



“Consultancy services for ESIA for three Solar Parks, namely, Agar Solar Park (550 MW), Shajapur Solar Park (450 MW) and Neemuch Solar Park (500 MW), including internal evacuation infrastructure and associated transmission lines, of three parks of aggregate capacity of 1500 MW in the State of Madhya Pradesh, India”: Agar Solar Park

Rewa Ultra Mega Solar
Limited

Final ESIA Report

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Final ESIA Report



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CONTENTS

EXECUTIVE SUMMARY	I
1. INTRODUCTION	1
1.1 Project Background	1
1.2 Objective and Scope of Assessment	3
1.2.1 Applicable Framework	4
1.3 Approach and Methodology	4
1.3.1 Kick-off Meeting	4
1.3.2 Desk Based Review	4
1.3.3 Inception Report	5
1.3.4 Site Visit and Baseline Data Collection	5
1.3.5 Stakeholders Consultation	5
1.3.6 Impact Assessment	6
1.3.7 Environment and Social Management Plan	6
1.4 Limitations	6
1.4.1 Uses of the Report	7
1.5 Structure of the Report	7
2. PROJECT DESCRIPTION	9
2.1 Project Location	10
2.2 Site Setting	13
2.3 Overview of the Project	14
2.3.1 Project Components	14
2.3.2 Associated Components	15
2.4 Summary of Project Activities	17
2.4.1 Planning and Pre-Construction Phase	17
2.4.2 Construction Phase	17
2.4.3 Operation and Maintenance	17
2.5 Resource Requirement	18
2.5.1 Raw Materials	18
2.5.2 Water Requirement	18
2.5.3 Power Requirement	19
2.5.4 Fire Safety and Security	19
2.5.5 Man Power Requirement	20
2.6 Land Requirement and Allotment Process	20
2.6.1 Land Details	21
2.6.2 Land Procurement Process	22
2.7 Pollution Stream	24
2.7.1 Solid Waste Generation	24
2.7.2 Air Emissions	26
2.7.3 Wastewater Generation	27
2.7.4 Noise Emission	27
3. POLICY, LEGAL AND ADMINISITRATIVE FRAMEWORK	28
3.1 Applicable Reference Framework	28
3.1.1 Environmental and Social Management Framework of Ministry of New and Renewable Energy	49
3.2 Applicable Environmental Standards	49
3.2.1 National Level Standards	49
3.2.2 IFC/ WB Standards	50

4.	ENVIRONMENTAL AND SOCIAL BASELINE.....	51
4.1	Study Area.....	51
4.1.1	Project Footprint area	51
4.1.2	Project Area of Influence (Aoi).....	51
4.2	Physical Environment	52
4.2.1	Site Visit.....	52
4.2.2	Secondary Baseline Data Collection	53
4.3	Physical Environment Baseline.....	56
4.3.1	Land Use and Land Cover	56
4.3.2	Topography and Slope.....	61
4.3.3	Geology and Geomorphology	64
4.3.4	Soil Quality.....	66
4.3.5	Hydrogeology.....	68
4.3.6	Hydrology.....	68
4.3.7	Water Resources - Availability and Quality	71
4.3.8	Natural Hazards.....	90
4.3.9	Ambient Air Quality	95
4.3.10	Ambient Noise.....	99
4.3.11	Traffic Monitoring	100
4.4	Biological Environment Baseline.....	101
4.4.1	Methodology for Baseline Data Collection	101
4.4.2	Habitat and Floral Survey	102
4.4.3	Faunal Assessment	108
4.4.4	Protected Areas	124
4.4.5	Migratory Corridor.....	124
4.4.6	Delineation of Critical, Natural and Modified Habitat.....	125
4.5	Social Environment Baseline	126
4.5.1	Socio Economic Setting	127
4.5.2	Study Area	130
4.5.3	Demographic Profile of Study Area.....	135
4.5.4	Social Stratification	135
4.5.5	Literacy and Education	137
4.5.6	Land ownership and use.....	138
4.5.7	Occupational Profile.....	145
4.5.8	Physical Infrastructure	152
4.5.9	Social Infrastructure	153
4.5.10	Energy Use	154
4.5.11	Gender: Role in Society	154
5.	STAKEHOLDER IDENTIFICATION, INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION	157
5.1	Stakeholder Identification and Categorization.....	157
5.2	Stakeholder Analysis	158
6.	ENVIRONMENTAL AND SOCIAL IMPACTS.....	178
6.1	Impact Assessment Methodology	178
6.1.1	Screening and Scoping.....	178
6.1.2	Impact Matrix	182
6.1.3	Prediction of Impacts	185
6.1.4	Evaluation of Impacts- Impact Significance	185
6.1.5	Identification of Mitigation and Enhancement Measures.....	188
6.1.6	Preparation of Environmental and Social Management Plan	189
6.2	Impacts on Physical Environment.....	189
6.2.1	Assessment Criteria.....	189

6.2.2	Planning and Construction Phase	196
6.2.3	Operation Phase	211
6.2.4	Photovoltaic Heat Island Effect (PVHI)	218
6.2.5	Natural hazards- Flood Likelihood Assessment	219
6.3	Impacts on Biological Environment	224
6.3.1	Assessment Criteria	224
6.3.2	Impact during Construction Phase	228
6.3.3	Impacts during Operation Phase	231
6.4	Impacts on Social Environment	233
6.4.1	Avoidance and optimisation of the Project footprint	233
6.4.2	Potential Impacts from Project activities on Stakeholder Categories	234
6.4.3	Assessing the Significance of Impacts	249
6.4.4	Planning Phase Impacts	249
6.4.5	Construction Phase Impacts	253
6.4.6	Operational Phase Impacts	258
6.4.7	Impact on Women – Construction Stage	262
6.4.8	Impact on Women – Operations Stage	265
6.5	Summary of Impact Assessment	266
7.	ANALYSIS OF ALTERNATIVES	268
7.1	Project vs No Project scenario	268
7.2	Alternate Source for Power Generation	268
7.2.1	Location for Project Site	271
8.	ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN	272
8.1	Introduction	272
8.2	Environmental and Social Management Plan	272
8.3	Institutional Structure for Implementation	298
8.3.1	Project Implementation- SPPD and SPD	298
8.3.2	Implementation of ESMP	299
8.3.3	Monitoring and Reporting	302
8.4	ESMP Budget	306
8.5	Training and Capacity Building	308
9.	GRIEVANCE REDRESSAL MECHANISM	310
9.1	Objectives of the Grievance Redressal Mechanism	310
9.2	Composition of the GRC	310
9.2.1	Functioning of the GRC for Grievance Redress	311
9.3	External Grievance Redressal Mechanism of RUMSL	311
9.3.1	Receipt and Recording	312
9.3.2	Resolution and Communication	313
9.4	Internal Grievance Redressal Mechanism	313
9.4.1	Receipt and Recording	313
9.4.2	Resolution and Closure	314
9.5	Monitoring and Evaluation	315
9.6	Budgeting	315
10.	CONCLUSION	316
11.	REFERENCES	317

APPENDIX A	PHOTO DOCUMENTATION
APPENDIX B	DETAILS OF CONSULTATIONS UNDERTAKEN DURING AGAR SOLAR PARK ESIA PREPARATION
APPENDIX C	ENVIRONMENTAL MONITORING RESULTS
APPENDIX D	FLOOD LIKELIHOOD ASSESSMENT
APPENDIX E	ESMP- MANAGEMENT PLANS

List of Tables

Table 0.1	Brief Description of Project	I
Table 0.2	Agar: Village Wise Land Allotment details	II
Table 0.3	Summary of Current Baseline Status.....	IV
Table 1.1	Key sources of information reviewed for the desk-based study	4
Table 1.2	Structure of the report	7
Table 2.1	Agar Solar Park – Project at a Glance	9
Table 2.2	Project Land Footprint.....	21
Table 2.3	Waste generated, source of waste and method of disposal to be adopted for the Project	25
Table 2.4	Waste Management during Operation Phase.....	26
Table 3.1	Applicability of Key Legislations in India and Reference Framework in Different Phases of the Project	29
Table 3.2	International Standards- IFC Performance Standards and WB Safeguard Policies	43
Table 4.1	Primary Baseline Data Collection	53
Table 4.2	Secondary Baseline Data Collection	53
Table 4.3	Landuse of Agar Solar Park (5-km radius Study Area).....	57
Table 4.4	Land use of Project Site Boundary	59
Table 4.5	Stratigraphic succession of the Region	64
Table 4.6	Soil Sampling Location Details of Agar Solar Project	66
Table 4.7	Soil Analysis Results of Agar Solar Project	67
Table 4.8	Classification of Water Risk Indicators.....	73
Table 4.9	Parameters included to assess water availability	76
Table 4.10	Water Quality Standards by CPCB for Best Designated Usage.....	85
Table 4.11	Surface Water Sampling Locations.....	86
Table 4.12	Surface Water Analysis Results.....	86
Table 4.13	Groundwater Monitoring Locations	88
Table 4.14	Groundwater Analysis Results.....	88
Table 4.15	Wind Hazard Categorisation	92
Table 4.16	Summary of Wind Hazard Categorisation	93
Table 4.17	Climatological Variations at Shajapur Station (1981-2010)	94
Table 4.18	Rainfall Data.....	95
Table 4.19	Details of Ambient Air Monitoring Stations	96
Table 4.20	Details of Methods for different Air Quality Parameters.....	96
Table 4.21	Ambient Air Quality Monitoring Results in the Study Area	96
Table 4.22	Details of Noise Sampling Locations	99
Table 4.23	Ambient Noise Monitoring Results	99
Table 4.24	Traffic Count Survey Location.....	100
Table 4.25	Existing Traffic (Motorised) Volumes in Study Area	100
Table 4.26	Percentage Composition of Vehicles in Study Area	100
Table 4.27	Methodology for ecological survey.....	102
Table 4.28	Amphibians observed/recorded from the Study Area	108
Table 4.29	Reptiles observed/reported from the Study Area.....	109

Table 4.30	Avifaunal species observed in Study Area	111
Table 4.31	Details of Mammals observed/ reported from the Study area	122
Table 4.32	Delineation of Habitats (Critical, Natural and Modified)	126
Table 4.33	Madhya Pradesh Demographic Profile	128
Table 4.34	Demographic Profile of Tehsils	130
Table 4.35	Land Details for the Solar Park	130
Table 4.36	Project Area and Surrounding Area Villages	131
Table 4.37	Demographic Profile of Study Area.....	135
Table 4.38	Land Use Break Up in the Study Area	139
Table 4.39	Working Population in the Study Area (as per Census 2011)	145
Table 4.40	Proportion and Break-down of Working Population in the Study Area (as per Census 2001)	146
Table 4.41	Productivity and related costing of major crops in Aol	149
Table 4.42	Livestock Holding in the Study Area	151
Table 4.43	Availability of Schools in the Study Area	153
Table 5.1	Stakeholder Group Categorisation.....	157
Table 5.2	Stakeholder Significance and Engagement Requirement	158
Table 5.3	Stakeholder Analysis	160
Table 6.1	Screening for Impacts	179
Table 6.2	Activity Receptor Interaction Matrix	183
Table 6.3	Impact Characteristic Terminology	186
Table 6.4	Impact Type Definitions	186
Table 6.5	Definitions of Likelihood Designations	187
Table 6.6	Criteria for Resource/ Receptor Sensitivity or Vulnerability.....	190
Table 6.7	Criteria for Impact Magnitude.....	192
Table 6.8	Status of Ground water in Project District.....	214
Table 6.9	Likelihood of flood evaluation.....	221
Table 6.10	Habitat-Impact Assessment Criteria	225
Table 6.11	Species-Impact Assessment Criteria	226
Table 6.12	Land identified for the Project	233
Table 6.13	Proportion of Village Land Identified for the Project	234
Table 6.14	Potential impacts from the project activities.....	236
Table 6.15	Population of SC and ST Communities in Project Villages	260
Table 6.16	Summary of Impacts	266
Table 7.1	Life-cycle Emissions from Power Sources.....	269
Table 7.2	Environmental Advantages and Disadvantages of Power Generation System.....	269
Table 7.3	Green House Emissions from Different Electricity Production Chains	270
Table 7.4	Daily and Monthly GHI at Agar Solar Park Site	271
Table 8.1	Planning Phase ESMP.....	273
Table 8.2	Construction Phase ESMP	276
Table 8.3	Operation Phase ESMP	292
Table 8.4	Responsibilities of SPPD and SPD.....	298
Table 8.5	Monitoring Action Plan	302
Table 8.6	Environmental Monitoring Budget.....	306
Table 8.7	Indicative Budgetary allocation for ESMP Implementation	307
Table 9.1	Format for External Grievance Tracker	313
Table 9.2	Format for Internal Grievance Tracker.....	314

List of Figures

Figure 2.1	Location Map of Agar Solar Park	12
Figure 2.2	Overview of Project Site	14
Figure 2.3	Power Evacuation Arrangement	16
Figure 4.1	Location Map of Environmental Baseline Monitoring Stations at Unit 4 (Agar)	55
Figure 4.2	Location Map of Environmental Baseline Monitoring Station at Unit 5 (Susner)	56
Figure 4.3	Land Use Map – Unit 4 (Agar) 5-km Study Area	58
Figure 4.4	Land Use Map – Unit 5 (Susner) 5-km Study Area	59
Figure 4.5	Land Use Map – Unit 4 (Agar) Site Boundary	60
Figure 4.6	Land Use Map – Unit 5 (Susner) Site Boundary	61
Figure 4.7	Digital Elevation Map (DEM) of the Unit 4 (Agar) Site	62
Figure 4.8	Digital Elevation Map (DEM) of the Unit 5 (Susner) Site	63
Figure 4.9	Slope Map of the Site and Watershed	64
Figure 4.10	Geomorphology Map of Site and Watershed	66
Figure 4.11	Base Map of Watershed of the Unit 4 (Agar) and Unit 5 (Susner) Sites	69
Figure 4.12	Drainage Map of Unit 4 (Agar) Site	70
Figure 4.13	Drainage Map of Unit 5 (Susner) Site	71
Figure 4.14	Map showing water sources- Unit 4 (Agar) and Unit 5 (Susner)	73
Figure 4.15	1Baseline Water Stress Map of the Project Sites and Watershed	78
Figure 4.16	Water Depletion Map of the Project Sites and Watershed	79
Figure 4.17	Inter Annual Variability Map of Project Sites and Watershed	80
Figure 4.18	Seasonal Variability Map of Project Sites and Watershed	81
Figure 4.19	Availability Index Map of Project Sites	82
Figure 4.20	Total Annual Rainfall Map of the Project Sites	83
Figure 4.21	Hydrogeological Map of the Project Sites	84
Figure 4.22	Earthquake Hazard Map of Madhya Pradesh	91
Figure 4.23	Basic Wind Hazard Map of Madhya Pradesh	92
Figure 4.24	Beaufort Scale of Wind Speed Characterization	93
Figure 4.25	Variation of PM ₁₀ Concentration in the Study Area	98
Figure 4.26	Percentage Composition of Different Vehicle Categories	101
Figure 4.27	Habitats in Study Area	104
Figure 4.28	Representative flora	105
Figure 4.29	Habitats in study area	106
Figure 4.30	Representative floral species	108
Figure 4.31	Avifauna observed within Unit 4 (Agar) and Unit 5 (Susner) Project sites	118
Figure 4.32	Mammalian Species observed within the Study Area	123
Figure 4.33	Central Asian Flyway	125
Figure 4.34	Madhya Pradesh and Agar-Malwa District	127
Figure 4.35	Agar-Malwa District Divisions	129
Figure 4.36	Map depicting villages in the Study Area of Agar	133
Figure 4.37	Map depicting villages in the Study Area of Susner	134
Figure 4.38	Proportion of SC/ST, and General Population in the villages of Study Area vis-à-vis District	136
Figure 4.39	Comparative Overview of the Literacy Rate across Study Area, District and State	137
Figure 4.40	Proportion of Land Use in Study Area	141
Figure 4.41	Decadal comparison of Working trends in the Project villages	147
Figure 4.42	Distribution of Main Working Population in the Study Area	148
Figure 4.43	Comparison of Adult and Child Sex Ratios across Study Area, Tehsil and District	155
Figure 6.1	Impact Assessment Process	178
Figure 6.2	Impact Significance Matrix	188
Figure 7.1	RPO target and compliance status of Madhya Pradesh	268
Figure 8.1	Proposed Organisation Structure for ESMP Implementation	300

Acronyms and Abbreviations

Name	Description
AAQ	Ambient Air Monitoring
AI	Availability Index
AMSL	Above Mean Sea Level
AoI	Area of Influence
BC	Block Categorisation
BMTPC	Building Materials and Technology Promotion Council
BWD	Baseline Water Depletion
BWS	Baseline Water Stress
C&D	Construction and Demolition
CGWA	Central Ground Water Authority
CGWB	Central Ground Water Board
CH	Critical Habitat
CHC	Community Health Centre
CHWTSDF	Common Hazardous Waste Treatment, Storage and Disposal Facility
CO	Carbon Monoxide
CPCB	Central Pollution Control Board
CPR	Common Property Resources
CR	Critical
CSR	Corporate Social Responsibility
D.G.	Diesel Generator
dB(A)	Decibels
DCP	Dry Chemical Powder
DD	Data Deficient
DEM	Digital Elevation Model
DPR	Detail Project Report
E&S	Environmental and Social
EBRD	European Bank for Reconstruction and Development
EHS	Environment, Health and Safety

Name	Description
EN	Endangered
EPC	Engineering, Procurement and Construction
ERM	Environmental Resource Management India Pvt. Ltd.
ESIA	Environmental and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environmental and Social Management Plan
ESS	Environment and Social Safeguards
FLA	Flood Likelihood Assessment
FPIC	Free Prior Informed Consent
GAP	Gender Action Plan
GoI	Government of India
GoMP	Government of Madhya Pradesh
GRC	Grievance Redressal Cell
GRM	Grievance Redressal Mechanism
GSS	Grid Sub Station
GW	Ground Water
Ha	Hectare
Ham	Hectare metre
HSE	Health, Safety and Environment
HW	Hazardous Waste
IA	Impact Assessment
IAV	Inter Annual Variability
IBAs	Important Bird and Biodiversity Areas
IFC	International Financial Corporation
IMD	India Meteorological Department
IP	Indigenous People
IPP	Indigenous People Plan
ISTS	Inter State Transmission System
IUCN	International Union for the Conservation of Nature

Name	Description
IWT	India Water Tool
JV	Joint Venture
KL	Kilo Litre
KLD	Kilo Litre per Day
Km	Kilo metre
Kmph	Kilometre per hour
KV	Kilo Volt
kVA	Kilo- Volt Ampere
LRP	Livelihood Restoration Plan
LUPA	Land Use Permission Agreement
MDR	Major District Road
MNRE	Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment, Forest and Climate Change
MoP	Ministry of Power
MP	Madhya Pradesh
MPPCB	Madhya Pradesh Pollution Control Board
MPPTCL	Madhya Pradesh Power Transmission Company Limited
MPUVNL	Madhya Pradesh Urja Vikas Nigam Limited
MSK	Medvedev-Sponheuer-Karnik Scale
MW	Mega Watt
NAAQS	National Ambient Air Quality Standards
NFPA	National Fire Protection Association
NGO	Non-Government Organization
NH	National Highway
NO _x	Oxides of Nitrogen
NQ	Noise Quality
NRSC	National Remote Sensing Centre
NT	Near Threatened
O&M	Operation and Maintenance

Name	Description
PAF	Project Affected Family
PCA	Primary Census Abstract
PCU	Passenger Car Unit
PGCIL	Power Grid Corporation of India Limited
PHC	Public Health Centres
PM ₁₀	Particulate Matter of particle size less than 10 micrometres
PM _{2.5}	Particulate Matter of particle size less than 2.5 micrometres
PMC	Project Management Consultant
PPEs	Personal Protective Equipment
PS	Performance Standard
PSS	Pooling Sub Station
PUC	Pollution Under Control
PV	Photo Voltaic
PVHI	Photo Voltaic Heat Island
R&R	Resettlement and Rehabilitation
RAP	Resettlement Action Plan
RFCTLARR Act 2013	The Right to Fair Compensation and transparency in land Acquisition, Rehabilitation and Resettlement Act, 2013
RoW	Right of Way
RPM	Respirable Particulate Matter
RPO	Renewable Purchase Obligation
RUMSL	Rewa Ultra Mega Solar Limited
SAR	Sodium Adsorption Ratio
SC	Scheduled Caste
SCADA	Supervisory Control And Data Acquisition
SECI	Solar Energy Corporation of India Limited
SH	State Highway
SO ₂	Sulphur Dioxide
SPD	Solar Project Developer

Name	Description
SPO	Solar Purchase Obligation
SPPD	Solar Power Park Developer
SQ	Soil Quality
ST	Scheduled Tribe
SV	Seasonal Variability
SW	Surface Water
TAR	Total Annual Rainfall
TL	Transmission Line
VD	Village Directory
VU	Vulnerable
WB	World Bank
WHO	World Health Organization
WII	Wildlife Institute of India
WRI	World Resources Institute

EXECUTIVE SUMMARY

Introduction

ERM India Pvt. Ltd. (ERM) has been engaged by Rewa Ultra Mega Solar Limited (RUMSL) to undertake an Environmental and Social Impact Assessment (ESIA) of three Solar Parks, including internal evacuation infrastructure and associated transmission lines (TLs) of aggregate capacity of 1500 MW in the Neemuch, Agar and Shajapur Districts of Madhya Pradesh, India.

The ESIA for the aggregate 1500 MW Solar Parks has been divided into four distinct studies:

- ESIA for Neemuch Solar Park of 500 MW capacity;
- ESIA for Agar Solar Park of 550 MW capacity;
- ESIA for Shajapur Solar Park of 450 MW capacity; and
- ESIA for the external Transmission Line¹ infrastructure for all three Solar Parks.

This report is the Environmental and Social Impact Assessment study for the Agar Solar Park of 550 MW capacity (*hereinafter referred to as the 'Project'*), located in Agar and Susner Tehsil, District Agar-Malwa in State of Madhya Pradesh.

The Resettlement Action Plan (RAP) and Indigenous People Plan (IPP) will be prepared as separate deliverables. RAP and IPP shall be referred for most updated information on the social baseline and impacts.

Project Description

A brief description of Project is given in table below:

Table 0.1 Brief Description of Project

S. No.	Particulars	Description
1.	Project Village location	<i>Unit 4 (Agar):</i> Pipalia Kumar, Madhopur, Ladwan, Kasai Dehariya, Karwa Khedi, Dudh pura and Bijnakhedi; <i>Unit 5 (Susner):</i> Palda, Naharkheda, Umariya and Pipalia Nankar
2.	Tehsil	Agar Tehsil and Susner Tehsil
3.	District Name/State	Agar, Madhya Pradesh
4.	Location Coordinates	■ Agar: 23°44'38.58"N and 76° 7'1.26"E ■ Susner: 23°55'28.07"N and 76° 2'21.30"E
5.	Capacity	■ Unit 4 (Agar): 200 MW ■ Unit 5 (Susner): 350 MW
6.	Pooling Stations and Power Evacuation	The evacuation from the proposed Solar Park at Agar shall be carried out through the development of 33/220 kV substation at each unit established in connection with the proposed 220/400 kV ISTS substation of PGCIL at Agar.
7.	Climatic zone	Semiarid and Tropical wet & dry type of climate
8.	Average Elevation	480 m amsl High gradient land area (>8°): Agar: ~130 Ha Susner: ~70 Ha
9.	Site Conditions	Barren rocky surfaces, flat land, hilly at some portions

¹ The external transmission line infrastructure refers to the power evacuation from the solar park site to the grid substation.

S. No.	Particulars	Description
10.	Road Accessibility	Agar: Through existing State Highway 27 and village roads Susner: Through existing State Highway 14 and village roads
11.	Roads crossing Project site	Village roads
12.	Nearest Airport	Devi Ahilyabai Holkar Indore Airport
13.	Nearest Railway station	■ Agar: Kalkund railway station (~30 km) ■ Susner: Madhopur railway station
15.	River/ pond present in project footprint	Several water bodies are present in the study area
16.	Number of Power line (66 KV and above) present in Project footprint	None
17.	Protected areas (National Park/ Sanctuary)/ Forest land	Unit 4 (Agar): 8 Wind Turbine (rated capacity-1.5 MW) and Transmission Line with poles for existing wind turbines in the Project foot print area. Unit 5 (Susner): Stone Crusher
18.	Land Area Allotted	1108.63 ha.
19.	Water Requirement	■ Construction Phase: 200- 300 KLD Operation Phase: ■ 340 KLD for solar panel cleaning; ■ 12 KLD domestic water; ■ 7 KLD for green belt maintenance; ■ 35 KL for firefighting and miscellaneous
20.	Source of Water	■ Construction Phase: Tankers ■ Operation Phase: Borewells
21.	DG sets	For backup power requirement during construction phase; No. and capacity yet to be determined.
22.	Soil Characteristics	Sandy Loam and Loamy Sand
23.	Seismic Zone	Zone II: Low damage risk zone
24.	Flood prone zone	Not prone to floods
25.	Wind zone	Moderate Damage Risk Zone $V_t = 44$ m/s

Source: Site visit, RUMSL, DPR August 2020

Land Requirement and Status

The following table provides a summary of the land requirement for the project.

Table 0.2 Agar: Village Wise Land Allotment details

Unit	Villages	Government Land (NRED Allotted and Newly Identified)	Private Land	Total land	Unusable land	Total usable land
A	B	C	D	E (C+D)	F	G (E-F)
Unit 4 (Agar)	Pipalia Kumar	34.80	5.06	39.86	11.08	28.78
	Madhopur	15.77	0.00	15.77	7.66	8.10
	Ladwan	168.32	2.80	171.12	57.94	113.18
	Kasai Dehariya	28.30	0.00	28.30	1.23	27.07
	Karwa Khedi	155.09	0.00	155.09	70.43	84.66
	Dudhpura	98.38	43.59	141.97	33.76	108.21
	Bijnakhedi	55.98	0.00	55.98	20.59	35.39
Sub-total		556.64	51.45	608.09	202.69	405.40

Unit	Villages	Government Land (NRED Allotted and Newly Identified)	Private Land	Total land	Unusable land	Total usable land
Unit 5 (Susner)	Palda	119.69	6.48	126.17	9.94	116.23
	Naharkheda	86.89	62.71	149.60	9.53	140.07
	Umariya	328.80	13.06	341.87	47.74	294.12
	Pipaliya Nankar	181.36	0.00	181.36	28.55	152.81
Sub-total		716.7384	82.225	798.9934	95.76	703.23
Grand total	11	1273.38	133.70	1407.08	298.45	1108.63

Source: Land Data provided by RUMSL, 19 June 2020

As shown in the Table above, total area for Unit 4 (Agar) is 608.08 hectares comprising of land from seven villages namely Pipalya Kumhar, Madhopur, Ladwan, Kasai Dehriya, Karwakhedi, Dudhpura, Bijanakhedi, which fall under Agar tehsil of Agar-Malwa District. Total area for Unit 5 (Susner) is 798.99 hectares comprising of land from four villages namely Palda, Naharkheda, Umariya and Pipaliya Nankar, which fall under Susner Tehsil of Agar-Malwa District.

Land for the Project comprises government and private land parcels, with nearly 90% of government land and 10% of private land.

Land Procurement

A Land Use Permission Agreement (LUPA) will be signed between New and Renewable Energy Department, Government of MP and RUMSL for the life of the project. Subsequently, M/S RUMSL will have a back-to-back Land Use Permission Agreement with the Solar Project developers, which would enable them to use the land for development of the solar project as per the agreed terms of the LUPA.

The private land for the project shall be purchased as per prevailing laws and policies in the State of Madhya Pradesh (through MP Mutual Consent Land Purchase Policy' dated 14th November, 2014). Under the policy, the District Collector (DC), may purchase private and patta land based on the requirement, due to non-availability of government land and or shortfall in meeting the project land requirement through government land.

Applicable Reference Framework

- Applicable Indian (national, state and local) Environmental and Social Regulations;
- Applicable Permits (licences, approvals and consents) and permitting agencies;
- IFCs Performance Standards on Environmental and Social Sustainability (2012) (IFC, 2012);
- World Bank Environmental and Social Safeguard Policies;
- IFC/ WB General EHS Guidelines (2007) (IFC, 2007);
- IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007; and
- MNRE Environmental and Social Management Framework for Solar PV Park, February, 2017.
- Applicable National Environmental Standards for Ambient Air, Noise, Water etc.

Current Baseline Status

The following table provides a summary of the baseline in the study area

Table 0.3 Summary of Current Baseline Status

S. N	Category	Description of Baseline
1.	Location Characteristics	■ Agar: 23°44'38.58"N and 76° 7'1.26"E ■ Susner: 23°55'28.07"N and 76° 2'21.30"E Unit 4 of Agar Solar Park is located at a distance of approximately 12.7 km from the Agar town. The State Highway 27 passes at a distance of approximately 12.7 km from the Unit 4. Unit 5 of Agar Solar Park is around 8.3 km away from Susner town. This Park can be accessed through State Highway 14 from the Susner town. In addition to this State Highway, the Solar Park can be accessed through Palda- Pipalaya Nankar village road, which bisects the proposed land.
2.	Study Area	The area of up to 5 km radius from the Project boundary (Solar Park area) has been demarcated as study area for the Project.
3.	Land Use and Land Cover	■ The current land use of the proposed project site is scrub land ■ Some area is under water features like natural drains, ponds
4.	Topography	■ The Project site area is fairly flat land; ■ The high gradient area, i.e. area > 8o is present.
5.	Drainage	■ Project site have water bodies and 3rd or 4th order dendritic drainage channels within the site area.
6.	Soil Characteristics	■ Soil in the area is black cotton soil; ■ No major anthropogenic activities are carried out in the area which may lead to soil contamination.
7.	Water Resources	■ Unit 5 (Susner) is categorized as 'overexploited' (Susner Block) as per CGWB; ■ Water bodies present in the study are mostly rainfed and are used for domestic purposes as washing of clothes and for domestic animals.
8.	Ambient Air Quality	As per baseline monitoring conducted for the Project, ambient air quality parameters (PM10, PM2.5, SO2, NOX) were within the prescribed NAAQS limits.
9.	Ambient Noise Quality	■ As per baseline monitoring conducted for the Project, the noise levels during night time were observed exceeding the CPCB prescribed limits.
10.	Biological Environment	■ Habitats in the study area include agricultural land, open scrub, water bodies and open forest areas; ■ No forest area within Project footprint; ■ A total of four (04) species belonging to 2 Amphibian families were observed from the study area. None of the species have any conservational significance; ■ One (01) reptile species Flapshell Turtle (<i>Lissemys punctata</i>) is listed as Schedule I species of Indian Wildlife Protection Act (1972); ■ The Egyptian Vulture (<i>Neophron percnopterus</i>) listed as Endangered as per IUCN ver.2020.1 was observed in the area. 5 species River Tern (<i>Sterna aurantia</i>), Oriental Darter (<i>Anhinga melanogaster</i>), Painted Stork (<i>Mycteria leucocephala</i>), Black headed Ibis (<i>Threskiornis melanocephalus</i>), Great Thicknee (<i>Esacus recurvirostris</i>) as Near Threatened as per IUCN ver.2020.1 were observed in the area; ■ Species such as Oriental Honey Buzzard (<i>Pernis ptilorhynchus</i>), Brahminy Kite (<i>Haliastur indus</i>), Shikra (<i>Accipiter badius</i>), White Eyed Buzzard (<i>Butastur teesa</i>), Indian peafowl (<i>Pavo cristatus</i>), Indian Grey Hornbill, (<i>Ocyrceros birostris</i>) were listed as Sch. I as per Wildlife Protection Act, 1972 and are of conservational significance as per national regulations;

S. N	Category	Description of Baseline
		One (01) mammal species Chinkara (<i>Gazella bennettii</i>) is categorized as Near Threatened as per IUCN (v 2020 1) and also listed as Sch. I species as per Indian Wildlife Protection Act, 1972.
11.	Demographic Profile	- The project footprint falls in 11 Project villages. The Project villages comprise of 2051 households with a population of 9,236 individuals (as per 2011 Census data while the current figure is expected to have increased significantly); - The average size of the households is 5 in the Study Area
12.	Social Stratification	The entire population in the Study Area falls in the rural category. The villages comprise of majorly Scheduled Castes (SC), Gurjars, Bhil (ST), and OBC communities. Ladwan village in Agar tehsil is the only village with the presence of ST households
13.	Gender Profile	- Palada village (Susner) is the only village reporting a positive sex ratio of 1051 amongst the Project villages. Overall, the Study Area has a sex ratio of 937 females per 1000 males, which is at a similar level to the district figure and the state figure (931). - Women are involved agriculture, livestock management, and household activities.
14.	Education and Literacy	The total literacy rate (44.7) and female literacy rate (32.7) in the Project Villages is the lowest as compared to the Study Area, and district figures. The district figures are 51.1 (total literacy) and 39 (female literacy).
15.	Land Ownership	Census 2011 figures for land area indicate that approximately 39 percent is net sown area, while 23 percent is categorized barren and uncultivable land. Only a nominal 6 percent of the area is categorized as forest land, while 14 percent of the area is for non-agricultural use, and 4 percent is cultivable waste land.
16.	Livelihood Profile	The Study Area is categorized by about 50 percent working population, where majority of the working population comes under “Main Workers”, i.e. being employed for more than 6 months in a year. The Project Villages have 68.1% Main workers of the total working population.
17.	Water Supply and Sanitation	As per the Census data of 2011, all the Project Villages except Kesai Dehariya and Ladwan source drinking water from hand pump. Most of the villages' source drinking water from common hand pumps which are present on an average of 2 – 3 per village. In some cases such as Madhopur, there is only one hand pump for the entire village.
18.	Health facilities and Health Seeking Behaviour	The health facilities in the Study Area follow a three-tier health infrastructure system, as also applies to the state of MP. As per Census 2011 data, in the Project Villages, however, there are no Community Health Centres (CHCs) or Primary Health Centres (PHCs). There is one Primary Health Sub Centre in Naharkheda village in Susner Tehsil, and one Maternity and Child Welfare Centre in both Umariya and Naharkheda village each of Susner Tehsil. The nearest government hospital is available in Susner town and Agar town

Stakeholder Consultations and Disclosure

During the ESIA process, a stakeholder identification and prioritization was conducted for identifying the key stakeholders of the project, while keeping in mind the nature of the project and its setting. Furthermore, consultations were conducted with these identified stakeholders through a participatory approach.

The table below gives the list of primary and secondary stakeholders, depending on the extent of impact (direct/ indirect) on the stakeholder by the project. Those person(s) or groups who will be directly impacted by the project are Primary Stakeholders and those who have an indirect influence or the Project impacts indirectly are the Secondary Stakeholders.

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Individual and Community	■ Private Land Owners from the Project Area villages ■ Encroachers on government land ■ Squatters for agriculture on government land ■ Farm and non-farm labourers ■ Grazers ■ Banjara households sustaining direct impacts(IP) ■ Women groups ■ Livestock holding households who use the government land for open grazing for their livestock ■ EPC Contractors ■ Potential unskilled labourers to be engaged during the construction phase of the Project	■ Fence Line Community ■ Vulnerable Social Groups ■ Other Indigenous people
Institutional Stakeholders	■ Gram Panchayats of the Project Villages ■ Agar and Susner Tehsildars; ■ Patwaris	■ Local Political Groups ■ Civil Society/Local Non-governmental organizations (NGOs) ■ Local Media
Government Bodies/Regulatory Authorities	■ Regulatory Authorities comprising the following: - MP Pollution Control Board; - Central Pollution Control Board (CPCB) - Ministry of Environment Forest and Climate Change (MoEFCC) - Local Fire Authority; - Ministry of Road Transport and Highways - State Transport Authority; - District Collector and Revenue Department; - Central Electrical Authority through C.E(P&D) Jabalpur; - Department of Telegraph – Communication, Govt. of Madhya Pradesh; - Department of Panchayati Raj, Madhya Pradesh; - Labour Department; - Wildlife Warden, State Forest Department;	■ Dairy Cooperatives ■ Agriculture and Livestock Department at Agar ■ Industrial Training Institute (ITI), Agar ■ Department of Animal Husbandry, Dairy Development, Agar

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	- District and State Forest Department, MoEFCC. ■ District Administration	

Potential Environmental and Social Impacts

Assessment of potential impacts on the various environmental, ecological and social elements due to the Project activities were carried out for this ESIA study. The likely impacts on loss of land, land-based and non-land based livelihoods, vulnerable groups (women, youth etc.), labour, water environment, air environment, biological environment and socio-economic environment has been identified based on the actual and foreseeable events/Project activities. For the impact assessment, wherever necessary, professional judgement, experience and knowledge on similar projects have been used. The extent and potential consequences of the impacts have been compared against applicable standards and guidelines. Mitigation measures have been suggested for each of the identified potential impacts.

The following table provides a summary of potential environmental and social impacts due to the project. The mitigation measures are also recommended to mitigate the adverse impacts.

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase				
Impact due to Private Land Purchase	■ Economic displacement will occur for the private land sellers whose land parcels will be purchased for project related activities affecting livelihoods and incomes. ■ Landlessness may potentially result due to purchase of private land parcels in some cases. ■ Loss of access or easement for the local community due to diversions/ barricading of areas due to construction phase activities	The private land sellers will be paid at twice the value of land and assets, as per MP Mutual Consent Policy, 2014; After assessing the applicability and need during the RAP Survey, a Resettlement Action Plan-Livelihoods Restoration Plan is required to be formulated to address: - Livelihood impacts Additional assistance to vulnerable and other households, as applicable (details in RAP), Provision of Grievance Redressal Mechanism ■ Compensation for assets built as part of investments on land development that includes bore well, standing crops, fruit/timber trees, etc. ■ Provision for alternate grazing land for livestock near the project village ■ Provision of easements shall be maintained in order to not sever the access to CPRs for the community ■ Employment to members of such encroacher and squatter households, based on qualification; ■ Skill development of members of such encroacher and squatter households, based on any existing skill set (if any), and self-declared interests. ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders	Moderate	Minor
Impacts due to long lease of Government land	■ This land has different uses by the local community: - Livestock grazing in the open as well as within encroached and bounded 'fodder lots' created by encroachers(see below); - Easements, access to assets and other resources not within the project boundary, etc. and the change in use and ownership of Government land will affect the users in the community to varying degrees. ■ Additionally, a portion of this Government land has been informally (and illegally) encroached by local land owners for cultivation of crops, livestock grazing, etc.		Major	Moderate
Construction Phase				
Land use and Land cover	■ The establishment of the Solar Park will convert scrub land and agricultural land to industrial use for the long term (at least 25 years). The total land area	■ Construction activities should be restricted to designated area;	Moderate	Moderate

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post- mitigation)
Soil erosion and compaction	- of more than 1,000 ha will undergo land use change, out of which almost 90% is government land. - In the construction phase, temporary land use changes will occur at contractor facilities and labour camps, material storage areas; - During construction phase, there will be permanent change of the land use within the land parcels where the Solar Park and pooling substation will be established.	- On completion of construction activities, land used for temporary facilities such as Contractor office, batching plant (if any), stockyard, labour camp should be restored to the extent possible; - The land use around permanent Project facilities should not be disturbed; and - The land should be restored back to the original state to the extent possible after completion of life cycle of the Project and in case there are plans not to continue further at the site		
	- The site clearance activities, excavation and levelling of ground will cause disturbance of the soil strata and impact on soil quality. - The project will undertake the soil compaction activity to ensure soil stability during the establishment of storage areas, labour camp, access road, installation of batching plant, establishment of substation, SCADA building etc. - During construction activities, there would be compaction of soil in the Project area during movement of vehicles/ construction machinery and work force movement. - In addition, laying of electrical wires in the agricultural field during erection of internal electrical lines will also lead to the compaction of agricultural soil to certain extent.	- The topsoil present in the construction shall be removed and stock piled in separate area; - The stock pile should be protected from natural elements to prevent from erosion and also degradation; - Topsoil to be reused on site for landscaping purpose; - Defined routes for transportation and construction vehicles, workers etc. to minimize soil compaction; - Good drainage as per the natural slope condition should be provided to reduce surface runoff and associated erosion; - Back filling and revegetation of the area disturbed will be undertaken phase wise immediately after the completion; and - Site clearance, piling, excavation and access road construction will not be carried out during the monsoon season to minimize erosion and run-off.	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post- mitigation)
Waste generation and soil contamination	- General construction waste generated onsite will comprise of concrete, steel cuttings/fillings, packaging materials or plastic. - Municipal solid wastes consisting of food waste, plastic, glass and waste paper will also be generated by the construction workforce at canteen facility/labour camp. - A small proportion of the waste generated during construction phase will be hazardous and will include waste fuel, grease, broken modules, paints, chemicals and waste oil containing rags.	- Construction and Demolition Waste should be stored separately and disposed through approved facility/landfill; - All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels; - A log book should be maintained for quantity and type of hazardous waste generated; - Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured; - EPC Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site; - Hazardous waste to be disposed through MPPCB authorised vendors; - In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste; - The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages; - Damaged/ discarded solar panels to be disposed with the help of authorised recycling vendors/ module installation contractors/ supplier; and	Minor	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		Other wastes such as e-waste, used discarded batteries shall be disposed off in accordance to E-waste rules and batteries management and handling rules		
Topography and Drainage	- Impact on topography of the Project site due to site levelling activities. - Any changes to topography in the area will adversely impact the drainage channels and might result in water logging in adjoining areas of the Project site.	- Project shall ensure to avoid any unnecessary changes in the topography especially during the preconstruction and construction phase; - Micro drainage channel should be particularly avoided when constructing access roads or planning the Transmission Line pathway in order to ensure no change to the topography of the area. - Storm water drains must be designed in line with the natural topography and eventually drain into the natural seasonal streams in the Site area	Moderate	Moderate
Water resources	Stress on local water resources due to water requirement for the foundation activities, establishment of substation, labour camp during construction phase	- No ground water abstraction for construction activities. - As part of project designing, SPD shall consider the rainwater harvesting ponds in the open area depending on the topography, slope, natural drainage etc. Accordingly infrastructure such as drains/ piping system/ size of pond etc. shall be designed. - Similarly, in case water is sourced from surface water bodies, infrastructure requirements shall be identified and planned in project design. - Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water;	Moderate	Moderate to Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Water quality	The quality of water in the water bodies could be affected due to surface runoff from contaminated soil (soil contamination due to oil/ fuel spillage and leakages) especially during monsoon season. The surface runoff carrying the loose top soil will lead to increased sedimentation in the receiving water bodies.	Regular inspection for identification of water leakages and preventing wastage of is necessary for efficient utilisation of water		
		Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;	Moderate	Minor
		Open defecation and random disposal of sewage will be strictly restricted;		
		Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;		
		Provision of number of toilets across with easily accessible location as the project site is spread across large area of 2 Units separated geographically;		
		Use of licensed contractors for management and disposal of waste and sludge;		
		Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets;		
Ambient air quality	Fugitive dust emissions from site clearance, piling work, handling of construction materials, emission	Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and	Minor	Minor to Negligible
		Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.		
		- The construction site shall be barricaded; - Keeping areas of open excavation to a minimum;		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	due to movement of vehicles on unpaved roads, plying of vehicles, etc. ■ Vehicular emissions due to increased traffic movement on site and on the approach roads; ■ Exhaust emissions from construction machinery and other equipment such as batching plant, if any; and ■ Emissions from diesel generators required to be run for construction power purposes	■ Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction activities; ■ Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures; ■ Speed of vehicles on site to be limited to 10-15 km/hr; ■ The emissions from diesel generator shall be by optimised operations, orientation at the site and providing adequate stack height for wider dispersion of gaseous emissions ■ Switch off machinery and equipment when not in use; ■ Prevent idling of vehicles and equipment; and Vehicle engines will be properly maintained and will have a valid Pollution under Control (PUC) to ensure minimization in vehicular emissions		
Ambient noise quality	■ Noise generation due to construction activities, operation of equipment's, machineries, D.G. sets, movement of vehicles and heavy earth moving machineries. ; ■ Local communities may get disturb due to higher than anticipated noise.	■ Ensure safe distance of project related activities from schools, hospitals, etc.; ■ Only well-maintained equipment to be operated on-site; ■ If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components to be carried out to bring down the noise. It is to be ensured that such machinery are kept far away from the households;	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Machinery and construction equipment that may be in intermittent use to be shut down or throttled down during non-work periods; ■ Low noise equipment shall be used as far as practicable; ■ The number of equipment operating simultaneously shall be reduced as far as practicable; ■ Install enclosures around construction area, in order to reduce the extent of noise emanating due to project related activities; ■ DG set with acoustic enclosures shall be used; ■ Vehicular movement through village roads should be planned to avoid traffic jam and inconvenience to local residents; ■ Equipment noise should be 85 dB (A) at 1 m from the source in line with WB/IFC EHS guidelines; ■ Minimal use of vehicle horns needs to be encouraged; ■ Limit construction related activities to day time in order to restrict the noise related nuisance in the evenings, where permissible noise threshold is lesser; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievances pertinent to noise and dust related issues		
Occupational health and safety	■ Construction of support structure for PV module would require operation of pile drivers.	■ Health & safety training to be provided during both construction and operation phase;	Minor	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	■ The installation of solar module will involve operation of cranes and other mechanical lifting equipment. ■ Laying of interconnecting cable with require digging. ■ The commissioning of the inverter rooms and Transmission Line will also involve live power lines. ■ Working on live wires carrying power has dangers of electric shock and electrocution. ■ Construction and commissioning of PSS and associated structures will involve multiple hazards i.e., working at height, use of cranes and mechanical lifting equipment, working with high voltage power; ■ Besides this, there could be slip and trip hazards especially during monsoon season; and ■ The area experiences extreme winter and summer condition. Working during very high and low temperature could cause health hazards. ■ The Project site also needs to implement proper measures for fire safety, structural safety and any for emergency situations. ■ There are Suzlon Wind Turbines passing through the Project site. Any construction activities nears these turbines will have safety risks.	■ Prior to start of work, workers should be informed about the related safety risks and precautions to be taken through tool box meetings; ■ Manual lifting by adult men to be less than 55 kg and for women it should be less than 30 kg; ■ Adequate PPEs to be provided for all activities at site including for welding, cutting or similar operations which may cause hazard to eyes; ■ All persons performing construction work to wear safety shoes and helmets confirming to national standard; ■ Every worker engaged in handling sharp objects which may cause injury to hand shall be provided suitable hand gloves; ■ While working in hot conditions, measures such as work break at regular intervals, keeping hydrated by drinking water and liquids, covering face with damp cloth etc. shall be used; ■ Obtain and check Contractor's safety method statements; ■ Monitor health and safety performance and have an operating audit system; ■ Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only; ■ Appropriate safety harnesses and lowering/raising tools should be used for working at heights;		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ All equipment should be turned off and checked when not in use; ■ Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; ■ The local/ host community to be kept at safe distance from construction site; ■ Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations; ■ Site specific/ activity specific Hazards Identification and Risk Assessment (HIRA) should be developed prior to start of the activities at site; and ■ Provide H&S achievement information to employees		
Vegetation Clearance and Construction Activities	■ Egyptian Vultures use the project site area to feed over the dumped livestock carcasses from the nearby villages. Removal of vegetation from the project site and surrounding areas may result in loss of perching areas and foraging areas with solar park present at the project site	■ Vegetation clearance should be kept restricted to project site only and should be avoided wherever possible. ■ It is recommended that the selected EPC contractor should display and educate labourers not to collect fuel wood from adjacent areas and alternate arrangement for fuel, like LPG must be made available in the labour camps for cooking. ■ Provision for identifying grazing areas for the livestock village wise and development of grass plots in 5 acre area with local grass species; ■ Sufficient arrangement for identifying water holes based on the terrain gradient to tap the surface water runoff during rains	Moderate	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		- Strengthening of existing waterbodies in the study area and development of water channels to connect the surface runoff to them. - Carcass dumping at the project site should be avoided and specific space should be earmarked for carcass dumping in nearby areas away from the transmission line infrastructure of the project.		
Impacts due to Influx of Labour and Labour camp	- Risk of hunting and trapping of local wildlife by labours for meat as well as for easy source of money by selling products like skin. - Apart from impacts like direct hunting or trapping, careless disposal of kitchen waste like discarded vegetable materials and excess food, may attract scavengers like golden jackal etc. - Human-wildlife conflict. - Collection of fuel wood for cooking from outside project area, may result in additional habitat degradation	- The likelihood of threatened and protected fauna venturing into the Project site is small but proper precautions should be taken to prevent any human-wildlife conflict. - It is recommended that the selected EPC contractor should display and educate labourers and staff about the hunting, poaching, trapping, injuring or killing of wildlife in the region. - Any such activity of hunting and poaching should be covered under contractual obligations of the EPC contractor; - The EPC contractor should in consultation with Forest Department should explore the options to minimize wildlife human interactions in the study area.	Minor	Not Significant
Impact on Community Health and Safety	- The movement of material and machinery would pose health and safety risks to the community and livestock - Labour influx in the area due to construction phase may lead to community health and safety related impacts such as- - Potential spread of communicable diseases (infectious and vector-borne), if external labour will be sourced from outside the region,	- As part of the stakeholder engagement and information disclosure process, - The community will be provided with an understanding of the activities to be undertaken and the precautions taken for safety; - The project will also propagate health and safety awareness amongst the community; - The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety; - The contractor shall be required to adhere to IFC's accommodation guidelines	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	- The issue of COVID-19 related infections may remain a relevant concern and may need to be especially managed both, within labour camps and in the interactions of workers and the local community	■ RUMSL shall put in place a grievance redressal mechanism to allow for the workers and community members to report any concern or grievance related to project activities		
Stress on community resources	■ Depletion of water resources in the area may take place due to use for project related activities like construction ■ Wear and tear of roads may take place due to movement of heavy machinery on the roads ■ Potential loss of forest resources due to exploitation triggered by influx of labour in the area	■ Provision of easements shall be maintained in order to not sever the access to CPRs for the community ■ There will be a worker Code of Conduct defined by RUMSL ■ The contractor shall be asked to use Tanker water supply during the summer months ■ Periodic maintenance activities for roads used for transportation of goods for the project	Moderate	Minor
Impact on Employment and Entrepreneurship opportunities	■ The construction phase will provide a boost to the local employment as a higher number is expected to be engaged as construction labour during construction phase ■ Development of smaller vendors in the area through petty shops, petty contractors, etc. providing essential goods and services during the construction phase	■ The sourcing of local labour wherever possible should be made obligatory for the Solar Project Developers and sub-contractors and in all major procurement activities ■ Employment of members of SC-STs and Women Headed households should be encouraged by the Solar Project Developers	Moderate (positive)	
Impact on women	■ Impacts on women groups can be linked to: ■ Safety and security from the migrant labourers, ■ Loss of livelihood and income from agricultural labour work, ■ Lower standard of living due to lack of decision making regarding financial matters in the household, ■ Loss of access to grazing land for collection of firewood and fodder	■ Ensure that the employment of women from vulnerable households is ensured in the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken; ■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	Increased significance of impacts due to being non-titleholders and dependent upon daily wage labour for income earning etc.	social groups and design community development and CSR programmes in light of the same		
Operations Phase				
Soil Environment	Operation phase will generate small amount of municipal waste from site office and waste such as broken solar panels. The hazardous waste generated at substation include used/spent oil, oil soaked cotton and filter waste, waste containers/tins of paints, used lead acid batteries, nonferrous scrap, insulated aluminium and copper wires/cables, waste dry chemical residues etc. which needs proper storage and disposal. Improper management of broken panels will cause damage to the environment.	- SPD shall prepared SOP for storage and disposal of broken solar panels and tie up with an authorized dismantling agency for disposal of panels. MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; (1) - The broken solar panels shall not be mixed with normal glass. - RUMSL shall prepare a waste audit checklist as part of their routine site monitoring and auditing plan during operation phase for monitoring of waste management at site. A waste management plan is provided in Appendix E of report	Minor	Minor
Water resources and availability	The Susner Block falls under Overexploited category whereas Agar is Safe for ground water abstraction. The utilization of ground water for operation phase of the project may compromise with competitive users (drinking water requirement of villages and irrigation purposes) in the district based on ground water availability	Conserving Water Resources - Dry robotic cleaning of modules to be explored as recommended by MNRE (2); - Alternate sources of water shall be explored	Major	Moderate

(1) <http://164.100.94.214/sites/default/files/webform/notices/DraftBluePrintAntimony.pdf>

(2) MNRE had issued a letter dated 3 June 2019 to Principal Secretaries of States and Solar Association of all States regarding optimal utilization of water and preferably use Robotic technology for cleaning of modules.

