Draft Initial Environmental Examination

Project Number: 55182-001
Initial Environmental Social Examination
April 2022

India: AJ Solar Power Project
(Part 1 of 3)

Prepared by Arcadis India Private Limited for AEW India West One Private Limited and the Asian Development Bank.

ARCADIS

Draft Report

Initial Environmental, Social & Gender Examination (IESE) & Rapid Bird Survey

80 MW Solar Project, Surendranagar, Gujarat, India

Ref. No. 10050057

Prepared for:

AEW India West One Private Limited and
Asian Development Bank (ADB)

Prepared by:

Arcadis India Private Limited

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Disclaimer:

Information contained in this report is based on the observations during survey and interview with stakeholders. The interpretation of data and judgment is based on the professional experience and represent professional opinion of the interpreter.

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LIST OF ABBREVIATIONS

AAQ	Ambient Air Quality
AC	Alternative Current
ADB	Asian Development Bank
AEWIWOPL	AEW India West One Private Limited
ASI	Archaeological Survey of India
AOI	Area of Influence
BMTPC	Building Materials and Technology Promotion Council
BPL	Below Poverty Line
CPCB	Central Pollution Control Board
CSR	Corporate Social Responsibility
CGWB	Central Ground Water Board
CGWA	Central Ground Water Authority
CTE	Consent to Establish
CTO	Consent to Operate
CR	Critically Endangered
E&S	Environmental & Social
EHS	Environment, health and safety
ESZ	Eco- sensitive Zone
EPA	Environment Protection Act
EPC	Engineering, Procurement, and Construction
IESE	Environment & Social Impact Assessment
ESMP	Environmental and Social Management Plan
ERP	Emergency Response Plan
EPF	Employees Provident Fund
FCA	Forest Conservation Act
FPIC	Free, prior, informed consultation
GHG	Greenhouse gas emissions
GRM	Grievance Redress Mechanism
GSS	Grid sub-station
GPCB	Gujarat Pollution Control Board
GUVNL	Gujarat Urja Vikas Nigam Limited
H&S	Health & Safety
HR	Human Resources
HSE	Health, Safety and Environment

HW	Hazardous Waste
HP	Handicap Peoples
IBA	Important Bird Area
IESE	Initial Environmental, Social and Gender Examination
IPs	Indigenous Peoples
IPP	Independent Power Producer
IFC	International Finance Corporation
EBRD	European Bank for Reconstruction and Development
IUCN	International Union for Conservation of Nature
ISO	International Organization for Standardization
ISMW	Inter-State Migrant Workmen
kV	Kilovolt
KLD	Kilo Litre per day
Lpcd	Litre per capita per day
MSW	Municipal Solid Waste
Km	Kilo meter
MW	Megawatt
MoEF&CC	Ministry of Environment, Forest & Climate Change
MoM	Minutes of Meeting
NH	National Highway
NOC	No Objection Certificate
NGO	Non-governmental organisation
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
PGCIL	Power Grid Corporation India Limited
PPE	Personal Protective Equipment
PPA	Power Purchase Agreement
PSS	Pooling Substation
PV	Photovoltaic
PS	Performance Standards
PUC	Pollution Under Control
POSH	Prevention of Sexual Harassment
RAP	Resettlement Action Plan
R&R	Rehabilitation & Resettlements
RO	Reverse Osmosis
RoW	Right of Way

SC	Scheduled Caste
ST	Scheduled Tribes
SEP	Stakeholder Engagement Plan
SOP	Standard Operating Procedure
SCADA	Supervisory control and data acquisition
SPV	Special Purpose Vehicle
SSNNL	Sardar Sarovar Narmada Nigam Limited
Taluka/ Tehsil/Block	Administrative division
TL	Transmission line
WHO	World Health Organization
WHH	Women Headed Households

EXECUTIVE SUMMARY

Background

AEW India West One Private Limited (hereinafter referred as "AEWIWOPL" or "AEW") is developing an 80 MW solar power plant in Jhakan and Kataria Villages, Limbdi Tehsil/Block of Surendranagar district Gujarat, India (hereinafter referred as the "project" or "proposed project").

Asian Development Bank (ADB) intends to invest in the proposed project. In this context, the environmental and social risks/impacts associated with the project require evaluation and development and implementation of mitigation measures to avoid adverse impacts.

Arcadis India Private Limited (hereinafter referred as Arcadis) was appointed by AEWIWOPL & ADB to undertake an Initial Environmental, Social and Gender Examination (IESE) of the proposed project. The objective of the IESE is to understand the environmental and social sensitivities associated with the solar power project as well as assess the ability of the project to comply with ADB requirements and implement mitigation measures during the Project's lifecycle in order to avoid, reduce or mitigate negative impacts.

To obtain data on the environmental & social conditions of the site along with consultation with relevant stakeholders of the project, Arcadis team has undertaken a site reconnaissance visit in fourth week of September 2021 to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the project. Suitable mitigation measures and Environmental and Social Management Plan (ESMP) have been devised accordingly. The identified impact and mitigation measures are discussed in the subsequent sections of this report.

The IESE study for the proposed project has been undertaken in accordance with the scope of work assigned by AEWIWOPL & the report is prepared in line with the requirement of ADB Safeguard Policy Statement (ADB SPS, 2009), ADB Social Protection Strategy (2001), ADB Gender and Development Policy (1998) and ADB Access to Information Policy (2018).

Project Overview

The proposed project is located on ~ 332 Acres land ranging from flat to slightly undulating private agricultural & open scrubland across two villages namely Jhakan and Kataria under Limbdi tehsil/Block of Surendranagar district in the state of Gujarat.

During the site visit of Arcadis team, the project was in early stages of planning and land procurement is underway; the site was greenfield, and no on-site activity was noticed.

The proposed project site is approachable through National Highway (NH-8A). Beyond the Jhakan village, the project site is accessible through an existing unpaved village road connecting the southern part of the project. The unpaved road itself runs along the southern part of the project site. Nearest railway station is the Limbdi Railway Junction located at an approximate distance of 14 km from site. Nearest airport to the site is Ahmedabad Airport, located at an approximate distance of 120 km.

The nearest villages to the project site are: i) Katariya village (towards south-west direction at an approximate aerial distance of 900m from the boundary of the proposed project site; ii) Jhakan village located towards south direction at an approximate aerial distance of 3.2 km from the boundary proposed project site; and iii) Choraniya village located ~ 3.2 km south- west from the proposed project site.

The EPC contractor for the project, responsible for installation of the project components and development/procurement of project related common infrastructure, is yet to be finalised and hired. The generated power from the project will be evacuated to 220 KV Grid Sub-station (GSS) is located Choraniya village which is ~ 3.5 km from the project site. The proposed project is scheduled for commissioning on 30th July 2022.

Applicable Reference Framework	ADB Policies and Strategies including but not limited to: (1) ADB's 2009 Safeguard Policy Statement (SPS) – Safeguards Requirement SR 1 on Environment, SR2 on Involuntary Resettlement (IR), and SR 3 on Indigenous Peoples (IP); (2) ADB Social Protection Strategy (2001); (3) ADB Gender and Development Policy (1998); (4) Access to Information Policy (2018); and o Applicable local, national and regional requirements, including but not limited to those related to environmental impact assessment, environmental permitting, labor, public consultation, resettlement and compensation, ethnic minorities/groups, occupational health and safety, community health and safety, and emergency response. o Relevant international conventions and protocols relating to environmental and social issues, as transposed into national legislation; and International best practices, including those promulgated by other international financial institutions as World Bank, IFC, International Labour Organization, and others. These include relevant IFC Performance Standards and international guidelines, such as the World Bank Group General Environment, Health & Safety (EHS) guidelines (2007), and the Guidelines for Electric Power Transmission and Distribution (2007), as well as the IFC/EBRD Workers' Accommodation: Processes and Standards (2009).
ADB- SPS 1: Environment	Applicable This SPS is applicable to environmental aspects like but not limited to air emissions, water and wastewater management, noise emissions, biodiversity, hazardous material management. The proposed project site and associated infrastructure (Transmission line) does not fall within 10 km of any Protected Areas such as National Parks, Wildlife Sanctuaries, etc. The nearest Protected Area and Important Bird Area (IBA) is Nalsarovar Bird Sanctuary located approximately 19.3 km north-east of the project site. The Nalsarovar Bird Sanctuary has a government notified Eco-sensitive Zone (ESZ). The Sanctuary has been designated as a Ramsar site[1] recognizing it as a Wetland of International Importance under the Ramsar Convention. A review of gazette notification/MoEF&CC notification dated 7th June 2017[2], indicates that an area to an extent varying up to 13 km from the boundary of the Nalsarovar Bird Sanctuary in the State of Gujarat, as Nalsarovar Bird Eco-sensitive Zone. However, the project site is located outside the boundary ESZ of Nalsarovar Bird Sanctuary. As per the available secondary information, Nalsarovar Sanctuary harbours 226 bird species, 20 species of fish and 13 species of mammals including globally threatened species of birds and mammals such as Sarus crane, Indian Skimmer, Asiatic Wild Ass and Wolf as outlined in above notification. Nalsarovar Bird Sanctuary is an important stopover site within the Central Asia Flyway, with globally threatened species such as the critically endangered Sociable Lapwing (*Vanellus gregarius*) and the vulnerable Marbled Teal (*Marmaronetta angustirostris*) stopping over at the site during migration, while the

[1] *https://rsis.ramsar.org/ris/2078?language=en Assessed on 28th Sep 2021*

[2] https://upload.indiacode.nic.in/showfile?actid=AC_CEN_16_18_00011_198629_1517807327582&type=notification&filename=Nalsarovar%20Bird%20Sanctuary,%20Gujarat.pdf Assessed on 28th Sep 2021

	vulnerable Sarus Crane (*Grus antigone*) takes refuge there during summer when other water bodies are dry. Therefore, the potential impact on biodiversity cannot be excluded. Furthermore, the project site is part of the reported ranges of certain potential Critical habitat (CH) trigger species such as Lesser Florican (*Sypheotides indicus*) as defined by the applicable reference frameworks, namely the IFC Performance Standard 6 (PS6), 2012 and the ADB Safeguard Policy Statement (SPS), 2009. During bird survey, three male Lesser Florican (Sypheotides indicus) (IUCN EN v. 2021-1) were sighted in Jakhan Village, in the grassland about 50-100 m opposite to the projected land for the Solar Power Project. The bird survey report is annexed separately. This IESE is being conducted by Arcadis as part of the "identification of risks and impacts" requirement under the IFC PS 1. The management plan prescribed in this IESE report will be implemented for mitigation of impacts identified. An Environmental and Social Management Plan (ESMP) has been prepared and included in Chapter 7 of the IESE for managing mitigating the potential social and environmental impacts or risks already identified & assessed in IESE.
SPS 2: Involuntary Resettlement	Applicable The project will be spread over on approx.332 acres of private agriculture land. Out of 332 acres of total land, approximately 238.7 acres of private land to be leased from the 87 (Eighty-seven) landowners in Katariya village and the remaining 93.3 acres of land to be leased from the 29 (twenty-nine) landowners in Jakhan village, who are primarily engaged in agricultural allied activities for their source of livelihood. o There is no land acquisition for the project, land is being voluntarily leased by the landowners and adequate lease rent will be paid. Most of the landowners have alternative land for doing agriculture activities. They are not solely dependent on the proposed project land. o Land leasing will not result in any physical or economic displacement among landowners, the land sourced for developing the project is unirrigated rainfed agriculture land. As discussed in the subsequent subsections, the agriculture is not extensively cultivated due to lack of irrigation. And as reported by during the consultation with the landowners, average earning of a good season from their land parcel leased for project was INR. 8000-12,000 /acre /annum. And by leasing the land to the project the landowners were able to make assured income through yearly lease rental of INR. 33,500/Acre/Annum for 29 years & 6 months with 5 % escalation for every three years. As reported, the landowners are willingly leasing their land because the existing agriculture practices on the proposed land has become unviable due to increased labour cost and infertile land in the region. Now they can have fixed income from leasing of land and have voluntarily agreed on the compensation/term payment Therefore, land leasing will not have any adverse impact on the livelihood of the landowners. Out of 116 landowners, 28 have been consulted during site visit and they are satisfied with the land leasing process and compensation package. o The six agriculture workers reported to have reduced agriculture activities due to the development of solar project. are not primarily dependent on the piece of project site land. Moreover, the project will generate number of direct and indirect employment opportunities in the neighbouring villages both during construction and operation phase, the work includes various construction works during the construction phase and during operation phase like grass cutting, module cleaning, panel tilting works, deployment of security staffs etc. o With respect to proposed transmission line, Right of way and payment of compensation will be decided following due criteria as per the Guidelines issued by Ministy of Power on Right of Way for Transmission lines dated 15th Oct 2015. Transmission towers are proposed to be erected on the private land through negotiation on voluntary basis.

	Hence, there is will not be regarding issues arise on Right of Way for transmission line, etc
SPS 3: Indigenous People	Not Applicable The study area (located in Surendranagar district) does not fall in any Notified Tribal Area of Surendranagar State. There is no tribal population reported in both the villages and also verified from the secondary data of Census of India 2011. Therefore, no tribal land will be involved.
Key impacts during construction phase	*Impact on air quality:* Air quality in the study area will be impacted in the form of fugitive dust emissions from construction/installation activities, dust during land clearance and preliminary construction, vehicular emissions and exhaust emissions from DG sets. *Impact on Noise:* Settlements of Chorania, Jakhan and Ghaghosar villages may be affected by increasing noise levels because of proximity to the project site and sealing of the village road(s). *Water resources*: Water demand during construction phase is not anticipated to put some pressure on local water resource. *Agriculture and Domesticated animals*: 332 acres of open land will be converted into solar project. Loss of open area and agricultural land will have some impact on agriculture. *Conflict between migrant and local community:* About 450 number of workers is expected to be involved in the construction activities. Social impact associated with migrant workers is negligible. *Health and safety:* The construction phase activities such as installationof solar PV panels, construction of transmission lines and substations and movement of material andpersonnel may result in impacts on the health and safety of the workers and the community. These activities will involve the use of heavy machinery and live transmission power lines. Accidents in workplace may lead to occupational health and safety issues, for which proper training to workers need to be given to combat the same as well as it needs to be further ensured that the workers wear appropriate PPE's according to their nature of work. *Impact on ecology & biodiversity*: The project region is characterised by the presence of White-rumped Vulture, *Gyps bengalensis* c.22 km north-east of the project, and fairly recent ones at a similar distance to the north-west. There is also record of Lesser Florican (*Sypheotides indicus*) about 22 km in the Nalsarovar Wildlife Sanctuary and in the project area as confirmed during surveys in July. Likely there is presence of Egyptian vulture in the study area (eBird); also Asian Houbara (*Chlamydotis macqueeni*) and Sociable Lapwing (*Vanellus gregarious*) are found in the area. Project layout and transmission line route have been modified to minimize impacts.
Key impacts during operation phase	*Ecological Risk*- The project area falls in the breeding site of the Lesser Florican. Lesser Florican is previously recorded from the district of Surendranagar and from Velavadar National Park and it was important to ground verify the same. Field surveys have confirmed presence of the species in the project area. Field surveys have been undertaken twice, once in late July (21st July to 28th July 2021) during the sighting of the Lesser Florican when it breeds & in September (monsoon season). Three male Lesser Florican species have been observed in July. Power lines located between feeding and roosting areas of flocking birds may present an increased collision risk. Birds recorded from the study area during the field survey that fly in groups and are at a high risk of collision with transmission line. Therefore, the impacts anticipated to the biodiversity, specifically birds will likely be adverse (may result in loss of population of species, impact from the electrical transmission infrastructure -electrocution and collision risk). Proposed mitigation would reduce the risk considerably to moderate.

Soil contamination: Storage/ improper disposal of broken/ damaged solar panel may result in soil/ ground water contamination.

Waste generation: The waste generated from project includes domestic solid waste at SCADA building and substation and hazardous waste like waste oil, lubricants and solar panels.

Water resources: Use of dry-cleaning technologies is proposed. Therefore, water requirement for module cleaning purpose will be negligble.

Occupational health and safety: Accidents like electrocution, short circuits may lead to occupational health and safety issues, for which proper training to workers need to be given to combat the same as well as it needs to be further ensured that the workers wear appropriate PPE's according to their nature of work.

Employment: During the operations phase, the requirement for unskilled and semi-skilled labour is expected to reduce to 20 and 15 respectively. The locally procured services will include maintenancework of the facility, 24 hour security, bush and undergrowth cleaning and housekeeping activities.

Social Welfare: A community development plan along with a grievance redressal mechanism should be implemented. Complaints received by locals should be registered, investigated and timely resolved.

Key Mitigation Measures

For the purpose of providing site specific mitigation measures to mitigate key identified impacts from the project, an ESMP has been developed. The ESMP specifies the standards and controls required to manage and monitor environmental and social impacts during construction and operation phases. To achieve this, the ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment. This is in accordance with ADB SPS which emphasizes the importance of managing social and environmental performance throughout the lifecycle of the project.

Construction phase:

Raw/fine material should be covered with tarpaulin sheet during transportation and in storage area.

All project vehicles will comply with national emission standards.

Temporary barriers/fencing shall be installed in excavated areas.

All the vehicles should have valid PUC certificate.

Secondary containment to be used for fuel storage tanks

Septic tank to be installed. Periodic maintenance of septic tank to be ensured to avoid overflowing.

Restrict major noise generating activities during nighttime 10:00 pm to 6:00 am

Avoid transmission line towards Plant side substation construction during lesser florican (LF) breeding season (last week of Julyto first week of September)

Ensure hazardous waste containers are properly labelled and stored onsite provided with impervious surface, shed and secondary containment system and disposed GPCB authorized vendors/recyclers.

The construction contractor should ensure collection and timely ((bi-monthly) disposal of construction waste generated debris, concrete, metal cuttings wastes as per the Construction and Demolition Waste Management Rules 2016.

.Broken Solar panels will be stored at a designated area within the plant with appropriate safety measures until the same is disposed of to the manufacturer/authorized dealer..

AEWIWOPL should implement Grievance Redressal mechanism. t should be ensured that a complaint register is maintained onsite so that any complaints from the locals or labours can be registered, investigated and timely resolved.

.Contracting opportunities for locals possessing tractors, dumper trucks or other vehicles which would be needed to carry away excavated soil and other material. Creation of indirect employment for local community through establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc.

Operational phase:

Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding noise or any other issue related to project activity is not left unnoticed. The complaints should be registered, investigated and timely resolved.

Ensure dry robotic cleaning is undertaken at the operational plant so as to decrease the stress on local water resources, especially groundwater resources.

Water to be used from authorised vendors, potable packaged water for staff & workers.

The sewage generated onsite will be treated and disposed through septic tanks and soak pits. Ensure that septic tanks are emptied and collected by contractor at appropriate intervals to avoid overflowing. The sewage generated onsite shall be treated and disposed through septic tanks and soak pits as per specifications given in IS 2470: 1995 (Part I and II)

The hazardous waste (such as transformer waste oil & bottom sludge) generated will be disposed through GPCB/CPCB approved vendors in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended.

Bird diverters will be installed on all capacity lines.

TL towers shall have 220 kV AL 59 conductor and each tower shall have porcelain insulator and connection at each tower point shall be through jumper conductor to avoid electrocution of nesting/roosting birds.

Monitoring of LF during the breeding season (late July to first week of September) to assess the site-specific impacts and updating the mitigation measures.

Monthly fatality monitoring along the TL route for the first 2 years of TL operations, to be revised thereafter based on the results thereof.

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E&S categorization of the project	**Safeguard Requirements 1: Environment.** The project has been evaluated considering the environmental (SPS1) categorization of ADB. The adverse environmental and social impacts of the project are considered site-specific and reversible. Therefore, it has been classified as **Category B** in accordance with ADB's SPS1 (2009). The rationale for categorisation is as follows: o Solar power project is a clean technology (while category as per CPCB categorization) project using solar energy for generation of electricity. o Potentially limited risks/impacts are reversible: Available data suggests that the construction, operation and decommissioning of the proposed solar project is likely to have environmental and social impacts during the construction, operation, and decommissioning phase and will encompass changes in land-use, increased noise levels, changes in air quality, biodiversity, use and changes in water availability and quality, occupational health & safety, etc. Most of these impacts identified are limited to the project site and its immediate vicinity and can be minimized through implementation of mitigation measures as proposed in the ESMP. Furthermore, no harmful emissions are expected from the project operations.

- The project site does not coincide or overlap with any Designated Area.
- Unprecedented: Solar power project is developing in large numbers in the last decade and therefore several such projects are located across India including Gujarat. Ministry of New & Renewable Energy (MNRE)/ Gujarat Urja Vikas Nigam Limited (GUVNL) has sanctioned various solar projects of varying capacities in Gujarat including the vicinity of proposed project site. The proposed project and its surrounding areas consist of a number of upcoming and operational solar projects (Refer Section 2.1). Therefore, the solar power project cannot be considered an unprecedented activity.

Safeguard Requirement 2: Involuntary Resettlement

On the backdrop of the understanding of the categorization of ADB Projects and based on Involuntary Resettlement impacts and based on the following facts, the proposed Project can be classified as **Category B** with respect to SPS 2 – Involuntary Resettlement:

- There is no land acquisition for the project, land is being voluntarily leased by the landowners and adequate lease rent will be paid. Most of the landowners have alternative land for doing agriculture activities. They are not solely dependent on the proposed project land. There will be temporarily shift of the farm labours working on the land.
- There is not a single case of involuntarily resettlement and no physical displacement is taking place due to leasing of land for the project. The lease rent is INR 33,500/Acre/Annum for 29 years & 6 Months with @5 % escalation after every three years on current rates, and lease. Also, it was reported at the site that lease rent INR 33,500/acre/annum will be paid uniformly to all the landowners, irrespective of the aspects like difference in land quality, location of land.

As reported, the landowners are willingly leasing their land because the existing agriculture practices on the proposed land has become unviable due to increased labour cost and infertile land in the region. Now they can have fixed income from leasing of land and have voluntarily agreed on the compensation/term payment Therefore, land leasing will not have any adverse impact on the livelihood of the landowners. Out of 116 landowners, 28 have been consulted during site visit and they are satisfied with the land leasing process and compensation package.

Safeguard Requirement 3: Indigenous Peoples

On the backdrop of the understanding of the categorisation of ADB Projects and based on impacts of IPs and based on the following facts, the proposed Project can be classified as **Category C** with respect to SPS 3 – IPs:

The study area (located in Surendranagar district) does not fall in any Notified Tribal Area of Surendranagar State. There is no tribal population reported in both the villages and also verified from the secondary data of Census of India 2011. Therefore, no tribal land will be involved. SR 3 is not applicable in this case.

Conclusion and Recommendation	The Project proposing to generate 80 MW power through solar energy. The Project and its key components such as access road, project office building, and transmission lines are likely to have potential environmental impacts on baseline parameters such as land use, ecology, water, ambient air quality, noise quality in the immediate vicinity of project during the construction phase. The project is also likely to have potential impact on biodiversity (avifauna) during operation phase due to operation of high voltage transmission line. Most of these Impacts due to proposed power project are short term, generally limited to construction and operation phase & have negligible, moderate to high environmental, social and ecological impacts. During bird survey, three male Lesser Florican (*Sypheotides indicus*) (IUCN EN v. 2021-1). were sighted on three different days in Jakhan Village, in the grassland about 50-100 m

opposite to the project land for the Solar Power Project. Adequate measures have been recommended to address the ecological impacts.

Additionally, the social impacts from the project are assessed to be generally beneficial in terms of local employment and overall local area development.

It is important for AEWIWOPL to implement the suggested mitigation measure to minimize the impacts over the environment, social and ecological resources in order to mitigate overall impact significance.

The Environmental and Social Management Plan (ESMP) and as outlined in chapter 6 of this report describes mitigation measures for impacts specific to project activities and also discusses implementation mechanism. To conclude, the implementation of ESMP will help AEWIWOPL in complying with national/state regulatory framework as well as to meet ADB Safeguard policy framework requirements.

This Executive Summary should be read in conjunction with the full report and reflects an assessment of the site based on information received by Arcadis at the time of reporting.

1 INTRODUCTION

AEW India West One Private Limited (hereinafter referred as “AEWIWOPL” or “AEW”’) is developing an 80 MW solar power plant in Jhakan and Kataria Village, Limbdi Tehsil/Block of Surendranagar district Gujarat, India (hereinafter referred as the “project” or “proposed project”).

AEWIWOPL participated in the tender issued by Gujarat Urja Vikas Nigam Limited (GUVNL) of India for setting up of Grid Connected Solar PV Project in Gujrat and won a capacity of 80 MW Solar Project for supply of solar energy for 25 years. The proposed project is scheduled for commissioning in October 2022.

AEWIWOPL has undertaken an Initial Environmental, Social and Gender Examination (IESE) for the project. The IESE aimed to assess Project-related impacts regarding to environmental and social aspect against ADB Safeguard Policy Statement (ADB SPS, 2009), ADB Social Protection Strategy (2001), ADB Gender and Development Policy (1998) and ADB Access to Information Policy (2018).

The objective of the study is to understand the environmental and social sensitivities associated with the solar power project as well as assess the ability of the project to comply with the requirements of the above-mentioned guidelines and implement mitigation measures during the Project’s lifecycle in order to avoid, reduce or mitigate negative impacts against the applicable standards to support AEWIWOPL’s application for finance from Asian Development Bank (ADB). For this purpose, Arcadis India Private Limited (Arcadis) has been appointed to carry out IESE of the proposed project.

The outcomes of the IESE, including mitigation measures and monitoring are summarized in the Environmental and Social Management Plan (ESMP). The ESMP will combine the mitigation and monitoring requirements identified in the IESE to provide an overview of future environmental and social commitments of this Project.

This IESE report also discusses the environmental and social baseline within which the proposed project will be commissioned and assesses the potential adverse, and beneficial impacts that the project could have, along with suitable mitigation measures and an Environmental and Social Management Plan (ESMP) for the project.

Arcadis team undertook a site reconnaissance visit for the project on 20^{th,} 21st and 22nd September 2021 to obtain data on the environmental conditions for the various identified parameters along with the social survey of the site. Biodiversity survey (bird survey) of the site was conducted during July and September 2021 to understand any ecological sensitivities in the vicinity of the project site.

1.1 Project Overview

Table 1.1 provides a snapshot of the proposed project. The location of the project is presented in **Figure 1.1**.

Table 1-1: Project Overview

Particulars	Description
Project Name	80 MW Solar Power Project
Project Capacity	80 MWac/120 MWp
Project Owner	AEW India West One Private Limited
Location of Site	Village: Jhakan and Kataria Village Tehsil/Block: Limbdi Surendranagar (Gujarat)

Particulars	Description
Geographical Coordinates	Latitude 22.58 °N Longitude 71.84 °E
Current Status	• Grid connectivity obtained for the Project • Bay allotment process completed for the Project. • Land aggregator appointed • Legal due diligence completed on Project land
Nearest village Settlements	North: Village Mota Timbla South: NH 47 East: Village Katariya West: Village Bhalgamda
Site Surroundings	North: Narmada Minor Canal South: NH 47 East: Village Katariya West: Village Bhalgamda
Nearest Town Major Town	Surendranagar (35 km in West)
Nearest Railway Station	Nearest railway station District -Limbdi (14km in West)
Nearest Airport	Ahmadabad Airport, ~ 120km.
Nearest Sea Port	Mundra Port
Total Land Area	332 acres
Period of land Leasing	29 years 6 Months
Land holding type/ Classification of land	Private agricultural land
Type of Land use (5 km radius from site)	Agricultural land, open scrub, water body and settlement
Present status of the project/project phase	Planning phase.
Power evacuation	Choraniya 220KV Substation. ~ 3.5 km (transmission line)
Location of PSS	Within the solar plant
Mode of Implementation	EPC (Engineering, Procurement and Construction)
Project Life	29 years 6 month

Source: information provided by client and consultation with project proponent during site visit of Arcadis team

1.2 Purpose & Scope of work

Arcadis understands that ADB intends to invest in the proposed 80 MW solar power plant in Surendranagar, Gujarat. In this context, the project requires evaluating the environmental and social risks/impact associated with the project and to implement mitigation measures to avoid adverse impacts for the remainder of the project's lifecycle. The project has to comply with international standards, which have been presented in the applicable reference framework below, along with applicable national, state and local regulations. This report discusses the environmental and social baseline within which the proposed solar power project is commissioned and assesses the adverse and positive impacts that the project could have, along with suitable mitigation measures and an Environmental and Social Management Plan (ESMP) for the project. The following section provides an understanding of the scope of work and the applicable reference framework for the project.

1.2.1 Scope of Work & Reference Framework

The scope of work for the proposed 80 MW solar power project entails the following.

- Determine administrative, legal and policy frameworks relevant to the proposed project at international, national, regional and local level.
- Project Categorization
- Biodiversity Survey
- Socio-economic baseline
- Gender Assessment
- Identify environmental sensitivity and land-use pattern.
- Land transaction
- Stakeholder engagement
- Collection and generation of baseline environmental data (primary & secondary)
- To list out all the species of Flora and Fauna affected due to project activity (both temporarily and permanently)
- Identify all potential significant adverse environmental and social impacts of the project and recommend measures for mitigation.

Preparation of IESE report. Development of Environmental & Social Management Plan (ESMP) to mitigate the adverse impacts during construction & operation phase along with suitable Green belt development plan with proposed Budget

The Reference Framework includes:

- ADB Policies and Strategies including but not limited to:
  - ADB's 2009 Safeguard Policy Statement (SPS) – Safeguards Requirement (SR) 1 on Environment, SR2 on Involuntary Resettlement (IR), and SR 3 on Indigenous Peoples (IP);
  - ADB Social Protection Strategy (2001);
  - ADB Gender and Development Policy (1998);
  - Access to Information Policy (2018); and
- Applicable local, national and regional requirements, including but not limited to those related to environmental impact assessment, environmental permitting, labor, public consultation, resettlement and compensation, ethnic minorities/groups, occupational health and safety, community health and safety, and emergency response.
- Relevant international conventions and protocols relating to environmental and social issues, as transposed into national legislation; and
- International best practices, including those promulgated by other international financial institutions as World Bank, IFC, International Labour Organization, and others. These include relevant IFC Performance Standards and international guidelines, such as the World Bank Group General Environment, Health & Safety (EHS) guidelines (2007), and the Guidelines for Electric Power Transmission and Distribution (2007), as well as the IFC/EBRD Workers' Accommodation: Processes and Standards (2009).

1.3 Methodology for the IESE

The approach and methodology adopted for undertaking the IESE study is as provided below. The IESE process has been undertaken following a systematic process which predicts and evaluates the possible impacts of the project on aspects of the physical, biological, socio-economic and cultural environment, and identifiesthe measures to be taken to avoid, minimize/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the IESE process are described below.

Task 1: Kick off Meeting

Arcadis team had an initial discussion with AEWIWOPL & ADB. The key discussions that were undertaken included the following:

- Introductory meeting with the AEWIWOPL
- A discussion was also held with regard to the expectations from this assessment in terms of scope of work, deliverables, timeline and the methodology to be followed for the same.
- Finalization of site visit plan
- Activity that will be undertaken by Arcadis team during site visit

Task 2: Screening & Scoping

The project screening process was conducted via desktop study, prior to the scheduled site visit. This is done to gain a broad understanding of the project site and to determine applicable Environmental and Social impact assessment requirements.

Desk- Top Review

Desk based review of the relevant documents of the project and its surroundings were undertaken to have a clear understanding of the Project and their impacts. Further, review of the secondary information available on the project areas, the administrative block, the district and the state was undertaken to substantiate the primary data. As part of the review, the proposed project area was screened using Google Earth. Based on the review of satellite imagery, the environmental and social sensitivities to be covered as part of the site visit were assessed and subsequently scoped in/out. This step was conducted utilizing a high-level description of the Project. The screening process involved the following

- Reviewing of applicable regulatory framework for the project;
- Reviewing of available project related activities and their impacts on various components of environment;
- Collection and compilation of available secondary baseline data from different sources; and
- Categorization of Project as per ADB Safeguard Policy.

The desk-based review was primarily focused on but was not limited to the following documents:

- Power purchase agreement (PPA)
- Site layout plan
- Project overview, technology, Power evacuation,
- Implementation Schedule
- Gram Panchayat NOC
- Draft copy of lease deed agreement

Site Reconnaissance, Consultation with Stakeholders

Thereafter, Arcadis environmental and social experts Mr. Santu Gorai, Dr. Chhavi Ankita, Nilay Kumar

and Sourabh Gupta visited the site in September 2021 (20h to 23rd September). Representatives from AEWIWOPL, Mr. Divya Bhagat accompanied Arcadis personnel during the site visit.

The site visit consisted of visual observation of relevant areas directly and indirectly impacted by the project, consultation with relevant stakeholders like AEWIWOPL site team, landowners and local community (a list of stakeholders and findings of consultation is provided in **Appendix F & Appendix G** in tabular form) associated with the project to discuss the environmental, safety and social issues, and obtaining any relevant additional information.

Following on- site activities were undertaken by the Arcadis team

- Debriefing with AEWIWOPL site team
- Site reconnaissance- visit to the project site
- Interaction with landowners and local community around the site
- Interaction with Landowners, land revenue department/tehsildar
- Discussion with local forest department.

Scoping Methodology

For this IESE study, scoping (refer to section 4 of this report) has been undertaken to identify the potential Area of Influence (AOI) & the study area for the project. AOI & study area has been defined in subsequent section 4 to identify potential interactions between the project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. This stage is intended to ensure that the impact assessment focuses on issues that are most important decision- making and stakeholder interest. The scoping exercise was undertaken on the basis of the information available on the project, the discussions with the project team and the prior understanding of Arcadis of solar power projects. Potential impacts have been identified through a systematic process whereby the features and activities (both planned and unplanned) associated with the operation and maintenance and decommissioning phases of the project have been considered with respect to their potential to interact with resources/ receptors.

Potential impacts have each been classified in one of three categories:

- **No interaction:** where the project is unlikely to interact with the resource/ receptor (e.g., wholly terrestrial projects may have no interaction with the marine environment);
- **Interaction likely, but not likely to be significant:** where there is likely to be an interaction, but the resultant impact is unlikely to change baseline conditions in an appreciable/detectable way; and
- **Significant interaction**: where there is likely to be an interaction, and the resultant impact has a reasonable potential to cause a significant effect on the resource/receptor.

The critical habitat screening (undertaken as part of the bird survey) indicated that the study area (including the project site) is part of the reported ranges of certain potential CH trigger species such as Lesser Florican (*Sypheotides indicus*) as defined by the applicable reference frameworks, namely the ADB Safeguard Policy Statement (SPS), 2009. The findings of the bird survey with biodiversity baseline is provided in Section 3.7.

Scoping Matrix

All environmental and social impacts and risks described in ADB -SPS have been considered for the interaction matrix. The Potential Interactions Matrix for project activities and likely impacted resources/ receptors is presented in Table 1.2.

The interaction matrix has been colour coded to indicate those interactions that are relevant to the project (coloured in black), possible (coloured in grey) or scoped-out (coloured in white). Those interactions that are grey are 'scoped out', but the IESE report includes a discussion that presents the evidence base (e.g., past experience, documented data, etc.) used to justify the basis upon which this decision was made.

Interactions that are likely to lead to significant impacts are presented in Table 1-3 and will be the focus of the impact assessment. Owing to site conditions there are certain possible interactions that will not take place. As a result, these interactions have been "scoped out" and are presented in Table 1-4.

