cover different parts of the Kingdom and highlighted renewable energy projects in the northern and western parts of Saudi Arabia. Eng. Asem stated that this stakeholder meeting addresses the projects in the central part of the Kingdom. Previous stakeholder meetings were held for other renewable energy projects in the western region (e.g. Mahd Al Dahab and Faisaliyah Solar Energy Parks Projects).	Inf.	
06	The Ministry of Interior representative asked on whether Saad Solar Energy Project will feed the city of Riyadh. Mr. Nikolaos of Worley answered that energy generated from the project will be connected to the National Grid and that the project is expected to supply energy to thousands of households.	Inf.	
07	An attendee asked on why there are smaller and larger scales solar projects. Eng. Asem of REPDO answered that there are various factors taken into consideration. These include outcomes of consultations with the Saudi Electricity Company and the energy demand per location. Eng. Asem highlighted the limitations associated with renewable energy in general, such as meteorology and weather conditions.	Inf.	

08	An attendee asked on when the projects will be released for tendering. Eng. Asem of REPDO answered that the projects will be developed as Independent Power Producer (IPP) projects and that REPDO is relying on the ministries and other relevant agencies to provide their non-objection letters as soon as possible in order to accelerate the process. The ESIA study is part of the pre-development studies for the projects and stakeholder engagement with relevant ministries and government bodies is a key component of the process. REPDO intends to release the projects for tendering in the final quarter of 2019.	Inf.	
09	A representative from Saudi Wildlife Authority asked on the type of mitigation measures considered in the projects with respect to Avifauna. Mr. Nikolaos of Worley answered that several mitigation measures are considered such as burying cables underground and keeping infrastructure as low as possible as well as good housekeeping. As part of the ESIA, a framework for Environmental Management Plan (EMP) and Environmental Monitoring Plan will be part of the ESIA in order to monitor potential impacts and determine the need for further mitigation measures throughout the life of the projects.	Inf.	
10	Mr. Malek Al Mazro'o of MODON asked whether all project locations are under REPDO's management. A REPDO representative answered that some locations are already under REPDO's management, while others will be under REPDO's management upon consultation with other relevant agencies.	Inf.	
11	A REPDO representative concluded the meeting by thanking the attendees. He urged the attendees to send their non-objection letters as soon as possible in order to speed the tendering process. Project location coordinates, along with the stakeholder meeting presentation, will be sent by REPDO to all attendees.	REPDO	Week (Aug 25-29)