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post- mitigation)
		- Ground water abstraction shall be done (if required) in accordance to CGWB guidelines. - Implement rainwater harvesting and/or groundwater recharge and replenishment opportunities within Site premises especially near the low-lying and gently sloping area. - Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.; - Maintain logbook for water consumption; - Implement groundwater and wastewater monitoring vis-à-vis quality/quantity; - Adopt less water consuming module cleaning methods; - The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow shall be treated in water treatment unit and recycled in the Project. - Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations. - The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		adopted are UN Global Compact's CEO Water Mandate or AWS Standards. - Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations. Rain Water Harvesting Rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones. Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site. Water Quality - Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body; - Open defecation and random disposal of sewage will be strictly restricted; - Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post- mitigation)
		■ Provision of number of toilets across with easily accessible location as the project site is spread across large area of both the Units; ■ Use of licensed contractors for management and disposal of waste and sludge; ■ Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets; ■ Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and ■ Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages. Other Management Aspects Preparing an inventory of water consumption during construction and O&M activities. A water management plan is provided in Appendix E of report		
Occupational Health and safety	■ Electrical and mechanical risks during O&M activities; ■ Fire hazards; ■ Contact with the transmission line can result in electrocution; ■ At substation location, risks associated with transformer blast, electrical hazards are predicted.	■ Periodic Health & safety training to be provided to team; ■ Activity specific Hazards Identification and Risk Assessment (HIRA) should be conducted and accordingly SOPs shall be prepared for all O&M activities. ■ The lock in-lock out system will be followed during maintenance/ repair activities at substation and Transmission Line; ■ Records of incident/ accidents shall be maintained; ■ Root cause analysis shall be carried out for any incident/ accident	Minor	Minor to Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ All persons performing maintenance/repairing work to wear safety shoes and helmets conforming to national standard; ■ Appropriate safety harnesses and lowering/raising tools should be used for working at heights; ■ All equipment should be turned off and checked when not in use; ■ Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; ■ The local/ host community to be kept at safe distance from construction site; ■ Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations; ■ Provide H&S achievement information to employees		
Photovoltaic Heat Island Effect	■ PV/HI effect are detectable in the day, the real significant warming occurs in the evening hours, partially because these large photovoltaic installations took longer to cool down in the night-time hours; The increase in localized temperature may cause discomfort to the habitation and wildlife in the vicinity of Solar Park	■ The existing ground vegetation in the Solar Park area shall be disturbed to minimum extent; ■ Ground vegetation shall be planted in the buffer areas/open areas available in the Solar Park; ■ The feasibility of mixed land use development in the Solar Park shall be explored		
Flood Likelihood Assessment	Likelihood of flooding event and its impact in and around the Site is evaluated as 'Low' to 'Moderate'.	■ Develop a robust "Storm Water Management Plan (SWMP)" to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff.		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		- Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour; - Storm water drains must be designed in line with the natural topography and eventually drain into the natural seasonal streams in the Site area; - Implement an effective flood monitoring and disaster management system in place for effective mitigation of floods at a Site level; - Coordinate with the district and local disaster management cells to update on flood early warning notifications.		
Collision and Electrocutation risks	Several species of birds, like Raptors (Family Accipitridae- 8 species) use transmission lines and poles as perching sites and are under threat of collision and electrocution from the transmission lines. Some birds also utilize the transmission towers for nesting; Egyptian Vulture [IUCN (v2020.1)EN] with 6 individuals was observed falling within IUCN threatened category.	- If possible transmission line should be aligned away from the waterbody. - Insulators should be suspended in order to reduce the electrocution of bird species; - Jump connectors should be insulated and of at least 60 cm in length (determined based on the average wing span of common avifauna) to reduce chances of electrocution of species flying through and wing tips coming into contact with the conductors and - Marking overhead cables using diffractors and avoiding use in areas of high bird concentrations of species vulnerable to collision including bird guards/diverters in low voltage lines/cables also. - A conservation plan for Egyptian Vulture shall be adopted as provided in Appendix E of report	Moderate	Negligible
Community health and safety	The Operations phase would have very limited activity outside the project site as the construction phase would	Community engagement and sensitization sessions should be re-organised at the beginning of Operations phase, in order to	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Impact on employment	have been over and the scale of activity and workforce at the project footprint area would have reduced significantly The Operations phase would require much smaller workforce as compared to construction phase and the skillset of the required workforce shall be different	mention about the new developments in the area and provide an understanding of the precautions to be taken for safety RUMSL shall ensure that the Solar Project Developers (SPDs) advertise the roles of Technical staff required during operations phases, in the local newspapers to enable hiring of competent people from nearby areas, to the extent feasible; Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-skilled jobs like housekeeping or Security Guards	Minor (positive)	
Impact on Indigenous Communities/Vulnerable groups	Out of the three phases, the Indigenous Communities and vulnerable groups are understood to be impacted the most during Planning phase of the project, on account of loss of livelihoods linked to land being procured for project. Since these agricultural workers are not rightful owners or users of land as per records, the project related compensation measures would not be directly reaching out to this group	To identify and assess the extent of impacts on this group, a review of the scope of RAP, FPIC and IPP, in terms of remaining impacts on IP groups, their traditional livelihoods and customary land use; including dependence on natural resources, will be undertaken	Moderate	Minor
Impact on women	Access to jobs during the construction phases generally skews in favour of males, thus preventing women from availing project benefits. Women and girls are disproportionately at risk in terms of safety (gender based violence, harassment, curtailed movement, reduced access to resources) during the construction phase, with the arrival of migrant labourers in the construction phase	As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities; Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.	Minor	Negligible

Analysis of Alternatives

An analysis of probable alternatives for the chosen technology and location of Project site along with other similar factors that contribute to the Project as a whole has been carried out. The following scenarios have been taken into consideration:

- Project vs No Project scenario;
- Alternate Source for Power Generation;
- Location for Project Site

The selected Project has following advantages:

- The Project is environment friendly with minimal greenhouse gas emissions;
- It is the most feasible choice of power generation in the State of Madhya Pradesh; and
- It will contribute towards the state of Madhya Pradesh attaining self-sufficiency in power supply
- Site with high solar irradiation;
- ~ 90% of Land area is government land;
- Most of the land parcels selected are scrubland with barren rocky surfaces with sparse vegetation;
- No physical displacement for Project;
- No ecological sensitive receptor such as National Parks, Wildlife Sanctuary, within 5 km radius;
- There are no places of Archaeologically Important Places (ASI recognized)

Environmental and Social Management Plan

The ESMP identifies potential impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, biological and social environment. This is in accordance to Environmental and Social Management Framework, February, 2017. A separate RAP-LRP document will contain the management plan for resettlement related impacts.

The ESMP describes the mitigation measures for all the identified potential impacts associated with the proposed project during its planning, construction and operation phases. The ESMP delineates the monitoring and management measures to avoid and/or minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures. The ESMP shall ensure a continuous communication process between RUMSL, EPC contractor, workers (including sub-contractors), local community and other stakeholders. RUMSL have an obligation to ensure compliance to all the commitments towards Environment, Social, Health and Safety Standards while executing all the project related activities for the proposed project.

A designated EHS Manager and a Supervisor for overseeing social and community aspects shall be appointed for the project and shall be responsible for implementation of ESMP at site, its monitoring, liaison with local community and reporting. An indicative budget for ESMP implementation and monitoring indicators are also given.

As part of ESMP, Project specific management plans have been identified and developed. Following management plans have been developed for the Project:

- Waste Management Plan;
- Water Management Plan;
- Occupational Health and Safety Plan;

- Disaster Management and Emergency Response Plan;
- Egyptian Vulture Conservation plan;
- Contractor and Labour Management Plan;
- Gender Action Plan; and
- Stakeholder Action Plan

Grievance Redressal Mechanism

Presently, RUMSL does not have a formal grievance redressal mechanism in place for external stakeholders. In order to manage these risks, it needs an internal mechanism to allow the aggrieved party/s to lodge their complaints and get them amicably settled prior to approaching the formal legal mode of solutions.

During site visit, ERM team provided project information note to representatives of Gram Panchayat of respective villages. However, a formal communication channel was yet to be established by RUMSL. It is expected that a formal GRM will be put in place for the project lifecycle.

The primary objective of the GRM shall be to provide an accessible mechanism to the stakeholders of the project and resolve any social and environmental related grievances. For this purpose, a Grievance Redressal Cell (GRC) shall be established, to resolve non-judicial disputes arising out of various matters related to the implementation of the ESMP, as well as other aspects of the project, as deemed fit to be raised before the GRC. The GRC will comprise of members from the EPC contractor team, RUMSL, community representatives, members of Gram Panchayat, women representatives.

Conclusion

The ESIA has assessed the overall acceptability of environmental and social impacts likely to arise as a result of construction and operation of Agar Solar Park.

- Project's potential environmental impacts will be mostly confined to construction phase and site-specific. These impacts include change in land use, stress on ground water resources, increase noise & vibration and air quality, etc. during the site preparation of Solar Park, pooling substations and community health and safety during material transportation.
- The proposed project will require water for cleaning of solar modules during operation phase. The Unit 5 (Susner) falls under over exploited category in terms of ground water availability. Water requirement for the project will be met mainly through ground water. Considering the stress on water resources in the area, it is recommended to evaluate alternate sources or plan for dry robotic cleaning.
- The usable land area for the project is 1108.63 hectares for Solar Park. Potential social impacts due to loss of access to land for farming, grazing, and loss of land-based livelihood sources for the households in the PFA can be mitigated through the RAP-LRP for the Project. Impact on common property resources will be limited and can be avoided by providing access to the villagers to continue their existing use of such occupied land parcels/water bodies, etc.
- The impact on community resources and community health and safety is limited to construction phase, while on the other hand, short term employment will also be generated.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to Project activities and also discuss implementation mechanism. Project specific management plans are also provided for certain Project activities such as waste management, occupational health & safety, contractor and labour management plan, gender action plan, stakeholder management plan, grievance redressal, etc. This ESIA study together with mitigation measures and follow up of recommendations on management actions will help RUMSL in complying with the environmental standards.

1. INTRODUCTION

ERM India Pvt. Ltd. (ERM) has been engaged by Rewa Ultra Mega Solar Limited (RUMSL) to undertake an Environmental and Social Impact Assessment (ESIA) of three Solar Parks, including internal evacuation infrastructure and associated transmission lines of aggregate capacity of 1,500 MW in the Neemuch, Agar and Shajapur Districts of Madhya Pradesh, India. Separate ESIA studies were conducted for three Solar Parks and Transmission Line for the complete Solar Park project.

The ESIA for the aggregate 1500 MW Solar Parks has been divided into four distinct studies:

- ESIA for Neemuch Solar Park of 500 MW capacity;
- ESIA for Agar Solar Park of 550 MW capacity;
- ESIA for Shajapur Solar Park of 450 MW capacity; and
- ESIA for the external Transmission Line¹ infrastructure for all three Solar Parks.

The present report is the ESIA study for the Agar Solar Park of 550 MW capacity that is located in two Tehsil i.e. Agar Tehsil (termed as Unit 4 of 200 MW) and Susner Tehsil (termed as Unit 5 of 350 MW). The subsequent RAP and IPP report will contain baseline information on the households from the villages falling in the project boundary, as well as the associated impacts.

The Unit 4 is spread across seven villages, viz. Pipaliya Kumhar, Madhopur, Ladwan, Kasai Dehraiya, Karwa Khedi, Dudh pura nad Bijnakhedi, Agar Tehsil and Unit 5 is spread across four villages- Palda, Naharkheda, Umariya and Pipaliya Nankar, Susner Tehsil in the State of Madhya Pradesh.

1.1 Project Background

The Government of India has identified the solar power sector as one of the critical components for infrastructure development and overall economic growth. The Government of Madhya Pradesh (GoMP), through Ministry of New and Renewable Energy (MNRE), is developing ground mounted grid connected solar power projects in Madhya Pradesh (MP).

Rewa Ultra Mega Solar Limited (RUMSL) is a Public Undertaking Company incorporated on 10th July 2015 with 50:50 joint venture (JV) between Solar Energy Corporation of India Limited (SECI) and Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL). The primary objective of RUMSL is to develop and facilitate development of large scale solar power projects in MP.

RUMSL is planning to develop following three Solar Parks and their associated internal evacuation infrastructure and transmission lines:

- Agar Solar Park of 550 MW capacity
- Shajapur Solar Park of 450 MW capacity and
- Neemuch Solar Park of 500 MW capacity

RUMSL is in the discussions with World Bank (WB) to provide financial support for the Project. International Finance Corporation (IFC) is providing investment advisory services to Government of Madhya Pradesh (GoMP) to develop the project on a Public Private Partnership mode and to support

¹ The external transmission line infrastructure refers to the power evacuation from the solar park site to the grid substation.

GoMP in meeting its energy requirements and in the process, meet GoMP's Renewable Purchase Obligation (RPO)¹ and Solar Purchase Obligation (SPO)².

Scoping Study

An Environmental and Social Scoping Study for the entire 1500 MW Project had been previously undertaken during September 2018- March 2019. The key outcomes of the scoping study that are relevant to the Agar Project site have been described below:

- The land is primarily used for agriculture in the study area of Susner and Agar sites to the extent of 48.92% and 61.67% respectively, of the geographical area. The land use of the transmission line study area is primarily scrub land and agricultural land.
- The vegetation around the Agar and Susner site was poor and consisted of stunted trees and shrubs. The Susner sub-site footprint was dominated by grasses with a few tall trees near the Panch Van area.
- The villages in the Project footprint area are segregated into settlements and hamlets, with each settlement determined by the social group that is in majority. The land holding and land use is determined by the majority social group, wherein major portion of available private land is under their ownership.
- In addition to the local community, the Rabari community for grazing and setting up temporary camps also uses the land in the core zone. The herder groups usually visit for around 3-5 days, during which they also engage in trade activities with the local community. This group travels from around 20-30 days, from Kota Rajasthan to Amravati Akola in Maharashtra. Within Madhya Pradesh they typically cross Jhalawaad and Ujjain prior to Susner.
- According to the local community, the landless households, which includes Scheduled Caste households, had received patta land from the government. However the patta land required land development, and investments on improving top soil have been undertaken over the years.
- More than 90% of the main and marginal workers are engaged in cultivation and in agricultural labour work. The landless households are employed as agricultural labourers. Some households are also reported to have at least one member of their household migrating for labour work in other states such as Gujarat and Rajasthan as well as other districts in Madhya Pradesh.
- The community was concerned that while the project would require the diversion of land from the villages, the local community is unlikely to benefit from the development of the project in terms of employment opportunities.
- Applicability of Free Prior Informed Consent (FPIC) to determine potential impact on ST communities in Ladwan village in Agar Solar Park has been identified;
- Applicability of Critical Habitat (CH) for the transmission lines from that could potentially affect vulture (*Gyps bengalensis*, *Sacrogyps calvus* and *Neophron percnopterus*) habitat³ has been identified. It is to be noted that now the Transmission Line route is changed for power evacuation from the Project site. Hence, impact of Transmission Line on Critical Habitat has been re-evaluated during ESIA study.

The defined list of impacts has been revisited during the ESIA study to confirm/validate the scoping study outcome as provided in **Section 6**.

¹ Renewable Purchase Obligations (RPOs) refers to the obligation imposed by law on some entities to either buy electricity generated by specific 'green' sources or buy, in lieu of that, renewable energy certificates from the market. The obligated entities are mostly electricity distribution companies and large consumers of powers.

² Solar Purchase Obligations (SPOs) are state-specific obligations for solar RPOs that have been created as per the National Tariff Policy.

³ Note that the Transmission Lines of the projects are being covered in a separate ESIA assessment for all Solar Parks under the aggregate 1500 MW.

1.2 Objective and Scope of Assessment

The key objective of this assignment is to conduct ESIA with a view to identify and mitigate/minimise the environmental, ecological and social concerns of the proposed Agar Solar Park and also to build in management plans as an integral part of project design.

The specific scope of work includes:

- To assess the existing environment and social status in the study area and area of influence (Aol) and to identify issues which have potential to adversely impact environmental, ecological and social features in the project influence area during various stages, such as planning, construction, operation & maintenance and decommissioning.
- Analyse various options available in the site layout and arrangements for ancillary facilities, like water supply, with special reference to sources – whether local groundwater or water from distant sources would be used; in case of the latter situation, conveyance facilities will also be analyzed for impacts, drainage, access, etc. to minimize adverse impacts and enhance positive impacts, where feasible.
- Based on final land footprint and georeferenced site boundaries of the project, the ESIA will also include a Resettlement Action Plan (RAP) and a Livelihood Restoration Plan (LRP) with an identification of the project affected households; assessment of loss of livelihood/ common property resources for affected communities and/or using the proposed site and in its immediate vicinity and also covering transmission line alignment through primary surveys covering all project affected families/ consultations.
- Conducting labour influx risk assessment with key impacts on local community associated with the temporary influx of labour during construction activities.
- Assess impacts on the indigenous/marginalized communities within the site and its influence area. Involve the services of a suitably experienced Indigenous People Expert to assist with the development of the approach and implementation of a Free, Prior, Informed Consent (FPIC) process. The overall principles, engagement process, and criteria for obtaining FPIC should be agreed on with the affected Indigenous People (IP) communities. Therefore, the focus of this task will be on seeking consent from affected IP communities for a draft package of proposed impact mitigation measures and benefits.
- To undertake consultations with potentially affected people to understand their views/concerns, taking into account perspectives from different social groups, women and men, to obtain their inputs regarding environmental and social issues, and to take these into account during the preparation of the plans that would be executed before the developers start working on the site.
- To assist the client in establishing the site boundary on-site by integrating the total station outputs (available with client department) with the baseline study output.
- To develop environmental codes of practices for common activities that need to be followed during various stages, such as planning, construction, operation & maintenance and decommissioning.
- Preparation of site-specific ESIA reports, in line with agreed Environment and Social Management Framework (ESMF) that is already in place for RUMSL.
- To prepare an Environmental and Social Management Plan (ESMP), Stakeholder Engagement Plan (SEP), in line with agreed Environment and Social Management Framework (ESMF) and Grievance Redressal Mechanism (GRM) for the mitigation/enhancement activities that will be undertaken by RUMSL. The ESMP will cover relevant activities to identify portions of the existing codes of practice/management framework that need to be integrated with the bidding documents

to ensure that the prospective bidders are aware of requirements during project implementation and operation from an environmental, health and safety, as well as social perspective.

- To identify portions of the codes of practice/management framework that need to be integrated with the bidding documents to ensure that the prospective bidders are aware of what all will be required during Project implementation and operation from an environmental, health and safety, as well as social perspective.

1.2.1 Applicable Framework

The applicable reference framework for the ESIA study are as follows:

- Relevant environmental, land labour and other relevant policies, laws, regulations and rules of the state of Madhya Pradesh (MP) and Government of India (GoI);
- World Bank Safeguard Policies;
- IFC Performance Standards, 2012;
- Environmental and Social Management Framework by Ministry of New and Renewable Energy (MNRE) Department, February 2017;
- IFC/WB General EHS Guidelines;
- IFC/WB General EHS Guidelines and sector specific guidelines for Electric Power Transmission and Distribution
- IFC/EBRD Guidance note for Worker's Accommodation, 2009; and
- IFC Project Developer's Guide to Utility-scale Solar Photovoltaic Power Plants.

1.3 Approach and Methodology

The approach and methodology utilized for the ESIA Study has been described in the relevant sections, and summarised below.

1.3.1 Kick-off Meeting

ERM undertook a kick-off meeting with RUMSL, IFC and WB on 21 October 2019, prior to site reconnaissance visit. 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.

1.3.2 Desk Based Review

ERM undertook a desk-based review of the Project to identify any environmental, social and ecological sensitivities around the Project site. The key sources of information that was reviewed as part of the study has been provided below.

Table 1.1 Key sources of information reviewed for the desk-based study

S.N.	Source
1.	Environmental and Social scoping study conducted in 2018 for proposed 1500 MW solar park project
2.	Topographic Maps published by Survey of India (SoI), the National Mapping Agency to Government of India under Department of Science & Technology (DST)
3.	Detailed Project Report (DPR) for the Project, August 2020
4.	Land details provided by RUMSL dated 19 June, 2020
5.	Project boundary map provided by RUMSL dated 19 June, 2020
6.	Land Allotment letters for government land

1.3.3 Inception Report

A site reconnaissance study for the entire 1500 MW Solar Park was undertaken from 22 October 2019 to 25 October 2019. The purpose of the site reconnaissance was to understand the Project setting, associated facilities, confirm discussion outcomes of the kick-off meeting, undertake limited documentation review and conduct onsite discussions with the RUMSL team. Post reconnaissance site visit, an Inception report for the complete 1500 MW Project was prepared and submitted to client. This inception report provided an understanding of the following:

- An understanding of the Project and Project setting and the associated facilities based on the kick-off meeting, documentation review, discussions with RUMSL and reconnaissance site visit undertaken;
- The status of ongoing activities related to the Project;
- Validation of earlier screening and scoping carried out for the ESIA of Solar Parks and Transmission Lines and identification of any changes since previous studies were conducted;
- The proposed work plan and methodology for next step in assignment including status of other inter-linked Project activities.

1.3.4 Site Visit and Baseline Data Collection

An ERM team comprising of environment, biodiversity and social experts undertook a site visit during 10- 20 December, 2019 and 22-30 January 2020 to understand the site setting, environmental and social sensitivities and to identify the relevant local stakeholders.

The activities undertaken during the site visits has been summarized below:

- Identification of key social and environmental risks/receptors in the study area;
- Understanding of prevailing community engagement processes;
- Understanding aspects of community health and safety, if any, linked to the proposed Project;
- Understanding land-based impacts, livelihood impacts, issues of vulnerable groups, cultural heritage issues;
- Understanding significance of impacts on biodiversity and natural resource management; and
- Consultations with the local communities and focused group discussions in the vicinity to understand their views and concerns of the Project.
- Environmental baseline data was collected through primary monitoring and surveys of the study area (5 km distance from Project area) during 10- 20 December 2019. Secondary information through literature surveys was also collected for the study area of the Project.

The details of environmental and social baseline conditions in the study area is provided in **Section 4** of this report. Photo-documentation of the site visit has been provided in **Appendix A**.

1.3.5 Stakeholders Consultation

The consultations with various stakeholders during site visit, has been guided by an internal stakeholder engagement strategy developed by ERM, to streamline the communication and messaging, for the ERM teams engaged for various tasks, viz, ESIA, RAP and IPP. During site visit, the team undertook consultations with various stakeholders of the Project. The summary of the stakeholder consultations undertaken for the Project has been provided in **Appendix B** and a detailed identification and categorization and analysis is provided in **Section 5**. This will be further updated in the RAP, based on surveys and in-depth consultations undertaken as a part of the RAP study.

1.3.6 Impact Assessment

Assessment of potential impacts on the various environmental, ecological and social elements due to the Project activities were carried out for this ESIA study. The likely impacts on loss of land, land-based and non-land based livelihoods, vulnerable groups (women, youth etc.), labour, water environment, air environment, biological environment and socio-economic environment has been identified based on the actual and foreseeable events/Project activities. For the impact assessment, wherever necessary, professional judgement, experience and knowledge on similar projects have been used. The extent and potential consequences of the impacts have been compared against applicable standards and guidelines. Mitigation measures have been suggested for each of the identified potential impacts. The detailed Impact Assessment is provided in **Section 6** of this report.

1.3.7 Environment and Social Management Plan

The Environmental and Social Management Plan (ESMP) has been developed to include the following:

- Introduction of purpose and objectives of the ESMP;
- Summary of significant adverse impacts and potential risks;
- Mitigations and control technologies as well as safeguards etc. to minimize adverse impacts on air, water, soil, ecological and socioeconomic environment;
- Institutional mechanism - roles and responsibilities for ESMP implementation including training of ESMP implementation team;
- Action Plans for effective control measures to minimize adverse impacts/risks; and
- Monitoring program for effective implementation of the mitigations and ascertain efficacy of the environmental management and risk control systems in place.

1.3.7.1 Management Plans

As part of ESMP, Project specific management plans have been identified and developed. Following management plans have been developed for the Project:

- Waste Management Plan;
- Water Management Plan;
- Occupational Health and Safety Plan;
- Disaster Management and Emergency Response Plan;
- Egyptian Vulture Conservation Plan;
- Contractor and Labour Management Plan;
- Gender Action Plan; and
- Stakeholder Action Plan (SEP)

The Management Plans have been provided in **Appendix E** of this report. The Resettlement Action Plan (including a Livelihood Restoration Plan) and Indigenous People Plan (IPP) will be prepared as separate deliverables.

1.4 Limitations

This ESIA report is based on scientific principles and professional judgment applied to facts with resultant subjective interpretations. Professional judgments expressed herein are based on the analysis of available data and information. The report was prepared with the following limitations:

- The ESIA report has been prepared based on the site assessment undertaken till January 2020 and information provided until 19 June 2020. All public domain information source also been accessed until 30 June 2020. If there is any change in the site conditions, documented information and/or public domain information post the above cited dates, then the same has not been captured in the report.
- Solar projects do not require an Environmental Clearance under the EIA Notification, 2006 and as amended. The ESIA has therefore been prepared based on international lender requirements defined in **Section 3**.
- The details pertaining to temporary facilities (batching plants, contractor facilities, labour accommodation and storage yards) were not determined at the time of the ESIA visit. ERM conducted a reconnaissance of environmental, social and ecological sensitivities associated with the entire land parcel being procured for the Project but has not identified any site-specific sensitivities associated with the temporary facilities in absence of their details.
- As per the ToR, this ESIA study had assessed impacts due to the Project during Construction and Operation phases only;
- At the time of writing the report, the optimized Project boundaries were received by ERM (received on 19 June 2020) based on prior identification of E&S sensitivities. However it is understood that the final Project boundary may change as a result of certain avoidance criteria used and exclusion principles applied.

1.4.1 Uses of the Report

ERM is not engaged in consulting or reporting for the purpose of advertising, sales promotion, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Client acknowledges that none of its advertising, sales promotion, or other publicity matter containing information obtained from this assessment and report will mention or imply the name of ERM. Nothing contained in this report shall be construed as a warranty or affirmation by ERM that the site and property described in the report are suitable collateral for any loan or that acquisition of such property by any lender through foreclosure proceedings or otherwise will not expose the lender to potential environmental or social liability.

1.5 Structure of the Report

The structure of this ESIA report is as given in **Table 1.2**.

Table 1.2 Structure of the report

Section	Title	Description
	<i>Executive Summary</i>	
Section 1	Introduction	<i>(this section)</i> Introduction to the Project and ESIA methodology
Section 2	Project Description	Technical description of the Project & related infrastructure and activities
Section 3	Policy, Legal and Institutional Framework	Discussion of the applicable environmental and social regulatory framework and its relevance for the Project.
Section 4	Environmental and Social Baseline	An outline of the Environmental, Social and flora & fauna baseline status in the area of the Project.
Section 5	Stakeholder Identification, Information disclosure, Consultation and Participation	Identification and engagement with the key stakeholders, in order to assess the impact of the Project on them and their influence on the Project.

Section	Title	Description
Section 6	Environmental and Social Impacts	This section includes details of identified environmental impacts and associated risks due to Project activities, assessment of significance of impacts and presents mitigation measures for minimizing and /or offsetting adverse impacts identified.
Section 7	Analysis of Alternatives	This sections provides an analysis of alternatives considered for the project w.r.t to location, technology etc.
Section 8	Environmental and Social Management Plan	Outline of the Environmental and Social Management Plan (ESMP) taking into account identified impacts and planned mitigation measures and monitoring requirements. This section also includes details of institutional arrangements for the Project, monitoring and reporting indicators for performance of ESMP and budgetary allocation.
Section 9	Grievance Redressal Mechanism	This section provides the grievance redressal mechanism proposed for the Project.
Section 10	Conclusion	This section summarize the conclusion of ESIA study
Section 11	References	-
<i>Appendices</i>		
Appendix A	Photo Documentation	
Appendix B	Details of Consultations Undertaken During Agar Solar Park ESIA Preparation	
Appendix C	Environmental Monitoring Results	
Appendix D	Flood Likelihood Assessment Report	
Appendix E	ESMP- Management Plans	

2. PROJECT DESCRIPTION

This section provides an overview of the proposed Project in terms of location, project components and associated infrastructure, resource requirements, land requirement and acquisition and activities to be performed during the construction, operation and decommissioning stages of the project.

The details of Agar Solar Park project at a glance is given in **Table 2.1**.

Table 2.1 Agar Solar Park – Project at a Glance

S. No.	Particulars	Description
1.	Project location	<i>Unit 4 (Agar):</i> Pipalia Kumar, Madhopur, Ladwan, Kasai Dehariya, Karwa Khedi, Dudh pura and Bijnakhedhi; <i>Unit 5 (Susner):</i> Palda, Naharkheda, Umariya and Pipalia Nankar
2.	Tehsil	Agar Tehsil and Susner Tehsil
3.	District / State	Agar, Madhya Pradesh
4.	Location Coordinates	■ Agar: 23°44'38.58"N and 76° 7'1.26"E ■ Susner: 23°55'28.07"N and 76° 2'21.30"E
5.	Capacity	■ Unit 4 (Agar): 200 MW ■ Unit 5 (Susner): 350 MW
6.	Power Evacuation	The evacuation from the proposed Solar Park at Agar shall be carried out through the development of 33/220 kV substation at each unit established in connection with the proposed 220/400 kV ISTS substation of PGCIL at Agar.
7.	Climatic zone	Semiarid and Tropical wet & dry type of climate
8.	Average Elevation	480 m amsl High gradient land area (>8°): Agar: ~130 Ha Susner: ~70 Ha
9.	Site Conditions	Barren rocky surfaces, flat land, hilly at some portions
10.	Road Accessibility	Agar: Through existing State Highway 27 and village roads Susner: Through existing State Highway 14 and village roads
11.	Roads crossing Project site	Village roads
12.	Nearest Airport	Devi Ahilyabai Holkar Indore Airport
13.	Nearest Railway station	■ Agar: Kalkund railway station (~30 km) ■ Susner: Madhopur railway station

S. No.	Particulars	Description
15.	River/canal/nallah/ pond present in project footprint	Several water bodies are present in the study area
16.	Protected areas (National Park/ Sanctuary)/ Forest land	None
17.	Any other feature existing in Project footprint	Unit 4 (Agar): 8 Wind Turbine (rated capacity-1.5 MW) and Transmission Line with poles for existing wind turbines in the Project foot print area. Unit 5 (Susner): Stone Crusher
18.	Usable Land	1108.63 ha.
19.	Water Requirement	- Construction Phase: 200- 300 KLD Operation Phase: 340 KLD per annum for solar panel cleaning; 12 KLD domestic water; 7 KLD for green belt maintenance; 35 KL for firefighting and miscellaneous
20.	Source of Water	- Construction Phase: Tankers - Operation Phase: Borewells
21.	DG sets	For backup power requirement during construction phase; No. and capacity yet to be determined.
22.	Soil Characteristics	Sandy Loam and Loamy Sand
23.	Seismic Zone	Zone II: Low damage risk zone
24.	Flood prone zone	Not prone to floods
25.	Wind zone	Moderate Damage Risk Zone $V_t = 44$ m/s

Source: RUMSL and site visit

2.1 Project Location

The proposed 550 MW Agar Solar Park will be developed in two Tehsils viz. Agar and Susner Tehsil of Agar District. The 550 MW solar park will be developed as two units. Unit 4 of capacity 200 MW at Agar Tehsil and Unit 5 of 350 MW at Susner Tehsil. The total land available for the development of Solar Park is 1108.63 hectare.

Unit 4 of Agar Solar Park is located at a distance of approximately 12.7 km from the Agar town. The State Highway 27 passes at a distance of approximately 12.7 km from the Unit 4. The nearest railway station is located at Kalkund railway station (Unit 4) is at an aerial distance of ~30 km and the nearest

airport is Indore airport located at an aerial distance of ~115 km from the proposed Project Site. The existing road approaching the site has a width of ~4-5 meter.

Unit 5 of Agar Solar Park is around 8.3 km away from Susner town. This Park can be accessed through State Highway 14 from the Susner town. In addition to this State Highway, the Solar Park can be accessed through Palda- Pipalaya Nankar village road, which bisects the proposed land. The existing village road has a width of ~4-5 meter and existing State Highway has a width of ~7.5 meter

The nearest railway station is located at Madhopur railway station, Madhya Pradesh which is at an aerial distance of ~5-10 km and the nearest airport is Indore airport located at a distance of ~135 km from the proposed site.

The Site location map is presented as **Figure 2.1** .

Agar Solar Park Project Footprint Map

Legend

- Settlement
- Study Area 2km
- Study Area 5km
- Project Boundary
- Waterbody

Scale: 0 2.5 5 10 Kilometers

Data Source: Survey of India, Department of Surveying, Government of India, 1964. Digitized by the National Bureau of Surveying and Mapping, Government of India, 2014. Projection: WGS 1984.

Environmental Resources Management

2.2 Site Setting

Proposed project site is primarily scrub land (used currently by local communities for grazing, and as encroached land for farming), with part of the land currently being practiced for agriculture. No patta land has been procured for the project. The proposed site also contains some structures of religious significance, structures /infrastructure for irrigation. There are natural water bodies (lakes), nallas present in/near both the Units. Unit 4 (Agar) has about 7 to 8 artificially constructed non perennial water bodies within Site boundary and three (3) large artificially created water bodies adjoining the Site boundary in the north, northcentral, and southwest of the Site. Unit 5 (Susner) has about five (5) artificially constructed non perennial water bodies located within the Site boundary and three (3) large artificially created water bodies adjoining the Site boundary in the north, southeast, and southwest of the Site. The water bodies serve as source of irrigation water, and replenishing ground water. The Project footprint is also used by nomadic herding groups (Rabari community) for grazing and making camps.

Unit 4 (Agar) of the project site, has a minimum elevation of 1417 ft, with an average elevation of 1500 ft. The site comprises of scanty vegetation. The nearest habitation is Madhopur village, towards east.

Unit 5 (Susner) of the project site has a minimum elevation of 1400 ft, with an average elevation of 1480 ft. The site is flat and irregular in shape, and comprises of little to negligible vegetation. The nearest habitation is Naharkheda village, towards the west.

There are no places of archaeological importance within the study area. There are no National Parks/ Wildlife Sanctuaries within 5 km radius.

Figure 2.2 Overview of Project Site



View of Bijnakhedhi Lake near Unit 4 (Agar)

View of Palda Lake near Unit 5 (Susner)



View of Unit 4 (Agar)

View of Unit 5 (Susner)

Source: ERM Site Visit

2.3 Overview of the Project

The proposed 550 MW project is located in Agar District in State of Madhya Pradesh, India. Due to issues in land contiguity and availability, the Solar Park is divided into 2 units- Unit 4 in Agar Tehsil and Unit 5 in Susner Tehsil. Each land parcel will be designed in consideration of MNRE guidelines. It is to be noted that, presently the Project is in planning stage and detailed design layout plan for the Project is yet to be finalized.

2.3.1 Project Components

- Solar PV Modules
 - Solar PV Modules based on Poly/Mono Crystalline and/or Thin Film (CdTe) of different rated capacities with fixed tilt and single axis tracking Module mounting structure are proposed to be installed.
- Power Conditioning Unit (PCU) or Inverter
 - TMIEC make Inverter of 2500 kW rating to be installed as proposed in DPR. This will be decided by SPD.
- Cables

- The cable rack method is envisaged to be adopted by Solar Project Developers to connect plant to 33 kV outdoor air insulated substation for the solar projects because of increased internal grid availability, low cost, lower losses and no impact of shading on generation etc.
- Main Control Room Infrastructure
 - The control rooms are envisaged at the pooling substation. This will have the facility for gathering data on monitoring, forecasting, scheduling and dispatching for the submission to the load dispatch center. The Main Control Building has been proposed to have the Switchgear Room, SCADA/ Control Room, telecommunication infrastructure, Battery/ Auxiliary Room apart from rooms for staff, supervisor and administrative purposes, one Pantry along with Toilets, Stores etc. Air conditioning shall be provided in the SCADA/ Control Room and Heat Ventilation System shall be provided in the Switchgear Room, Auxiliary Room, Battery Room and Toilets. The entire building shall be provided with fire protection and detection system.

2.3.2 Associated Components

2.3.2.1 Power Evacuation

Pooling Substations (PSS)

RUMSL plans to develop two 33/220 kV Pooling Substations (PSS), one PSS at each individual unit. The Solar Project developer will be responsible to connect plant to 33/220 kV Pooling Substation through appropriate 33 kV cable arrangement.

ISTS Substation

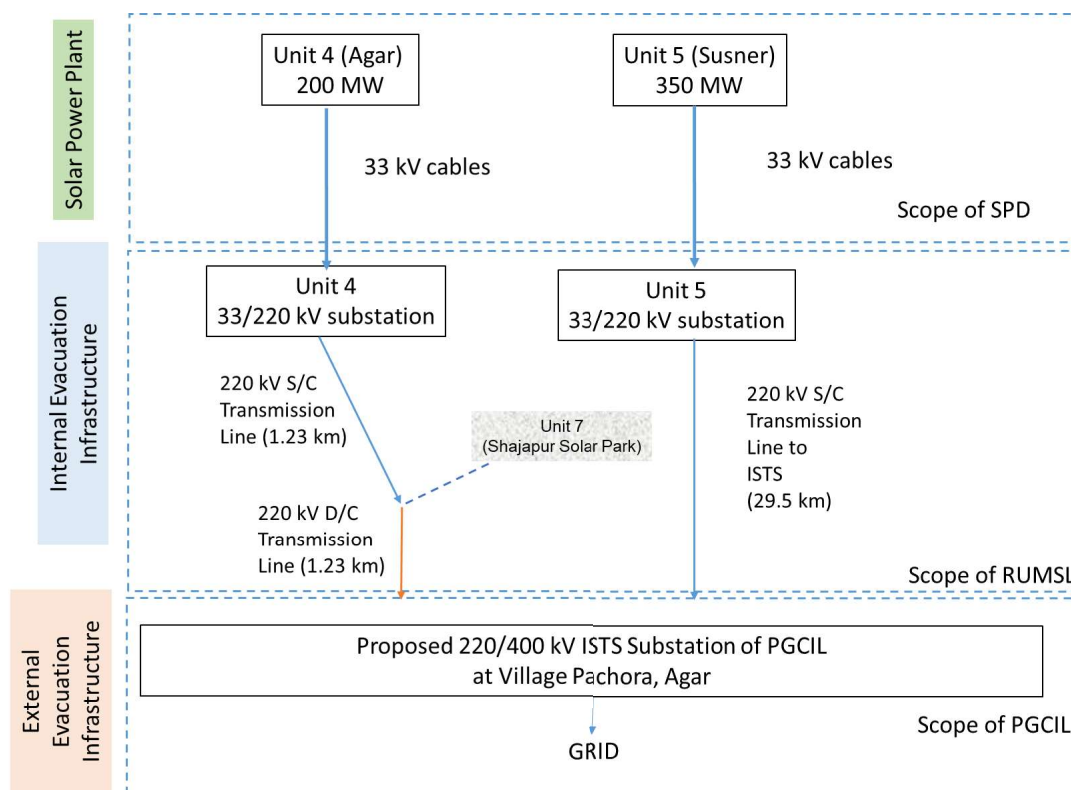
The power generated from the Solar Park will be evacuated through the proposed 220/400 kV ISTS substation of Power Grid Corporation of India Limited (PGCIL) planned in Pachora village, Agar. The connection of internal pooling substation to grid substation will be established through proposed 220 kV single circuit and double circuit transmission line.

Transmission Line

It is proposed to erect single circuit and double circuit 220 kV transmission lines to connect Solar Park to 220/400 ISTS substation of PGCIL at village Pachora, Agar. The single circuit 220 kV transmission line from Unit 4 will be of 1.23 km length, where it will be interconnected with transmission line of Unit 7 (Shajapur Solar Park). Post interconnection, a double circuit line of 1.23 km will be erected upto ISTS substation of PGCIL. Unit 5 will be connected to ISTS substation through single circuit 220 kV transmission line of 29.5 km length.

The evacuation arrangement for the project is as presented in **Figure 2.3** below.

Figure 2.3 Power Evacuation Arrangement



Source: RUMSL, August 2020

2.3.2.2 Access Roads *(Source: DPR, August 2020)*

Access roads planned as a part of this project includes:

Access to Unit 4 (Agar): The existing road connects Agar Malwa village to the Unit 4 of Agar Solar Park and is of 12.7 km length. The proposed road will connect the existing road to the utility area i.e. near Khasra 30 & 35 of Ladwan village.

Access to Unit 5 (Susner): This Unit can be accessed through State Highway 14 from the Susner town. In addition to this State Highway, the Solar Park can be accessed through Palda- Pipalaya Nankar village road, which bisects the proposed land. The existing village road has a width of ~4-5 meter and existing State highways has a width of ~7.5 meter. The approach to location of proposed internal 33/220 kV pooling substation shall be from the village road passing through the middle.

As per the final DPR, the primary and secondary road shall be of 7.5 meter width with necessary strengthening of existing roads. The road shall not have any divider in the middle and the street lighting has been envisaged on one side of the road.

2.3.2.3 Greenbelt

Greenbelt is proposed to be developed close to utility area and nearby fencing & boundaries.

2.3.2.4 Common facilities

It is proposed that key amenities and facilities such as lighting, drainage, office building of RUMSL, firefighting arrangement, telecommunication infrastructure, sewage treatment, waste collection, medical facility, weather monitoring station, water and power shall be provided in the Unit 4 and 5.

2.4 Summary of Project Activities

Key project activities during different phases of the Project have been summarised below:

2.4.1 Planning and Pre-Construction Phase

The planning phase includes the following components:

- Identification of land area and site;
- Site surveys as topographic, geo-technical investigations, solar radiation and yield study, electrical grid studies, etc.;
- Obtaining all necessary approvals/clearances; and
- Design and finalization of contractors.

Identification and land procurement is a key component of the planning and pre-construction phase. The process of land procurement can be divided into following

- (a) Land survey;
- (b) Land title verification;
- (c) Land compensation; and
- (d) Land procurement.

As mentioned earlier, the land survey and final demarcation of land footprint was under process at the time of assessment.

2.4.2 Construction Phase

Construction phase of project activities will include the following:

- Contractor mobilization;
- Site Preparation including fencing, clearing of bushes, pit filling, levelling and grading;
- Construction of site office and internal roads;
- Construction of temporary storage facilities;
- Foundation laying for ground mounted structures;
- Storage of PV modules delivery and their installation;
- Laying of internal electrical connections;
- Construction of sub-station and office buildings;
- Installation of inverter and transformers;
- Excavation foundation and setting up of external transmission line towers; and
- Stringing of transmission lines.

2.4.3 Operation and Maintenance

The list of activities to be carried out in the operation and maintenance phase would be:

- Routine cleaning of PV modules;
- Control of vegetation viz. weeds, bushes etc. within the site and those immediately surrounding it;
- Routine inspection of all PV modules and associated structures viz. cables, transformers, inverters, mounting structures etc.;

- Operation and maintenance of ancillary facilities such as power substation;
- Inspection and maintenance of transmission lines; and
- Inspection and maintenance of internal site pathways/access roads.

As reported by site contact, the project will be having a dedicated operations and maintenance (O&M) team comprising of technical staff to conduct the aforesaid maintenance activities. This will also require additional resources in the form of water (for module cleaning), consumable spares and insurance.

2.5 Resource Requirement

As mentioned above, the project site is in stage of planning, details on the resources such as raw materials, man power requirement, definite water sources, power supply and backup etc. are not yet decided. However, per the detailed project report prepared for the project the details have been provided in the sub-sections stated below.

2.5.1 Raw Materials

Construction Phase

The major raw materials for the Project includes cement, aggregates, sand, electrical installations, capacitors, stringing wires, transformers, transmission tower components such as steel tower structure, circuit plates etc. As informed by site representatives, construction materials such cement, aggregates, sand etc. will be procured from local market. The project specific components will be purchased from selected vendors via procurement tendering process.

Operation Phase

There will not be any major raw material required during operation except for maintenance purpose viz. consumable spares.

2.5.2 Water Requirement

Construction Phase

During construction phase, water will be primarily required for foundations of establishing solar panels, electrical installations at PSS at solar park and foundations for Transmission towers. Besides this, civil construction activities such as construction of control room, security guard room, utilities, labour camp etc. will also have water requirement.

As stated in the detailed project report, August 2020, water requirements for all purposes shall be met by tanker water. Based on industry practices, it is estimated that approximately 250-300 KLD of water would be required for civil works during construction stage. Water will also be required for domestic use by workers at Project site. Considering peak worker requirement of 500-600 workers, daily water requirement is estimated as 80-90 KLD (including labour camp). The water requirement will be met through tanker water. Bottled water will be used for drinking purpose.

Operation Phase

During operation phase, water requirement will be mainly for cleaning of solar panels and domestic consumption at substations. Wet cleaning of the PV modules may be done either by pressurized water supplied using a mobile tanker mounted pump or water supplied through a permanent piping network laid across the length and breadth of the plant or section of the plant.

During operation and maintenance phase of the solar power projects, apart from the module cleaning, the water will be required for the other purposes such as potable water for manpower at site, electrical operation of different pooling substations, firefighting system and marginal availability. As per DPR, total workforce during operation phase will be 250 including technical manpower of around ~165 for

the operation and maintenance of entire solar project. . Total water requirement is estimated as 393 KLD and described below

- ~340 KLD for solar panel cleaning, assuming 2.5 litres per sqm for panel cleaning and considering 12 cleaning cycles per year;
- 12 KLD domestic water, assuming 250 no. of O&M staff and 45 LPCD;
- 7 KLD for green belt maintenance (as per DPR);
- 35 KL for firefighting and miscellaneous

2.5.3 Power Requirement

Construction Phase

Construction Power shall be met through individual DG sets for each unit or through temporary supply from Distribution Company.

Operation Phase

Based on initial assumptions, power requirement during daytime would be met through auxiliary generation. During the night time power requirement would be met through grid as per applicable regulations. DG sets would also be kept at the control room for emergency power backup.

2.5.4 Fire Safety and Security

Construction Phase

Appropriate firefighting system and equipment shall be provided throughout the construction period. The fire extinguishers will 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 onsite.

Operation Phase

The Solar Park shall be equipped with suitable Fire Protection and Fighting Systems for all common infrastructure and Pooling Sub-station as per the National Fire Protection Association (NFPA) and CEA Fire Safety Standards and requirements of Government of Madhya Pradesh. Following firefighting protection system are proposed:

- Portable Fire Extinguishers of DCP, CO2, Foam type.
- Fire Buckets, painted red with additional handle at the bottom with fine sand and fixed on an angle iron frame as per requirement of Local Authorities.
- Automatic Fire Detection cum Alarm System in the Switchyard, Main Control Building and Administration Building.
- Fire Detection and Alarm System integrated with required cabling to a single Fire Alarm Control Panel with long range audible alarm facility.
- Manual Call Points and Hooters integrated with the Fire Alarm Control Panel in the respective Control Rooms.

2.5.5 Man Power Requirement

Currently, manpower requirement for construction, labour camp requirement etc., are under planning stage. It is estimated that average 500-600 workers will be deployed on site.

During the operation phase, approximately 165 technicians would be deployed at site. Apart from these, project will also deploy housekeeping and security guards. Total work force during operation phase is estimated to be ~225.

2.5.5.1 Labour Accommodation

As reported by RUMSL, during construction phase, labour accommodation will be provided by SPD within the Solar Park site area. The IFC/EBRD guidelines for Worker's Accommodation shall be followed during establishment of the labour camp for the project.

Box 2.1 IFC/EBRD Guidelines for Worker's accommodation- Summary

- Living facilities shall be located to avoid flooding and other natural hazards. Where possible, living facilities are located within a reasonable distance from the worksite;
- Transport from the living facilities to worksite is safe and free;
- The living facilities shall be built with adequate materials, kept in good repair and kept clean and free from rubbish and other refuse;
- The building site shall be adequately drained to avoid the accumulation of stagnant water;
- Heating, air-conditioning and ventilation should be appropriate for the climatic conditions;
- Access to an adequate and convenient supply of free potable water shall be always available. Drinking water shall meet national/local or WHO drinking water standards;
- Wastewater, sewage, food and any other waste materials shall be adequately discharged, in compliance with local or World Bank standards;
- Specific containers for rubbish collection shall be provided and emptied on a regular basis;
- Rooms/dormitories shall be kept in good condition, aired and cleaned at regular intervals;
- A separate bed for each worker shall be provided. The practice of "hot-bedding" should be avoided;
- Sanitary facilities shall be provided separately for men and women. Sanitary and toilet facilities shall be constructed of materials that are easily cleanable;
- An adequate number of toilets, facilities for washing and bathing shall be provided to workers;
- Canteen, cooking and laundry facilities shall be kept in a clean and sanitary condition. If workers can cook their own meals, kitchen space is provided separate from sleeping areas;
- An adequate number of staff/workers shall be trained to provide first aid;
- Security at worker's accommodation shall be ensured.

In addition, National/State/Local guidelines shall be followed amid of COVID Pandemic

Source: Workers' accommodation: processes and standards, A guidance note by IFC and the EBRD

2.6 Land Requirement and Allotment Process

This section provides a discussion on the Project land requirement and procurement process for the Agar Solar Park, along with any key issues pertaining to the land selection and procurement process. The Project's land requirements are inclusive of:

- Permanent land requirement for the solar park, *such as* for solar modules, site offices, inverter room, pooling sub-station, switchyard, internal access roads etc.
- Tower footing for the transmission lines,
- Land use restrictions within the Right of Way (RoW) of the Transmission Line,
- Temporary land requirements *such as* for labour camps, stockyards or any other not located within the identified project footprint during the construction phase.

2.6.1 Land Details

The Agar Solar Park of 550 MW is proposed to be spread across 1407.08 hectares of area comprising of land from eleven villages in Agar Tehsil, and Susner Tehsil of Agar-Malwa District. The village-wise land take for the Project is given in the **Table 2.2** below.

Table 2.2 Project Land Footprint

Unit	Villages	Government Land (NRED Allotted and Newly Identified)	Private Land	Total land	Unusable land	Total usable land
A	B	C	D	E (C+D)	F	G (E-F)
Unit 4 (Agar)	Pipalia Kumar	34.80	5.06	39.86	11.08	28.78
	Madhopur	15.77	0.00	15.77	7.66	8.10
	Ladwan	168.32	2.80	171.12	57.94	113.18
	Kasai Dehariya	28.30	0.00	28.30	1.23	27.07
	Karwa Khedi	155.09	0.00	155.09	70.43	84.66
	Dudhpura	98.38	43.59	141.97	33.76	108.21
	Bijnakhedi	55.98	0.00	55.98	20.59	35.39
Sub-total		556.64	51.45	608.09	202.69	405.40
Unit 5 (Susner)	Palda	119.69	6.48	126.17	9.94	116.23
	Naharkheda	86.89	62.71	149.60	9.53	140.07
	Umariya	328.80	13.06	341.87	47.74	294.12
	Pipliya Nankar	181.36	0.00	181.36	28.55	152.81
Sub-total		716.7384	82.225	798.9934	95.76	703.23
Grand total	11	1273.38	133.70	1407.08	298.45	1108.63

Source: RUMSL, June 2020 and DPR, August 2020

As shown in the Table above, total area for Unit 4 (Agar) is 608.08 hectares comprising of land from seven villages namely Pipalya Kumhar, Madhopur, Ladwan, Kasai Dehriya, Karwakhedi, Dudhpura, Bijanakhedi, which fall under Agar tehsil of Agar-Malwa District. Total area for Unit 5 (Susner) is 798.99 hectares comprising of land from four villages namely Palda, Naharkheda, Umariya and Pipliya Nankar, which fall under Susner Tehsil of Agar-Malwa District.

Land for the Project comprises government and private land parcels, with nearly 90% of government land and 10% of private land. Similarly, at unit level as well, majority of Project land is comprised of government owned land parcels with some privately owned land parcels. In terms of continuity, the plant area for both units is made of discontinuous parcels due to the feasible avoidance criteria applied in the selection process (*please refer to section 2.6.2*). The government land shall be allotted to the Project on rights of use basis through execution of land use permission agreement, whereas the private land will be purchased from its owners under the Madhya Pradesh Mutual Consent based

Land Purchase Policy 2014. As of June 2020, about 1229 hectares of government land (out of total 1274 hectares) has been allotted to RUMSL.

As the Project is currently in the planning stage, the component wise break-down of land is not available. However, it is understood from discussions with RUMSL that temporary activities such as labour accommodation, stockyard, batching plant will be set up inside the procured area and no additional parcels of land, outside the Project land boundary will be required for such activities. The existing road network will be used for external approach roads to the Project. Repairs and strengthening of the existing roads will be carried out as necessary; however, the requirement to construct new roads is not envisaged at this stage by RUMSL. Approximately 1km of stretch of road will undergo the repair work.

Information regarding the individual land owners is not available at this stage, but will be collected during the RAP consultations in the field.

2.6.2 Land Procurement Process

This section outlines the procurement process to be followed for each type of land (based on ownership) identified for the Project area and has been updated up to June 2020, when the optimised land data was received from RUMSL.

2.6.2.1 Process for procurement of Government Land

A Land Use Permission Agreement (LUPA) will be signed between New and Renewable Energy Department, Government of MP and RUMSL for the life of the project. The duration of construction phase will be incorporated in the project life to ensure that the LUPA is for a period of 25 years from the day of commissioning. M/S RUMSL will sign the LUPA with the Govt. of Madhya Pradesh for the Government land. The transfer of rights is undertaken once the allotment is finalized and approved by the Superintendent of Land Records (SLR) of the district. Subsequently, M/S RUMSL will have a back-to-back Land Use Permission Agreement with the Solar Project developers, which would enable them to use the land for development of solar project as per the agreed terms of the LUPA.

2.6.2.2 Process for procurement of Private Land

The private land for the project shall be purchased as per prevailing laws and policies in the State of Madhya Pradesh (through MP Mutual Consent Land Purchase Policy' dated 14th November, 2014).

Under the Policy, the District Collector (DC), based on the information regarding the requirement of private land in the Project area, due to non-availability of government land and or shortfall in meeting the project land requirement through government land.

The broad steps under the MP Mutual Consent based Land Purchase Policy 2014, are given below:

- The Designated official from the Department/ Enterprise (in this case RUMSL) will submit an application to the collector for the purchase of the land as per Mutual Consent based Land Purchase Policy 2014. RUMSL to undertake land survey and demarcate the land to be acquired and submit the information to the District Collector for verification;
- The application would include the following particulars:
 - a. Name of the project and purpose';
 - b. Area of the land proposed to be purchased;
 - c. Details of budget availability with the Department/ Enterprise for the purpose of land purchase for the project, as assessed, based on the Policy;
 - d. Land details (survey number, plot number, nazool sheet number, area, village, tehsil and map)
 - e. Land owner details;

- f. Estimated land value based on the prevailing market rates, also known as the Collector Guideline Rate;
 - g. Estimated value of the assets available on the land
 - h. Any other details which Department/ Enterprise would like to provide;
- In case of land requirement for the purpose of the infrastructure and development projects of various projects and enterprises of the state government, the collector will firstly allocate suitable government land available as per the established rules.
- The District Collector (DC) identifies private land parcels (only after government land options have been exhausted);
- Private land to be identified and shortlisted. The rate for the same to be decided, based on the guidelines issued by the District Collector's office;
- The DC after receiving the application from the concerned department/ enterprise
 - a. Will require the Tehsildar to submit a report ascertaining claims over the land and whether the land title is clear or not. A team from the district and the tehsil visit the parcel and undertake an inventory of the assets thereon;
 - b. The DC will also ask the concerned departments (Forest, horticulture, Public works department to measure the assets as relevant (house, well, trees, boundary wall, etc.
 - c. As per the guidelines including the land value (double the district level official market rate which is technically known as the Collector Guideline Rate plus a one-time Solatium) and the asset value (double the value of the asset assessment) arrives at the final value to be offered
- After verification of land use of the private land parcels, if the DC feels that the land is suitable for purchase, then the DC office submits a "Bhoomi Kray Prastav" or an Initial Offer to the land owner which has the proposed price. After being notified through the Bhoomi Kray Prastav (prastav), the landowner has 15 days to provide consent. This timeline can however be extended by the DC as per need.
- In addition to providing the (first) consent, the land owner will also need to make an undertaking that the land is free of any litigations and/or encumbrances (sahmati patra); and in case there are encumbrances or other claims, the land owner will provide all the necessary details to the collector.
- After the undertaking has been received from all landowners, the DC to publish a Public Notification to raise any concern, within a timeline of fifteen (15) days from the date of publication of notification. The publication to be published in local newspaper, and available with the Panchayat or an equivalent village level administration office, Tehsil office and the District Collector's Office;
- If any objection is received regarding ownership disputes pertaining to the identified land, or regarding the compensation amount, the land procurement would not proceed. In case of no objections are received, the DC will allow the land purchase to proceed. .
- After seeking land owner and public consent, the payment of the consideration amount to the land seller should be completed within one year from the date of consent provided by the landowner; Any expenses pertaining to the land registration such as stamp duty, registration cost will be borne by the concerned government department/ agency;
- After the registration, the Mutation process (to update the land records) will be completed in the name of the MP government and the name of the concerned department/ agency will also be mentioned;

- In case the proposed project for which the land is purchased fails or does not move forward for any reason, the concerned Department/ Agency will transfer this land to the Revenue Department, and Revenue Department will be free to give it for any other project, as required.
- Any Government land given on patta for agriculture by the Government will be treated like private land for the purpose of seeking consent and payment of consideration to the patta holder.
- The required private land for the Project M/S RUMSL will hold ownership of all such private land parcels and sign sub-lease agreements with Solar Project Developers.

Presently RUMSL intends to procure all private and patta land through the MP Mutual Consent based Land Purchase Policy, (the RFCTLARR 2013 Act may only be used for land parcels that either do not have clear titles, or have ownership related disputes)

Any additional private land, if required for temporary use outside the project footprint, during the construction phase will be taken on lease based on negotiations with landowners. However, no such need for temporary land has been assessed, as RUMSL intends to use the land within the project boundary for all temporary requirements, such as temporary labour camps, lay down and storage areas etc., during the construction phase. According to the discussion with the project team, to the extent possible, the temporary land requirement for the construction phase will be accommodated within the identified project footprint.