Table 1-2: Activity-Impact Interaction Matrix for Planning, Construction, Operation & Maintenance and Decommissioning Phases

Environmental & Social Resource/ Receptors / Project Activity/ Hazards	Topography and Drainage	Land Environment	Land scape – Visual Impact	Soil Environment	Groundwater Resources	Surface Water	Air Environment	Noise Environment	Terrestrial Ecology	Ecology/Biodiversity	Loss of land base livelihood	Employment Opportunity	Infrastructure and services	Occupational Health and safety	Community Health and safety
Pre-construction phase															
Land Procurement															
Construction Phase															
Development/strengthening of access roads															
Site clearance and site preparation															
Transportation of construction materials															
Mobilizing and operating construction equipment, machinery and DG sets															
Transportation of solar modules and ancillary facilities															
Foundation excavation, piling and construction for solar mounts, site office, transformers, etc.															
Electrical cable laying and installation of PV module															
Operation and Maintenance Phase															
Washing of solar modules															
Grass cutting															
Regular Inspection and Maintenance of equipment															
Cumulative Impacts arising from solar projects in the area															
Decommissioning															
Removal of PV Modules															
Removal of ground mounted structures, ancillary facilities															

	Represents “no” interactions is reasonably expected
	Represents interactions reasonably possible but none of the outcome will lead to significant impacts
	Represents interactions reasonably possible with one of the outcomes leading to potential significant impact

Table 1-3: Identified interactions with potential significant impacts

Sl. No.	Interaction (between project activity and Resource/Receptor	Justification for Expectation of Potentially Significant Impacts
1.	Changes in Land Use	○ Construction of temporary structures during the construction phase, such as portacabins, office & toilets would lead to changes in the land use albeit for a short period; ○ Setting up the project would require clearing of vegetation for Project related activities. ○ Installation of solar panels and other components, paving and widening the existing access roads, setting up site office will lead to permanent change in land use; and ○ Restoration of solar plant site after Project cycle will reverse the land use to the original one.
2.	Alteration of Topography and drainage	○ The terrain of the project land is plain and very limited undulations. The project layout will follow natural contour. Hence, no cut and fill is envisaged for the Project land.
3.	Impact on Soil / Land Environment	○ Vegetation clearance and construction can change the soil properties and negatively affect soil stability in the area. ○ Vehicle movement can compact or erode soil further. ○ Improper waste disposal can contaminate soil and groundwater. ○ Storage and handling of hazardous waste (e.g. fuel and lubricant) and accidents/negligence leading to leaks and soil contamination; ○ Generation of hazardous waste during operation of the Project e.g. small amounts of waste oil; and discarded solar panels (treated as hazardous waste)
4.	Impact on Air Quality	○ Operation of D.G. sets, vehicular movement and construction activities can cause fugitive and point source emission and dust.
5.	Impact on Water Environment	○ Construction of the project will require water from local sources to carry out its activities. Water will be sourced from authorized vendors through tankers for civil works, domestic use in site office & dust suppression. Packaged water will be used for drinking Therefore, there will not be any impact on surface/ground water resource. ○ During operation phase, for cleaning solar PV modules, project will be using 100% robotic Dry cleaning where water requirement is very minimal, thus, Dry cleaning methods for module cleaning would minimize impact on local water environment.
6.	Increased Ambient Noise Level	○ Operation of construction equipment, machinery, piling, D.G. sets, vehicular movement and maintenance activities would increase the ambient noise levels; ○ Local communities, such as that of Jhakan and Kataria villages, may be disturbed due to higher than anticipated noise.
7.	Ecology/Biodiversity Assessment/ Bird Survey	○ Impact on habitats and species may result from vegetation clearance, construction of site and access roads. Impact to avifauna may also occur due to collision & electrocution with the transmission lines.

Sl. No.	Interaction (between project activity and Resource/Receptor	Justification for Expectation of Potentially Significant Impacts
8.	Local Economy and Employment	○ The project will hire 150skilled and 300 unskilled laborer, contractors and subcontractors. It is within the scope of contractor to provide rented accommodation for construction staff. No international staff are envisaged to be required. ○ The small contracts and trades of various goods and services required for the project development will be mostly sourced locally which will directly and indirectly encourage local employment and economic activities in the region.
9.	Land-based Livelihoods	○ There is no land acquisition for the project, land is being voluntarily leased by the landowners and adequate lease rent will be paid. Most of the landowners have alternative land for doing agriculture activities. They are not solely dependent on the proposed project land. Therefore, land leasing will not have any adverse impact on the livelihood of the landowners. Out of 116 landowners, 28 have been consulted during site visit and they were satisfied with the land procurement process and compensation package. ○ Among 15 agriculture labours consulted, about 06 women agriculture workers reported to have reduced agriculture activities/job opportunities due to the development of solar project. These agriculture labours are not primarily dependent on the piece of project site land. Moreover, the project will generate number of direct and indirect employment opportunities in the neighbouring villages both during construction and operation phase
10.	Community Health & Safety	○ Community health and safety hazards during construction phase include increased traffic, dust pollution due to movement of large vehicles, and during operation phase there is risk of electrocution and structural damage of the transmission lines. In addition improper management of solid & hazardous waste and broken solar panels at site may lead to soil/water contamination. ○ The labour during the construction and operation phase will primarily be recruited from the local community who are willing and eligible, the influx of population in the study area due to the project is expected to be restricted to the 150 skilled project workers. The skilled workers will be given rented accommodation at the nearby villages. Interference of the staffs and technicians travelling to site with the local workforce may lead to spread of communicable disease and COVID-19.
11.	Labour and Human Rights	○ The internal policies of the developer, contractors and subcontractors will largely determine the labour and working conditions practiced in the project throughout its lifecycle. However, the scale of impacts either positive or negative will be observed mainly during the construction stage when the number of workers engaged is the highest compared to other stages of the project. ○ Labor conditions and human rights of the supply chain have been assessed by ADB separately to this IESE.
12.	Gender Impact Assessment	○ Assess impacts on demographics, education attainment, participation in income generation activities, labour division and decision making within the family in term of gender equality, especially ethnic minority.

Sl. No.	Interaction (between project activity and Resource/Receptor	Justification for Expectation of Potentially Significant Impacts
13.	Traffic Safety	○ Changes in traffic volume contributes to increase risks of traveller safety, especially the Project is located near to National Highway.
14.	Cumulative Impact	○ Due to presence of other solar projects the following cumulative impacts may occur: ○ Land rates in the area may increase due to multiple solar projects being developed in the area. Also, there will be further loss of agricultural land. ○ Construction phase of current and upcoming projects in the area may cause increased air emissions and noise levels. ○ Ecological impacts associated with additional transmission line.

Table 1-4: Scoped-out Interactions

Sl. No.	Impact Title	Reason for Scoping-Out
1.	Indigenous People	○ According to the Census records and consultations with the local community, the study areas do not have any Scheduled Tribe population. Therefore, no impacts on indigenous people are envisaged.
2.	Impact on cultural resources and heritage structures	○ No structures bearing cultural, historical, religious or spiritual significance are located within the vicinity of the project. ○ Community consultations and discussions with the project site team also confirmed that the project would not impact any such structure.
3.	Natural/Common Property Resources	○ Common property resources either due to traditional use or recognizable rights (legal) include animal grazing land, pathways of commute, meeting/gathering areas etc. Such areas may be belonging to a private owner or government but used by the community at large. ○ Based on the consultation with local community, it was understood that villagers have their animal grazing land, community hall etc. within the village and no such common property has been procuredby the project.

Task 3: Analysis of Alternatives

The individual project components and the construction technologies, project planning has been considered for the development of the project alternative. These would include both locations alternatives and technological alternatives which are evaluated considering the bio-physical and Socio-economic sensitivities to identify the best alternative as described in the subsequent section.

Task 4: Stakeholder Analysis & Engagement Plan

Based on the understanding developed during the screening and scoping stage, Arcadis has developed a Stakeholder Engagement Plan (SEP) including and Grievance Mechanism, as a part of the IESE.

Task 5: Baseline environmental monitoring

Environmental monitoring has been carried out within 10km (Study area) of the project site. Technical approach for baseline monitoring is presented in the subsequent sections: Arcadis has engaged NABAL accredited third -party monitoring agency for baseline monitoring of physical environmental quality (Air, water, noise and soli etc.)

Task 6: GIS Mapping

Maps for the study area such as land-use, ecological sensitivity map, drainage map, contour map/digital elevation map and areas of cultural and ecological importance has been represented through GIS mapping. Geotagged location map has been provided in Figure 3.50. Various maps have been depicted in the report to substantiate the project description and impact assessment sections.

Task 7: Ecological Assessment

Assess proximity of solar sites to ecologically sensitive areas, i.e., national parks, wildlife sanctuaries, wetlands of conservation importance, forest areas and animal corridors.

Assess major habitat types; screening of potential critical habitat if any; mapping the extent of modified and/or natural habitat (including critical). The ecology study should determine if there are species protected as per the Indian Wildlife Protection Act, 1972 and threatened as per IUCN Red List (latest version) located within a 10-km radius of the proposed solar projects. Impacts to sensitive habitats and species from construction activities and determine electrocution risk of flora and fauna on transmission line components.

Task 8: Identification & Assessment of Environmental & Socioeconomic Impacts

It involves the prediction, evaluation and mitigation of impacts, and also report on impacts including residual impacts (impacts remaining after all possible mitigation has been incorporated). Impact prediction will take into account control measures that are part of the Project design. Additional mitigation measures aimed at further reducing predicted impacts has been proposed where necessary or appropriate.

The principal aim of this task is to identify and assess potential impacts on various environmental components due to the Project. The impacts will be identified and quantified for the intensity using matrix techniques and evaluated as major, medium, minor or insignificant impacts on the environment and communities in the study area. The likely impacts has been assessed during the construction and post construction phase (once the project interventions are complete) has been presented in the IESE report.

Task 9: Environmental and Social Management and Monitoring Plan (“ESMP”)

The ESMP specifically not only delineates preventive measures, but also includes end of the pipe treatment which need to be adopted during the project implementation. This will serve as an optimal mix to minimise the adverse environmental impacts of the proposed activities and to meet the prescribed limits of environmental standards.

The ESMP included information on the potential impact being managed, the proposed management control, responsibility for implementation, when mitigation should be applied and how it will be documented. Consists of the set of mitigation and management measures to be taken during implementation of the project to avoid, reduce, mitigate, or remedy for adverse impacts.

To understand the effectiveness of the implementation of the environmental safeguards a monitoring mechanism has been defined. The Monitoring mechanism has defined the aspects / parameters to be monitored, frequency of the sampling and the reference standards against which it would be analysed. A reporting and evaluation mechanism would also be proposed in the Environmental Monitoring Plan.

An institutional mechanism for the implementation of the ESMP and the management plans has been suggested. For each of the actions/ mitigation measures, proposed responsibilities etc. are defined as part of the institutional mechanism for ESMMP Implementation, including roles for monitoring. In

addition, if gaps have been identified in the institutional studies with respect to the capacities of the institution, training plans would be formulated as part of the institutional mechanism.

1.3.1 Limitations

This report has been prepared primarily based on the information/ documentation provided to Arcadis team by the client and information gathered during consultation with site representatives and stakeholders. The completeness of the work is based to a considerable extent upon the accuracy, correctness, completeness and fitness of the information provided by client and whilst Arcadis have sought to evaluate this completeness and robustness where practicable, it makes no assurances, representations as to, or assume any responsibility for, the accuracy, correctness, completeness or fitness for purpose of the data itself. Where specific concerns regarding, the data have been identified, these are raised in this report.

The conclusion and observations are based upon available data from AEWIWOPL and the assessment has taken into account variations in site conditions throughout the year. All potential impacts have been identified.

Further, most information and findings are based on oral statements by the AEWIWOPL team and land aggregator which have been verified, as much as possible, by observations on site, as well as through document analysis. The IESE team had to rely partly on management interviews. This has been indicated in the report using the word “reportedly” or “As reported”.

The site-specific limitation is given below:

- As the project is in early stages of planning and land procurement is underway, information related to technical details including specification of modules and the other plant components are presently unavailable.
- During Arcadis team visit to the site, land parcels were not demarcated and reportedly the same will be undertaken after land procurement is completed. Hence, Arcadis team has to rely upon site representative of AEWIWOPL to understand the site area. During site visit, the site was greenfield, and no activity was noticed in identified land parcels.
- Information related to project logistics, organizational structure and resource requirement is also presently unavailable and will be shared by AEWIWOPL upon preparation of Detailed Project Report (DPR). An information request checklist has been shared with AEWIWOPL.
- Ground water sampling could not be carried out due to unavailability of source. However, to understand the ground water scenario in the area, the report published by Central ground water board (CGWB) has been referred in the following baseline section. During site visit, consultation with stakeholders was carried out together with AEWIWOPL site representative and same is provided in the report recorded through photographic evidence. Consultation with landowners were also carried out during the site visit. Consultation was carried out with limited numbers of landowners as per their availability during site visit.

1.4 Structure of the IESE Report

Table 1-5: Structure of the IESE Report

Section	Title	Description
Section 1	Introduction	Introduction to the Project as well as IESE methodology
Section 2	Project Description	Technical description of the Project & related infrastructure and activities

Section	Title	Description
Section 3	Administrative Framework	Discussion of the applicable environmental and social regulatory framework and its relevance for the Project.
Section 4	Environmental, Ecological and Social Baseline	An outline of the Environmental, Ecological and Social Baseline status in the area of the Project.
Section 5	Analysis of Alternatives	An outline of current and no of project scenario, alternative method of power generation and conclusion
Section 6	Environmental and Social Impact Assessment	Details of identified environmental impacts and associated risks due to project activities of the Project, assessment of significance of impacts and mitigation measures for minimizing and /or offsetting adverse impacts identified.
Section 7	Environmental and Social ManagementPlan	Outline of the Environmental and Social Management Plan (ESMP) considering identified impacts and planned mitigation measures and monitoring requirements.

2 PROJECT DESCRIPTION

This section provides a description of the project in terms of location, facilities and associated project infrastructure and activities during the project lifecycle and facilitates an identification of the potential impacts on resources and receptors that could result from project activities during the planning, construction and operation stages.

As observed during Arcadis team visit to the site, the project was in early stages of planning and land procurement is underway and the site was greenfield, no on-site activity was noticed.

As mentioned in Table 1-1 of this report, the proposed project is located on land ranging from flat to slightly undulating private agricultural & open scrubland across two villages namely Jhakan and Kataria village under Limbdi tehsil/Block of Surendranagar district in the state of Gujarat. Project location map is depicted in Figure 2.1. The location of the project on toposheet is depicted in Figure 2.2.

The nearest villages to the project site are i. Katariya village (towards south-west direction at an approximate aerial distance of 900m from the boundary of the proposed project site); ii. Jhakan village is located towards south direction at an approximate aerial distance of 3.2 km from the boundary proposed project site and iii. Choraniya village is located ~ 3.2 km south- west from the proposed project site.

The proposed project site and associated infrastructure (Transmission line) does not fall within 10 km of any Protected Areas such as National Parks, Wildlife Sanctuaries, etc. The nearest Protected Area and Important Bird Area (IBA) is Nalsarovar Bird Sanctuary located approximately 19.3 km north-east of the project site. The location of Nalsarovar Bird Sanctuary from the project site is depicted in Figure 2.4.

As reported during site visit and in consultation with land aggregator, the project will be spread over on approximately 332 acres of private agriculture land. Around 116 titleholders are there of which 29 titleholders are from Jakhan and rest 87 are from Katariya village. No physical displacement is taking place due to leasing of land for the project and no locals are being physically displaced due to the associated project activities. As reported, the landowners are satisfied with the leasing of land because the existing agriculture practices on the proposed land has become unviable due to increased labour cost and infertile land in the region. Now they can have fixed income from leasing of land and have voluntarily agreed on the compensation/term payment provided which is Rs 33,500/Acre/annum for 29 years & 6 months with 5 % escalation after every 3 years. However, during consultation about 6 women agriculture labors reported that there will be reduced agriculture labor works in the village due to the upcoming solar projects. These workers are seasonal floating agriculture labors from the neighboring villages and are not primarily dependent on the piece of project site land.

220 KV Grid Sub-station (GSS) is located in Choraniya village which is ~ 3.5 km from the proposed project site. Compensation for the Right of Way (RoW) for Transmission line shall be made as per the Ministry of Power Guidelines. A transmission line between the project pooling substation and the GSS will be developed. There are currently 3 options, depicted in Figure 2.6.

- Option 1. AEW Proposed independent TL Route 1, from 220KV PSS AEW to GETCO Choraniya 400KV Substation (shown in red color in Fig 2.6).
- Option 2. AEW Proposed TL Route 2 with Juniper line, from 220KV PSS AEW till Juniper line independent line (green color) and then with Juniper line (pink color) to GETCO Choraniya 400KV Substation.
- Option 3. AEW Proposed independent TL Route 3, from 220KV PSS AEW to GETCO Choraniya 400KV Substation as shown in green color.

The project will upgrade 2 village roads which shall be approximately 4m and 0.5 m shoulder on both side and ~ 1.2 km in length. The accessibility map to the project site is depicted in Figure 2.3. The access road to the project site gets connected to National Highway (NH)- 8A. Nearest railway station is the Limbdi Railway Junction located at an approximate distance of 14 km from site. Nearest airport to the site is Ahmedabad Airport, located at an approximate distance of 120 km.

Figure 2.5 depicts the project plant layout. The red outline distant from the PV panels on the western side is the area for the Main control room and Plant PSS, the blue dotted line represents village road.

Figure 2-1: Project Location Map

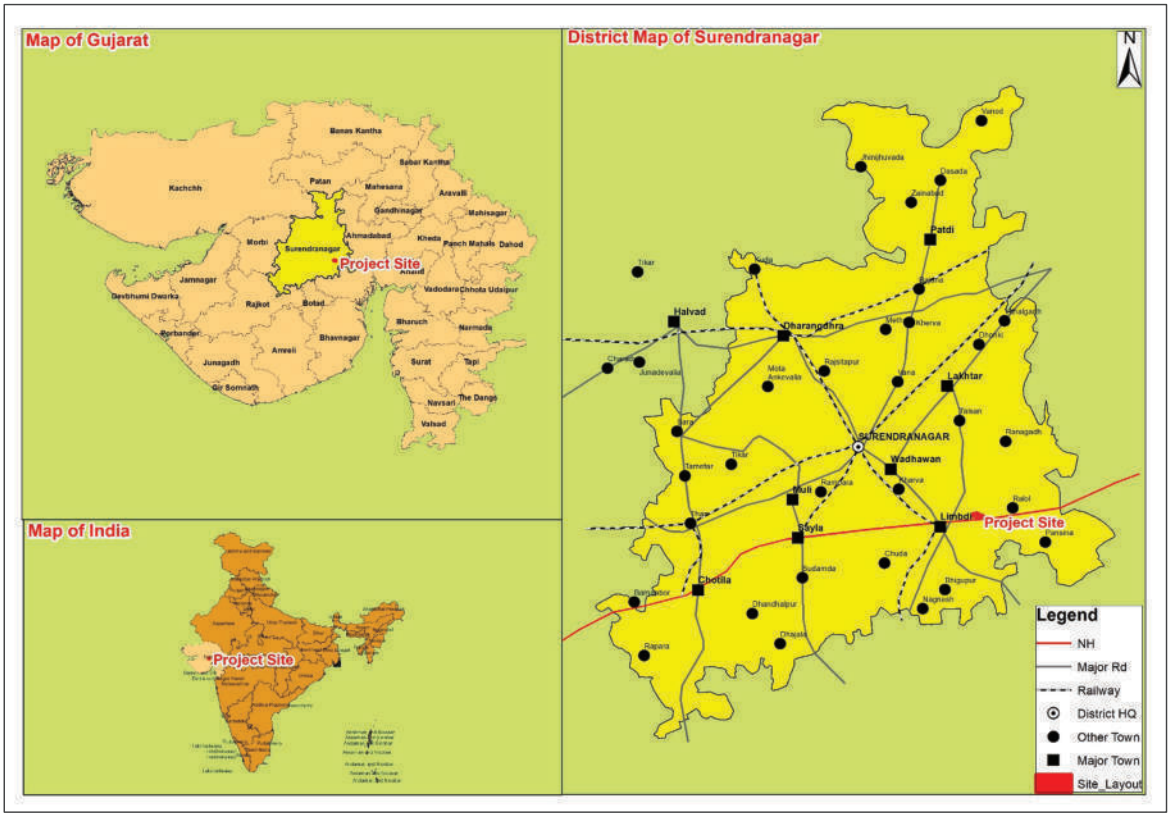


Figure 2-2: Project Location Map (Toposheet)

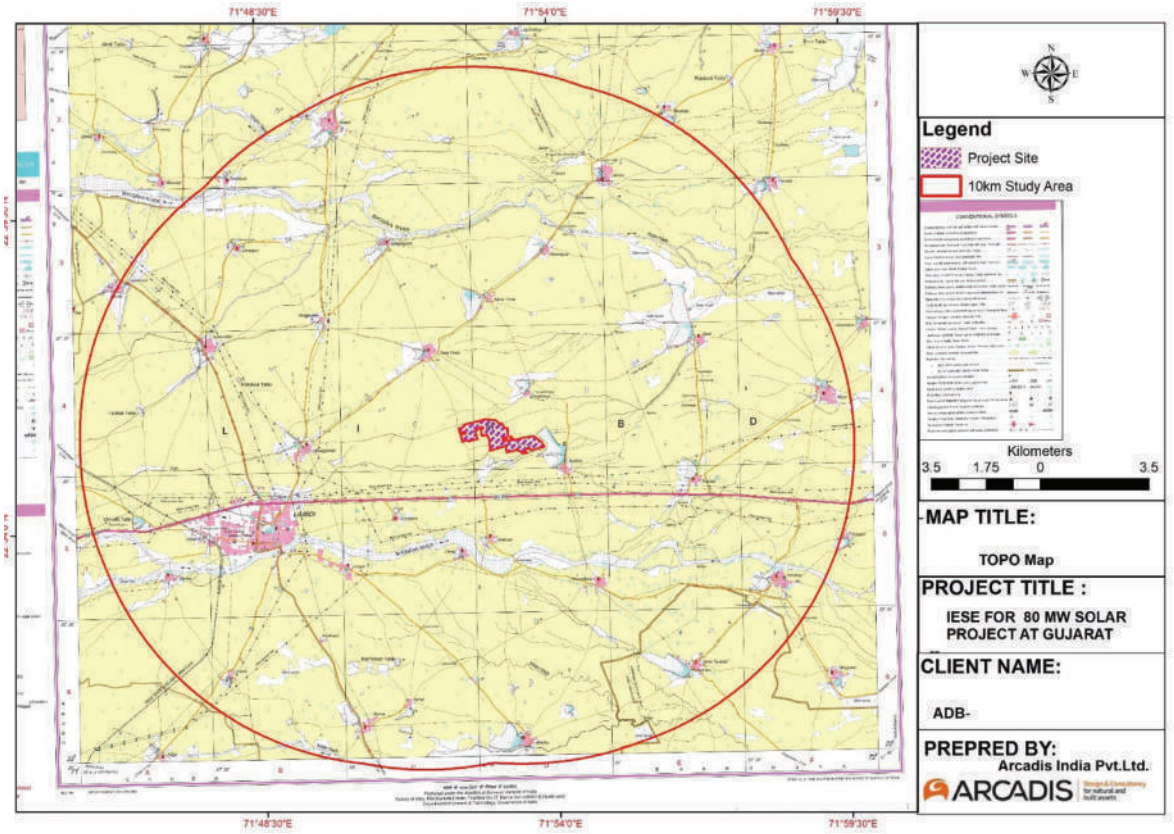


Figure 2-3: Accessibility of the Project Site

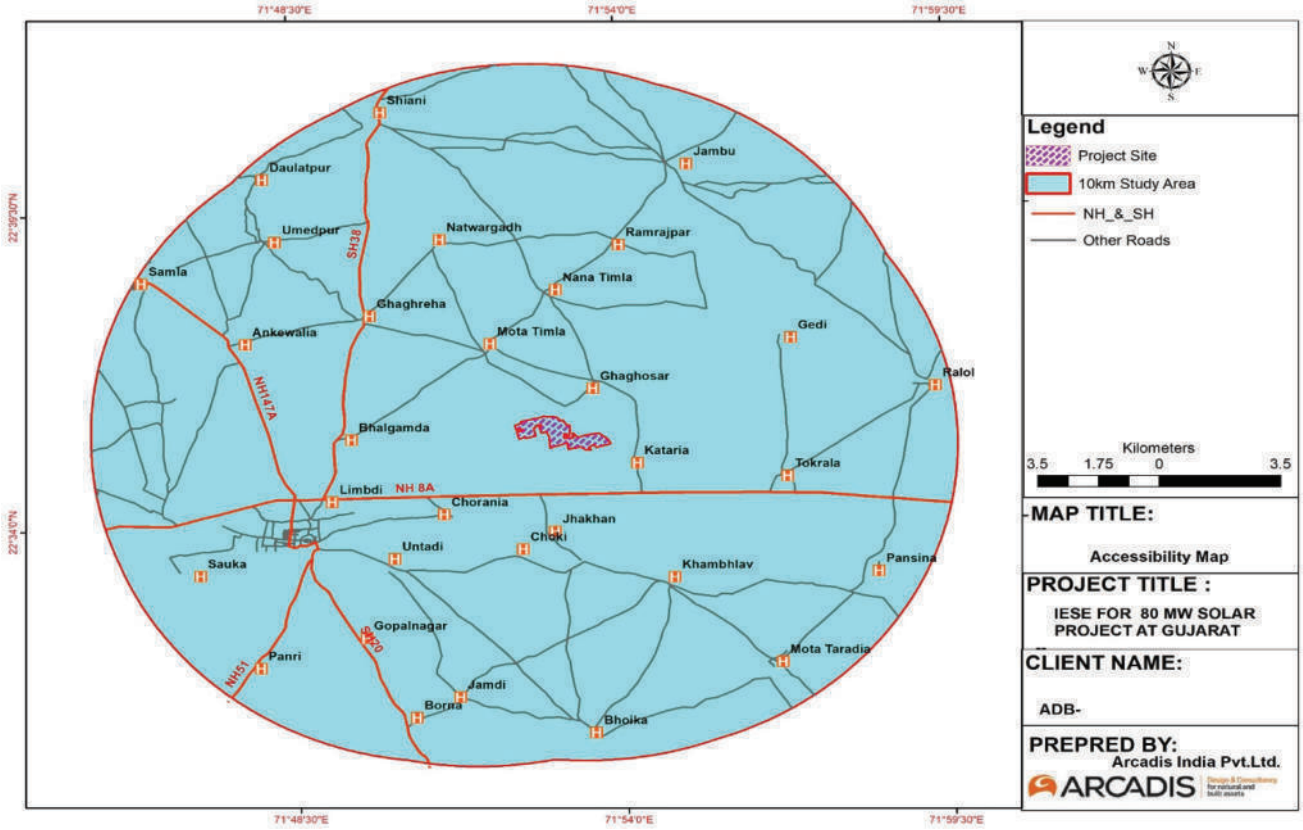


Figure 2-4: Map Showing the location of Nalsarovar Bird Sanctuary from the project site

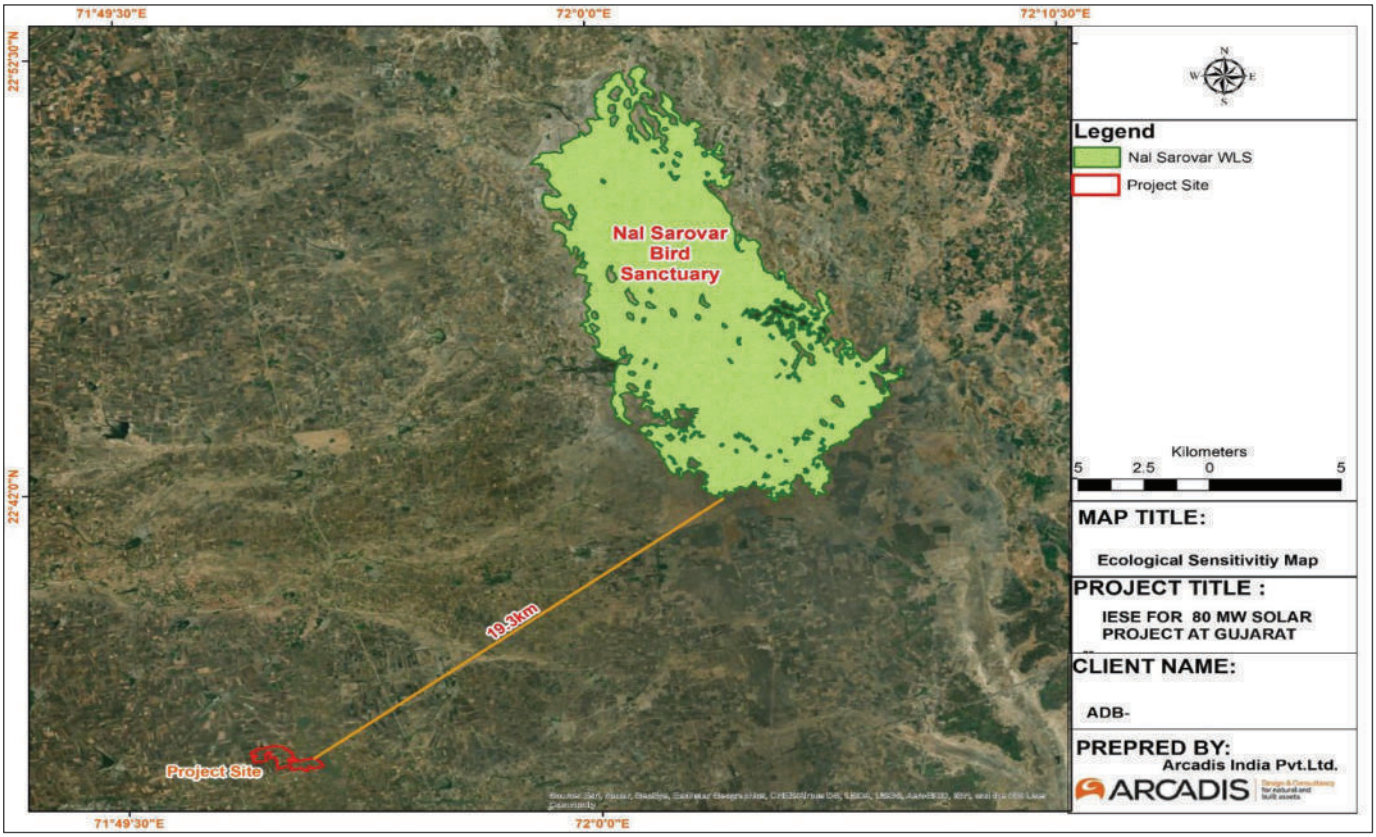
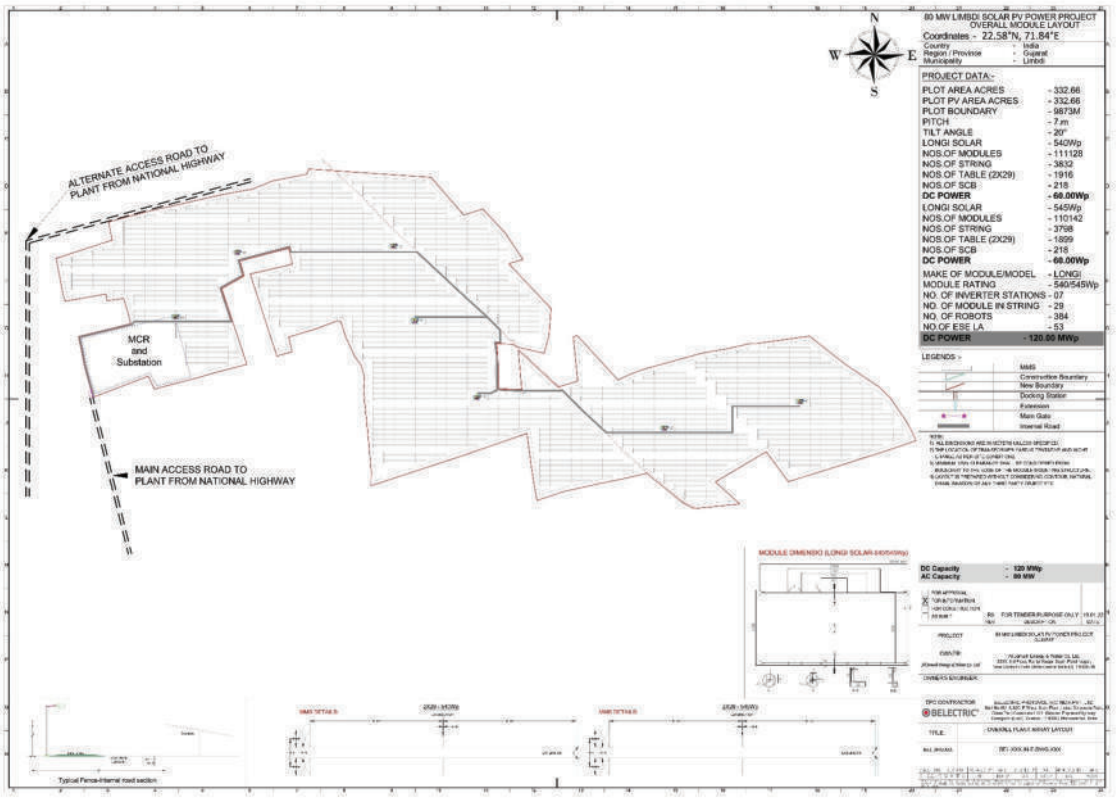


Figure 2-5: Project Plant layout



2.1 Other Renewable Projects in Vicinity

The area surrounding the project site are characterized by both proposed and operational solar power plants. One operational solar power plant is present was in the study area. The details of solar plants observed within 20 km from the site (along with their distance from the proposed project site), are as follows.

Operational solar plant:

- 300 MW solar power plant by Avaada ~ 19km North of the proposed 80 MW project site (also funded by ADB).
- Aditya Birla Renewables at ~ 14 km from the project site

Proposed solar plant:

- Juniper is planning to develop a 150 MW solar power project near the proposed 80 MW project site. This will include a transmission line which connects to the same GSS as the current project.