The land area and land boundaries finalised during this stage will be further assessed as part of RAP and FPIC resource mapping surveys, in terms of extent of economic losses, confirmation on the number and types of Project affected families (General, SC, ST, Women Headed Households, etc.), nature of impacts and whether landlessness is arising out of the land procurement for the project

The Project land in Ladwan village, Agar Tehsil, (currently has 168.32 hectares of government land and 2.80 hectares of private land identified for Project) will be assessed against the FPIC criteria before finalisation of the land boundary.

2.7 Pollution Stream

Pollution streams during construction and operation phase of solar power plant will include air emissions, wastewater generation and solid waste generation.

2.7.1 Solid Waste Generation

2.7.1.1 Construction Phase

The solid waste generated by the Project will consist of domestic solid waste, packaging waste, metal scrap and construction debris. The main types of waste that would likely be generated and its sources are shown in Table 2.3.

Table 2.3 Waste generated, source of waste and method of disposal to be adopted for the Project

S. No	Waste Type	Source	Method of disposal
Non-Hazardous Waste			
1.	Domestic solid waste	Temporary site office, storage area, labour activities	Waste shall be segregated onsite and shall be disposed of as approved by local authority.
2.	Construction debris	Construction activities within Solar Park including construction of access road, substation, storage yard etc.	Excavated materials shall be used for backfilling and levelling and other construction debris shall be used for road construction.
3.	Packaging waste containing wood, cardboard and other recyclables.	Packaging material from solar panels, cables and accessories	Return back to the supplier or used as storage boxes/ racks at site.
4.	Sludge from Septic Tank	Site Office and labour camp	Collected and disposed off through contractors.
5.	All non-recyclables waste	Construction activities	Collected and disposed off by the contractor at designated municipal landfill site.
6	Plastic waste	Packaging material	Shall be collected and disposed of through recycler
7	Biomedical waste	First aid kits kept at construction site and site office	Shall be collected, transported and disposed through an authorised agency as prescribed in <i>Bio-Medical Waste (Management and Handling) Rules 2016, as amended</i> .
8	Broken solar panels and other electronics waste (E waste)	Solar Park, PSS and Site Office	Shall be sent back to vendor as a buy back arrangement
9	Batteries	Solar Park, PSS and Site Office	Batteries shall be disposed through manufacturer under the buy-back arrangement.
Hazardous Waste			
1.	Used oil/waste oil, lubricants and oil contaminated rags	DG set, construction machinery	Hazardous wastes shall be stored onsite at separate designated covered area provided with impervious flooring and secondary containment. The storage containers/ bins/ drum will be

S. No	Waste Type	Source	Method of disposal
			clearly marked and identified for their hazards. Before completion of 90 days, hazardous waste materials shall be sent to MPPCB/CPCB authorised vendor for eventual disposal at the Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDF). The nearest CHWTSDF facility is located in Pithampura, ~ 300 km away from the site.

2.7.1.2 Operation Phase

Waste expected to be generated during operation phase from the Project will include domestic waste at site office, scrap materials like scrap tools, damaged personal protective equipment (PPEs) etc.; hazardous waste like waste oil, lubricants, used transformer oil; damaged batteries; damaged PV modules etc. Main types of waste generation and its disposal is as presented in table below.

Table 2.4 Waste Management during Operation Phase

S. No	Waste Type	Source	Method of Disposal
Non Hazardous Waste			
1	Domestic solid waste and office waste	Site Office	Will be disposed of through local municipal corporation
2	Metal Scrap	Site Office and PSS	Will be disposed of with the help of authorised scrap dealer
3	Damaged PPEs	Site Office and PSS	Through authorised vendor
Hazardous Waste			
4	Used oil/waste oil, lubricants and oil contaminated rags	Maintenance activities at site	stored temporarily onsite at separate designated covered area provided with impervious flooring and secondary containment and will be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended
5	Broken solar panels, batteries (dry type or wet type), electronics	Site office and PSS	will be sent back to the vendor as part of buyback arrangement

2.7.2 Air Emissions

2.7.2.1 Construction Phase

There will be impact on air quality due to onsite construction activities. The likely emissions from construction activities would include the following:

- Fugitive emissions from site clearing, material handling, transportation, piling, use of construction machinery, etc.;
- Fugitive dust emissions from unpaved roads;
- Vehicular emissions from increased traffic volume from vehicles used for transport of construction material; transportation of PV modules and accessories; and
- Exhaust emissions from operation of diesel generators (D.G. sets).

To control air emission during construction phase from operation of D.G. sets, adequate stack height as per CPCB norms will be provided to ascertain regulatory compliance. Fugitive dust emission arising from various activities such as piling, transportation of material (loading and unloading), vehicular movement (on unpaved roads) will be minimized through sprinkling of water and maintaining vehicular speed to 10-15 km/hr. Vehicular emission will be controlled through proper maintenance of vehicles and vehicles with proper PUC will be operated at project site.

2.7.2.2 Operation Phase

Under normal operating conditions there would be no gaseous emissions from the operating areas. However, there is a likelihood of gaseous and fugitive dust emissions, albeit in smaller concentrations, owing to the operating of maintenance vehicles. As a means of best practice and adherence to country regulations, well maintained vehicles with proper PUC will only be used for operation and maintenance purposes.

2.7.3 Wastewater Generation

2.7.3.1 Construction Phase

Liquid effluents generated during the construction phase will include domestic sewage from temporary site office as well as from labour camps if any. As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office. The sewerage system will consist of soak pits for the collection of wastewater from the kitchen and washing areas and Office facility. Sewage from the toilets will go into lined septic tanks. Sewage disposal trucks will be used to periodically remove the sludge/sewage from the site.

2.7.3.2 Operation Phase

The operational phase will have 9 KLD of wastewater generation at site. Septic tank and soak pits will be provided at the site offices, pooling substations of each Units for disposal of sewage.

2.7.4 Noise Emission

2.7.4.1 Construction Phase

During the construction phase noise will be generated primarily during the day time. Noise will be generated from piling, moving vehicles as well as construction equipment and machineries, including the DG sets utilized for power. Since there are settlements in the near vicinity of the construction site, the receptors of noise pollution will be the residents of the settlements and the construction workers.

As a control measure it will be ensured that noise emission from the vehicles and equipment's shall not exceed 91 dB(A) (for Passenger or commercial vehicles with gross vehicle weight above 12000 kg as specified in Central Motor Vehicles Rules, 1989). D.G. sets will be provided with acoustic enclosures and workers near noise generating machines will be provided with earplugs as safeguard against high noise hazards.

2.7.4.2 Operation Phase

Under normal operations, none of the activities of solar power plant will generate noise. Any activities generating from maintenance work will be restricted to daytime only.

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This section presents key environmental and social rules and regulations as well as international safeguard requirements that will be applicable to the Project, during different phases with respect to the following reference framework:

- Applicable Indian (national, state and local) Environmental and Social Regulations;
- Applicable Permits (licences, approvals and consents) and permitting agencies;
- IFCs Performance Standards on Environmental and Social Sustainability (2012) (IFC, 2012);
- World Bank Environmental and Social Safeguard Policies;
- IFC/ WB General EHS Guidelines (2007) (IFC, 2007);
- IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007; and
- MNRE Environmental and Social Management Framework for Solar PV Park, February, 2017.
- Applicable National Environmental Standards for Ambient Air, Noise, Water etc.

3.1 Applicable Reference Framework

A list of applicable environmental legislations and their specific application for the proposed Project are given in **Table 3.1**. The International Standards and their applicability for the Project is provided in **Table 3.2**. Earlier, a preliminary review of applicable regulations was conducted in the scoping stage. The present table has been built upon that and is an outcome of revised review. The table shall be updated as the Project progresses.

Table 3.1 Applicability of Key Legislations in India and Reference Framework in Different Phases of the Project

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
Environment Protection					
Environment Protection Act, 1986 and as amended	X	✓	✓	Madhya Pradesh Pollution Control Board (MPPCB) Central Pollution Control Board (CPCB) Ministry of Environment Forest and Climate Change (MoEFCC)	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 during Project lifecycle.
Noise Pollution (Regulation and Control) Rules, 2000 and the Noise Pollution (Regulation and Control) (Amendment) Rules, 2010	X	✓	✓	MPPCB	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, the rules for residential areas would need to be followed.
The Water (Prevention and Control of Pollution) Act, 1974, as amended	X	✓	✓	MPPCB	The conditions within the Water and Air Act need to be followed through construction and operation of the project.
The Air (Prevention and Control of Pollution) Act 1981, as amended	X	✓	✓	MPPCB	As per MPPCB Notification no. 4551 dated 27.12.2016, Solar Parks are listed under White Category and does not require Consent to Establish/Operate.
Guidelines/Criteria for Evaluation of Proposals/Requests for Groundwater Abstraction, 2012 as amended	X	✓	✓	MPPCB	Per the guidelines, any ground water abstraction for project will require permission from Central Ground Water Authority (CGWA). Presently, DPR of the Project has identified tanker water and ground water as source of water to meet water requirements of the Project during construction and operation phases respectively.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended	X	✓	✓	MPPCB	Generation of used oil/diesel, paint cans, oil contaminated rags transformer oil, oil contaminated materials at Solar Park and substation site attracts the provisions of Hazardous and Other Waste Rules, 2016. As per amendment vide G.S.R 178 dated 1 st March 2019, Project does not require HW authorisation as the project does not require consent to establish and consent to operate under white category provided. HW and other wastes generated from the project shall be given to the actual user, waster collector or operator of the disposal facility in accordance with CPCB guidelines.
Explosive Rules 2008	X	✓	X	Chief Controller of Explosives, Petroleum and Explosives Safety Organisation	If any controlled blasting is proposed in the project for site levelling, these Rules will be applicable. The Project will have to obtain a license for storage and use of explosives from the Chief Controller. The rules with respect to storage requirements, safety, labelling and records/submission of annual returns needs to be followed as indicated in the explosive rules.
Batteries (Management and Handling) Rules, 2001, as amended	X	✓	✓	MPPCB	Batteries need to be managed and stored with respect to the Batteries Management and Handling Rules and disposed through an authorized recycler.
E-waste (Management) Rules, 2016, as amended	X	✓	✓	MPPCB	Electrical and electronic waste needs to be managed and stored with respect to the electronic waste rules and disposed through an authorized recycler.
Construction and Demolition (C&D) Waste Management Rules, 2016	X	✓	X	MPPCB	If there is any demolition for structures in the Project during construction and decommissioning activities, these Rules will be applicable. The C&D waste has to be disposed as per the Rules.
Manufacture, Storage & Import of Hazardous Chemical Rules, 1989 as amended	X	✓	✓	MPPCB	Storage and handling of hazardous chemicals in the form of diesel and transformer oil will be carried out in accordance to the relevant provision of this Rule. All chemical storage to be appropriately labelled with Material Safety Data Sheets (MSDS) available and displayed.
The Madhya Pradesh Bhumi Vikas Rules, 1984	X	✓	✓	Local Fire Authority	The Project will require Fire NOC for substations if the height of control room qualifies category of High rise building (height of building above 18 m) as given in the Rules.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
The Motor Vehicles Act, 1988 as amended	X	√	√	Ministry of Road Transport and Highways State Transport Authority	■ Compliance of stipulated standards under Rule; ■ Display of emergency information panel by vehicles carrying hazardous substances as per Rule 134; ■ Vehicular pollution control measures; ■ Other environmental and safety compliance under the Rules.
Social					

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
The Madhya Pradesh Land Revenue Code, 1959	✓	X	X	District Collector and Revenue Department	This Code provides guidance on the evaluation of government and patta land and assets impacted; According to this Act, "Market Value" means the value of land assessed according to guidelines issued by the Collector under the Madhya Pradesh Bajar Mulya Margdarshak Siddhanton ka Banaya Jana Tatha. Unka Punrikshan Niyam, 2000 made under the Indian Stamp Act, 1899 Chapter 18 of the Act puts in place the provisions for the declaration of Nistar rights by the Sub-Divisional officer, for each village. The Nistar Patrak may include matters such as: ■ Terms and conditions on which grazing of livestock in the village may be permitted ■ The terms and conditions on which and the extent to which any resident may obtain - Wood, timber, fuel or any other forest produce - Mooram, kankar, sand, earth, clay, stones or any other minor mineral etc. The Wajib-ul-arz document, also with the Sub-Divisional Officer, is a record of customary land on non-vacant land- rights such as easements and wayleaves, rights of water use for irrigation, fishing etc. The code also allows for the Collector to set apart unoccupied land for uses including timber and fuel reserve, pasture grass bir or fodder reserve, gaothan, encamping ground, threshing floor etc.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
MP Mutual Consent Based Land Purchase Policy, 2014 (<i>Apasi sehmati se Bhu kraya Niti, 2014</i>)	✓	X	X	Revenue department	The government agencies requiring land for various infrastructure projects can procure land with the mutual consent of the land owners as it saves time, ensure timely payment of land value to owners and the procedures are less cumbersome. The objective is to purchase land from owners with their consent and making them understand the social and economic benefits as a result of the project. The policy facilitates speedy procurement of land and the sellers receive the land and asset value as per the provisions of the policy in a timely manner.
The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013).	✓	X	X	District Collector and Revenue Department	This act is only planned to be used for private or patta land parcels that do not have clear titles or have ownership disputes. All other private and patta land will be procured using the MP Mutual Consent based Land Purchase Policy 2014. Such parcels within the area required for the project will not exceed 100 acres for any unit The Section 45.1 and 45.2 of the Act require that in case the land for acquisition is => 100 acres; a R & R Committee will be formed, with the collector as the Chairman. The purpose of the committee will be to monitor and review the progress of the implementation of the R & R Scheme and to undertake post-completion audits in consultation with the GS and municipalities.
The Indian Telegraph Act, 1885	✓	X	X	Department of Telecommunication, Govt. of Madhya Pradesh	■ The Telegraph Act define the compensation payable for damages to crops/ trees and structures along the transmission line route
Seventy Third Constitution Amendment Act,	✓	X	X	Department of Panchayati Raj, State Government	■ The Act enables participation of Panchayat level institutions in decision-making. Panchayats at the village level will be involved for preparation and implementation of the project.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
MoP Guidelines for Payment of Compensation Towards Damages in regard to RoW, 2015	✓	X	X	Revenue Department	Guidelines for payment of compensation towards damages in regard to Right of Way for transmission lines. the guidelines have proposed compensation to be paid for the base area in between the transmission tower (between four legs) and towards diminution of land value in the width of the RoW corridor due to laying of transmission line @ 85 % and 15 % respectively of the land value as determined by the District Magistrate or any authority based on circle rate/ guideline value/ stamp value/ stamp act.
Labour					

Applicable Indian Legislation/Guidelines/International Conventions	Pre-Operational	Construction	Operational	Agency Responsible	Remarks
Factories Act, 1948 and Madhya Pradesh Factories Rules 1962	√			Labour Department	The act to regulate the work of labour in factories. The state amendments introduced in the central act include: A male adult worker will be allowed to work for more than 48 hours in a week subject to – ■ The total numbers of hours in a day does not exceed 12; ■ The spread over, including rest interval does not exceed 13 hours in a day; ■ The total number of work hours in a week, including overtime does not exceed 60; ■ No worker shall work overtime for more than 7 days at a stretch and the total overtime hours in a quarter shall not exceed 125; ■ Such overtime shall not be made compulsory or obligatory; ■ For women, who are required to work between 8 PM and 6 AM, the state government shall specify conditions of safety; ■ For worker who has worked for more than 180 days in a calendar year, shall be entitled to annual leaves. The Act and the subsequent rules are applicable to all factories, in the premises wherein 10 or more workers are employed with the use of power.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
The Industrial Disputes Act (1948) amended in 2010	√	√	√		The amended act of 2010 introduced the following provisions: ■ Wage ceiling for supervisors was raised from INR 1600/month to INR 10,000/month; ■ Direct access for workmen to labour court in case of disputes arising on retrenchment, discharge or termination of service; ■ Establishment of Grievance Redressal Mechanism (GRM) for establishments with more than 20 workers
Minimum Wages Act 1948	√	√	√	Labour Department	The act ensures minimum wages for each category of workers
Equal Remuneration Act and Rules 1976;	√	√	√	Labour Department	Puts in place rules and regulations governing the remuneration payable to workers and employees. The Rules put in place the forms for complaints and claims under the Act.
The Payment of Wages Act, 1936, amended in 2005 and 2017;	√	√	√	Labour Department	Under the 2017 central amendment, Section 6 was substituted with the following: ■ All wages shall be paid in current currency or by cheque or by crediting the wage in the bank account of the employee

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
The E.P.F. and Miscellaneous Provisions act, 1952 and The Madhya Pradesh Labour Laws (Amendment) And Miscellaneous Provisions Act 2015 was passed under the Madhya Pradesh Act (21 of 2015) in November 2015; Payment of Bonus Act, 1965 and rules and subsequent amendment Payment of Gratuity Act, 1972;	✓	✓	✓	Labour Department	The central amendment of 2015 introduced the following changes: - Revision of wage threshold- the wage has been upwardly revised from INR 10,000/month to INR 21,000/month - Change in the wage ceiling for calculation of bonus- the calculation ceiling was raised from INR 3500/month to INR 7000/month
ESI Act , 1948 (Employees State Insurance Act, 1948) and Central Amendment Rules, 2016	✓	✓	✓	Labour Department	The central amendment of 2016 brought about four major changes are: - An employee whose average daily wage is upto INR 137 is exempted from contribution (it was INR 100 earlier) - In areas where the Act is implemented for the first time; the rates of contribution for the first 24 months is: Employer – 3% of wages, Employee - 1% of wages - Wage limit for coverage of an employee has been enhanced from INR 15,000 to 21,000

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Const	Operati	Agency Responsible	Remarks
Workmen's Compensation Act, 1923 amended in 2017 and renamed as Employees Compensation Act	✓	✓	✓	Labour Department	The central amendment introduced in 2017 had the following changes: - It is the duty of the employer to inform the employee of his/her rights to compensation under the Act; - The minimum penalty payable under Section 18A (penalties on employer) was increased from INR 50,000 to INR 1,00,000. Also, failure to inform the employee regarding the act has been included as a penal offence; - The minimum amount in dispute has been raised from INR 300 to INR 1000 for an appeal to High court against the order of the Labour Commissioner; Section 30A, which dealt with withholding amounts payable to employee through Commissioner's order has been omitted
Child Labour (Prohibition and Regulation) Act, 1986 amended in 2016	✓	✓	✓	Labour Department	Prohibits employment of children below 14 years of age. Under the 2016 amendment, the following provisions were introduced: - Adolescent term introduced (person between 14 and 18 years), and adolescents will be prohibited from employment in hazardous occupations and processes; - Regulation of working conditions of adolescents with regards to working hours limited to 6 hours in a day, 1 hour rest after every 3 hours of work, and no overtime; Prohibition of employment of a child (under 14 years) in all occupations except where the child helps the family after school hours

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Const	Operati	Agency Responsible	Remarks
Contract Labour (Regulation & Abolition) Central Act 1970 and Rules, 1971 (Madhya Pradesh Amendment, 2015)	✓	✓	✓	Labour Department	Ensure basic welfare measures to be made available to the contract workers by the employer. Under the state amendment (2015), two provisions have been introduced: ■ Provision of deemed registration if the registering officer fails to pass an order either granting or refusing or objecting to grant or amend the registration within a period of 30 days after submission of an application; Provision of duly licensed if the registering officer fails to pass an order either granting or refusing or objecting to grant or renew or amend the registration within a period of 30 days after submission of an application.
The Bonded Labour System (Abolition) Act 1976;	✓	✓	✓	Labour Department	Abolishes Forced labour in the country
Inter-state Migrant Workmen Act 1979 (Madhya Pradesh Amendment, 2015)	✓	✓	✓	Labour Department	Regulate the condition of service of inter-state labourers in Indian labour law. Under the state amendment (2015), one provision has been introduced: The registration deemed to be duly granted, if no adverse order is passed within thirty days from the date of submission of application.
The Building and other Construction Workers Act, 1996 (Madhya Pradesh Amendment, 2015)	✓	✓	✓	Labour Department	Ensure safety measures at construction work site and other welfare measures such as canteens, first-aid facilities, ambulance, and housing accommodation for Workers near the Workplace etc. Under the state amendment (2015), two provisions have been introduced: ■ The State Government, by notification, may exclude cost on purchase and transportation of plant and machinery to be used in a factory and such other costs from the cost of construction; An employer aggrieved by an order of assessment made under Section 5 or by an order imposing penalty under Section 9, may appeal to the appellate authority against the said order in such manner as prescribed.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-	Constr	Operati	Agency Responsible	Remarks
The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013		√	√	Labour Department	An act to protect women from sexual harassment at their place of work.
Indigenous People					

Safeguards in the Indian Constitution					"Scheduled Tribes" means such tribes or tribal communities or parts of or groups within such tribes or tribal communities as are deemed under article 342 to be Scheduled Tribes for the purposes of the Constitution. As it is stipulated in the constitution, the President (President of India) may with respect to any State or Union Territory, and where it is a State, after consultation with the Governor thereof, by public notification, specify the tribes, or tribal communities or parts of or groups within tribes or tribal communities which shall for the purposes of this Constitution be deemed to be Scheduled Tribes in relation to that State or Union Territory, as the case may be. With regard to inclusion or exclusion, Parliament may by law include in or exclude from the list of Scheduled Tribes specified in a notification, any tribe or tribal community or part of or group within any tribe or tribal community. <u>Prohibition of Discrimination</u> As per this provision, the States shall not discriminate against any citizen on grounds only of religion, race, caste, sex, place of birth or any of them. Other provisions are; No citizen shall, on grounds only of religion, race, caste, sex, place of birth or any of them, be subject to any disability, liability, restriction or condition with regard to (a.) access to shops, public restaurants, hotels and places of public entertainment; or (b.) the use of wells, tanks, bathing Ghats, roads and places of public resort maintained wholly or partly out of State funds or dedicated to the use of general public. Nothing (clause (2) of article 29) shall prevent the State from making any special provision for the advancement of any socially and educationally backward classes of citizens or for the Scheduled Castes and the Scheduled Tribes. Nothing (sub-clause (g) of clause (1) of article 19) shall prevent the State from making any special provision, by law, for the advancement of any socially and educationally backward classes of citizens or for the Scheduled Castes or the Scheduled Tribes in so far as such special provisions relate to their admission to educational institutions including private educational institutions, whether aided or unaided by the State, other than the minority educational institutions referred to in clause (1) of article 30.
The SCs and the STs (Prevention of Atrocities) Act, 1989					The act was passed in 1989 to prevent Scheduled Castes and Scheduled Tribes from atrocities. The act suggests Precautionary and Preventive Measures under

				which State Government shall identify the area where it has reason to believe that atrocity may take place or there is an apprehension of reoccurrence of an offence under the Act: The state shall order the concerned officer to visit the identified area and review the law and order situation. If deemed necessary, in the identified area cancel the arms licenses of the persons, not being a member of the Scheduled Castes or Scheduled Tribes, their near relations, servants or employees and family friends and get such arms deposited in the Government Armoury. The act suggests constitution of a high-power State-level committee, district, and divisional level committees or such number of other committees as deemed proper and necessary for assisting the Government in implementation of the provisions of the Act; The act has made provision to set-up a vigilance and monitoring committee to suggest effective measures to implement the provisions of the Act. The state can set-up Awareness Centres and organise Workshops in the identified area or at some other place to educate the persons belonging to the Scheduled Castes and the Scheduled Tribes about their rights and the protection available to them under the provisions of various Central and State enactments or rules, regulations and schemes framed there under. Under the act, Non-Government Organisations are encouraged for establishing and maintaining Awareness Centres and organizing Workshops and provide them necessary financial and other sort of assistance. As per the provision of the act, the State Governments shall set up a Scheduled Castes and the Scheduled Tribes Protection Cell at the State head quarter under the charge of Director General of Police/Inspector General of Police. This Cell shall be responsible for (i) conducting survey of the identified area; (ii) maintaining public order and tranquility in the identified area; (iii) recommending to the State Government for deployment of special police force or establishment of special police post in the identified area; (iv) making investigations about the probable causes leading to an offence under the Act; (v) restoring the feeling of security amongst the members of the Scheduled Castes and the Scheduled Tribes; (vi) informing the nodal officer and special officer about the law and order situation in the identified area; (vii) making enquiries about the investigation and spot inspections conducted by various officers; (viii) making enquiries about the action taken by the Superintendent of Police in the cases where an officer in-charge of the police station has refused to enter an information in a book to be maintained by that police station; (ix) making enquiries about the wilful negligence by a public servant.
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Applicable Indian Legislation/Guidelines/International Conventions	Pre	Const	Operati	Agency Responsible	Remarks
Biodiversity Conservation					
Wildlife Protection Act, 1972, 2002 and Rules, 2003 and as amended	✓	✓	✓	Wildlife Warden, State Forest Department	If any protected/ endangered flora or fauna (as listed in Schedules of WP Act, 1972) are found in the project area, the proponent should implement conservation measures for their protection.
Forests (Conservation) Act, 1980 and Rules 1981 as amended	✓	✓	✓	District and State Forest Department MoEFCC.	In case, if any Protected or Reserve Forest land is acquired for the project or its component, it shall require a prior Forest Clearance from the state and central authorities.

Table 3.2 International Standards- IFC Performance Standards and WB Safeguard Policies

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
1.	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	OP 4.01: Environmental Assessment	Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of the Project and runs through all subsequent standards. World Bank compliant ESMF is already developed for the project and will guide the impact assessment and management plans. (Section 6 and 8)	Yes	The Project will have moderate impacts on environment, health, safety and social aspects throughout its lifecycle and will need to be managed and monitored through the implementation of policies and procedures in compliance with IFC PS 1 and OP 4.01.
			Identification of the area of impact, types of impacts and affected stakeholders, to be addressed/ mitigated/ managed and consulted, respectively. Conducting environmental and social assessment of the Project to identify E&S risks and impacts of the		

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
2.	PS 2: Labour and Working Conditions	OP 4.01: Environmental Assessment	project. It shall inform the design of the project, and be used to identify mitigation measures and actions The economic growth through employment creation and income generation is recognised and balanced protecting the basic rights of workers. This standard outlines the minimum requirements of working conditions, protection to the workforce (including issues of child and forced labour) and ensuring occupational health and safety of both its employees as well as non-employees' working through contractors.	Yes	The construction and operation phase for the Project will include employment of labour for varying activities such as widening of access roads, site preparation, boundary wall construction and module installation. The Project will also require the establishment of temporary labour camps during the construction phase at all sites and staff accommodation during the operation phase that fall within the purview of IFC PS 2 and OP 4.01.
3.	PS 3: Resource Efficiency and Pollution Prevention	OP 4.01: Environmental Assessment	The Standard outlines the approach to pollution prevention and abatement in line with internationally disseminated technologies and practices.	Yes	Some air emissions and pollution discharge is anticipated from the Project including use of D.G. sets, use of groundwater in project activities (during operation phase) and labour camp, impact on drainage, wastewater discharge from labour camps, solid waste disposal such as broken solar panels, general office waste, waste generated during repair and maintenance during project life cycle. Water requirement during construction and operation phase, will also lead to stress on available water resources. The above activities fall within the purview of PS 3 and OP 4.01.
4.	PS 4: Community Health, Safety & Security	OP 4.01: Environmental Assessment	The Standard requires a project to evaluate risks and impacts to the health and safety of the affected community during the Project life cycle and establish measures to avoid minimize and reduce risks and impacts from the Project.	Yes	The construction and operational phases of the project will have impacts on neighbouring communities particularly traffic safety risks during movement of construction materials and machinery. Electrocutation risk linked to transmission line and substations during operation phase. In addition, there will be interaction of community with security personnel during construction

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
5.	PS 5: Land Acquisition and Involuntary Resettlement	OP 4.12: Involuntary Resettlement	The PS-5 applies to physical or economic displacement resulting from the <u>following types of land transactions</u>: Type I: Land rights for a private sector project acquired through expropriation or other compulsory procedures; Type II: Land rights for a private sector project acquired through negotiated settlements with property owners or those with legal rights to land, including customary or traditional rights recognised or recognisable under the laws of the country, if expropriation or other compulsory process would have resulted upon the failure of negotiation The O.P 4.12 applies to direct physical and economic displacement resulting from the following types of land acquisition or restrictions on land use undertaken or imposed in connection with project implementation: (a) involuntary taking of land resulting in relocation or loss of shelter, loss of assets or access to assets, or loss of income sources or means of livelihood; (b) Involuntary restriction of access to legally designated parks and protected areas that might result in adverse impacts on the livelihoods of the displaced persons	Yes -for Private and Patta land Yes- for encroached/ squatted upon land	and operation phases. These falls under purview of PS 4 and OP 4.01. The Project will involve land procurement (Government Patta and Private land) for development of Solar Park and its associated facilities. The IFC PS and WB OP 4.12 are likely to be applicable on the project if land is taken in the types of transactions identified and will result in physical or economic displacement. This will in turn guide the land procurement process, the Resettlement Action Plan and Livelihood Restoration Plan for the project. It is RUMSL's intention to use the MP Mutual Consent-based Land Purchase Policy, 2014 for land procurement of private and patta land. However, the land acquisition act may be used for the parcels that do not have clear titles or have ownership disputes, if any are found during the MP Mutual Consent process. The process of land procurement is understood to be through negotiated settlement hence, PS 5 is applicable. There will be economic displacement for Graziers using the Government land for livestock grazing and Agricultural labourers working on the identified private Patta or occupied (encroached or squatted upon) land parcels that they do not have rightful claims on. These economic displacement impacts will also be covered in the RAP-LRP.

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
			To address the above impacts, a resettlement action plan (RAP) is required that will cover the following: (a) Displaced persons are informed about their options and rights pertaining to resettlement; (b) Consulted on the relocation options; (c) Provided with prompt and effective compensation at full replacement cost for loss of assets If the impacts include physical displacement, the RAP then should ensure that: (a) Moving allowances are provided for relocation; (b) Residential housing/housing sites/agricultural sites as required in combination is provided; (c) Provided with development assistance for land preparation, credit facilities, training or job facilities; (d) Offer transitional allowance for the time needed to restore livelihood and standard of living		
6.	PS 6: Biodiversity Conservation and Sustainable Management of Natural Living Resources	OP 4.04: Natural Habitats	The Standard aims at protecting and conserving biodiversity, the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve, is fundamental to sustainable development.	Yes	The project area and the surrounding area around it is a habitat for IUCN v2020.1 EN species Egyptian Vulture (<i>Neophron percnopterus</i>) at the Susner site, which may be impacted due to the project activities

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
7.	PS 7: Indigenous Peoples	OP 4.10: Indigenous Peoples	The Standard acknowledges the possibility of vulnerability of indigenous people owing to their culture, beliefs, institutions and living standards, and that it may further get compromised by one or other project activity throughout the life cycle of the project. The O.P 4.10 (revised in 2013) recognizes the linkage between land and the cultural identity of Indigenous People (IP), and requires a social assessment, process of free, prior and informed consultation with the affected IP community at each stage of the project, preparation of Indigenous People's Plan (IPP) and disclosure of the same.	Yes	The villages in the project footprint area are comprised of ST population (primarily Bhil, Bhilala) who may be impacted by the project activities, in terms of loss of Common property resources, loss of structures and impact on livelihoods. The PS is thus applicable for all three projects. The FPIC approach paper has identified two locations (villages) where the processes will be carried out to seek consent for the project.(Details are included in the Draft FPIC approach note, submitted 3rd Sept 2020)
8.	PS 8: Cultural Heritage	OP 4.11: Physical Cultural Resources	The Standard aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. In addition, the requirements of this PS on project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity	No	Presently the Standard is not expected to be triggered for the project. However, structures or places with religious or cultural significance may be identified during the resource mapping process for FPIC and during the RAP survey, the applicability of the Standard will be reviewed and management plans prepared, if avoidance is not feasible.
WB/IFC EHS Guidelines					
9.	General EHS Guidelines		The IFC/WB General Environmental, Health and Safety (EHS) Guidelines documents Good International Industry Practices (GIIPs) by covering the ambit of environmental, social and ecological concerns associated with establishing and managing a project. The aspects covered in the guidelines	Yes	General EHS Guidelines will need to be followed during the construction and operation phase of the project.

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
			include ambient air quality monitoring, energy conservation, wastewater management, water conservation processes, hazardous materials management, waste management, noise reduction processes, occupational health and safety, community health and safety and project phase-specific concerns.		
10.	Electric Power Transmission and Distribution		The IFC/WB EHS Guideline for Electric Power Transmission and Distribution covers industry-specific issues associated with laying, operation and dismantling of transmission towers, lines and substations. Key issues covered in the guidelines include terrestrial habitat alteration, right-of-way access, right of-way maintenance, electrocution risk to bird and bat species, health and safety of working with or near electric and magnetic fields, storage and maintenance of hazardous materials (e.g. oils, fuels, preservatives) and aircraft navigational safety.	Yes	Aspects of the EHS guidelines with respect to occupational health and safety, right of way maintenance and hazardous materials management as is relevant for internal transmission lines and the pooling substation infrastructure has been covered in the report.
11.	IFC/EBRD Workers' accommodation: processes and standards		This guidance note, provide guidance on the provision of housing or accommodation for workers by employers and the issues that arise from the planning, construction and management of such facilities.	Yes	These guidelines will need to be followed during establishment of labour camps for the project.

3.1.1 Environmental and Social Management Framework of Ministry of New and Renewable Energy

MNRE have framed an Environmental and Social Management Framework for Solar PV Park, dated February 2017. The framework had identified the following key environmental and social issues/impacts to be kept in consideration for sub-projects:

- Impacts on biological environment, especially forest land;
- Impacts due to water requirements as most projects are located in water scarce regions;
- Impacts on livelihoods of land owners and land users;;
- Impacts on common property resources;
- Impacts due to soil erosion and dust.

In keeping with the impacts identified, the ESMF requires the formulation of a project specific Environmental and Social Management Plan, which would include relevant management plans, such as (not limited to) the following:

- Resettlement Action Plan/ Framework
- Gender Action Plan
- Indigenous Peoples Policy Framework
- Stakeholder Engagement Plan; and
- Grievance Redressal Mechanism

3.2 Applicable Environmental Standards

3.2.1 National Level Standards

The Central Pollution Control Board (CPCB) has stipulated different environmental standards w.r.t. with respect to ambient air quality, noise quality, water and waste water quality for the country as a whole under EP Act, 1986. Following standards are applicable for the project and needs to be complied with during the project life cycle.

- National Ambient Air Quality Standards (NAAQ Standards), as prescribed by MoEF&CC vide, Gazette Notification dated 16th November, 2009;
- Drinking water quality- Indian Drinking Water Standard (IS 10500: 2012);
- General standards for discharge as prescribed under the Environment Protection Rules, 1986 and amendments (G.S.R 422 (E) dated 19.05.1993 and G.S.R 801 (E) dated 31.12.1993 issued under the provisions of E (P) Act 1986);
- Noise standards specified by the MoEF&CC vide gazette notification dated 14th February, 2000 (Noise Pollution (Regulation and control) Rules, 2000)

3.2.2 IFC/ WB Standards

The General EHS Guidelines (30th April 2007) of IFC/ WB have outlined following environmental standards which needs to be complied for the project.

- IFC/WB Air Emissions and Ambient Air Quality Standards;
- IFC/WB Guidelines for treated sanitary sewage discharges; and
- IFC/WB Noise Standards.

4. ENVIRONMENTAL AND SOCIAL BASELINE

This section describes the physical, biological, cultural and human conditions that will prevail in the absence of the Project, including interactions amongst them. It also includes projected changes that will be used by the Project such as existing traffic, population etc. The baseline information has been collected through primary and secondary sources with specific reference to project aspects which may influence the surrounding environment from the solar park development activities. This data had been collected through a concerted effort of:

- Reconnaissance survey and field visits;
- Primary monitoring of key environmental parameters like air, water, soil, noise, ecological and socioeconomic survey during summer season;
- Stakeholder consultations with local people, government departments such as Forest Department, Panchayats etc.; and
- Review of literature on available secondary information.

The purpose of describing the environmental and social baseline of the study area is to:

- To describe the environmental characteristics of the Project site and surrounding areas to identify key resources and receptors that will be affected by the Project during the scoping process;
- To determine if any nearby communities or structures will be affected by the Project establishment; and
- To understand the significance of the different habitats within the study area and its importance for sustaining species of conservation importance, in terms of providing habitat contiguity to the surrounding region and dependency of surrounding communities.

4.1 Study Area

The area of up to 5 km radius from the Project boundary (Solar Park area) has been demarcated as study area for the Project by considering the extent of project impact in terms of air quality, noise, water resources, human settlement, cultural heritage sites, location of labour sites, location of the access roads besides considering the actual land area which has been procured for the project and its utilities footprints.

4.1.1 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 for Project includes land used for the setting up the Solar PV panels, transformer rooms, site office, access roads, storage of material and equipment, labour camps and pooling substation at Solar Park site. It was informed by RUMSL that all temporary structures during construction phase, i.e. material storage area, labour camp, site office etc. will be established only within the Solar Park area. The Project footprint details provided by RUMSL dated 19 June, 2020 has been considered for this report. Information from the Final DPR, August 2020 are also considered.

4.1.2 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, including:

- Nature of the activity;
- Specific resource or receptor;
- Sensitivity of that resource or receptor; and
- Whether the impact is direct or indirect (e.g. a secondary effect).

The Project area of influence refers to the Project footprint area as well as to a larger area in its immediate vicinity. This includes the footprint of the associated Project components, such as access road as well as the immediate surroundings that will see increased movement of vehicles, personnel and land-use change. Most of the impacts will occur within the Project footprint area as identified above. However, certain impacts can be further reaching in terms of expected impacts.

The Aol considered for 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 roads and surroundings, i.e. an area of ~2 km from the Unit 4 (Agar) and Unit 5 (Susner) site. The Aol for individual environmental attributes is as below:
 - *Air Quality:* Dust emissions, fugitive dust – typically up to 500 m – 1 km from major construction areas;
 - *Noise:* Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) – typically 500 m from construction site;
 - *Soil environment:* The impacts on soil and land- typically upto 500 m from project foot print area;
 - *Water Environment:* The impacts on water quality of water bodies – on the water bodies present in nearby area of project activities.
- **Flora and Fauna (Terrestrial and Aquatic):** This includes 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). This kind of disturbance has been estimated to occur within 2 km of the project footprint;;
- **Social:** The project footprint is spread across 11 villages (excluding Transmission Line, the alignment for which is being finalised).). Roads for movement of materials and people during the construction phase will also be included in the Area of influence, based on volume and intensity. This is taken as the area of influence, though social impacts are likely to largely remain confined to these villages. Other villages/groups may come to be included if it emerges during assessments and consultations that there is economic dependence on the proposed project areas. The detailed sub-categorization of Study Area considered for Social baseline and assessment is presented in **Section 4.4.2**. The detailed baseline will emerge after the RAP survey and analysis have been completed and this will be included in the RAP document.

4.2 Physical Environment

4.2.1 Site Visit

ERM team undertook a site survey from 10 to 13 December 2019 to understand the site setting and to map environmental sensitivities in the area. The collection of soil and water samples was undertaken from 11 to 13 December 2019. Air and noise monitoring was carried out from 19 to 25 December 2019 and traffic count was undertaken on 20 December 2019.

4.2.1.1 Primary Baseline Data Collection

M/s Netel India Private Limited, an MoEF&CC and NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited laboratory was engaged for collection of baseline information on ambient air quality, surface water quality, ground water quality, ambient noise quality, soil quality and traffic count. The primary baseline data was collected for aspects detailed out in **Table 4.1**.

Table 4.1 Primary Baseline Data Collection

S. No	Environmental Attribute	No. of Locations/ Area	Frequency	Remarks
1	Ambient Air Quality	2 for each Unit	24 hourly, twice a week for one week	Ambient air quality at nearest village in both upwind and downwind direction was monitored to understand baseline AAQ of the area
2	Ambient Noise Quality	5 for each Unit	Once for 24 hours during monitoring period	Ambient noise samples were collected over a 24 hour period from the nearby villages
3	Ground Water Quality	3 for each Unit	Once during monitoring period	Groundwater was mainly collected from the primary drinking water source such as hand pumps/dug wells to analyse ground water quality
4	Surface Water Quality	3 for each Unit	Once during monitoring period	Water samples was collected from ponds/lakes from the study area villages that were found to be used by the inhabitants for washing/ bathing etc.
5	Soil Quality	3 for each Unit	Once during monitoring period	Soil samples covering different land uses were collected from the study area
6	Traffic Count	1 traffic junction for each Unit	Once during monitoring period	Traffic count was done on hourly basis for 24 hours at the road proposed to be used for transportation of raw material and manpower during construction phase

Map showing monitoring locations for Unit 4 (Agar) and Unit 5 (Susner) are presented in **Figure 4.1** and **Figure 4.2**.

4.2.2 Secondary Baseline Data Collection

Secondary baseline data collection involved identifying and collecting existing published materials and documents. Information on various environment aspects (like geology, hydrology, drainage pattern, ecology etc.), meteorology were collected from different institutions, government offices and literatures etc. Secondary data was collected for the aspects as given in **Table 4.2**.

Table 4.2 Secondary Baseline Data Collection

S. No	Attribute	Source of Data Collection
1	Meteorological data	India Meteorological Department (IMD)

S. No	Attribute	Source of Data Collection
2	Geology, geomorphology, hydrogeology and hydrology	U.S. Department of the Interior, U.S. Geological Survey, 2017 National Remote Sensing Centre (NRSC)-Bhuvan services Central Ground Water Board (CGWB) Geological Survey of India (GSI) Water Resources Department Madhya Pradesh (MPWRD) National Water Development Agency (NWDA) Department of Agriculture, Cooperation & Farmers Welfare (AGRICOOOP)
3	Land use	Through Satellite Imageries
4	Natural Hazards	National Flood Vulnerability Assessment System World Resource Institute (WRI) Vulnerability Atlas of India Building Materials and Technology Promotion Council

Environmental baseline data was collected through primary surveys as well as through secondary sources by literature survey and discussions with the concerned departments/agencies. Details of data collected are summarized in subsequent sections.

Legend

- Air Quality
- Noise
- Traffic
- Ground Water
- Surface Water
- Soil
- Forest
- Settlement
- Road Network
- River
- Waterbody
- Project Site
- Study Area 5km
- Study Area 2km

Title: Monitoring Location Map

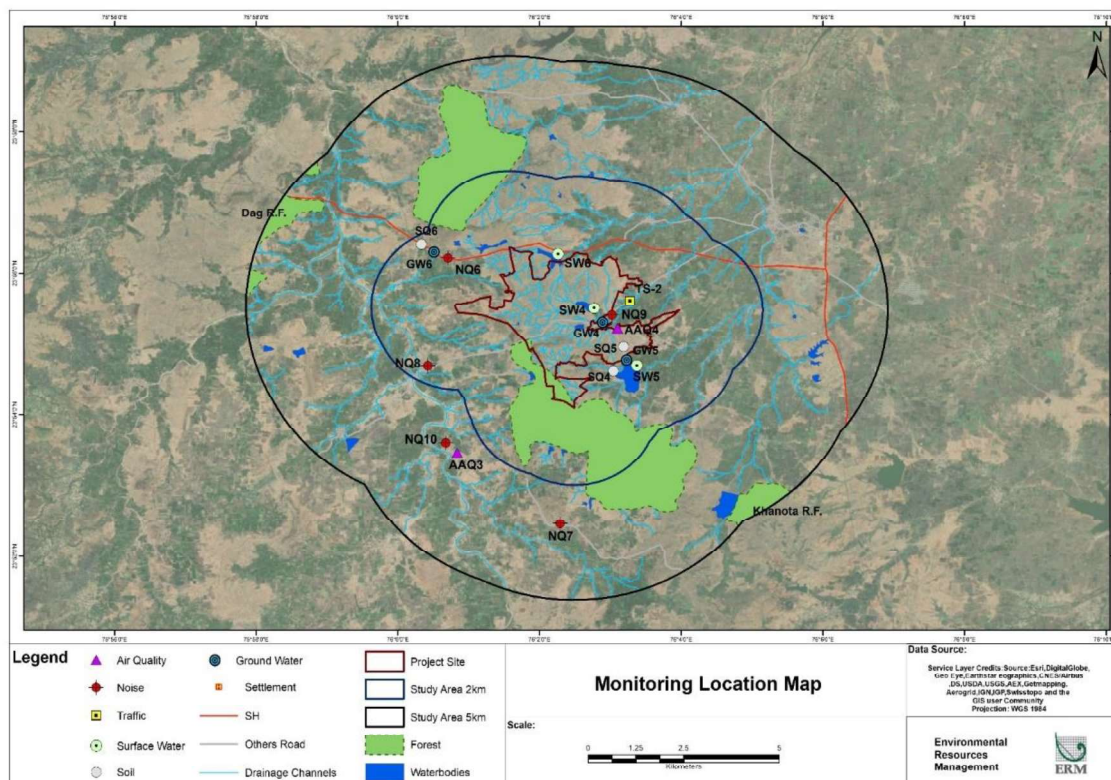
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Data Source: For Lakshmi Kheda Waterbody, the data was collected from the following sources: 1. Lakshmi Kheda Waterbody, 2. Lakshmi Kheda Waterbody, 3. Lakshmi Kheda Waterbody, 4. Lakshmi Kheda Waterbody, 5. Lakshmi Kheda Waterbody, 6. Lakshmi Kheda Waterbody, 7. Lakshmi Kheda Waterbody, 8. Lakshmi Kheda Waterbody, 9. Lakshmi Kheda Waterbody, 10. Lakshmi Kheda Waterbody, 11. Lakshmi Kheda Waterbody, 12. Lakshmi Kheda Waterbody, 13. Lakshmi Kheda Waterbody, 14. Lakshmi Kheda Waterbody, 15. Lakshmi Kheda Waterbody, 16. Lakshmi Kheda Waterbody, 17. Lakshmi Kheda Waterbody, 18. Lakshmi Kheda Waterbody, 19. Lakshmi Kheda Waterbody, 20. Lakshmi Kheda Waterbody, 21. Lakshmi Kheda Waterbody, 22. Lakshmi Kheda Waterbody, 23. Lakshmi Kheda Waterbody, 24. Lakshmi Kheda Waterbody, 25. Lakshmi Kheda Waterbody, 26. Lakshmi Kheda Waterbody, 27. Lakshmi Kheda Waterbody, 28. Lakshmi Kheda Waterbody, 29. Lakshmi Kheda Waterbody, 30. Lakshmi Kheda Waterbody, 31. Lakshmi Kheda Waterbody, 32. Lakshmi Kheda Waterbody, 33. Lakshmi Kheda Waterbody, 34. Lakshmi Kheda Waterbody, 35. Lakshmi Kheda Waterbody, 36. Lakshmi Kheda Waterbody, 37. Lakshmi Kheda Waterbody, 38. Lakshmi Kheda Waterbody, 39. Lakshmi Kheda Waterbody, 40. Lakshmi Kheda Waterbody, 41. Lakshmi Kheda Waterbody, 42. Lakshmi Kheda Waterbody, 43. Lakshmi Kheda Waterbody, 44. Lakshmi Kheda Waterbody, 45. Lakshmi Kheda Waterbody, 46. Lakshmi Kheda Waterbody, 47. Lakshmi Kheda Waterbody, 48. Lakshmi Kheda Waterbody, 49. Lakshmi Kheda Waterbody, 50. Lakshmi Kheda Waterbody, 51. Lakshmi Kheda Waterbody, 52. Lakshmi Kheda Waterbody, 53. Lakshmi Kheda Waterbody, 54. Lakshmi Kheda Waterbody, 55. Lakshmi Kheda Waterbody, 56. Lakshmi Kheda Waterbody, 57. Lakshmi Kheda Waterbody, 58. Lakshmi Kheda Waterbody, 59. Lakshmi Kheda Waterbody, 60. Lakshmi Kheda Waterbody, 61. Lakshmi Kheda Waterbody, 62. Lakshmi Kheda Waterbody, 63. Lakshmi Kheda Waterbody, 64. Lakshmi Kheda Waterbody, 65. Lakshmi Kheda Waterbody, 66. Lakshmi Kheda Waterbody, 67. Lakshmi Kheda Waterbody, 68. Lakshmi Kheda Waterbody, 69. Lakshmi Kheda Waterbody, 70. Lakshmi Kheda Waterbody, 71. Lakshmi Kheda Waterbody, 72. Lakshmi Kheda Waterbody, 73. Lakshmi Kheda Waterbody, 74. Lakshmi Kheda Waterbody, 75. Lakshmi Kheda Waterbody, 76. Lakshmi Kheda Waterbody, 77. Lakshmi Kheda Waterbody, 78. Lakshmi Kheda Waterbody, 79. Lakshmi Kheda Waterbody, 80. Lakshmi Kheda Waterbody, 81. Lakshmi Kheda Waterbody, 82. Lakshmi Kheda Waterbody, 83. Lakshmi Kheda Waterbody, 84. Lakshmi Kheda Waterbody, 85. Lakshmi Kheda Waterbody, 86. Lakshmi Kheda Waterbody, 87. Lakshmi Kheda Waterbody, 88. Lakshmi Kheda Waterbody, 89. Lakshmi Kheda Waterbody, 90. Lakshmi Kheda Waterbody, 91. Lakshmi Kheda Waterbody, 92. Lakshmi Kheda Waterbody, 93. Lakshmi Kheda Waterbody, 94. Lakshmi Kheda Waterbody, 95. Lakshmi Kheda Waterbody, 96. Lakshmi Kheda Waterbody, 97. Lakshmi Kheda Waterbody, 98. Lakshmi Kheda Waterbody, 99. Lakshmi Kheda Waterbody, 100. Lakshmi Kheda Waterbody.

Environmental Resources Management

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Figure 4.2 Location Map of Environmental Baseline Monitoring Station at Unit 5 (Susner)



4.3 Physical Environment Baseline

4.3.1 Land Use and Land Cover

The land use and land cover (LULC) map for the proposed Project is prepared by adopting interpretation techniques of the high resolution (30m or less) satellite image along with ground truthing surveys undertaken during site reconnaissance by the Project team members, Survey of India toposheet (55A1, 55A2, 45P16, 46M13 and 54D4) and census records. Image classification was done using visual interpretation techniques and digital classification image processing software say ArcGIS.

For the present study, ArcGIS 10.7.1 software was used for pre-processing, rectification, and classifying the satellite data for preparation of land use land cover map for assessing and monitoring the temporal changes in land use land cover and land developmental activities. The methodology followed in the digital classification of satellite data is as under:

- Digitization of administrative base maps of the district and bring them to a projection system. For the current study UTM projection is used. The details are as below:
 - Projection: Universal Transverse Mercator (UTM)
 - Projected Coordinate System: WGS_1984_UTM_Zone_43Q
- Landsat8 (30m resolution) imagery for land use and land cover mapping was geo-referenced with Google Earth Images. The satellite scenes covering the said district were put in the form of mosaic.
- Land use and land cover mapping was done using the supervised image classification of Landsat8. The accuracy of classified image was checked through confusion matrix. The classification was further refined till the desired accuracy is reached.

- The classified raster image was converted to vector layer and then brought under GIS environment for generation of Land-use and land cover maps with proper labels. Finally the area calculation for various categories of land use and land cover was done.

The breakup of land use in the 5 km study area of Unit 4 (Agar) and Unit 5 (Susner) site is provided in **Table 4.3** and shown in **Figure 4.3** and **Figure 4.4**. The table suggests that the land use is primarily agricultural (~64% and ~56%) followed by scrub land (~31% and ~28%) in the 5 km study area of Unit 4 (Agar) and Unit 5 (Susner) sites. Study area of Unit 4 (Agar) also consists of ~311 ha reserved forest land (1.9%).

Table 4.3 Land use of Agar Solar Park (5-km radius Study Area)

S.N.	Land Use Type	Unit 4 (Agar)	Unit 5 (Susner)
		Area (in %)	Area (in %)
1.	Agriculture	64.2	55.8
2.	Scrub Land	30.6	28.4
3.	Waterbody	1.4	0.8
4.	Settlement	1.4	3.4
5.	Reserve Forest	1.9	9.6
6.	River	0.4	-
7.	Road Network	0.1	0.5
8.	Solar Plant	-	0.3
9.	Drainage Channel	-	1.4
	Total	100.0	100.0

Source: GIS based assessment for the Project

Figure 4.3 Land Use Map – Unit 4 (Agar) 5-km Study Area

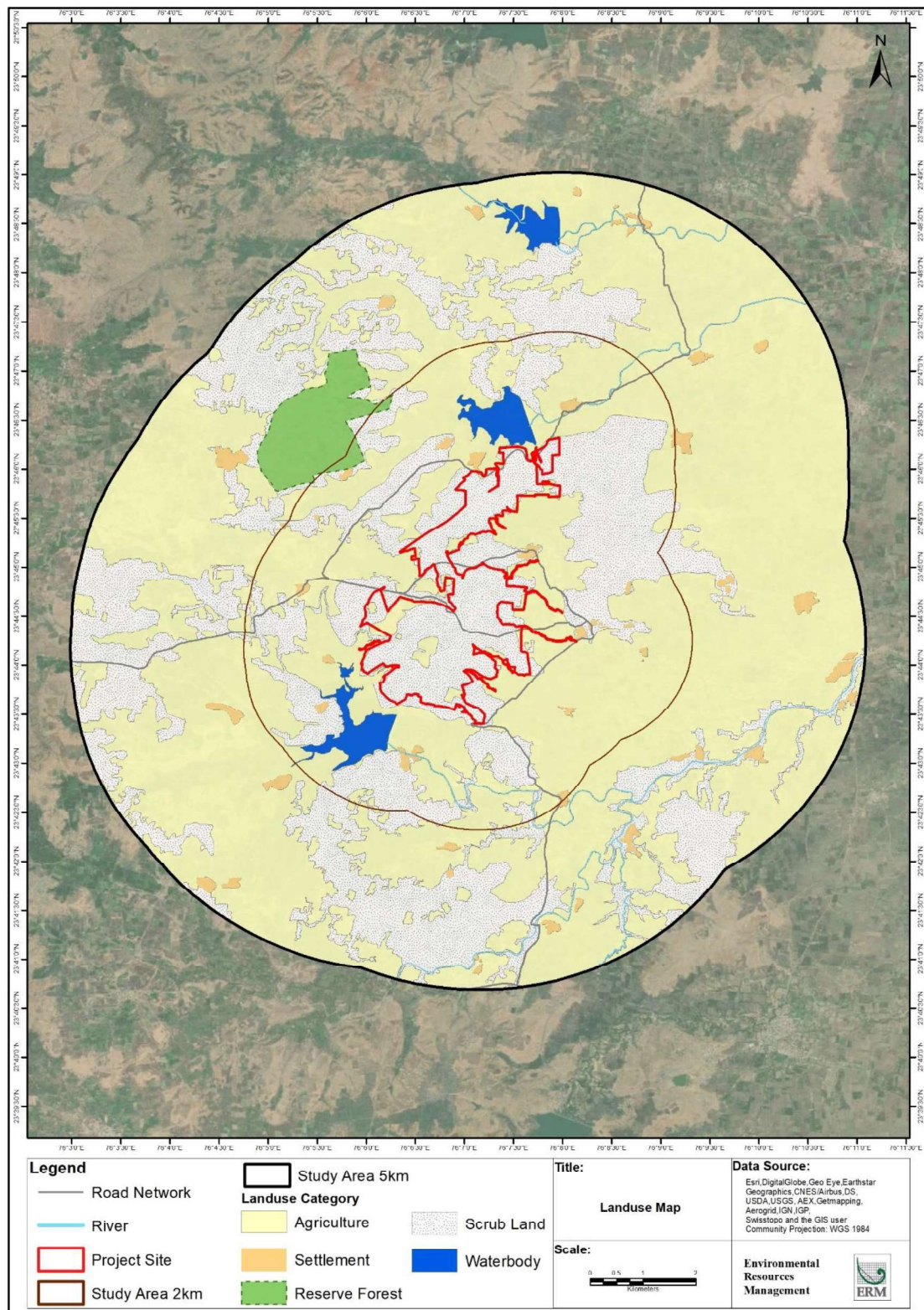
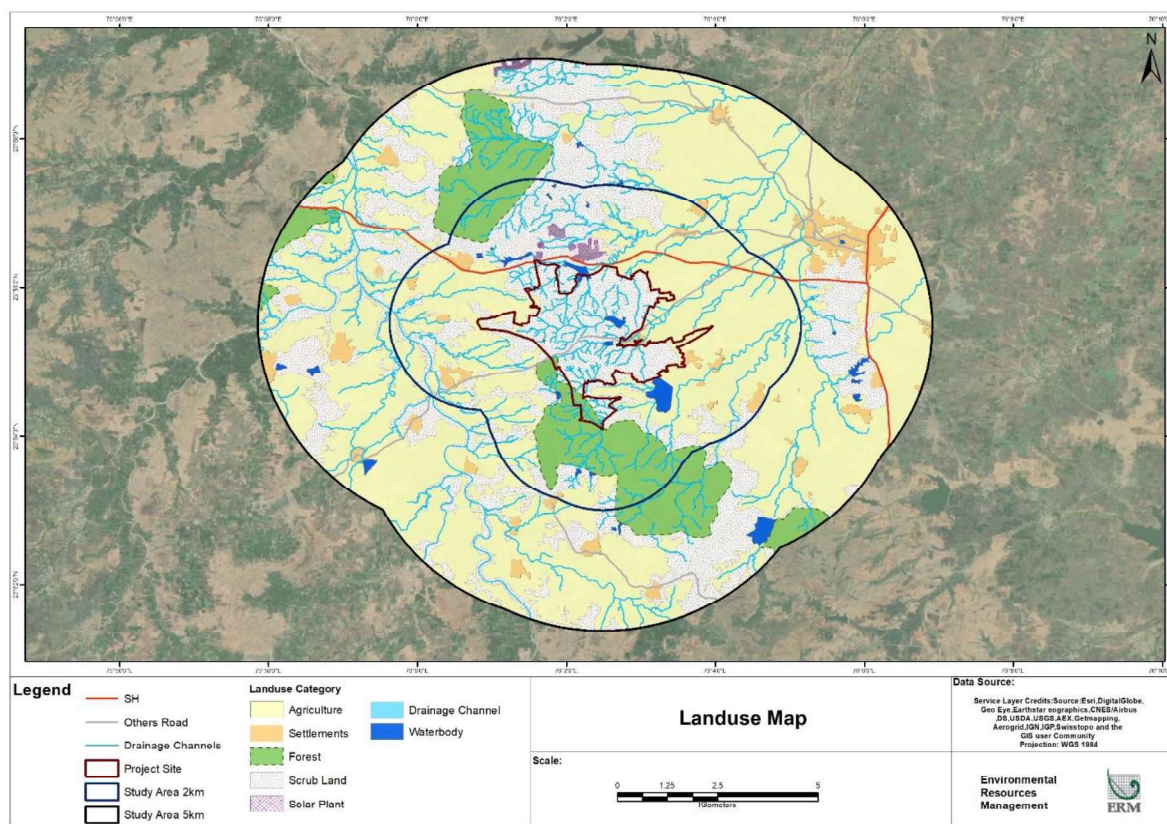


Figure 4.4 Land Use Map – Unit 5 (Susner) 5-km Study Area



The land use break-up of the Project Site foot print is given in **Table 4.4** and shown in **Figure 4.5** and Figure 4.6.

Table 4.4 Land use of Project Site Boundary

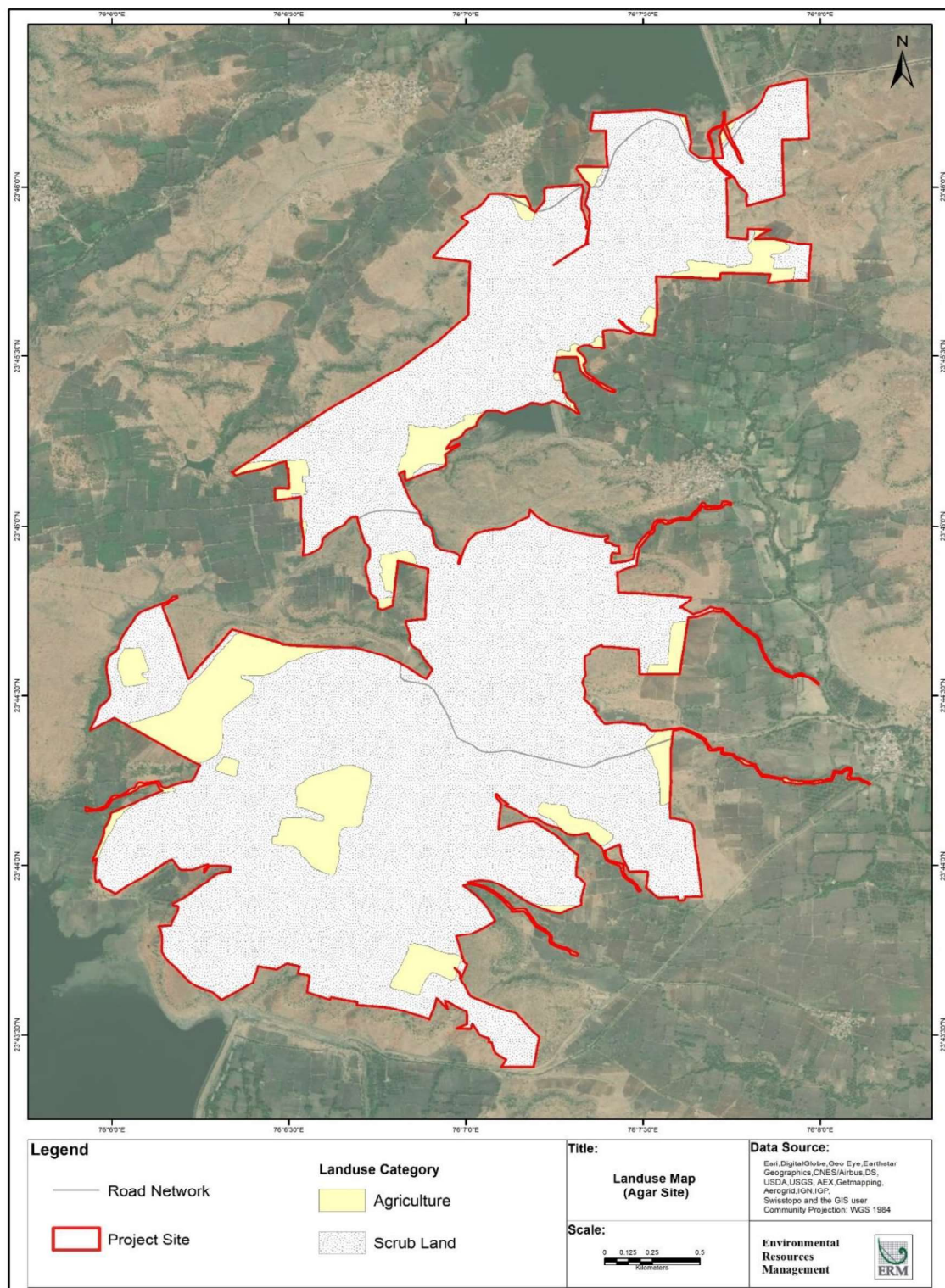
S. No.	Land use Type	Unit 4 (Agar)	Unit 5 (Susner)
		Area (in %)	Area (in %)
1.	Scrub Land	88.1	84.8
2.	Agriculture Land	11.6	6.5
3.	Forest	-	3.4
4.	Drainage Channel	-	3.0
5.	Settlements	-	0.5
6.	Waterbody	-	1.7
7.	Road Network	0.3	0.1
	Total	100.0	100.0

Source: GIS based assessment for the Project

The above table suggests that the Project Site footprint is almost scrubland (88% & 85%) followed by small patches of agriculture land (12% & 7%) at Unit 4 (Agar) and Unit 5 (Susner) Site. Besides, these

Sites also have small percentage of road network whereas drainage channel, forest and settlements exists only at Unit 5 (Susner) Site.

Figure 4.5 Land Use Map – Unit 4 (Agar) Site Boundary



Legend

- Others Road
- Drainage Channel
- Project Site

Landuse Category

- Agriculture
- Settlements
- Scrub Land
- Forest
- Solar Plant
- Drainage Channel
- Waterbody

Landuse Map (Susner Site)

Scale:

Data Source:

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus, USDA, USDA, USDA, AeroGRID, IGN, SGP, Swisstopo and the GIS User Community
Projection: WGS 1984

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The topography and slope information plays a vital role in understanding land use and runoff-recharge characteristics of the terrain. The topography of the Unit 4 (Agar) Site is undulating with elevation ranging from 404 m to 488 m above mean sea level (amsl). The slope of site is towards north east. The topographic highs were observed in the western parts of the Site. The topographic lows were observed mostly along the major stream which runs from west to east. The lowest elevation was observed in the eastern parts of the watershed, near the outlet of the stream.

The 5-km radius Digital Elevation Map (DEM) of the study area for Unit 4 (Agar) and Unit 5 (Susner) Sites are presented in **Figure 4.7** and **Figure 4.8** respectively.

Figure 4.7 Digital Elevation Map (DEM) of the Unit 4 (Agar) Site

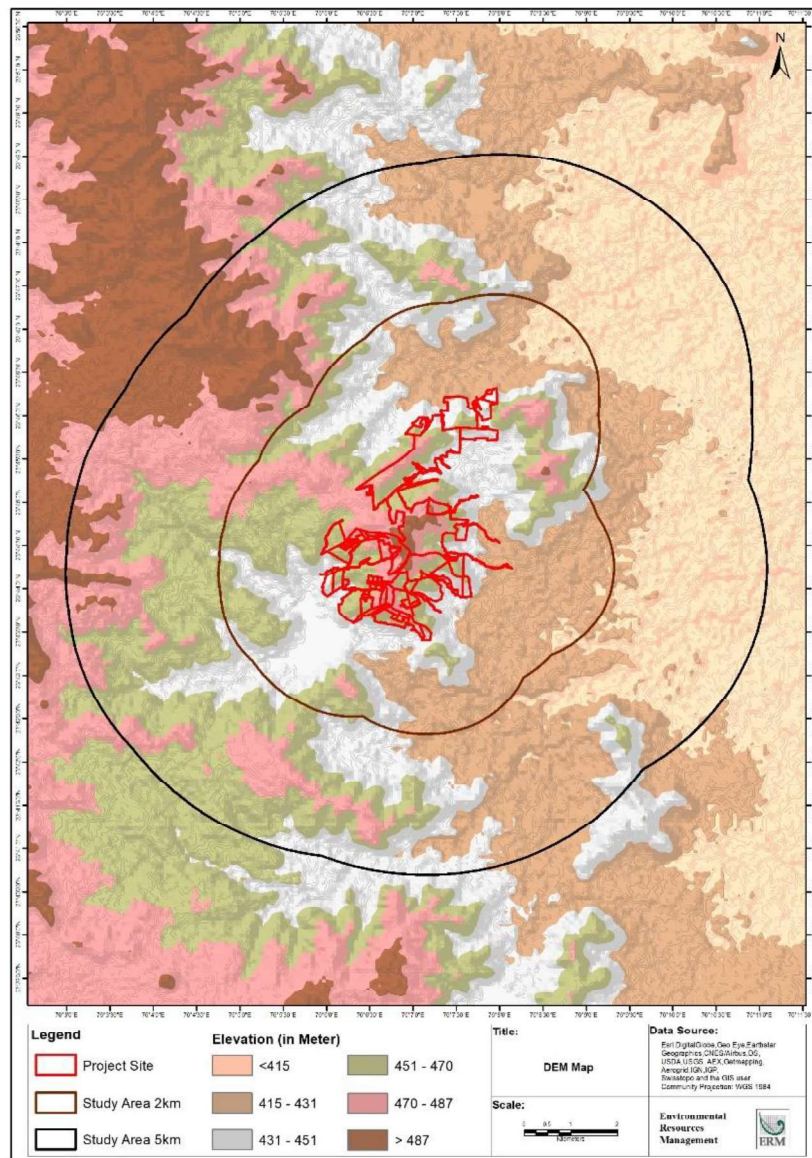
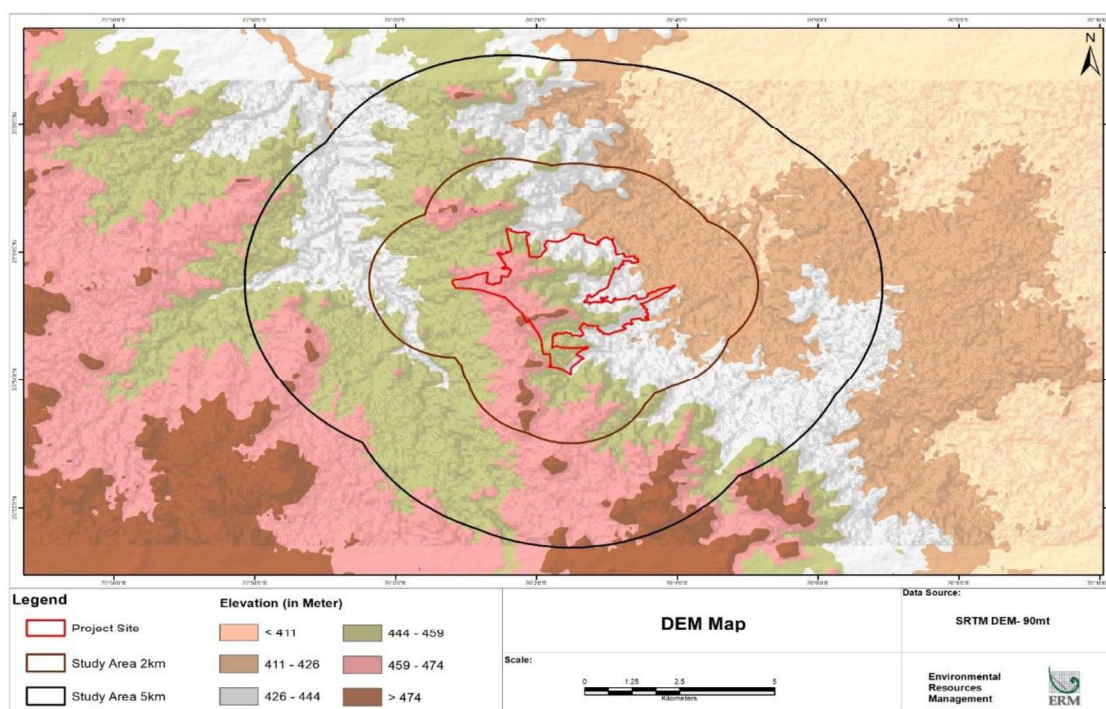


Figure 4.8 Digital Elevation Map (DEM) of the Unit 5 (Susner) Site

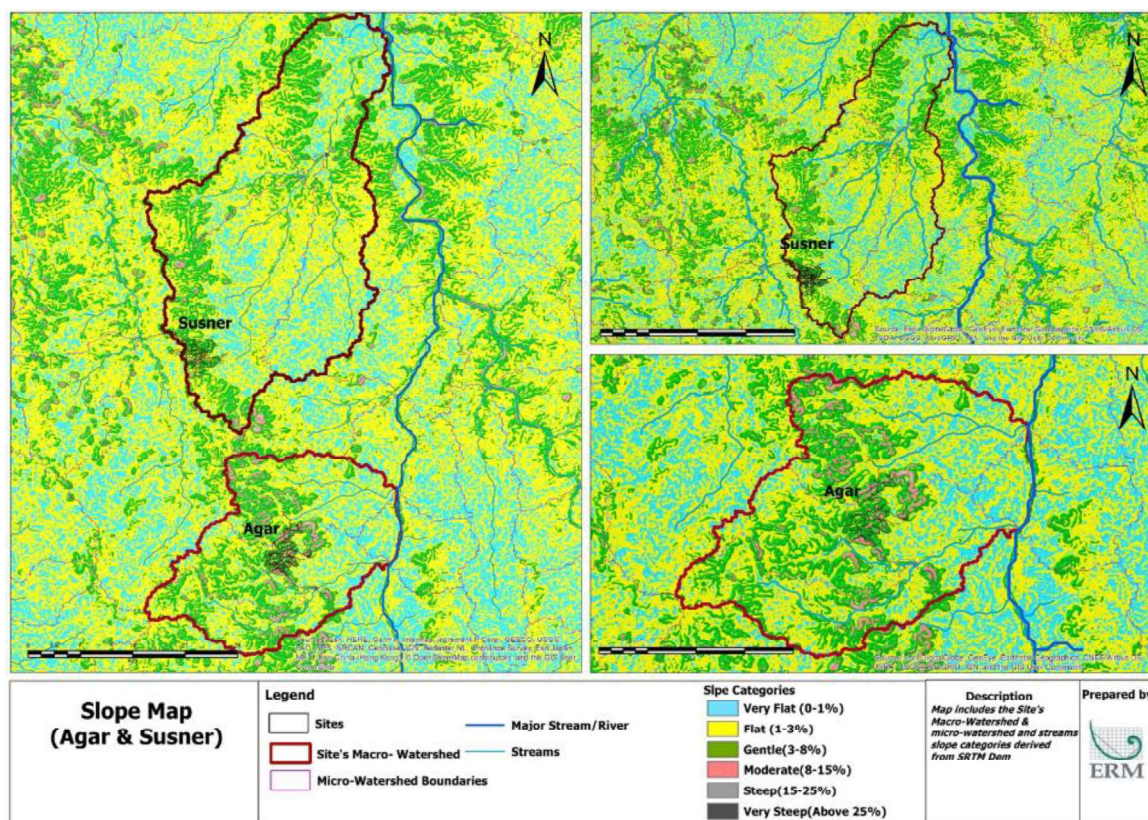


The slopes of watersheds were classified into following categories: very flat (0-1%), flat (0-1 %) gentle (3-8 %), moderate (8-15 %), steep (15-25 %) and very steep (>25 %). Slope map incorporating this classification is presented in **Figure 4.9**. Slope in the watershed of Agar and Susner Sites was observed to be under 8 % ranging from very flat to gentle category.

The steeper slopes in the watershed of Agar Site were observed along the north-western, south-western and central parts of the watershed. Slope in the Site area mainly ranged from 3- 8 % which was categorised as gentle. In comparison to slope in the watershed, the slope at Site was relatively steeper. However, gentler slope patterns generally facilitate lower runoff, higher infiltration and higher stagnation of water. Furthermore, these slopes would increase the flood risks in case of extreme precipitation.

The steeper slopes in the watershed of Susner Site were observed along the north-western, north-eastern and south-western periphery of the watershed. Slope in the Site area mainly ranged from 3- 8 % which was categorised as gentle. In comparison to slope in the watershed, the slope in the Site area was relatively steeper. However, gentler slope patterns generally facilitate lower runoff, higher infiltration and higher stagnation of water. Furthermore, these slopes would increase the flood risks in case of extreme precipitation.

Figure 4.9 Slope Map of the Site and Watershed



4.3.3 Geology and Geomorphology

4.3.3.1 Geology

The Chambal watershed region is a junction between the north-western lobe of the Vindhyan watershed and the south-eastern fringe of the Aravalli range such that the younger formations of the Vindhyan period have truncated and faulted against the Gwalior formation.

The north-western part comprises the intensely folded Archean formations while the south-eastern part is composed of horizontally reposing Vindhyan system. The Vindhyan of the southern part are covered by the Deccan Trap. In particular, the study region comprising of districts such as Neemuch, Agar and Shajapur is located in Malwa region of Madhya Pradesh and is underlain by rocks of Vindhyan Super Group (Pre-Cambrian) and the Deccan Traps (Upper Cretaceous to lower Eocene).

Table 4.5 presents the geology of the region.

Table 4.5 Stratigraphic succession of the Region

Age	Super Group	Member
Sub-Recent to Recent	Laterite, Quaternary	Alluvium, Laterite
Lower Eocene to Upper Cretaceous	Deccan Traps	Basaltic lava flow
Pre-Cambrian	Lower Vindhyan	Limestone and conglomerate

4.3.3.2 Geomorphology

Geomorphic features integrated with geology and hydrogeology controls the occurrence, movement and quality of groundwater. The geomorphological features of the Site's watershed were extracted

from National Remote Sensing Centre (NRSC) - Bhuvan services¹ and are presented in **Figure 4.10**

The Agar district lies on a part of Malwa plateau and are characterized by a typical Trappean geomorphology comprising extensive plain, low lying hills and hills clusters with gentle northerly slope. Western, south, south-eastern parts are highly undulated with broad flat topped hills, cluster terraces and isolated hills².

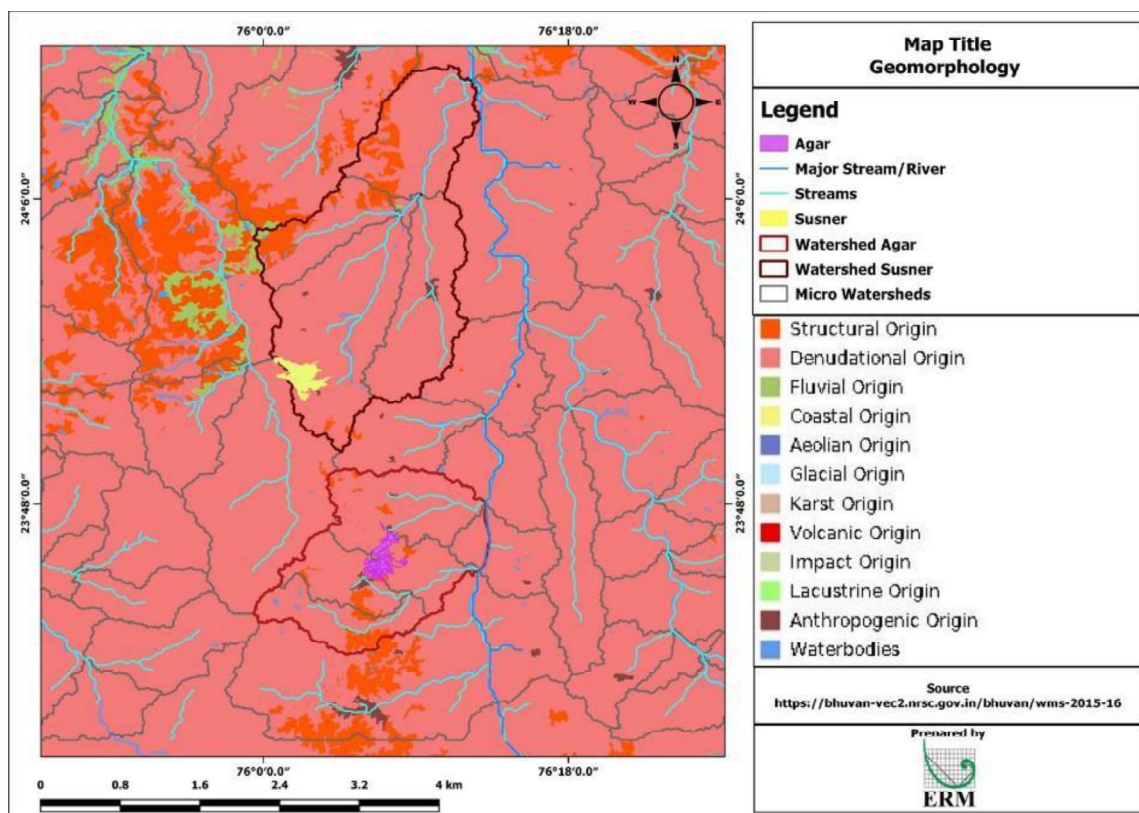
Most of the region around both the Sites (Susner and Agar) was observed to be under pediment complex of denudational origin with patches of structural origin in the south of Agar Site. Denudational origin features were reported along the flow of the major stream indicating their influenced on topography through weathering caused by the flow of water. Geomorphic features of structural origin were observed only in patches in both the watersheds- these topographic features were formed by the differential wearing of rocks and the deposition of the resulting debris under the influence of exogenic geomorphic forces. The geomorphology of the region is not supportive of groundwater recharge due to presence of denudational features in large parts of the watershed. This is likely to result in poor yield and limited scope for groundwater development in the watershed. However, existence of major fractures/lineaments/ faults might influence the groundwater yield.

Within the Site area, topography is mainly influenced by denudational features. The prospects of groundwater recharge and occurrence are anticipated to be low resulting in limited scope for groundwater development. Few lineaments were reported in the vicinity of Susner Site. These are developed generally due to tectonic stress and strain and provide an important clue on surface features that are responsible for infiltration of surface run off into sub-surface and movement/ storage of groundwater. Lineaments in the pediplain or valley fill are considered significant in groundwater prospects. Further, the flood plains along the river course are expected to have good groundwater prospects.

¹ http://bhuvan.nrsc.gov.in/bhuvan_links.php

² http://cgwb.gov.in/District_Profile/MP/Shajapur.pdf

Figure 4.10 Geomorphology Map of Site and Watershed



4.3.4 Soil Quality

The soil in the Agar district are of mixed type and there is no distinct boundary in between any two type of soils. There are three categories of soils identified in the district area – black cotton (cultivated areas), lateritic (plateau area) and alluvium soil (river bank areas).

4.3.4.1 Soil Quality Monitoring & Analysis

The soil characteristics within the study area, especially the physical quality and fertility of the soil have been characterized by analysing the soil sample collected from 6 locations within the study area. Table below provides details of soil sampling locations.

Table 4.6 Soil Sampling Location Details of Agar Solar Project

Location Code	Location	Unit	Zone	Easting (E)	Northing (N)	Type of land
SQ1	Pipaliya Kumhar	Unit 4 (Agar)	43Q	612781.50 m	2624265.39 m	Agricultural Field
SQ2	Karwa khedi		43Q	615108.63 m	2627126.08 m	Agricultural Field
SQ3	Kasai Dehariya		43Q	611112.40 m	2626695.34 m	Agricultural Field
SQ4	Umariya	Unit 6 (Susner)	43Q	606948.86 m	2644694.59 m	Agricultural Field
SQ5	Naharkheda		43Q	607236.16 m	2645073.83 m	Agricultural Field
SQ6	Palda		43Q	602629.04 m	2647765.41 m	Agricultural Field

The soil quality analysis results are presented in **Table 4.7** and described in the further subsections. Selected few parameters of the soil quality results (i.e., pH, EC) have been compared with standard soil classification as given in Handbook of agriculture, Indian Council of Agricultural Research, New Delhi.

Table 4.7 Soil Analysis Results of Agar Solar Project

S. N.	Parameter	Unit	SQ1	SQ2	SQ3	SQ4	SQ5	SQ6
1	Particle size distribution							
a	Sand	%	86	78.5	86.5	84.3	86.5	80.2
b	Silt	%	10.8	8.8	8.9	9.2	5.2	5.3
c	Clay	%	3.2	12.7	4.6	6.5	8.3	14.5
2	Texture	-	Loamy Sand	Sandy Loam	Loamy Sand	Loamy Sand	Loamy Sand	Sandy Loam
3	Bulk Density	g/cm ³	1.36	1.29	1.3	1.43	1.65	1.48
4	pH	-	7.15	7.75	7.24	7.57	6.5	7.54
5	Electrical Conductivity	mmhos/cm	0.248	0.374	0.624	0.489	0.083	0.534
6	Moisture Content	%	16.8	18.1	18.1	12.5	5.35	11
7	Cation Exchange Capacity	meq/100gm	43.5	87.2	110.6	61.2	37	71.7
8	SAR	-	4.24	7.06	11.3	3.4	6	9.9
9	Water Holding Capacity	%	53.7	69.5	77.4	71.3	30.8	51.9
11	Total Nitrogen	mg/kg	237.6	1225	1050.3	369.2	554.3	1122.3
12	Sulphate	mg/kg	35.8	54.8	81.3	33.3	16.3	69.4
13	Chloride	mg/kg	47.6	48.2	66.5	38.2	48.1	66.8
14	Sodium (Na)	mg/kg	348.4	590.9	930.8	331.8	430.7	803.9
15	Total Potassium (K)	mg/kg	128.7	1380.5	1759.2	471.7	BDL	502.3
16	Calcium (Ca)	mg/kg	7602.5	3788.1	6686.5	12159.5	511.5	6603.2
17	Magnesium (Mg)	mg/kg	1445.2	4000.2	1983.4	1035.8	1314.4	1760.9
18	Permeability	cc/gm	0.024	0.001	0.013	0.005	0.035	0.03

4.3.4.2 Discussion of Results

Texture and Electrical Conductivity: Soil texture is an important soil characteristic that could influence water retention capacity, aeration, drainage, and susceptibility to erosion, which drives crop production and management. Samples collected from the monitoring locations exhibited two types of soil texture viz. loamy sand and sandy loam. Electrical conductivity is used to estimate the soluble salt concentration in soil, and is commonly used as a measure of salinity. The electrical conductivity (EC) of soil samples were recorded to be within a range of 0.083 mmhos/cm to 0.624 mmhos/cm which can be assessed to be average for germination.

pH: Generally, soil pH in the range of 6.5-7.0 is considered to be best suited for growing most crops. The pH level in soil samples was recorded to be varying from 6.5 to 7.75 indicating neutral to slightly alkaline pH.

Sodium Adsorption Ratio (SAR): The sodicity¹ hazard of soil, which affects water infiltration in the soil is expressed as the Sodium Adsorption Ratio (SAR). Soil with high level of exchangeable sodium may cause dispersion of soil particles leading to the replacement of major cations (calcium and magnesium) adsorbed on the soil. This could possibly lead to deterioration of soil structures and water infiltration problems. The SAR value in the soil was observed to be 3.4 – 11.3 (agricultural land parcel).

Total Nitrogen: Value of total nitrogen in the soil samples ranges from 237.6 mg/kg to 1,225 mg/kg (agricultural land).

Total Potassium: Value of total potassium in the samples collected ranges from BDL to 1,759.2 mg/kg.

Water holding capacity: Water Holding Capacity in the samples ranges from 30.8-77.4%.

4.3.5 Hydrogeology

Deccan trap basaltic rock occupies the large parts of the study area. It consists of lava flows wherein a typical flow unit comprises of a lower dense massive horizon passing upwards into a vesicular, amygdaloidal or jointed basalt. At places, top of individual flows are marked by reddish brown clayey material (Red bole) of few cm to 5 m thickness. Usually the red- bole and vesicular basalt are prone to weathering and give rise to extensive black cotton soil. There are sixteen basaltic flows which were identified by Geological Survey of India in a vertical column of 275 m between altitude of 335 to 610 m amsl) in entire Shajapur district. The various flows of basalts are at times inter-bedded and fossiliferous inter trappen (CGWB Shajapur)²

- Ground Water movement occurs in different lava flows driven by its porosity (primary and secondary). In weathered and vesicular rocks, primary porosity drives the flow while secondary porosity becomes a significant driver in jointed and fractured basalt unit. Alternating sequence of pervious and compact horizon function as a multi aquifer system. Shallow ground water occurs in the weathered and vesicular, jointed and fractured zones of basaltic flows. The occurrence of shallow groundwater may range from unconfined to semi-confined to confined conditions depending on the rock properties vis-à-vis the structural system.
- Groundwater was also reported at shallow depths in alluvium along Lakhunda, Kalisindh, Newaj and Parvati river courses.
- Laterite development on basalt is not extensive except in and around Agar town where the traps have undergone maximum degree of leaching (CGWB, Shajapur). In general, the occurrence of laterites was reported in patches in different parts of the district.

The groundwater aquifers at both Units, were reported in discontinuous basalt formations (weathered and intensely fractured) with yield ranging from 0 to 149 m³/day in weathered and 12 to 600 m³/day in intense fractured basalt. The variability in the yield may largely be due to the variability in the thickness of weathered basalt and density of fractures and joints. Further, it was reported that the Upper Chambal Sub-Watershed in Malwa region of Madhya Pradesh is one of the most water deficit hydrological unit in India despite low irrigation development (Mukesh Chauhan, 2013)³.

4.3.6 Hydrology

Based on the geographical location of the Project site, the corresponding drainage network and watersheds (major and micro) were delineated using the Shuttle Radar Topography Mission's (SRTM's)⁴ Digital Elevation Model (DEM) having a 30 m resolution. Based on the DEM, ERM

¹ Sodidity is a term given to the amount of Sodidity is a term given to the amount of sodium held in a soil. Sodium is a cation (positive ion) that is held loosely on clay particles in soil. It is one of many types of cations that are bound to clay particles in soil.

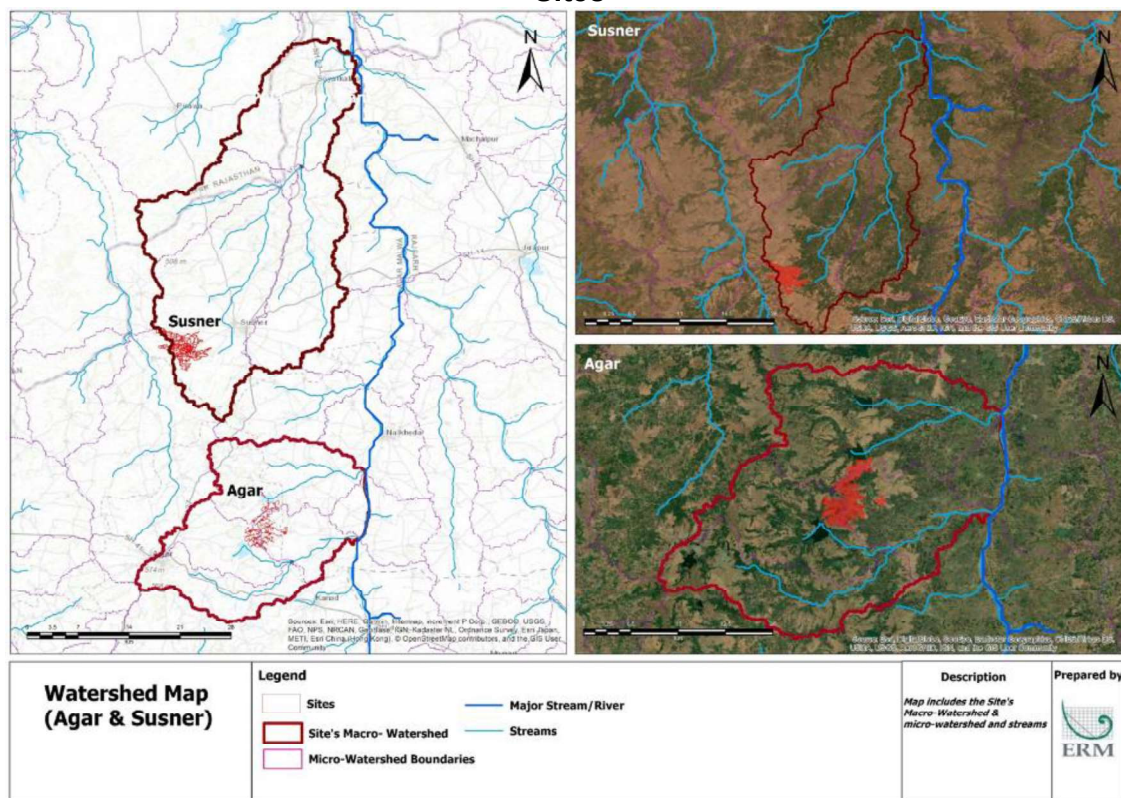
² http://cgwb.gov.in/District_Profile/MP/Shajapur.pdf

³ <http://www.iwrs.org.in/journal/april2013/5apr.pdf>

⁴ <https://earthexplorer.usgs.gov/>

identified key topographic features in the study area such as topographic highs and lows and natural drainage network in the area. These were used to delineate the catchment area of the micro-watershed in which the Site is located. The base map of the watershed of the Unit 4 (Agar) and Unit 5 (Susner) Sites is presented in **Figure 4.11**. The base map indicates that Susner Site is located in the south-western in the south-western part while the Agar Site is located in the central part of their respective catchments.

Figure 4.11 Base Map of Watershed of the Unit 4 (Agar) and Unit 5 (Susner) Sites



4.3.6.1 Drainage

The stream network in both watersheds is dendritic. Based on the topographical conditions, the general surface water flow direction in the Unit 4 (Agar) Site's watershed was anticipated from west to east, whereas, the general surface water flow direction in the Unit 5 (Susner) Site's watershed was anticipated from south-west to north-east. Both the Sites are located at a relatively higher elevation compared to the remaining parts of their respective watershed indicating the likelihood of drainage of stagnant water during the rainy season and hence reducing the risk of inundation at the Site.

During site visit, the presence of water storage structures such as artificial water bodies and reservoirs in and/or around both the Units was observed. Drainage maps for the Agar and Susner sites are provided in **Figure 4.12** and **Figure 4.13** respectively.

Figure 4.12 Drainage Map of Unit 4 (Agar) Site

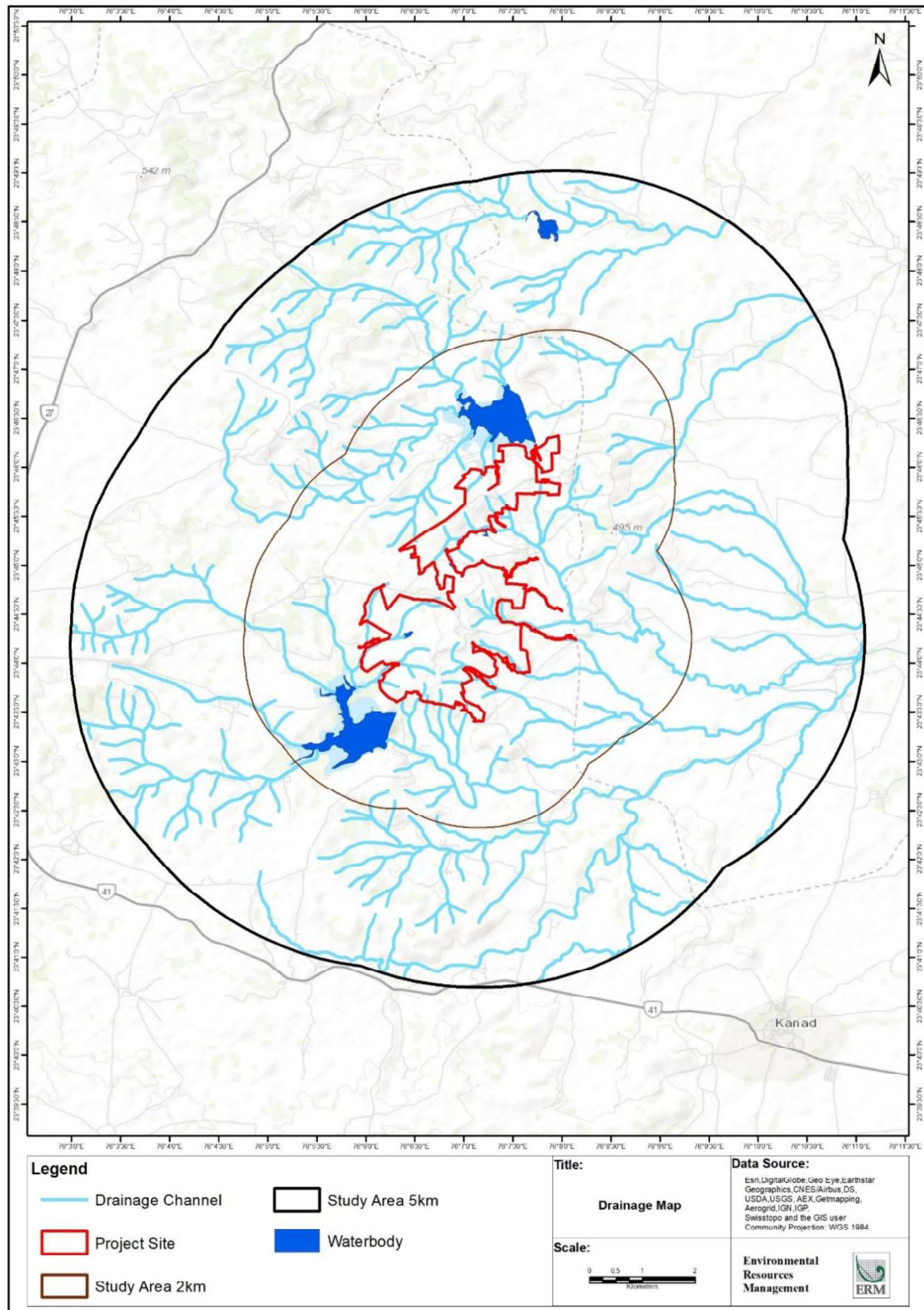
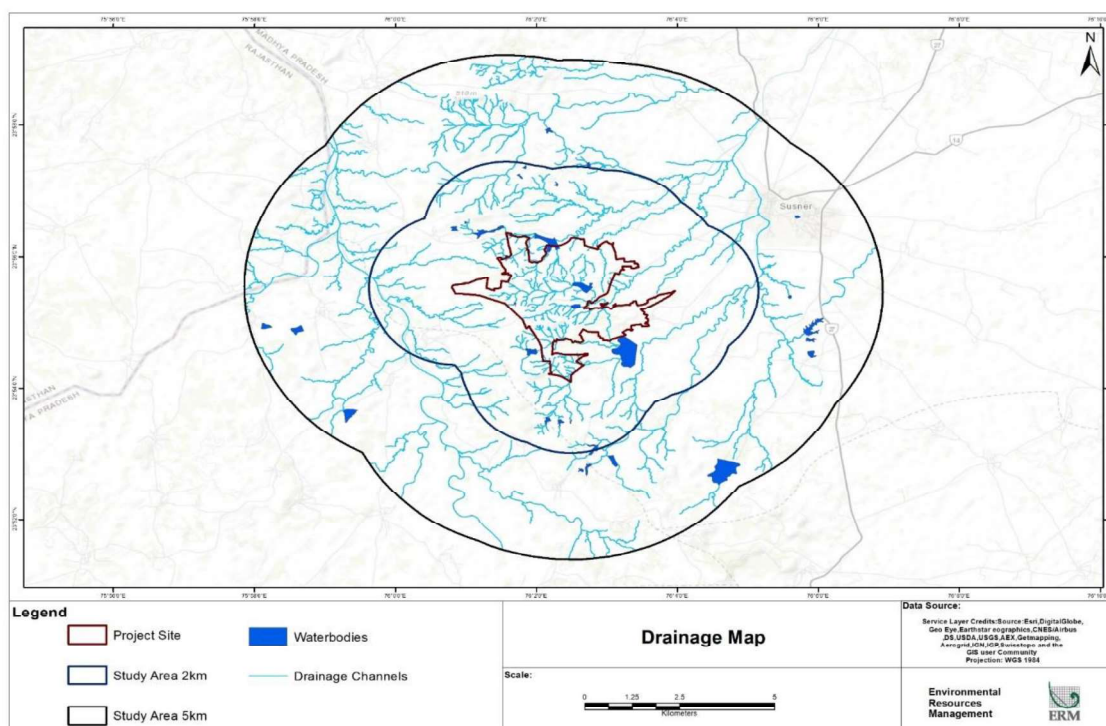


Figure 4.13 Drainage Map of Unit 5 (Susner) Site



4.3.7 Water Resources - Availability and Quality

4.3.7.1 Groundwater Resources

The groundwater aquifers at both Units, were reported in discontinuous basalt formations (weathered and intensely fractured) with yield ranging from 0 to 149 m³/day in weathered and 12 to 600 m³/day in intense fractured basalt. The variability in the yield may largely be due to the variability in the thickness of weathered basalt and density of fractures and joints. Further, it was reported that the Upper Chambal Sub-Watershed in Malwa region of Madhya Pradesh is one of the most water deficit hydrological unit in India despite low irrigation development (Mukesh Chauhan, 2013)¹. As per document of CGWB, 2013 ⁽²⁾ (http://cgwb.gov.in/District_Profile/MP/Shajapur.pdf).

Ground Water Levels

Variation of ground water levels is an important component of hydrological cycle because it is a physical reflection of aquifer system. As the change in ground water level is directly related to ground water balance and its continuous records provide direct information of sub surface geo environmental changes due to withdrawal of ground water. To monitor the seasonal & annual fluctuation, change in quantity and quality of ground water, CGWB has established. Ground water monitoring wells and piezometers in entire Shajapur district. The monitoring of ground water levels in these wells is being carried out by CGWB during the month of May, August, November and January. High frequency ground water level monitoring is being carried out at many places deep piezometers using automatic water level recorders.

Depth to Water level

Depth to water (DTW) levels in pre-monsoon (May) of 2016 varied from 5 m to 20 m in the district. DTW during monsoon (August) of 2016 varied between <2 m to 5m and between 2m to 20 m during

¹ <http://www.iwrs.org.in/journal/april2013/5apr.pdf>

(2) Earlier, Agar District was part of Shajapur District, therefore this document is referred for ground water data in Agar District.

post monsoon (November) of 2016 while it remains same in winter (January) of 2017 between 5 m to 20 m in the district.

Decadal Water level fluctuations

The ground water levels of May 2016 were compared with the 10 years May (2006-2015) average ground water levels to decipher the long-term changes in the ground water regime. The long term behaviour of water levels of the phreatic zone using the average water level data of last ten years shows that there is a general rising trend of up to 0.20 m/year in the entire District during both pre monsoon (May 2007 to May 2016) and post monsoon (Nov 2007 to Nov 2016). The rising trend in pre monsoon indicates that either the developmental activities have reduced, or that, recharge due to sources other than the rainfall, such as applied irrigation has increased. The rising trend in post monsoon shows that additional water is being stored in the aquifer, due either to increased rainfall or to seepage through applied irrigation¹.

4.3.7.2 Water Availability

Groundwater was reported as the primary source of water in Unit 4 (Agar) Site and its surrounding area with some seasonal streams contributing for domestic use as secondary source of water. At the Unit 5 (Susner) Site, groundwater was reported as the primary source while surface water bodies in form of lakes and ponds contribute as the secondary source. Water availability was reported in some of these water bodies at Susner Site all through the year. Some of the surface water bodies and groundwater structures identified at Susner and Agar Sites were presented in **Figure 4.14**. Groundwater bore wells were also reported at Susner and Agar Sites. However, their locations and depth information was not available for review.

Water availability at the watershed/ study area of Subject Site was evaluated using the online water risk assessment tool Aqueduct Water Risk Atlas developed by World Resource Institute (WRI)² and the India Water Tool (IWT). A total of eight (8) parameters were considered to evaluate water availability. These parameters are Baseline Water Stress (BWS); Baseline Water Depletion (BWD); Inter Annual Variability (IAV); Seasonal Variability (SV); Availability Index (AI); Total Annual Rainfall (TAR), Hydrogeology, and Block Categorisation (BC). The water risks were evaluated and ranked on a traffic-light based risk matrix, categorising water risk from each parameter into 'high', 'medium', and 'low'. **Table 4.8** presents the original and new classification of water risk indicators.

¹ Groundwater Year Book, Madhya Pradesh (2016-2017), Central Ground Water Board, North Central Region, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India, January 2018

² Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated Decision Relevant Global Water Risk Indicators." Technical Note. Washington, DC: World Resources Institute. Available online at: <https://www.wri.org/publication/aqueduct-30>

Figure 4.14 Map showing water sources- Unit 4 (Agar) and Unit 5 (Susner)

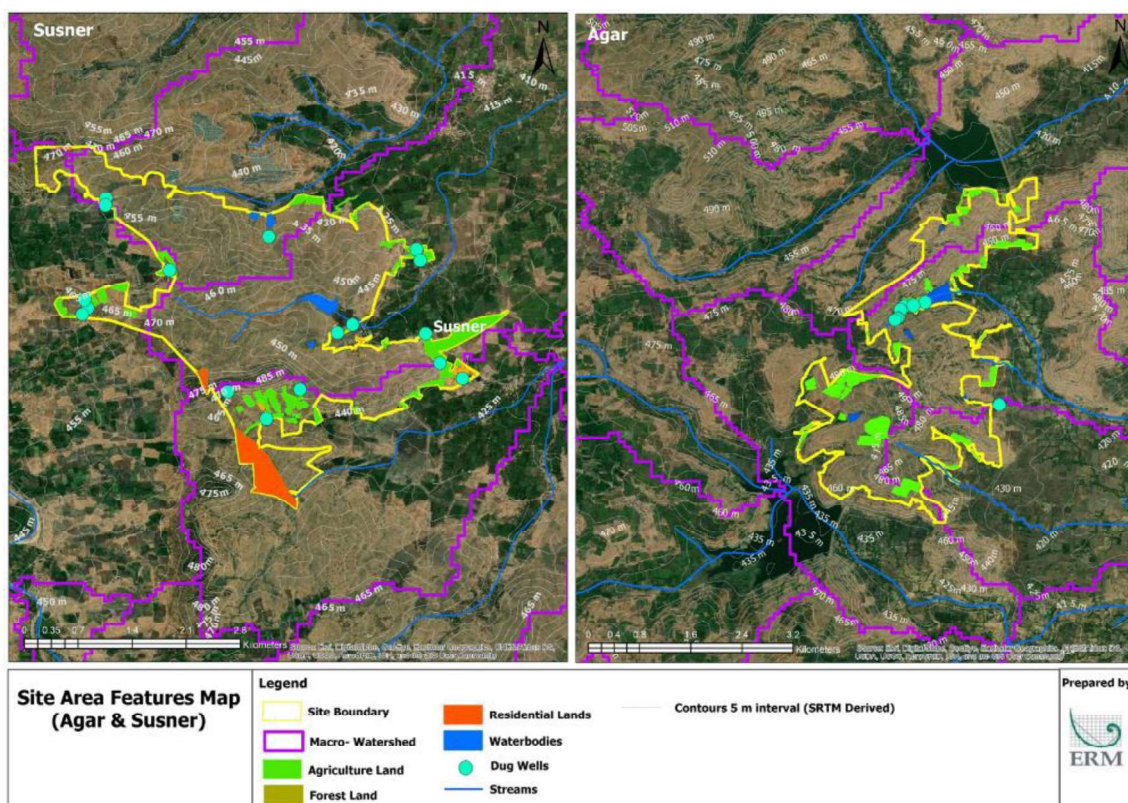


Table 4.8 Classification of Water Risk Indicators

Sr. No.	Water Risk Indicator	Original Categorization ⁽¹⁾	Modified Categorization ⁽²⁾
1	Baseline Water Stress (BWS)	Low: <10%	Low: <20%
		Low-Medium: 10-20%	Medium: 20-40%
		Medium-High: 20-40%	High: >40%
		High: 40-80%	
		Extremely High: >80%	
2	Baseline Water Depletion (BWD)	Low: <5%	Low: <5%
		Low-Medium: 5-25%	Medium: 5-25%
		Medium-High: 25-50%	High: >25%
		High: 50-75%	

(1) Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated Decision Relevant Global Water Risk Indicators."

Technical Note. Washington, DC: World Resources Institute. Available online at:

India Water Tool

(2) Modified by ERM

Sr. No.	Water Risk Indicator	Original Categorization ⁽¹⁾	Modified Categorization ⁽²⁾
		Extremely High: >75%	
3	Inter Annual Variability (IAV)	Low: <0.25	Low: <0.25
		Low-Medium: 0.25-0.5	Medium: 0.25-0.5
		Medium-High: 0.5-0.75	High: >0.5
		High: 0.75-1	
		Extremely High: >1	
4	Seasonal Variability (SV)	Low: <0.33	Low: <0.33
		Low-Medium: 0.33-0.66	Medium: 0.33-0.66
		Medium-High: 0.66-1	High: >0.66
		High: 1-1.33	
5	Availability Index (AI)	Extremely Low	High
		Low	
		Low-Medium	
		Medium-High	Medium
		High	Low
		Extremely High	
6	Total Annual Rainfall (TAR)	Low (0-708 mm/year)	High
		Low-Medium (709 -1104 mm/year)	Medium
		Medium (1105-1500 mm/year)	
		Medium-High (1501-1896mm/year)	Low
		High (1896+ mm/year)	
7	Hydrogeological Map (HM)	>40 (Unconsolidated)	Low
		25-40 (Unconsolidated)	
		10-25 (Unconsolidated)	Medium

Sr. No.	Water Risk Indicator	Original Categorization ⁽¹⁾	Modified Categorization ⁽²⁾
		<10 (Unconsolidated)	
		1-25 (Consolidated/semi-consolidated)	High
		1-10 (Consolidated/semi-consolidated)	
		1-5 (Consolidated/semi-consolidated)	
		<1 (Hilly areas)	
8	Block Categorisation (BC) ¹	Safe	Low
		Semi-Critical	
		Critical	Medium
		Over-Exploited	High

The assessment against these parameters is provided in **Table 4.9**.

¹ The ground water resources are assessed in units, i.e., blocks/ talukas/ mandals/ watersheds. The blocks are generally be of the same size (or lesser) as the Talukas. These assessment units are categorized for ground water development based on two criteria - a) stage of ground water development, and b) long-term of pre and post monsoon water levels. The groundwater resources are typically assessed by CGWB (Central Ground Water Board) and categorized for groundwater development based on two (2) criteria:

- Stage of groundwater development; and
 - Long-term trend of pre- and post-monsoon water levels
- The long-term groundwater level trends are computed generally for a period of ten (10) years. Based on the above, groundwater resource units are typically divided into 'Notified' and 'Non-notified' areas. The Non-notified areas are further divided into the following categories:
- 'Safe' areas which have ground water potential for development;
 - 'Semi-critical' areas where cautious groundwater development is recommended;
 - 'Critical' areas and 'Over-exploited' areas, where there should be intensive monitoring and evaluation and future ground development will be linked with water conservation measures.

The details of criteria for categorization of assessment units are provided in the table below.