Figure 2-6: Map showing Transmission Line Option Routes

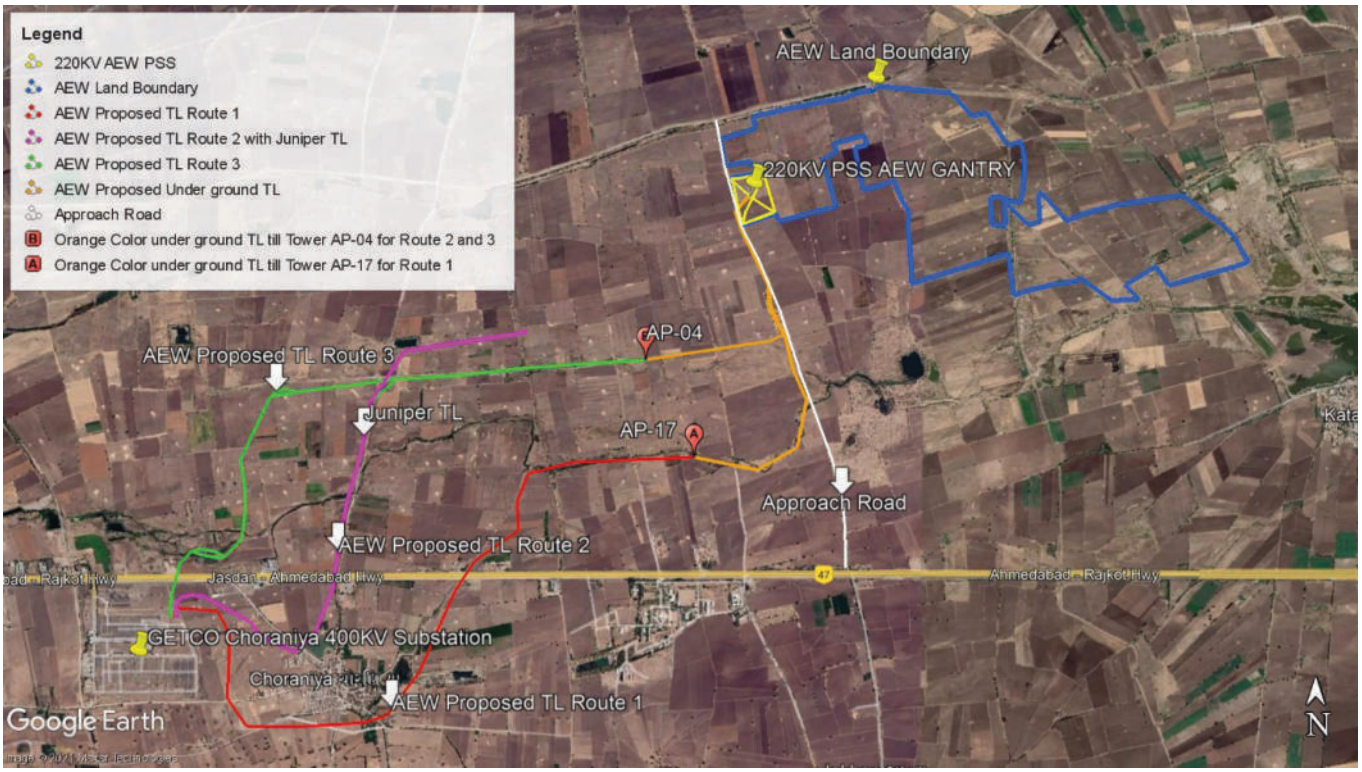
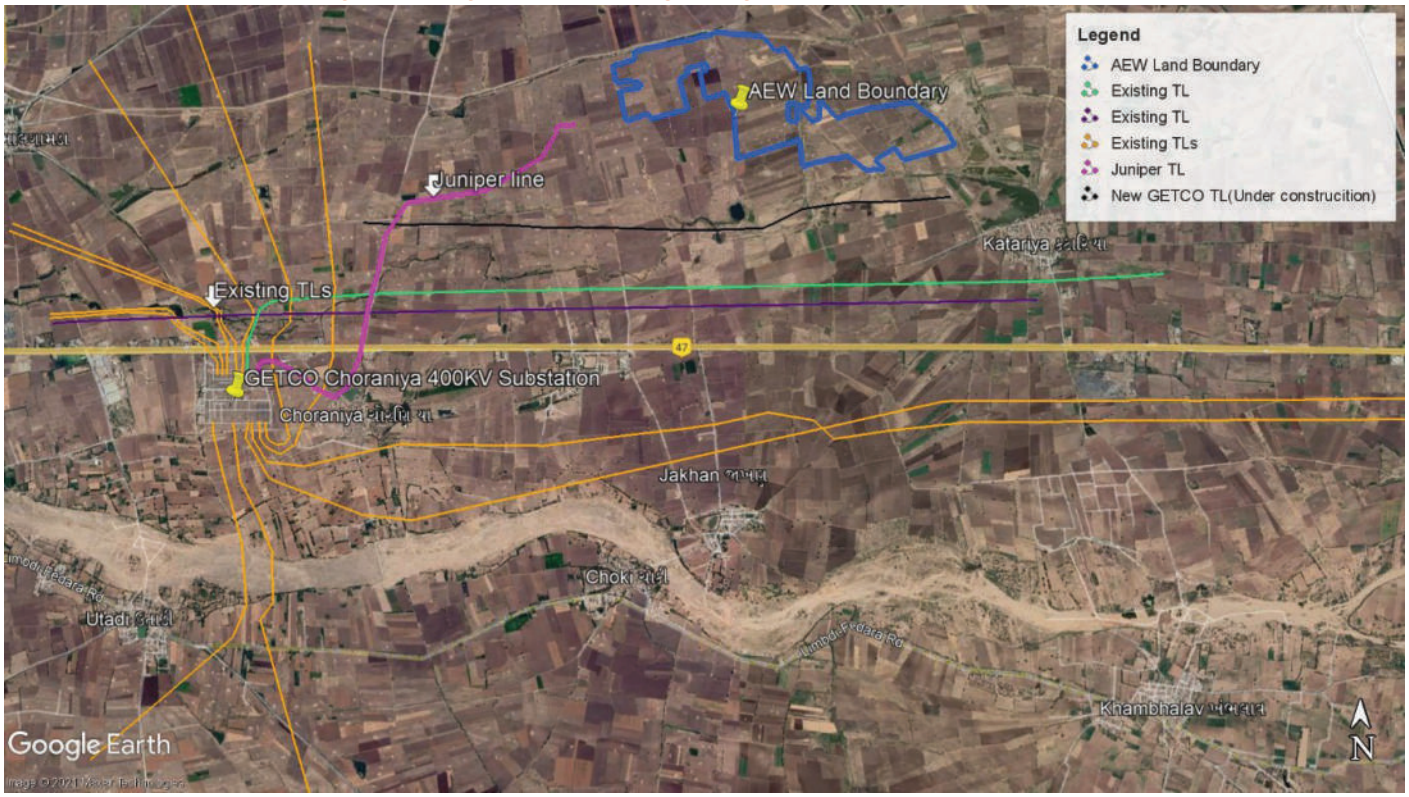


Figure 2-7: Google earth Map showing existing transmission lines in the area



2.2 Description of Project Facilities, Components and Activities

The proposed 80 MW solar power project will be based on Bifacial Silicon technology. The tentative project land boundary is identified & depicted in the above Figure 2.5. The proposed solar plant will include the following. The technical details are presented in Table 2-1.

Key components for this project are

- Solar PV Modules
- Power Conditioning Unit
- Underground cables to interconnect solar panels & other electrical components
- Transformers
- Switchyard
- Earthing and Lighting protection on 9 meter pole and main control room-
- Site office/Main Control Room
- Inverters
- Pooling substation
- Site office consisting of emergency contact details, fire extinguishers, first aid kit, PPE room and the lock out/tag out station
- The SCADA control room will also be present within the project site;

Table 2-1: Technical Details

Particulars	Details
Project Capacity	80 MWac/120MWp
Procurer	Gujarat Urja Vikas Nigam Limited (GUVNL), owned by Government of Gujarat (GUVNL has a long-term credit rating of AA-, making GUVNL PPAs highly sought after in India)
PPA term and structure	• Build own operate • PPA term of 25 years
Tariff	• INR 1.99 per kWh • Single levelized tariff for entire PPA term
Interconnection	400/220 kV Choraniya grid substation within ~3 km from site through 220 kV overhead Transmission line
Technology	• Fixed tilt 14°, south direction • PV modules: Tier-1 suppliers (Longi/Trina/JA/Jinko); Mono PERC • Inverters: Sungrow
COD	14 October 2022
PPA Status	Signed on 30 January 2021
Tariff Adoption Status	Approved on 8 January 2021
Annual Global Horizontal	2019

Particulars	Details
Irradiation (kWh/m2)	
Annual Global Irradiation Incident (kWh/m2)	2161.3
Module peak power (Wp)	540 Wp to 570 Wp
Number of Modules per string	28 Nos to max 30 Nos
Per Module Area (m2)	2.256 m x 1.133 m = 2.556 sqm
Pitch (m)	7 m
Peak power of plant (MWp)	45% to max 50%
First Year Energy Yield (MWh/annum)	216176
First Year Specific Yield (kWh/kWp)	1806
Performance Ratio (PR) (%)	83.34%
Components	**Details**
Solar PV Modules	540/545 Wp Mono Crystalline Silicon technology
Power Conditioning Unit (PCU) or Inverter	3.125 MVA Inverter, 1500 V System
Cables	6 sqmm UV Cable, 1Cx400 sqmm armored XLPE Insulation Cables AC Cable, 3Cx240 sqmm Armored XLPE Insulation Cables LV cable, 1Cx630 sqmm Armored XLPE, with Al conductor HV cable
Transformers	12.5 MVA 5 winding transformer
Switchyard	33 kV Switchyard with 6 incoming feeders and 1 outgoing feeder
Earthing and Lighting protection	Maintain the earth resistance of 1ohm and LA radius 105 m
Site office/Main Control Room	Main Control room having switchyard, SCADA, UPS, battery bank, Aux transformer etc.
Inverters	3.125 MVA Inverter, 1500 V System
Pooling Sub- station (PSS)	220/33 kV, 80 MVA POWER TRANSFORMER, LA, CVT, CT, PT, Isolators, circuit breaker etc.

Source: AEWIWOPL

Table 2-2: Land Area Requirement on Various Project Components

Project Components and Associated Facilities	Land Area	Remarks on Land Acquisition
Solar Power Plant		
Module Area	227 Acres	Part of leased property
Inverter and Inverter Transformer	35 Acres	Part of leased property
Plant Side Switchyard along with Main Control room	10 Acres	Part of leased property

Project Components and Associated Facilities	Land Area	Remarks on Land Acquisition
Internal Roads within Site	15 acres	Part of leased property
Laydown/Storage Area	5 acres	Part of leased property
Boundary Wall: Approx 10-12 KM (Chainlink fencing)		Part of leased property
Standby Land	40 acres	Part of leased property
Total	332 acres	Part of leased property
Access road	Existing Road Width: 3.5 Mtr, 0.5 Mtr shoulder on each side. Distance from highway to site: Approx 1-1.5 km Access road enhancement shall be double compacted Murram road	The project will be using existing village roads, therefore no RoW/ leasing required. ○ Primary approach to the site is through NH-8A which connects Ahmedabad to Rajkot. The project will use the existing road which is presently unpaved, thus the project will further develop/upgrade the existing road as access road for access to the proposed project site. Approach road for the project shall be ~4-5 meter wide and ~ 1.2 km in length.
Internal transmission line	No Internal TL, only underground cabling inside the plant. Length of Cable trench shall be approx. 12 km	No additional land will be required.
External transmission line and towers	• Based on RoW, approx. 4-5 km. With both UG and OG lines. • For OG: Approx. 18-20 towers (3-4 towers per km) • Area of each tower shall be Approx. 4Mtr x 4 Mtr • Height of each tower from ground to conductor shall be approx. 22-27 Mtr • For UG: Approx. 0.5-1.5 KM (UG cabling shall be under trench) –(2m depth and 1m wide open trench will be excavated by JCB or any other tool)	All area for TL shall be on RoW compensated land.

Source: AEWIWOPL

2.2.1 Project Phases and Activities

The proposed project plant is currently at initial stages of planning. The activities for the project canbe divided into the following phases/stages.

- Planning phase;
- Construction phase;
- Operation and maintenance phase; and
- Decommissioning phase.

The key activities for the above are as showcased in Table 2.3.

Table 2-3: Land Key Activities

Task Name	Start	Finish
LOA GUVNL	Completed	Completed
PPA Signing	Completed	Completed
Connectivity Agreement and Bay Allotment	Completed	Completed
Modules ordering and LC Opening	Mar-22	Apr-22
Equipment ordering (PSS and GSS and TL)	Jan-22	May-22
Equipment ordering (BOS Plant)	Mar-22	May-22
Approach Road and Fencing	Nov-21	April-22
TL works NTP	April-22	April-22
BOS Plant NTP	Apr-22	April-22
Civil works of Plant and PSS and GSS	Apr-22	Aug-22
Module Dispatches from China		
Lot-1 (30 Mw) Sealift	May-22	May-22
Lot-2 (30 Mw) Sealift	May-22	May-22
Lot-3 (30 Mw) Sealift	Jun-22	Jun-22
Lot-4 (30 Mw) Sealift	Jun-22	Jun-22
Module Arrival At Port		
Lot-1 (30 Mw)	Jun-22	Jun-22
Lot-2 (30 Mw)	Jun-22	Jun-22
Lot-3 (30 Mw)	July-22	July-22
Lot-4 (30 Mw)	July-22	July-22
Module custom clearance		
Lot-1 (30 Mw)	Jun-22	Jun-22
Lot-2 (30 Mw)	Jun-22	Jun-22
Lot-3 (30 Mw)	July-22	July-22
Lot-4 (30 Mw)	July-22	July-22
Module from port to site		

Task Name	Start	Finish
Lot-1 (30 Mw)	Jun-22	Jun-22
Lot-2 (30 Mw)	Jun-22	Jun-22
Lot-3 (30 Mw)	July-22	July-22
Lot-4 (30 Mw)	July-22	July-22
Modules at site		
Lot-1 (30 Mw)	Jun-22	Jun-22
Lot-2 (30 Mw)	Jun-22	Jun-22
Lot-3 (30 Mw)	July-22	July-22
Lot-4 (30 Mw)	Aug-22	Aug-22
Equipment Deliveries	Jun-22	Sep-22
Transmission line EHV Works	Apr-22	Aug-22
PSS Electrical & installation Works	Apr-22	June-22
GSS Works	March-22	June-22
Module Mounting Structure Installation	Apr-22	Jul-22
Equipment installations (Module Mounting, Inverter Mounting, Inverter duty transfer installation, string combiner box, SCADA installation, etc)	Jul-22	Sep-22
Module mounting		
Lot-1 (30 Mw)	Jul-22	Aug-22
Lot-2 (30 Mw)	Jul-22	Aug-22
Lot-3 (30 Mw)	Aug-22	Sep-22
Lot-4 (30 Mw)	Aug-22	Sep-22
Pre-commissioning	Sep-22	Sep-22
First sync	Oct-22	Oct-22
Commissioning and COD	Oct-22	Oct-22
PR test	Oct-22	Oct-22
Punch list closure	Oct-22	Oct-22
HOTO	Oct-22	Oct-22

Note: Implementation schedule is provided in project overview section.

Works associated with the TL in the Lesser Florican area, including delivery of modules using the village road closest to the breeding area, will be avoided during LF breeding season or will happen through an alternate route.

2.3 Resource Requirement

The resource requirement for construction and operation phases of the proposed project have been made based on professional judgement since the project is in the initial stages of planning. The resources required have been assessed based on assumptions and discussions made with the AEWIWOPL's project team. The resource requirements are as elaborated below.

2.3.1 Land requirement

The total land identified for the proposed project is 332 acres of private agricultural land. The project is located in two villages: Katariya village and Jakhan village located in Limdi Taluka of Surendranagar District. The land would be leased through the land aggregator "M/S Ocean Trading Company," who has been appointed by AEWIWOPL for the land procurement. Out of 332 acres of total land,

approximately 238.7 acres of private land to be procured on lease from the 87 (Eighty-seven) landowners in Katariya village and the remaining 93.3 acres of land to be leased from the 29 (Twenty-Nine) landowners in Jakhan village, who are primarily engaged in agricultural allied activities for their source of livelihood. It was reported on the site, the procedure of lease agreement with the landowners is not yet started and consultation with them indicates that the land has been obtained voluntarily and has not resultant any landowners into landlessness. Complete list of landowners' details of around 116 landowners have been attached in Appendix D. NOC from respective Village Panchayats is also obtained and copy of the same attached in Appendix C.

Table 2-4: Village wise land details and no of landowners

Sl. no	Village Name	Land Leasing (Acres)	No of Landowners
1	Jakhan	93.3 acres	29
2	Katariya	238.7 acres	87
Total		332 acres	116

Source: *AEWIWOPL*

According to the government records, the entire parcel of land is classified as agricultural land. However, due to a scarcity of rain and lack of irrigation facilities, the land is incompatible for intense agricultural activities. During the site visit (September 2021) it was observed that the identified land parcels were observed to be under cultivation with Kharif season crops. Mostly Kharif crops like cotton used to be cultivated during monsoon while Jowar was cultivated during post-monsoon period in few land parcels. It is understood that the land is not intensely cultivated with diversified crops throughout the year due to lack of any irrigation facilities.

Land Aggregator (M/s Ocean Trading Company) has been engaged by AEW Power since last year to review the legal status of the identified land parcels. As per the agreement, no land which is disputed, belonging to the scheduled caste/tribe or has construction or houses on it, would be approached for land leasing.

During the site visit, negotiation for transmission route finalization is under development stage. As reported, no land shall be procured for laying the transmission line. Compensation for the RoW shall be made as per the Ministry of Power 'Guidelines for payment of compensation towards damages in regard to right of way for transmission lines or provision for underground transmission route.

Since the IESE Study is carried out during land procurement process, it was found that land leasing process was undertaken by the landowners and AEW voluntarily and the lease compensation would be given to landowners as mentioned above. Copy of Draft land lease deeds document is presented in Appendix I. Land leasing process has not yet started.

The details of the land requirement for various components and the present status of the land procurement process are captured in the Table 2.5 below.

Table 2-5: Summary of Land Required for the Project

Project Component	Land Area	Type of Land	Village	Status
Solar Project includes installation of solar modules, Scrap yard, storage area, Site office, Inverter room, Switchyard, inverters, transformers and main control room, PSS, internal (underground) TLs	332 acres	Private land	The land is being procured from following villages – Katariya & Jakhan village	According to the site representative, 332 acres private land to be procured on lease. However, the leasing process has not been started yet. The switchyard for the project will be constructed on the same land parcels that would be procured for the proposed solar project. It will be connected to nearby Chorania sub-station.
External Transmission Lines	To be finalized	Private Land	Katariya & Jakhan village	The external transmission is still under planning stage. However, based on the discussion, the length of external transmission line will be approximately 4 to 5 km with 18 to 20 towers. As reported location of towers has not been finalized. Furthermore, it was reported that the transmission line will pass through the private land. The land required for RoW tower for external transmission line, will be procured on leased. Compensation for the RoW shall be made as per the Ministry of Power 'Guidelines for payment of compensation towards damages in regard to right of way for transmission lines or provision for underground transmission route

Source: *AEWIWOPL*

Land Procurement Procedure

AEW land procurement team was involved in identification, selection and procurement of land from willing landowners on a negotiated settlement basis. Based on the discussion with the project site team and landowners, the land has been procured on lease on voluntary land transactions basis. The Project has engaged land aggregator named M/s M/S Ocean Trading land developer to support the land procurement process through local panchayat head support as key intermediaries at the village level.

The land procuring process for the project started in January 2021 and the process will be completed by June 2022. As reported by the Project Proponent and the local community during the consultation, the lease rent was established based on negotiations held with landowners and the market rate in the area. The lease rent is INR 33,500/Acre/Annum for 29 years & 6 Months with 5 % escalation after every three years on current rates, and lease. Also, it was reported at the site that lease rent INR 33,500/acre/annum will be paid uniformly to all the landowners, irrespective of the aspects like difference in land quality, location of land. This was further confirmed based on following evidence:

- Consultation with representative of AEW, Land aggregator and landowners
- Draft Sample copy of lease deed and Copy of NA order (Appendix I & J**)**

Land procurement/Lease procedure: The land leasing for the project is being undertaken through experienced land aggregator who is having prior experience on land acquisition of similar projects.

- The land parcels were identified during pre-bid stage in collaboration with experienced land aggregators.
- Variety of factors were taken into consideration for land finalisation including proximity to grid substation with spare capacity, solar resource availability, proximity to highways etc.
- The land aggregators have been responsible for:
  - To Identifying a contiguous land parcel (with survey numbers) which shall consist of a legal, marketable, encumbrance free, vacant with no construction of any nature and/or without any crops/plants, trees, vegetation etc. of any nature, private land parcels, where landowners enjoy lawful and peaceful possession totaling to Project Land for development of the Project.
  - To provide land revenue records and other documents required for the completion of the legal due diligence.
  - Discuss and negotiate with the Landowners of the Project Land.
  - The leasing of the all the land parcel forming part of the project site must be unconditional and irrevocable for the lease period of at least 30 years.
  - The Developer shall have all rights over the land parcels, except the ownership rights, and such rights should be duly transferred to the IPP under the lease agreement executed with IPP.
  - Lease agreements shall have an explicit/expressed provision regarding the right of the lessee i.e., Developer to permit creation of any charge in favor of any party/parties including any domestic or international banks/NBFCs/FIs etc. and enforcement of such charge in terms of the applicable laws.
  - In case encumbrances were created over the land parcel by the owners, then Land Aggregator shall obtain the No dues certificates from banks/ co-operative societies/other financial institutions (as applicable) and shall submit to Developer before execution of lease for the land parcel.
  - Procuring a certified copy of the village/SOI map including boundary with approved access/approach roads for the Project Site.
  - Process the conversion of Land from Agriculture status to non-Agriculture status.
  - To obtain the mutation of all land parcel forming part of Project Site in IPP's name and get the land use changed from agriculture to non-agricultural/ appropriate noting in the land records in terms of respective States Land Revenue Rule.
  - To obtain Gram Panchayat NOC required for the Project Land.
  - Getting project site demarcation done along with updating in revenue records if required.

Land procurement related specific issues are as presented in Table 2.6 below.

Table 2-6: Land procurement and specific issues

Features	Location	No. of Household/ No. of Individuals	Description
Schedule V Area	Katariya/ Jakhan	Not Applicable	The Project Area does not fall under the Schedule V area. There is no tribal population reported by Census of India 2011 in both the villages.

Features	Location	No. of Household/ No. of Individuals	Description
Forest Land	Katariya/ Jakhan	Not Applicable	As per the available information, no forest land has been procured for the project.
Tribal (Schedule Tribe) Land	Katariya/ Jakhan	Not Applicable	According to the information available and the consultation with landowners, the land identified for the project is comprised of private agricultural land, and no tribal land has been procured for the project as there is no tribal population reported.
Landlessness	Katariya/ Jakhan	None	As per the consultation with the landowner, it is understood that the land procurement for the project has not resulted into landlessness of any landowners. Based on the consultation with the land owners, more than 85 percent of these landowners have an additional land parcel which is more fertile and have better irrigation facility.
Encroachment and Squatting	Katariya/ Jakhan	None	The land parcels identified for the project are primarily comprised of private agricultural land. Based on the consultation with the landowners, land agreegators and village representatives no encroachments were observed or reported.
Physical Displacement	Katariya/ Jakhan	None	Land leasing will not result in any physical displacement as no structure/ hut/boundary wall (temporary or permanent) etc. reported on the proposed land during site visit.
Economic Displacement	Katariya/ Jakhan	6 individuals	And as reported by during the consultation with the landowners, average earning of a good season from their land parcel leased for project was INR. 8000-12,000 /acre /annum. And by leasing the land to the project the landowners were able to make assured income through yearly lease rental of INR. 33,500/Acre/Annum for 29 years & 6 Months with @ 5 % escalation for every three years. This is more than the average yield per acre of land. Among 15 agriculture labours consulted, about 06 women agriculture workers reported to have reduced agriculture activities/job opportunities due to the development of solar project. These agriculture labours are not primarily dependent on the piece of project site land. Moreover, the project will generate number of direct and indirect employment opportunities in the neighbouring villages both during construction and operation phase, the work includes various construction works during the construction phase and during operation phase like grass cutting, module cleaning, panel tilting works, deployment of security staffs etc..

Features	Location	No. of Household/ No. of Individuals	Description
Common Property Resource	Katariya/ Jakhan	No Impact	The project is located on private land and no CPRs found on proposed land and it is also not influencing any common property resource (CPR) land, hence no CPR will be use for the project.
Land use Change	Katariya/ Jakhan		The project with all its components shall be set up on private land and entire land parcel is reported to be an agricultural land. Under such circumstances, the setting up of the solar power project will result into the permanent land use change to industrial use. The application for the conversion of land shall be applied once the land procurement process is completed.
Cultural Heritage	Katariya/ Jakhan	No impact	As confirmed during site visit, no cultural heritage will be affected by the project activities.
Access Road	Katariya/ Jakhan	No impact	Existing village road will be used and there will be no permanent or temporary restriction in access to village road due to the project activities.
Affected due to loss of access to facilities/assets	Katariya/ Jakhan	No impact	No impact envisaged due to the project. Since there is no restriction of any access road or no CPR within the project site.
Temporarily affected during construction	Katariya/ Jakhan	NA	No impact envisaged due to the project. Since there is no restriction of any access road or no CPR within the project site.

2.3.2 Water requirement

The source of water for the project is through licensed tanker.

The estimation of quantity of water required for civil works during construction stage will be determined by contractor in construction phase. The water requirement will be met through tankers supplied by authorized contractors. Packaged water will be purchased for drinking purpose. Water for dust suppression will also be met from tankers. During construction period, approximately 50 tankers of 4000 liter each will be utilized.

As reported, AEWIWOPL will use 100% robotic dry-cleaning system for cleaning of solar panels which will reduce the water requirement of the project. If required, tanker water from authorised sources will be used on site. Water requirement for domestic use during operation phase considering 25 employees and workers will be ~ 1.25 KLD @50 lpcd each). Packaged water will be purchased for drinking purpose.

2.3.3 Manpower requirement

During the construction phase, it has been estimated that 150 nos. skilled workers, 300 nos. of unskilled manpower will be involved during the peak construction. And it is reported that AEWIWOPL will instruct contractors and their subcontractors to give preference to hire unskilled labourers from nearby villages during the construction phase.

2.3.4 Raw material requirement

As per the discussion held with AEWIWOPL project team, the major raw materials required for the construction phase are fencing material, construction materials like cement, sand, aggregate that will be sourced by EPC contractors from local areas for piling and array yard works. However, as confirmed by AEWIWOPL, no on-site batching plant will be established as the quantity of aggregates required will be obtained locally during construction phase, (concrete will reportedly be sourced from authorized vendor. Sand & aggregate will be required for MMS foundation, Inverter station foundation and MCR foundation. The quantity is provided below in Table 2.7.

The terrain of the project land is plain and very limited undulations. The project layout will follow natural contour. Hence, no cut and fill is envisaged for the project land.

Table 2-7: Raw Material Required

Material quantity					
S.No.	Material Description	Units	Qty for Piling	Qtys for Array Yard Works	Total Qtys
1.	Cement	Bags	49455	3500	52955
2.	Sand	Tons	5129	363	5492
3.	Aggregate	Tons	8227	582	8809
4.	Water	Ltr	1112746	78750	1191496
5.	Admixture	Ltr	21019	1488	22507

There will not be major requirement of raw materials during operation except for maintenance purpose viz. consumable spares.

2.3.5 Power requirement

Power requirement during the construction phase will be met through Diesel Generators (DG). Reportedly, one DG set of 40 kVA will be installed at site during construction phase.

Based on initial assessment, operational power requirement during daytime would be met through auxiliary generation. During the nighttime power requirement would be met through State Electricity supply/existing transmission line (which would be used to evacuate power during daytime) or DG sets would also be kept at the control room for emergency power backup Additionally, Uninterrupted Power Supply (UPS) and DG sets would also be kept at the control room for emergency power backup.

2.3.6 Fire safety and security requirement

Construction Phase: Appropriate firefighting system and equipment is expected to be provided throughout the construction period. The fire extinguishers are expected to be placed at all strategic locations such as site office, storage yard, near construction area, welding area, etc. Besides this, emergency contact numbers shall also be displayed at appropriate locations at site.

Operation Phase: Suitable fire protection and fighting systems viz. portable fire extinguishers, fire buckets and automatic fire detection system are expected to be made available at the entire PV array, inverter stations, main control room and switchyard. The aforesaid systems and equipment's will conform to National Fire Protection Authority (NFPA) fire safety standards and local fire authority requirements. Firefighting arrangements for electrical utilities like transformers etc. is expected be in

accordance to tariff advisory committee, Central Board of Irrigation and Power (CBIP), Indian Standard (IS) 10028 i.e. Code of practice for selection, installation and maintenance of transformers, National Fire Protection Association (NFPA) 70 and 15 requirements. Security contractor will be employed during operations as part of the O&M contractor's scope.

2.4 Indian Regulatory Framework

Table 2-8: Administrative Enforcement Agencies relevant to the Project

Agency	Function	Application/relevance to the project
Central Level		
Environment, Forests and Climate Change (MoEF&CC)	Ministry of Environment Forest and Climate Change (MoEF&CC) is the apex administrative body for (i) regulating and ensuring environmental protection; (ii) formulating the environmental policy framework in the country; (iii) undertaking conservation & survey of flora, fauna, forests and wildlife; and (iv) planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. Several laws have been framed for protection of environment and for Occupational Health & Safety in India by the Central Government.	MoEF&CC is responsible for the implementation and enforcement of the Environment Protection Act, 1986, and Rules issued under the Act, including the EIA notification. Under sections 3 and 5 of the EP Act, 1986, it retains enormous powers to issue directions in the interests of environment protection. As per the EIA Notification (2006) and its amendments, the Solar Power Project does not require prior Environmental Clearance (EC) from the Ministry of Environment Forest and Climate Change (MoEF&CC) or the State Environmental Impact Assessment Authority (SEIAA).
Central Pollution Control Board (CPCB)	The Central Pollution Control Board (CPCB) has been constituted for the control of water, air and noise pollution, land degradation and hazardous material and waste management. The specific functions of CPCB are as follows: ○ Prevent pollution of streams and wells. ○ Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution ○ Co-ordinate the activities of SPCB's and provide them with technical and research assistance. ○ Establish and keep under review quality standards for surface and groundwater and for air quality. ○ Planning and execution of national programme for the prevention, control and abatement of pollution through the Water and Air Acts.	Refer section 3 of below Table 2.9. Based on the notification released by the Central Pollution Control Board (CPCB Ref No: B-29012/ ESS (CPA)/2015-201610), "Solar projects, wind power projects and mini hydro projects (less than 25 MW)" have been moved from "green category" to "white category"and there shall be no necessity of obtaining Consent to Operate, an intimation to SPCB/PCC shall suffice.
Ministry of New and Renewable Energy (MNRE)	The Ministry of New and Renewable Energy (MNRE) is the nodal Ministry of the Government of India for all matters relating to new and renewable energy. The broad aim of the Ministry is to develop and deploy new and renewable energy for supplementing the energy requirements of the country. The	Project will be developed based on MNRE guidelines

Agency	Function	Application/relevance to the project
	Ministry facilitate research, design, development, manufacture and deployment of new and renewable energy systems/devices for transportation, portable and stationary applications in rural, urban, industrial and commercial sectors.	
Central Electricity Authority (CEA) (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008, (CET)	The Act is applicable for the solar power plant as the plant is going to have electrical appliances and facilities installed for grid connected power generation. As per the Act, all equipment's and system installed should comply with the provision of the statute, regulations and safety codes.	○ The Central Electricity Authority (CEA) is a statutory organization constituted under Section 3 of the repealed Electricity (Supply) Act, 1948, here in after replaced by the Electricity Act, 2003. Some of the functions performed by CEA include the following: ○ Advise the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plans for development of the electricity system and coordinate activities of the planning agencies for the optimal utilization of resources to sub-serve the interests of the national economy and to provide reliable and affordable electricity to all consumers ○ Specify the technical standards for construction of electrical plants, electric lines and connectivity to the grid. ○ Specify the safety requirements for construction, operation and maintenance of electrical plants and electric lines. ○ Promote and assist in the timely completion of schemes and projects for improving and augmenting the electricity system. ○ Collect and record the data concerning the generation, transmission, trading, distribution and utilization of electricity and carry out studies relating to cost, efficiency, competitiveness and such like matters. ○ Make public from time to time the information secured under this Act, and provide for the publication of reports and investigations; ○ Advise any State Government, licensees or the generating companies on such matters which shall enable them to

Agency	Function	Application/relevance to the project
		operate and maintain the electricity system under their ownership or control in an improved manner and where necessary, in coordination with any other Government, licensee or the generating company owning or having the control of another electricity system; etc
Central Electricity Regulatory Commission	The Commission intends to promote competition, efficiency and economy in bulk power markets, improve the quality of supply, promote investments and advise government on the removal of institutional barriers to bridge the demand supply gap and thus foster the interests of consumers	Establishment of projects subject to the provisions of various Acts of the State Government and mainly the Electricity Act 2003 and the rules under it; rules, regulations, codes etc. fixed by the Gujarat Electricity Regulatory Commission and improvements thereto from time to time.
Central Ground Water Authority (CGWA)	The Central Ground Water Authority (CGWA) was constituted in 1997 to regulate, control and manage groundwater development in the country, under the EP Act 1986. One of the main functions of CGWA is to regulate indiscriminate boring and withdrawal of groundwater and to issue necessary regulatory directions with a view to preserve and protect the groundwater. CGWA has declared certain areas of India as “notified areas” from the point of over-development of resource, or from groundwater quality point of view, or for registration of groundwater abstraction structures. In these so "notified areas” further extraction is regulated in order to prevent the depletion of groundwater levels and deterioration of its quality.	Refer section 8 of below Table 2.9. Project needs to obtain permission/NOC, if ground water abstraction takes place through on-site or off-site borewell to meet water requirement for construction and operational phase.
Petroleum and Explosives Safety Organisation (PESO)	The PESO is under the Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, Government of India. The Chief Controller of explosives is responsible to deal with provisions of: The Explosive Act, 1884 and Rules, 2008, The Petroleum Act, 1934 and the Rules 2002, The Static and Mobile pressure vessels (Unfired) Rules, 2016 and amended 2018, and Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment 2000	PESO’s major work is to administer the responsibilities delegated under the Explosives Act 1884 and Petroleum Act 1934 and the Rules made there under related to manufacture, import, export, transport, possession, sale and use of Explosives, Petroleum products and Compressed gases. With an overall objective of ensuring safety and security of public and property from fire and explosion, the Organisation as a statutory authority is entrusted with the administration of Explosives Act, 1884, Petroleum Act, 1934; Inflammable Substances Act, 1952 and the rules framed under these acts.

Agency	Function	Application/relevance to the project
		No licence is required for storage and transport of any such product (i.e. petroleum class B) if the total quantity in possession does not exceed 2500 litres in non-bulk (i.e. drums) or 1000litres in a receptacle / tank (i.e. bulk). Thus, obtaining PESO license for Solar project is not required unless any Flammable liquid/ petroleum product of Class B or C type is stored of more than the quantity mentioned above. "Petroleum" means any liquid hydrocarbon or mixture of hydro-carbon and any inflammable mixture (liquid, viscous or solid) containing any liquid hydro-carbon; (a) "petroleum Class A" means petroleum having a flashpoint below twenty-three degrees centigrade; (b) "petroleum Class B" means petroleum having flashpoint of twenty-three degrees centigrade and above but below sixty-five degrees centigrade; (c) "petroleum Class C" means petroleum having a flashpoint of sixty-five degrees centigrade and above but below ninety-three degrees centigrade; (d) flash-point" of any petroleum means the lowest temperature at which it yields a vapour which will give a momentary flash when ignited, determined in accordance with the provisions of Chapter II and the rules made thereunder ** No licence is needed for import, transport or storage of small quantities of petroleum Class A and transport or storage of limited quantities of petroleum Class B or petroleum Class C. Kerosene is not "dangerous petroleum" and no licence is necessary to store less than 500 gallons in drums of less than 50 gallons capacity and thus, the charge for possessing Kerosene of less than 500 gallons without licence is unsustainable.
Director Industrial Safety and Health (DISH)	The main objective of the DISH is to ensure safety, health, welfare and working conditions of workers working in factories and in construction works by effectively enforcing the provisions of the Factories Act, 1948 the	The Directorate Industrial Safety and Health Department enforces the provisions of Factories Act 1948 and State Factories Rules and the rules made there under to ensure the safety health and welfare of the workers. It

Agency	Function	Application/relevance to the project
	Building & Other Construction Workers Act 1996 and other labour legislations. It is also to ensure the protection of rights of workers and to redress their grievances. Factory license is required as 'factory' means 'any premises having ten or more workers involved in a manufacturing process'. Factory License from the State Government or Chief Inspectorate of Factories, Gujarat is required to be obtained for the project. Project proponent/ Construction contractor shall comply with all requirements of Gujarat Factories Rules 1963 and participate in periodic inspection. It is also to be ensured that no child labour is engaged during construction or operation phases of the project	also plays a significant role in regularizing working hours and working conditions and reducing the accident and dangerous occurrences in the factories, redressal of the grievances of the workers in respect of Safety Health and Welfare through a set of policies and programs developed by both the Central and State Government. Some of the functions of DISH are ○ Eliminating inequality and discrimination in the work place; ○ Enhancing occupational health and safety awareness and compliance in the workplace; ○ Workforce and community participation, to employers, employees, workplaces, communities, businesses and unions; and ○ Providing policy advice and analysis to government on labour and employment related matters.
State Level		
Gujarat Urja Vikas Nigam Limited (GUVNL)	Functions of GUVNL are summarised below • The one of the objects/functions of the Company apart from above includes Co-ordination of the activities of its subsidiaries, business, works to determine their economic and financial objectives/targets and to review, control, guide and direct their performance with a view to secure optimum utilization of all resources placed at their disposal. • To carry on the business of purchase, procurement, import, sale, supply, export and trade of all forms of electrical power, conventional and non-conventional, and to coordinate, enter into association with others in connection with such purchase, procurement, import, sale, supply, export, trade and distribution of all forms of electrical power and undertake all connected functions in India and abroad and without prejudice to the generality of the above, to purchase or procure electricity from generating companies, captive power plants, Electricity Utilities,	The PPA for the project was executed between AEW India West Private Limited & GUVNL. GUVNL is the power procurer for the project.