Criteria for groundwater categorisation				
Serial No.	Stage of Groundwater Development	Significant Long-term Decline		Categorization
		Pre-monsoon	Post-monsoon	
1.	<= 70%	No	No	Safe
2.	>70% and <=90%	No	No	Safe
		Yes/No	No/Yes	Semi-critical
3.	>90% and <=100%	Yes/No	No/ Yes	Semi-critical
		Yes	Yes	Critical
4.	>100%	Yes/No	No/Yes	Over-Exploited
		Yes	Yes	Over-Exploited

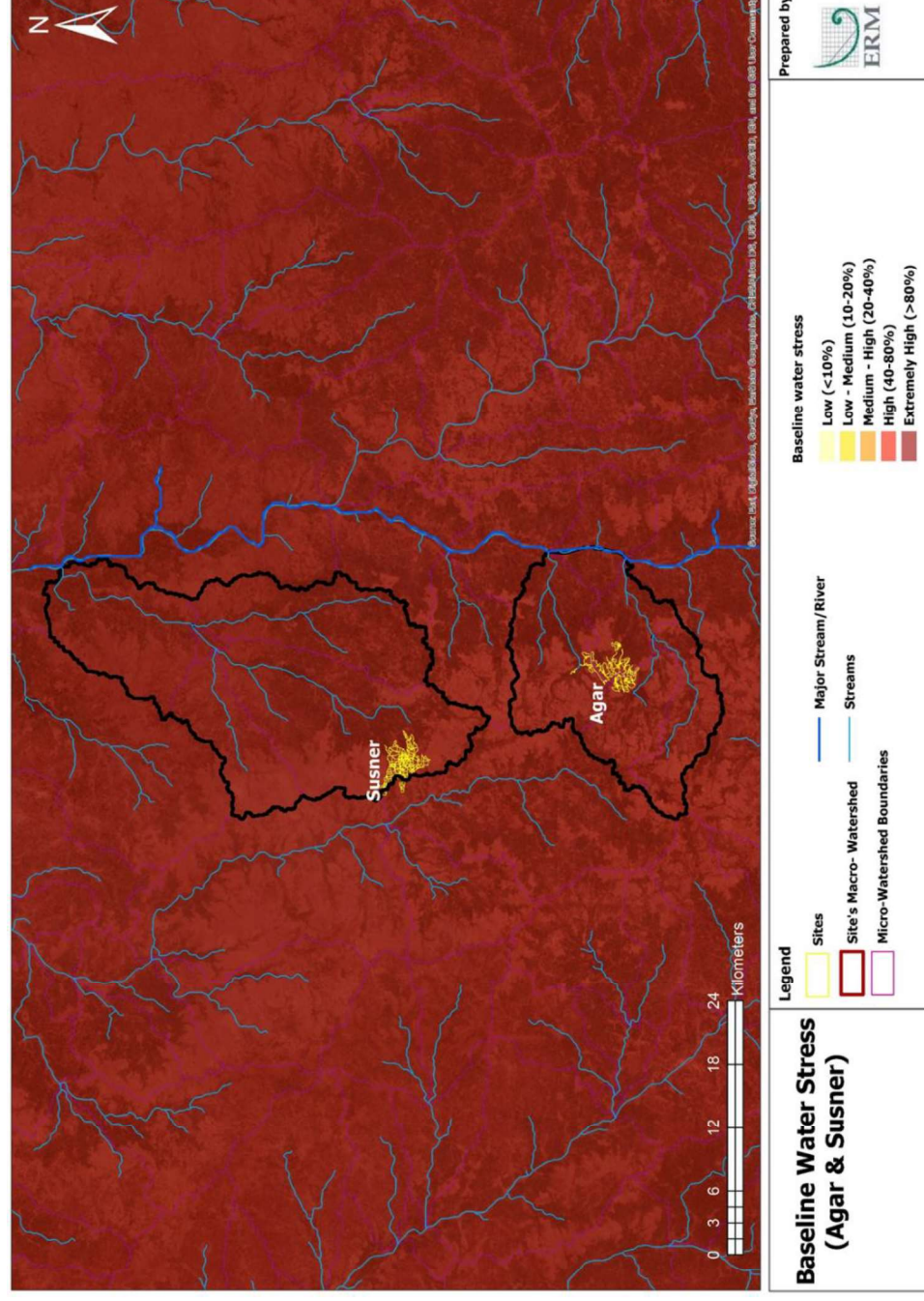
Table 4.9 Parameters included to assess water availability

S. No.	Parameter	Definition	Analysis
1	Baseline Water Stress (BWS) <i>Aqueduct</i>	Baseline water stress is defined as the ratio of the total annual water withdrawals to the total available annual water renewable supply, accounting for upstream consumptive use. Higher value indicate more competition among users.	BWS map is presented in Figure 4.15 . This map, originally developed for the world, also captures baseline water stress for the Subject Sites. This map was developed based on BWS at the watershed- level for different regions of the world. The Subject Site fall in the region of extremely high baseline water stress. This indicates High risk of water stress in Susner and Agar Site areas.
2	Baseline Water Depletion (BWD) <i>Aqueduct</i>	Baseline water depletion measures the ratio of total water consumption to available renewable water supplies. Total water consumption includes domestic, industrial, irrigation and livestock consumptive uses. Available renewable water supplies include surface and groundwater supplies and considers the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate larger impact on the local water supply and decreased water availability for downstream users.	BWD map is presented in Figure 4.16 . Both the Sites (Susner and Agar) fall in the region of high baseline water depletion indicating High risk of depletion.
3	Inter Annual Variability (IAV) <i>Aqueduct</i>	It indicates the variation in water supply from year to year.	Inter Annual Variability (IAV) map is presented in Figure 4.17 . This map, originally developed for the world, also captures IAV for both the Sites and its watershed. Both the Sites fall in the region of 'medium to high' IAV. This indicates High risk from inter-annual variability.
4	Seasonal Variability (SV) <i>Aqueduct</i>	Seasonal variability indicates variation in water supply between months of the year.	SV map is presented in Figure 4.18 . This map, originally developed for the world, also captures SV for subject Sites located in Susner and Agar. Both the Sites fall in the region of medium-high seasonal variability indicating non-uniform availability of water supply over different month/seasons in a year. Hence, the water risk from seasonal variability was estimated to be High .
5	Availability Index (AI) <i>India Water Tool</i>	This indicator – the Normalised Difference Water Index (NDWI)- is a remote sensing derived index estimating surface water availability by recording water level in open surface water. Positive values are typically open water areas and negative values are non-water features (i.e. terrestrial vegetation, bare soil etc.). Source: National Aeronautics and Space Administration and U.S. Geological Survey, 2001-2016; Data processed with the support of the Earth Genome	AI map for both the Sites is presented in Figure 4.19 . Both the Sites (Susner and Agar) fall in the region of low to medium availability index indicating relatively lower availability of surface water. This indicates High risk for surface water availability in the area.
6	Total Annual Rainfall (TAR) <i>India Water Tool</i>	This indicator is the arithmetic average of the annual rainfall recorded at all Meteorological stations under each district. Source: India Meteorological Department, 2004-2013 Unit: mm	TAR map is presented in Figure 4.20 . The Total Annual Rainfall Map indicates 'low to medium' annual rainfall at both the Site regions which is indicative of low replenishment of water in surface and groundwater reservoirs. The risk of water availability is estimated to be High .
7	Hydrogeological Map <i>India Water Tool</i>	The indicator gives the broad types of geological formations – Unconsolidated, Semi-consolidated and Consolidated - that inform the groundwater potential and control the hydraulics of groundwater. This is a relatively qualitative estimate based on the tentative water yielding potential of the geological unit and does not include the groundwater availability in the region. Source: Central Ground Water Board, 2011	Hydrogeological map (HM) for the Subject Sites is presented in Figure 4.21 . The map provides information on the aquifer yield of hydrogeological formations in the regions where the Site is located. Both the Sites are located in aquifers with 'low' groundwater yield (1-5 %) indicating lower possibility of water availability and hence has a High likelihood of groundwater risk.
8	Block Categorisation <i>India Water Tool</i>	The ground water resources are assessed in units, i.e. blocks/talukas/mandals/watersheds. These assessment units are categorized for ground water development based on two criteria - a) stage of ground water development, and b) long-term of pre and post monsoon water levels. The long term ground water level trends are computed generally for the period of 10 years. The significant rate of water level decline are taken between 10 to 20 cm per year depending upon the local hydrogeological conditions. There are four categories, namely - 'Safe' areas which have ground water potential for development; 'Semi-critical' areas where cautious groundwater development is recommended; 'Critical' areas; and 'Over-exploited'	Block Categorisation (BC) data for Agar and Susner blocks is summarised below for the years 2004, 2009, 2011 and 2017. The category provides an understanding of the overall status of groundwater in the block. As per the latest data available for 2017, Susner is categorised as 'over-exploited' block indicating high risk of groundwater in the area as groundwater development in the region is relatively high. No data was available from 2017 survey for Agar block. In such a case, groundwater block categorisation data for 2011 was reviewed indicating 'critical' categorisation of the block in terms of groundwater development and depletion. Hence, the risk of groundwater availability in Agar block was considered as high .

S. No.	Parameter	Definition	Analysis				
		areas, where there should be intensive monitoring and evaluation and future ground development be linked with water conservation measures.	Block Name	2004 Block Category	2009 Block Category	2011 Block Category	2017 Block Category ¹
			Susner	Overexploited	Overexploited	Overexploited	Overexploited
			Agar	Semi-critical	Critical	Critical	No data

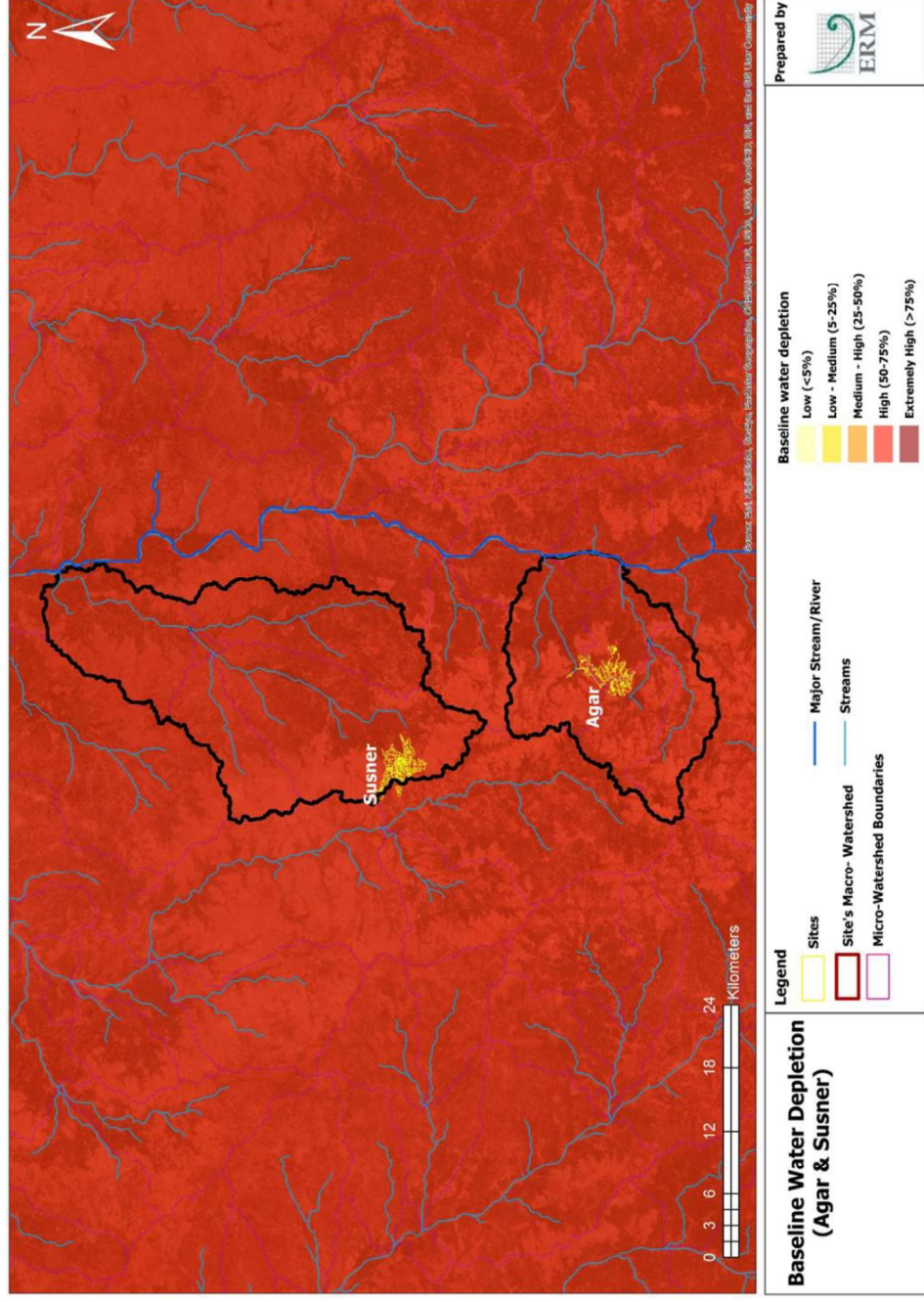
¹ <http://cgwb.gov.in/GW-Assessment/GWRA-2017-National-Compilation.pdf>

Figure 4.15 1Baseline Water Stress Map of the Project Sites and Watershed



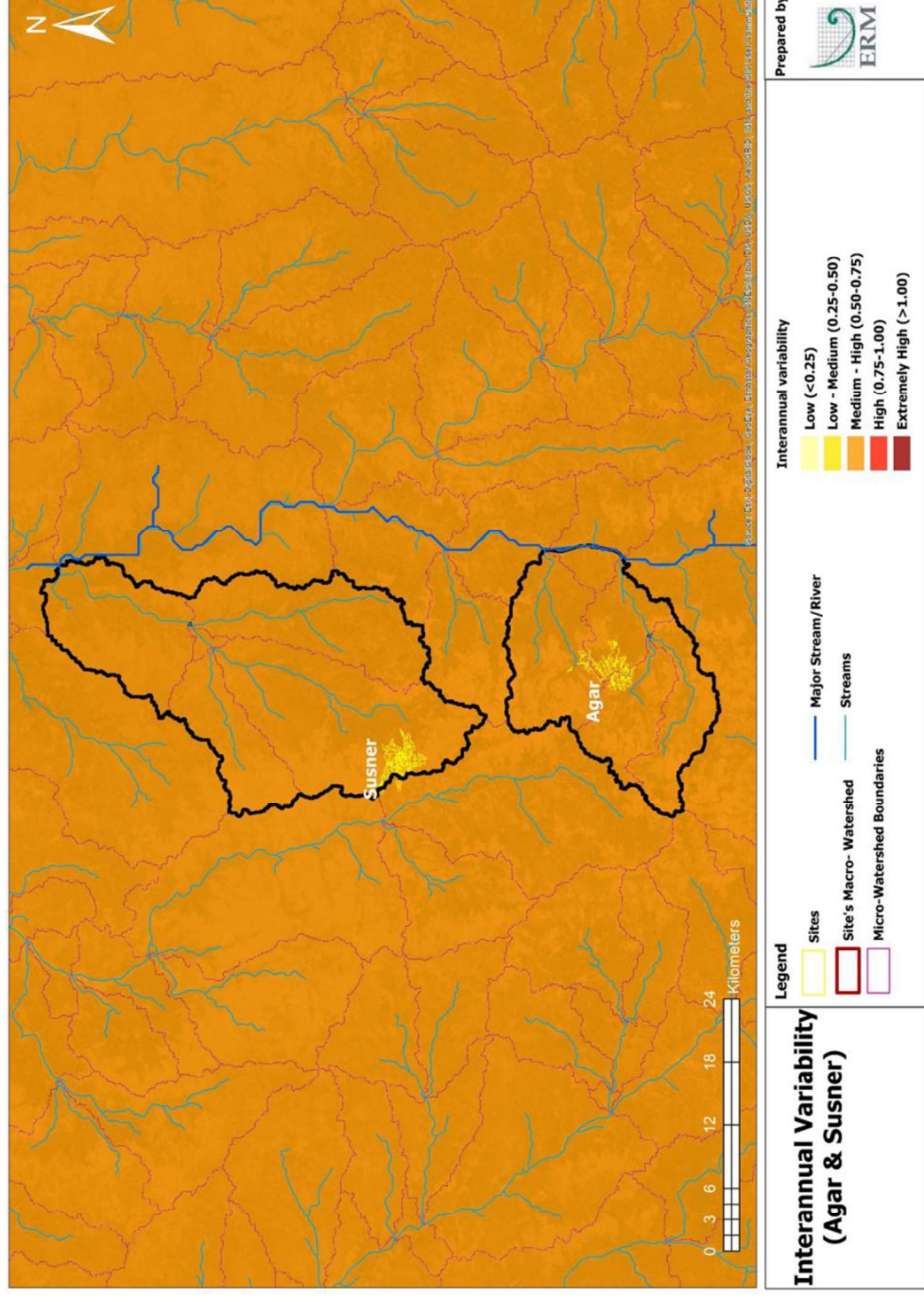
Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. “Aqueduct 3.0: Updated DecisionRelevant Global Water Risk Indicators.” Technical Note. Washington, DC: World Resources Institute. Available online at: <https://www.wri.org/publication/aqueduct-30>

Figure 4.16 Water Depletion Map of the Project Sites and Watershed



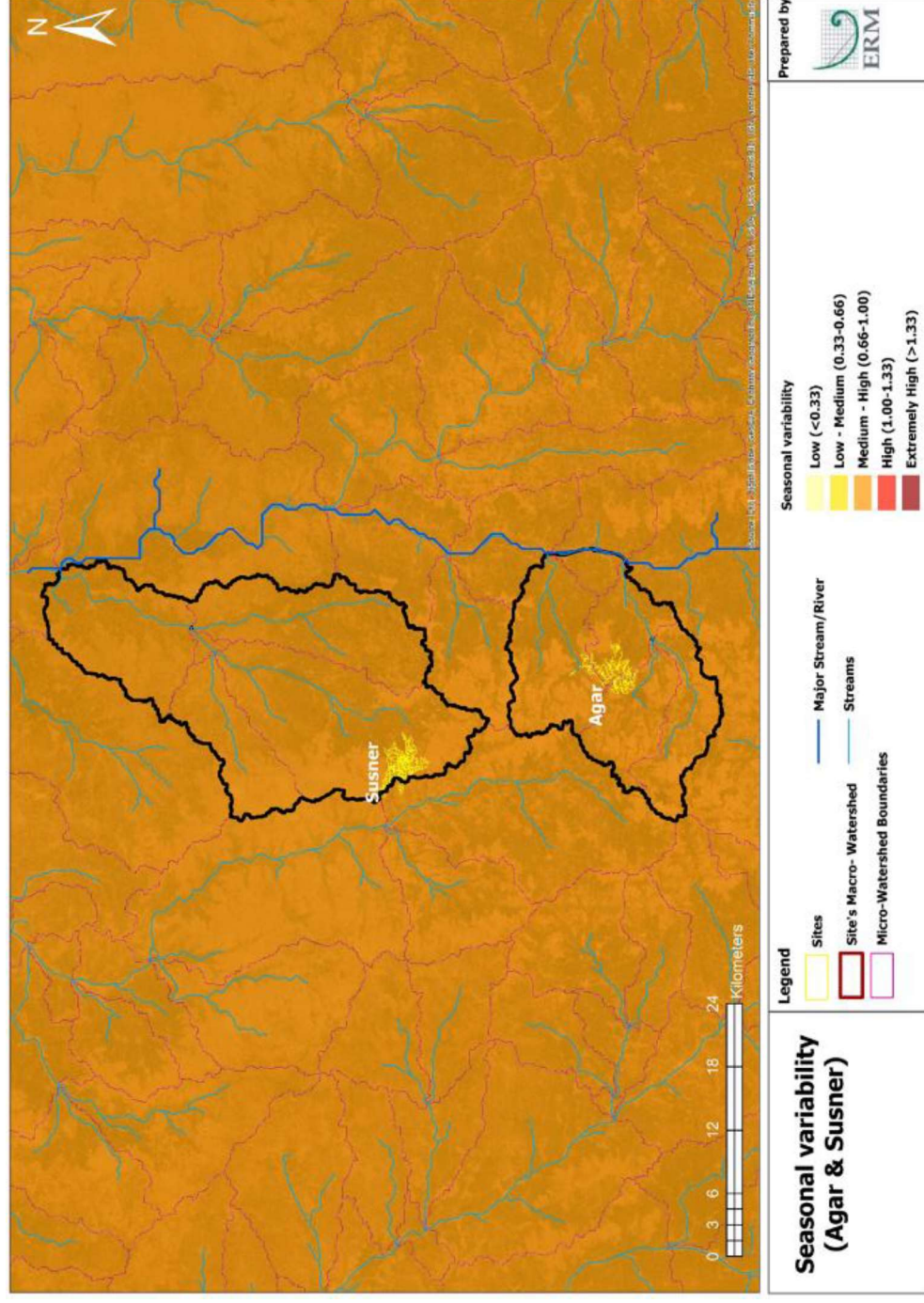
Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated Decision Relevant Global Water Risk Indicators." Technical Note. Washington, DC: World Resources Institute. Available online at: <https://www.wri.org/publication/aqueduct-30> (2019)

Figure 4.17 Inter Annual Variability Map of Project Sites and Watershed



Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated Decision Relevant Global Water Risk Indicators." Technical Note. Washington, DC: World Resources Institute. Available online at: <https://www.wri.org/publication/aqueduct-30>

Figure 4.18 Seasonal Variability Map of Project Sites and Watershed



Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated Decision Relevant Global Water Risk Indicators." Technical Note. Washington, DC: World Resources Institute. Available online at: <https://www.wri.org/publication/aqueduct-30> (2019)

Legend

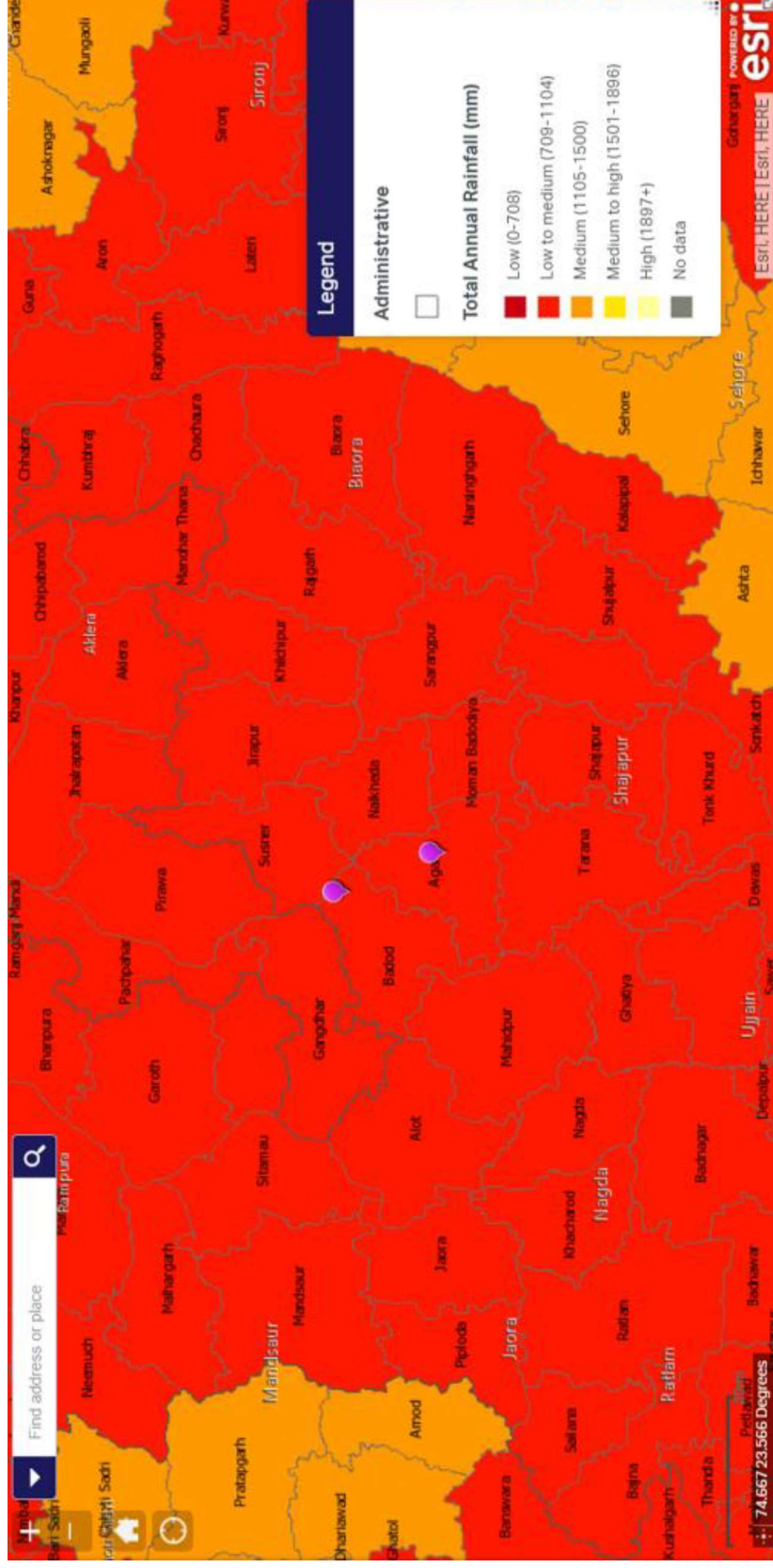
Administrative

Availability Index

- Extremely Low (-0.149 - -0.025)
- Low (-0.024 - 0.044)
- Low to Medium (0.045 - 0.122)
- Medium to High (0.123 - 0.198)
- High (0.199 - 0.275)
- Extremely High (0.276 - 0.389)

Administrative districts shown on the map include: Bhopal, Indore, Jabalpur, Gwalior, Bilaspur, Raipur, Bargarh, Deogarh, Sambalpur, Jharsuguda, Sundergarh, Keonjhar, Mayurbhanj, Jajpur, Khurda, Puri, Ganjam, Gajapati, Nandigram, Paschim Medinipur, Purbi Medinipur, Jharkhand, West Bengal, Odisha, Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka, Andhra Pradesh, Telangana, Karnataka, Kerala, Tamil Nadu, Pondicherry, Andaman and Nicobar Islands, Lakshadweep.

Figure 4.20 Total Annual Rainfall Map of the Project Sites



Source: The India Water Tool Version 3 (IWT 3.0) is an easy-to-use, online tool for companies and other users to understand their water-related risks and prioritize actions toward sustainable water management. IWT 3.0 combines data from Indian government agencies and water stress indicators from the World Resources Institute and Columbia Water Centre. <http://www.indiawatertool.in/>

management. IWT 3.0 combines data from Indian government agencies and water stress indicators from the World Resources Institute and Columbia Water Centre. <http://www.indiawaterportal.in/>

Overall Water Resources Availability Risk

The overall water risk was evaluated based groundwater and surface water risk. Groundwater risk was estimated based on Block Categorization and Hydrogeology while surface water risk was estimated based on Inter Annual Variability, Seasonal Variability, Availability Index and Total Annual Rainfall. Baseline Water Stress and Baseline Water Depletion were evaluated as risk factors common to both groundwater and surface water risk. For each asset, total water risk was evaluated based BWS and BWD while groundwater and surface water risks were evaluated based on the aforementioned individual factors.

- Groundwater risk was estimated to be '**High**' due to high risk of availability of resources and high risk from BC.
- Surface Water risk was estimated to be '**High**' due to high risk from AI, SV, IAV and TAR.
- Overall water risk was estimated to be '**High**' due to high risk from BWS and BWD.

4.3.7.3 Surface Water Quality

Surface water quality monitoring was conducted within the study area at 6 locations during winter season (December 2019). These samples were analysed against the designated best use classification of Central Pollution Control Board (CPCB) as given in Table 4.10. The details of water sampling locations are given in Table 4.11. Samples were taken from water bodies such as river, lakes, ponds in and around the villages in the study area. Field parameters viz. temperature, pH, dissolved oxygen were analysed at the site.

Table 4.10 Water Quality Standards by CPCB for Best Designated Usage

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	■ Total Coliforms Organism MPN/100ml shall be 50 or less ■ pH between 6.5 and 8.5 ■ Dissolved Oxygen 6mg/l or more ■ Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organised)	B	■ Total Coliforms Organism MPN/100ml shall be 500 or less ■ pH between 6.5 and 8.5 ■ Dissolved Oxygen 5mg/l or more ■ Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	■ Total Coliforms Organism MPN/100ml shall be 5000 or less ■ pH between 6 to 9 ■ Dissolved Oxygen 4mg/l or more ■ Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	D	■ pH between 6.5 to 8.5 ■ Dissolved Oxygen 4mg/l or more ■ Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	■ pH between 6.0 to 8.5 ■ Electrical Conductivity at 25°C micro mhos/cm Max.2250 ■ Sodium absorption Ratio Max. 26 ■ Boron Max. 2mg/l
-	Below-E	Not Meeting A, B, C, D & E Criteria

Table 4.11 Surface Water Sampling Locations

S.N.	Location	Unit	Sample Code	Zone	Easting (E)	Northing (N)
1	Pipaliya Kumhar Lake	Unit 4 (Agar)	SW1	43Q	612305.35 m	2623966.41 m
2	Bijnakhedi Lake		SW2	43Q	614769.79 m	2629241.76 m
3	Dehariya Deo Lake		SW3	43Q	615363.14 m	2633308.17 m
4	Umariya Lake	Unit 5 (Susner)	SW4	43Q	606470.41 m	2646328.10 m
5	Naharkheda Lake		SW5	43Q	607370.88 m	2644908.38 m
6	Palda Lake		SW6	43Q	605595.00 m	2647735.85 m

Source: ERM's Site Assessment

The results obtained are shown below in **Table 4.12**:

Table 4.12 Surface Water Analysis Results

S.N.	Parameter	Unit	SW1	SW2	SW3	SW4	SW5	SW6
Physico-chemical characteristics								
1.	pH at 25 °C	-	6.76	7.24	7.41	7.74	7.34	7.38
2.	Temperature	° C	25.0	24.7	25.5	24.5	25.0	24.8
Chemical parameters								
3.	Total Alkalinity	mg/L	148.8	151.2	151.2	108.0	124.8	144.0
4.	Total Hardness	mg/L	883.2	134.4	138.2	99.8	115.2	115.2
5.	Dissolved Oxygen	mg/L	6.7	6.3	6.4	6.3	6.5	6.5
6.	Chloride (as Cl)	mg/L	9.64	8.7	7.7	7.7	6.75	4.82
7.	Fluorides (as F)	mg/L	0.31	0.25	0.3	0.46	0.11	0.54
8.	Sulphate (as SO ₄)	mg/L	9.6	5.7	<1	<1	<1	<1
9.	Nitrite	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
10.	Total Nitrogen	mg/L	4.31	3.36	<1.5	2.50	6.72	7.23
11.	COD	mg/L	12	<10	12	<10	<10	<10
12.	BOD	mg/L	<5	<5	<5	<5	<5	<5
13.	Phenol	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
14.	Salinity	ppt	0.04	0.05	0.04	0.04	0.04	0.04
15.	Iron (as Fe)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
16.	Silver (as Ag)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
17.	Lead (as Pb)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
18.	Cadmium (as Cd)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
19.	Zinc (as Zn)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20.	Manganese (as Mn)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

S.N.	Parameter	Unit	SW1	SW2	SW3	SW4	SW5	SW6
21.	Sodium (Na)	mg/L	15.0	14.2	14.9	11.2	12.7	9.6
22.	Potassium (K)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
23.	Total Phosphorus	mg/L	<1	<1	<1	<1	<1	<1
24.	Oil and grease	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
25.	Total Coliform	MPN/100ml	150	540	32	120	>1,600	94
26.	Faecal Coliform	MPN/100ml	Absent	12	Absent	Absent	32	Absent

Note: the Symbol '<' indicates BDL i.e., Below Detectable Limits

Observations from the surface water analysis results from the study area have been discussed below:

- SW1 - Water sample test results from lake at village Pipaliya Kumhar show total coliform as 150 MPN per 100 ml, pH as 6.76, dissolved oxygen as 6.7 mg/L, BOD as BDL (detection limit of 5 mg/L). The COD levels of 12 mg/L is much below the wastewater limits of 250 mg/L. The oil and grease, phenols and heavy metals Fe, Ag, Pb, Cd, Zn, Mn, K, P were all BDL. These levels indicate that the inorganic and organic pollution load of the water body is low and can be used as a drinking water source without conventional treatment but after disinfection (Class A);
- SW2 - Water sample test results from lake at village Bijnakhedi show that the total coliform as 540 MPN per 100 ml, pH as 7.24, dissolved oxygen as 6.3 mg/L, BOD as BDL (detection limit of 5 mg/L). The COD levels of <10 mg/L is much below the wastewater limits of 250 mg/L. The oil and grease and heavy metals Fe, Ag, Pb, Cd, Zn, Mn, K, P were all BDL. Presence of faecal coliform (12 MPN/100 ml) indicate contamination with human and animal excreta and therefore unsuitable for potable supply. These levels indicate that the organic pollution load of the water body is low and can be used for outdoor bathing (Class B);
- SW3 - Water sample test results from lake at village Dehariya Deo show total coliform as 32 MPN per 100 ml, pH as 7.41, dissolved oxygen as 6.4 mg/L, BOD as BDL (detection limit of 5 mg/L). The COD levels of 12 mg/L is much below the wastewater limits of 250 mg/L. The oil and grease, phenols and heavy metals Fe, Ag, Pb, Cd, Zn, Mn, K, P were all BDL. These levels indicate that the inorganic and organic pollution load of the water body is low and can be used as a drinking water source without conventional treatment but after disinfection (Class A);
- SW4 - Water sample test results from lake at village Umariya show total coliform as 120 MPN per 100 ml, pH as 7.74, dissolved oxygen as 6.3 mg/L, BOD as BDL (detection limit of 5 mg/L). The COD levels of <10 mg/L is much below the wastewater limits of 250 mg/L. The oil and grease, phenols and heavy metals Fe, Ag, Pb, Cd, Zn, Mn were all BDL. These levels indicate that the inorganic and organic pollution load of the water body is low and can be used as a drinking water source without conventional treatment but after disinfection (Class A);
- SW5 - Water sample test results from lake at village Naharkheda show total coliform as >1,600 MPN per 100 ml, pH as 7.34, dissolved oxygen as 6.5 mg/L, BOD as BDL (detection limit of 5 mg/L). The COD levels of <10 mg/L is much below the wastewater limits of 250 mg/L. The oil and grease, phenols and heavy metals Fe, Ag, Pb, Cd, Zn, Mn, K, P were all BDL. These levels indicate that the inorganic pollution load of the water body is low but organic pollution exists. Presence of faecal coliform (32 MPN/100 ml) indicate contamination with human and animal excreta and therefore unsuitable for potable supply. The quality of water indicates that this can be used as a drinking water source only after conventional treatment and disinfection (Class C);
- SW6 - Water sample test results from lake at village Palda show total coliform as 94 MPN per 100 ml, pH as 7.38, dissolved oxygen as 6.5 mg/L, BOD as BDL (detection limit of 5 mg/L). The COD levels of <10 mg/L is much below the wastewater limits of 250 mg/L. The oil and grease, phenols and heavy metals Fe, Ag, Pb, Cd, Zn, Mn were all BDL. These levels indicate that the

inorganic and organic pollution load of the water body is low and can be used as a drinking water source without conventional treatment but after disinfection (Class A).

The physico-chemical analysis of the monitored surface water indicate satisfactory quality at all the locations (except SW2 and SW5) and can be used as a drinking water source with conventional treatment and disinfection.

4.3.7.4 Groundwater Quality

The groundwater quality assessment was done to understand the baseline water (groundwater) quality of the study area. Ground water samples were collected from 6 locations within the Study area/ AoI during winter season (December 2019) and assessed against the BIS10500:2012 standards. The sampling locations is given in **Table 4.13**.

Table 4.13 Groundwater Monitoring Locations

Location Code	Location	Unit	Zone	Easting (mE)	Northing (mN)	Selection Criteria
GW-1	Pipaliya Kumhar	Unit 4 (Agar)	43Q	613019.93 m E	2623370.94 m N	Understanding the existing ground water quality in the nearby habitation and assess any impact on ground water quality due to proposed Project
GW-2	Karwa Khedi		43Q	615108.63 m E	2627126.08 m N	
GW-3	Kasai Dehariya		43Q	611015.71 m E	2626524.26 m N	
GW-4	Umariya	Unit 5 (Susner)	43Q	606678.87 m E	2645960.15 m N	
GW-5	Naharkheda		43Q	607261.32 m E	2644976.51 m N	
GW-6	Palda		43Q	602629.04 m E	2647765.41 m N	

The groundwater monitoring results are given in **Table 4.14**.

Table 4.14 Groundwater Analysis Results

S.N.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	IS: 10500, 2012 Limits	
									Desirable	Permissible

Physico-Chemical Parameters

1.	pH at 25 °C	-	6.66	7.08	7.13	6.94	6.77	6.84	6.5-8.5	No relaxation
2.	Temperature	° C	25	25	25	24.5	24.5	26	---	---
3.	Electrical Conductivity	ms/cm	1.52	0.64	0.62	0.72	0.58	1.61	---	---
4.	Turbidity	NTU	1.6	4.7	1.8	1.1	0.9	1.1	1	5
5.	Colour	Hazen	<5	12.4	<5	<5	<5	<5	5	15

Chemical parameters

6.	Total Alkalinity	mg/L	408	312	264	261.6	316.8	350.4	200	600
7.	Total Dissolved Solids	mg/L	832	350	345	397	319	885	500	2000
8.	Salinity	ppt	0.3	0.06	0.07	0.09	0.05	0.35	---	---
9.	Chloride (as Cl)	mg/L	149.5	14.4	25.1	34.7	9.64	176.5	250	1000
10.	Fluorides as F-	mg/L	0.58	0.58	0.63	0.78	1.12	0.41	1.0	1.5
11.	Total hardness (as CaCO ₃)	mg/L	652.8	299.5	253.4	326.4	291.8	706.6	200	600

S.N.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	IS: 10500, 2012 Limits	
									Desirable	Permissible
12.	Sulphate (as SO ₄)	mg/L	54	24.8	25.8	31.5	6.12	71.9	200	400
13.	Nitrate (as NO ₃)	mg/L	3.23	<0.1	2.12	3.82	2.0	0.64	45	No Relaxation
14.	Phosphate (as PO ₄)	mg/L	<3	<3	<3	<3	<3	<3	---	---
15.	COD	mg/L	28	12	<10	16	<10	24	---	---
16.	BOD	mg/L	11	<5	<5	6	<5	7	---	---
17.	Phenolic Compound (as C ₆ H ₅ OH)	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001	0.002
18.	Iron (as Fe)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	No Relaxation
19.	Silver (as Ag)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	No Relaxation
20.	Chromium (as Cr)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	No Relaxation
21.	Lead (as Pb)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	No Relaxation
22.	Cadmium (as Cd)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	No Relaxation
23.	Nickel (as Ni)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	No Relaxation
24.	Copper (as Cu)	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	1.5
25.	Zinc (as Zn)	mg/L	0.19	1.6	0.35	<0.05	1.13	<0.05	5	15
26.	Manganese (as Mn)	mg/L	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	0.1	0.3
27.	Calcium (as Ca)	mg/L	158.2	59.9	64.5	33.8	33.8	175.1	75	200
28.	Magnesium (as Mg)	mg/L	61.7	35.9	22.1	58.1	49.8	64.5	30	100
Microbiological parameters										
29.	Total Coliform	MPN/100ml	430	2	17	430	540	540	Shall not be detectable in any 100 ml sample	
30.	Faecal Coliform	MPN/100ml	24	Absent	Absent	Absent	10	Absent		

Source: ERM; ND=Not Detected; BDL=Below Detection Limit; DL= Detection Limit; BLQ=Below Limit of Quantification; LOQ= Limit of Quantification.

Observations from the surface water analysis results from the study area have been discussed below:

- pH of the groundwater samples were found from 6.66 at GW1 (Pipaliya Kumhar) to 7.13 at GW3 (Kasai Dehariya), which are in compliance with the IS 10500 standard of 6.5 to 8.5.
- Turbidity in the water samples ranges from 0.9 at GW5 (Naharkheda) to 4.7 at GW2 (Karwa Khedi). Turbidity level exceeds the acceptable limit (1 NTU) at all locations except GW5 (Naharkheda). However, it is within the permissible limits (5 NTU) at all locations.
- TDS in the water samples was found to be between 319 mg/L at GW5 (Naharkheda) to 885 mg/L at GW6 (Palda). Groundwater samples collected from GW1 (Pipaliya Kumhar) and GW6 (Palda) exceeded the acceptable limit (500 mg/L). However, all the samples are within the permissible limit (2,000 mg/L).
- Total Hardness values in the groundwater samples were found to be in the range of 253.8 mg/L at GW3 (Kasai Dehariya) to 706.6 mg/L at GW6 (Palda). Samples collected from all the locations exceeded the acceptable limit of 200 mg/L and samples collected from GW1 (Pipaliya Kumhar) and GW6 (Palda) exceeded the permissible limit of 600 mg/L.

- Concentration of fluoride in groundwater samples ranged from 0.41 mg/L at GW6 (Palda) to 1.12 mg/L at GW5 (Naharkheda). Sample collected from GW5 (Naharkheda) exceeded the acceptable limit of 1 mg/L. However, all the samples were found to be within the permissible limit of 1.5 mg/L.
- Value of sulphate in water sample collected varied from 6.12 mg/L at GW5 (Naharkheda) to 71.9 mg/L at GW6 (Palda). All the samples were found to be within the acceptable limit of 200 mg/L.
- Concentration of calcium in water samples ranged from 33.8 mg/L at GW4 (Umariya) and GW5 (Naharkheda) to 175.1 mg/L at GW6 (Palda). Samples from GW1 (Pipaliya Kumhar) and GW6 (Palda) exceeded the acceptable limit (75 mg/L). However, all the samples were within the permissible limit of 200 mg/L.
- Number of total coliform ranged from 2 MPN/100mL at GW2 (Karwa Khedi) to 540 MPN/100mL at GW5 (Naharkheda) and GW6 (Palda).

The analysis results indicate the groundwater to be in compliance for most of the parameters as per prescribed standards at all monitored locations. However, the presence of total and faecal coliform in groundwater indicates that they would require conventional treatment and disinfection prior to being used for drinking purposes.

4.3.8 Natural Hazards

Various relevant natural hazards were analysed based on secondary information. This includes floods, earthquake and drought severity.

4.3.8.1 Earthquake Risk

As per the Earthquake Hazard/Zoning Map¹, India is classified into four (4) zones based on the severity of probable earthquake on the Medvedev-Sponheuer-Karnik Scale (MSK), as shown below:

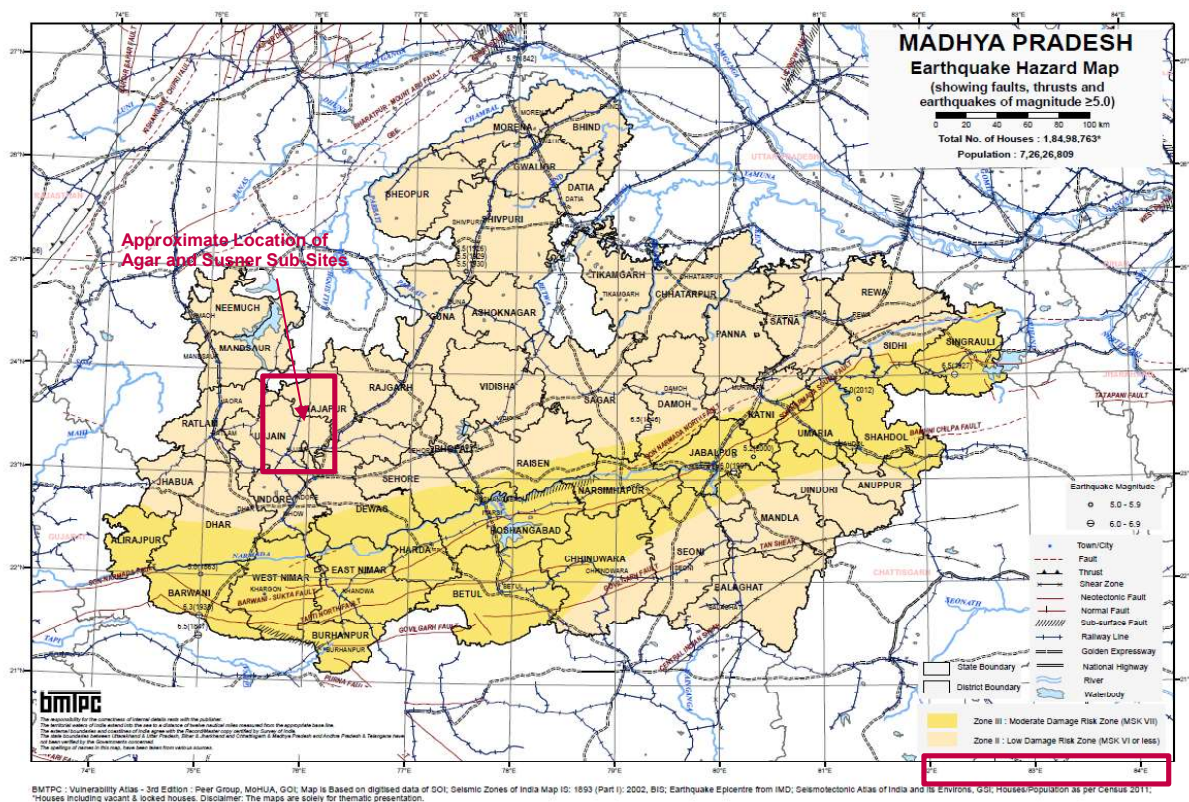
- Zone V: Very High Damage Risk Zone (MSK IX or more);
- Zone IV: High Damage Risk Zone (MSK VIII);
- Zone III: Moderate Damage Risk Zone (MSK VII); and
- Zone II: Low Damage Risk Zone (MSK VI or less)

MSK Intensity Scale is a macro-seismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence. The MSK scale comprises of twelve (12) intensity degrees ranging from I to XII, where 'I' represents least severe and XII represents most severe intensity. The zoning was defined primarily depending on the known seismic history of the region, the postulated seismic activity of the future, and the indicative time intervals between two (2) consecutive occurrences in the same area². The earthquake hazard map is presented in **Figure 4.22**. Based on the review of the earthquake data and map, the location of the Project site falls under Zone II (low damage risk zone/ degree VI or less earthquake hazard on the MSK scale). Hence the risk of earthquake in the Site and its study area is anticipated to be 'Low'.

¹ Building Materials and Technology Promotion Council (BMTPC), Ministry of Housing and Urban Affairs, Government of India. Earthquake Zoning Map: http://bmtpc.org/DataFiles/CMS/file/VAI2019/MAP/eqmap/EQ_JPG/EQ_INDIA.jpg

² Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India: <http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html>

Figure 4.22 Earthquake Hazard Map of Madhya Pradesh



Source: Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India: <http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html>

4.3.8.2 Wind and Cyclones

Wind hazard for Project site was evaluated based on two (2) wind hazard maps. These are Average Wind Speed Map (available in Global Wind Atlas 2.0 and developed by DTU) and Basic Wind Speed Map of India (developed by BMTPC). Basic Wind Speed is defined as the peak wind velocity over a 50 years return period, and is considered to be an extreme and conservative estimate of wind speed at the Site and in surrounding areas. On the other hand, the average wind speed is defined as long term annual mean wind velocity.

The macro-level wind speed zones of India have been formulated and published in IS: 875 (Part 3) - 1987 entitled as 'Indian Standard Code of Practice for Design Loads (other than earthquakes) for Buildings and Structures, Part 3, Wind Loads'. The six (6) wind speed zones and extent of likely damage corresponding to each wind speed zone are presented in **Table 4.15**. The basic wind hazard map of the study region is shown in **Figure 4.23**. The basic wind speeds are applicable to 10 m height above mean ground level in an open terrain with a return period of 50 years¹. The basic wind speeds (as per BMTPC) were compared against the Beaufort Scale of Wind Classification² as presented in **Figure 4.24**. The Beaufort scale is an empirical measure that relates wind speed to observed conditions at sea or on land. The scale classifies mean speeds, usually averaged over 10 minutes by

¹ Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India: <http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html>

² The Beaufort Scale. Royal Meteorological Society: <https://www.rmets.org/resource/beaufort-scale>

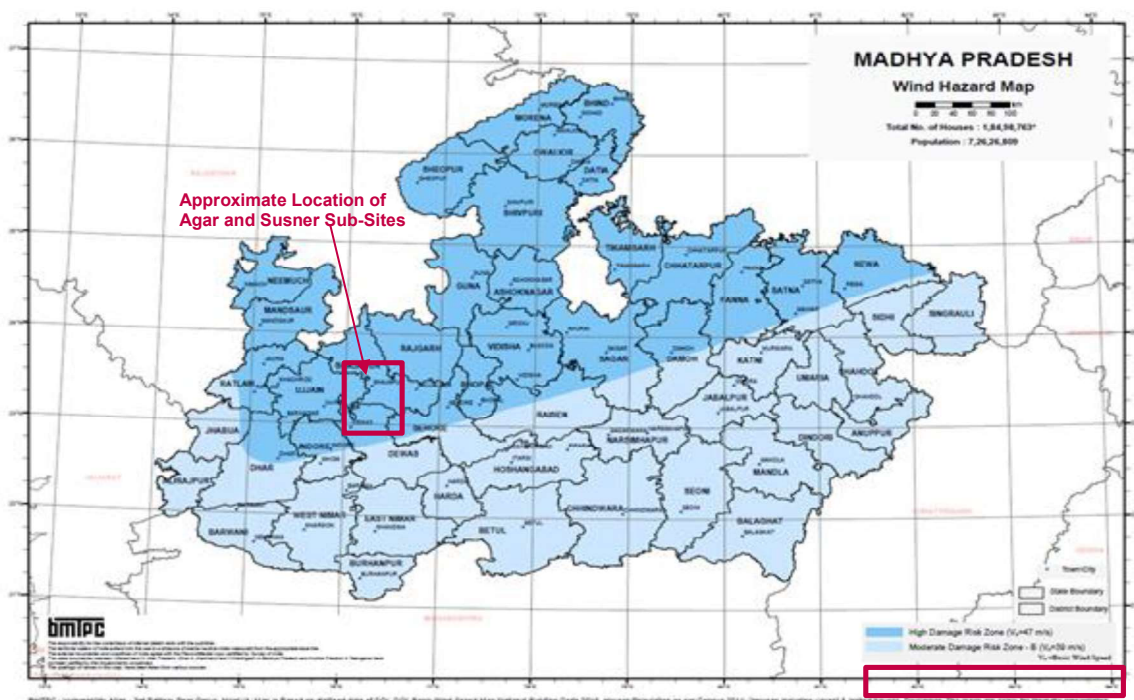
convention, and does not capture the speed of wind gusts. The quoted wind speed is that measured at 10 m above ground, not at the surface (which, at 2 m, may be only 50-70% of these estimates).

Table 4.15 Wind Hazard Categorisation

S.N.	Wind Speed (m/s and km/hr)	Wind Damage Zone
1	55 m/s (198 km/h)	Very High Damage Risk Zone - A
2	50 m/s (180 km/h)	Very High Damage Risk Zone - B
3	47 m/s (169.2 km/h)	High Damage Risk Zone
4	44 m/s (158.4 km/h)	Moderate Damage Risk Zone - A
5	39 m/s (140.4 km/h)	Moderate Damage Risk Zone - B
6	33 m/s (118.8 km/h)	Low Damage Risk Zone

Source: Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India: <http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html>

Figure 4.23 Basic Wind Hazard Map of Madhya Pradesh



Source: https://bmtpc.org/DataFiles/CMS/file/VAI2019/map/windmap/WIND_madhya%20pradesh.pdf

Figure 4.24 Beaufort Scale of Wind Speed Characterization

Wind Force	Description	km/h	mph	knots	Specifications
0	Calm	<1	<1	<1	Smoke rises vertically
1	Light Air	1-5	1-3	1-3	Direction shown by smoke drift but not by wind vanes
2	Light Breeze	6-11	4-7	4-6	Wind felt on face; leaves rustle; wind vane moved by wind
3	Gentle Breeze	12-19	8-12	7-10	Leaves and small twigs in constant motion; light flags extended
4	Moderate Breeze	20-28	13-18	11-16	Raises dust and loose paper; small branches moved
5	Fresh Breeze	29-38	19-24	17-21	Small trees in leaf begin to sway; crested wavelets form on inland waters
6	Strong Breeze	39-49	25-31	22-27	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty
7	Near Gale	50-61	32-38	28-33	Whole trees in motion; inconvenience felt when walking against the wind
8	Gale	62-74	39-46	34-40	Twigs break off trees; generally impedes progress
9	Strong Gale	75-88	47-54	41-47	Slight structural damage (chimney pots and slates removed)
10	Storm	89-102	55-63	48-55	Seldom experienced inland; trees uprooted; considerable structural damage
11	Violent Storm	103-117	64-72	56-63	Very rarely experienced; accompanied by widespread damage
12	Hurricane	118 plus	73 plus	64 plus	Devastation

From wind damage viewpoint, the Project site falls in the region with a basic wind speed of 47 m/s (169.2 km/h) which is classified as 'high risk zone', considering the damage it can cause on built and natural environment. Based on the basic wind speed maps, the likelihood of risk at the Project site was evaluated as **High** based on BMTPC scale and Beaufort scale of wind classification (**Table 4.16**).

Table 4.16 Summary of Wind Hazard Categorisation

Asset Name	(A) Wind Hazard Zone per BMTPC Map	(B) Beaufort Scale as per Basic Wind Speed	Wind Hazard Category (higher of (A) and (B))
Agar Solar Park	High Damage Risk Zone	High	High

4.3.8.3 Flood Risks

Agar and Susner Sites are located ~30 km and ~24 km west from the Kali Sindh River which is the nearest river. Nearest prominent stream is ~1.35 km west of Susner Site. This stream is non-perennial in nature. Both Agar and Susner Sites are located within the Kali Sindh River Basin. Both Sites are located at the ridge in the west-central portion of the basin and ~30 km west from the Kali Sindh River.

- Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Agar and Susner Sites are not prone to flooding;
- Per the global flood hazard map developed by FM Global, the Agar and Susner Sites are not prone to high or medium flood risk;
- Based on Aqueduct's global flood hazard map, the Site and its surroundings at both Agar and Susner fall in the "Low" river flooding hazard zone;
- Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Agar and Susner are not prone to flooding;

Considering the above mentioned attributes, the Site is 'Low' to 'Moderately' susceptible to flooding. Detailed Flood Likelihood Assessment is provided in **Appendix D**.

The climate of Agar district is characterized by hot summer and general dryness except during the south-west monsoon season. The year may be divided into four seasons; summer season from March–May, rainy season from June–September, post- monsoon season October and November, and the winter season from December–February.

The long term (period 1981-2010) meteorology of the region was based on data recorded at the nearest observatory station of India Meteorological Department (IMD) at Shajapur that is ~22 km (aerial) from the proposed Solar site at Agar. The climatological data of Shajapur observatory is presented in **Table 4.17** and described in subsequent sections.

Table 4.17 Climatological Variations at Shajapur Station (1981-2010)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Predominant Winds (wind from)		Mean Wind Speed (kmph)
	Daily Max	Daily Min	08:30 hrs	17.30 hrs		08:30 hrs	17.30 hrs	
January	26.1	8.8	69	43	8.0	NE	NE	2.4
February	29.1	10.7	57	33	4.2	NE	W	2.8
March	34.6	15.7	44	24	1.6	W	W	3.5
April	39.3	21.6	33	18	3.0	W, NW	W, NW	4.9
May	41.4	26.2	42	22	11.4	W, NW	W, NW	6.5
June	38.1	25.8	63	43	95.1	W, NW	W, NW	7.3
July	32.0	23.9	81	67	239.4	SW, W	SW, W	7.0
August	29.7	23.1	86	76	318.3	W, NW	W, NW	5.7
September	32.0	22.2	79	65	126.8	W, NW	W, NW	3.9
October	33.6	17.8	62	43	24.9	W, NW	N, NE	2.2
November	30.5	12.4	59	43	10.6	SE, NE	NE, N	2.0
December	27.3	9.2	65	46	4.5	SE, NE	NE, N	1.8
Annual	32.8	18.1	61	43	847.7	W	NW	4.2

Source: Climatological Normals, 1981-2010, issued by Office of Additional Director General of Meteorology, India Meteorological Department, Pune

- **Temperature:** Temperatures vary considerably from season to season. The summers are generally hot and winters are mildly cool. Mean maximum temperature ranges between 26.1°C during January to about 41.4°C during May and the mean minimum temperatures vary between 8.8°C during January and 26.2°C during May. The annual average maximum temperature was 32.8°C and minimum of 18.1°C.
- **Relative humidity:** The monthly average relative humidity ranged from 33% to 86% at 08.30 am and from 18% to 76% at 17.30 pm. The annual average relative humidity ranged from 43% at 17.30 hrs to 61% at 08.30 am. The relative humidity during morning was always recorded to be higher than evenings. This is because the cooler morning air is closer to saturation than the hot afternoon air, even with the same amount of water vapor.
- **Wind Speed and Wind Direction:** The monthly mean wind speed varied between 1.8 kmph (~0.5 m/s) in December to 7.3 kmph (~2.0 m/s) in June. The annual average wind speed was 4.2 kmph (~1.2 m/s). The predominant wind directions at 08.30 am and 17.30 pm was wind blowing from NE, W and NW.
- **Rainfall:** Long-term (1981 - 2010) average annual total rainfall for Shajapur station was 848 mm, as per IMD Climatological Table. Most of the rainfall is received during the month of August (318 mm) and minimum in April (1.6 mm). Rainfall recorded in Agar- Malwa district from 2016 to 2018 has been presented in **Table 4.18**. As per this table, total annual rainfall from 2016 to 2018 was 1360 mm, 816 mm and 820 mm respectively with maximum rainfall occurring in August for 2016 and July for other years.

Table 4.18 Rainfall Data

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total (mm)
2016	0.0	0.0	0.0	0.0	2.1	123.4	491.3	633.8	76.7	33.0	0.0	0.0	1360.3
2017	0.3	0.0	0.0	0.0	0.1	107.9	309.9	201.8	195.0	0.0	0.0	0.5	815.5
2018	0.0	0.0	0.0	0.0	0.0	115.6	388.5	154.4	161.5	0.0	0.0	0.0	820.0

Source: [http://hydro.imd.gov.in/hydrometweb/\(S\(zq1q35r5cjodlzybet3ilqn\)\)/DistrictRaifall.aspx](http://hydro.imd.gov.in/hydrometweb/(S(zq1q35r5cjodlzybet3ilqn))/DistrictRaifall.aspx)

4.3.9 Ambient Air Quality

The existing ambient air quality of the study area was monitored at two (2) locations for each Unit during the study period. The monitoring parameters includes Respirable Particulate Matter (RPM) i.e. PM₁₀ (particulate matter of particle size less than 10 micrometres) and PM_{2.5} (particulate matter of particle size less than 2.5 micrometres), Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO). PM₁₀, PM_{2.5}, SO₂ and NO_x were monitored on 24 hourly basis while CO was monitored on 8 hourly basis twice a week for a week during the study period.

4.3.9.1 Selection of Sampling Locations

The baseline status of the ambient air quality has been established through ambient air quality monitoring network and the sampling locations were selected taking into consideration the factors such as:

- Predominant wind direction for winter season based on IMD climatological information;
- Topography of the study area;

- Information on existing and proposed pollution sources; and
- Location of dense settlement.

The details of monitoring locations within the study area has been presented in **Table 4.19** below. Map showing location of ambient air quality monitoring locations for Unit 4 (Agar) and Unit 5 (Susner) are presented in **Figure 4.1** and **Figure 4.2**.

Table 4.19 Details of Ambient Air Monitoring Stations

Location Code	Sampling location	Zone	Easting (E)	Northing (N)	Direction and distance from project site	Justification for selection of location and its setting
AAQ1	Pipaliya Kumhar	43Q	612771.90 m	2623444.86 m	~1.2 km SW of Unit 4 (Agar)	Downwind Location
AAQ2	Karwa Khedi	43Q	614917.97 m	2627326.41 m	~0.14 km North of Unit 4 (Agar)	Upwind Location
AAQ3	Gyasari	43Q	602948.76 m	2642791.25 m	~2.5 km SW of Unit 5 (Susner)	Downwind Location
AAQ4	Umariya	43Q	606904.08 m	2646154.93 m	Adjacent to the Unit 5 (Susner) in NE direction	Upwind Location

Source: ERM Site visit

The applied testing procedures are given in **Table 4.20**.

Table 4.20 Details of Methods for different Air Quality Parameters

S. N	Parameter	Range/ Detection Limit
1	PM ₁₀	IS-5182 (Part -23):2006 & CPCB Guidelines Volume 1 (2012-2013)
2	PM _{2.5}	CPCB Guidelines Volume 1 (2012-2013)
3	SO ₂	IS-5182 (Part-II):2001
4	NO _x	IS-5182 (Part-VI):2006
5	HC	NIOSH (1994) Hydrocarbons : Method 1500, Hydrocarbons BP 36°C -216°C, NIOSH manual of Analytical Methods (NMAM), Issue-3, March 15 2003;

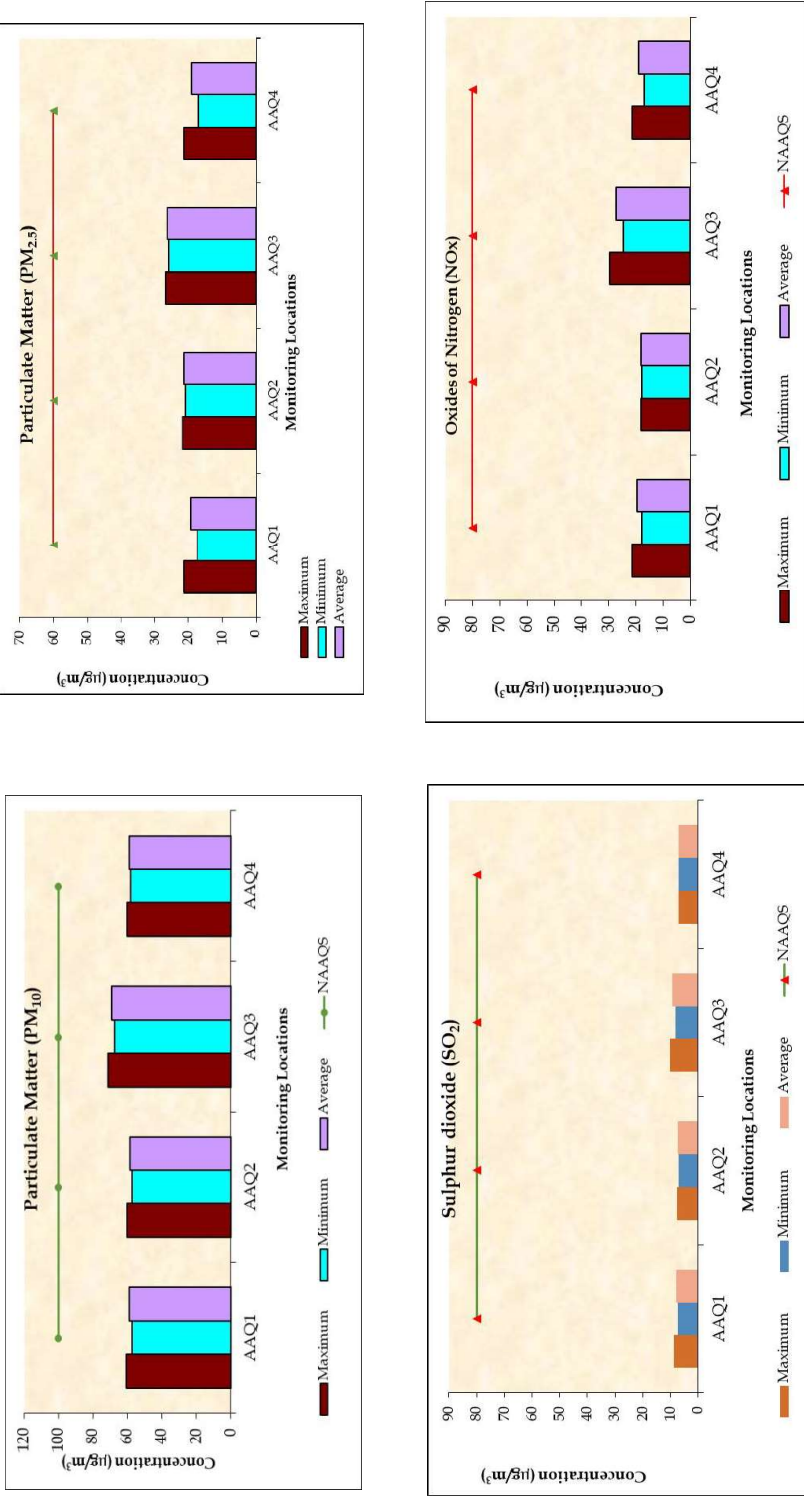
Summarised AAQ results as monitored at various locations are presented in **Table 4.21**. The ambient air quality results have been presented in **Appendix C**.

Table 4.21 Ambient Air Quality Monitoring Results in the Study Area

Parameter	Units	Observed	AAQ1- (Agar)	AAQ2- (Agar)	AAQ3- (Susner)	AAQ4- (Susner)	Inferences
PM ₁₀	µg/m ³	Minimum	57.5	57.1	67.5	58.0	The PM ₁₀ concentration recorded at both the sampling locations was within the National Ambient Air Quality Standards (NAAQS).
		Maximum	60.5	60.2	71.3	60.3	
		Average	59.0	58.6	69.4	59.1	
		NAAQS	100	100	100	100	
PM _{2.5}	µg/m ³	Minimum	17.4	20.9	25.8	17.0	

Parameter	Units	Observed	AAQ1- (Agar)	AAQ2- (Agar)	AAQ3- (Susner)	AAQ4- (Susner)	Inferences
		Maximum	21.3	21.7	26.8	21.3	The PM _{2.5} values were observed to be within the prescribed NAAQS standards (60 µg/m ³).
		Average	19.3	21.3	26.3	19.1	
		NAAQS	60	60	60	60	
SO ₂	µg/m ³	Minimum	7.3	7.1	8.3	6.9	All the values were observed to be within the prescribed NAAQS standards (80 µg/m ³).
		Maximum	8.6	7.5	10.2	7.1	
		Average	7.9	7.2	9.2	7.0	
		NAAQS	80	80	80	80	
NO _x	µg/m ³	Minimum	17.8	17.8	24.7	16.9	All the values were observed to be within the prescribed NAAQS standards (80 µg/m ³).
		Maximum	21.3	18.2	29.7	21.3	
		Average	19.5	18.0	27.2	19.1	
		NAAQS	80	80	80	80	
HC	µg/m ³	Minimum	5.8	5.6	10.4	10.9	
		Maximum	8.1	6.3	18.0	12.5	
		Average	6.9	5.9	14.2	11.7	
		NAAQS	-	-	-	-	

Figure 4.25 Variation of PM₁₀ Concentration in the Study Area



4.3.10 Ambient Noise

The ambient noise levels within the study area was monitored at five (05) locations for each Unit within 2-5 km radius of the site. The details regarding the samples collected and the results obtained are discussed as.

Table 4.22 Details of Noise Sampling Locations

Location	Sample Code	Zone	Easting (E)	Northing (N)	Distance and direction from Project Site
Karwa Khedi village	NQ1	43 Q	614917.97 m	2627326.41 m	~0.2 km North of Unit 4 (Agar)
Kesai Dehariya	NQ2	43 Q	610951.16 m	2626521.31 m	~1.5 km West of Unit 4 (Agar)
Pipaliya Kumhar	NQ3	43Q	612771.90 m	2623444.86 m	~1.2 km South of Unit 4 (Agar)
Nanya Khedi	NQ4	43Q	616922.45 m	2625393.18 m	~1.2 km East of Unit 4 (Agar)
Ladwan	NQ5	43Q	616229.86 m	2625891.81 m	~0.6 km East of Unit 4 (Agar)
Palda	NQ6	43Q	602658.19 m	2647768.51 m	~1.6 km North West of Unit 5 (Susner)
Maharundi	NQ7	43Q	605703.15 m	2640700.68 m	~2.5 km South of Unit 5 (Susner)
Dehariya Nana	NQ8	43Q	602508.40 m	2644796.00 m	~1.3 km South West of Unit 5 (Susner)
Umariya	NQ9	43Q	606904.08 m	2646154.93 m	Near to Unit 5 (Susner) in North East direction
Gyasari	NQ10	43Q	602948.76 m	2642791.25 m	~2.5 km South West of Unit 5 (Susner)

Source: ERM site visit

Sound pressure level (SPL) measurements in dB(A) was recorded for 24 hours with the noise values computed as Leq (Daytime) and Leq (Night time) for each location. Daytime is considered between 06:00 to 22:00 hours and night from 22:00 hours to 06:00 hours. The results so obtained were compared with ambient noise standards specified for respective category under the *Noise Pollution (Regulation & Control) Rules, 2000*. The summary of noise quality results is presented in **Table 4.23**.

Table 4.23 Ambient Noise Monitoring Results

S.N.	Location	Leq day	CPCB and WHO limits* Leq	Leq night	CPCB and WHO limits Leq
1	Karwa Khedi	60.9	55	58.1	45
2	Kesai Dehariya	55.8	55	54.0	45
3	Pipaliya Kumhar	59.8	55	57.2	45
4	Nanya Khedi	58.9	55	56.6	45
5	Ladwan	62.1	55	59.6	45
6	Palda	55.4	55	52.2	45
7	Maharundi	59.2	55	57.6	45
8	Dehariya Nana	52.9	55	51.2	45
9	Umariya	66.5	55	65.9	45
10	Gyasari	60.0	55	59.1	45

* Note: As per WHO limits, Day time is considered from 7 am to 10 pm and night time is considered from 10 pm to 7 am

Discussion of Results

The observations from noise monitoring at different locations in the study area indicate that the recorded Leq day levels varied from 52.9 dBA (Dehariya Nana) to 66.5 dBA (Umariya) both falling within Susner sub unit. The Leq night levels varied from 51.2 dBA (Dehariya Nana) to 65.9 dBA (Umariya) again both falling within the Susner sub unit. The day time noise levels were found to be exceeding the prescribed standards (55 dBA) at almost all locations except NQ8 (Dehariya Nana) while the night time levels do not comply with the prescribed standards (45 dBA) at any of the locations. The high noise levels could be due to the reason due of closely located habitation and therefore noise does not dissipates in the environment properly.

Thus, the noise quality in the areas falling under both the Units – Agar and Susner was exceeding the prescribed CPCB limits and adequate measures shall be taken during construction and operation phase of the proposed project to try and minimise and further incremental increase in noise levels.

4.3.11 Traffic Monitoring

Traffic count survey was conducted at 2 intersections which forms the important access to the site for the baseline. Detail of traffic survey locations is given in **Table 4.24**.

Table 4.24 Traffic Count Survey Location

Monitoring Location	Sample Code	Distance & Direction w.r.t Project Site	Justification for Selection of Location
Bajinath Mahadev to Ladwan	TS-1	~4.0 km, East	Access road to the Unit 4 (Agar) Site
SH-14 to Umariya	TS-2	~0.05 km, West	Access road to the Unit 5 (Susner)

The summarised results of the traffic survey are given in **Table 4.25** & **Table 4.26**. Refer **Appendix C** for detailed results of traffic survey.

Table 4.25 Existing Traffic (Motorised) Volumes in Study Area

Description	Bajinath Mahadev to Ladvan Road	SH-14 to Umariya
Total Traffic (Nos.) / 24 Hours (To & fro)	891	1,199
Average Traffic Flow / hr.	75	100
Max Traffic Flow (nos.) / hr.	92	129
Min Traffic Flow (nos.) / hr.	2	6
Max Traffic Flow (Time- hours)	13:00- 14:00 hrs	18:00-19:00 hrs
Min Traffic Flow (Time-hours)	02:00- 03:00 hrs	04:00- 05:00 hrs

Table 4.26 Percentage Composition of Vehicles in Study Area

Location	Percentage Composition				
	Non-Motorised	Two Wheeler	Three Wheeler	LMV	HMV
Bajinath Mahadev to Ladwan Road	0.58	40.37	2.00	16.18	15.18

Location		Percentage Composition			
SH - 14 to Umariya	0.41	40.53	3.42	25.27	30.36

Note: Non-Motorised includes cycles, rickshaws, bullock carts, horse carts; Two/Three wheelers include scooters, motorcycles, Mopeds and autos; Light motor vehicles (LMVs) include passenger cars, metadors, tractors, tempos, jeeps, van.; Heavy Motor Vehicles (HMTVs) include buses, trucks, dumpers, tankers and trailers.

The percentage composition of different vehicle categories in the total traffic at monitored locations is shown in Figure 4.26.

Figure 4.26 Percentage Composition of Different Vehicle Categories



4.4 Biological Environment Baseline

The ecological baseline data was collected in two session i.e., first session from 10th -13th December 2019 and second session from 22nd to 24th January 2020 in the project area (core area) and surrounding 5 km radial area (Buffer area) in order to assess and establish an ecological baseline of the study area, which helps to understand the impacts of the project on the floral and faunal species and habitats in the surrounding areas and finally in the management strategy and mitigation. The study was conducted with following objectives:

- Identification of the sensitive areas falling within and adjoining areas;
- Classification of flora for any endangered or protected or endemic floral species prevailing in the Area of Influence (including solar plant) based on field surveys; and
- Identification of areas protected under international conventions, national or local legislation and those recognized nationally and internationally for their ecological, landscape, cultural or other related value.
- Identification of fauna (specifically birds, amphibians, mammals and reptiles) based on direct sightings, calls, pugmarks, droppings, nests, etc.;
- Identification and classification of any species recognized as threatened (in accordance with International Union for the Conservation of Nature [IUCN] Red List Online Version 2019-2) and according to the schedules of the Wildlife (Protection) Act, 1972; and
- Identification of areas which are important or sensitive for ecological reasons including their breeding, nesting, foraging, resting, overwintering areas including wildlife migratory corridors/avian migratory routes.
- Identification and assessment of aquatic ecological resources within the study area.

4.4.1 Methodology for Baseline Data Collection

The methodology followed for floral and faunal analysis is given in **Table 4.27**.

Table 4.27 Methodology for ecological survey

Particular	Methodology
Floral Analysis	The major vegetation habitats identified in the proposed Solar Plant area and 5 km buffer area include vegetation on plateau, open scrub, grasslands and agricultural lands. Habitat specific vegetation survey was undertaken to enumerate the trees, shrubs and herbs in the Area of Influence.
Faunal Analysis	
Herpetofaunal	Intensive search was made along the hedges of all the aquatic habitats and open wells located in the study area were checked to identify and list the amphibians. Status of reptiles was assessed using Intensive Time Constrained Search Methods ⁽¹⁾⁽²⁾ covering different micro habitats surveyed within the core (solar plant area) and buffer zones (5 km radius) of the Area of Influence.
Avifauna	Avifaunal species were enumerated by habitat surveys at the representative areas in different available habitats. Avian nomenclature followed Standard field guides ⁽³⁾
Mammals	Habitat survey for mammals was conducted. Identification was followed by standard literature ^{(4) (5)}

Secondary literature from published books and research publications were also consulted for the flora and fauna of the study area. Review of Forest Working Plan of the area was undertaken to validate the findings of the primary survey. The enumerated list of faunal species assessed with the IUCN Red data list (v2019.3) and schedule 1-6 of Wildlife Protection Act, 1972 to confirm their conservation status.

4.4.2 Habitat and Floral Survey

Unit 4 (Agar) Site

The study site comes under 4B: Semi-Arid – Gujarat Rajputana Biogeographical Province of India⁶; Deccan Plateau Agro Ecological Sub Region (ICAR)⁷ and Western Plateau and Hills Region (IX) Agro-Climatic Region⁸. As per the Champion and Seth forest classification⁹, the study area represents Tropical Dry deciduous Babul Forest (5/E3) and Secondary Dry Deciduous Forests (5/2S₁) types of vegetation.

In the Agar study area, the project site (core zone) is dominated with scrublands; while the agricultural land is dominated in the surrounding area (buffer zone) (**Figure 4.27**). The project site (core zone = scrub land) is dominated with few drought resistance trees, *Acacia senegal* (L.) Willd., *Acacia nilotica*

(1) Welsh, H.H., jr. 1987. Monitoring herpetofauna in woodlands of north western California and south west Oregon: a comparative strategy. Pp. 203-213. In: Multiple – Use Management of California's hardwood resources. T.R. Plumb, N.H. Pillsbury (eds. Gen. Tech. Regional Environmental Planning, PSW – 100) US Department of Agriculture, Forest Service

(2) Welsh, H.H. Jr. and Lind, A. 1991. The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and south western Oregon. Pp: 395-411. In: Wildlife and vegetation of unmanaged Douglas-fir forests. (Tech.Coords). L.F. Ruggiero, K.B. Aubry, A.B. Carey and M.H. Huff. Ge. Tech. Rep. PNW-GTR-285. Portland, OR: US. Department of Agriculture, Forest Service.

(3) Birds of India, Srilanka, Pakistan, Nepal, Bhutan, Bangladesh and Maldives. 2000. Krys Kazmeierczak and Ber Van 'Perlo. Om Field Guides.

(4) Prater. S. H. 2005. The Book of Indian Animals. Bombay Natural History Society and Oxford University press 12th Edn. pp. 316.

(5) Menon, V. 2003. A field guide to Indian Mammals. Dorling Kindersley (India) Ltd. New Delhi. 201 p.

⁶ Wildlife Institute of India - ENVIS Centre

⁷ http://iasri.res.in/agridata/12data%5Cchapter1%5Cdb2012tb1_3.pdf

⁸ http://iasri.res.in/agridata/12data%5Cchapter1%5Cdb2012tb1_2.pdf

⁹ Champion, H. G. and Seth, S. K. (1968). A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi, p. 404.

(L.) Delile, *Butea monosperma* (Lam.) Taub., etc.; shrubs, *Carissa carandas* L., *Carissa spinarum* L., *Acacia jacquemontii* Benth., *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Senna tora* (L.) Roxb., etc.; herbs, *Solanum virginianum* L., *Tridax procumbens* L., *Alternanthera sessilis* (L.) R.Br. ex DC., *Euphorbia hirta* L., etc.; grass, *Chrysopogon fulvus* (Spreng.) Chiov., *Apluda mutica* L., etc.

The surrounding area (buffer zone) is represented by agricultural lands with the scattered trees [e.g., *Acacia nilotica* (L.) Delile, *Azadirachta indica* A. Juss, *Ficus benghalensis* L., *Ficus religiosa* L., *Ficus racemosa* L., *Leucaena leucocephala* (Lam.) de Wit, *Prosopis juliflora* (Sw.) DC., *Holoptelea integrifolia* (Roxb.) Planch, *Tamarindus indica* L., *Mangifera indica* L., *Melia azedarach* L., *Ailanthus excelsa* Roxb., *Dalbergia sissoo* Ssensu Miq., *Pongamia pinnata* (L.) Pierre, *Ziziphus jujuba* Mill., etc.] and shrubs [e.g., *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Lantana camara* L., *Ricinus communis* L., *Calotropis procera* (Aiton) W.T.Aiton, *Jatropha gossypifolia* L., etc.] (**Figure 4.28**).

Figure 4.27 Habitats in Study Area



Figure 4.28 Representative flora



Butea monosperma (Lam.) Taub.



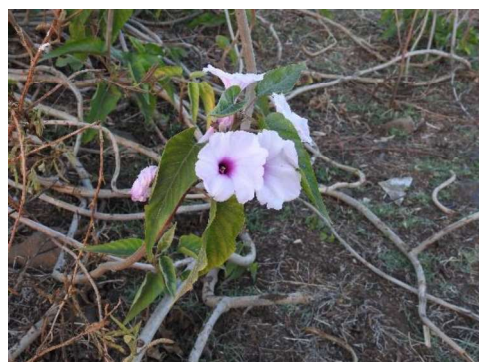
Acacia nilotica (L.) Delile.



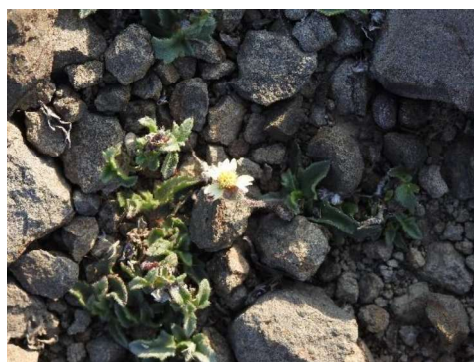
Carissa carandas L.



Acacia jacquemontii Benth.



Ipomoea carnea Jacq.



Tridax procumbens L.

Unit 5 (Susner) Site

The study site comes under 4B: Semi-Arid – Gujarat Rajputana Biogeographical Province of India¹; Deccan Plateau Agro Ecological Sub Region (ICAR)² and Western Plateau and Hills Region (IX) Agro-Climatic Region³. As per the Champion and Seth forest classification⁴, the study area represents Tropical Dry deciduous Babul Forest (5/E3); Secondary Dry Deciduous Forests (5/2S1) and Southern Thorn Forest (6A/C1) types of vegetation.

¹ Wildlife Institute of India - ENVIS Centre

² http://iasri.res.in/agridata/12data%5Cchapter1%5Cdb2012tb1_3.pdf

³ http://iasri.res.in/agridata/12data%5Cchapter1%5Cdb2012tb1_2.pdf

⁴ Champion, H. G. and Seth, S. K. (1968). A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi, p. 404.

In the Susner study area, the project site (core zone) is dominated with scrublands; while the agricultural land is dominated in the surrounding area (buffer zone) (**Figure 4.29**). The project site (core zone = scrub land) is dominated with few drought resistance trees, *Acacia nilotica* (L.) Delile, *Acacia leucophloea* (Roxb.) Willd., *Acacia senegal* (L.) Willd., *Butea monosperma* (Lam.) Taub., *Diospyros exculpta* Buch.-Ham., *Prosopis juliflora* (Sw.) DC., etc.; shrubs, *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Carissa spinarum* L., *Senna occidentalis* (L.) Link, *Senna tora* (L.) Roxb., *Triumfetta bartramia* L., etc.; herbs, *Tridax procumbens* L., *Argemone mexicana* L., *Alternanthera sessilis* (L.) R.Br. ex DC., *Euphorbia hirta* L., etc.; grass, *Apluda mutica* L., *Bothriochloa pertusa* (L.) A.Camus, *Chrysopogon fulvus* (Spreng.) Chiov., etc.

The surrounding area (buffer zone) is represented by agricultural lands with the scattered trees [e.g., *Azadirachta indica* A. Juss, *Acacia nilotica* (L.) Delile, *Ficus benghalensis* L., *Ficus religiosa* L., *Ficus racemosa* L., *Leucaena leucocephala* (Lam.) de Wit, *Prosopis juliflora* (Sw.) DC., *Holoptelea integrifolia* (Roxb.) Planch, *Tamarindus indica* L., *Annona squamosa* L., *Mangifera indica* L., *Ailanthus excelsa* Roxb., *Dalbergia sissoo* Ssensu Miq., *Pongamia pinnata* (L.) Pierre, *Cordia dichotoma* G. Forster, *Ziziphus jujuba* Mill., etc.] and shrubs [e.g., *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Lantana camara* L., *Calotropis procera* (Aiton) W.T.Aiton, *Ipomoea carnea* Jacq., *Jatropha gossypifolia* L., etc.] (Figure 4.30).

Figure 4.29 Habitats in study area



Scrub land

Agriculture land with Mustard crop



Open Scrub/Grasslands



Waterbody

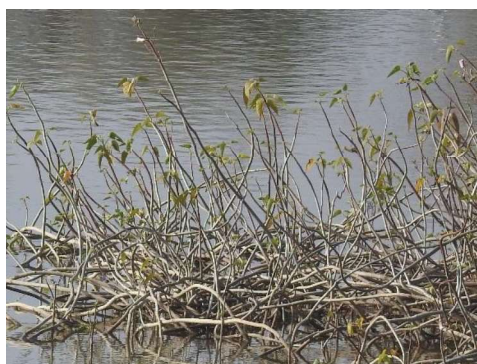
Figure 4.30 Representative floral species



Butea monosperma (Lam.) Taub.



Acacia leucophloea (Roxb.) Willd.



Ipomoea carnea Jacq.



Annona squamosa L.

4.4.3 Faunal Assessment

Faunal species from the study area were recorded based on direct sightings, indirect evidences such as dung, droppings, scats, pugmarks, scratch signs, burrows, nests etc. and consultation with Forest Department officials and local community. During consultation with communities, pictorial representations of species from field guides and other literature of the faunal species of India were shown for identification of species. The species occurring within the study area are discussed in the following sections:

Herpetofauna

The Herpetofaunal (amphibian and reptilian) species found in the study area are discussed below;

Amphibians

A total of four (04) species belonging to 2 families were observed from the study area. None of the species have any conservational significance. The details of the species are given in **Table 4.28**.

Table 4.28 Amphibians observed/recorded from the Study Area

S. No.	Common Name	Zoological Name	Family	WPA Schedule / IUCN 2020.1	Unit 4 (Agar) Site	Unit 5 (Susner) Site

				Status		
1	Indian Skipper Frog	<i>Euphlyctis cyanophlyctis</i>	Dicroglossida e	LC /Not Listed	Y	Y
2	Common Indian Toad	<i>Duttaphrynus melanostictus</i>	Bufonidae	-/ LC	Y	Y
3	Indian Pond Frog	<i>Euphlyctis hexadactylus</i>	Dicroglossida e	-/LC	Y	Y
4	Indian Bull Frog	<i>Hoplobatrachus tigerinus</i>	Dicroglossida e	-/LC	Y	Y

Notes: LC-Least Concern,

Reptiles

A total of sixteen (16) species belonging to 10 families were observed from the study area. One (01) species Flapshell Turtle (*Lissemys punctata*) is listed as Schedule I species of Indian Wildlife Protection Act (1972). The details of reptiles are shown in **Table 4.29**.

Table 4.29 Reptiles observed/reported from the Study Area

S. No.	English / Popular Name	Scientific Name	Family	WPA Schedule / IUCN 2020.1 Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site
1	Flap Shell Turtle	<i>Lissemys punctata</i>	Pythonidae	I / LC	Y	Y
2	Beaked Worm Snake	<i>Typhlops acutus</i>	Tylopidae	IV/LC	Y	N
3	Common Sand Boa	<i>Eryx conica</i>	Uropeltidae	IV/LC	Y	Y
4	Black Cobra	<i>Naja naja oxiana</i>	Elapidae	II/LC	Y	Y
5	Common Indian Krait	<i>Bungarus fasciatus</i>	Elapidae	IV/LC	Y	Y
6	Rat snake	<i>Ptyas mucosa</i>	Colubridae	IV/LC	Y	Y
7	Buffed-striped Keelback	<i>Amphiesma stolata</i>	Colubridae	IV/LC	Y	N
8	Common Indian Trinket Snake	<i>Elaphe helena helena</i>	Colubridae	IV/ LC	Y	N
9	Checkered Keelback Water Snake	<i>Xenchrophis piscator</i>	Colubridae	II/ LC	N	Y
10	Common Wolf Snake	<i>Lycodon aulicus</i>	Colubridae	IV/ LC	Y	Y

S. No.	English / Popular Name	Scientific Name	Family	WPA Schedule / IUCN 2020.1 Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site
11	Russell's Viper	<i>Daboia russelii</i>	Viperidae	IV/ LC	Y	Y
12	Saw-scaled viper	<i>Echis carinata</i>	Viperidae	IV/LC	Y	Y
13	Keeled Grass Skink	<i>Eutropis carinata</i>	Scincidae	-/ LC	Y	Y
14	Indian Garden Lizard	<i>Calotes versicolor</i>	Agamidae	-/-	Y	Y
15	Hardwicke's bloodsucker	<i>Brachysaura minor</i>	Agamidae	-/DD	Y	Y
16	Flat tailed Gecko	<i>Hemidactylus platyurus</i>	Gekkonidae	-/-	Y	Y

Notes: DD- Data Deficient, LC-Least Concern, NT-Near Threatened

Avifauna

A total of 107 species were observed/reported from the study area. The details of species are given in **Table 4.30** and photographic representation is provided in **Figure 4.31**.

The Egyptian Vulture (*Neophron percnopterus*) listed as Endangered as per IUCN ver.2020.1 was observed in the area. 5 species River Tern (*Sterna aurantia*), Oriental Darter (*Anhinga melanogaster*), Painted Stork (*Mycteria leucocephala*), Black headed Ibis (*Threskiornis melanocephalus*), Great Thicknee (*Esacus recurvirostris*) as Near Threatened as per IUCN ver.2020.1 were observed in the area.

Species such as Oriental Honey Buzzard (*Pernis ptilorhynchus*), Brahminy Kite (*Haliastur indus*), Shikra (*Accipiter badius*), White Eyed Buzzard (*Butastur teesa*), Indian peafowl (*Pavo cristatus*), Indian Grey Hornbill, (*Ocyrceros birostris*) were listed as Sch. I as per Wildlife Protection Act, 1972 and are of conservational significance as per national regulations.

Fourteen (14) species migratory species occur at the site and are subject to obligations to avoid impacts under the Convention of Migratory Species (CMS) to which India is a signatory ⁽¹⁾.

(1) The Convention on Conservation of Migratory Species (CMS) or Bonn Convention aims to conserve migratory species throughout their range. The Convention came into force in 1979. India is a signatory to the convention since 1983.

Table 4.30 Avifaunal species observed in Study Area

S. No.	Common Name	Scientific Name	Family	Migratory Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site	A/T	Conservation Status	
								IUCN 2020.1	IWPA,72
1	Rosy Starling	<i>Pastor roseus</i>	Sturnidae	Migratory	Y	Y	T	LC	IV
2	Asian Pied Starling	<i>Gracupica contra</i>	Sturnidae	Resident	Y	N	T	LC	IV
3	Grey Francolin	<i>Francolinus pondicerianus</i>	Phasianidae	Resident	Y	Y	T	LC	IV
4	Large Grey Babbler	<i>Turdoides malcolmi</i>	Leiothrichidae	Resident	Y	Y	T	LC	IV
5	Little Cormorant	<i>Microcarbo niger</i>	Phalacrocoracidae	Resident	Y	Y	A	LC	IV
6	Indian Courser	<i>Cursorius coromandelicus</i>	Glareolidae	Resident	N	Y	T	LC	IV
7	Chestnut-bellied Sandgrouse	<i>Pterocles exustus</i>	Pteroclididae	Resident	Y	Y	T	LC	IV
8	Cotton-pygmy Goose	<i>Nettapus coromandelianus</i>	Anatidae	Resident	Y	N	A	LC	IV
9	Great Egret	<i>Ardea alba</i>	Ardeidae	Resident	Y	Y	A	LC	IV
10	Intermediate Egret	<i>Mesophoyx intermedia</i>	Ardeidae	Resident	Y	Y	A	LC	IV
11	Little Egret	<i>Egretta garzetta</i>	Ardeidae	Resident	Y	Y	A	LC	IV
12	Livestock Egret	<i>Bubulcus ibis</i>	Ardeidae	Resident	Y	Y	T	LC	IV
13	Indian Pond Heron	<i>Ardeola grayii</i>	Ardeidae	Resident	Y	Y	A	LC	IV
14	Desert Wheatear	<i>Oenanthe deserti</i>	Muscicapidae	Resident	N	Y	T	LC	IV
15	Spotted Owllet	<i>Athene brama</i>	Strigidae	Resident	N	Y	T	LC	IV
16	Black Winged Stilt	<i>Himantopus himantopus</i>	Recurvirostridae	Resident	Y	Y	A	LC	IV

S. No.	Common Name	Scientific Name	Family	Migratory Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site	A/T	Conservation Status IUCN 2020.1	IWPA,72
17	Short toed Snake Eagle	<i>Circaetus gallicus</i>	Accipitridae	Resident	Y	Y	T	LC	I
18	Black Kite	<i>Milvus migrans</i>	Accipitridae	Resident	Y	Y	T	LC	I
19	Indian Eagle Owl	<i>Bubo bengalensis</i>	Strigidae	Resident	N	Y	T	LC	IV
20	Common Kestrel	<i>Falco tinnunculus</i>	Falconidae	Migratory	Y	Y	T	LC	IV
21	Black winged Kite	<i>Elanus caeruleus</i>	Accipitridae	Resident	Y	Y	T	LC	I
22	Common Myna	<i>Acridotheres tristis</i>	Sturnidae	Resident	Y	Y	T	LC	IV
23	Brahminy Starling	<i>Sturnia pagodarum</i>	Sturnidae	Resident	Y	Y	T	LC	IV
24	Long tailed Shrike	<i>Lanius schach</i>	Laniidae	Resident	Y	Y	T	LC	IV
25	Green Bee-eater	<i>Merops orientalis</i>	Meropidae	Resident	Y	Y	T	LC	IV
26	House Sparrow	<i>Passer domesticus</i>	Passeridae	Resident	Y	Y	T	LC	IV
27	Greater Coucal	<i>Centropus sinensis</i>	Cuculidae	Resident	Y	Y	T	LC	IV
28	House Crow	<i>Corvus splendens</i>	Corvidae	Resident	Y	Y	T	LC	IV
29	Jungle Crow	<i>Corvus macrorhynchos</i>	Corvidae	Resident	Y	Y	T	LC	IV
30	Eurasian Thick knee	<i>Burhinus oedicephalus</i>	Burhinidae	Resident	Y	Y	T	LC	IV
31	Yellow-eyed babbler	<i>Chrysomma sinense</i>	Sylviidae	Resident	Y	Y	T	LC	IV
32	Spot Billed Duck	<i>Anas poecilorhynchos</i>	Anatidae	Resident	Y	Y	A	LC	IV
33	Oriental Honey Buzzard	<i>Pernis ptilorhynchos</i>	Accipitridae	Resident	Y	Y	T	LC	I

S. No.	Common Name	Scientific Name	Family	Migratory Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site	A/T	Conservation Status IUCN 2020.1	IWPA,72
34	Brahminy Kite	<i>Haliastur indus</i>	Accipitridae	Resident	Y	Y	T	LC	I
35	Shikra	<i>Accipiter badius</i>	Accipitridae	Resident	Y	Y	T	LC	I
36	White Eyed Buzzard	<i>Buteo teesa</i>	Accipitridae	Resident	Y	Y	T	LC	I
37	Yellow legged Buttonquail	<i>Turnix tanki</i>	Turnicidae	Resident	Y	Y	T	LC	IV
38	Indian peafowl	<i>Pavo cristatus</i>	Phasianidae	Resident	Y	Y	T	LC	I
39	White breasted Water hen	<i>Amaurornis phoenicurus</i>	Rallidae	Resident	Y	Y	A	LC	IV
40	Common Coot	<i>Fulica atra</i>	Rallidae	Resident	Y	Y	A	LC	IV
41	Red Wattled Lapwing	<i>Vanellus indicus</i>	Charadriidae	Resident	Y	Y	T	LC	IV
42	Yellow Wattled Lapwing	<i>Vanellus malabaricus</i>	Charadriidae	Resident	Y	Y	T	LC	IV
43	Wood Sandpiper	<i>Tringa glareola</i>	Scolopacidae	Migratory	Y	Y	A	LC	IV
44	Green Sandpiper	<i>Tringa ochropus</i>	Scolopacidae	Migratory	Y	Y	A	LC	IV
45	Red collared Dove	<i>Streptopelia tranquebarica</i>	Columbidae	Resident	Y	Y	T	LC	IV
46	Spotted Dove	<i>Spilopelia chinensis</i>	Columbidae	Resident	Y	Y	T	LC	IV
47	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	Columbidae	Resident	Y	Y	T	LC	IV
48	Laughing Dove	<i>Spilopelia senegalensis</i>	Columbidae	Resident	Y	Y	T	LC	IV
49	Rose ringed Parakeet	<i>Psittacula krameri</i>	Psittaculidae	Resident	Y	Y	T	LC	IV
50	Plum headed Parakeet	<i>Psittacula cyanocephala</i>	Psittaculidae	Resident	Y	Y	T	LC	IV

S. No.	Common Name	Scientific Name	Family	Migratory Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site	A/T	Conservation Status IUCN 2020.1	IWPA,72
51	Plain Prinia	<i>Prinia inornata</i>	Cisticolidae	Resident	Y	Y	T	LC	IV
52	Asian Koel	<i>Eudynamys scolopaceus</i>	Cuculidae	Resident	Y	Y	T	LC	IV
53	Indian Nightjar	<i>Caprimulgus asiaticus</i>	Caprimulgidae	Resident	Y	Y	T	LC	IV
54	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	Apodidae	Resident	Y	Y	T	LC	IV
55	House Swift	<i>Apus nipalensis</i>	Apodidae	Resident	Y	Y	T	LC	IV
56	Indian Roller	<i>Coracias benghalensis</i>	Coraciidae	Resident	Y	Y	T	LC	IV
57	Common Kingfisher	<i>Alcedo atthis</i>	Alcedinidae	Resident	Y	Y	T	LC	IV
58	Pied Kingfisher	<i>Ceryle rudis</i>	Cerylidae	Resident	Y	Y	A	LC	IV
59	White Throated Kingfisher	<i>Halcyon smyrnensis</i>	Halcyonidae	Resident	Y	Y	A	LC	IV
60	Common Hoopoe	<i>Upupa epops</i>	Upupidae	Resident	Y	Y	T	LC	IV
61	Coppersmith Barbet	<i>Megalaima haemacephala</i>	Megalaimidae	Resident	Y	Y	T	LC	IV
62	Indian Grey Hornbill	<i>Ocyrceros birostris</i>	Bucerotidae	Resident	Y	Y	T	LC	I
63	Black-naped Oriole	<i>Oriolus chinensis</i>	Oriolidae	Resident	Y	Y	T	LC	IV
64	Rufous Tailed Lark	<i>Ammomanes phoenicura</i>	Alaudidae	Resident	Y	Y	T	LC	IV
65	Ashy crowned Sparrow Lark	<i>Eremopterix griseus</i>	Alaudidae	Resident	Y	Y	T	LC	IV
66	Oriental Skylark	<i>Alauda gulgula</i>	Alaudidae	Resident	Y	Y	T	LC	IV
67	Red rumped Swallow	<i>Cecropis daurica</i>	Hirundinidae	Resident	Y	Y	T	LC	IV

S. No.	Common Name	Scientific Name	Family	Migratory Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site	A/T	Conservation Status IUCN 2020.1	IWPA,72
68	Black Drongo	<i>Dicrurus macrocercus</i>	Dicruridae	Resident	Y	Y	T	LC	IV
69	Red vented Bulbul	<i>Pycnonotus cafer</i>	Pycnonotidae	Resident	Y	Y	T	LC	IV
70	Red Whiskered Bulbul	<i>Pycnonotus jocosus</i>	Pycnonotidae	Resident	Y	Y	T	LC	IV
71	Red Throated Flycatcher	<i>Ficedula albicilla</i>	Muscicapidae	Resident	Y	Y	T	LC	IV
72	Zitting Cisticola	<i>Cisticola juncidis</i>	Cisticolidae	Resident	Y	Y	T	LC	IV
73	Common Tailer Bird	<i>Orthotomus sutorius</i>	Cisticolidae	Resident	Y	Y	T	LC	IV
74	Indian Robin	<i>Saxicoloides fulicatus</i>	Muscicapidae	Resident	Y	Y	T	LC	IV
75	Great Egret	<i>Ardea alba</i>	Ardeidae	Resident	Y	Y	A	LC	IV
76	Egyptian Vulture	<i>Neophron percnopterus</i>	Accipitridae	Resident	N	Y	T	EN	IV
77	Sarus Crane	<i>Grus antigone</i>	Gruidae	Resident	Y	Y	A/T	VU	IV
78	River Tern	<i>Sterna aurantia</i>	Sternidae	Resident	Y	Y	A	NT	IV
79	Red napped Ibis	<i>Pseudibis papillosa</i>	Threskiornithidae	Resident	Y	Y	A	LC	IV
80	Greater Flamingo	<i>Phoenicopterus roseus</i>	Phoenicopteridae	Migratory	Y	Y	A	LC	IV
81	Red wattled Lapwing	<i>Vanellus indicus</i>	Charadriidae	Resident	Y	Y	A	LC	IV
82	Spotted Redshank	<i>Tringa erythropus</i>	Scolopacidae	Migratory	Y	Y	A	LC	IV
83	Little Grebe	<i>Tachybaptus ruficollis</i>	Podicipedidae	Resident	Y	Y	A	LC	IV
84	Garganey	<i>Anas querquedula</i>	Anatidae	Migratory	Y	Y	A	LC	IV

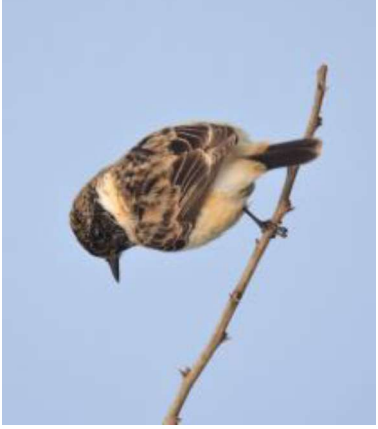
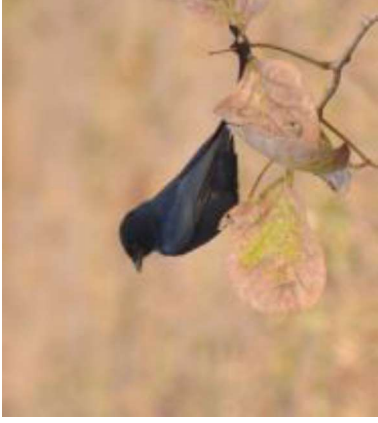
S. No.	Common Name	Scientific Name	Family	Migratory Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site	A/T	Conservation Status IUCN 2020.1	IWPA,72
85	Ruddy Shelduck	<i>Tadorna ferruginea</i>	Tadorninae	Migratory	Y	Y	A	LC	IV
86	Pied Bush Chat	<i>Saxicola caprata</i>	Muscicapidae	Resident	Y	Y	T	LC	IV
87	Paddyfield Pipit	<i>Anthus rufulus</i>	Motacillidae	Resident	Y	Y	T	LC	IV
88	Purple Sunbird	<i>Cinnyris asiaticus</i>	Nectariniidae	Resident	Y	Y	T	LC	IV
89	Purple rumped Sunbird	<i>Leptocoma zeylonica</i>	Nectariniidae	Resident	Y	Y	T	LC	IV
90	Indian Silverbill	<i>Lonchura malabarica</i>	Estrildidae	Resident	Y	Y	T	LC	IV
91	White Wagtail	<i>Motacilla alba</i>	Motacillidae	Resident	Y	Y	T	LC	IV
92	Western Yellow Wagtail	<i>Motacilla flava</i>	Motacillidae	Resident	Y	Y	T	LC	IV
93	Bay-backed Shrike	<i>Lanius vittatus</i>	Laniidae	Resident	Y	Y	T	LC	IV
94	Grey Heron	<i>Ardea cinerea</i>	Ardeidae	Resident	Y	Y	A	LC	IV
95	Common Stonechat	<i>Saxicola maurus</i>	Muscicapidae	Migratory	Y	Y	T	LC	IV
96	Common Pochard	<i>Aythya ferina</i>	Anatidae	Migratory	Y	Y	A	VU	IV
97	Common Teal	<i>Anas crecca</i>	Anatidae	Migratory	Y	Y	A	LC	IV
98	Black Redstart	<i>Phoenicurus ochruros</i>	Muscicapidae	Migratory	Y	Y	T	LC	IV
99	Black Stork	<i>Ciconia nigra</i>	Ciconiidae	Migratory	Y	N	A	LC	IV
100	Oriental Darter	<i>Anhinga melanogaster</i>	Anhingiidae	Resident	N	Y	A	NT	IV
101	Painted Stork	<i>Mycteria leucocephala</i>	Ciconiidae	Resident	Y	Y	A	NT	IV

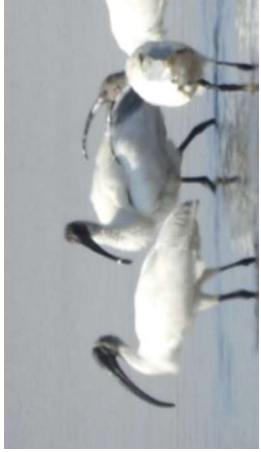
S. No.	Common Name	Scientific Name	Family	Migratory Status	Unit 4 (Agar) Site	Unit 5 (Susner) Site	A/T	Conservation Status IUCN 2020.1	IWPA,72
102	Eurasian Spoonbill	<i>Platalea leucorodia</i>	Threskiornithidae	Resident	Y	Y	A	LC	IV
104	Black headed Ibis	<i>Threskiornis melanocephalus</i>	Threskiornithidae	Resident	Y	Y	A	NT	IV
105	Great Thicknee	<i>Esacus recurvirostris</i>	Burhinidae	Resident	Y	Y	A	NT	IV
106	Bar-headed Geese	<i>Anser indicus</i>	Anatidae	Migratory	Y	N	A	LC	IV
107	Rufous tailed Lark	<i>Ammomanes phoenicura</i>	Alaudidae	Resident	Y	Y	T	LC	IV

Notes: LC-Least Concern, NT-Near Threatened, VU-Vulnerable, EN-Endangered, IUCN- International Union for the Conservation of Nature, IWPA,72-Indian Wild Life Protection Act 1972 as amended thereof;

Figure 4.31 Avifauna observed within Unit 4 (Agar) and Unit 5 (Susner) Project sites

			
Zitting Cisticola	Eurasian Collared Dove	Livestock Egret	Bay backed Shrike
			
Red wattled Lapwing	Grey Heron	Common Stonechat Female	Indian Bush Lark

			
Indian Silverbill	Spotted Owlet	Common Stonechat Male	Black Drongo
			
Indian Roller	Common Pochard	Spot billed Duck	Common Teal

			
Black Redstart	Egyptian Vulture	Black Stork	Oriental Darter
			
Pied Kingfisher	River Tern	Painted Stork and Eurasian Spoonbill	
			

Black winged Kite		Black headed Ibis		Little ringed Plover		Great Thickknee	
Sarus Crane		Bar headed Geese		White throated Kingfisher		Rufous-tailed Lark	

Mammals

A total of 12 species were observed/ reported from the study area. One (01) species Chinkara (*Gazella bennettii*) is categorized as Near Threatened as per IUCN (v 2020 1) and also listed as Sch. I species as per Indian Wildlife Protection Act, 1972. A list of species observed/reported* from the study area are given in **Table 4.31** and represented in **Figure 4.32**.

Table 4.31 Details of Mammals observed/ reported from the Study area

S. No.	English Name	Scientific Name	Family	Unit 4 (Agar) Site	Unit 5 (Susner) Site	IWPA Schedule / IUCN Status
1	Jackal	<i>Canis aureus</i>	Canidae	Y	Y	II/LC
2	Common Fox	<i>Vulpes bengalensis</i>	Canidae	Y	Y	II/LC
3	Rhesus Macaque	<i>Macaca mulatta</i>	Cercopithecidae	Y	Y	II/LC
4	Northern plains gray langur	<i>Semnopithecus entellus</i>	Cercopithecidae	Y	N	II/LC
5	Nilgai	<i>Boselaphus tragocamelus</i>	Bovidae	Y	Y	III/LC
6	Chinkara	<i>Gazella bennettii</i>	Bovidae	Y	Y	I/ NT
7	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	Herpestidae	Y	Y	II/LC
8	Jungle Cat	<i>Felis chaus</i>	Felidae	Y	Y	II/LC
9	Five Striped Squirrel	<i>Funambulus pennantii</i>	Sciuridae	Y	Y	IV/LC
10	Bandicoot rat	<i>Bandicota indica</i>	Muridae	Y	Y	V/LC
11	Indian Flying Fox	<i>Pteropus giganteus</i>	Pteropodidae	N	Y	V/LC
12	Indian Hare	<i>Lepus nigricollis</i>	Leporidae	Y	Y	IV /LC

Notes: IUCN-International Union for Conservation of Nature, IWPA-Indian Wildlife Protection Act ,1972, LC-Least Concern, NT-Near Threatened

*Source; Forest Working Plan Shajapur Forest Division

Figure 4.32 Mammalian Species observed within the Study Area



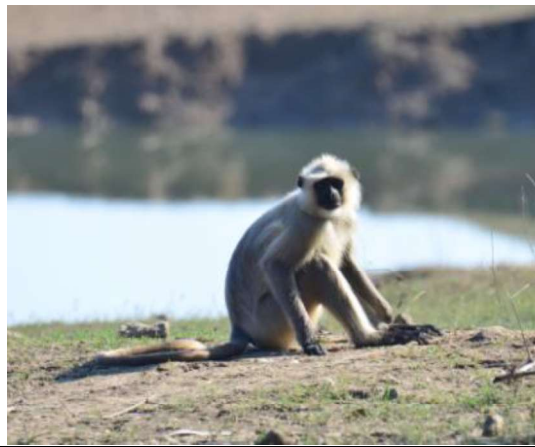
Nilgai



Chinkara



Indian Grey Mongoose



Northern plains gray langur



Indian Flying Fox

4.4.4 Protected Areas

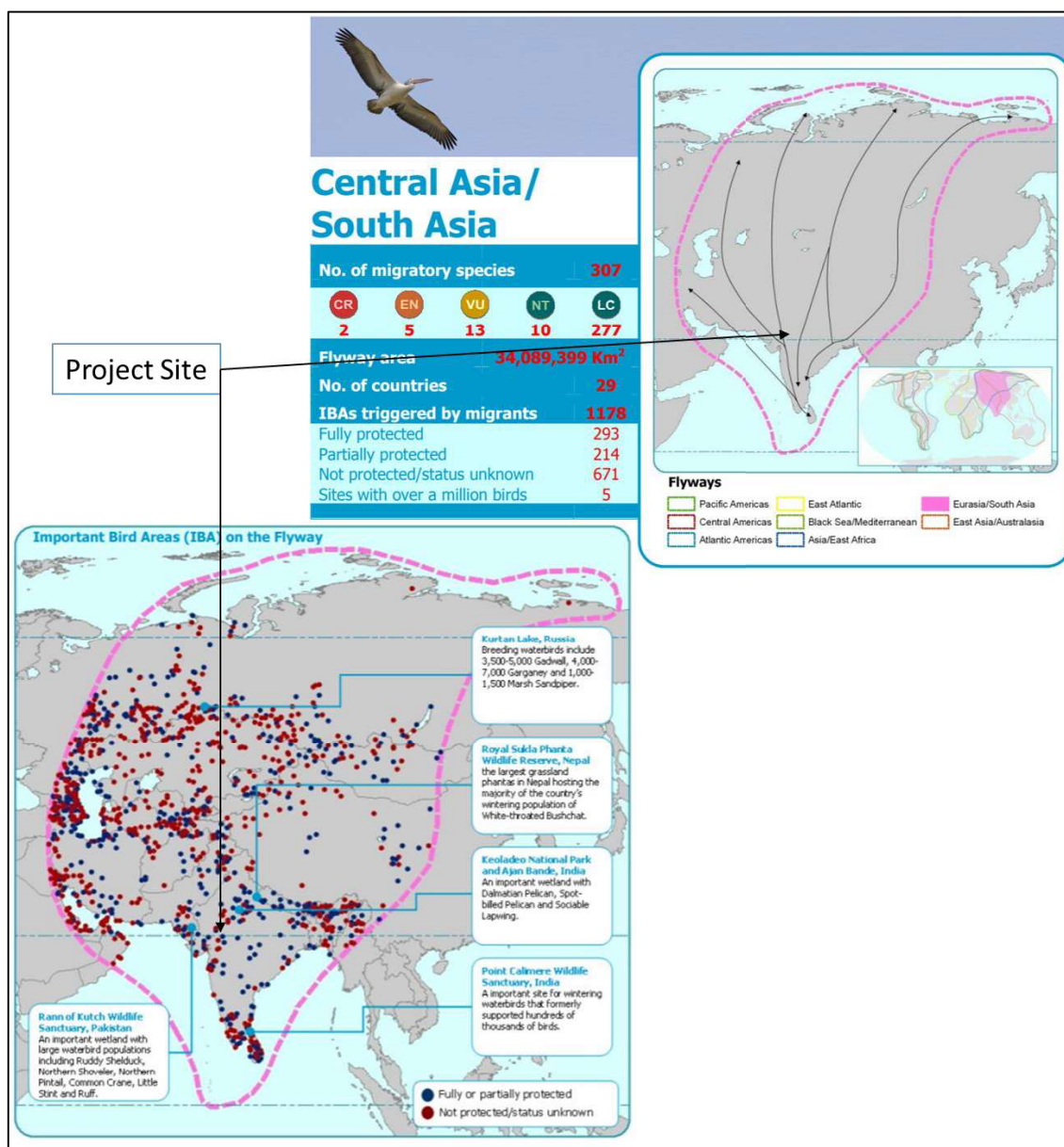
No protected area falls within 25 km radius of the project site. No sites identified as Internationally Recognized Areas such as Key Biodiversity Area (KBA) that include Important Bird areas (IBA) and Alliance for Zero Extinction (AZE) sites fall within 25 km radius of the project sites.