Agency	Function	Application/relevance to the project
	Governments, other bodies and organization, trading concerns, licensees and others, including import from abroad and to sell, supply, trade, export and otherwise deal in electrical power to the electricity utilities, licensees, Governments, other bodies and organizations trading concerns and others including export. • To plan, promote, develop and establish an efficient and reliable power trading system, power exchange and system for transfer / wheeling of power from the power producers, generating and transmission companies within India and abroad in accordance with the applicable laws, rules and regulations and to promote and organize research and development or to carry on consultancy services in the field of power supply, trading conservation of electricity and other related activities of the Company. • To carry on the business of construction, management of fuels systems, hydel, wind and solar resources and to search for, get, acquire, buy, sell or otherwise deal in oils, gases, coal, coal rejects, fuel oil, naphtha, liquefied natural gas, raw petroleum stock or any other fuel solid, liquid or gas whether found in natural state or obtained by processing from other substances and to carry on business of production, working, treating, manufacturing and preparation of any such or related materials which can be usefully applied for the power generation of electricity or conveniently be combined with manufacturing, engineering or other business of the company or any contracts undertaken by the company either for such purpose or an independent business, subject to approval required, if any, of appropriate authority.	
Gujarat Solar Power Policy-2021[3]	Gujarat Energy Transmission Corporation (GETCO), Gujarat Power Corporation Limited, Ministry of New and Renewable	With the aim of becoming a primary contributor to the national target of 100 GW solar capacity by 2022, the State Government of Gujarat introduced the "Gujarat Solar

[3] https://suryagujarat.guvnl.in/Gujarat-Solar-Power-Policy-2021.pdf

Agency	Function	Application/relevance to the project
	Energy, and SECI (Solar Energy Corporation of India) The State Government in collaboration with the Central Government/ MNRE/ MoP/ Multilateral Agencies will undertake measures to provide solar powered pump sets through subsidy support. The state of Gujarat has strong policies in favour of stimulating solar energy in the region. Gujarat has set a renewable purchase obligation (RPO) of 1.75%	Power Policy 2021" on 29th December, 2020. This policy will remain in operation upto 31st December, 2025. The state government introduces the Gujarat solar power policy 2021 with the following objectives: ○ To rapidly scale up the states solar energy capacity in order to contribute to India's overall renewable energy targets keeping in mind India's commitment under International climate agreements. ○ To reduce the dependence on fossil fuels and further energy security in the state. ○ To further the sustainable development goals of Gujarat ○ Employment generation and skill enhancement and promotion by promoting research, development, deployment, and innovation in the solar energy sector. ○ To spread awareness about solar power technologies amongst all the electricity consumers ○ To create an investment friendly environment that can provide a win win situation for all the stakeholders in the power sector. ○ There is a reference of Gujarat Solar Power Policy-2021 in the PPA.
Gujarat Energy Development Agency (GEDA)	Gujarat Energy Development Agency (GEDA) is shouldering the responsibility of a state nodal agency (SNA) for the Ministry of New and Renewable Energy Sources (MoNRE) and the state designated agency (SDA) for Bureau of Energy Efficiency (BEE). It aims to provide a platform to utilization of sustainable energy (renewable energy and energy efficient) technologies on mass scale to make them techno-economically and socio-culturally viable in the context of Gujarat's energy scenario.	As per the above mentioned policy, Gujarat energy development agency (GEDA) will be the state government nodal agency for the following activities: ○ Registration of projects ○ Accreditation and recommendation of solar projects for registering with central agency under REC mechanism ○ Certifying the commissioning of solar projects GEDA is working in the field of renew able energy development and energy conservation. GEDA is shouldering the responsibility of a state nodal agency (SNA) for the Ministry of New and Renew able Energy Sources (MoNRE) and the state

Agency	Function	Application/relevance to the project
		designated agency (SDA) for Bureau of Energy Efficiency (BEE).
Gujarat Energy Transmission Corporation Limited (GETCO)	Gujarat Energy Transmission Corporation Limited (GETCO) was set up in May 1999 and is registered under the Companies Act, 1956. The Company was promoted by erstwhile Gujarat Electricity Board (GEB) as its wholly owned subsidiary in the context of liberalization and as a part of efforts towards restructuring of the Power Sector. The Government of Gujarat issued Notification No. GHU-2004–99-GEB-1104-7318-K dated the 31st December 2004, notifying the Provisional Opening Balance Sheet as on 31st March 2004 of the Six Transferee Companies containing the value of assets and liabilities transferred from erstwhile Gujarat Electricity Board (GEB) to the Transferee Companies. Assets of the Board were dis-aggregated into six companies – One each in Generation and Transmission and Four in Distribution. As a part of the above exercise, all the generation plants of GEB have been transferred to GSECL, which was a company already, existing since 1993.	○ GETCO is currently responsible for overseeing the transmission infrastructure within the state. ○ Project needs to obtain necessary permission from GETCO for grid connectivity.
Gujarat Pollution Control Board (GPCB)	GPCB is responsible for implementing various environmental legislations in the state, mainly including Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, and some of the provisions under Environmental (Protection) Act, 1986 and the rules framed there under like, Biomedical Waste (M&H) Rules, 1998; Hazardous Waste (M&H) Rules, 2008; Municipal Solid Waste Rules, 2000 etc. GPCBs functions under the administrative control of Environment Department of the State.	As per Central Pollution Control Board's (CPCB) recent notification dated March 7th, 2016 vide No. B-29012/ESS (CPA)/2015-16 for modified directions under Section 18 (1) (b) of the Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981, regarding harmonization of classification of industrial sectors under red/orange/green/w hite categories. Industrial sectors having Pollution Index scores inclusive and up to 20 fall under the White Category projects. Solar & Wind projects are categorised as White Category. According to the notification, there is no necessity of obtaining CTO for White Category industries. Intimation to GPCB shall suffice for the Project. Furthermore, as per Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2019, project shall not be required to obtain Hazardous Waste Authorization from GPCB in case CTE

Agency	Function	Application/relevance to the project
		or CTO are not required under The Air (Prevention and Control of Pollution) Act, 1981 and The Water (Prevention and Control of Pollution) Act, 1974. Provided that the hazardous and other wastes generated by the project will be given to the actual user, waste collector or operator of the disposal facility in accordance with CPCB guidelines. (Refer section 3,4, 5 & 6 of below Table 2.9)
Labour & Employment Department, Government of Gujarat	The Department of Labour is responsible for formulation, implementation, and enforcement of the labour laws in the Gujarat state. It also undertakes prevention and settlement of industrial disputes, Industrial safety, Health and promotes welfare of workers in the undertakings falling within the sphere of the State.	Project will have to obtain principal employer labour license during construction & operational phase Labour to be involved during the construction phase and few labours shall be required during in the operation phase. The labours (local and migrant) should be provided with wages and other facilities which should be in compliance with the state law s and acts.
Gujarat Forest Department and Wildlife Department	Key functions are summarised below. ○ To protect, develop and manage the forest and wildlife resources of the state. ○ To implement policies and programmes of the State Government with regard to protection, development and management of forest and wildlife resources of the state. ○ To enforce acts, laws, rules and regulations pertaining to the protection and management of forests and wildlife. ○ To take steps for the implementation of the National Forest Policy & State Forest Policy. ○ To accord permission/ NOC for project developments in the region ○ To check the process of desertification through massive Afforestation Programmes in desert and IGNP areas of the State ○ To undertake plantations on large scale on available revenue wastelands	Refer section 2 of below Table 2.9. *As reported, no forest land is involved for deforestation purpose for the development of the proposed project.* Approval of the Forest Department is required if project-related infrastructure, activities or personnel occur within a legally protected forest area, which is not applicable in this case

2.5 Applicable Regulations, Guidelines and Standards

This section describes regulations, statutory guidelines and obligatory standards that are applicable to the social and environmental performance of the project.

Unlike fossil fuel-based power generation, solar power does not lead to any harmful emissions during operation. As per the Ministry of Environment, Forests and Climate Change (MoEF&CC) EIA Notification (2006) and subsequent amendments, setting up of solar power project does not require prior environmental clearance from Central or State Department of Environment. Under specific circumstances (where forest diversion is involved or in the case of location within Eco-sensitive Zones), forest clearance and specific approvals from the National Board of Wildlife may get triggered.

The Central Pollution Control Board (CPCB) has issued a notification (dated 7th March 2016) that all solar projects are classified under the White Industrial Category and hence will not require Consent to Operate (CTO). A brief description of the relevant enforcement agencies with respect to the institutional framework is described below.

Table 2-9: Environmental, Health, Safety and Social Regulations

S.N.	National Environment, Health & Safety Regulation	Regulatory Authority	Requirement	Applicability /Remarks
1.	Environmental Clearance (EC) as per Environmental Impact Assessment Notification dated 14th September 2006 and 01.12.2009 from MoEF&CC	MoEF&CC	The EIA Notification 2006 and thereafter the MoEF&CC Office Memorandum dated, 13th May 2011 exempts solar power project from obtaining prior Environmental Clearance from the regulatory authorities. But, under the provision of MoEF&CC office memorandum dated 30th June 2011, requisite permission is required to be obtained from competent authority for water and land usage.	*Not applicable* Solar energy projects in India at present are not covered under the 2006 EIA notification and are, therefore, exempted from regulatory EIA process for obtaining environmental clearance.
2.	Forest Clearance under the Forest (Conservation) Act 1980 from Ministry of Environment, Forests & Climate Change	MoEF&CC	The Forest Conservation Act and Rules mandate projects requiring diversion of forest land for non-forest purposes to seek Forest Clearance from the Ministry of Environment and Forests and Climate Change (MoEF&CC)	*Not Applicable* *As reported, no forest land is involved for deforestation purpose for the development of the proposed project.* Approval of the Forest Department is required if project-related infrastructure, activities or personnel occur within a legally protected forest area.
3.	Consent to Establish (CTE) & Consent to Operate (CTO) from Gujarat Pollution Control Board (GPCB) under Gujarat Air (Prevention & Control of Pollution) Amendment Rules, 2016 The Water (Prevention and Control Of Pollution) Act 1974	GPCB	With reference to the CPCB modified direction No. B-29012/ESS(CPA)/2015-16; dated March 07, 2016 Solar power project falls in White category, and it is mentioned in the notification that there shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice.	*CTE & CTO for the proposed project is not applicable, However, project needs to ensure followings including project need to intimate GPCB prior to commissioning its operation.* o Permissible limits for ambient air quality, water quality, noise limits has been laid down by CPCB under EP Act, 1986 which requires to be complied with. o Based on the notification released by the Central Pollution Control Board (CPCB Ref No: B-29012/ ESS (CPA)/2015-201610), "Solar projects, wind power projects and mini hydro projects (less than 25 MW)" have been moved from "green category" to "white category" and there shall be no necessity of obtaining Consent to Operate, an intimation to SPCB/PCC shall suffice.
4.	Hazardous Waste Authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its Amendments	GPCB	According to Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2019, an occupier shall not be required to obtain an Hazardous Waste Authorization from SPCB in case Consent to Establish (CTE) or Consent to Operate (CTO) is not required under The Air (Prevention and Control of Pollution) Act, 1981 and The Water (Prevention and Control of Pollution) Act, 1974. Provided that the hazardous and other wastes generated by the occupier shall be given to the actual user, waste collector or operator of the disposal facility in accordance with CPCB guidelines. Since the Project does not require CTE and CTO hence Project is exempted from obtaining hazardous waste authorization.	*Not Applicable.* Since the project does not require CTE and CTO under the Air Prevention and Control of Pollution Act, 1981 (Air Act, 1981) and Water Prevention and Control of pollution) Act, 1974 (the Water Act 1974), hence, hazardous waste authorization is not applicable for the project. However, the project requires to dispose hazardous waste (such as transformer waste oil/ bottom sludge) through CPCB/GPCB authorized waste collector or operator of the disposal facility (formal agreement yet to be executed),. *Refer section below*
5.	Hazardous Waste Management Gazette notification (no 158 MARCH 5 , 2019) of Hazardous and Other Wastes (Management and Transboundary Movement) Amendment, Rules, 2019	GPCB	These Rules outline the responsibilities hazardous and other wastes generated by the occupier shall be given to the actual user, waste collector or operator of the disposal facility, in accordance with the Central Pollution Control Board guidelines."	Applicable during construction & operation phase. As stated in the above cited notification, an occupier shall not be required obtain an authorisation under this rule, from the State Pollution Control Board, in case the consent to establish or consent to operate, is not required from the State Pollution Control Board or Pollution Control Committee under the Water (Prevention and Control of Pollution) Act, 1974 (25 of1974) and Air (Prevention and Control of Pollution) Act, 1981 (21 of 1981); The project will result in generation of some quantities of hazardous waste, mostly in the form of waste/used oil released from transformer. In this regard, with reference to the above stated rule, *occupier* shall be given to the actual user, waste collector or operator of the disposal facility, in accordance with the Central Pollution Control Board (CPCB) guidelines.". Refer above section. AEWIWOPL will ensure that Hazardous waste stored on a paved surface in a designated area with adequate secondary containment, with adequate labelling and before it is disposed to an GPCB approved vendor. Though not covered under the rule, the broken solar panels are recommended to be sent back to the manufacture or an authorised recycler or should be sent back to the CPCB/GPCB authorized vendor for safe disposal or should be stored in safe place so that it don't harm the environment/soil etc.
6.	Wildlife (Protection) Act 1972, Wildlife (protection) Amendment Act 2002 and 2003 amendment.	Chief Conservator Wildlife, NBWL/State Forest Department and MoEF&CC	The Act provides for the protection of wild animals, birds and plants; and for matters connected therewith or ancillary or incidental there to. The application of the Order of the Honourable Supreme Court in WP 460 of 2004 dated 04.12.2006 in the matter of Goa Foundation v. Union of India and other wherein the Honourable Supreme Court has directed that all projects which require environmental clearance and are located within the distance of 10Km of National Park and Sanctuaries must be placed before the standing Committee of the National Board for Wildlife constituted under the Wildlife (Protection) Act, 1972.	Not applicable No wildlife sanctuary or national park or eco-sensitive zone exists within 10 km radius from the project site. Approval of the National Board for Wildlife is required if project-related infrastructure, activities or personnel occur within national parks and sanctuaries

S.N.	National Environment, Health & Safety Regulation	Regulatory Authority	Requirement	Applicability /Remarks
7.	Permission/ NOC from Central Ground Water Authority (CGWA) under Environmental Protection Act (EPA) (1986)	Central Ground Water Authority	As per the notification [4] of Ministry of Jal Shakti, Central Ground Water Authority dated 24th September 2020"All new/existing industries, industries seeking expansion, infrastructure projects and mining projects abstracting ground water (more than 10 m^3 /day), will be required to seek No Objection Certificate from Central Ground Water Authority or, the concerned State/ UT Ground Water Authority as the case may be."	*Not Applicable, since the project doesn't envisage any ground water abstraction*
8.	Noise (Regulation and Control) Rules 2000 amended in 2010 Ambient Noise Standards	GPCB	The Rules stipulate ambient noise limits during daytime and nighttime for industrial, commercial, residential and ecologically sensitive areas. The rules apply both during the construction and operation of the project. Violation of the standards for assessing the noise quality due to the project will lead to penalty as under the EPA Act 1986.	*Applicable only to comply with the standard (No NOC required) during construction and operation phase.* Installation of solar panels, construction activities may generate significant amount of noise. During operation phase noise generation is expected from inverter room. As per the Act, ambient noise levels are to be maintained as stipulated in the rules for different categories of areas such as residential, commercial, and industrial and silence zones. Considering the context of the Project, AEWIWOPL and their contractors will need toabide by the limits prescribed for residential zones.
9.	Solid Waste Management Rules 2016	GPCB local municipal bodies	All bio-degradable, non-biodegradable and domestic hazardous wastes generated from theproject will be managed by AEWIWOPL (the waste generator) in accordance to the relevant provision of this Rule.	*Applicable during construction and operation phase.* AEWIWOPL shall ensure disposal of solid waste through an authorized vendor.
10.	The Batteries (Management and Handling) Rules 2001 as amended later	GPCB	Filing of Half Yearly return by bulk consumers and auctioneers of batteries to State Pollution Control Board as per Form 8 and 9 under Rules10 (2) (ii) and 11 (ii) respectively	Rules will be applicable during construction and operation phases as the project will use batteries for power back up
11.	E-waste (Management) Rules, 2016, as amended in 2018	GPCB	E-waste authorization,	Applicable during operational and decommissioning phase Rules will be applicable as electrical and electronics as listed in the Schedule I of the aforesaid rules will be used and will require replacement within the lifecycle of the wholeproject as well during decommissioning.
12.	Storage of Petroleum products ○ The Petroleum Act 1934, as amended in August 1976 ○ The Petroleum Rules 1976, as amended in March 2002.	PESO (Chief Controller of Explosives)	As per Section 3 of The Petroleum Act 1934 and Rule 116 of The Petroleum Rules 1976, ESPL will be required to obtain a license from PESO, if the quantity of the fuel stored exceeds two thousand and five hundred litres and/ or is stored in a receptacle exceeding one thousand litres in capacity	Not Applicable during construction phase, as storage quantity shall be very low There will be storage of Diesel at site for operation of generators during construction phase.
13.	Surface Transportation ○ The Motor Vehicles Act 1988, as amended by Motor Vehicles (Amendment) Act 2000, dated 14th August 2000. ○ The Central Motor Vehicles Rules 1989, as amended through 20th October 2004 by the Central Motor Vehicles (Fourth Amendment) Rules 2004	State Transport Authority		AEWIWOPL to ensure compliance of the Section 39, Motor Vehicle Act, 1988 as amended in 2017 and Rule 47, Motor Vehicle Rule, 1989.
14.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	Local Administration District Collector Revenue Officer	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RTFCTLARR Act), stipulates mandatory consent of at least 70% of affected people for acquiring land for Public Private Partnership (PPP) projects and 80% for acquiring land for private companies. It also requires that payment of compensation for the owners of the acquired land will be four times the market value in rural areas and twice in urban areas. It also stipulates that the land cannot be vacated until the entire compensation is awarded to the affected parties. The law has the provision that the companies can lease the land instead of purchasing it. Besides, the private companies will have to provide for rehabilitation and resettlement if land acquired through private negotiations is more than 50 acres and 100 acres in urban and rural areas, respectively.	*Not applicable* Land for the proposed project has been purchased and/or taken on lease on willing seller-willing buyer basis. It does not involve any involuntary displacement. Therefore, LARR 2013 is not applicable for this project.
15.	The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act 1996	Ministry of Labour and Employment	This Act provides for safety, health and welfare measures of construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare amenities like drinking water, latrines, urinals, crèches, first aid, canteens and temporary living quarters within or near	*Applicable during construction phase* Project proponent will ensure through its contractors that basic amenities are provided to the labours. Project proponent through its contractors should also ensure all vendors employed should have valid labour license. Compensation to workers (own and vendors) should not

[4] http://cgwa-noc.gov.in/landingpage/LatestUpdate/NewGuidelinesNotified250920.pdf#ZOOM=100 Assessed on 24th Sep 2021

S.N.	National Environment, Health & Safety Regulation	Regulatory Authority	Requirement	Applicability /Remarks
			the work site. This Act also requires application of the following: Building or other construction workers' (regulation and Employment Conditions of Service) Central Rules 1998 & Workman's compensation Act, 1923 to buildings and other construction workers. These will be followed by contractor & developer during construction and operation phase.	be below daily wage rate as specified by Government. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with. Failure to comply results in financial penalty /imprisonment of the principal employer along with vendor and closure of project.
16.	Workmen's Compensation Act, 1923 & Rules 1924	Labour Welfare Board, Gujarat	The Act requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer should be liable to pay compensation in accordance with the provisions of this Act.	*Applicable during both construction and Operation phase* Project proponent should ensure through its contractors and subcontractors in case of any accident/ injury/ loss of life the workmen should be paid a minimum compensation as calculated under this act both during construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount of compensation and wages.
17.	The Contract Labour (Regulation and Abolition) Rules, 1971 Contract Labour (Regulation and Abolition), 1973	Labour Welfare Board, Gujarat	The Contract Labour (Regulations & Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registering the establishment. The Act and its Rules apply to every establishment in which 20 or more workmen are employed on any day on the preceding 12 months as contract labour and to every contractor who employs or who employed on any day preceding 12months, 20 or more workmen. It does not apply to establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the Act and Rules if the work performed is more than 120 days in a year, and where work is of a seasonal nature if work is performed more than 60 days in a year.	*Applicable during both construction and Operation phase.* All vendors employed including contractors and subcontractors should have valid labour license. Compensation to contract workers (own and vendors) should not be below daily wage rate as specified by Government of India. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with. Failure to comply results in financial penalty. AEWIWOPL through its contractors should also ensure that conditions like hours of work, fixation of wages and other essential amenities in respect of contract labour are provided and in compliance with the standards.
18.	Minimum Wages Act, 1948	Labour Welfare Board, Gujarat	This Act provide for fixing minimum rates of wages in certain employments and requires the employer to provide to every worker engaged in a scheduled employment to be paid wages at a rate not less than the minimum rate of wages fixed by such notification for that class of employees in that employment without any deductions except as may be authorized within such time and subject to such conditions as may be prescribed.	*Applicable during both construction and Operation phase*
19.	Factory License under factories act 1948 and Gujarat Factories Rules, 1951	Labour Welfare Board, Gujarat	With reference to the factories act 1948, the same is applicable because this solar plant generating, transforming or transmitting electrical energy and more than 10 workers are employed/working at site.	*AEWIWOPL should obtain the same for this project prior to commissioning of the project*
20.	The Child Labour (Prohibition and Regulation) Act, 1986	Labour Welfare Board, Gujarat	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions of work for children, if permitted to work.	*AEWIWOPL should ensure that no child labour is engaged at site for construction or operation works either directly or by the sub-contractors. AEWIWOPL should include a clause in the subcontractor agreements prohibiting employment of child labour.*
21.	Inter-state Migrant Workers (ISMW) Act, 1979	Labour Department, Government of Gujarat	If the project deploys labours outside Gujarat state during construction phase.	Applicable if If the project deploy labours outside Gujarat state. Certificate of registration for Inter-State Migrant Workmen should be obtained as per the inter-state migrant workmen (Regulation of Employment and conditions of service) Act, 1979
22.	Companies Act, 2013	AEWIWOPL	According to Schedule 135 subsection 1, the companies meeting the threshold criteria (Minimum net worth of rupees 500 Crore, Turnover up to "1000 Crore" and having a net profit of at least '5 crore') specified should spend in every financial year, at least 2% of the average net profits of the Company made during the three immediately preceding financial years in pursuance of CSR policy.	*The project will need to comply with the requirement as stated in the law.*
23.	The Gujarat Panchayati Raj Act 1994 and its amendments.	Panchayat Union	The act gives powers to the Panchayats in case there is any grievance arises by the project. There is Provision for application of consent from the respective panchayat body/village administrative officer etc., during the project life cycle.	*The project will need to comply with the requirement as stated in the law.* *NOC from Jakhan & Katariya village Panchayat has been obtained* (Appendix C*).*

2.6 ADB Safeguard Policy Statement

In July 2009, ADB's Board of Directors approved the Safeguard Policy Statement (SPS) governing the environmental and social safeguards of ADB's operation. The SPS builds upon ADB's previous safeguard policies on the Environment, Involuntary Resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and more comprehensively address environmental and social impacts and risks. The SPS also provide platform for participation by affected people and other stakeholders in the Project design and implementation.

ADB adopts a set of specific safeguard requirements that are required to address environmental and social impacts and risks: -

- Safeguard Requirements 1: Environment.
- Safeguard Requirement 2: Involuntary Resettlement.
- Safeguard Requirement 3: Indigenous Peoples; and
- Policy on Gender and Development: ADB's Policy on Gender and Development (2006) is the guiding framework for gender and development activities. The policy adopts gender mainstreaming as the key strategy for promoting gender equality and women's empowerment across the ADB funded projects. The Policy on Gender and Development (GAD) is guiding document to ensure that their needs and concerns are addressed and that gender issues in resettlement are mitigated. The policy adopts gender mainstreaming as a key strategy for promoting gender equity, and for ensuring that women participate and that their needs are explicitly addressed in the decision-making process.

Applicability of ADB SPS along with IFC PS has been discussed below.

2.6.1 Applicability of ADB SPS & IFC PS

An overview of ADB's Safeguard Policy Statement (SPS) and their applicability to the project is provided in the table below.

Table 2-10: Broad Overview ADB SPS and their applicability to the Project

Sl. NO	ADB's Policy/SPS	Overview	Applicability to the Project
1	SPS 1: Environment	The Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. The projects are initially screened to determine the level of assessment that is required. ADB categorises the projects into three project categories based on the severity, sensitivity and the magnitude of its potential environmental impacts: Category A (if the project likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required); Category B (if the project likely to have potential impacts are less adverse than category A and minor impacts expected can be mitigated. An initial environmental examination (IEE), including an EMP, is required); and Category C (if the projects likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required).	Applicable This SPS is applicable to environmental aspects like but not limited to air emissions, water and wastewater management, noise emissions, biodiversity, hazardous material management. The proposed Project site and associated infrastructure (Transmission line) does not fall within 10 km of any Protected Areas such as National Parks, Wildlife Sanctuaries, etc. The nearest Protected Area and Important Bird Area (IBA) is Nalsarovar Bird Sanctuary located approximately 19.3 km north-east of the project site. The Nalsarovar Bird Sanctuary has a government notified Eco-sensitive Zone (ESZ). The Sanctuary has been designated as a Ramsar site[5] recognizing it as a Wetland of International Importance under the Ramsar Convention. A review of gazette notification/MoEF&CC notification dated 7th June 2017[6], indicates that an area to an extent varying up to 13 km from the boundary of the Nalsarovar Bird Sanctuary in the State of Gujarat, as Nalsarovar Bird Eco-sensitive Zone. However, the project site is located outside the boundary ESZ of Nalsarovar Bird Sanctuary. As per the available secondary information, Nalsarovar Sanctuary harbours 226 bird species, 20 species of fish and 13 species of mammals including globally threatened species of birds and mammals such as Sarus crane, Indian Skimmer, Asiatic Wild Ass and Wolf as outlined in above notification. Nalsarovar Bird Sanctuary is an important stopover site within the Central Asia Flyway, with globally threatened species such as the critically endangered Sociable Lapwing (*Vanellus gregarius*) and the vulnerable Marbled Teal (*Marmaronetta angustirostris*) stopping over at the site during migration, while the vulnerable Sarus Crane (*Grus antigone*) takes refuge there during summer when other water bodies are dry. Therefore, the potential impact on biodiversity cannot be excluded. Furthermore, the project site is part of the reported ranges of certain potential Critical habitat (CH) trigger species such as Lesser Florican (*Sypheotides indicus*) as defined by the applicable reference frameworks, namely the IFC Performance Standard 6 (PS6), 2012 and the ADB Safeguard Policy Statement (SPS), 2009. During bird survey, Thrice male Lesser Florican (Sypheotides indicus) (IUCN EN v. 2021-1) were sighted in Jakhan Village, in the grassland about 50-100 m opposite to the projected land for the Solar Power Project. The bird survey report is annexed separately. ○ This IESE is being conducted by Arcadis as part of the "identification of risks and impacts" requirement under the IFC PS 1. The management plan prescribed in this IESE report will be implemented for mitigation of impacts identified. ○ An Environmental and Social Management Plan (ESMP) has been prepared and included in Chapter 7 of the IESE for managing mitigating the potential social and environmental impacts or risks already identified & assessed in IESE.

[5] https://rsis.ramsar.org/ris/2078?language=en *Assessed on 28th Sep 2021*

[6] https://upload.indiacode.nic.in/showfile?actid=AC_CEN_16_18_00011_198629_1517807327582&type=notification&filename=Nalsarovar%20Bird%20Sanctuary,%20Gujarat.pdf *Assessed on 28th Sep 2021* [7] https://www.ifc.org/wps/wcm/connect/29f5137d-6e17-4660-b1f9-02bf561935e5/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES&CVID=jOWim3p *Assessed on 18th Oct 2021*

Sl. NO	ADB's Policy/SPS	Overview	Applicability to the Project
2	SPS 2: Involuntary Resettlement	The policy is designed to avoid the risk of impoverishment among those displaced as a direct result of ADB investment. The policy recognizes that restoring the incomes and living standards of the affected people is complex, and requires a development strategy that encompasses compensation, resettlement and rehabilitation packages to improve, or at least restore, their social and economic base. The ADB's Policy on Involuntary Resettlement stipulates three important elements in involuntary resettlement: (i) compensation for lost assets and loss of livelihood and income, (ii) assistance in relocation including provision of relocation sites with appropriate facilities and services, and (iii) assistance with rehabilitation to achieve at least the same level of well-being with the project as before.	Applicable o The project will be spread over on approx.332 acres of private agriculture land. Out of 332 acres of total land, approximately 238.7 acres of private land to be leased from the 87 (Eighty-seven) landowners in Katariya village and the remaining 93.3 acres of land to be leased from the 29 (Twenty-Nine) landowners in Jakhan village, who are primarily engaged in agricultural allied activities for their source of livelihood. o There is no land acquisition for the project, land is being voluntarily leased by the landowners and adequate lease rent will be paid. Most of the landowners have alternative land for doing agriculture activities. They are not solely dependent on the proposed project land. There will be temporarily shift of the farm labours working on the land. o Land leasing will not result in any physical displacement, the land sourced for developing the project is unirrigated rainfed agriculture land. As discussed in the subsequent subsections, the agriculture is not extensively cultivated due to lack of irrigation. And as reported by during the consultation with the landowners, average earning of a good season from their land parcel leased for project was INR. 8000-12,000 /acre /annum. And by leasing the land to the project the landowners were able to make assured income through yearly lease rental of INR. 33,500/Acre/Annum for 29 years & 6 Months with 5 % escalation for every three years. As reported, the landowners are willingly leasing their land because the existing agriculture practices on the proposed land has become unviable due to increased labour cost and infertile land in the region. Now they can have fixed income from leasing of land and have voluntarily agreed on the compensation/term payment Therefore, land leasing will not have any adverse impact on the livelihood of the landowners. Out of 116 landowners, 28 have been consulted during site visit and they are satisfied with the land leasing process and compensation package. o Six agriculture workers reported to have reduced agriculture activities due to the development of solar project are not primarily dependent on the piece of project site land. Moreover, The project will generate number of direct and indirect employment opportunities in the neighbouring villages both during construction and operation phase, the work includes various construction works during the construction phase and during operation phase like grass cutting, module cleaning, panel tilting works, deployment of security staffs etc. o With respect to proposed transmission line, Right of way and payment of compensation will be decided following due criteria as per the Guidelines issued by Ministy of Power on Right of Way for Transmission lines dated 15th Oct 2015. Transmission towers are proposed to be erected on the private land through negotiation on voluntary basis. Hence, there is will not be regarding issues arise on Right of Way for transmission line, etc
3	SPS 3: Indigenous People	The Policy on Indigenous Peoples is triggered if a project directly or indirectly affects the dignity, human rights, livelihood systems, or culture of indigenous peoples or affects the territories or natural or cultural resources that indigenous peoples own, use, occupy, or claim as an ancestral domain or asset. The policy on states that the borrower/ client will ensure (i) that affected indigenous peoples receive culturally appropriate social and economic benefits; and (ii) that when potential adverse impacts on indigenous peoples are identified, these will be avoided to the maximum extent possible. Where this avoidance is not feasible, based on meaningful consultation with indigenous communities, the Indigenous Peoples Plan (IPP) will be prepared which outlines measures to minimize, mitigate, and compensate for the adverse impacts.	Not Applicable The study area (located in Surendranagar district) does not fall in any Notified Tribal Area of Surendarnagar State. There is no tribal population reported in both the villages and also verified from the secondary data of Census if India 2011. Therefore, no tribal land will be involved.
4.	Policy on Gender and Development	ADB's Policy on Gender and Development (2006) is the guiding framework for gender and development activities. The policy adopts gender mainstreaming as the key strategy for promoting gender equality and women's empowerment across the ADB funded projects. The Policy on Gender and Development (GAD) is guiding document to ensure that their needs and concerns are addressed and that gender issues in resettlement are mitigated. The policy adopts gender mainstreaming as a key strategy for promoting gender equity, and for ensuring that women participate and that their needs are explicitly addressed in the decision-making process.	Applicable This policy is applicable to social aspects such as recruitment and selection, terms of employment, equal opportunity and non-discrimination, parity in salary/ wages etc.

Table 2-11: Broad Overview of IFC Performance Standards and their applicability to the Project

Title of Performance Standard	Performance Standard (PS) objectives in brief	Applicability to project (Conformance requirement)
Performance Standard (PS) - 1 Assessment and Management of Environmental and Social Risks and Impacts	Assess and manage Environmental and Social Impacts of the project, appropriate to the nature of the project's environmental and social risks and potential impacts.	The IESE study is being conducted to identify the environment and social risks that may arise due to the project and recommend mitigation measures for the same. The PS 1 is applicable to projects with environment and/or social risks and/or impacts. The project will have environmental, ecological and social impacts resulting from project activities on air pollution, water pollution, waste generation and noise pollution during construction phase; on avifauna & due to unmanaged waste practices (both construction & operation phase), ***PS 1 is therefore applicable for the project***.
PS 2: Labour and Working Conditions	o Establishment of a Human Resources Policy consistent with the requirements of this Standard that informs employees of their rights under national labour and employment laws. o Document and communicate to all employees' conditions and terms of employment. o Provide workers with a safe and healthy work environment, considering risks inherent to the particular project sector. o Practice non-discrimination and equal opportunity in making employment decisions. retrenchment, protecting the workforce and occupational health and safety. Provide a mechanism for workers to raise workplace concerns.	o The PS 2 applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers). o The project is expected to involve employment of 350 nos. direct and contracted workers during the peak construction phase of which 150 will be working as skilled, 150 semi-skilled and 100 unskilled workers and 30-35 no's during operation phases. Locals will be preferred to carry out unskilled work. o AEWIWOPL should ensure that adequate facilities and amenities are provided in the labour accommodation for construction workers including adequate living/sleeping facilities and space per person; potable water that meets national standards and standards as laid down by EBRD; Accommodation facilities like drinking water, canteen and cooking facility, sanitation, bed arrangements, toilets facility medical facility and leisure and social entertainment and nutrition and food safety ; and facilities for management and disposal of garbage, sewage and other waste at the labour accommodation facilities. o The company, as a part of oversight procedures will need regular monitoring of compliance to the aforesaid guidelines/requirements and ensure that these are met at the project site. Internal audits and follow up on corrective actions will also need to be undertaken to assess efficacy of the oversight system. o The project will have to develop a human resource policy and ensure non-discrimination and equal opportunity, protection of the workforce and occupational health and safety. o AEWIWOPL would engage labours through its contractors, however the same should be supervised so that the engagement of workers is in accordance with applicable rules and regulations. o AEWIWOPL through contractor will ensure adequate provisions of facilities such as access to clean water, sanitary facilities and other necessary facilities at the labour camps and construction sites. o Equal opportunity should be given to both men and women depending on their skills and capacity wages, work hours and other benefits should be as per the national labour and employment Laws. o AEWIWOPL's Grievance Redressal Mechanism (GRM) should be in place under integrated management policy the same will be implemented at project level. o This is applicable both during construction and operation phase and should be supervised by AEWIWOPL o AEWIWOPL or their contractor should follow its SHES policy while operating onsite. In absence of SHES policy of contractor, ESMS policies of AEWIWOPL will be applicable. AEWIWOPL or their contractor should appoint an SHES manager onsite, who has well defined roles and responsibilities at all the solar power site
PS 3: Resource Efficiency & Pollution Prevention	o Adequate control techniques to minimize emissions or achieve a pre-established performance level and Minimize pollution from project activities.	The project would involve air & noise emissions, waste generation (construction waste, domestic waste, waste water), hazardous material disposal. ***Hence PS 3 is applicable for the project.***
PS 4: Community Health, Safety and Security	This PS-4 requires due diligence to anticipate and avoid adverseimpacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances. It also requires ensuring that the safeguarding ofpersonnel and property is carried out in accordance with relevanthuman rights principles and in a manner that avoids or minimizes risks to the affected Communities. Key areas of compliance screened under PS-4 includes infrastructure/equipment safety, hazardous material safety, natural resource issues, exposure to disease, emergency preparedness and response, and security personnel requirements. The project would affect the health and safety of the communities adjacent to it during construction phase.	o This Performance Standard is applicable to projects which entail potential risks and impacts to the health and safety of affected communities from project activities. The project will involve transportation of components such as mounting structures, electrical equipment's, solar modules, which may pose safety risks to the local communities. o The Project activities will involve upgradation of village roads connecting the site and construction activities will lead to stress on the Project access road and on the area in general. Transportation of equipment and increased traffic in the area may lead to accidents and other threats on community health and safety. Moreover, the Project may pose stress on common water resources such as SSNNL canals, water ponds and groundwater due to use of significant amount of water during construction and operation phase

Title of Performance Standard	Performance Standard (PS) objectives in brief	Applicability to project (Conformance requirement)
		○ While solar power projects have a limited and controlled footprint major issue is related to glare or reflection. Considering scale of project substantial movement of heavy vehicles are envisaged. ***The PS 4 is therefore applicable for the project.***
PS 5: Land Acquisition and Involuntary Resettlement	○ PS 5 is applicable when there is physical and/or economic displacement due to acquisition of land for the project. ○ This PS does not apply to resettlement resulting from voluntary land transactions (i.e. market transactions in which the seller is not obliged to sell, and the buyer cannot resort to expropriation or other compulsory procedures if negotiation fails). The impacts arising from such transactions should be dealt with as under PS1, though sometimes, when risks are identified, the project proponent may decide to adhere to PS 5 requirement. ○ Avoidance or at least minimization of involuntary resettlement by exploring alternative project designs balancing environmental, social and economic costs and benefits; and by acquiring land through negotiated Settlements. ○ Compensation and benefits for displaced person as per Performance Standard ○ Disclosure of all relevant information and consultation with affected persons and communities in decision making process related to resettlement. Establish a grievance mechanism to record and resolve communities' concerns and grievances about the relocation (if any) and compensation	Not Applicable ○ The project will be spread over on approx.332 acres of private agriculture land. Out of 332 acres of total land, approximately 238.7 acres of private land to be leased from the 87 (Eighty-seven) landowners in Katariya village and the remaining 93.3 acres of land to be leased from the 29 (Twenty-Nine) landowners in Jakhan village, who are primarily engaged in agricultural allied activities for their source of livelihood. ○ There is no land acquisition for the project, land is being voluntarily leased by the landowners and adequate lease rent will be paid. Most of the landowners have alternative land for doing agriculture activities. They are not solely dependent on the proposed project land. There will be temporarily shift of the farm labours working on the land. ○ There is not a single case of involuntarily resettlement and no physical displacement is taking place due to leasing of land for the project. The lease rent is INR 33,500/Acre/Annum for 29 years & 6 Months with @5 % escalation after every three years on current rates, and lease. Also, it was reported at the site that lease rent INR 33,500/acre/annum will be paid uniformly to all the landowners, irrespective of the aspects like difference in land quality, location of land. ○ As reported, the landowners are willingly leasing their land because the existing agriculture practices on the proposed land has become unviable due to increased labour cost and infertile land in the region. Now they can have fixed income from leasing of land and have voluntarily agreed on the compensation/term payment Therefore, land leasing will not have any adverse impact on the livelihood of the landowners. Out of 116 landowners, 28 have been consulted during site visit and they are satisfied with the land leasing process and compensation package. Among 15 agriculture labours consulted, about 6 women agriculture workers reported to have reduced agriculture activities/job opportunities due to the development of solar project. These agriculture labours are not primarily dependent on the piece of project site land. Moreover, the project will generate number of direct and indirect employment opportunities in the neighboring villages both during construction and operation phase, the work includes various construction works during the construction phase and during operation phase like grass cutting, module cleaning, panel tilting works, deployment of security staffs etc..Hence, there are no reported Economic displacmenet concerining the seasonal labors involved occasionaly in the farms.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Avoiding impacts on biodiversity and ecosystem services is the first priority. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity to be implemented.	Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The project area of influence has critically endangered & endangered avifauna species which can be subjected to electrocution & collision with transmission lines, ***PS6 is therefore applicable to the project.***
PS 7: Indigenous Peoples	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. Therefore, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities	The study area (located in Surendranagar district) does not fall in any Notified Tribal Area of Surendranagar State. There is no tribal population reported in bothe the villages and also verified from the secondary data of Census if India 2011. Therefore, no tribal land will be involved. ***PS 7 is not applicable in this case.***
PS 8: Cultural Heritage	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage during their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.	Based on the secondary information available and observation made during site visit, there is no structure of archaeological and cultural heritage reported on the proposed project site. No monument or structure of religious importance were observed within 10 Km radius of the study area village. ***Therefore, PS 8 stands not applicable.***

2.6.2 E&S Categorization of Project as per ADB SPS

Safeguard Requirements 1: Environment.

The ADB SPS along with the ADB Environmental Safeguards, A Good Practice Sourcebook, 2012 clarifies the rationale, scope and content of an environmental assessment and supported by technical guidelines (e.g., Environmental Assessment Guidelines, 2003). Projects are initially screened to determine the level of assessment that is required according to the following environmental categories (A, B, or C).

- **Category A:** The project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA), including an environmental management plan (EMP), has to be prepared by the borrower/client.
- **Category B:** The project's potential environmental impacts are less adverse and fewer in number than those in category A. Impacts are site-specific, few of which, if any, are irreversible. Impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, has to be prepared by the borrower/client.
- **Category C:** The project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, but ADB will conduct a desk review of the project's environmental implications.
- **Category FI:** The project involves the investment of ADB funds to or through a financial intermediary.

The project has been evaluated considering the environmental (SPS1) categorization of ADB. The adverse environmental and social impacts of the project are considered site-specific and reversible. Therefore, it has been classified as **Category B** in accordance with ADB's SPS1 (2009). The rationale for categorisation is as follows:

- Solar power project is a clean technology (while category as per CPCB categorization) project using solar energy for generation of electricity.
- Potentially limited & reversible risks/impacts: Available data suggests that the construction, operation and decommissioning of the proposed solar project is likely to have environmental and social impacts during the construction, operation, and decommissioning phase and will encompass changes in land-use, increased noise levels, changes in air quality, biodiversity, use and changes in water availability and quality, occupational health & safety, etc. Most of these impacts identified are limited to the project site and their immediate vicinity and can be minimized through implementation of mitigation measures as proposed in the ESMP. Furthermore, no harmful emissions are expected from the project operations. Also, potential impacts on avifauna will be minimised by implementing the measures proposed & through effective monitoring.
- The Project Site does not coincide or overlap with any Designated Area.
- Unprecedented: Solar power project is developing in large numbers in the last decade and therefore several such projects are located across India including Gujarat. Ministry of New & Renewable Energy (MNRE)/ Gujarat Urja Vikas Nigam Limited (GUVNL) has sanctioned various solar project of varying capacities in Gujarat including the vicinity of proposed project site. The proposed Project and its surrounding areas consist of a number of upcoming and operational solar projects (Refer Section 2.1). Therefore, the solar power project cannot be considered an unprecedented activity.

Safeguard Requirement 2: Involuntary Resettlement.

The involuntary resettlement impacts of an ADB – supported project is considered significant if 200 or more persons will be physically displaced from home or lose 10% or more of their productive or income generating assets

For those involving involuntary resettlement, a resettlement plan is prepared that is commensurate with the extent and degree of the impacts: the scope of physical and economic displacement and the vulnerability of the affected persons

The ADB Safeguard Policy identified Project categories in term of Involuntary Resettlement is summarized below:

- **Category A:** A proposed project is classified as Category A if it is likely to have significant involuntary resettlement impacts. A resettlement plan, including assessment of social impacts, is required.
- **Category B:** A proposed project is classified as Category B if it includes involuntary resettlement impacts that are not deemed significant. A resettlement plan, which includes assessment of social impacts, is required.
- **Categories C:** A proposed project is classified as Category C if it has no involuntary resettlement impacts. No further action is required. –
- **Categories FI:** A proposed project is classified as Category FI if it involves the investment of ADB funds to, or through, a financial intermediary.

On the backdrop of the understanding of the categorization of ADB Projects and based on Involuntary Resettlement impacts and based on the following facts, the proposed Project can be classified as **Category B** with respect to SPS 2 – Involuntary Resettlement:

- There is no land acquisition for the project, land is being voluntarily leased by the landowners and adequate lease rent will be paid. Most of the landowners have alternative land for doing agriculture activities. They are not solely dependent on the proposed project land.
- There is not a single case of physical displacement due to leasing of land for the project. The lease rent is INR 33,500/Acre/Annum for 29 years & 6 Months with 5 % escalation after every three years on current rates, and lease. Also, it was reported at the site that lease rent INR 33,500/acre/annum will be paid uniformly to all the landowners, irrespective of the aspects like difference in land quality, location of land.
- As reported, the landowners are willingly leasing their land because the existing agriculture practices on the proposed land has become unviable due to increased labour cost and infertile land in the region. Now they can have fixed income from leasing of land and have voluntarily agreed on the compensation/term payment Therefore, land leasing will not have any adverse impact on the livelihood of the landowners. Out of 116 landowners, 28 have been consulted during site visit and they are satisfied with the land leasing process and compensation package.
- Among 15 agriculture labours consulted, about 6 women agriculture workers reported to have reduced agriculture activities/job opportunities due to the development of solar project. These agriculture labours are not primarily dependent on the piece of project site land. Moreover, the project will generate number of direct and indirect employment opportunities in the neighboring villages both during construction and operation phase, the work includes various construction works during the construction phase and during operation phase like grass cutting, module cleaning, panel tilting works, deployment of security staffs etc.

Safeguard Requirement 3: Indigenous Peoples

- The impacts of an ADB-supported project on Indigenous Peoples are determined by assessing the magnitude of impact in terms of –
- Customary rights of use and access to land and natural resources;
- Socioeconomic status;
- Cultural and communal integrity;
- Health, education, livelihood and social security status; and –
- The recognition of indigenous knowledge; and
- The level of vulnerability of the affected Indigenous Peoples community

The ADB Safeguard Policy identified Project categories in term of Indigenous Peoples (IPs) is summarized below:

- **Category A:** A proposed project is classified as Category A if it is likely to have significant impacts on Indigenous Peoples. An Indigenous Peoples plan (IPP), including assessment of social impacts, is required.
- **Category B**: A proposed project is classified as Category B if it is likely to have limited impacts on Indigenous Peoples. An IPP, including assessment of social impacts, is required.
- **Category C:** A proposed project is classified as Category C if it is not expected to have impacts on Indigenous Peoples. No further action is required.
- **Category FI:** A proposed project is classified as Category FI if it involves the investment of ADB funds to, or through, a financial intermediary.

On the backdrop of the understanding of the categorisation of ADB Projects and based on impacts of IPs and based on the following facts, the proposed Project can be classified as **Category C** with respect to SPS 3.

The study area (located in Surendranagar district) does not fall in any Notified Tribal Area of Surendranagar State. There is no tribal population reported in both the villages and also verified from the secondary data of Census if India 2011. Therefore, no Indigenous Peoples, Scheduled Tribes/Castes will be adversely affected. This project is categorized as C for Indigenous Peoples.

3 DESCRIPTION OF ENVIRONMENT AND SOCIO-ECONOMIC BASELINE CONDITIONS

This chapter describes the existing environmental settings of the project area and its immediate surroundings. This includes physical environment comprising air, water and noise components, biological environment and socio-economic environment. Attributes of the physical environment such as air, water and noise quality in the block and surrounding area were assessed primarily through monitoring and analysis of samples collected from the area. Air, water, and noise quality monitoring was conducted by Vison lab Pvt. Ltd. (a NABL certified laboratory, documents in Annexure). Arcadis team were responsible for selecting the monitoring stations and supervision during on site monitoring which was conducted during the month of September 2021. During monitoring there was some rainfall at site.

Information on geology, hydrology, prevailing natural hazards such as floods, and earthquakes have been collected from literature reviews and authenticated information made available by government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified by the forest officials and against published information and literature. The socioeconomic environment has been studied through consultations with various stakeholders within the site. Additionally, socio-economic data have been obtained from the Census of India, 2011 report.

3.1 Delineation of the Area of Influence

For the purpose of baseline establishment and impact assessment, an Area of Influence (AoI) has been determined for the project site. The subsequent sections provide an understanding of the AoI and reasons for its selection.

3.1.1 Project Footprint Area

The project footprint is the area that may reasonably be expected to be physically touched by Project activities, across all phases. The project footprint includes land used for the setting up theSolar PV's, transformer rooms, storage of materials, site office, access roads, and internal and external transmission lines.

3.1.2 Project Area of Influence (AoI)

The effects of the project and project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of factors. The area of up to 10 km radius from the project boundary (solar plant area) has been demarcated as Area of Influence (AOI) for the project by considering the extent of project impact in terms of noise, water resources, human settlement, cultural heritage sites, location of labour sites, location of the access roads besides considering the actual land area which is to be procured for the project and its utilities footprints. The study area is falling in two villages namely Jhakan and Kataria of Limbdi Tehsil in Surendranagar district of Gujarat.

These factors are incorporated in the definition of the project's Area of Impact (AoI).

The AoI considered for the existing project with respect to the environmental and social resources was based on the following reach of impacts:

- **Environmental parameters:** Project site boundary, immediate vicinity, access road and surroundings, i.e. a study area of approximately 10 km (hereafter referred to as the AoI) distance from project line has been used to depict these parameters;

- Air Quality: Dust emissions, fugitive dust- (impact ranges typically up to 500 m from a construction area and 100m from operations and maintenance area within the AOI. However, to gauge impact on habitations/senstitve receptors, locations have been selected within the entire AOI.
- Noise: Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) –typically 1 km from operations; however, to gauge impact on habitations/senstitve receptors, locations have been selected within the entire AOI.
- Land environment: The impacts on soil and land- typically up to 100 m from project footprint (1 location within project footprint area has been chosen)

- **Ecological/Biodiversity Environment (Terrestrial and Aquatic):** This includes: (a) the direct footprint of the project comprising the solar project; (b) The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence and project related activities (e.g., trampling, transportation activities). The impact of biodiversity is assessed up to 10 km from project footprint area.
- **Social and Cultural**: The AoI for the project is identified as the area within a 5 km radius from the project footprint area and area identified beyond 5 km that is impacted by project activities.

3.2 Baseline Data Collection

As part of the site visit, primary data was collected from sensitive areas and other places inside the study area and concerned government departments. The following subsections provide an understanding of the same.

3.2.1 Collection of Primary Data

Site reconnaissance, identification of sensitive receptors, rapid ecological surveys and consultations were conducted to collect information related to the physical environmental conditions, biological resources and socio-economic profile of the study area respectively. The details of the same have been provided in below Table 3.1**.**

Table 3-1: Sources of Primary Data

Attribute	Source of data collection
Physical Environment	Monitoring of air, noise, water, soil as depicted in Table 4-5 & Figure 4-10. Methodology of monitoring as per Central Pollution Control Board (CPCB) guidelines. (cpcb.nic.in) -included in Appendix Q
Socio-economic Status	Primary consultations were carried out in the study area
Flora and Fauna Survey	Ecological survey was undertaken during site visit as well as secondary information from published literature and data from Forest department and Arcadis previous regional experience in similar type of project

3.2.2 Collection of Secondary Data

Secondary baseline data collection involved identifying and collecting existing published materials and documents. Information on various environment aspects (like geology, hydrogeology, drainage pattern, meteorology, ecology, etc.) and socio-economic aspects were collected from different institutions, government offices and literatures, etc. Secondary data was collected for the aspects as provided in below **Table.**

Table 3-2: Sources of Secondary Data

Attribute	Source of data collection
Meteorological Data	Indian Meteorological Department (IMD)
Geology, hydrogeology, rainfall, topography and drainage	Central Ground Water board (CGWB)
Land-use data	Through satellite imageries and Survey of India topographical sheets
Natural hazards data	Building Materials and Technology Promotion Council of India (BMTPC)
Socio-economic data	Census of India
Land related information	As provided by AEWIWOPL/ Consultation with Local revenue office and landowners

3.3 Baseline Conditions

3.3.1 Climate and Meteorological Conditions

The climate in the area is typical subtropical type of climate with low humidity. The climatological information for the site was obtained from IMD station at Rajkot which is ~ 106 km from the site. The average monthly maximum temperature is 40.5ºC whereas average monthly minimum temperature is 12.8ºC. The temperature profile of the district is shown in **Table 3.3**. The total rainfall in the district is 676.1 mm. June - September is the rainy season and receives maximum rainfall. Monthly variation of rainfall pattern is shown in **Table 3.3.** There is not much difference in the morning and evening relative humidity. Maximum relative humidity reaches during monsoon (June-Sep, 89%) whereas lowest relative humidity is recorded in the month of Nov (54%). Long term Meteorological Data, IMD (Rajkot Station) is shown in **Table 3.3.**

Table 3-3: Long-term Meteorological Data, IMD (Rajkot Station)

Month	Temperature (°C)		Wind Pre-dominant Direction	Monthly Total Rainfall (mm)	Relative Humidity (%)
	Daily Max	Daily Min			
Jan	28.4	12.8	NE	0.8	58
Feb	30.9	15	NE	0.3	62
Mar	35.5	19.2	W	0.1	68
Apr	39.1	22.6	W	1.4	71
May	40.5	25.4	W	5.4	75
June	37.8	26.5	SW	108.4	79
July	33	25.4	SW	253.4	87
Aug	31.6	24.4	SW	165.3	89
Sep	33.6	23.8	W	115.1	86
Oct	35.9	22.4	W	19.3	71
Nov	33.2	18.4	E	6.3	54
Dec	29.9	14.4	E	0.3	56

***Source: Climatological Tables 1981-2010, Indian Meteorological Dept., Govt. of India*

3.3.2 Topography

The site has almost flat terrain with some undulation. As per google earth imagery, The highest and lowest elevation is 28m and 32 m above mean sea level respectively within project boundary. The tentative plant boundary has been identified & upon completion of land procurement the same is expected to be finalized. and the land procurement process is still underway. The digital elevation map is depicted below Figure 3.2.

Figure 3-1: Topography view of the project site

Figure 3-2: Digital Elevation Map

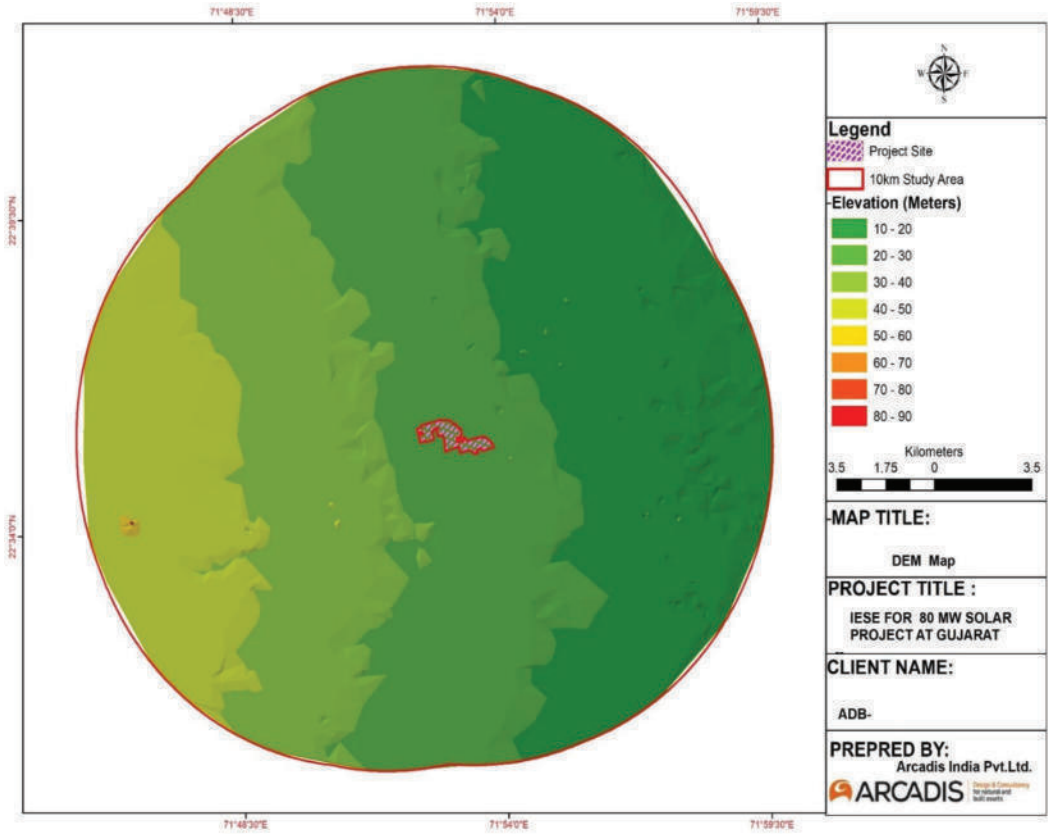
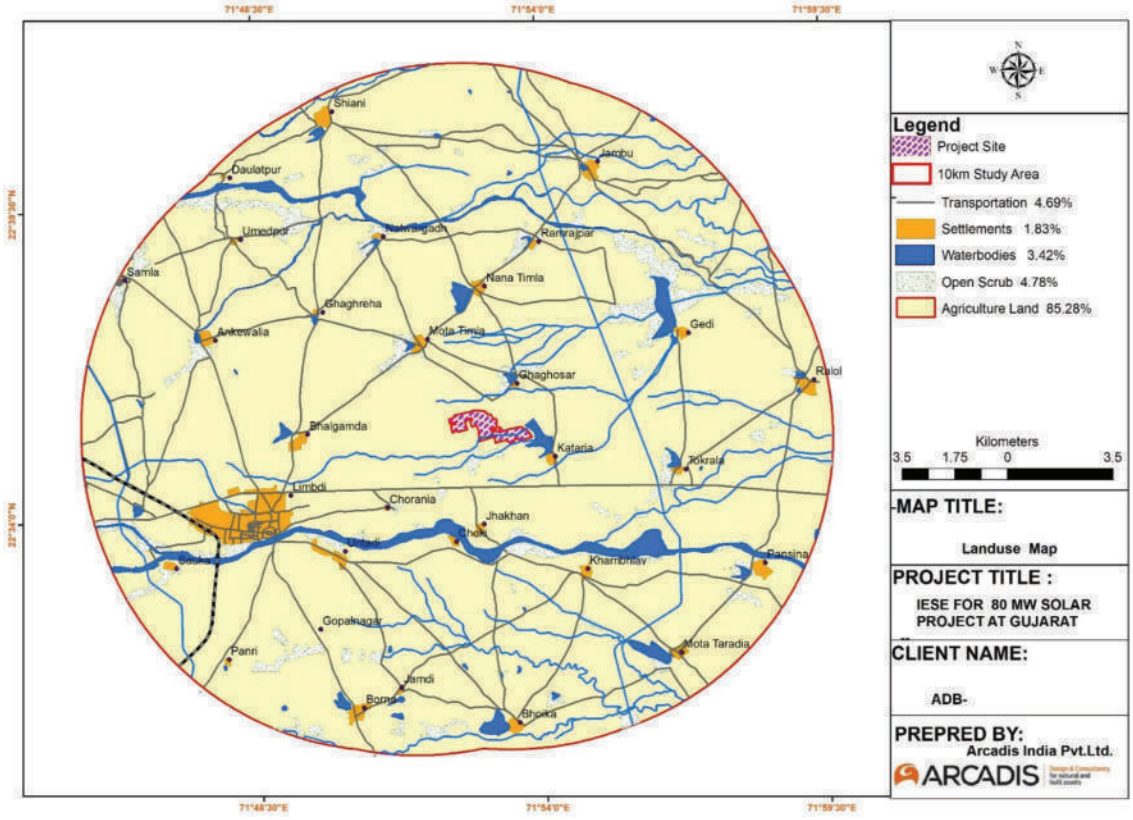


Figure 3-3: Land Use Map



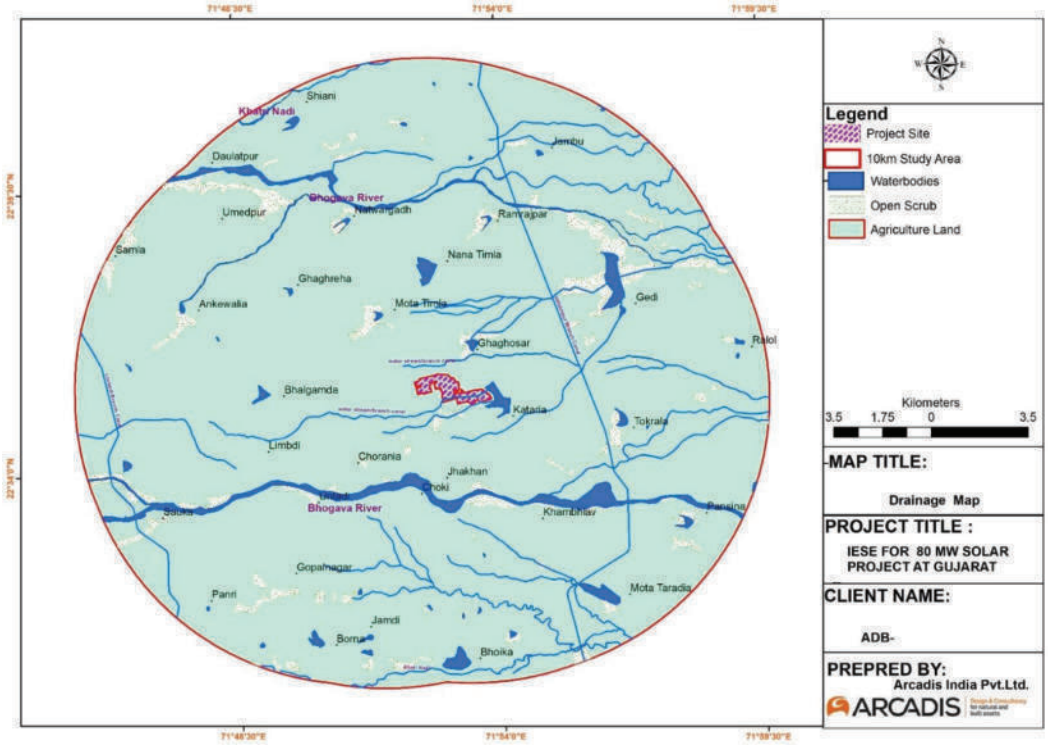
3.3.3 Surface water

As per CGWB District Groundwater brochure Surendranagar District (May 2014), the drainage in the northern most and eastern parts comprises mostly of short streams which disappear into the Little Rann of Kachchh towards north in the low-lying saline/partly marshy land and towards east in the sandy tracts (figure no.2). Limbdi- Bhogava I and Wadhvan- Bhogava II i.e., Bhogava II which originate from the hilly range of Chotilla about 64 km. west of Surendernagar are two east flowing rivers. These rivers have almost no tributaries in the alluvial tracts. Instead, here are several small / insignificant interdunal drains and also many west-east flowing streams which are running parallel to the Bhogava II. There are many small northerly flowing streams out of which the Brahmanani or Bhambani and Kankavati are the only major streams and are ephemeral.

The project site has an adjacent water body in the north-eastern side. The waterbody is predominantly rain fed and water from the adjacent check dam enters here. As per consultation with locals, this canal water is the source of water for domestic as well as irrigation purpose.

The surface water map of the study area is depicted in Figure 3.4.

Figure 3-4: Surface Water Map



3.3.4 Hydrogeology

As per CGWB District groundwater brochure Surendranagar District (May 2014), the groundwater in the area occurs phreatic, semi-confined and confined conditions. The ground water occurrence is controlled by topography, drainage, lithology and disposition of fractures and joints. The medium to coarse grained sandstone act as good repository of ground water. The main water bearing formations identified with in the area as follows:

(a) Ground Water in alluvium: Most of the northern and eastern parts of the district, covering an area of about 5375 Sq. Km, comprise semi and unconsolidated formations. The ground water occurs under unconfined to confined conditions. The depth of the wells in this formation ranges between 2.00 and 30.00 m bgl. The depth of water levels ranges from 0.20 to 20.0 m bgl. The yield of shallow dugwells varies from 40 to 60 m3/day. The depth of the tube wells ranges from 60 to 300 m. The free flow discharge of these well ranges from 5 to 60 m^3/day.

(b) Ground Water in Dhragadhra & Wadhwan Sandstone: The Dhragadhra and Wadhwan sandstone are the most important water bearing formations in the district. They occupy about 2700 Sq.Km. area and situated in the central and northwestern parts of the district.

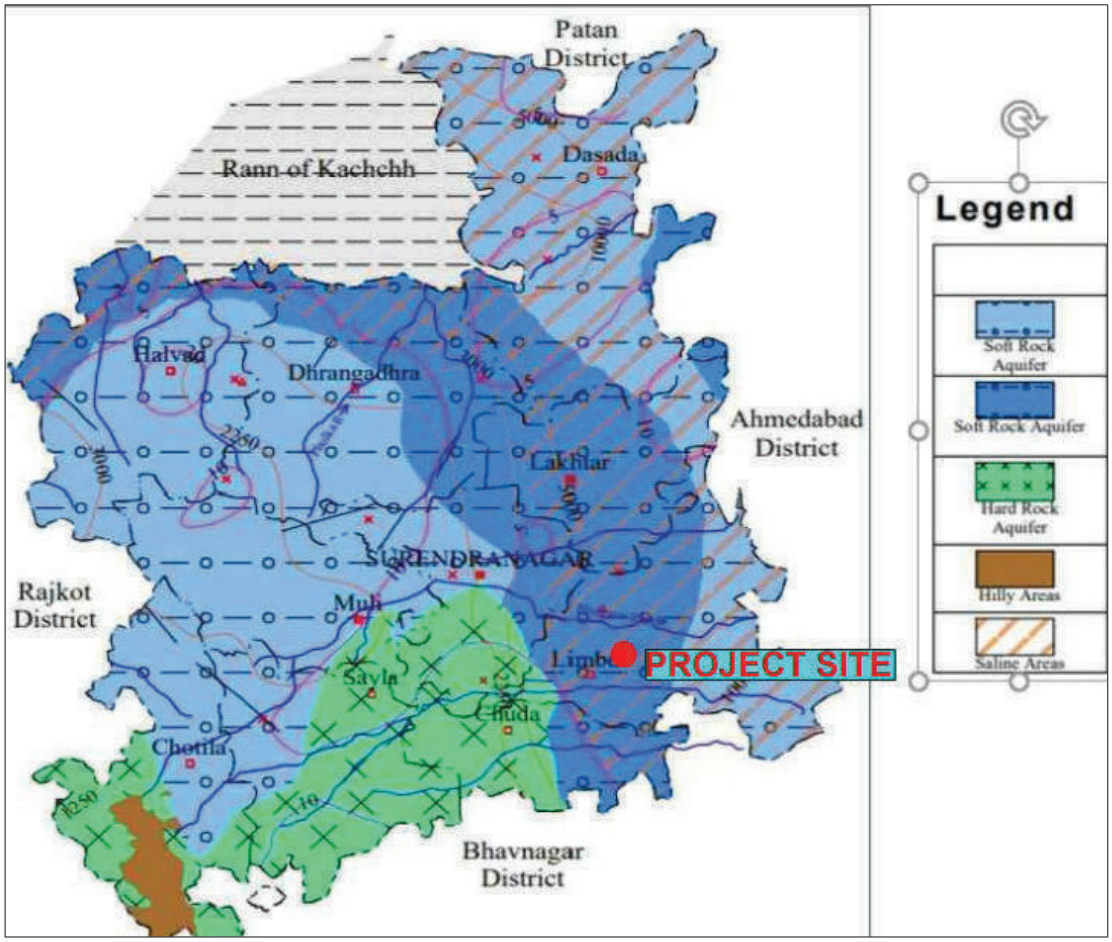
The shallow dugwells in the depth range between 5 and 28m, tapping Upper Dhragadhra sandstone have water yielding capacity of 20 to 60 m^3/day. The general range of water level in these aquifers is around 4 to 22 m.

The Wadhwan sandstone exposed in certain areas near streams and river channels or in the vicinity of surface water reservoirs are yielding fresh water in the order of 15 to 30 m3/day.

(c) Ground Water in Deccan Traps: The Deccan basalts, unconfirmbly overlying the Dhrangadhra and Wadhwan formations form aquifers in southern part of the district, covering an area of 2100 Sq.Km. The movement of ground water is controlled by weathered zone, joints and fissures. The groundwater occurs under both water table and semi-confined conditions. The depth of the dug wells in the traps range from 6.0 to 28.0 m and depth to water level rests between 1.0 and 20 m bgl. The yield of shallow dugwells ranges from 20.0 to 50.0 m^3/day. The depth of the boreholes tapping interflow zones range from 80 to 110 m, where in the piezometric head rests between 18 and 25 m bgl. As such the yield of the shallow/deep boreholes in the traps are ranging from 35 to 70 m^3/day.

The hydrogeological map of the district is depicted in Figure 3.5**.**

Figure 3-5: Hydrogeological Map of Surendranagar District



Source: District Groundwater Brochure, CGWB, Surendranagar district

3.3.5 Ground Water Resources

As per CGWB report, the ground water resources and irrigation potential of the district were calculated as on March 2011 in collaboration with the Government of Gujarat using the methodology suggested by Ground Water Estimation Committee (GEC-97). These resources were computed after reorganisation of the districts. The annual ground water recharge varies from 2122.60 ha m. in Limbdi Taluka. Present stage of ground water development in the Limbdi Taluka is 35.73 %, which indicates that the scope of ground water development is safe. In Surendranagar district, the depth to water level ranges between 0.67m to 20.53 m bgl during pre-monsoon season, however, the project site is located in the area where depth to ground water is 2-5 m bgl (during pre-monsoon) whereas during post monsoon the water level of the district is in range of 0.85 m to 20.85 m bgl. As per report of District ground water profile compiled by CGWB west central region in May 2014, water table in Surendranagar district in pre-monsoon and post monsoon period vary from about 2 mt to 40 Mt and 0.85 mt to 20.85 mt respectively. However as per the details collected from the neighboring project the water was intercepted by them at more than 10 mt during drilling of the borewell. Considering 10 mt depth of water table no impact is anticipated on the project activities (project will require 1.5 mt depth for mounting structure foundation purposes).

The depth to water level during pre-monsoon (April) and post-monsoon (November) is depicted Figure 3.6 & Figure 3.7.