4.4.5 Migratory Corridor

India lies along the Central Asian Flyway, a global migratory pathway that connects the Palearctic (Europe and Northern Asia) to the Indian subcontinent. The birds that utilize this flyway congregate at key water bodies around India.

The site is located along the Central Asian Flyway. The project site falls within the Central Asian Flyway. A total of 14 avifaunal species were reported from site which migrate along the Central Asian Flyway and winter in the Indian Subcontinent. This assessment is based on the two site visits undertaken in December 2019 and January 2020. The map of Central Asian Flyway is provided in the **Figure 4.33**.

Figure 4.33 Central Asian Flyway



4.4.6 Delineation of Critical, Natural and Modified Habitat

The delineation of critical, natural and modified habitats is presented in the table below.

Table 4.32 Delineation of Habitats (Critical, Natural and Modified)

Habitat Type	Discussion	Conclusion
Scrub Land and grassland	The scrub lands in the study area (open scrub and dense scrub) are remains of once dense forest in the past. Increased pressure for fuel wood and building construction material by the local villagers along with the increase of agricultural land has converted the land use from forest areas to open scrub and dense scrub within the study area, Grassland/Open scrub areas in the post monsoon period are typically more productive in comparison to the other seasons where they are parched dry. It was observed that the flora and fauna of the area are largely undisturbed by human activity. The main activity during post monsoon season is livestock grazing due to the large availability of fodder. The IUCN listed threatened species Egyptian Vulture (<i>Neophron percnopterus</i>) [IUCN (v2020.1) EN] was also found to use this habitat type. The habitat still supports a large variety of avifaunal and mammalian species. These includes IWPA Sch-I listed mammalian and avifaunal species including IUCN listed threatened species Egyptian Vulture (<i>Neophron percnopterus</i>) [IUCN (v2020.1)EN], The presence of Egyptian Vulture in this landscape is opportunistic and mostly recorded at site in an event of any livestock carcass disposal.. Agar site constitutes 30.6% of scrub land, while Susner site constitutes 28.42% of scrub land of the study area respectively.	The habitat can thus be safely considered as MODIFIED habitat
Agricultural Land	Agricultural land is largely influenced by the anthropogenic activities were in the native flora and fauna are disturbed to a great degree	Owing to the disturbance the habitat can be considered as MODIFIED habitat
Waterbodies	The Study areas do not present occurrence of large natural waterbodies. The area bears large waterbodies mainly reservoirs for accumulating rain water for irrigation in non-monsoon months. Fish farming was also undertaken in these large reservoirs.	As there was significant interaction between humans and habitat, there was significant disturbance in the habitat and thus considered as MODIFIED habitat

4.5 Social Environment Baseline

The purpose of this section is to provide a general socio-economic profile of the area and the issues relevant to the project area. This section provides an understanding of the administrative set up of the district, the demographic profile of the villages in the study area, the social groups present, the land use pattern in the area, the livelihood profile of the community, common property resources and their use, etc. It also highlights the social and physical infrastructure available to support education, health infrastructure, the water supply for irrigation and drinking purposes, sanitation facilities and connectivity.

The social baseline for the project area is based on official data and other secondary information available in the public domain, consultations in the field with key informants and with the communities through focus group discussions. It also includes visual observations made during the site survey. **Section 1.3** provides an understanding of the methodology followed for the social baseline data collection.

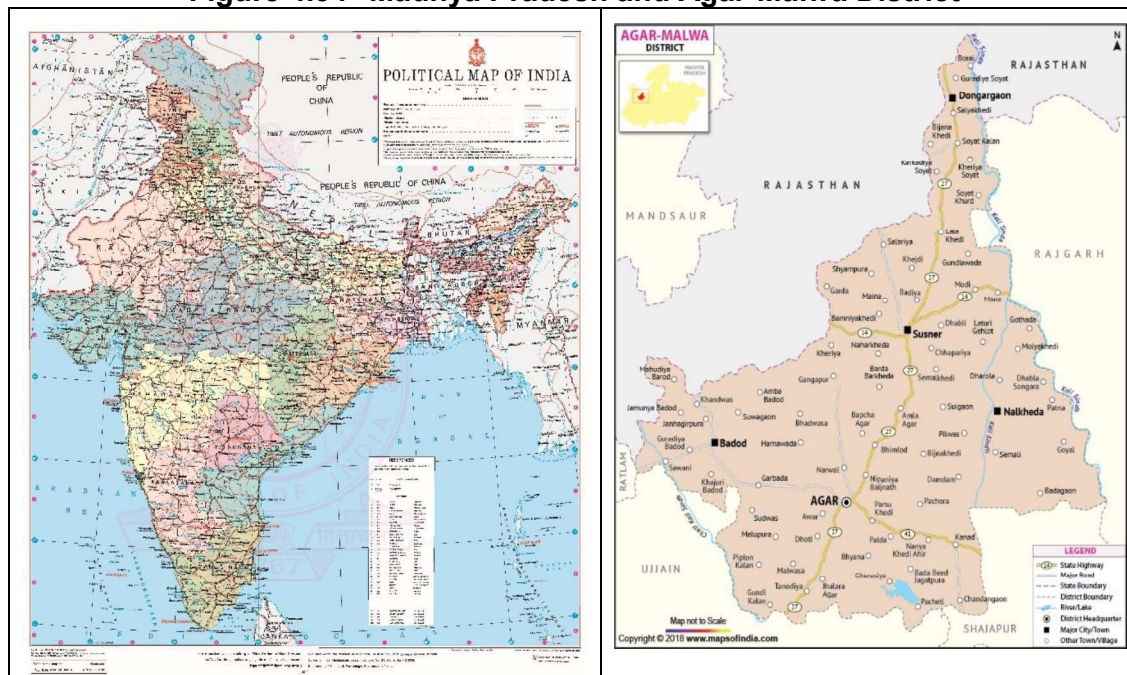
4.5.1 Socio Economic Setting

The project is situated in Agar and Susner tehsil of Agar-Malwa district in Madhya Pradesh. The sections below provide an overview of these administrative units.

4.5.1.1 State Profile: Madhya Pradesh

Madhya Pradesh, as the name suggests, is located in the centre of the country and is the second largest state in India (in terms of geographical area). It shares a boundary with Rajasthan in north-west, Gujarat in south-west, Maharashtra in south, Chhattisgarh in south-east and Uttar Pradesh in north east. The state administers 3,08,252 sq. km. of area which is 9.37% of the total geographical area of the country and its accounts for 6 percent population of India, according to the provisional data of Census 2011. The capital of the state is Bhopal.

Figure 4.34 Madhya Pradesh and Agar-Malwa District



Source: <http://www.surveyofindia.gov.in/files/Political%20Map%20of%20India.jpg>

<https://www.mapsofindia.com/maps/madhyapradesh/districts/agar-malwa.html>

The state of Madhya Pradesh is divided into 52 districts, 367 Tehsils, 313 development Blocks and 52,557 populated villages.

The state comprises of a population of 72,626,809 individuals, who pre-dominantly live in rural areas and make up 72.37 percent of the state's total population. The decadal population growth has reduced from 24.34 percent during the period 1991-2001 to 20.35 percent during 2001 to 2011. The sex ratio in the state is 931, which has increased from 920 in the past decade; however it is still lower

than the sex ratio of India, being 940 females per 1000 males. The population density of India is 382 persons/sq. km. while that of Madhya Pradesh is 236 persons/sq. km. The state has the second largest geographical area, of any state in the country.

Table 4.33 Madhya Pradesh Demographic Profile

Attribute	Number
Area (sq. km)	3,08,252 (9.37% of India)
Total population	7,26,26,809 (6.0% of India)
Males	3,76,12,306 (6.03% of India)
Females	3,50,14,503 (5.97% of India)
Sex ratio	931
Percentage of rural Population	72.37
Percentage of urban population	25.63
Population density	236
Percentage of SC population	15.6
Percentage of ST population	21.1
Total literacy rate	69.32
Male Literacy rate	78.73
Female Literacy Rate	54.49
Rural Literacy	63.94

Source: Census of India, 2011

The literacy rate of Madhya Pradesh is nearly 70 percent (of which the rural literacy stands at 63.94%) which is lower than that of the country, at 74.04 percent. The male literacy rate is relatively higher, at 78.73 percent while the female literacy rate is 54.49 percent, which is quite low when compared to the national female literacy rate of 65.46 percent.

Madhya Pradesh ranks 1st amongst all States and Union Territories with regards to Scheduled Tribe (ST) population and 12th in terms of Scheduled Caste (SC) population. The proportion of ST population in the state is 21.1 percent and SC population is 15.6 percent.

4.5.1.2 District Profile: Agar-Malwa

Agar-Malwa district is located in north- west Madhya Pradesh and lies at 23°42' latitude and 76°036' longitude. Agar-Malwa district shares a boundary with Ujjain towards the South, Rajgarh towards the East and it is bound by the state of Rajasthan towards the West.

The total area of the district is 2,701.93 km² and it is comprised of 512 inhabited villages. There are a total of 6 towns in the district which includes seven municipalities i.e. Agar, Susner, Badod, Badagaon, Kanad, Nalkheda, Soayat Kalan corresponding to four tehsils (Agar, Susner, Badod and Nalkheda) and 227 Gram Panchayats. The district is divided into two sub-divisions – Agar-Malwa and Susner division.(Figure 4.35) helps in understanding the various sub-divisions of the district.

Figure 4.35 Agar-Malwa District Divisions



Source: <https://www.mapsofindia.com/maps/madhyapradesh/districts/agar-malwa.html>

With a population of 5,71,278 individuals, the district accounts for 0.78 percent population of Madhya Pradesh. Since the district was earlier a part of Shajapur district during the earlier Census (2001), the decadal growth rate has not been stated.

The population density of Agar-Malwa district (193.9/ km²) is significantly less than that of Madhya Pradesh, given that the district was carved out in 2013. Most of the district is rural, and only Agar and Susner are towns and classified as urban areas. The proportion of Scheduled Caste people is about 24 percent of the population in Agar-Malwa, which is higher than the state figure of 15.6 percent. On the other hand, the Scheduled Tribe population in Agar-Malwa at 2.4 percent, is significantly lower than the state figure of 21.1 percent. The sex ratio of the district at 949 is higher than the state figure of 931 and the country's sex ratio of 940 females per thousand males. The child sex ratio in 2011 is 935 girls per 1000 boys, at par with the state figure.

The status of literacy in the district also reflects an average scenario with the proportion of literate population (54.45 percent) lower than that of the state (69.32 percent). The female literacy rate (21 percent) is almost one-third of the state figure (54.49 percent). Most of the population resides in rural areas, with 79.5 percent of the population of the district being rural, and the rest is classified as urban.

4.5.1.3 Tehsil Profile: Agar and Susner

The Project footprint area is spread across eleven villages in Agar and Susner tehsils while the Area of Influence (AoI) is spread across villages spanning four tehsils i.e. Agar, Nalkheda, Susner and

Badod of Agar-Malwa district. These four tehsils taken together comprise the entire population of the newly created district of Agar. In terms of SC population, Badod tehsil has the highest share at 23.48 percent, while Susner and Nalkheda tehsil have a lower share at 5.5 and 4.7 percent, respectively.

In the Project footprint, Agar tehsil has the highest share of ST population, whereas in the Aol, Nalkheda has the highest share of 1.45 percent among the four tehsils. Agar tehsil has a share of 1.02 percent of the total ST population in the district and Susner tehsil has 0.64 percent. In terms of sex ratio, Susner tehsil exhibits a relatively higher Sex Ratio at 956, while Nalkheda tehsil has the lowest ratio of 931.

Table 4.34 Demographic Profile of Tehsils

Attribute	Agar-Malwa District	Agar Tehsil	Susner Tehsil	Nalkheda Tehsil	Badod Tehsil
Population	5,71,278	173335	143828	118592	135523
% of District Population	N/A	30.34	25.8	20.7	23.7
% SC population	23.78	8	5.5	4.7	23.48
% ST population	2.44	1.02	0.64	1.45	0.15
Sex Ratio	949	944	955	931	952
% Total literacy rate	54.45	17.05	13.7	11.7	59.54
% Female literacy rate	21	13.7	10.8	9.3	38.9

Source: Census of India, 2011

4.5.2 Study Area

The Study Area for the current assessment comprises of the area identified for the project as well as villages which might be impacted directly or indirectly by the project. The use of term "Study Area" in the social baseline and impacts sections would comprise consolidated data from Project Villages and Area of Influence. It differs slightly from the manner Study Area is defined for the Environment and Ecology sections.

The key terms used for sub-categorization of the Study Area are:

- Project footprint – The Project footprint comprises the area within the proposed boundary of Agar-Susner Solar Park which includes the following villages
- Project Villages – There are eleven villages (Palada, Naharkheda, Umariya, and Pipalya Nankar) from Susner and (Pipalya Kumhar, Madhopur, Ladwan, Kesai Dehariya, Dudhpura, and Bijnakhedi) from Agar from where the land for the project is being identified will be referred to as "Project Villages"
- Area of influence (Aol) - Area of Influence comprises of the villages (43 in total) falling within the 5 km radius of the project, apart from Project Villages, that may be directly or indirectly affected.

Table 4.35 provides the land area details for the Project villages, the land area allotted for the solar park.

Table 4.35 Land Details for the Solar Park

Details	Village	Govt Land (Ha)	Private Land (Ha)	Total Area (Ha)
Unit 4 (Agar)	Pipalya Kumhar	34.80	5.06	39.86
	Madhopur	15.77	0.00	15.77

Details	Village	Govt Land (Ha)	Private Land (Ha)	Total Area (Ha)
	Ladwan	168.32	2.80	171.12
	Kesai Dehariya	28.30	0.00	28.30
	Karwa Khedi	155.37	0.00	155.37
	Dudhpura	98.38	43.59	141.97
	Bijnakhedi	55.98	0.00	55.98
Unit 5 (Susner)	Palada	119.69	6.48	126.17
	Naharkheda	86.89	62.71	149.6
	Umariya	328.80	13.06	341.87
	Pipalya Nankar	181.36	0.00	181.36
Grand Total		1273.652	133.70	1407.362

Source: Land Data provided by RUMSL, 19 June 2020

While the project footprint is present in Agar and Susner tehsil, the Area of Influence (Aoi) spreads across 43 villages, of which 21 villages are in the Aoi of Agar, that includes Nalkheda tehsil, and 22 villages are in the Aoi of Susner, that includes Badod tehsil.

Table 4.36 and Figure 4.36 illustrate the Study Area for Unit-4 and Unit-5, which shows the villages present within 5 km radius of the project site. The villages lying in the Project Footprint Area and Aoi are also listed below in the Table 4.36.

Table 4.36 Project Area and Surrounding Area Villages

S. No.	Project villages	S. No.	Area of Influence villages*
1.	Pipalya Kumar	1.	Lakhami Kheda
2.	Madhopur	2.	Dehrideo
3.	Ladwan	3.	Kherkhedi
4.	Kesai Dehariya	4.	Tolakya Khedi
5.	Karwa Khedi	5.	Khelagaon
6.	Dudhpura	6.	Rindoli
7.	Bijnakhedi	7.	Damdham
8.	Palada	8.	Pachlana
9.	Naharkheda	9.	Nanya Khedi
10.	Pipalya Nankar	10.	Pachora
		11.	Salri
		12.	Ahir Bardiya
		13.	Bhanpura
		14.	Karkadiya
		15.	Shivgarh

S. No.	Project villages	S. No.	Area of Influence villages*
		16.	Bhadka
		17.	Pachori
		18.	Chikali Goyal
		19.	Chikali Parmar
		20.	Jhikadiya
		21.	Bans Kheri
		22.	Binaya Agar
		23.	Maharundi
		24.	Barda Barkheda
		25.	Khanota
		26.	Laturi Gajar
		27.	Kadiya
		28.	Ankali
		29.	Morukhedi
		30.	Amla Nankar
		31.	Bamniyakhedi
		32.	Bid Pipliya
		33.	Nawa Kheda
		34.	Borkhedi Lada
		35.	Arniya ka Kheda
		36.	Nahar Ghatti
		37.	Kheriya
		38.	Gadhi
		39.	Pipalya Chacha
		40.	Gyasari
		41.	Pharaspuri
		42.	Shyamgarh
		43.	Sarangakhedi

Source: Assessed based on Google Earth imagery corroborated with Toposheet

*Aol villages also include the Project villages

Figure 4.36 Map depicting villages in the Study Area of Agar

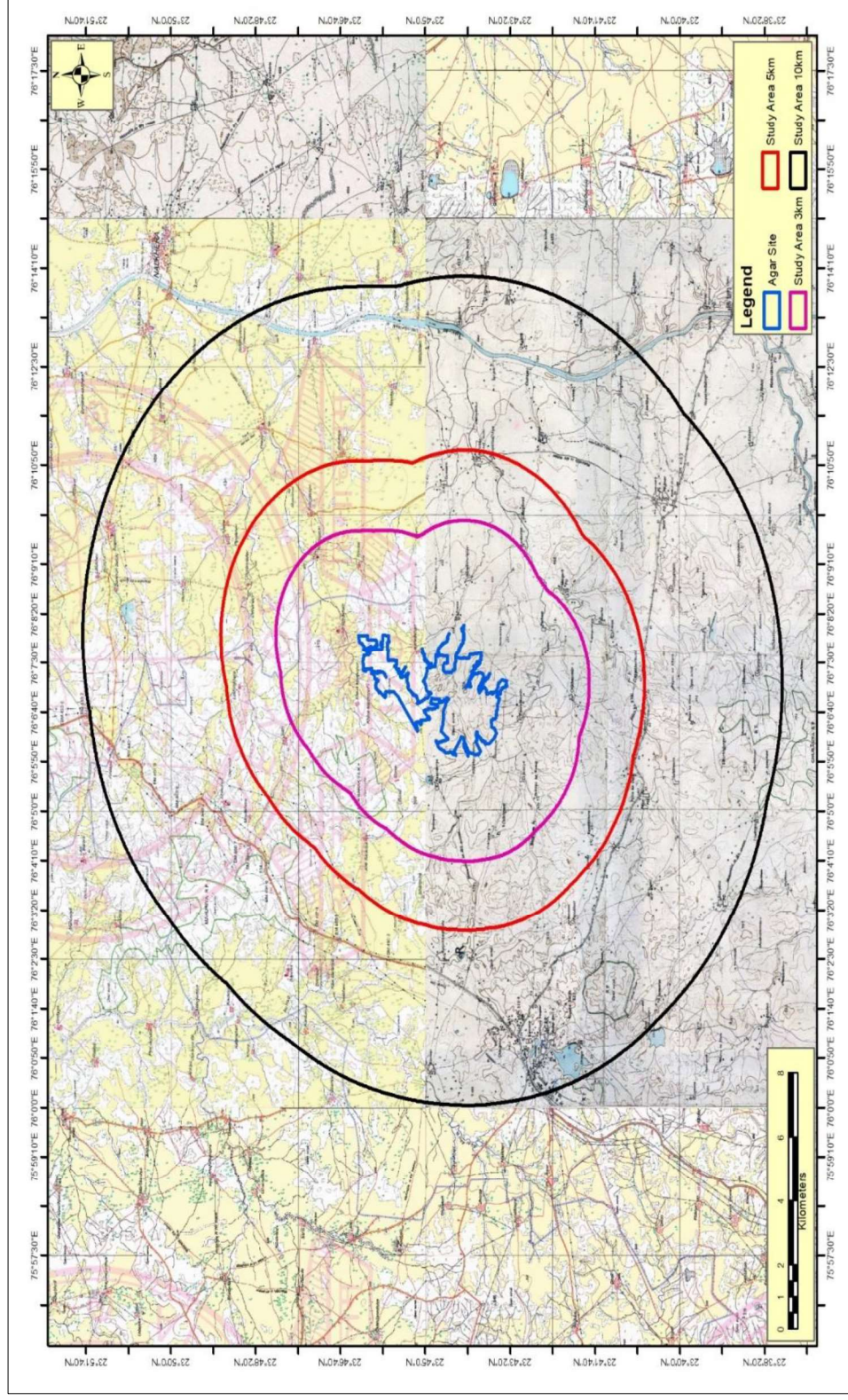
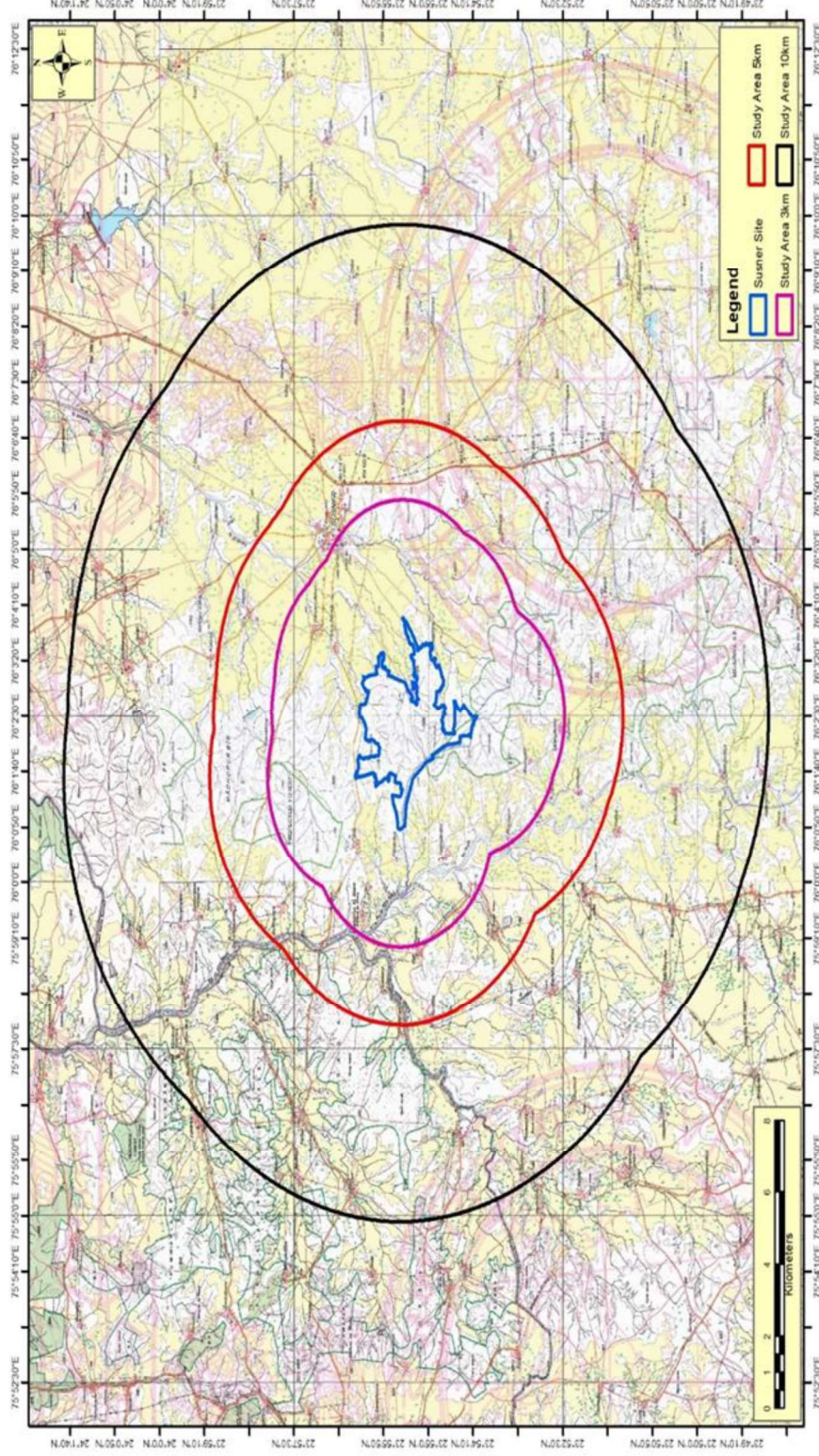


Figure 4.37 Map depicting villages in the Study Area of Susner



4.5.3 Demographic Profile of Study Area

The project footprint falls in eleven villages (known as "Project Villages") while the Aol has 43 villages, as depicted in Table 4.37. The Project Villages comprise of 2051 households supporting a population of 9236 individuals. The average size of the households is 5. Palada village is the only one reporting a positive sex ratio amongst the Project villages with the number of females at 1051 per 1000 males.

Overall, the Aol has a sex ratio of 932 females per 1000 males, which is at a similar level to the district figure and the state figure (931).

Table 4.37 Demographic Profile of Study Area

Village	No of HHs	Population	Sex Ratio	% SC	% ST	% Lit	% F Lit
Project Villages							
Pipalya Kumar	143	631	900	42	0	49.8	32.1
Madhopur	202	852	986	11.2	0	40.25	33.5
Ladwan	213	829	950	30.2	5.8	38.35	24.7
Kesai Dehariya	149	651	914	21	0	54.22	40.2
Karwa Khedi	175	715	833	57.6	0	48	26.7
Dudhpura	93	424	990	0.23	0	38.9	25.1
Bijnakhedi	268	1216	990	26.7	0	51.2	41.1
Palada	166	837	1051	36.4	0.35	49.4	39.6
Naharkheda	222	1148	993	29.2	0	39.4	27.8
Umariya	135	610	876	44.1	0	49.2	35.8
Pipalya Nankar	285	1323	971	33.63	0	40.6	30.2
Total	2051	9236	956	31.03	0.55	44.6	32.7
Area of Influence							
Aol Total	7865	36916	932	27	3	49.4	36.9
Study Area Total	9916	46152	937	25	2.6	48.5	36

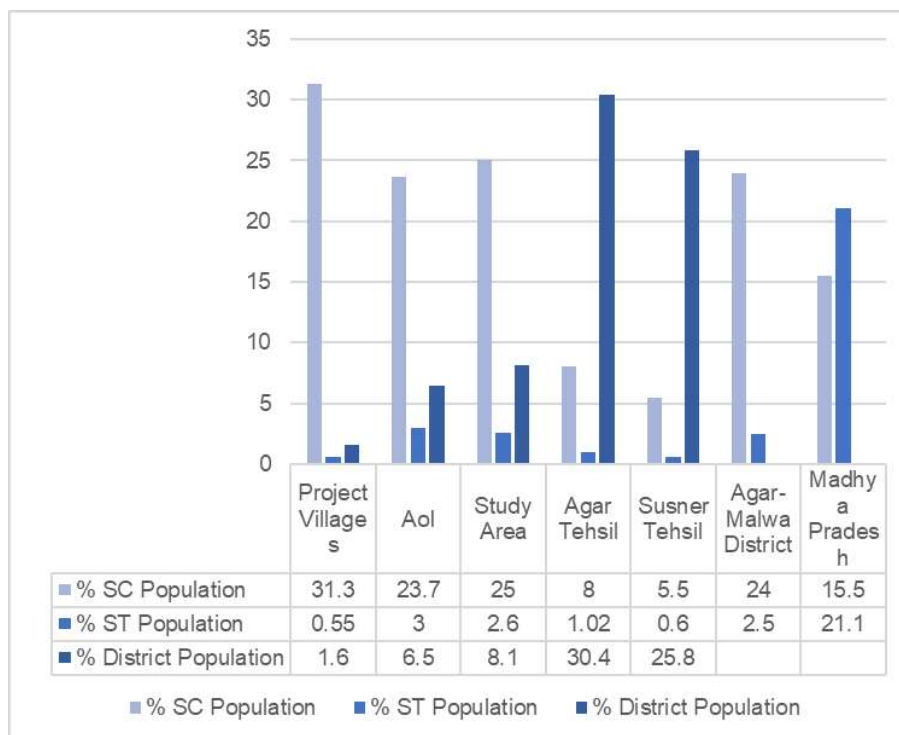
Source: Census of India, 2011

The total literacy in the Study Area is 48.5 percent whereas the Female literacy rate is lower (36 percent). The proportion of SC population is higher in the Project Villages as compared to the Aol figures, while the proportion of ST population is higher in the Aol as compared to the Project Villages, depicting a nominal presence of ST households in the Project footprint area.

4.5.4 Social Stratification

The entire population in the Aol falls in the rural category. The villages comprise of majorly Scheduled Caste (SC), Gurjars, Bhil (ST), and OBC communities. Ladwan village in Agar tehsil and Palada village in Susner tehsil are the only two villages with the presence of ST households.

Figure 4.38 Proportion of SC/ST, and General Population in the villages of Study Area vis-à-vis District



Source: Census of India, 2011

4.5.4.1 Scheduled Caste Population

The major sub castes of SC population inhabiting the area are *Harijan, Chamar, Nat, Balai, Malvia, Suthar, Nai*, etc. The livelihood pattern of SC population does not differ significantly from the General community. However, they are predominantly, landless or households with marginal (less than 1 hectare) land holding. Their dependence, is on seasonal agriculture, casual labour work, and as grazers/herders. The SC population that includes *Chamars, Nai, Balai*, etc. have a history of encroachment on government land, adjoining their allotted patta land parcels for agriculture. They use the encroached parcel for seasonal farming (mostly one rain-fed crop in a year), that supplements their main income earning from livestock. The latter is their primary source of income, as reported during consultations with grazers and livestock owners in villages across the project footprint. The SC households are almost equally distributed across Agar and Susner tehsil in the Project Villages.

4.5.4.2 Scheduled Tribe Population

While Madhya Pradesh has a very high proportion of ST population, the presence of ST population is relatively low in the district, and the Study Area. Within the Project Villages, from where the land for the project will be procured, only 3 percent population is from ST category. The ST category comprises the Bhil tribe, which inhabits the project area villages, in small numbers.

Within the Project Area, the ST community is present in Ladwan village in Agar tehsil, and Palada village in Susner tehsil (as per Census data, 2011). However, as reported during consultations, the former has about 10 households of Bhils (ST), as reported during the consultation, while the respondents of Palada village did not report the presence of any ST community households- the baseline may have changed in the past decade.

The Bhil community has been residing in Ladwan for over five generations (the number of years will be confirmed during the FPIC consultations but it probably implies more than 50 years), and are residents of the village. There has been no inward or outward migration of the tribal families from the village, and these households are largely agrarian. Similarly, there are Banjara households in Madhopur who are the original inhabitants of the village. The Banjaras although tribal in origin and classified as such in another state, have a history of migration, and are not classified as ST in Madhya Pradesh.

Box 4.1 Bhil Tribe

The main occupations of the Bhil tribe are agriculture and livestock rearing, however, the land holdings amongst the community were reported to be slightly lower (0.22-0.33 ha average) than that of the general community. The tribe has access to the mainstream education, health and justice system, participates in religious festivals such as Diwali, Holi and Raksha Bandhan and is part of the Gram Panchayat of the village. Nevertheless, the tribe has their own traditional leadership in the form of group elders, who play an important role in decision making and conflict resolution

4.5.5 Literacy and Education

The total literacy rate and female literacy rate in the Project Villages is the lowest as compared to the Aol, Study Area, and district figures. The female literacy rates in the Aol is marginally higher than in the Project Villages but significantly lower than the district and state figures.

Figure 4.39 Comparative Overview of the Literacy Rate across Study Area, District and State



Source: Census of India, 2011

The scenario is changing in terms of education of girl children, wherein all girls in the Project Villages attend schools, and some girl children are currently studying in Agar and Susner towns for higher education. Dropout rates are common across boys and girls after completing upper primary (8th standard) level of education. The stated reason for dropouts is the distance to be travelled as higher education institutions are located in towns, and also the lack of residential facilities in neighbouring

cities for undertaking graduate level courses. There is no stated bias amongst the villagers against sending their girl children to school, as most of the villages have an associated primary or secondary schools within the same or in neighbouring village. However, they are not supportive of sending girls out of the village to the nearby towns for further education as it involves additional costs and risks.

As understood from the consultations, most of the school going children undertake agriculture as means of livelihood after dropout of formal schooling. The boys also explore the option of construction work for daily wages, while girl children have limited earning options – either as herders/grazers, or agricultural labour. Due to lack of information regarding formal private sector jobs, and scarcity of government jobs in the district, formal sector jobs are negligible. There are no Industrial Training Institutes (ITIs) in the district to provide specialized training courses, neither is there any scope of on-the-job training due to lack of industrial establishments. The proportion of children completing 10th and 12th (both boys and girls) is about 5 – 10 percent of the total school going population.

Lower educational attainment is a limiting factor for other employment opportunities and also highlights that the dependence on agricultural land continues to be very significant for both subsistence and livelihoods.

4.5.6 Land ownership and use

This section presents an overview of the ownership and use of land in the project area, based on the Census 2011. The area has an agrarian economy and hence the dependence on land as a resource is high. The table for land utilization reiterates the heavy dependence on agriculture, making it one of the primary sources of their livelihood.

Consultations with village communities suggest that grazing, agriculture, and fodder, firewood collection are undertaken as year round activities, with more intense activities in certain months. The trend of using bore wells and irrigation channels for improving agricultural productivity of the land has also been reported on private land, in recent years.

4.5.6.1 Land Category Breakup

An analysis of the secondary data on the land use and cover pattern in the Project Villages and the AoI shows that there is a similar trend across both, with the highest share of the total available area utilized for agriculture. Barren land, not suitable for farming, but used by the villages for other purposes open grazing) has the next highest share, with the Project Villages having a higher share of barren land, as compared to the AoI. The detailed break-down of the total available area, by use category, is given in the table below.

Table 4.38 Land Use Break Up in the Study Area¹

Villages	Total Area (in Ha)	Net Area Sown ²	Forest Area ³	Area under Non-Agricultural Uses ⁴	Barren & Uncultivable Land ⁵	Permanent Pastures & Other Grazing Land ⁶	Land Under Miscellaneous Tree	Culturable Waste Land ⁸	Current Fallows ⁹	Fallows Land other than Current ¹⁰
Project Villages										
Pipalya Kumar	383.51	175.51	0	72	79	19	13.28	19	2.61	3
Madhopur	509.42	171.39	53.48	76.15	155.35	6.97	0	4.74	0	41.34
Ladwan	590.74	266	2	0.74	160	46	9	25	51	31
Kesai Dehariya	252.77	252.36	0	28.78	75.55	119.34	0	4.45	0	41.29
Karwa Khedi	587.09	223	0	258	7.09	29	7	45	0	18
Dudhpura	495.71	66.01	117.04	142.6	71.94	27	0	35.56	0	35.56
Bijnakhedi	709.41	277.62	0	122.94	250.91	6.97	0	3.34	0.6	47.03
Palada	801.75	368.47	81.42	57	237.19	16.03	0	41.28	0.36	0
Naharkheda	837.35	313.5	146.2	99.04	221.91	16.44	0	39.86	0.4	0
Umariya	607.12	181.93	0	56.82	108.07	245.46	0	14.84	0	0
Pipalya Nankar	630.81	333.61	0	47.27	192.87	12.61	0	41.79	2.66	0
Project Villages Total	6405.68	2629.4	400.14	961.34	1559.88	544.82	29.28	274.86	57.63	217.22
	20241.4	10611.8	1421.3	1652.3	3148.2	1073.4	507.2	1074.5	116.7	636.0

² Net sown area is the total area sown with crops and orchards, counting area sown more than once in the same year, only once

³ All lands available for cultivation whether not taken up for cultivation or taken up for cultivation once but not cultivated during the current year and the last five years or more in succession for one reason or the other. Such lands may be either wholly or partly covered with shrubs and jungles, which are not put to any use. Land once cultivated but not cultivated for five years in succession would also be included in this category

⁴ This includes all lands occupied by buildings, roads and railways or under water, e.g. rivers and canals and other lands put to uses other than agriculture.

⁵ all barren and unculturable land like mountains, deserts, etc.

⁶ all grazing lands whether they are permanent pastures and meadows

⁷ all cultivable land which is not included in 'Net area sown' but is put to some agricultural uses

⁸ This includes lands available for cultivation, whether not taken up for cultivation or taken up for cultivation once but not cultivated during the current year and the last five years

⁹ This represents cropped area, which are kept fallow during the current year

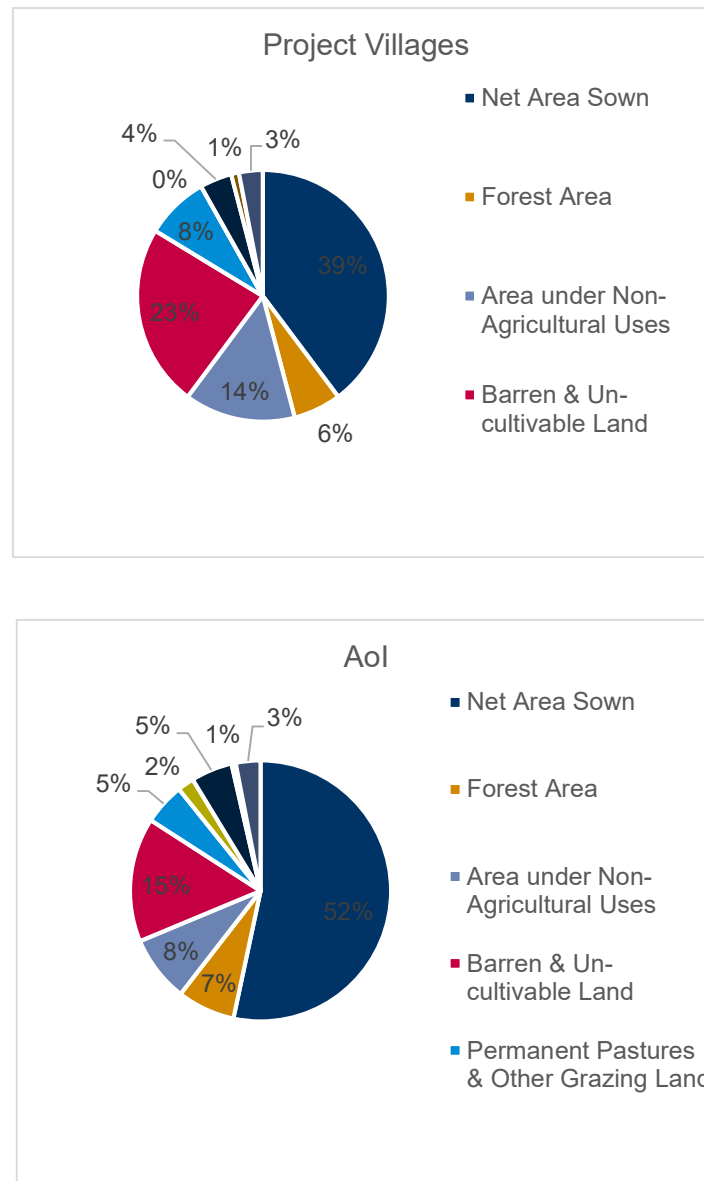
¹⁰ All lands, which were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years

Villages	Total Area (in Ha)	Net Area Sown ²	Forest Area ³	Area under Non-Agricultural Uses ⁴	Barren & Uncultivable Land ⁵	Permanent Pastures & Other Grazing Land ⁶	Land Under Miscellaneous Tree	Culturable Waste Land ⁸	Current Fallows ⁹	Fallows Land other than Current ¹⁰
Aoi Total										
Study Area Total	26647.08	13241.2	1821.5	2613.7	4708.2	1618.2	536.5	1349.4	174.3	853.2

Source: Census of India, 2011

Figure 4.40 shows that approximately 39 percent is net sown area, while 23 percent is categorized barren and uncultivable land. About 6 percent of the area is categorized as forest land, while 14 percent of the area is for non-agricultural use, and 4 percent is culturable waste land. It should be noted that this data is based on Census 2011 estimates, which is now a decade old. More recent estimates of the land use for the Project Villages have been assessed based on aerial imagery and are included in the Physical Environment section of the baseline.

Figure 4.40 Proportion of Land Use in Study Area



Source: Census of India, 2011

In the Aol, approximately 52 percent of the land is categorised as net sown area, while 15 percent of the total area is barren and uncultivable land. Forest area is a meagre 7 percent, 8 percent is under non-agricultural uses, 5 percent is cultivable wasteland, 2 percent of land comprises of miscellaneous tree crops, and 5 percent comprise of permanent pastures and other grazing land. Current fallows area comprise of only 1 percent respectively in the Aol, while fallow other than current fallow area is of 3 percent of the Aol.

4.5.6.2 Land Ownership and Occupation (Squatting/Encroachment)

Baseline assessment shows that encroachment has been in existence on an average for 3- 5 years, and in some cases more than 20 years. According to discussions with the communities, encroached land parcels have been used to provide for fodder for the large number of livestock, and for seasonal agriculture. Landless households are present in some of the Project villages, and reported to be about 10 - 20 households per village in the project footprint area. These households belong to the SC and OBC community and depend on agricultural labour, daily wage labour, and/or tending to livestock

animals of other households for income. Among the land owning households¹, the minimum area owned is 0.22 – 0.55 ha, with the average land holding of 1.1 – 1.65 ha.

Squatting on government land for agriculture, locally referred to as *Atikraman* by the Patwari and villagers alike, is a more recent phenomena and has been a result of combination of two factors – due to increase in population of certain villages, the available land (both private and government combined) has reduced for any land-based livelihood to be undertaken, and secondly, the existing history of encroachment by private and patta holders has led to squatting by landless households (particularly in Susner tehsil). The land used by squatting households is rain –fed, lacks any permanent source of irrigation, and produces lower output (mainly soyabean, and wheat if rainfall is good).

The informal use (squatting/encroachment) of government has the following patterns:

- Encroachment of government land adjacent to existing owned land to cultivate larger parcels or plots in few villages of Agar Tehsil (Ladwan, Karwa Khedi, Dudhpura, Pipalya Kumhar) and in Naharkheda, and Palda village in Susner Tehsil ;
- “*Kabza*”: Certain communities in the villages around Agar (Bijnakhedi, Dudhpura, Madhopur Kheda) have informally (amongst themselves) occupied land for grazing, collection of fodder, and seasonal farming. This seems to be a historical phenomenon over at least two generations (more than 30- years) with land holding classes (also the more power people in the village) accumulating additional land parcels over the years. There are no physical markers to identify the captured land but sine people in the village are aware of this, they do not use these land (or treat these as out of bounds for their livestock);
- Government land near *abadi* or habitation areas is used for set up of livestock sheds through encroachment
- Limited scale of squatting (“*Atikraman*”) for agriculture: In certain villages of Susner tehsil, the use of government land is prevalent among the marginal land holding households and/or landless households (Pipalya Nankar, Umariya, Palda);
- Parts of Charnoi and charagah land (classified by government for grazing purposes) has been encroached in some areas, over the years for agricultural use

Patta land is present in all the villages, which were allotted on lease to landless households (5 bigha each, or 0.55 hectare) by the government. The patta land parcels have been in existence for more than 20 years. The holder of patta land cannot transfer the rights of use or ownership to any other person, without the permission of the District Collector. In spite of land allocation, there are several landless households in the Project Villages, for the reasons as stated by the local community during consultations:

- The list of households eligible for patta allocation (landless households) has not been updated since the last patta allocation was carried out in 2000, during which district administration had undertaken targeted distribution of land to landless households of Dalits, and tribals². This was also confirmed in discussions with members of village Panchayat;
- The extent of encroachment by households that are relatively higher in the social and economic ranking has reduced the available land for households of lower strata (Kumhar, Nai, harijan,

¹ Agricultural Census Definitions of Land Holdings
Marginal land holding
Small land holding
Semi-medium
Medium
Large

Below 1 ha :
1.0 – 2.0 ha
2.0 – 4.0 ha
4.0 – 10.0 ha
10.0 ha and above

² https://sas-space.sas.ac.uk/5653/1/AHRC_5%2C_Sudha_Pai%2C_Land_Caste_and_Power.pdf

Chamar, Rai Balai, etc, all belonging to SC community). Many of these households depend on agricultural labour work alone, and use the squatted land for grazing.

According to the consultations held in villages, most of the patta land is of poor quality and largely unirrigated, thus, it is used for only one rain-fed crop, per year. It is, used for grazing of livestock and fodder. The patta land holders have undertaken land development measures such as clearance of gravel, stones, levelling and addition of fresh top soil, in some cases, to make it cultivable/productive.

Box 4.2 Encroachment as a generational phenomenon

Encroachment as a process has been in existence for more than 20 years, wherein, land owners have extended their boundaries to occupy areas of government land – this has been the practice for both agricultural land parcels extended to government land, and inclusion of parts of government land into private residential area. This process, is however, a directly correlated with land holding.

This practice has been reported by villagers in Kerwa Khedi, Bijnakhedi, Dudhpura, Pipalya Kumhar, and Madhopur villages in Agar tehsil.

Households with greater land holding in the village have the tendency and power to also establish claim "kabza" upon government land (Jangal zameen) in the village, which is meant to be a common resource for grazing.

The people distinguished between "atikraman" and "kabza" – both forms of encroachment of government land- the former is by extending boundaries of owned land while the latter is for demarcating and using 'jungle zameen' for livestock grazing, without making any improvements or changes to it and appears to be a symbolic power statement.

Atikraman or encroachment on government land is used for residential structures, wherein the boundaries are extended to include government land into their residential area.

Source: Community Consultations undertaken by ERM in December (2019) – January (2020)

Use of Government Land- Grazing

Government Land is largely used for open grazing of livestock (grazing on shrubs, grass that grows in the open) and there are designated land areas (*Charnoi*, *Charagarh*) which are meant to be used by the village community, and have fodder crops for grazing. Apart from these, villages with access to forest land, called 'Jungle Zameen' (Naharkheda, Dudhpura, Bijnakhedi, Palda) use the land for collection of dry fodder and fuelwood.

The average livestock holding in each village is around 2 – 3 livestock animals per household. Discussions have revealed that there is no household without any livestock ownership. Even the landless households have goats that they use for supplementing daily food requirement. The livestock animals owned are – cows, buffaloes, goats and hens. Cows are present in the largest numbers, both privately owned for milk, and abandoned cows which were previously privately owned but are now unproductive and abandoned. Abandoned cows ("avara gai"), have become a major issue in the last several years as people shifted from buying cows to buffaloes which fetched higher return on milk supply and could also be used as farm animals. Cows were also abandoned as bans on slaughter and restrictions on sale came into force. Majority of the cows graze on private lands, and/or available grazing land without any direct supervision. Abandoned cows are usually found on government land and may be tended to by some people from the village, although without any claim of ownership or responsibility. There have been reports of destruction of agricultural fields by groups of abandoned cows in some villages in Susner, especially in the last few years.

Box 4.3 The issue of abandoned livestock

The issue of abandoned cows ("avara gai"), is reported in Umariya, Naharkheda Palda villages of Susner tehsil and Pipalya Kumhar, Madhopur, Bijnakhedi, Dudhpura villages of Agar tehsil.

There is a shelter for abandoned cows, or a Gaushala in Agar where owners can keep animals to be tended to, against a fee. However, the gaushala is already full and has no more space to keep animals. The gaushala can be accessed by the wealthier households who can pay to keep their livestock (charged on per day basis). Due to lack of space in the villages to hold the large livestock counts (80% comprising of cows), there has been the case of cows being abandoned. Abandoned cows of each village trespasses into lands of other village, eating up fodder or crops of private land parcels. The village collectively takes responsibility for such cows who do not have designated owners anymore to provide for their fodder and providing access to grazing on government land.

Source: Community Consultations undertaken by ERM in December (2019) – January (2020)

Open grazing of livestock on government land, Charnoi/Charagah and land not designated as Charagah/Charnoi is a common practise. As reported from consultations with households that undertake grazing, open grazing is the preferred option, and typically the grazing land is at an average of 2- 3 km (minimum of 1 km)..

Typically, some youths are given the responsibility to oversee the grazing livestock. There were a few women who would take livestock out to graze, as reported during consultations in Susner tehsil (Umariya, Naharkheda), as the time taken to travel to grazing land is 20 minutes on an average, and the areas are relatively close to the settlements. However, there are challenges to access in other villages, due to greater distance or some households having to travel further as the landed households have captured grazing areas closer to the settlements. The major access issue is the distance of the grazing land parcel, and the time cost associated with tending to livestock.

Increase in number of livestock (mainly cows) in a village has reduced the available fodder for open grazing, and this has led to people using more government land. The adequacy of such grazing areas is seasonal and thus, households resort to purchase of fodder to make up the gap. In villages of Palda, and Umariya of Susner, access to government land has also reduced due to encroachment of such charnoi/charagah land for agriculture from other villages, and grazing by abandoned cows. Here most livestock owning households report purchasing fodder three times a year, buying one trolley load (INR 1500 – 2000 per trolley) per household, at an average.

Land capture or 'kabza' for grazing is a predominant feature of villages in Agar - The village communities of Karwa Khedi, Lawdan, are aware of these 'kabza' boundaries on common (government owned) pasture land and other people are not allowed by the person responsible for the 'kabza' or capture, to graze their livestock on this land. This encroachment is also a generational phenomenon, having continued across 25 – 50 years. There are unwritten rules in the village regarding who can graze such as- outsiders, landless households cannot access such encroached parcels for grazing.

In a recent site visit, local protests against land procurement for the Solar Park project were noted. The protestors were concerned about the further reduction in grazing land. The field survey teams were unable to interact with the protestors as they were opposed to the project, thus the detailed reasons and dynamics of the protests, or who was leading/supporting them was unclear and will be explored through the FPIC consultations, if feasible.

Use of Government Land - Agriculture

Encroachment is prevalent in all the villages, wherein owners of private land have assimilated adjoining government land parcels, or portions of it, into their private agricultural area.

Squatting for agriculture has also been reported to be common, wherein a household/ a group of households are using government land that is more fertile and productive for farming, while their private land/patta land is at a different location in the village. The practice of squatting is prevalent among Banjara households, Some SC households in Susner are using government land parcels classified as charnoi/charagah for farming/ fodder lots.

As reported, the patta holders and private land holders from the adjoining plots have extended their boundaries to include adjoining land parcels for cultivation. The extent of encroachment is difficult to be identified, as there are no physical boundaries demarcating government and private land. The demarcation exercise for the Project boundary was been undertaken in the Project Footprint villages. However, the boundary stones put in place have been displaced from their locations, not evident due to lack of markings, or have been broken, and are not visible currently. A nominal fine is collected by the Patwari, calculated on the yield of crop produced from the land parcel. This fine is collected at an irregular interval (usually 3- 4 years), and not annually. However, no official estimation of encroached land and receipts of the files paid are issues based on the land parcel numbers (Khasra numbers) of the encroacher. The prevailing misconception among the long term encroachers is that after a certain period of time, the encroached land will be transferred to private owners. However, consultations with the Patwaris confirm that there is no change in ownership of land, and it continues to be recorded as encroachment on government land. The RAP will include an assessment of affected encroached land, based on self declaration by the encroachers.

4.5.7 Occupational Profile

The Study Area is categorized by about 50 percent working population, where majority of the working population comes under "Main Workers", i.e. being employed for more than 6 months in a year. The Project Villages have 68.1% Main workers of the total working population. Table 4.39 below depicts that women are relatively lesser contributors to the Main Working Population as men with the difference sometimes more than three fold. In the case of Marginal Workers, women are in higher proportion (18.5%) in the Project Villages, as compared to men (13.4%). The trend is similar in the Study Area as well.

The proportion of Non-working population, comprising of children, the older folks as well as unemployed youth, in the Study Area is higher than that in the Project Villages.

Table 4.39 Working Population in the Study Area (as per Census 2011)

Villages	WPR	Main ¹ (% of WPR)	Main M (% of WPR)	Main F (% of WPR)	Marg ² (% of WPR)	Marg M (% of WPR)	Marg F (% of WPR)	Non Work (% of Total Population)
Project Villages								
Unit 4 (Agar)								
Pipalya Kumar	58.5	62.1	36.3	25.7	37.9	14.9	23	41.5

¹ Main Workers are those workers who had worked for the major part of the reference period (i.e. 6 months or more);

² Marginal Workers are those workers who have not worked for major portion of reference period (i.e. less than 6 months)

Villages	WPR	Main ¹ (% of WPR)	Main M (% of WPR)	Main F (% of WPR)	Marg ² (% of WPR)	Marg M (% of WPR)	Marg F (% of WPR)	Non Work (% of Total Population)
Madhopur	42.7	93.4	62.4	31	6.6	3.8	2.7	57.3
Ladwan	33.5	97.8	82.4	15.5	2.2	0.4	1.8	66.5
Kesai Dehariya	35.6	99.6	81.9	17.7	0.4	0.4	0	64.4
Karwa Khedi	32.4	94.8	92.7	2.2	5.2	4.3	0.9	67.6
Dudhpura	55	94.4	47.2	47.2	5.6	3	2.6	45
Bijnakhedi	55	91.2	48.1	43	8.8	3.6	5.2	45
Unit 5 (Susner)								
Palada	52.9	92.1	50.3	41.8	7.9	0.9	7	47.1
Naharkheda	56.6	37.8	32.3	5.5	62.2	20.9	41.2	43.4
Umariya	61.5	70.4	39.7	30.7	29.6	17.3	12.3	38.5
Pipalya Nankar	58.1	13.4	11.3	2.1	86.6	39.3	47.3	41.9
Project Villages Total	50	68.1	45.4	22.7	31.9	13.4	18.5	50
Aol Total	51.5	67.4	47.8	21.1	32.6	11.2	21.6	47.5
Study Area Total	51.2	67.5	47.4	21.4	32.4	11.6	21	48

Source: Census of India, 2011

The Table 4.40 below presents the worker participation in the Project Villages, during the previous decade, obtained from the 2001 Census of India. It is observed that the overall worker work participation has decreased from 2001 Census to 2011 Census, even though the Non-Working population has decreased. This can be explained by the fact that even though the absolute number of working population has increased, the increase in the total population has been proportionately larger. Similarly, the absolute number of Non-Working population has increased between the two decades, thereby bringing about an increase in the proportion of Non-Working population, especially in the male category. This change, as observed through consultations with youth groups, farmers, etc is a result of number of factors, some of them being increasing landlessness or sub-optimal land holdings, women dropping out of the workforce to take on household work (for economic and cultural reasons), some youths opting for further education, rather than joining the workforce as they enter adulthood. Although agriculture is the mainstay of the economy, the youth population is seasonally employed/employed for minor labour work in agriculture. The lack of formal jobs has increased the dependency on agriculture has led to many youth waiting to join jobs, rather than join the agricultural workforce.