Figure 3-6: Depth to water level during Pre-Monsoon

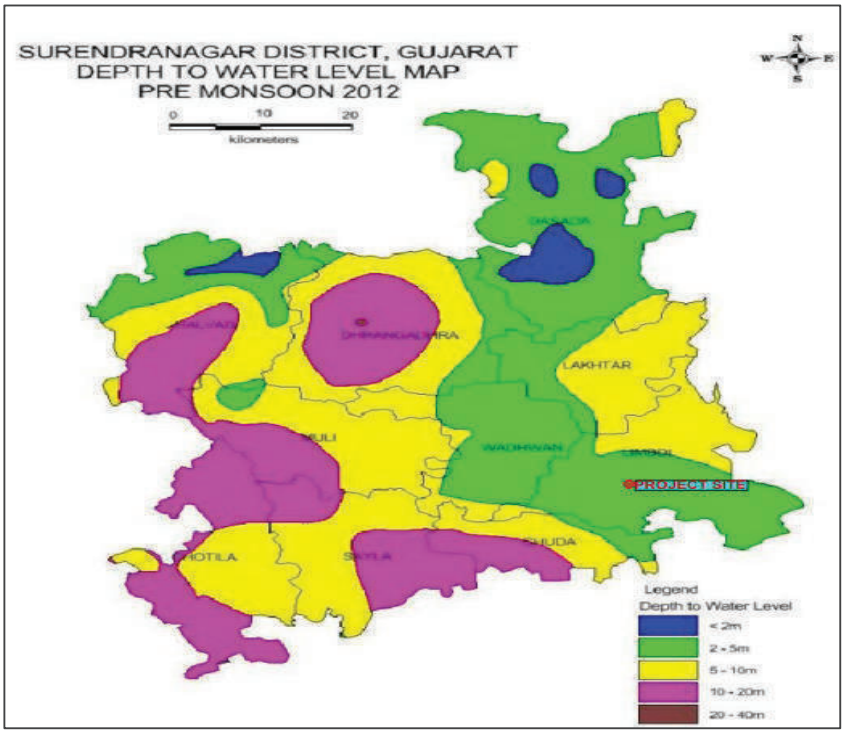
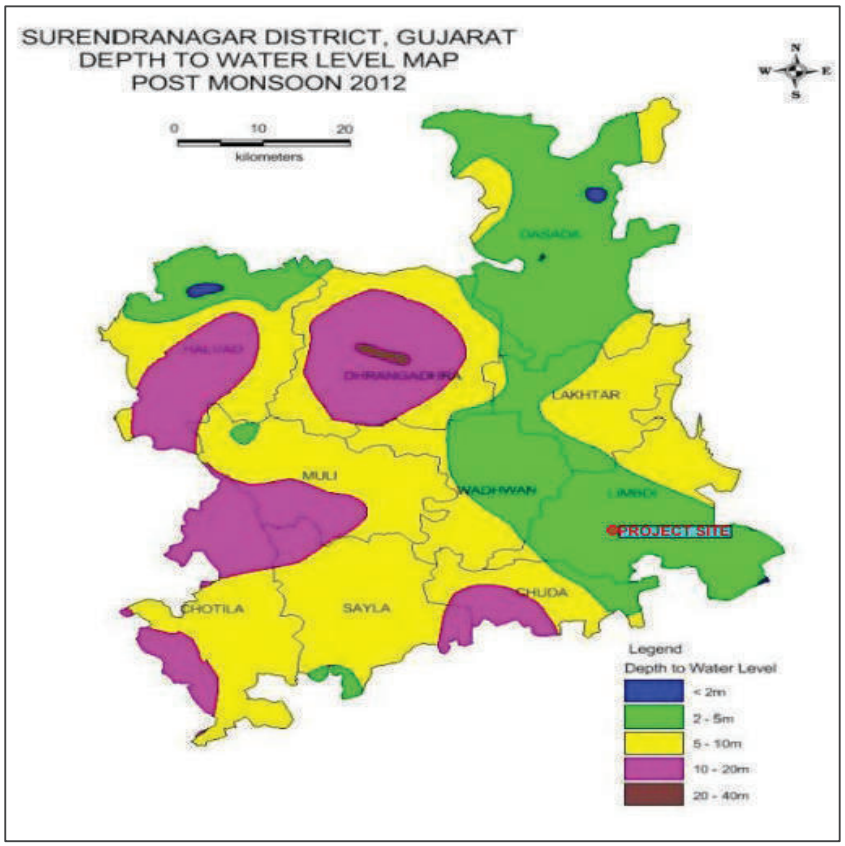


Figure 3-7: Depth to water level during Post-Monsoon



Source: CGWB - Ground Water Brochure (Surendranagar)

3.3.6 Natural Hazards

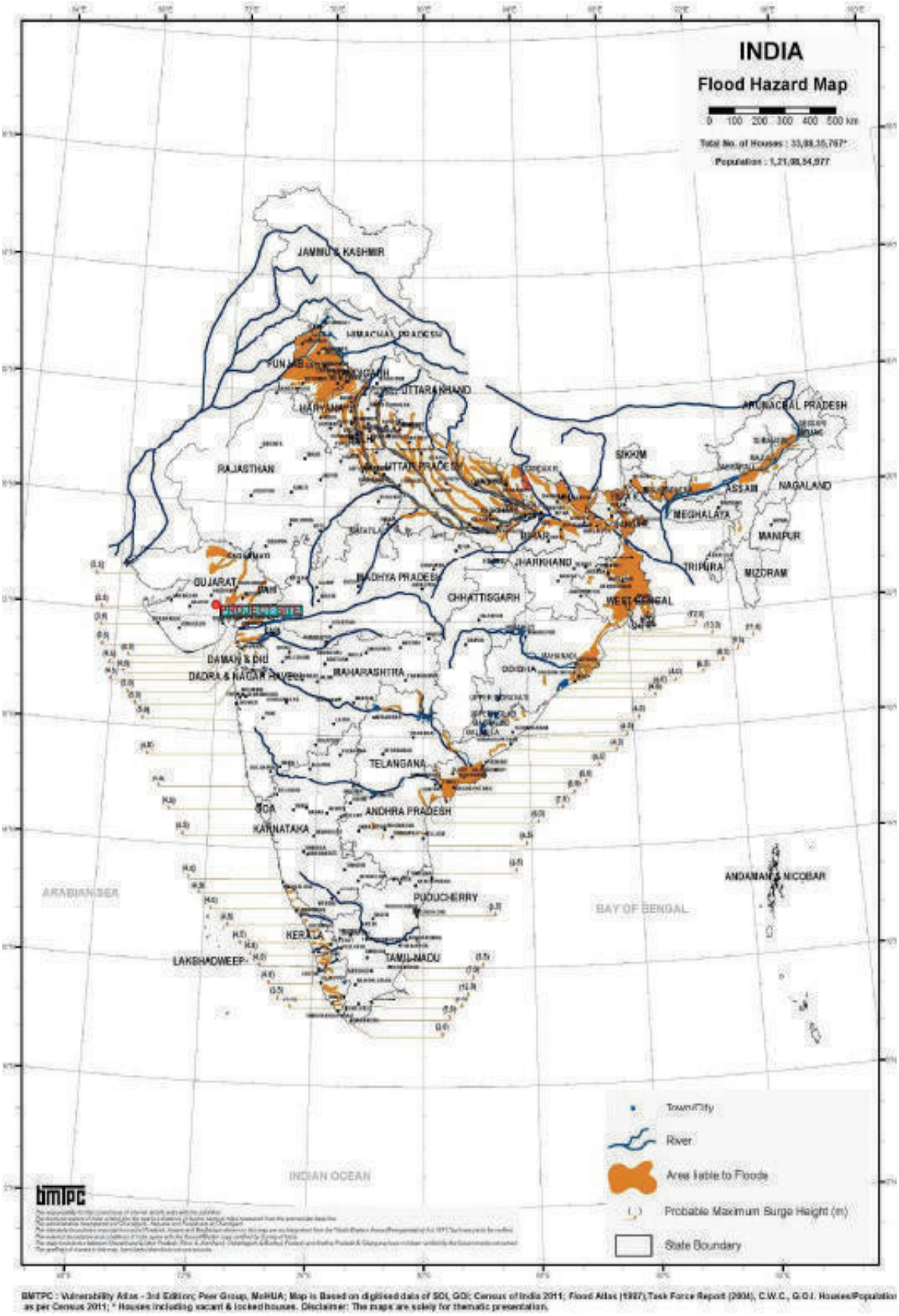
The seismic, flood and cyclone data are shown in Table 3.4 below**.** As provided in the table, the project area is low susceptible to earthquakes & not susceptible to floods and has low to moderate risk. for cyclone damage. As per IS875, wind speed is around 39m/s & the site is very far from coastal area. Natural hazards have been factored into the project's design.

Table 3-4: Seismic, Flood and Cyclone data

Natural Hazards	Intensity	Source	Reference
Seismic Hazard	Zone III: Moderate Damage Risk Zone	Building Materials and Technology Promotion Council (BMTPC) produced Earthquake Hazard Map in Vulnerability Atlas of India (2nd Edition)	Figure 3.8
Flood Hazard	The Project area is not located in the area liable to floods as per Flood Hazard Map	Building Materials and Technology Promotion Council (BMTPC) produced Flood Hazard Map in Vulnerability Atlas of India (2nd Edition)	Figure 3.9
Wind and Cyclone Hazard	Moderate Damage Risk Zone (Vb = 44 m/s)	Building Materials and Technology Promotion Council (BMTPC) produced Wind and Cyclone Hazard Map in Vulnerability Atlas of India (2nd Edition)	Figure 3.10

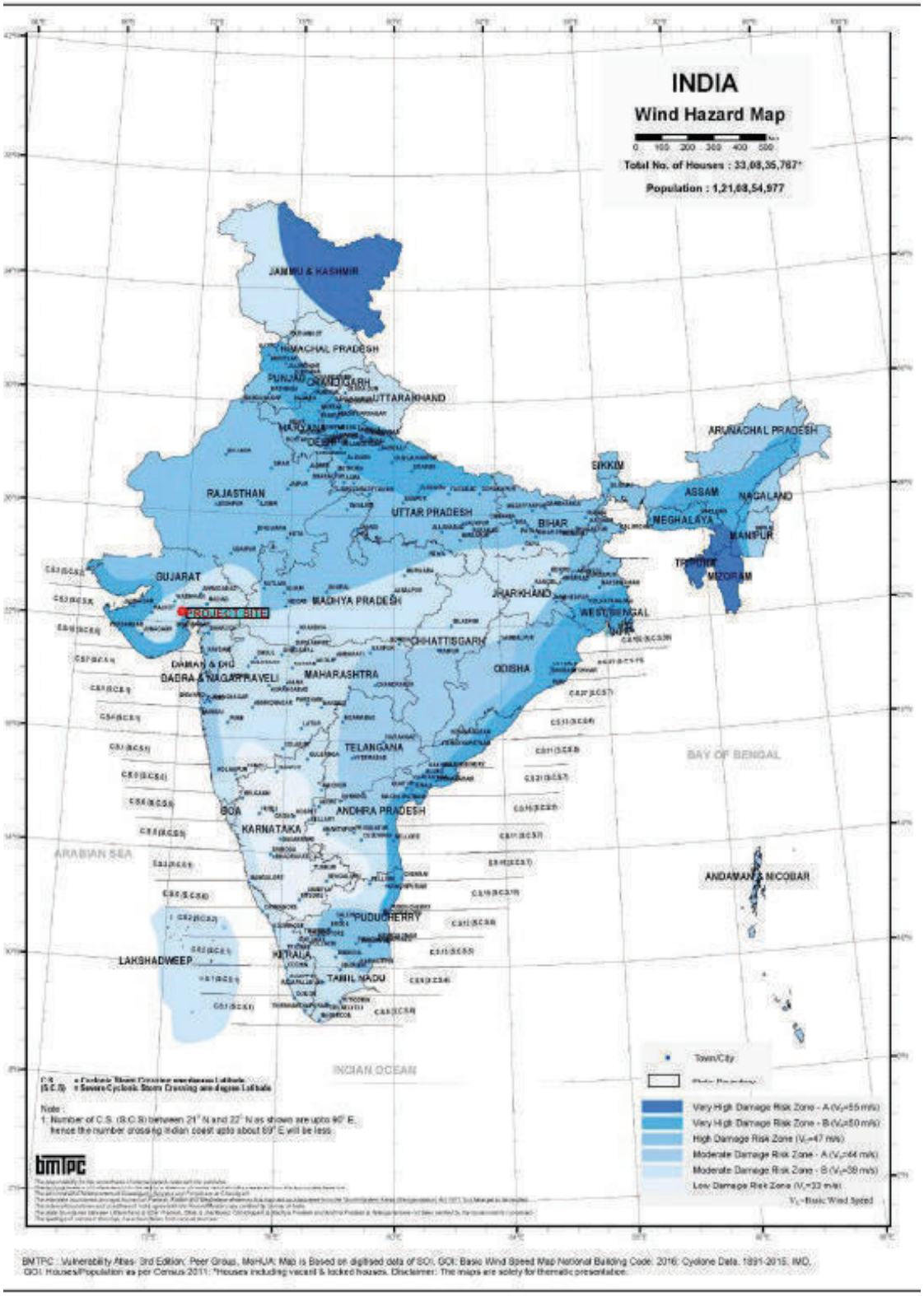
Figure 3-8: Seismic Hazard Map

Figure 3-9: Flood Hazard Map



BMTPC : Vulnerability Atlas - 3rd Edition; Peer Group, MoHUA; Map is Based on digitised data of SOI, GOI; Census of India 2011; Flood Atlas (1997),Task Force Report (2004), C.W.C., G.O.I. Houses/Population as per Census 2011; * Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Figure 3-10: Wind and Cyclone Hazard Map



BMTPC : Vulnerability Atlas- 3rd Edition; Peer Group, MoHUA; Map is Based on digitised data of SOI, GOI: Basic Wind Speed Map National Building Code: 2016; Cyclone Data: 1891-2015, IMD, GOI: Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

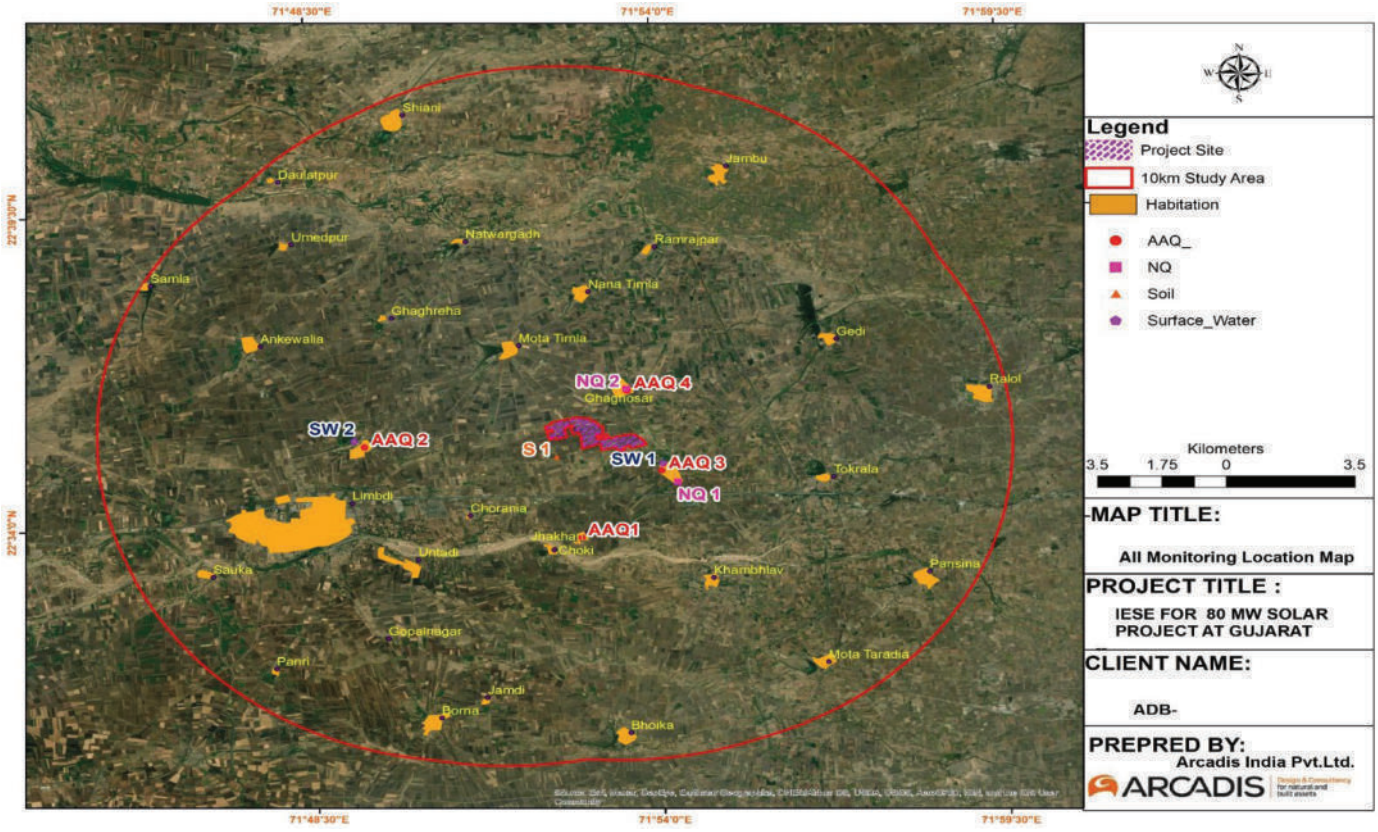
3.4 Environmental Monitoring

Vison Labs (NABL accredited Laboratory) was engaged to collect and analyze the baseline air, water, noise & soil. The monitoring was conducted during September 2021. The primary baseline data was generated for various baseline components as detailed out in Table 3.5.

Table 3-5: Environmental Monitoring Data

Attributes	Nos of locations	Remarks	Location rationale
Ambient Air quality	4	Ambient Air quality samples were collected from four locations/villages within the study area namely Near Jakhan Village (AAQ1), Near Bhalgamda Village (AAQ2), Near Katariya Village (AAQ3) and Near Ghaghosar Village (AAQ4)	Monitoring stations were chosen on the basis of their proximity to sensitive receptors, settlements, topography and predominant wind direction.
Noise quality	2	Noise monitoring were undertaken in two locations/villages Near Primary School Katariya Village (NQ1) and Near Primary School Ghaghosar Village (NQ2)	Monitoring stations were chosen on the basis of their proximity to sensitive receptors such as settlements,
Surface water quality	2	Surface water samples were collected from two locations namely Katariya Village Talab (SW1) & Ghaghosar Village Talab (SW2)	Understanding the existing surface water quality in the nearby habitation and assess any impact on surface water quality due to proposed project
Soil	1	To understand the soil quality, soil sample was taken from one location near PSS (Project site)	Soil characteristics within the study area, especially the physical quality and fertility of the soil have been characterized by analysing soil samples collected from one location near PSS (Project site)

Figure 3-11: Environmental Monitoring Location Map



3.4.1 Ambient Air Quality

Ambient air monitoring was carried out at four locations (24-hourly sampling for particulate & gaseous pollutants and 8-hourly sampling for CO) with a frequency of twice per week for one week. Sampling and analysis were done as per the guidelines prescribed by CPCB /IS-5182. Monitoring stations were chosen on the basis of their proximity to sensitive receivers, settlements, topography and predominant wind direction. The details of the monitoring locations are depicted in Table 3.6 & Figure 3.13.

Table 3-6: Ambient Air Quality Monitoring Results

Sl. No.	Parameter	Unit	Locations				NAAQS Limit (Industrial, Residential, Rural and other area)	WHO Air Quality Guidelines
			Jakhan Village (AAQ1)	Near Bhalgamda Village (AAQ2)	Near Katariya Village (AAQ3)	Near Ghaghosar Village (AAQ4)		
1	Particulate Matter (PM_{10})	µg/m^3	42	44	49	46	< 100	< 45
2	Particulate Matter ($PM_{2.5}$)	µg/m^3	19	21	26	24	< 60	< 15
3	Sulphur Dioxide (SO_2)	µg/m^3	5.4	5.9	6.8	6.2	< 80	< 40
4	Nitrogen dioxide (NO_2)	µg/m^3	12.8	13.5	19.2	15.3	< 80	< 25
5	Ozone as O_3	µg/m^3	<5.0	<5.0	<5.0	<5.0	<180	< 100
6	Ammonia as NH_3	µg/m^3	<10	<10	<10	<10	< 400	--
7	Lead as Pb	µg/m^3	<0.01	<0.01	<0.01	<0.01	<01	--
8	Arsenic as AS	ng/m^3	< 0.06	< 0.06	< 0.06	< 0.06	--	--
9	Nickle as Ni	ng/m^3	< 1.0	< 1.0	< 1.0	< 1.0	--	--
10	Benzine as C_6H_6	µg/m^3	< 0.01	< 0.01	< 0.01	< 0.01	--	--
11	Benzo[a]pyrene as BaP	ng/m^3	< 0.01	< 0.01	< 0.01	< 0.01	--	--
12	Carbon monoxide (CO)	mg/m^3	< 1.0	< 1.0	< 1.0	< 1.0	< 2	< 4

Interpretation of Air Quality Results

- Interpretation of Air Quality Results Concentrations of all the ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO) at all four monitoring stations were observed to be well within the National Ambient Air Quality Standards (NAAQS) 2009.
- Particulate Matter (PM_{10}) Concentration monitored was in the range of 42 µg/m^3 to 49 µg/m^3 i.e. well within the NAAQS permissible limit of 100 µg/m^3
- The average Particulate matter ($PM_{2.5}$) monitored for the project site at four locations was found in the range of 19 to 26 µg/m^3 which are well within the NAAQS limit of 60 µg/m^3
- Sulphur dioxide, Nitrogen Oxide and Carbon monoxide too were recorded well below the CPCB permissible limits

- On comparison of the ambient air quality values with NAAQ Standards, the recorded values are well within the prescribed standards and no significant impact on the ambient air is anticipated at this stage.

3.4.2 Ambient Noise Quality

The ambient noise monitoring was conducted at two locations in the study area. The noise monitoring network was established based on the understanding of the project activities and professional judgment.

Sound pressure level (SPL) measurements in dB(A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring stations and equivalent noise levels in the form of Leq day and Leq night. The results so obtained were compared with the standard specified in Noise Pollution (Regulation and Control) Rules, 2000. The summary of noise quality results is presented in the Table below, also locations depicted in Figure 3.13.

Table 3-7: Noise Quality Monitoring Results

S.no.	Parameter	Unit	Results	
			(NQ1) Near Primary School Katariya Village Category: Residential	(NQ2) Near Primary School Ghaghosar Village Category: Residential
1	Leq Day	dB(A)	49.7	47.7
2	Leq Night	dB(A)	38.5	37.0
CPCB standard (dayt) dB(A)			55	55
CPCB standard (Night) dB(A)			45	45
IFC EHS guideline for Noise Level [7] (daytime) dB(A)			55	55
IFC EHS guideline for Noise Level [8] (Night-time) dB(A)			45	45

Interpretation of Noise Quality Results

On comparison of day and night equivalent values with Ambient Noise Quality Standards in respect to Residential areas, the obtained values are well within the prescribed standards of CPCB for residential area.

3.4.3 Surface Water Quality

For understanding the existing surface water quality in the nearby habitation and assess any impact on surface water quality due to proposed project Surface water samples were collected from two locations namely Katariya Village Talab (SW1) & Ghaghosar Village Talab (SW2) was studied to have an idea of the quality of surface water in the study area. Physico chemical analysis were done as per IS: 2296 Class C Specifications and results are presented in the Table 3.8, also depicted in Figure 3.13.

[7] *https://www.ifc.org/wps/wcm/connect/29f5137d-6e17-4660-b1f9-02bf561935e5/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES&CVID=jOWim3p Assessed on 18th Oct 2021*

[8] *https://www.ifc.org/wps/wcm/connect/29f5137d-6e17-4660-b1f9-02bf561935e5/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES&CVID=jOWim3p Assessed on 18th Oct 2021*

Table 3-8: Surface Water Analysis Results

S. No	Parameters	Test Method	Units	Test Results (SW1)	Test Results (SW1)	IS: 2296 Class C Tolerance Limit/ Specifications
1.	pH at 25°C	IS:3025 part 11 1983 RA-2017		7.92	7.90	6.5 – 8.5
2.	Conductivity at 25°C	IS: 3025 Part 14 1984 RA-2013	mS/cm	396	364	--
3.	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2017	mg/L	273	251	1500
4.	Color	IS: 3025 Part 4 1983 RA-2012	Hazen	50	30	300
5.	Turbidity	IS: 3025 Part 10 1984 RA-2014	NTU	28.6	18.4	--
6.	Temperature at Site	IS: 3025 Part 38 1989	° C	26.6	26.5	--
7.	Total Suspended Solids	IS: 3025 Part 17 1984, RA-2017	mg/L	22.8	15.2	--
8.	Dissolved Oxygen	IS 3025 Part 38 : 2009	mg/L	3.8	3.9	4min
9.	Total Hardness as $CaCO_3$	IS: 3025 Part 21 2009, RA-2014	mg/L	100	80	--
10.	Alkalinity	IS: 3025 Part 23 1986, RA-2014	mg/L	90	80	--
11.	Calcium as Ca	IS: 3025 Part 40 1991, RA-2014	mg/L	24.0	20.0	--
12.	Magnesium as Mg	IS: 3025 Part 46 1994, RA-2014	mg/L	9.6	7.2	--
13.	Chloride as Cl	IS: 3025 Part 32 1988, RA-2014	mg/L	45	40.0	600
14.	Sulphate as SO_4^{--}	IS: 3025 Part 35 1988, RA-2014	mg/L	31.3	31.8	400
15.	Sodium as Na	IS: 3025 Part 45 1993, RA-2014	mg/L	40	43	--
16.	Potassium as K	IS: 3025 Part 45 1993, RA-2014	mg/L	3.1	2.3	--
17.	Iron as Fe	IS: 3025 Part 53 2003, RA-2014	mg/L	0.16	0.10	50
18.	Fluorides as F^-	APHA 4500 F D 23rd Edition	mg/L	0.44	0.32	1.5

S. No	Parameters	Test Method	Units	Test Results (SW1)	Test Results (SW1)	IS: 2296 Class C Tolerance Limit/ Specifications
19.	Chemical Oxygen Demand	IS 3025 Part 58 2006, RA-2017	mg/L	20	20	--
20.	BOD (3 days at 27°C)	IS 3025 Part 44 1993, RA-2014	mg/L	06	04	< 3.0
21.	Total Nitrogen	IS: 3025 Part 34: 1988, RA-2014	mg/L	<0.1	<0.1	--
22.	Cyanides as CN	IS 3025 Part 27 1986	mg/L	<0.001	<0.001	0.05
23.	Lead as Pb	IS 3025 Part 47 1994, RA2014	mg/L	<0.001	<0.001	0.1
24.	Copper as Cu	IS 3025 Part 42 1992, RA2014	mg/L	<0.001	<0.001	1.5
25.	Arsenic as As	IS 3025 Part 37 1988, RA2014	mg/L	<0.001	<0.001	0.2
26.	Phenolics as C_6H_5OH	APHA 23rd Edition 5530D	mg/L	<0.001	<0.001	0.005
27.	Boron	IS 3025 Part 57 2005, RA 2017	mg/L	<0.001	<0.001	--
28.	Total Chromium as Cr	IS 3025 Part 52 2003, RA2014	mg/L	<0.001	<0.001	0.05
29.	Zinc as Zn	IS 3025 Part 49 1994, RA2014	mg/L	<0.001	<0.001	15
30.	Total Phosphorus	IS 3025 Part 31 1988	mg/L	<0.02	<0.02	--
31.	Mercury as Hg	IS 3025 Part 48 1994, RA2014	mg/L	<0.001	<0.001	--
32.	Oil and grease	IS 3025 Part 39 :1991, RA-2014	mg/L	<1.0	<1.0	0.1
33.	Coli form Organisms	IS: 1622:1981 RA 1996	MPN/100 mL	540	330	Should not exceed 5000
34.	Faecal Coliform	IS: 1622:1981 RA 1996	MPN/100 mL	110	72	--
35.	Pesticides	USEPA	µg/L	<0.001	<0.001	<0.001

Interpretation of Surface Water Quality Results:

All the parameters were observed to be within permissible limit for both the sampling locations except for Biological Oxygen Demand (BOD) for SW1 (06 mg/l) SW 2 (04 mg/l) which exceeded the permissible limit. Increase in BOD can lead to decrease in dissolved oxygen in the water which may impact aquatic life.

3.4.4 Soil Quality Assessment

Soil characteristics within the study area, especially the physical quality and fertility of the soil have been characterized by analysing soil sample collected from one (01) location in September 2021. Soil analysis and results have been presented in Table 3.9 & depicted in Figure 3.13. As there is no Indian standard/ specification for soil quality reference has been made to Dutch Intervention Values (DIV).

Table 3-9: Results of Soil Sampling in the Study Area

S. No	Parameters	Test Method	Units	Test Results	DIV
1.	**Texture**	Department of Agriculture & Cooperation Ministry of Agriculture Government of India	**--**	**Clay**	
	Sand		**%**	22	NA
	Silt		%	18	NA
	Clay		%	60	NA
2	Moisture		%	25.4	NA
3	Acidity	FAO Method 2007	Cmol/kg	Nil	NA
4	Specific Gravity	FAO Method 2007	--	2.78	NA
5	Bulk Density	FAO Method 2007	g/cc	1.19	NA
6	Porosity	FAO Method 2007	%	0.61	NA
7	Infiltration Capacity	FAO Method 2007	mm/hr	3.72	NA
8	pH @ 25 °C (1:5 Ratio)	IS 2729(Part 26):1987	--	7.39	NA
9	Conductivity (1:5 Ratio)	IS 14767:2000	µS/cm	124	NA
10	Total Nitrogen	IS 14684: 1999	mg/kg	530	NA
11	Phosphorus	FAO Method	mg/kg	68	NA
12	Potassium	FAO Method	mg/kg	425	NA
13	Calcium	FAO Method	mg/kg	412	NA
14	Magnesium	FAO Method	mg/kg	139	NA
15	Chloride	FAO Method 2007	mmol/kg	56	NA
16	Sulphates	FAO Method 2007	mmol/kg	12.1	NA
17	Carbonate	FAO Method 2007	%	0.02	NA
18	Sodium Absorption Ratio (SAR)	FAO Method	--	0.17	NA
19	Permeability and Water Holding Capacity	FAO Method	Inch/Foot	1.34	NA
20	Cation Exchange Capacity	FAO Method	cmol/kg	46	NA

S. No	Parameters	Test Method	Units	Test Results	DIV
21	Alkali Metals	EPA 3050B – 1996 (Rev -2)	mg/kg	3.51	NA
22	Iron	EPA 3050B – 1996 (Rev -2)	mg/kg	0.25	NA
23	Copper	EPA 3050B – 1996 (Rev -2)	mg/kg	0.19	190
24	Zinc	EPA 3050B – 1996 (Rev -2)	mg/kg	6.57	720
25	Sodium	FAO Method	mg/kg	15.24	

Sources referred for DIV:

1) *https://docplayer.net/58133676-Soil-remediation-circular-2013.html (pg 26)*
2) *https://www.esdat.net/environmental%20standards/dutch/annexs_i2000dutch%20environmental%20standards.pdf*
3) *https://rwsenvironment.eu/publish/pages/126603/into_dutch_soils.pdf*
4) *https://circabc.europa.eu/sd/a/53d8c8a2-6fbf-41fa-acfc-40008431999b/Presentation%20-%20Soil%20and%20groundwater%20screening%20values.pdf*

- **Texture:** The texture of soil samples analysed at one location (S1) were found to be Sandy clay. Soil at sampling location comprised mostly of sand, with high concentrations of clay and low silt content.
- **pH:** The pH level in soil sample were observed to be 7.29 indicating moderately alkaline soil as per standard soil classification.
- **Conductivity:** EC is used to estimate the soluble salt concentration in soil and is commonly used as a measure of salinity. The EC value of soil sample were found to be 124 µS/cm
- **Metals:** Iron, copper and zinc are important soil micronutrients considered essential for the normal growth of plants. Deficiencies of micronutrient drastically affect plant growth and metabolism. The level of iron in the soil sample were found 0.25 mg/kg. The level of copper in the soil sample were found to 0.19 mg/kg. The level of zinc in the soil sample were also found to 6.57 mg/kg. Nitrogen, content was found to be 530 mg/kg.
- **Contamination**: Based on a review of test results against DIV, for those parameters tested, soil is not contaminated.

3.5 Ecological Environment

3.5.1 Objectives

The ecology survey has been undertaken with the following objectives:

- determine whether any target species occur, or have occurred in the last ten years, in the project site or its vicinity (a 5 km buffer of the project site, for the purposes of this survey) – henceforth referred to as the “survey area”;
- where target species currently occur, or have previously done so, identify their seasonality, abundance and preferred locations/habitats in the survey area.

3.5.2 Key tasks

The objectives have been achieved through the following key tasks.

Task 1: Desktop review and screening

- Reviewing of existing literature, such as: (i) existing environmental studies, scientific literature or other types of biodiversity assessments available for the project area and/or adjacent areas; (ii) national or regional plans (e.g., Strategic Environmental Assessments, National Biodiversity Strategies and Action Plans, management plans, if any, for the protected area, Important Bird and Biodiversity Areas (IBAs) and the Key Biodiversity Area (KBA) within the area of influence; (iii) existing conservation programs or initiatives;
- ENVIS, IUCN, IBAT and BirdLife International data repository for endangered species and protected areas.
- Reviewing Bird Migration booklet (BNHS) for migration routes of migrating avifauna.
- Protected and internationally recognized areas: Review management plans (if any)

Task 2: Habitat surveys

- Determining the presence of “target species” and identifying their potential habitats in the project site or its vicinity (5 km area of influence zone, i.e. the survey area)
- Direct field surveys of grassland areas within the survey area for the possibility of breeding Lesser Florican, focusing on scanning from vantage points on cooler hours of the day.
- Direct field surveys to identify potential habitats of the target species in the survey area.

Task 3: Stakeholder consultation

- Consult with relevant experts on target species in the survey area.
- Consult knowledgeable local people to identify any records of target species in the survey area observed during the last 10 years.
- Consult with relevant local officials, Forest Department and Wildlife Department to identify any official records of target species in the survey area within the last 10 years and to identify other reliable informants.

Task 4: Target species (screening)

- Identifying the seasonality, abundance and habitat characteristics of where “target species” occur
- Incidental recording of target species seen during field surveys.
- If any target species is recorded through consultation or direct observation, data on seasonality, abundance and the habitat characteristics of the species needs to be noted

Task 5: Bird surveys

- Direct field surveys of any grassland areas within the survey area for the possibility of breeding Lesser Florican, focusing on scanning from vantage points (e.g., elevated areas) cooler hours of the day when any males are more likely to be displaying;
- Consultations with relevant local officials (e.g., Forest Department) to identify any official records of target species in the survey area within the last ten years;
- Consultations with local people to identify any records of target species in the survey area within the last ten years. Such surveys should focus on people most likely to be knowledgeable about birds (e.g., hunters) and those most likely to spend time in target species’ habitat (e.g., graziers, or other farmers). First discussions with local people should gauge level of expertise about birds by offering a field guide and assessing the level of accuracy in their reports of which species do/do

not occur in the survey area. After this, apparently reliable informants should be directly questioned for records of target species, and to identify other reliable informants; and

- Incidental recording of any other target species seen during field surveys.
- The consultant will record the habitat type and location of direct observations (i/iv) and reliable reports (ii/iii).

3.5.3 Methodology

Desktop review

To understand the ecology & biodiversity of the project area, first desk top review of secondary data was undertaken. During the desk top review, the project site location and immediate surroundings was run for IUCN listed threatened species (CR, EN, and VU Species), WLPA 1972 for the list of Scheduled Species. The Bird Migration Booklet (by BNHS) was looked into for migration routes of avifauna in the study area. Databases such as iBAT (Integrated Biodiversity Assessment tools), and crowdsourcing platforms such as eBIRD and Naturalist was referred to, to understand the presence and absence of the target species as well as other potential Critical Habitat (CH) trigger species and their habitat values. A list of references is presented in Table 3.10.

Table 3-10: Secondary sources used for screening of target species

S No.	Source	Purpose
1	IUCN Red List for Threatened Species Online Version (2021-1)	The world's most comprehensive inventory of global conservation status of species. It provides a list of threatened species by classifying them under different categories from Least Concern (LC) to Extinct (EX) through an understanding of global distribution, population status and trends of the species. Classification of species, distribution, habitat preference and threats of species are also given.
2	ENVIS Scheduled Species Database	Provides updated data of Scheduled species within the Wildlife Protection Act (WLPA 1972)
3	ebird.org	ebird.org provides a geo-referenced list of identified bird species in a given area.
4	Bird Life International Data Zone	BirdLife International maintains a database of Important Bird Areas (IBAs) with a species list found in these IBAs, measure of sensitivity of these habitats and identifies migratory, congregatory and threatened species in the area.
5	iBAT (Integrated Biodiversity Assessment Tool)	IBAT is a multi-institutional programme of work involving BirdLife International, Conservation International, IUCN, and UNEP-WCMC. iBAT reports were generated for the project AoI to understand the presence of IUCN listed Threatened species in the area. Areas of conservation significance such as Protected areas, IBAs and KBAs falling within the AoI were also included in this assessment.
6	Bird Migration booklet (BNHS)	Routes of migrating avifauna are given in the booklet, with their breeding and non-breeding distribution as well as their time of visit.
7	iNaturalist	An online social network of naturalists, citizen scientists, and biologists built on the concept of mapping and sharing observations of biodiversity across the globe. Areas falling within AoI were run through this database.

Field data collection

Desktop review was followed by field surveys which involved determining the presence of "target species" and identifying their potential habitats in the project site or its vicinity (5 km area of influence zone, i.e. the survey area). Field survey was conducted during the conducive time (between 20th -27th July 2021- pre-monsoon) when the species comes to breed, the grass is not that high (post-monsoon the grass height increases to such an extent that it becomes difficult to spot the illusive and shy species) and it is comparatively easier to spot the male in display.

A repeat ecological survey visit was conducted in the proposed project site from 24th to 29th September, due to layout changes since the first season of surveys.

Waterbody surveys

The bird survey was conducted between 20th -27th July 2021 by two ecologists. To establish a strong baseline of waterfowls/aquatic birds (both resident and migratory), waterbodies present in the 5 km buffer of the project area (i.e. the survey area) were surveyed using Point Count Method (PC). There are other waterbodies which were not reachable due to bad road condition during the onset of monsoon.

Along the PCs, for every waterbody, the following information was recorded:

- Bird species seen
- No. of birds (individuals) sighted
- Age/sex wherever possible
- Activity of the species observed
- Waterbody characteristics

Table 3-11: Location of Waterbody surveys – Season 1

Waterbody Points	Latitude	Longitude
PC1	22°40'32"	71°43'51"
PC2	22°36'24.15"	71°53'30.52"
PC3	22°34'47.62"	71°56'39.37"
PC4	22°37'20.06"	71°56'38.04"

Figure 3-12: Location of Waterbody Surveys – Season 1

Water body surveys were repeated in September utilizing the same methodology, but to capture the areas close to the revised project footprint.

Table 3-12: Location of Waterbody surveys – Season 2

Waterbody Points	Latitude	Longitude
PC1	22°35'03"	71°54'06"
PC2	22°35'27.29"	71°53'59.59"
PC3	22°35'31"	71°49'10"
PC4	22°36'32"	71°53'33"

Figure 3-13: Location of Waterbody Surveys – Season 2

Vantage point surveys

The standard survey methodology as developed by Scottish Natural Heritage (Band 2001, SNH 2005, 2010, Band et al. 2007), with modifications according to the local topography and terrain, were followed, which are further described below.

The entire proposed solar power project area plus a 5 km buffer (together is called the survey area) where the birds flying could be at risk of collision with transmission line was considered for vantage point survey. The Vantage Points (VP) were selected that enabled observation of the whole of the proposed project site.

Selection of the vantage point locations was based on the following criteria:

- Vantage Point(s) gives a clear view across the project site;
- The solar power project site can be observed by looking in a 180-degree arc forward from the Vantage Point; and
- The VPs were selected in such a way that most parts of the Solar Power Project area and parts of buffer were covered. This is crucial to document the actual use and flight activity of birds within the proposed project area.

The Vantage Points (8) spread along the project landscape were planned. Each vantage point was no further than 2 km from the other. The locations of the Vantage Points are provided hereunder in Table 3.13 & 3.14. The view shed of each vantage point is provided in the Figure 3.14 & 3.15. A map of locations is in Figure 3.16.

Table 3-13: Location of Vantage Points – Season 1

Vantage Point	Latitude	Longitude
VP1	22°35'10"	71°52'23.6"
VP2	22°34'23"	71°50'48"
VP3	22°34'38"	71°51'32"
VP4	22°35'23"	71°52'19"
VP5	22°35'10"	71°52'23.6"
VP6	22°34'38"	71°51'32"
VP7	22°35'23"	71°52'19"
VP8	22°34'23"	71°50'48"

Table 3-14: Location of Vantage Points – Season 2

Vantage Point	Latitude	Longitude
VP1	22°35'15"	71°53'45"
VP2	22°34'3"	71°50'47"
VP3	22°35'15.50"	71°53'51.05"
VP4	22°35'11"	71°52'24"
VP5	22°35'15"	71°53'45"

Observations were recorded for two hours in a day. During each observation the flight height, flight direction (from & to), and activity of each bird species along with numbers were noted. VP data was

collected and includes information on bird species, number of individuals, time of observation, flight height and direction and behaviour.

Due to the change in TL route and Project footprint, VPs taken during season 2 were altered and concentrated near the area not previously included. The second survey was undertaken in peak monsoon and so there was no accessibility to several season 1 VPs.

Observations were attempted to record seasonal migrants, however as the survey was undertaken during the off-migration time (in pre-monsoon), no migrant species were encountered. To estimate flight height as accurately as possible available reference structures were used (for example electric poles, big trees, etc.).

Table 3-15: Hours of Vantage Points

Vantage Point	Date	Hours	Time of day (morning, noon, evening)
Season 1			
VP1	22/07/2021	2 hours	Morning
VP2	22/07/2021	2 hours	Noon
VP3	22/07/2021	2 hours	Evening
VP4	23/07/2021	2 hours	Noon
VP5	25/07/2021	2 hours	Evening
VP6	26/07/2021	2 hours	Morning
VP7	26/07/2021	2 hours	Morning
VP8	26/07/2021	2 hours	Morning
Season 2			
VP1	24/09/2021	2 hours	Morning
VP2	24/09/2021	2 hours	Evening
VP3	25/09/2021	2 hours	Morning
VP4	26/09/2021	2 hours	Morning
VP5	28/09/2021	2 hours	Evening

The survey was carried out to figure out the presence of target species in the AOI (in accordance with the scope). SNH guidelines does not mention any specific time reference for solar farms; the best possible methodology was adapted to ensure the findings and to ascertain the impact on the habitat. Also, the report made available by Devatrish Mori, Honorary Wildlife Warden, Surendranagar district was considered to identify the probable areas.

Figure 3-14: Vantage Point View Shed- Season 1

VP 1 and 5

VP 2 and 8

VP 3 and 6

VP 4 and 7

Figure 3-15: Vantage Point View Shed- Season 2

VP 1 and 5

VP 2

VP 3

VP 4

Figure 3-16: Location of Vantage Points – Two Seasons combined

Line Transects

Line transect method was used wherein transects were walked to collect faunal diversity data. During Season 1, each transect of around 900-1000 meters was walked through, 20 meters on both sides of transect was considered as the survey area for each transect and the species and their abundance were taken. Line transects conducted during season 2 were interrupted by waterlogging of the roads, hence most of the transects were 500 – 700m.

- The bird species observed, conducive habitat of the species and the activity of the bird was recorded.
- Other faunal species were also noted based on direct sightings as well as opportunistic encounters.

Table 3-16: Line transects – Season 1

Line Transects	Start Coordinates	End Coordinates	Transect Length
LT1	22°35'45.6"N, 71°52'7.97"E	22°35'53.21"N, 71°52'41.56"E	951 m
LT2	22°34'32"N, 71°52'01"E	22°35'05"N, 71°51'53"E	1038 m
LT3	22°34'34"N, 71°52'36"E	22°35'6"N, 71°52'27"E	1100 m

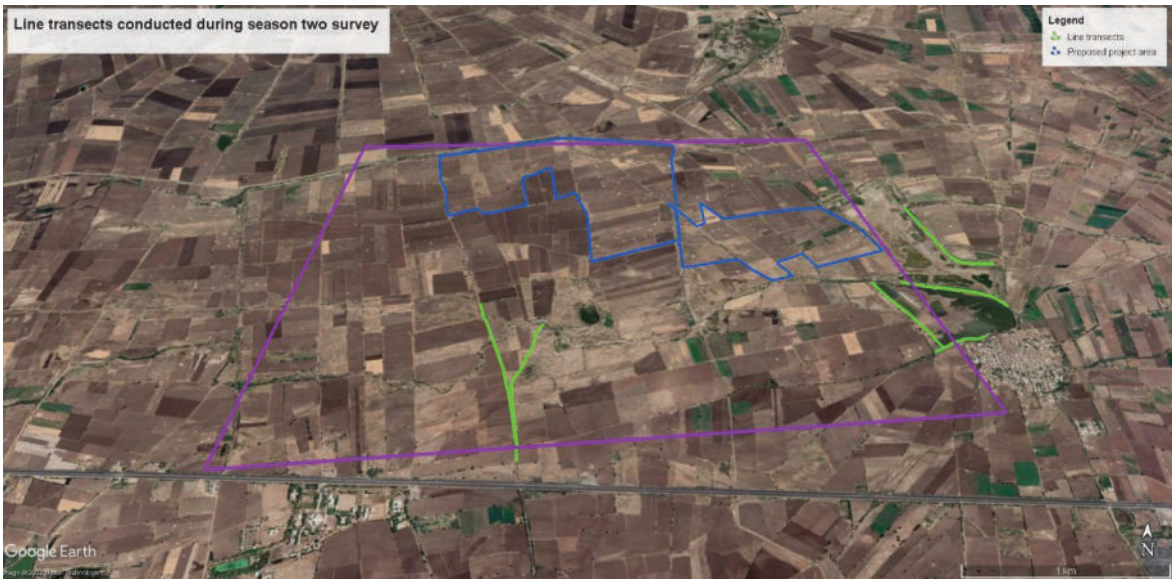
Figure 3-17: Line Transect – Season 1

Table 3-17: Line transect – Season 2

Line Transects	Start Coordinates	End Coordinates	Transect Length
LT4	22°35'3.94"N 71°54'7.71"E	22°34'58.76"N 71°53'55.11"E	400 m
LT5	22°35'0.35"N 71°53'57.36"E	22°35'15.31"N 71°53'45.65"E	546 m
LT6	22°34'35.00"N 71°52'35.89"E	22°35'3.32"N 71°52'38.96"E	902 m
LT7	22°35'11.45"N 71°54'11.32"E	22°35'15.50"N	595 m

		71°53'51.05"E	
LT8	22°34'50.72"N 71°52'33.63"E	22°35'11.22"N 71°52'24.66"E	700 m
LT9	22°35'20.84"N 71°54'6.83"E	22°35'34"N 71°53'56"E	522 m

Figure 3-18: Line Transect – Season 2



Random survey through vehicular transects

The transect survey route was chosen to ensure that most parts of the study area were covered. Transects were established along the available motorable roads in the study area and searched for the target species and their habitat. Transects were also laid along the roads running in the vicinity of TL route. The natural (scrubland) and modified (agricultural land) habitats were covered during the vehicular transect survey. All birds observed within 50 m on both the sides were recorded. In the case of sensitive and large sized birds, the species were recorded if identifiable, even if seen beyond 50m.

Stakeholder Consultation

Field survey included stakeholder consultation, consulting local people & relevant local officials, Forest Department and Wildlife Department to identify any official records of target species in the survey area within the last 10 years and to identify other reliable informants.

During stakeholder engagement, secondary data for the project site was also collected from the Forest Department (both Limbdi Forest Office and Surendranagar DFO office), relevant experts were consulted with (suggested by Surendranagar DFO) and available published scientific literature referred to.

Both one to one consultation was done with forest officials as well as with local people and also focused group discussion with local people in the study area. Avifauna experts were consulted regarding the presence of target species in the study area. Pictures of target species were shown to local people for identification of the species. The discussions were undertaken both over a telephone call as well as face to face discussions. Results are provided in Section 3.7.6.

Schedule

Field surveys have been undertaken twice, once in late July (21st July to 27th July 2021) during the sighting of the Lesser Florican & in September (monsoon season), and subsequently.

Table 3-18: Field Schedule Activities

Activity	Dates
Baseline data collection	22nd to 27th July 2021; 24th to 28th September 2021
Baseline data review and CH screening	30th July to 10th August; 1st to 19th October 2021
Survey season 1	
Vantage points	22nd to 26th July
Transects	23rd, 24th and 27th July
Point Counts	22nd to 26th July
Habitat mapping	28th September
Stakeholder consultation 1 (included focus group discussion)	21st to 27th July
Survey season 2	
Vantage points	24th – 26th, 28th September
Transects	24th to 27th September
Stakeholder consultation 2	24th to 28th September

3.6 Screening

Screening has been undertaken to confirm preliminary assumptions regarding baseline conditions, potential ecological impacts and suitability of proposed methodologies. The process is based on information from an initial desktop analysis and literature review of biodiversity values within the landscape to determine predicted biodiversity values associated with the Project Area.

3.6.1 Key Biodiversity Areas

The proposed project site and associated infrastructure (Transmission line) does not fall within 10 km of any Protected Areas such as National Parks, Wildlife Sanctuaries, etc. The nearest Protected Area and Important Bird Area (IBA) is **Nal Sarovar Bird Sanctuary** located approximately 19.3 km north-east of the project site. The Nal Sarovar Bird Sanctuary has a government notified Eco-sensitive Zone (ESZ). The Sanctuary has been designated as a Ramsar site[9] recognizing it as a Wetland of International Importance under the Ramsar Convention. A review of gazette notification/MoEF&CC notification dated 7th June 2017[10], indicates that an area to an extent varying up to 13 km from the boundary of the Nal Sarovar Bird Sanctuary in the State of Gujarat, as Nal Sarovar Bird Eco-sensitive Zone (ESZ). However, the project site is located outside the ESZ boundary of Nal Sarovar Bird Sanctuary.

Bhal KBA:

The Bhal area is located south of the Nal Sarovar Bird Sanctuary (as depicted in Figure 3.19) & is a flat alluvial plain, with mosaic of croplands, saline wastelands, grasslands, pastureland and marshes (Dharmakumarsinhji 1978), covering an area of 259,000 hectares. It is bordered on the south by the

[9] *https://rsis.ramsar.org/ris/2078?language=en Assessed on 28th Sep 2021*

[10] *https://upload.indiacode.nic.in/showfile?actid=AC_CEN_16_18_00011_198629_1517807327582&type=notification&filename=Nalsarovar%20Bird%20Sanctuary,%20Gujarat.pdf Assessed on 28th Sep 2021*

Kalubar river, extends north to Dholka and Dhandhuka, and northwest to Limbdi. The Bhal region is prone to droughts and floods. Cyclones occasionally strike the coast of Saurashtra. During such times, the Bhal becomes a large swamp. This attracts a very large number of waders and other waterbirds. The Bhal area was an open treeless habitat as recently as 50 years ago (Dharmakumarsinhji 1978, Mungall et al. 1981). *Prosopis chilensis* was planted in the Bhal area about 60 years ago near Mithapur, to provide fuel wood. It has since spread rampantly and converted much of the grasslands into savanna and thorn-forest habitat (Jhala 1991). Nearly forty species of grasses have been identified from the area.

The dominant grass species are:

- *Dicanthium annulatum*, *Sporobolus virginicus*, *S.coromandelianus* and *S. maderspatensis*.
- *Prosopis chilensis* is the dominant species of shrub.

Figure 3-19: IBAs/KBAs and Protected areas in the proximity of the project site

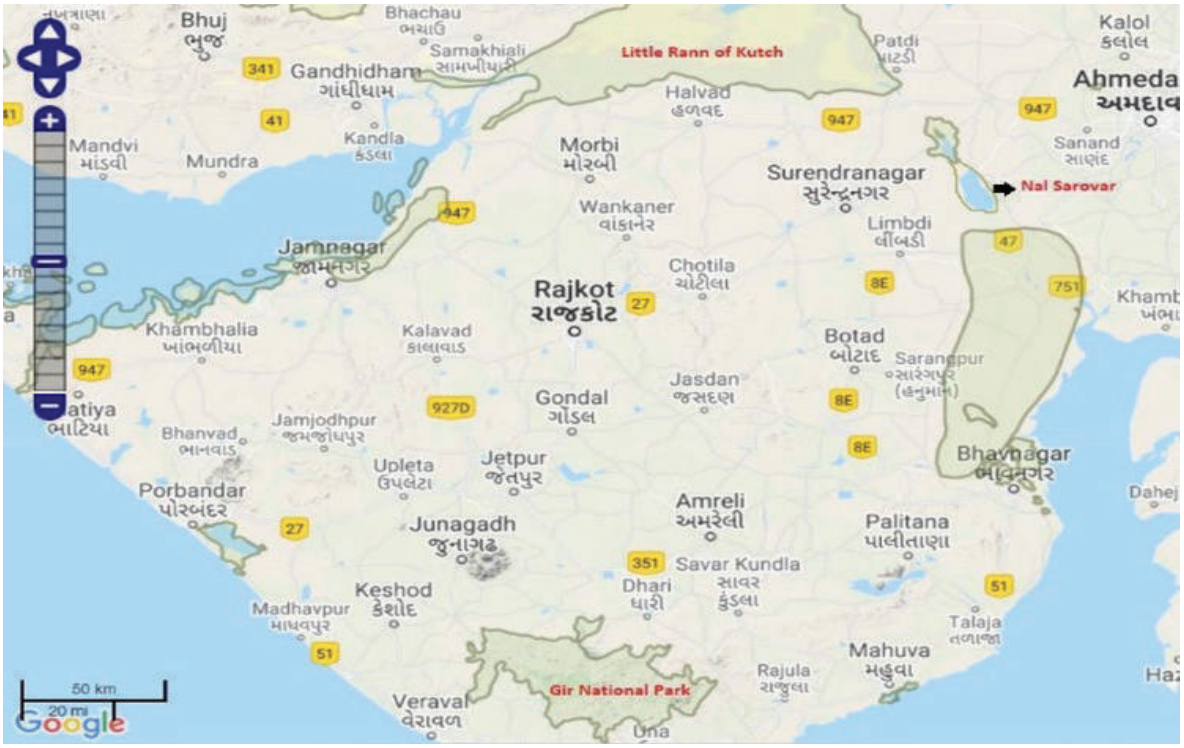
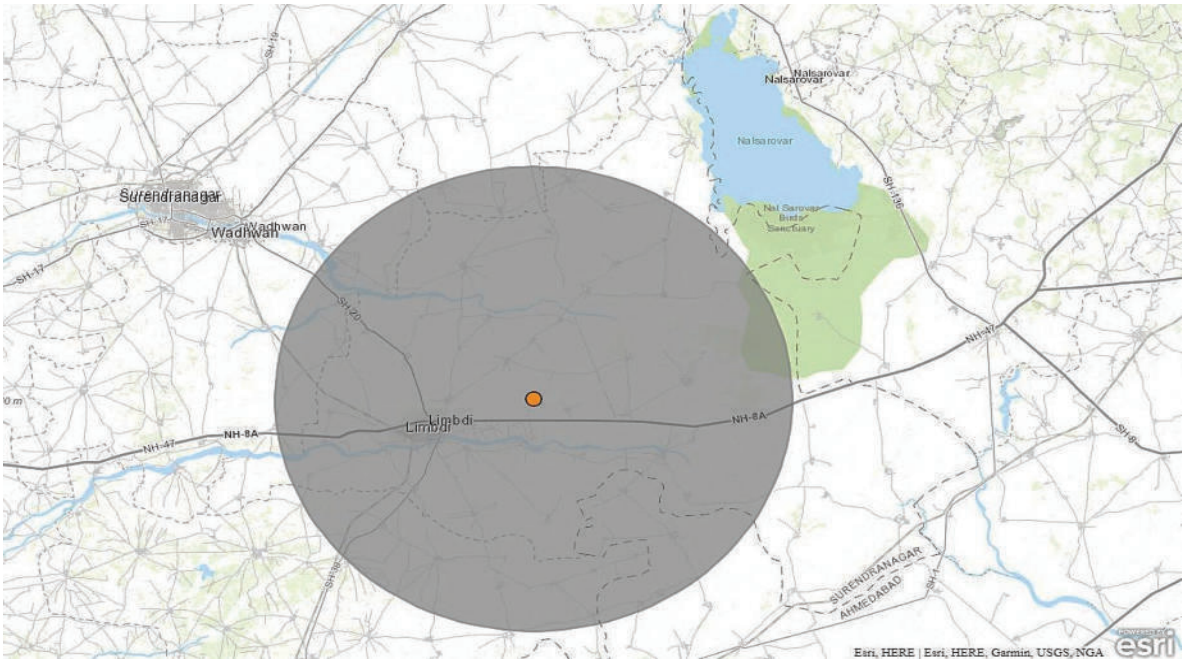


Table 3-19: Protected Areas/Forest areas from project site

Area Name	Within area of	Direction
Nal Sarovar	20 km	NE of project site
Vulture Nesting Site, Bharad village	60 km	NW of project site
Velavadar National Park	60 km	SE of project site
Little Rann of Kutch	60 km	N of project site
BediyaBeli Forest	70 km	W of project site

Figure 3-20: Nalsarovar Sanctuary Boundary



As per the available secondary information, Nal Sarovar Sanctuary harbors 226 bird species, 20 species of fish and 13 species of mammals including globally threatened species of birds and mammals such as Sarus crane, Indian Skimmer, Asiatic Wild Ass and Wolf as outlined in above notification. Nal Sarovar Bird Sanctuary is an important stopover site within the Central Asia Flyway, with globally threatened species such as the critically endangered Sociable Lapwing (*Vanellus gregarius*) and the vulnerable Marbled Teal (*Marmaronetta angustirostris*) stopping over at the site during migration, while the vulnerable Sarus Crane (*Grus antigone*) takes refuge there during summer when other water bodies are dry.

The Bhal KBA: No detailed study of the avifauna has been conducted here, except for notes by Dharmakumarsinhji and others. However, the scattered patches of grasslands were perhaps the most important breeding areas for the Lesser Florican, and even now they could become important if protected during monsoon. Velavadar (another IBA), also in Bhal region, has well-protected grassland and between 40- 45 male floricans are seen there. Bhal region is an important habitat of Stoliczka's Bushchat Saxicola macrorhyncha (Gadhvi and Rathod 2003). It is seen in and around Velavadar National Park but is likely to occur in more areas in the Bhal. Wherever water remains for a couple of months, Sarus Crane (*Grus Antigone*) breeds. No population estimate has been done, but after Kheda region in north Gujarat, the Bhal could be the most important habitat for this bird in Gujarat. In winter, Houbara or Macqueen's bustard *Chlamydotis macqueeni* is found, albeit in small numbers. The Bhal region is also important for raptors. Scattered grasslands and crop fields host a huge population of harriers. According to Asad Akhtar (pers. comm. 2001), between 3-4 thousand harriers roost in Velavadar NP. During the daytime, most of these harriers spread out in the Bhal region for foraging. Therefore, small grassland patches are important for the survival of harriers.

Figure 3-21: The Bhal KBA & the project site

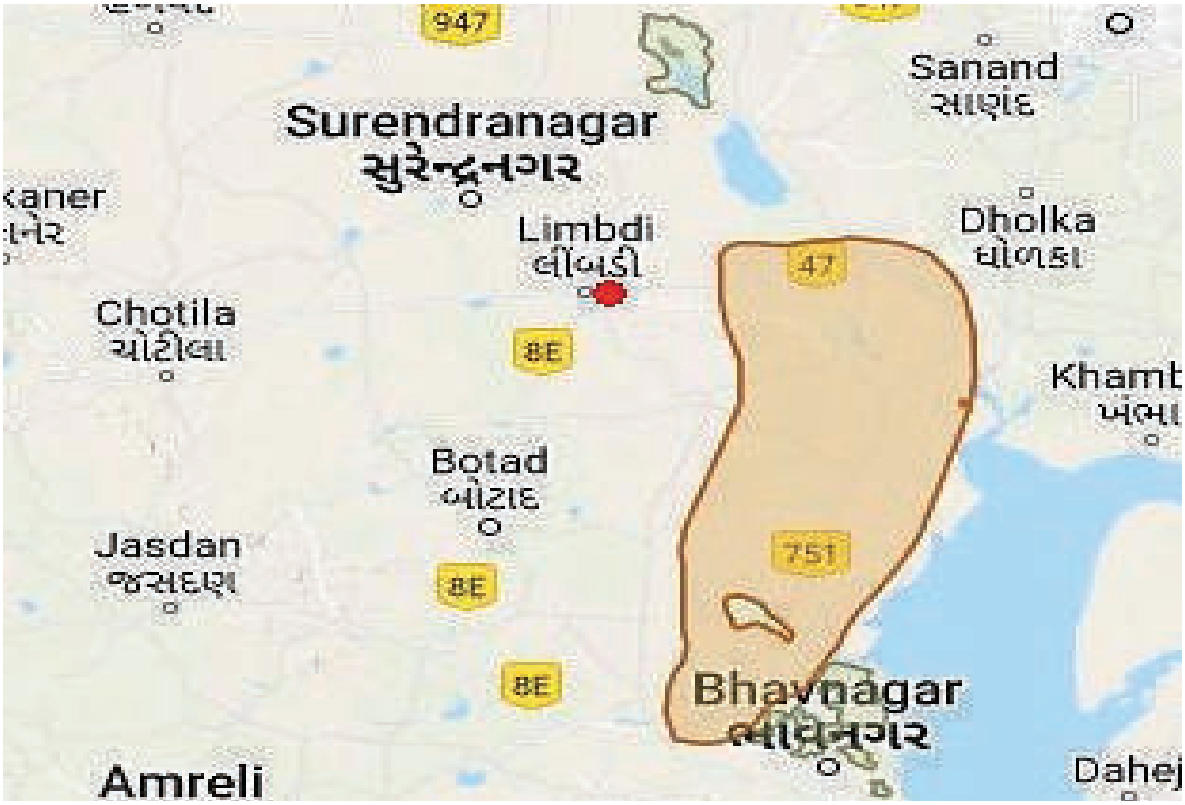
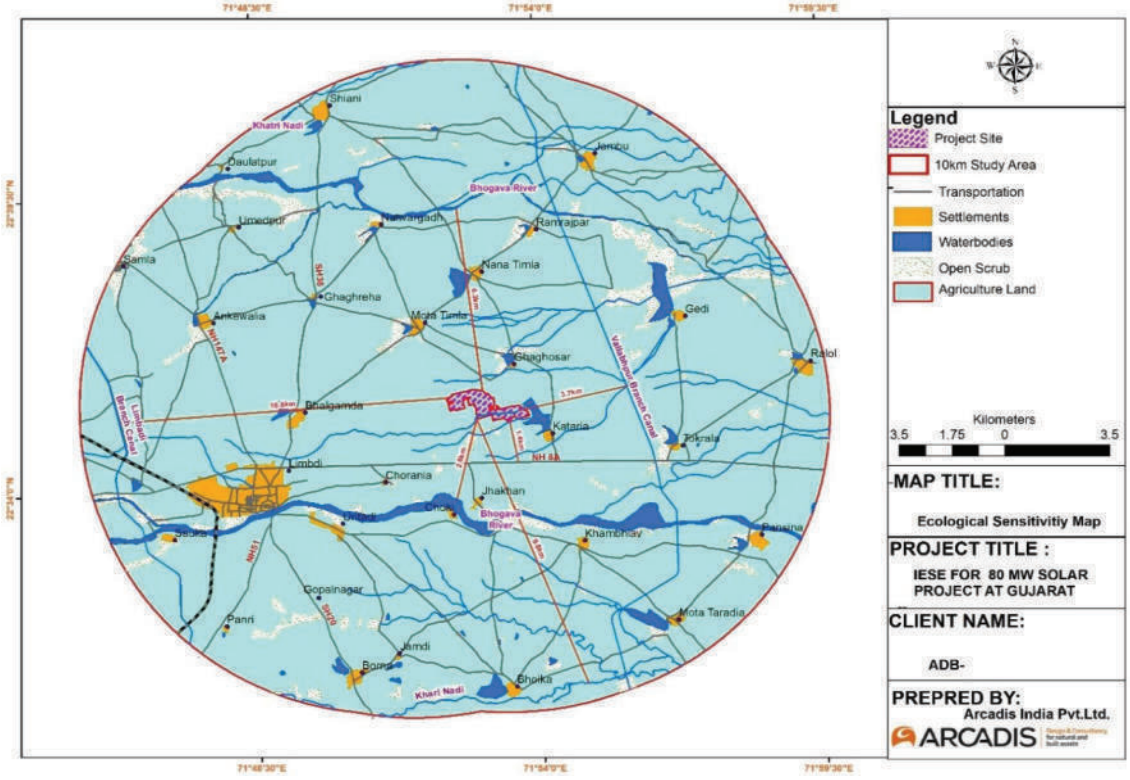


Figure 3-22: Ecological Sensitivity Map within 10 Km radius of Project Site



A review of species of conservation significance potentially present in the KBAs within 20km, i.e. IBA Nal Sarovar, has been undertaken and presented in Table 3.21. This has been cross-referenced with the IBAT report to confirm preliminary assumptions identified from Wildlife Institute of India (WII) ENVIS database on wildlife and protected areas. CR and EN species listed in Table 3.20 are the target species. It is confirmed that the preliminary methodology as outlined above requires limited enhancement to ensure adequacy to identify target species during surveys.

Table 3-20: Species of conservation significance in the IBA Nal Sarovar

Scientific name	Common name	IUCN cat	IWPA status
Sypheotides indicus	Lesser Florican	CR	Sch I
Gyps bengalensis	White-rumped Vulture	CR	Sch I
Neophron percnopterus	Egyptian Vulture	EN	Sch IV
Sterna acuticauda	Black-bellied Tern	EN	Sch IV
Marmaronetta angustirostris	Marbled Duck	VU	Sch IV
Pelecanus crispus	Dalmatian Pelican	VU	Sch IV
Ciconia episcopus	Asian Woollyneck	VU	Sch IV
Haliaeetus leucoryphus	Pallas's Fish-eagle	VU	Sch IV
Clanga clanga	Greater Spotted Eagle	VU	Sch IV
Aquila heliaca	Eastern Imperial Eagle	VU	Sch IV
Grus antigone	Sarus Crane	VU	Sch IV
Rynchops albicollis	Indian Skimmer	VU	Sch IV
Anhinga melanogaster	Oriental Darter	NT	Sch IV
Mycteria leucocephala	Painted Stork	NT	Sch IV
Ephippiorhynchus asiaticus	Black-necked Stork	NT	Sch IV
Threskiornis melanocephalus	Black-headed Ibis	NT	Sch IV
Phoeniconaias minor	Lesser Flamingo	NT	Sch IV
Aythya nyroca	Ferruginous Duck	NT	Sch IV
Aegypius monachus	Cinereous Vulture	NT	Sch IV
Circus macrourus	Pallid Harrier	NT	Sch IV
Numenius arquata	Eurasian Curlew	NT	Sch IV
Limosa limosa	Black-tailed Godwit	NT	Sch IV
Sterna aurantia	River Tern	NT	Sch IV

Source: WII ENVIS database on wildlife and protected areas

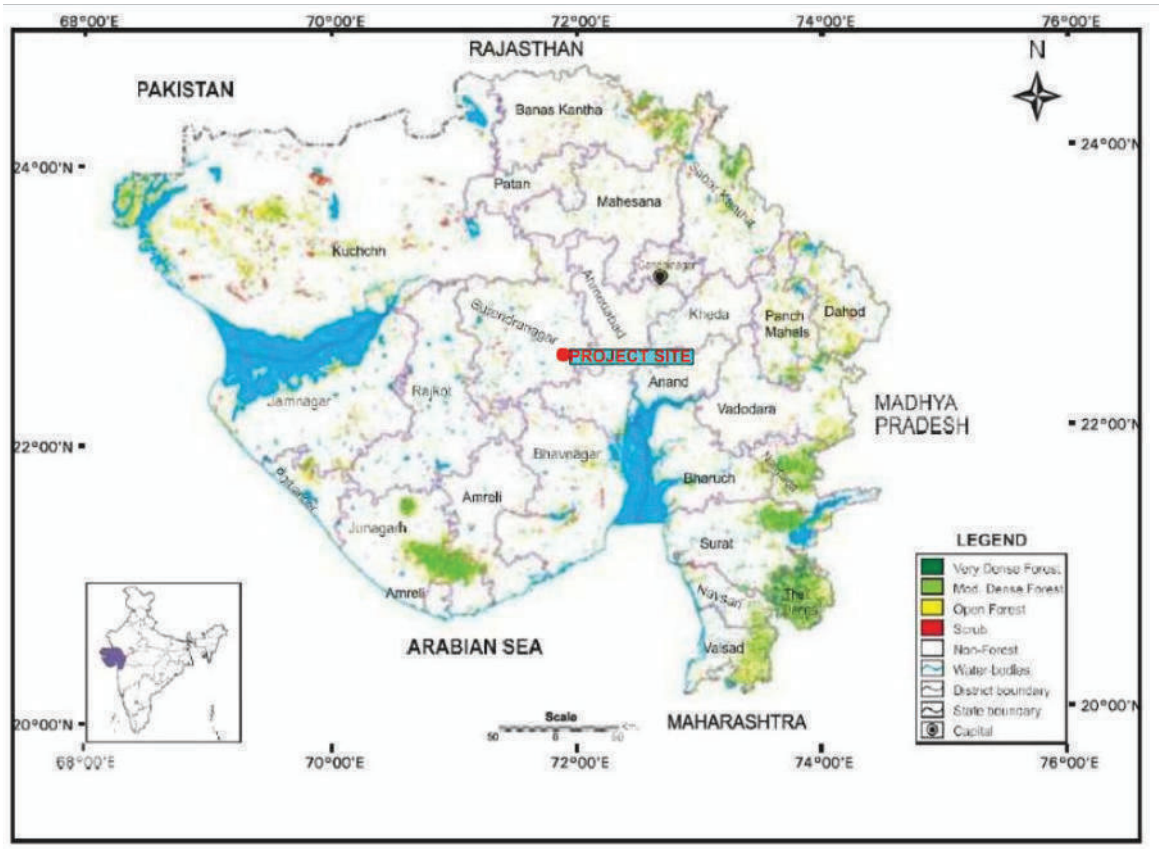
3.6.2 Habitat Assessment

According to the classification of biogeographical zones in India (Rodgers and Panwar, 1988), the state of Gujarat consists of the following zones:

- The Indian Desert: Kutch
- The Semi-arid zone: Gujarat Rajwara
- The Western Ghats: Malabar Coast and Western Ghat Mountains
- The Coast of India: West Coast

Surendranagar falls in the Semi-arid zone: Gujarat Rajwara. The district falls in North Saurashtra Agro climatic zone, characterised by semi-arid climate & medium black calcareous soil. The vegetation is characteristic of dry deciduous forest.

Figure 3-23: Forest cover map of Gujarat



The land use at the project site was found to be predominantly cotton and sorghum cultivation field with adjacent patches of grassland.

Table 3-21: Cropping pattern in the area

Crops	Harvesting Season	Used For
Wheat	Winter	Subsistence as well as commercial
Sorghum	Winter	Subsistence
Groundnut	Monsoon	Subsistence as well as commercial
Corn	Monsoon	Subsistence as well as commercial
Cotton	Monsoon	Commercial purpose
Red Chili	All season	Subsistence as well as commercial
Soybean	Post Monsoon, Winter	Subsistence as well as commercial
Brinjal	Post-monsoon, Summer	Subsistence as well as commercial
Onion	Summer	Subsistence as well as commercial
Bottle gourd	Post-monsoon, Winter, Summer	Subsistence
Coriander	Summer, Monsoon, Post-monsoon	Subsistence as well as commercial
Maize	Post-monsoon	Subsistence as well as commercial

Peas	All season	Subsistence
Cumin	Summer	Subsistence as well as commercial

Habitat mapping of the proposed project area was conducted using Remote Sensing and GIS. The project footprint area is predominantly agricultural fields with few large waterbodies and small waterholes, both perennial and annual waterbodies and canals, few scattered scrublands and patchy grasslands are also present. Few patchy plantation area (of neem and eucalyptus) is also present and some big trees mostly near waterbodies are present.

Table 3-22: Type of habitats in the survey area

Type of habitat	Description
Agricultural lands	Most of the area is agricultural fields, both for subsistence and commercial purpose. The survey area is predominantly agricultural lands, harvesting Cotton, Jowar and Corn during the monsoon season.
Scrubland	The survey area is terrestrial with scattered patchy scrublands, agricultural farmlands, scattered grassland and human settlements. These forests contain spare and stunted growth of species like Acacia and *Prosopis juliflora* bushes etc. Very few big trees were observed, mostly beside waterbodies.
Agricultural lands turned Grasslands	The grassland foliage is limited only during monsoon. The survey area has a number of small patches of scattered grasslands, very few large grassland patches are present, frequented by herbivores and are used as grazing patches by domestic herbivores.
Plantation	Very few private plantations were seen, mostly of Neem and Eucalyptus in few patches.

Figure 3-24: Lesser Florican sighting area around project site

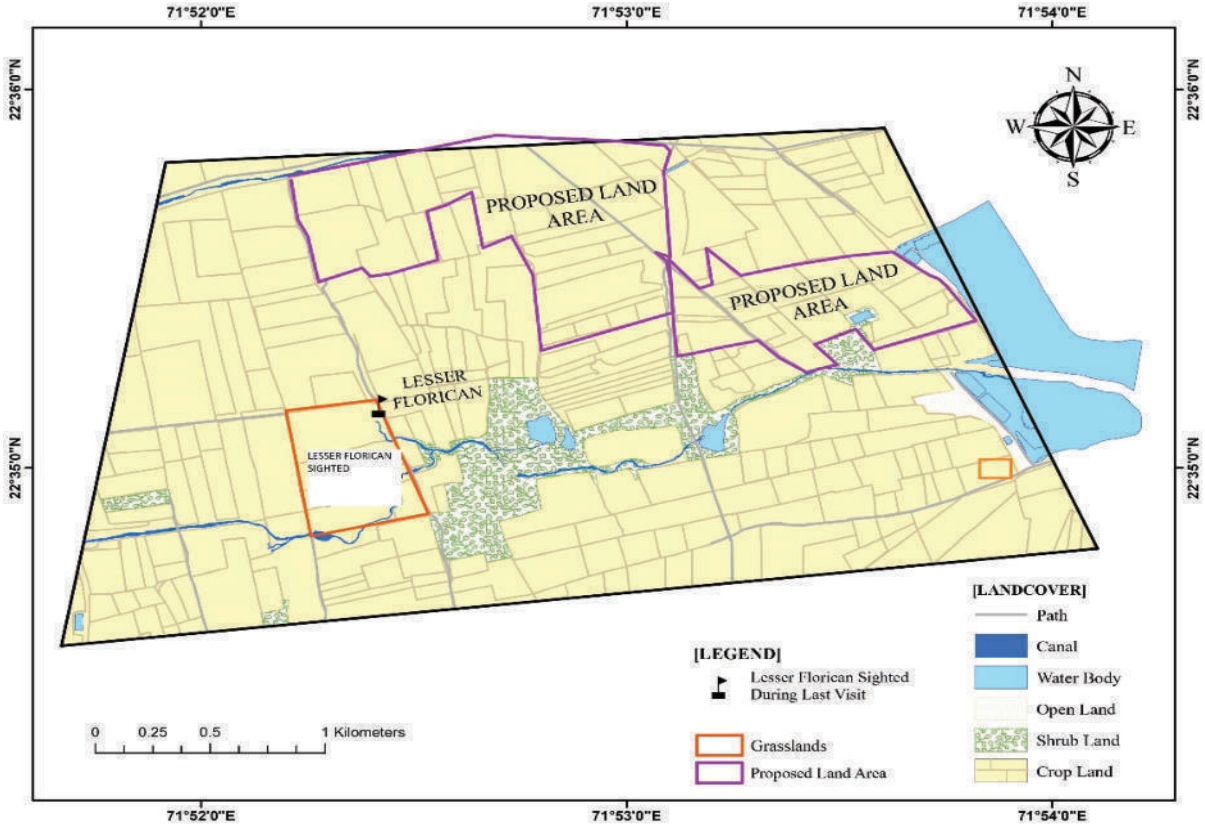


Figure 3.24 is a schematic representation of the patch where Lesser Florican were sighted adjacent to the project site. The land use -landcover map (Figure 3.32) depicts land use in the 5 km radius area of the project site. It is to be noted that the area has predominantly agricultural lands, some patches turn to grasslands during pre-monsoon and monsoon period. These grasslands are cut & reclaimed by locals during the cultivation phase.

The grassland is predominated by mainly two species of grasses and one shrub:

1. Grass species (been submitted to botanist for identification)

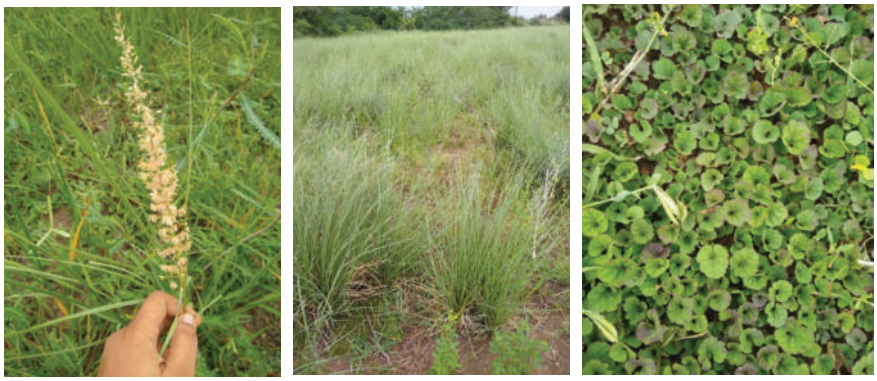
2. *Cyprus* sp.

3. *Merremia emorginata* (shrub)

The grass (1) was mainly predominant and is of 2.5-3 feet in height, the grassland is surrounded by cotton and sorghum fields all around. The grassland is open is nature with few Prosopis trees and no other big trees.

There are few small patches of grasslands within the project footprint area that could be potential habitat for the Lesser Florican. These habitats were surveyed during second season and it was noted that most of these small grassland patches were submerged in water and and are inaccessible.

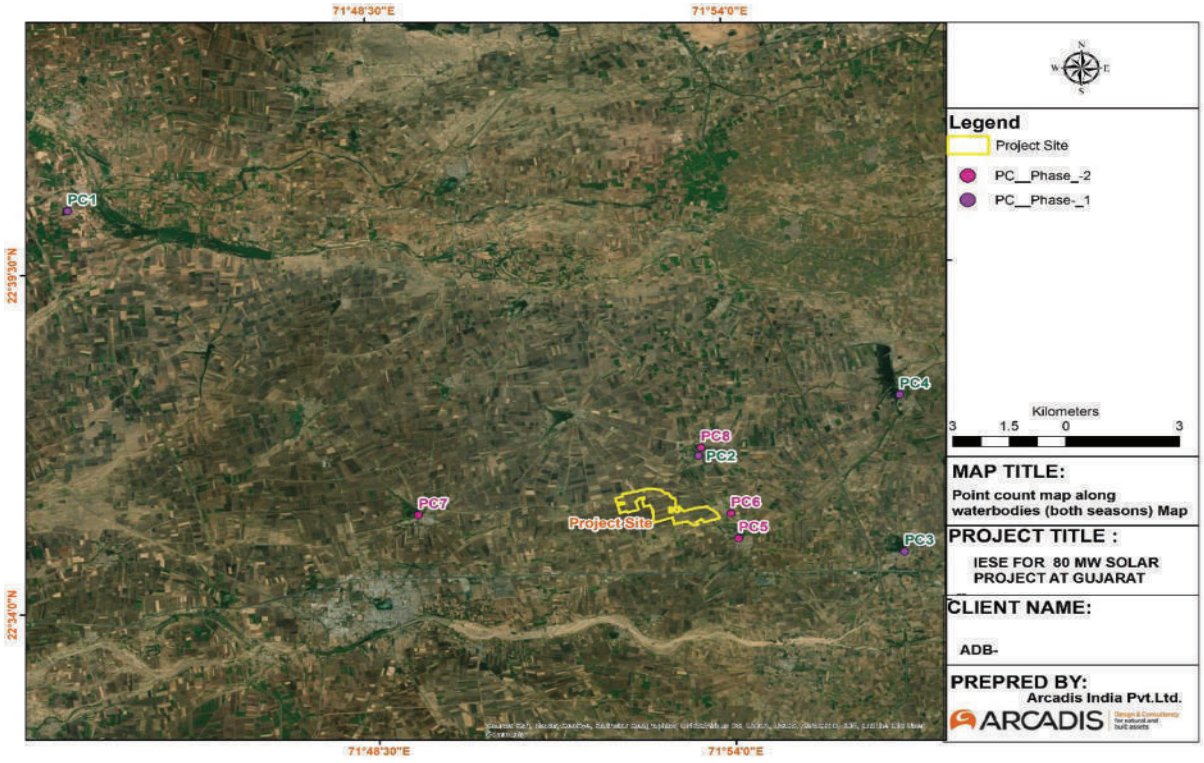
Figure 3-25: Grassland characteristics



Waterbodies

One major connected waterbody (in Kataria village) falls within the direct impact area of the project. The water bodies are predominantly rain fed and the adjacent checkdam stores the excess water which is then utilized for agriculture. Avifauna observed in the waterbody is given in Table 3.32 & 3.33. The point counts around water bodies is depicted in Figure 3.26.

Figure 3-26: Map showing Point count locations in both seasons



Diversity

The Shannon-Weiner Diversity Index (H) value for the water bodies surveyed is given in the figure below. Shannon value ranging from 1.5-3, where above 3 is considered considerably good diversity and below 1 represents low diversity. For diversity analysis, "H" is an information statistic index, which means it assumes all species are represented in a sample and that they are randomly sampled.

$$H = -\sum_{i=1}^{s} p_i \ln p_i$$

Due to the nature of the proposed project, the project will have the maximum impact on the avian fauna. The diversity index for the same has been carried using the vantage point and point count data. This will help us to ascertain the impact of the project in the ecological process of the study area.

Table 3.23 indicates a good avifaunal diversity, keeping in mind the study was conducted during pre-monsoon (off-migration season). The second season surveys near the waterbodies, the analysis was repeated, with a minor increase in diversity noted.

Table 3-23: Species richness, diversity and abundance

Area	Number of Species	Abundance	Shannon-diversity Index	Evenness
Season 1				
Limbdi	53	548	3.1648	0.797
Season 2				
Limbdi	76	634	3.56	0.85

The mentioned water bodies have a good avifaunal diversity and show less dominance by one particular group. The Kataria village waterbody has a considerably good abundance and diversity of avifauna both resident and migratory species.

Figure 3-27: Shannon-Weiner Diversity values of the three waterbodies surveyed

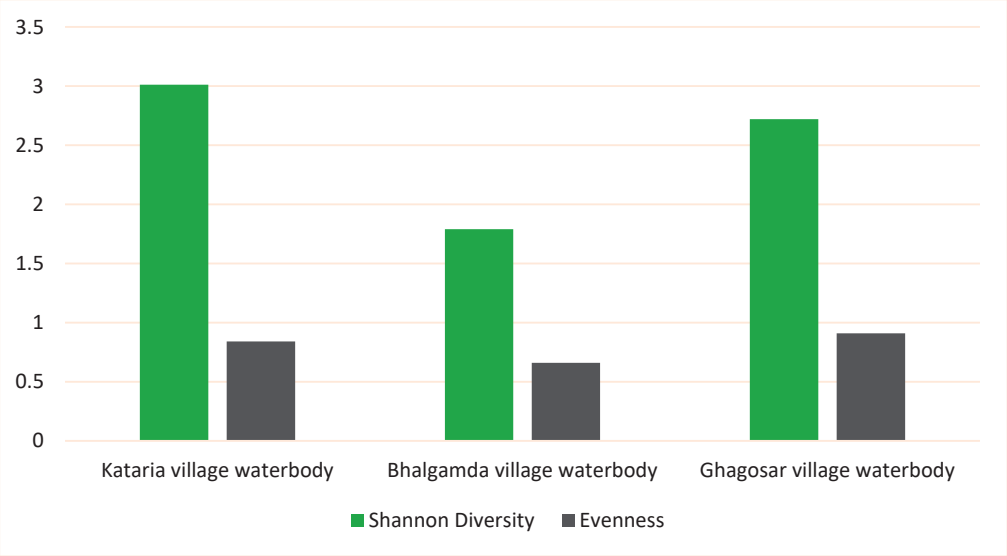
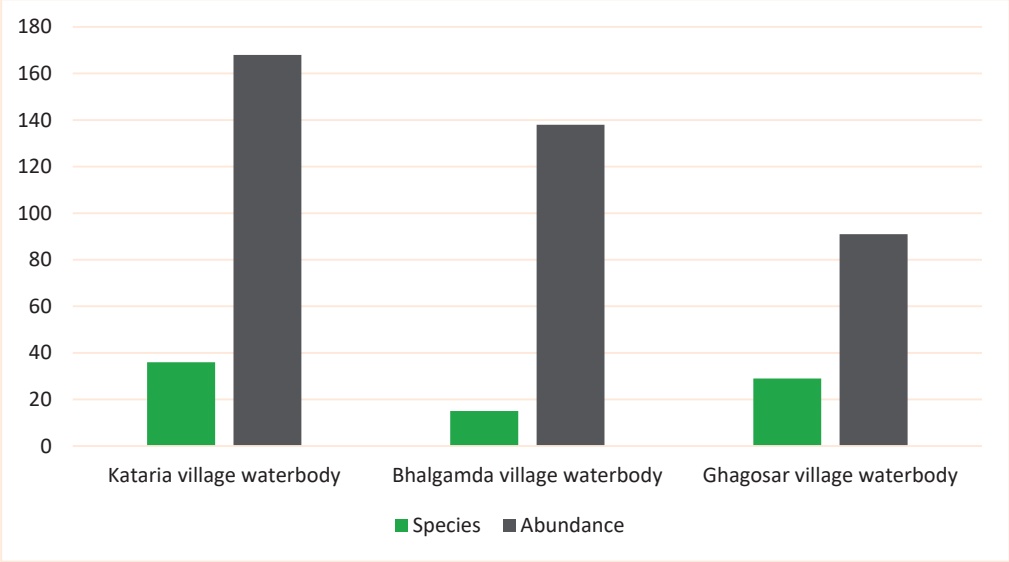


Figure 3-28: Abundance and number of species recorded from the waterbodies



3.6.3 Ecologically Appropriate Area for Analysis

The project is expected to have impact outside the project boundary. These impacts may be direct or indirect on the environmental attributes around the project site. The project footprint is where the impact of project site clearance, construction work, operation work and demobilisation takes place and is within the control of the project proponent. The Area of Influence is outside the project footprint and extends up to the area which has residual or indirect impacts. This area is normally not within the control of the project proponent.

The full extent of ecosystems that might be affected in any way, together with any additional areas that have a functional role in supporting those ecosystems or their associated biodiversity were considered for determining the Ecologically Appropriate Area for Analysis (EAAA). EAAA typically extend well beyond a project's anticipated physical footprint and may extend beyond the project area of influence.

For most species, the EAAA was defined based on a review of secondary data around the Project footprint based on the IBAT assessment, presence of migratory birds and contiguity of habitat, largely agricultural land. The grasslands and scrub land, including those surrounding the water bodies near the project site, are particularly important in the EAAA as this area may support Lesser Florican during breeding season. The EAAA is represented here as 10 km radius area from project site/footprint area; this is considered appropriate for the purpose of the Critical Habitat screening below.

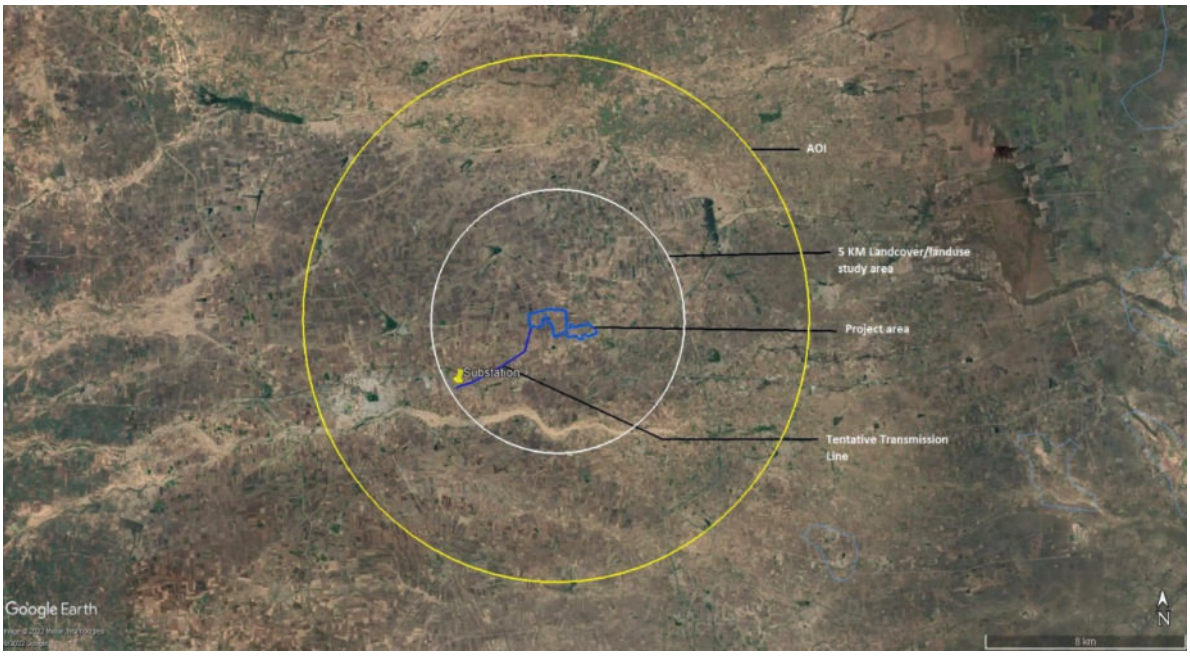
There is no significant natural vegetation present in the project area. The major land use pattern of the project area is dominated by agricultural fields. There are no shading elements such as mountains or tall trees available at the site. It is clear that no portion of the tentative transmission lines (old and new) are passing through any forest patches.

5 Km radius area from the project site represents the area where land-use and land-cover, Transmission route & surrounding area has been surveyed through ground verification during Avifauna survey. This is represented in Figure 3.33.

The impact of the project would mainly be within this immediate impact zone and mitigations have been proposed likewise. Figure 3.29 represents the Area of Influence (also the Ecological Area of Analysis

over 10 km study area) & the 5 km landuse/landcover study area (5 km radius landuse-landcover is detailed out in Figure 3.33).

Figure 3-29: EAAA /AOI



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3.6.4 Critical Habitat Screening

This Critical Habitat screening has been undertaken as part of the impact assessment using the secondary data. The IBAT database has been used to identify potential critical habitat species (threatened species, restricted range and migratory species) within the EAAA in order to assess against the thresholds for Critical Habitat Criterion 1 (critically endangered and endangered species), Criterion 2 (endemic and/or restricted-range species) and Criterion 3 (migratory and/or congregatory species).

The term 'Critical Habitat' is an area with high biodiversity value as defined in ADB SPS. This includes areas that meet the required thresholds (Table 3.26) for one or more of the following criteria (Table 3-24 & 3.25).

Table 3-24: Category and Criteria for delineating Critical Habitat

Criteria	Category	Parameters
I.	Habitat of significant importance to Critically Endangered (CR) and/or	■ Habitat of significant importance to Critically Endangered (CR) and/or Endangered Species (EN) as per the latest IUCN Red List; ■ Areas required for the reintroduction of CR and EN species and refuge sites for these species; ■ Ecosystems of known special significance to EN or CR species for climate adaptation purposes; and ■ Concentrations of Vulnerable (VU) species in cases where there is uncertainty regarding the listing and the actual status of the species may be EN or CR.

	Endangered (EN) species [11]	
II.	Habitat of significant importance to Restricted Range species	■ Habitats supporting species where ≥ 95% of its global range is inside a country or region of analysis; and ■ Terrestrial vertebrates have to fall within a 50,000 km2 or less area to be classified as restricted range; and ■ Freshwater species have to fall within a 20,000 km2 or less area to be classified as a restricted range (fish, crab, and mollusks only).
III.	Habitat supporting globally significant concentrations of migratory species and/or congregatory species.	■ Habitats supporting species where a significant proportion of its members are cyclically and predictably moving from one geographical area to another; ■ Habitats supporting congregatory species include species that form colonies and large gatherings for non-breeding purposes (e.g. foraging, roosting); and ■ Habitats that are bottleneck sites for species movement, contain clumped distributions of species or hold populations of species that make an inordinate contribution to the recruitment of the species.
IV.	Highly threatened and/or unique ecosystems	■ Habitats that are at significant risk of decreasing in area/quality, have a small spatial extent or contain unique assemblages of species; and ■ Habitats are determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out in the area.
V.	Areas associated with key	■ Habitats where the physical feature of the landscape might be associated with particular evolutionary processes

Table 3.25 provides detail of the qualifying requirements (i.e., thresholds) for Criteria 1 to 5.

Table 3-25: Critical Habitat Criterion

Criterion	Threshold
Criterion 1: Critically Endangered and Endangered Species. Species threatened with global extinction and listed as CR and EN on the IUCN Red List of Threatened Species.	1. Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (0.5% of the global population and 5 reproductive units of a CR or EN species); species. 2. Areas that support globally important concentrations of an IUCN Red-listed VU species, the loss of which

[11] Species are classified as Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) as per the International Union for the Conservation of Nature (IUCN) Red List that classified flora and fauna globally based on their risk of extinction. The database provides information from governmental organizations, non-governmental organizations, scientific institutions, published journals and discussions with researchers to provide up-to-date information on the global distribution, abundance, behaviour and threats to extinction to classify species as Least Concern (LC) to Extinct (EX).

Species that are listed nationally/ regionally as CR or EN in countries that have adhered to IUCN guidance in consultation with competent professionals.	would result in the change of the IUCN Red List status to EN or CR and meet the thresholds at (a). 3. As appropriate areas containing nationally/regionally important concentrations of an IUCN Red-listed EN or CR
Criterion 2: Endemic and Restricted-range Species The term endemic is defined as restricted range. Restricted range refers to a limited extent of occurrence (EOO): For terrestrial vertebrates and plants, a restricted-range species is defined as those species that have an EOO less than 50,000 km2.	• Areas that regularly hold ≥10% of the global population size and ≥10 reproductive units of a species.
Criterion 3: Migratory and Congregatory Species Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem). Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis; examples include the following: • Species that form colonies. • Species that form colonies for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes (e.g., foraging, roosting). • Species that move through bottleneck sites where significant numbers of individuals of a species pass over a concentrated period of time (e.g., during migration). Species with large but clumped distributions where a large number of individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed (e.g., wildebeest distributions). Source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere (especially important for marine species).	• Areas known to sustain, on a cyclical or otherwise regular basis, ≥1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. • Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.
Criterion 4: Highly Threatened or Unique Ecosystems	• Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.
Criterion 5: Key Evolutionary Processes The structural attributes of a region, such as its topography, geology, soil, temperature and vegetation and combinations of these variables can influence the evolutionary processes that give rise to regional configurations of species and ecological properties.	No specific criterion available, however examples may include: • Landscapes with high spatial heterogeneity are a driving force in speciation as species are naturally selected on their ability to adapt and diversify. • Environmental gradients, also known as ecotones, produce transitional habitat which has been associated with the process of speciation and high species and genetic diversity. • Edaphic interfaces are specific juxtapositions of soil types (e.g., serpentine outcrops, limestone and gypsum deposits), which have led to the formation of unique plant communities characterized by both rarity and endemism. • Connectivity between habitats (e.g., biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats

		and for the conservation of meta populations. This also includes biological corridors across altitudinal and climatic gradients and from “crest to coast.” • Sites of demonstrated importance to climate change adaptation for either species or ecosystems are also included within this criterion.	

Table 3.26 Critical habitat screening of IBAT species and other species or groups identified within the EAAAfrom relevant data sources.

Table 3-26: Critical Habitat Screening results

Species/common name	Status and global population trend	Discussion	CH triggered
Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species;			
Lesser Florican	CR; Decreasing	Is known to be present in Gujarat. Lesser Florican (Sypheotides indicus) is an endangered species listed under the IUCN Red List of Threatened Species List (IUCN 2021-1) and Schedule I species under WLPA, 1972. Also, its population and habitat being rapidly decreasing, it is a species of high conservation value. The species is a grassland species with relatively wide distribution across India. The project area falls under the breeding site of the Lesser Florican. The species exhibits a lek mating system, where males establish territories of 2-3 ha, spaced at 200-500 m from each other (Sankaran 1994). Sankaran (1994) reported an average 4.7 territories per sq km, while a more recent study (Dutta and Jhala 2012) estimated an average 1.5 males per sq km in grasslands of Kutch and also Females visit male arenas exclusively for mating, and nest outside or at the periphery of their territories (Sankaran 1994), raising the offsprings alone. Also, as per Birdlife International (as on 12 August 2021), the total global population estimate of matured individuals is 1228 & the Gujarat region records approximately 61 as on 31st Dec 2021(as reported by State government), thus % of occurrence in Gujarat region is 0.049%. Again, the surveys in the EAAA accounted for 3 male LF. So, the EAAA population of LF is 0.002%. Thus, the Criterion 1 threshold for Critical	Not triggered.

Species/common name	Status and global population trend	Discussion	CH triggered
		Habitat is not met in the Gujarat region as well as in the EAAA. The EOO (extent of occurrence) for this species is 2,160,000 sq.km. The EAAA is 0.0145% of the EOO of this species, thus the species threshold is very low (i.e EOO below 0.5%) for the project EAAA.	
White-rumped Vulture	CR ; Decreasing	The White-rumped Vulture (*Gyps bengalensis*) is a critically endangered species listed under the IUCN Red List of Threatened Species List (IUCN 2021-1) and Schedule I species under WLPA, 1972. The global population of this bird species is 2,500-9,999. This species occurs mostly in plains and less frequently in hilly regions where it utilizes light woodland, villages, cities, and open areas. Such habitat is present in the project site. There are 230 sightings of this species in the Gujarat region recorded on the eBird database (0.023% occurrence). The EOO for this species is 7,370,000 km^2. The EAAA represents 0.004% of the EOO for this species.	Not triggered
Great Indian Bustard	CR	The global population of this bird species is 50-249. This species inhabits arid and semi-arid grasslands with scattered short scrub, bushes and low intensity cultivation in flat or gently undulating terrain. Birds congregate in traditional less disturbed grassland patches to breed during mid-summer and monsoon. It nests in open ground, laying only one clutch per year. Outside of breeding season, it probably makes local and possibly long-distance nomadic movements (largely unknown) in response to various factors, using areas rich in food resources and surrounded by natural grass-scrub habitat. This species is not a migrant. The EOO for this species is 12,500,000 sq.km and its range is largely limited to Indian, with the potential for non-breeding populations occurring in Pakistan. It has been extirpated from 90% of its former range and is now principally confined to Rajasthan. Some	Not triggered

Species/common name	Status and global population trend	Discussion	CH triggered
		information sources consider this species to be 'near-endemic'. Recent declines have been noted in several areas, including Maharashtra (Kasambe et al. 2006, P. Patil in litt. 2011, Anon. 2015), Kachchh (Dutta in litt. 2012) and Rajasthan (P. Patil *in litt*. 2015). In Kachchh the latest population estimate is fewer than 20 birds at densities of 0.05 per km^2 in c. 400 km^2 of suitable habitat (Dutta in litt. 2012). According to eBird, there are records of GIB from Velavadar Sanctuary, about 90 kms from the project site. The EAAA represents 0.003% of the EOO for this species.	
Sociable Lapwing	CR; Decreasing	The global population of this bird species is 11,200. This species is migratory and flocks of several thousand birds have been known to gather before migration in Siberia and Kazakhstan, but migration itself usually occurs in small groups of 15-20 birds. It arrives on its wintering grounds in India and Pakistan by September-October, and in Sudan by late October. Small flocks of similar size to those observed on migration are usual on the wintering grounds, although very occasionally larger flocks of over 100 birds have been recorded. It breeds mainly in the transition zones between *Stipa* and *Artemisia* grassland steppes where bare saline areas occur near waterbodies. It uses dry wasteland, cultivated, ploughed and stubble fields. On migration it uses mainly sandy plains with short grass, dry meadows, fallow land and cultivated fields. The wintering grounds are burnt steppe and savannah, dry plains, sandy wastes, harvested millet fields, damp pastures and short grass areas, often adjacent to water. The EOO is 1,620,000 sq.km. The EAAA is 0.02% of the EOO of this species.	Not triggered
Red-headed Vulture	CR; Decreasing	The global population of this bird species is 2,500-9,999. As its rarity in South-East Asia it is unlikely that more than a few hundred individuals remain there, while the total population seems	Not triggered

Species/common name	Status and global population trend	Discussion	CH triggered
		unlikely to exceed 10,000 mature individuals as the patchiness of its distribution across India and the apparently catastrophic very recent declines. It frequents open country usually away from human habitation, well-wooded hills and dry deciduous forest with rivers, usually below 2,500 m. Nesting has been recorded in tall trees. It occurs at lower density than *Gyps* vultures owing to its predominantly territorial behaviour, and movements are poorly known. There are 72 sightings of this species in the Gujarat region recorded on the eBird database (0.007% occurrence in Gujarat region). The EOO for this species is 5,230,000 sq.km and the EAAA represents 0.006% of this EOO. Therefore, this species does not meet the threshold for Criterion 1.	
Indian Vulture	CR; Decreasing	The global population of this bird species 30,000. This species is found in cities, towns and villages near cultivated areas, and in open and wooded areas. They feed almost entirely on carrion, and often associates with the white-rumped vulture when scavenging at carcass dumps and slaughterhouses. It nests almost exclusively in colonies on cliffs and ruins, although in one area, where cliffs are absent, it has been reported nesting in trees. There are 254 sightings of this species in the Gujarat region recorded on the eBird database (thus 0.008% occurrence in Gujarat region). The EOO for this species is 2,150,000 sq.km. The EAAA represents 0.00146% of the EOO for this species. Therefore, this species does not meet the threshold for Criterion 1.	Not triggered
Indian Skimmer	EN; Decreasing	The global population of this bird species is 2,450-2,900. In India, most observations during the non-breeding season are of few birds but larger congregations are known from a handful of key sites. Individuals or very small numbers may occur almost anywhere around the coast and wander widely in central India during the non- breeding season. This bird is now almost	Not triggered

Species/common name	Status and global population trend	Discussion	CH triggered
		completely restricted to India as a breeding bird, with only occasional breeding in western Bangladesh. In India the species remains widely distributed, but breeding areas are now highly restricted. Most colonies now occur along the Rivers Chambal, Ganges, Yamuna, Mahanadi and Son. This species is a full migrant. It occurs primarily on larger, sandy, lowland rivers, around lakes and adjacent marshes and, in the non-breeding season, estuaries and coasts. There are 209 sightings of this species recorded on the eBird database (0.07% occurrence). The EOO for this species is 1,400,000 sq.km. The EAAA is 0.02% of the EOO of this species. Therefore, this species does not meet the threshold for Criterion 1.	
Black-bellied Tern	EN; Decreasing	This species is almost extinct in a large part of its range and is thought to be in very rapid decline overall, owing to a multitude of threatening processes that affect riverine species in southern Asia. It is therefore listed as Endangered. The population estimate is currently placed at 10,000-25,000 individuals, roughly equating to 6,700-17,000 mature individuals. It is found on large rivers (usually breeding on sandspits and islands) and marshes, occasionally on smaller pools and ditches, in lowlands (but not on the coast), up to 730 m. There are 9 sightings of this species recorded on the eBird database (0.0005% occurrence). The EOO for this species is 4,490,000 km^2. The EAAA is 0.07% of the EOO of this species. Therefore, this species does not meet the threshold for Criterion 1.	Not triggered
Pallas's Fish-eagle	EN; Decreasing	This species has a small, declining population as a result of the widespread loss, degradation and disturbance of wetlands and breeding sites throughout its range. The global population is thought to comprise a single, migratory subpopulation. Global population estimate is 1,000-2,499 mature individuals. It is closely associated with	Not triggered

Species/common name	Status and global population trend	Discussion	CH triggered
		wetlands, principally large lakes and rivers, from the lowlands to 5,000 m. It generally nests in trees near water. Key threats are habitat loss, degradation and disturbance. Across the Indian subcontinent, and probably most of its range, wetlands have been drained or converted for agriculture and human settlements. The felling of large trees near wetlands has reduced the availability of nest and roost sites. The EOO for this species is 1,740,000 km^2. The EAAA is 0.2% of the EOO of this species. Therefore, this species does not meet the threshold for Criterion 1.	
Egyptian Vulture	EN; Decreasing	The global population of this species is 12,000-38,000. The EOO for this species is 55,500,000 sq.km. This species occupies a large range with isolated resident populations. The species is listed as a full migrant and these birds winter within the resident range, and in addition throughout the Sahel region of Africa. This species typically nests on ledges or in caves on cliffs, crags and rocky outcrops, but occasionally also in large trees, buildings (mainly in India), electricity pylons and exceptionally on the ground. It forages in lowland and montane regions over open, often arid, country, and also scavenges at human settlements. There are 412 sightings of this species recorded on the eBird database from Gujarat region (0.01%occurance). The EOO for this species is 4,490,000 km^2. The EAAA is 0.0006% of the EOO for this species. Therefore, this species does not meet the threshold for Criterion 1.	Not triggered
Steppe Eagle	EN; Decreasing	The global population of this bird species 50,000-75,000. The steppe eagle's preferred habitat is savanna, grassland, and rocky areas (e.g., inland cliffs, mountain peaks). It inhabits areas of steppe and semi-desert and is recorded breeding up to 2,300 m in mountainous regions. It avoids sea crossings and thus forms large concentrations at bottleneck sites. EOO	Not triggered

Species/common name	Status and global population trend	Discussion	CH triggered
		for this species is 12,600,000 sq.km. This species is thought to occur throughout India, with non-breeding populations. This species is a locally common, widespread winter migrant in India. The eBird database records 1281 observations of this species in the Gujarat region (0.01% occurrence in Gujarat region) and the site is within the non-breeding range of the population. Known threats include power lines and potential wind energy developments. The rate of mortality has increased due to collisions with power lines. The EAAA represents 0.0025% of the EOO for this species, therefore, this species does not meet the threshold for Criterion 1.	
Saker Falcon	EN; Decreasing	This species is listed as Endangered because a population trend analysis indicates that it may be undergoing a very rapid decline. This negative trend is a result of a range of anthropogenic factors including electrocution on power lines, unsustainable capture for the falconry trade, as well as habitat degradation and the impacts of agrochemicals, and the rate of decline appears to be particularly severe in the species's central Asian breeding grounds. The global population was estimated at c.17400-28,800 breeding pairs. It is physically adapted to hunting close to the ground in open terrain, combining rapid acceleration with high manoeuvrability, thus specialising on mid-sized diurnal terrestrial rodents (especially ground squirrels *Spermophilus*) of open grassy landscapes such as desert edge, semi-desert, steppes, agricultural and arid montane areas. In some areas, particularly near water and even in urban environments. There are 3 sighting records of this species on the Indian Biodiversity Portal and iNaturalist database from Gujarat region. The EOO for this species is 19,100,000 km^2. The EAAA is 0.002% of the EOO for this species. Therefore, this species does not meet the threshold for Criterion 1.	Not triggered
Criterion 2: Endemic and/or restricted-range species;			

Species/common name	Status and global population trend	Discussion	CH triggered
No endemic or restricted range species identified.			
Criterion 3: Migratory and/or congregatory species;			
A total of 242 migratory species were identified. Endangered and Critically Endangered migratory species are considered below.			
Sociable Lapwing	CR; Decreasing	As above	Not triggered
Lesser Florican	CR ; Decreasing	The species has a wide distribution range but found in grassland patches. The species is summer migrant to the project site. However, the EAAA & Gujarat region doesnot hold ≥1 percent of the global population of LF.	Not triggered
Indian Skimmer	EN; Decreasing	As above	Not triggered
Pallas's Fish-eagle	EN; Decreasing	As above	Not triggered
Egyptian Vulture	EN; Decreasing	As above	Not triggered
Steppe Eagle	EN; Decreasing	As above	Not triggered
Saker Falcon	EN; Decreasing	As above	Not triggered
Criterion 4: Highly threatened and/or unique ecosystems			
The natural and modified habitats within the Project EAAA do not meet the criteria for EN or CR ecosystems as detailed by IUCN, 2015. Therefore, the critical habitat is not triggered under criterion 4 of IFC PS6/ADB SPS. The habitats present within the Project EAAA have been likely modified by agricultural activities. These habitats are generally degraded in terms of biological diversity and importance compared to the natural habitats that they replaced.			
Criterion 5: Key evolutionary processes.			
There is no evidence to suggest that the Project is located within an area which is considered to represent Critical Habitat from the perspective of key evolutionary processes. Neither the terrestrial nor the aquatic EAAA contain a large proportion of locally endemic species which could be indicators of key evolutionary processes.			

Based on the critical habitat screening, field survey timing was adjusted to coincide with the conducive time (pre-monsoon) when the Lesser Florican comes to breed, the grass is not that high (post-monsoon the grass height increases to such an extent that it becomes difficult to spot the elusive and shy species) and it is comparatively easier to spot the male in display. All other survey methods remain valid to confirm if CH trigger species may occur in the project area.