Table 4.40 Proportion and Break-down of Working Population in the Study Area (as per Census 2001)

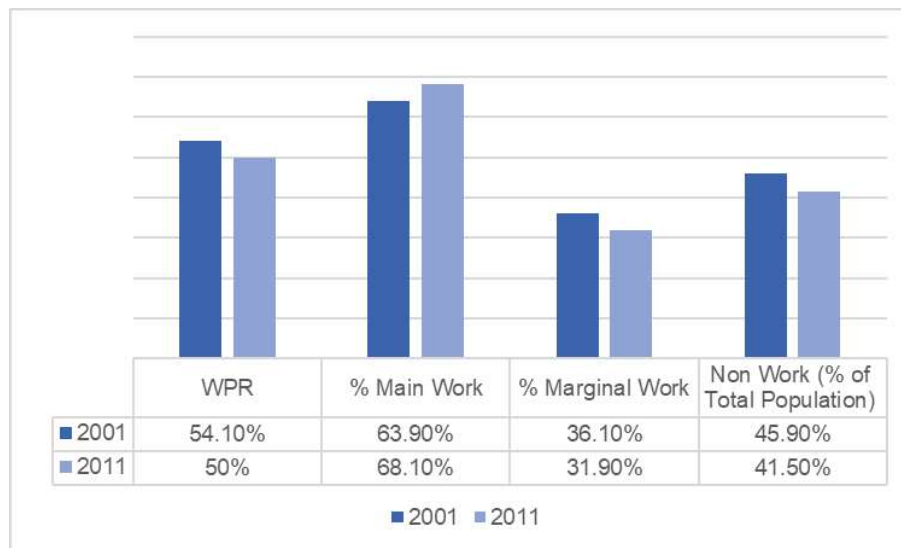
Villages	WPR	Main (% of WPR)	Main M (% of WPR)	Main F (% of WPR)	Marg (% of WPR)	Marg M (% of WPR)	Marg F (% of WPR)	Non Work (% of Total Population)
Project Villages								
Unit 4 (Agar)								

Villages	WPR	Main (% of WPR)	Main M (% of WPR)	Main F (% of WPR)	Marg (% of WPR)	Marg M (% of WPR)	Marg F (% of WPR)	Non Work (% of Total Population)
Pipalya Kumar	51.1	55.9	52.8	3.1	44.1	1.3	42.8	48.9
Madhopur	52.5	63.3	52.9	10.4	36.7	1.8	34.9	47.5
Ladwan	56.6	72.8	52	20.8	27.2	1.2	26	43.4
Kesai Dehariya	68.7	67.2	43.8	23.4	32.8	10.8	22.1	31.3
Karwa Khedi	42	80.9	62.6	18.3	19.1	7.6	11.5	58
Dudhpura	48	42.4	22.9	19.4	57.6	29.9	27.7	52
Bijnakhedi	59.4	49.7	45.7	4	50.3	9.6	40.7	40.6
Unit 5 (Susner)								
Palada	57.6	71.6	53.3	18.3	28.4	3.2	25.2	42.4
Naharkheda	53.5	50	49.5	0.5	50	0.7	49.3	46.5
Umariya	69.9	45	44.5	0.5	55	10	45	30.1
Pipalya Nankar	50.5	95.9	59.3	36.6	4.1	0.7	3.4	49.5
Project Villages Total	54.1	63.9	49.5	14.4	36.1	6.6	29.4	45.9

Source: Census of India, 2001

The proportion of marginal workers' participation has increased over the decade; this is explained by two interlined trends -across genders, female workers have increased in Main workers category accompanied by a reduction in the marginal workers category. On the other hand, male workers, have seen a rise in marginal workers and reduction in Main workers. This indicates that the engagement of women in agriculture and allied activities or non-agricultural labour has become an economic transaction, either resulting from economic empowerment of women or the need for them to take on agricultural labour work as the men migrate out of villages for work in towns and cities.

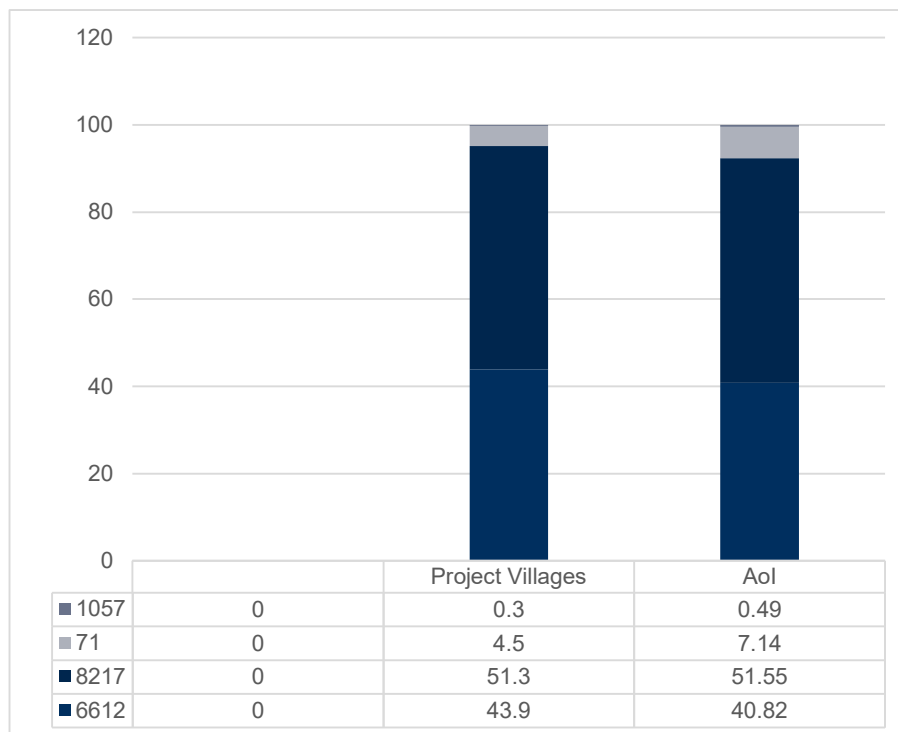
Figure 4.41 Decadal comparison of Working trends in the Project villages



Source: Census 2001 and 2011 data

Out of the Main Working Population, majority of the population can be categorized as Cultivators¹ or Agricultural Labourers², endorsing the fact that the region has an agrarian economy. Other work was reported by 4.5% of the population in Project Villages and 7.1% population in the Aol like construction labourers, working in the stone quarries in Rajasthan, Gujarat, non-farm casual labour in Ujjain and other nearby cities, etc. The proportion of Household workers is negligible across the Study Area, as depicted in Figure 4.42 below. It can be observed as per Census 2011 data.

Figure 4.42 Distribution of Main Working Population in the Study Area



Source: Census of India, 2011

The following categories comprise the main occupational activities within the Study Area:

- Farm Based Activities (cultivators, agricultural labourers and livestock rearing);
- Non-farm based activities (contractual labour for construction, stone quarries, etc.)

4.5.7.1 Farm Based Livelihoods

The farm based activities comprise of agriculture, agricultural labour and livestock rearing. As can be seen from Table 4.41 43.9% of the main working population comprises of agricultural labourers, which is higher than in the Aol. Based on the consultations, it is understood that all the Project Villages have irrigation facility through canals, open wells borewells (60 – 70 ft deep) constructed on private land,

¹ A person is classified as cultivator if he or she is engaged in cultivation of land owned or held from Government or held from private persons or institutions for payment in money, kind or share. Cultivation includes effective supervision or direction in cultivation

² A person who works on another person's land for wages in money, or kind or share is regarded as agriculture labourer. He or she has no risk in the cultivation, but merely works on another person's land for wages. An agriculture labourer has no right of lease or contract on which she or he works

and perennial embankment dams. All the households have reported agricultural work, both by men and women. There are some agriculture allied activities, which are unaccounted for in Census data such as herders who are hired on rent to tend to livestock of others, tractor drivers on rent, fodders suppliers who bring in fodder from nearby villages, sometime also from Rajasthan. Wells, as well the supply of electricity for the entire day for irrigation, form the major sources of irrigation across villages. The current dependence on land and livestock rearing in the area is higher.

Dependence on Agriculture in the Project Villages

Villagers cultivate on their own (private) land parcels, patta land parcels and upon government land that has been encroached/ by the villagers. Information regarding the Solar Farm project was already available in some of the Project Villages due to earlier visits made for drone surveys and information received from Patwari.

Gender Roles in Agriculture

Consultations with women's groups, farmers, and general community in the Project Footprint Villages reveals that the role of women in agriculture is limited to activities such as sowing, weeding, cutting, and during harvesting season. Their primary activities are housework, care of children and the elderly, tending to livestock, cleaning their sheds, collection of fodder, and fuelwood in addition to agriculture work in the fields.

A typical day for women of the household, as described during consultations with women groups is described here - Women divide time between household and agricultural work: They wake up at 5 a.m. and finish all household chores, including tending to livestock of the household by 11 a.m. and then leave to work on field. On the field, they are involved in cutting, sowing, threshing, watering, and collecting fuel wood. They return by 4 – 5 pm, and once back, prepare meals for the family members. In terms of remuneration, men are paid INR 200 - 300 /day while women are paid INR 100 - 200 /day. However, women of the household undertake agricultural work for the agricultural fields owned in their family, which is not accounted for as economic work. This difference in wages has been observed in other villages of Susner.

Crops and cropping pattern in the Project Villages

The primary crops in the region comprise of Wheat, Chana, Mustard, Onion as Rabi crops and Soyabean, Urad, as Kharif crops. In addition, some households also cultivate vegetables for self-consumption. The availability of irrigation facilities has made multi-cropping possible and has reduced the dependence on monsoon for agriculture. The major inputs for agriculture are seed, diesel, fertilizer, pesticides, and labour. Consultations across the Project Villages has shown that the major input cost is towards fertilizers and pesticides combined, while the cheapest component, or one that is usually not costed, is labour.

Table 4.41 Productivity and related costing of major crops in Aol

Crop	Agricultural Season	Costing per Hectare (INR)	Production	Price per quintal in INR (approx.)
Soybean	June-October	40,000-50,000	20 quintals	3000
Wheat	November-April	50,000 – 60,000	50-60 quintals	1600-1700 (last year govt. rate) 1400-1600 (open market rate)
Chana	November-April	25,000	18-20 quintals	5,000-7,000

Crop	Agricultural Season	Costing per Hectare (INR)	Production	Price per quintal in INR (approx.)
Mustard	October- April	30,000	20-25 Quintals	3500-4000
Onion	November–April	2,60,000	620 Quintals	700-800

Source: Community Consultations undertaken by ERM in December (2019) – January (2020)

The villagers sell their produce in government wholesale market or in open mandi to middlemen. The prices quoted in the table above are based on the previous agricultural cycle and produce. All the Project Villages produce soybean and wheat, while a few of the villages also include a third crop. According to the respondents, the entire produce is sold without retaining part of it for self-consumption, as it is grown as a cash crop. Their food requirements are based on market economy, i.e. everything is purchased from local markets, while some minor vegetable produce is self-consumed. The farmers sell their agricultural produce to wholesale traders in open Mandi and not in the Government Mandis due to flexibility in terms of time of sale, lack of documentation required, preference for getting cash payments, against the less preferred practice of receiving cheques for sale in Mandis. The government Minimum Support Price (MSP) for Wheat during 2019-20 was INR 1,840 per Quintal, for Gram was INR 4,620 per Quintal, for Mustard was INR 4,200 per Quintal, and for Soybean was INR 3,399 per Quintal. Additionally, farmers don't get MSP, if the crops are cultivated on Encroached land parcels.

During consultations with farm land owning households in Agar and Susner tehsils it was stated that-

- There are weekly haats in Agar where farm output is sold. Soyabean is a major Kharif cash crop, and similarly, wheat is the staple Rabi crop. Productivity was reported to be higher in Agar tehsil due to irrigation related development activities undertaken by the watershed department more than 10 years ago (as per latest project footprint layout, dated June, 2020, the watershed structures are excluded from the project footprint).
- Rainfall lasts from June to September, as part of South-West monsoon. The average rainfall¹ in the region is around 300 mm during the fourth months of monsoon season. The villagers stated that monsoon is crucial for replenishing the ground water table, as many agricultural and household activities are dependent on ground water sources such hand pumps, open well, etc.
- The government land leased out to the watershed department was utilized for construction of canals, digging of trenches, mini dams constructed to improve irrigation potential. It has helped in multi-cropping, water availability for irrigation, and improvement in productivity of otherwise barren land.

In contrast, the people of Susner tehsil have not reported any change in farm productivity over the years. Villages such as Palda (Agar tehsil), Pipalya Kumhar (Susner tehsil) have not benefitted from land development activities of the Watershed department.

Livestock Rearing

In addition to agriculture, livestock holdings play an important part in the livelihoods of the community, in terms of supplementing household income from agriculture and other sources. The livestock also plays a key role in meeting the nutritional intake of the household as well as producing and selling the surplus milk to local dairy. There is one dairy in Susner Tehsil and one in Agar Tehsil. Apart from the government dairy, there are private dairies which pay a higher price for the milk sold. The price difference is INR 5 – 10, with the private dairy paying higher based on the fat content in the milk.

¹ Based on IMD's rainfall data for the period of four months of monsoon from June - September

Every household has at least 2 – 3 livestock animals, including the landless households. The main livestock holdings in the area comprise of Cows, Buffaloes, Goats and Hen. However, none of the households, as reported during consultations sell livestock animals. There is a government Gaushala in Agar Tehsil for keeping livestock for a daily payment. The gaushala is sometimes used by the households for feeding their livestock when there is a scarcity of fodder. The table below represents the livestock holding (Livestock Census 2019), segregated by type of livestock. Among the project villages, Pipalya Nankar (15%) has the highest holding, followed by Palda, and Ladwan (11%).

Table 4.42 Livestock Holding in the Study Area

Villages	Livestock	Buffalo	Sheep	Goat
Project Villages				
Pipalya Kumar	256	139	0	122
Madhopur	415	345	0	352
Ladwan	367	156	0	172
Kesai Dehariya	290	358	0	77
Karwa Khedi	331	278	0	286
Dudhpura	139	170	0	105
Bijnakhedi	181	289	0	211
Palada	348	270	30	351
Naharkheda	163	97	0	174
Umariya	195	146	0	196
Pipalya Nankar	487	542	0	507
Project Villages Total	3172	2790	30	2553
Aol Total	12871	12718	40	13286
Study Area Total	16043	15508	70	15839

Source: 20th Livestock Census, 2019

Gender Roles in Livestock

With regards to livestock, although the responsibilities are shared by both men and women, women do the major share of the activities – stall feeding, washing of the animals, preparation of dung cakes, milking the animals, while the men (mostly youths) are involved in tending to livestock which grazes in the open. If the men of the household are occupied in agricultural activities, then open grazing of

livestock is undertaken by either youth of the households, or by a rented herder. However, the sale or purchase of livestock/livestock products (milk) is controlled by men. There are also socio-economic variations as women from SC/Muslim and poor households tend to be employed for tending to livestock of upper caste households.

Discussions with livestock holding households reveal that the main concern regarding the project and project related activities is the potential reduced access to common grazing areas, and restrictions on use, imposed by dominant groups in the villages. The provision of alternative grazing land, as suggested, should be closer to the villages (within a radius of 2 km), so that the women/children can take the responsibility of open grazing, and access should be secured for the poor and landless. The loss/reduction in grazing land will impact availability of fodder, income of herders who graze the livestock of others for a fee, and income from livestock (due to reduced fodder availability).

Typically, there are private grazing lots, and encroached grazing lots, with unwritten rules of access (**Section 4.5.6.2**) that restrict grazing of livestock owned by social groups considered lower in the social hierarchy in the villagers of Agar. Setting up fodder lots and cultivation of fodder crops in designated areas has been suggested as a mitigation strategy, such areas should have ease of access by all households in the villages.

In Susner, it is understood from consultations that majority of the fodder is purchased, however, open grazing is preferred for the type of breed of cows that are local or 'desi', and is important for milk productivity. It is suggested that the existing grazing land, attached to the village be excluded from the project, and the grazing lands that are further away, and involves higher time cost in grazing, can be included in the project boundary. However, since this is not technically feasible, other mitigation measures that are acceptable to the community at large and particular groups will need to be worked out.

4.5.7.2 Non- Farm Based Livelihoods

Non-farm based livelihoods comprise of construction labour and daily wage labour in nearby towns. Most of the non-farm livelihood, however, is based on out-migration to other cities in the state, and in some cases, to other states. The non-farm based livelihoods in the area primarily comprise of casual labour involved in construction of houses in nearby villages and Ujjain, working as labourers in stone quarries in Rajasthan, in construction units in Gujarat. The stakeholder consultations also suggested migration of people, either alone or with family, to the cities of Ujjain, Indore, etc., during the agriculturally lean periods to work as wage labourers.

4.5.8 Physical Infrastructure

4.5.8.1 Water Supply and Sanitation

As per the Census data of 2011, all the Project Villages except Kesai Dehariya and Ladwan source drinking water from hand pump. The same has been confirmed during village consultations also. Most of the villages source drinking water from common hand pumps which are present on an average of 2 – 3 per village. In some cases such as Madhopur, there is only one hand pump for the entire village.

Water for irrigation is available from the man-made lakes created by embankment dams, canals which were constructed during 2000s. Some private land owners have also constructed open wells (average depth of 50 – 60 ft) in their fields and linked with pipe system for irrigating the fields. There is one embankment lake that provides irrigation water to Kodiya, Rindoli, Damdam, Khelagaon, Khedi, Kheda, Pilwar, Bijnakhedi, Salri, and Madhopur villages in Agar tehsil.

The villages have open kutchha or unlined drainage for collection and disposal of water sewage from households. These open drains lead to sewers/nullah carrying sewage. As observed during consultation, the system of drainage is primitive and in most cases, the fluid waste is washed off into

fields. Dry waste collection is also not present, and the households either incinerate waste or use it for land fill, to be later used as manure.

As per the consultations carried out with households, toilet facility with dry latrine is present, separate from the household structure. However, due to lack of water for sanitation, most of these toilets have been abandoned, and as a result, open defecation is a prevalent phenomenon. Different groups use different areas near the outskirts of the village, for open defecation, usually on government land. These are both unsafe and unsanitary, however, availability of water and behavioural change are required to ensure the use of toilets

4.5.9 Social Infrastructure

4.5.9.1 Education Infrastructure

According to Census of India, Primary Schools provide education from class 1st to 5th, Middle Schools cater to children studying from classes 6th to 8th, Secondary School provides education to students of classes 9th and 10th and similarly, senior secondary school teaches children studying in classes 11th and 12th. One interesting fact here is that, a composite school with classes 1st to 12th, will be treated as four separate units and will be counted separately as a Primary, Middle, Secondary and Senior Secondary school.

All the Project Villages have co-educational primary schools. There is scarcity of middle schools, with only seven (7) villages having the infrastructure (5 villages in Agar Tehsil and 2 villages in Susner Tehsil). There are no secondary and senior secondary schools present, either in the Project Villages or in the Aol. In total, there are 14 primary schools, 7 middle schools in the Project Villages while there are 29 primary schools, 14 middle schools and one secondary school in the Aol (comprising of 28 villages).

Table 4.43 Availability of Schools in the Study Area

Villages	Government Primary school (P)	Government Middle school (M)
Project Villages		
Unit 4 (Agar)		
Pipalya Kumar	2	1
Madhopur	1	1
Ladwan	2	
Kesai Dehariya	2	1
Karwa Khedi	1	1
Dudhpura	1	
Bijnakhedi	1	1
Unit 5 (Susner)		
Palada	1	
Naharkheda	1	1
Umariya	1	
Pipalya Nankar	1	1
PFA Total	14	7
Aol Total	49	33

Villages	Government Primary school (P)	Government Middle school (M)
Study Area Total	63	40

Source: Census of India, 2011

The lack of village level facilities at the middle and higher levels of education forms one of the primary reasons of children dropping out of schools. As understood from village level discussions, almost all the villages in the PFA have schooling facilities till 5th standard (primary). Upper primary schools are usually at the Gram Panchayat village, and then middle schools, degree colleges are in and around the district headquarter tehsil.

4.5.9.2 Health Facilities and Health Seeking Behaviour

The health facilities in the Study Area follow a three-tier health infrastructure system, as also applies to the state of MP. As per Census 2011 data, in the Project Villages, however, there are no Community Health Centres (CHCs) or Primary Health Centres (PHCs). There is one Primary Health Sub Centre in Naharkheda village in Susner Tehsil, and one Maternity and Child Welfare Centre in both Umariya and Naharkheda village each of Susner Tehsil. The nearest government hospital is available in Susner town and Agar town, as reported during consultations. All the villages rely on the hospital facility available in the towns. There is ambulance facility available for the villages. However, most of the villages prefer private healthcare facility for treatment, both OPD (Out Patient Department) and emergency cases.

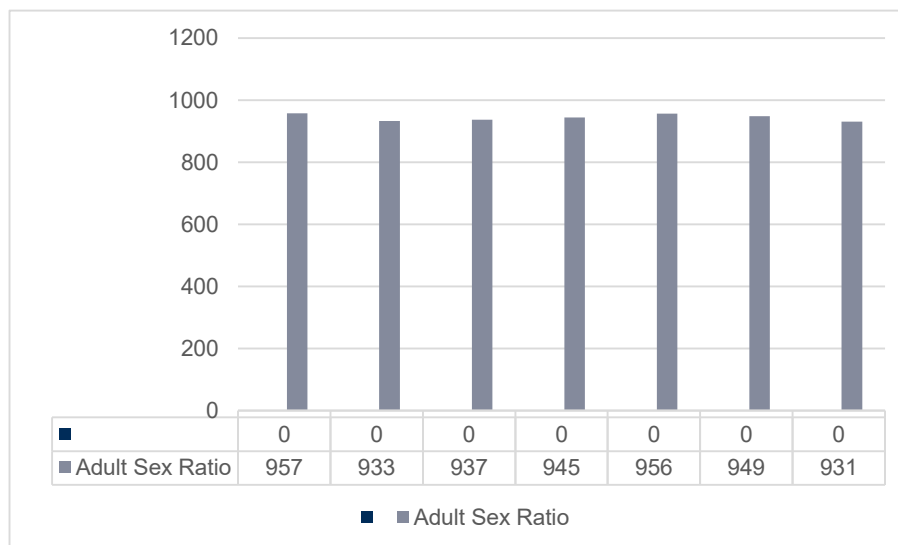
4.5.10 Energy Use

The population in the Study Area is understood to use both LPG as well as fuel wood (as fuel source) to meet their daily domestic energy requirements. While LPG adoption and availability across the villages has improved over the past few years because of Pradhan Mantri Ujjwala Yojana; firewood as fuel continues to be the main domestic fuel for cooking requirements. This usage/dependence also goes up to form the overall economics of livestock rearing in the area. Consultations have revealed that households prefer more of fuelwood for majority of the cooking while the use of LPG is limited. This is due to the high cost of refilling and the distance to be travelled for refilling the LPG cylinders.

4.5.11 Gender: Role in Society

The Project Villages exhibit higher adult sex ratio and child sex ratio as compared to the Aol, tehsil, district and the state figures of sex ratio (both adult and child). Consultations have revealed that there are no gender based preferences for male child and both the genders have equal opportunity at schooling and learning. Discussions with women participants have shown that women take part in Panchayat activities and some of them have even been the Sarpanch of their villages. There is an ASHA worker for each of the Project Villages who provides with maternal health nutrition requirements and keeps a record of maternal health cases.

Figure 4.43 Comparison of Adult and Child Sex Ratios across Study Area, Tehsil and District



Source: Census of India, 2011

4.5.11.1 Role in Agriculture and Livestock

Women from all social and caste groups are entirely responsible for household work, child care and care of the elderly, looking after and cleaning livestock and sheds, as well as work on their private agricultural land parcels. They divide their work hours between household work and work on fields. Their labour work on farm is largely unaccounted for, and is not compensated as an economic activity, in cash terms, except when they work as paid agricultural labour on other people's farms. Women are not usually hired for construction related work due to the nature of work. However, they work as loaders in non-farm daily wage labour. They also tend to livestock and are responsible for taking care of livestock.

The role of women in agriculture is viewed as supplementary in nature, and their main responsibility is towards tending to livestock. Labour work in agriculture is associated with sowing, harvesting, cutting, collection of fuelwood, and loading/unloading activities. The difference in nature of activities is also reflected in the remuneration, as women are generally paid INR 100 – 200 lesser, as compared to men, for daily agricultural labour work as women's work is viewed as lower cost.

With regards to livestock, although the responsibilities are shared by both men and women, women are involved major share of the activities – stall feeding, washing of the animals, preparation of dung cakes, milking the animals, while the men are involved in herding livestock that open graze. If the men of the household are occupied in agricultural activities, then open grazing is undertaken by either youth of the households, or by a rented herder/. However, the sale of livestock/livestock products (milk) is controlled by men. There are also socio-economic variations as women from SC/Muslim and poor households tend to be employed for tending to livestock of upper caste households.

Box 4.4 Role of Women in Panchayat

In Naharkheda village, consultation was held with women participants. One of the respondents was a former Sarpanch of the village. Consultations revealed that women had the decision making power and Patwari used to consult the Panchayat regards to farm loan wavers. However, there exists class based differences where the land owning class dominates over the households with small and/or marginal landholdings. Women labourers, who work on the fields of others, face oppression in terms of lower wages compared to men for the same work, and distribution of work. The wage differential is Rs 100 – 150 /day, with men paid higher

Source: Community Consultations undertaken by ERM in December (2019) – January (2020)

Role of Self-Help Groups (SHGs)

Government led SHGs are present and active in Ladwan (9 SHGs), and Pipalya Kumhar (5 SHGs) villages of Agar Tehsil. None of the other villages in the Project Footprint have reported to the presence of any active (operational) SHG currently. In Ladwan, there are 12 – 13 members in each SHG, and the activities are limited to loan disbursement. They lack institutional building capacity and are in need of government support. In Pipalya Kumhar, the SHGs have been provided with credit through microfinance institutions. These loans are provided to women for creating income-generating assets. The loans have been used to purchase livestock animals, which explains the high number of cows in the village.

The presence of SHGs group as a collective body has been observed in only these two villages, where women members have a strong opinion in the decision making on matters relating to community well-being, economic growth of the village, and protection/conservation of natural resources (land, water) available to the village.

Section 5 discusses the various categories of stakeholders that are present in the Study area for this assessment and presents their profiles, expectations from and influence on the project.

5. STAKEHOLDER IDENTIFICATION, INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

This section provides the stakeholder identification and mapping for the project based on the current planning stage. The identification is based on present understanding of revised land procurement. The analysis of the identified stakeholders is based on their profiling and the significance of impact/influence each stakeholder in relation to the project. This information is important for the development of the Resettlement Action Plan (RAP). This analysis will be revisited as the project progresses into resettlement implementation and construction phase.

5.1 Stakeholder Identification and Categorization

A stakeholder is defined as "any identifiable group or individual who can affect the achievement of an organization's objectives or who is affected by the achievement of an organization's objectives". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project.

The table (**Table 5.1**) below presents the key stakeholders identified until the current stage of the Project, and have been categorized as primary and secondary stakeholders. Those person(s) or groups who will be directly impacted by the project are **Primary Stakeholders** and those who have an indirect influence or the Project impacts indirectly are the **Secondary Stakeholders**.

Table 5.1 Stakeholder Group Categorisation

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Individual and Community	■ Private Land Owners from the Project Area villages ■ Encroachers on government land ■ Squatters for agriculture on government land ■ Farm and non-farm labourers ■ Grazers ■ Banjara households sustaining direct impacts(IP) ■ Women groups ■ Livestock holding households who use the government land for open grazing for their livestock ■ EPC Contractors ■ Potential unskilled labourers to be engaged during the construction phase of the Project	■ Fence Line Community ■ Vulnerable Social Groups ■ Other Indigenous people
Institutional Stakeholders	■ Gram Panchayats of the Project Villages ■ Agar and Susner Tehsildars; ■ Patwaris	■ Local Political Groups ■ Civil Society/Local Non-governmental organizations (NGOs) ■ Local Media
Government Bodies/Regulatory Authorities	■ Regulatory Authorities comprising the following: ○ MP Pollution Control Board; - Central Pollution Control Board (CPCB)	■ Dairy Cooperatives ■ Agriculture and Livestock Department at Agar ■ Industrial Training Institute (ITI), Agar

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	- Ministry of Environment Forest and Climate Change (MoEFCC) - Local Fire Authority; - Ministry of Road Transport and Highways - State Transport Authority; - District Collector and Revenue Department; - Central Electrical Authority through C.E(P&D) Jabalpur; - Department of Telegraph – Communication, Govt. of Madhya Pradesh; - Department of Panchayati Raj, Madhya Pradesh; - Labour Department; - Wildlife Warden, State Forest Department; - District and State Forest Department, MoEFCC.	■ Department of Animal Husbandry, Dairy Development, Agar
	■ District Administration	

5.2 Stakeholder Analysis

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale and frequency) or degree of influence (power and proximity) of stakeholder group and urgency/likelihood of the impact associated with the particular stakeholder group in the project context.

The magnitude of stakeholder impact/influence is assessed taking the power/responsibility and proximity of the stakeholder group and the group is consequently categorized as negligible, small, medium or large. The urgency or likelihood of the impact on/influence by the stakeholder is assessed on a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in table below.

Table 5.2 Stakeholder Significance and Engagement Requirement

		Likelihood of Influence on/ by Stakeholder		
		Low	Medium	High
Magnitude of	Negligible	Negligible	Negligible	Negligible
Influence/	Small	Negligible	Minor	Moderate

		Likelihood of Influence on/ by Stakeholder		
		Low	Medium	High
Impact	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

The influence and priority have both been primarily rated as:

- High Influence: This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority to engage with the stakeholder;
- Medium Influence: Which implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level to engage the stakeholder which is neither highly critical nor significant in terms of influence; and
- Low Influence: This implies a low degree of influence of the stakeholder on the project in terms of participation and decision making or low priority to engage that stakeholder.

The intermediary categories of low to medium or medium to high primarily imply that their influence and importance could vary in that particular range subject to context specific conditions or also based on the responses of the project towards the community

The stakeholders identified above, and their corresponding significance for the project is based on current understanding at the planning stage. The influence and/or impact by a stakeholder group, and its consequence on the project can change during construction and operation stages in future. The stakeholder mapping, therefore is a live document that will be revised from time to time, so as to make it comprehensive for any given period of time.

Table 5.3 Stakeholder Analysis

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Primary Stakeholder					
Private Land Owners from the eleven villages in the Project Footprint Area (PFA)	- Private Land Owners comprise of those households, whose land parcels are falling within land footprint of the solar park; - This group is dependent on their land parcels for their livelihood needs; - Among the communities in the villages of PFA, majority of the land holding is with the Sondhiyas, Rajputs, Gurjars, and Thakurs. While SC and Banjaras have the lowest or no landholding, as reported during consultations; - Among the land owning households, the average land holding reported is of 0.55 – 1.1 ha;	- The project will be set up on 51.45 ha of private land in Agar across seven villages and 82.25 ha of private land across four villages in Susner; - The dependence on land for agriculture and livestock in the area is high, as depicted in the Census data and reported during initial consultations; - The purchase of land for the project development activities will affect the livelihood of this stakeholder group due to reduced/no land holdings; - Additionally, if this stakeholder group is provided with an alternate land parcel,	- The stakeholder groups' influence on the project is important to ensure their consent to sell land as per the MP Mutual Consent Policy 2014 - Their support is key for the smooth functioning of the project related activities in the area, even after land purchase, in the operations phase.	- Concerns regarding private land being procured by the Project and whether people will get a fair price, because there has been significant cost and effort expended in the preparation of the land for making it cultivable; - The community at large wants minimal disturbance with regards to access issues, pollution, health and safety risks and influx of migrant workers - This Stakeholder group may expect income generating activities or employment as construction labourers, masons, drivers, etc. during the construction phase of the Project;	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
		the quality of alternate land parcels and the effort and investment required to make it fit for cultivation, is also of key concern, as the entire terrain is rocky, uneven and requires sufficient amount of top soil to make the land fertile; The private land owners with small land holdings (less than 1 ha.) also work as agricultural labourers on private agricultural land as daily wage labour. The impact on livelihood will be therefore two-fold – loss of income from reduced land holding of self, and loss of income from agricultural labour work due to reduced land holding of others.		- Access to the GRM established for the project; - Clarity in terms of scope of work, expectations, key performance indicators, responsibilities and timelines for the project;	

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Encroachers/occupiers (for agriculture)	- Encroachment differs in Agar and Susner tehsils- - In Agar, large private land owners who are relatively economically well-off in the village, have used encroachment as a practice to increase the area under private control, and used for agricultural, livestock practices. This practice has been in existence for more than ten (10) years due to which the land owning class has amassed large parcels for farm-related use. - In Susner, the landless households and households with patta land have relied on encroachment for seasonal cropping, and grazing. The landless households of Scheduled Caste and the Sondiya community have been practicing encroachment on government land which is barren and mountainous terrain	- This stakeholder group has been using the land for livelihood activities; though does not have legitimate claims or ownership of the land. In fact, they are well aware of their illegal status; - The project would lead to disruption of economic activities and incomes to these households, particularly the households in Susner tehsil who have marginal land holding and rely on encroached land for farm-based income.	The influence of this stakeholder group on the project is moderate, considering they do not have legal rights on the land; however there have influence in the village by virtue of their economic power, as in the case of households having access to encroached land in Agar tehsil who belong to the wealthier strata and have a dominant position in the villages.	- Adequate compensation for the encroached/squatted upon government land being procured for the project activities as users have made improvements to the land without any formal rights (encroachers, squatters); - Additionally, their concern is for the proportion of land parcels under their (informal) possession are undeclared; - This stakeholder group might expect employment in the project and/or support for income generation activities	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	When the encroachment related practices are identified by the Government officials, these individuals are willing to pay fines against the use of Government land;				
Squatters on government land (for agriculture)	- Squatting for agriculture has been reported by households wherein arable land parcels/land classified as grazing land is used for farming at a location which is not adjoining their patta/private parcels. - In squatting for agriculture, the parcel is sub-divided among the households that make up a larger family. Typically brothers of a family separate their farming land in the larger squatted area demarcated by either timber trees, stone boundary, etc.	The project would lead to disruption of economic activities of these households, where the squatted land parcel is falling in project boundary. As reported from consultations, the households have undertaken investments for land improvement, and sometimes depend on squatting as a source of substantial income, that supplements labour work	The influence of this stakeholder group on the project is moderate, considering they do not have legal rights on the land.	- The concerns of this stakeholder group is similar to that of encroachers - - Another major concern is loss of grazing land for livestock, and if alternative grazing land is being provided, the time taken to cover long physical distance and the limited usability of such alternate land remains a concern.	Medium
Farm and non-farm labourers	Agricultural labour work and non-farm labour is a prominent economic activity for all the villagers.	This stakeholder group has been using the land for livelihood activities;	The influence of this group on the project is minimal, considering they are a subset of the private land owning	The key concern of this stakeholder group is of losing the access to land parcels from which they	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ Almost all private land owners and patta land holders work as farm and non-farm labourers; ■ Households owning marginal land (less than one ha) work as farm labour for other land owners for daily wages. They are employed by large land parcel owners and those who are higher in the caste hierarchy in the village; ■ Farm labour work is also undertaken by women of the land owning households as well as single-women headed households. As understood from consultations, women working in their own land consider the work as a part of their household duties; ■ Non-farm labour is sought in towns of Ujjain and Susner, and sometimes in neighbouring villages. It comprises of construction work, manual labour work; ■ Non-farm work is primarily undertaken by men of the	■ Both men and women derive income from agricultural labour; ■ There also exists sharecropping arrangement where the farm labour work is paid in terms of share in crop output; ■ The project would lead loss of income for this stakeholder group, and also force them to shift to non-farm labour; ■ The impact is two-fold- firstly, loss of daily income from farm labour, and secondly, higher dependence on non-farm labour which is majorly seasonal in nature	group and/or belong to landless households	derive daily wage farm income; ■ There is expectation however that they will be deriving some form of temporary employment from the project;	

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	village because it involves more physical labour. Women are involved in loading and unloading of materials only; ■ Even though the payment is higher in non-farm work, people tend to prefer farm work as the former involves uncertainty of finding work on a daily basis; ■ Out migration to cities in MP and to Gujarat and Rajasthan has also been reported during consultations, as a part of non-farm labour work. ■ The wages in farm labour is as follows: - Rs 200 – 250 /day (for men) - Rs 100 – 150 /day (for women) The wages in non-farm labour is at a minimum of Rs 200/day				
Banjara households	■ There are certain pockets of banjara settlements in the PFA (Dudhpura village, Agar tehsil) who depend on income	■ The project would lead loss of income for this stakeholder group, and	■ The influence of this group is similar to encroachers/squatters	■ Losing access to land for farming and grazing of livestock;	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	- from livestock and are primarily squatters for agriculture on government land. - There is no specific/distinct customs or practices of these households that is separate from the general community. - They have settled in the villages for more than three generations - However, their location of living is distinctly separate from the larger community	- also force them to shift to non-farm labour; - The impact is two-fold-one loss of daily income from farm labour, and second higher dependence on non-farm labour which is majorly seasonal in nature	- and their concerns are of similar nature. - Although this group forms part of the larger category of encroachers/squatters their concerns and impacts are to be treated separately as their livelihood profile and location profile is relatively unique compared to the overall profile of the village	Whether the proposed alternative livelihood arrangements cater to their needs and treat them uniquely	
Women groups	- There are Self-Help Groups (SHGs) active in 2 of the Project villages only, who are provided with microfinance assistance, and loan grants. The women associated with the SHGs in the village invest on buying livestock and are responsible for the tending to livestock animals, milking them and supplying milk to dairy. - SHGs were reported to exist and currently active in Pipalya Kumhar, and Ladwan in Agar	Due to potential loss of grazing land, the available livestock will be faced with short supply of fodder. The investments made in purchase of livestock animals will, in such scenario, won't provide the expected returns from sale of animal/animal products	- There were protests undertaken by women groups in Ladwan village against the impact on grazing land, and have submitted an official letter to the DC- the drivers and supporters behind the protests are not clear as they did not participate in consultations - However, women groups in other villages are not empowered to the extent	- This Stakeholder group may expect employment as loaders, housekeeping activities, and skill-based training for starting self-employment initiatives; - Access to the GRM established for the project; - Clarity in terms of scope of work, expectations, key performance indicators, responsibilities and timelines for the project	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	tehsil. The SHG activities are limited to loan disbursement.		as witnessed in Ladwan. In the overall sense, their role in decision making is low. The influence of women groups is limited across other villages. The influence of women groups on the overall project is limited		
Livestock holding households/Graziers of livestock on government land	- Livestock holding is an economic activity to support farm income, and for landless households, the major income source. All households, whether holding large land parcels, small/marginal land parcels, or landless own some amount of livestock; - As reported, the landless households will at least have goats for milk consumption, while the land owning households have a mix of cows, buffaloes, goats; - Almost all the communities reported during consultations the issue of abandoned cows – cows which were purchased	- This group, which is a part of the private land owners group as well as households without any land holding will be impacted by loss of available government land for grazing - The impact of such loss will be higher for landless households with livestock who rely on government grazing land for fodder	- This group also has minimal influence on the project as they have no direct control on the land purchase; however they can raise concerns regarding the loss of common property resource (CPR) of the village which was being used for grazing - Based on the consultations undertaken during RAP study, villagers in Dudhpura, Ladwan, and Palda have raised objections to the location of the Project on their village land due to their concern regarding	- Concerns regarding loss of access to fodder from government land (common property resource), and access to forest land; - Concerns over lack of space for animals to graze; - The issue of abandoned animals and how they will be accommodated in the constrained land space;	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	5 – 10 years back and then were replaced with buffaloes which are used as farm animals. Such cows do not have any designated area of grazing and as a result, have caused damage to crops, and grazing land meant for other livestock; ■ Livestock holding gives rise to various earning sources such as hired herder for cows, sale of fodder, and sale of animal/animal products.		the potential impact on grazing land, and loss of access to common fodder lots.		
■ Owners of land required for temporary occupation or use	■ Some of the project components would require short term leasing of land available, largely from Private and/ or Patta land owners; ■ This requirement would be better understood during the time of initiation of construction activity.	■ The short term leasing of land by the project may bring in additional income from lease, if the land is not being used for any other commercial purposes; ■ The project related activities on these land parcels may be for purposes of storage, set up of labour camps, etc. and may result in change in land use/ land cover due to	■ This stakeholder group is critical for availability of land parcels that are conveniently located in the vicinity of project footprint (based on the needs) and are available without disturbances or issues during the lease period.	■ The expectations of this stakeholder group is clear communication of lease terms and amount and timely payments, as necessary; ■ Restoration of land to its original state, or better, at the time of handing it back to the owners.	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
EPC Contractor	This stakeholder group comprises of the EPC contractors and other sub-contractors who will be involved in the Project for various tasks, like access for road construction, building of the solar plant, laying down of Transmission Line towers, civil and electric works for the power plant, etc.	- The Project will create employment opportunities for the staff associated with the contractors - The contractor(s) will be impacted by the grievances that will arise as a part of construction activities from the local community - The project will create demand among the existing labourers (both farm and non-farm) in the PFA to be recruited for project activities. The contractor will be impacted to meet the need of local employment demand	- This stakeholder group is critical for the smooth functioning and timely implementation of the Project; - This group may also play an important role in the formation of public opinion towards the project	- Continued economic opportunities, and employment generation; - Sharing of responsibilities between the SPD, and the EPC contractor - Level of information disclosure to the community and local authorities - Adhering to EHS Standards specified in the agreement, and reporting on the same - Undertake project activities in keeping with the contractual agreements and applicable regulations in place - Establishing an external Grievance Redressal	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Unskilled contractual workers	- This group is comprised of skilled and semi-skilled workers, who will be involved in the project on a contractual basis during the construction phase. - The activities will include, but not limited to transmission tower erection, laying of lines, land levelling, erection of solar panels, security, logistics, etc - The number of such workers during the operation phase generally reduces, and is limited to maintenance activities, site security, etc. Most of the workers are likely to be migrants.	- The project will have a high level of impact on this group in terms through: - As a source of employment - Interaction with the local communities - Safety and security at work - A Labour force Management Plan (LMP) will be required for management of the impacts arising out of their employment at site, and due to influx of migrant labour	The stakeholder group will be critical during construction phase in forming public opinion of the project due to their conduct in and around site premises, and are also responsible for timely completion of the project	Mechanism (GRM) for the community The primary concerns and expectations of the stakeholder group pertaining to the project is as follows: - the role of the project in continued economic opportunity, and a source of income - Legal compliance in accordance to the labour laws in the labour agreements, and payment of income and insurance coverage - Health and Safety at work - Extended work opportunities beyond the construction period.	Medium
Gram Panchayats	This stakeholder group is comprised of Sarpanch, ward member and Gram Sewak of Panchayats of Palda, Naharkheda (including	The influence of project on this stakeholder group is minimal due to limited control that the project can exert on the	This group has the ability to influence the perception of the community in regards to	Involvement of this group in decision making process for the project, especially related to the land taking process	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Agar and Susner Tehsildars	This group is comprised of the regulatory authorities at the tehsil level that are responsible for land demarcation for the project and for various permits and licenses pertaining to the project.	- The project should comply with the requirements of the Tehsil regarding approvals and verification of allotted land parcels; - Secondly, the tehsildars should have complete information on the project, and awareness of the land-based impacts the project can create in the villages falling under their tehsil.	- This stakeholder group is high in priority as this group provides the land demarcation and permits and licenses essential for the functioning of the project; - Noncompliance to conditions laid down in permits issued by this group stakeholders group can result in penalties and fines being levied on the Project.	- Involvement in the formulation and implementation of the community development activities for the project; - Adequate communication of project information, in terms of timelines of key activities and their potential impacts.	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Patwaris	This stakeholder group is critical because the physical verification of the allotted land parcels, verification of encroachment on the allotted land parcels, and demarcation of the parcels is undertaken by the Patwaris;	None	This group has high impact because of their role determining the land parcels but of low influence due to their position in the lower order of government machinery	- Information disclosure regarding the project timelines; - Disclosure of project footprint area;	Low
District Administration	The District administration is the nodal administration that approves land allotment, directs the lower level government bodies and finalizes the project footprint area	None	The District Collectorate (DC) is a high impact and high influence stakeholder due to their pivotal role in land allotment approval, oversight on private land purchase, and acting as the final authority on compensation, solatium for private land purchase	- Information disclosure of the project; - Approvals and regulations undertaken by the project proponent; - GRM of the project; - Compensation principles followed by the project proponent; - Engagement undertaken with local level bodies (Tehsil office, Panchayat)	Low
Regulatory Authorities at state and central levels	This stakeholder group is comprised of the central, state and district level regulatory authorities;	The main concerns of the Regulatory Authorities from the Project Proponents is abidance to all	These authorities influence the project in terms of establishing policy, granting permits and approvals for the	Concerns regarding necessary approvals for use of panchwan land (if any);	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	These authorities influence the project in terms of establishing policy, granting permits and approvals for the project, monitoring and enforcing compliance with the applicable rules and regulations.	applicable guidelines, policies and laws	project, monitoring and enforcing compliance with the applicable rules and regulations;	Use of community forest, and provision of alternative land for creation of such forest	
Secondary Stakeholders					
Fence Line Community	- This stakeholder group is comprised of the local population in the eleven villages, coming under the project boundaries; - This stakeholder group has been using the land identified for the Project for grazing of their livestock, accessing their agricultural fields or using the land for other common activities.	- The project will use land which is currently being used by this stakeholder group in accessing their farms, ponds and other common areas, grazing their livestock, etc.; - Some of the community members also use this land for cultivation (through encroachments) or work on the farm lands as agricultural	This stakeholder group shall play a critical role in the smooth functioning of the Project.	- Adequate provisions of easements while designing various project features in order to ensure minimal access restriction for this group; - Minimal disturbance to this group due to various activities of construction, operation and decommissioning phases.	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Vulnerable social groups such as women headed households, Landless households, households depending solely on grazing of livestock	- This stakeholder group is comprised of groups/households that are considered to be vulnerable due to their social, or economic status in the society. - For the project, the vulnerable groups are identified as women headed households, landless households and those with less than 1 ha of land and families in the Below the Poverty Line (BPL) Category.	labourers, etc. These activities will be disrupted after the project related activities commence on the identified land The influence of project on this group is similar in nature as the entire fence line community, as it is a subset of the same.	- The involvement of this stakeholder group is expected to be as part of the larger local community; - This stakeholder group should be specifically consulted to ensure adequate provisions in the RAP and LRP for the differential impacts expected on this group	- Priority in economic benefits and development opportunities created by the project; - Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	Medium
Indigenous People (apart from Banjara households)	While the project is not located in a scheduled V area, there is one village with small presence of ST population – Ladwan (10 HHs) in Agar.	The influence of project on this group is included in the group of private land owners, and farm/non-farm labour as they	In the case of Agar, Bhil community is present only in Ladwan village. They live on the outskirts of the village, and are	Priority in economic benefits and development opportunities created by the project;	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ Due to their economic dependency and to ensure safety and security of their family during their absence, they do not create social animosity with the dominant community in their village. ■ Women of the Bhil households are further marginalized and do not take part in decision making process.	undertake similar livelihood activities as of other communities in the villages	■ marginalized in terms of social hierarchy; ■ In keeping with the requirements of the IFC PS 7, the project will require to obtain Free Prior Informed Consent from this stakeholder group prior to the initiation of project activities.	■ Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	
Local Political Groups	■ This stakeholder group is comprised of the political parties and local politicians active in the region; ■ This group might be active in the area and may play an important role in the polarisation of public opinion towards the Project.	■ The project is expected to have minimal or no impact on this stakeholder groups	■ This group can influence the project life cycle by polarising public opinion of the local communities (within PFA and fenceline); ■ The political groups/parties can capitalize on certain negative sentiment regarding the project site/construction activities and make it a	■ The main expectation and concern of the stakeholder group from the project includes the project's role in the development of the area in keeping with the broader agenda of the projects and keeping the expectations of the parties at the forefront.	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Civil Society/Local NGOs	- This stakeholder group comprises of NGOs and Civil Society Organizations at local level who may be active in the area. Most of the NGOs and CSOs working in the region are district level NGOs, involved in literacy, holistic development, children, health and nutrition, agriculture, family welfare. - However, currently there are no active NGOs working in the Agar-Malwa region in the project affected villages, and hence no consultation could be undertaken	The level of influence of project on this stakeholder group is limited as it does not affect the functioning of this group	tool of propaganda against the project - The influence of this stakeholder group is potentially limited as currently, there are no active NGOs working in this region - Based on understanding through consultations with villagers on NGOs who were operating in the past, their role is short-term in nature and limited in outreach.	- Contributing towards the overall development of the area; - The interest of this stakeholder group primarily pertains to the roles of the project in implementing community development activities in the area; and - Involvement in the formulation and implementation of the community development activities for the project.	Low
Agriculture and Livestock Department; Dairy Development Board	- To increase agricultural production in the district - To increase livestock and increase milk production in the district. Promote small/marginal and landless	The level of influence of project on this stakeholder group is limited as it does not affect the functioning of this group	The stakeholder group can provide assistance to the project and help the project in creating a goodwill among the villagers in the affected areas;	To provide technical assistance to farmers to increase their productivity, adopt sustainable farming practices that be undertaken in limited land parcels, and suggest	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	farmers to undertake animal husbandry		They can influence the impact mitigation measures to be adopted by the Project during the construction and operation stage	methods for utilizing the land under solar park area for preserving its fertility; Assist in formation of livestock management cooperatives at village level for efficient livestock and fodder management. Support the project by providing information on stall feeding and how it can be effectively managed.	
Industrial Training Institute (ITI)	To provide training in industrial trades to men and women and develop the capacity for securing employment in industrial establishments	The level of influence of project on this stakeholder group is limited as it does not affect the functioning of this group	- The stakeholder group can provide assistance to the project and help the project in creating a goodwill among the villagers in the affected areas; - They can influence the impact mitigation measures to be adopted by the Project during the construction and operation stage	To form as technical partner in providing skill-based training to youth who can be employed in the project, and thereby creating a pool of skilled work force with authorized certification.	Medium

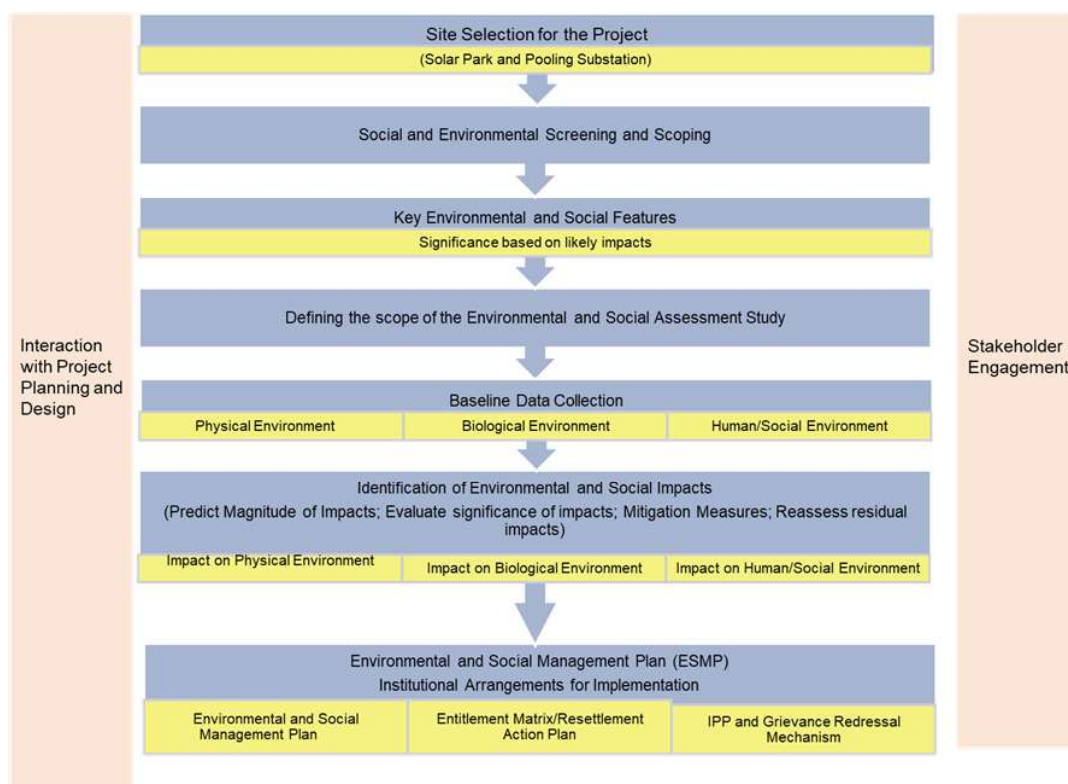
6. ENVIRONMENTAL AND SOCIAL IMPACTS

This section assesses the manner in which the Project will interact with elements of the physical, ecological or social environment to produce impacts to resources/ receptors. It has been organized as per the phases of the project i.e. pre-construction, construction and operational phases of the project life cycle to understand the risks and impacts associated with each phase.

6.1 Impact Assessment Methodology

The ESMF for Solar Park (Feb 2017) states that sub-projects shall be appraised based on a step-by-step process beginning with screening stage. The overall process as depicted in the ESMF is reproduced here and followed in the study.

Figure 6.1 Impact Assessment Process



Source: Developed based on ESMF process as per ESMF for Solar Park, Feb 2017, page-27 and ERM IA Standards

This section describes the impact assessment steps and methodology followed in this report which complies to the impact identification process and methodology (Section-4) of the ESMF for Solar Park.

6.1.1 Screening and Scoping

An Environmental and Social Scoping Study for the entire 1500 MW Project had been previously undertaken during September 2018- March 2019. The earlier identified impacts has been revisited during the ESIA study to confirm/validate the scoping study outcome. The screening checklist

provided in ESMF for Solar Park (page 29) is used to identify relevant components to be investigated in detail during this study. The results of this screening are provided in table below.

Table 6.1 Screening for Impacts

Environmental and Social features	Status/Availability in and around site (study area)	Justification for Expectation of Potentially Significant Impacts
Physical Environment		
Land use and Land cover	- The current land use of the proposed project site is scrub land - Some area is under water features like natural drains, ponds	- In the construction phase, temporary land use changes will occur at contractor facilities and labour camps, material storage areas; - Permanent changes in land use due to installation of PV Modules, Central Monitoring Station, Switching Yard, access roads.
Topography and Slope percentage	- The Project site area is fairly flat land; - The high gradient area, i.e. area > 8° is present.	Impact on topography of the Project site due to site levelling activities.
Soil Environment	- Soil in the area is black cotton soil; - No major anthropogenic activities are carried out in the area which may lead to soil contamination.	- Soil compaction during construction and operation stage due to site activities and vehicular movement; - Decrease of soil quality due to loss of vegetation cover; - Soil erosion during monsoon season and windy periods; - Sedimentation into nearby water bodies due to soil erosion and run-off; - Storage and handling of hazardous materials (e.g., fuel and lubricant) and waste generated from operation of construction equipment and machinery and their maintenance may lead to soil contamination due to leaks/ spillage; and - Impact on soil and land environment due to improper management of domestic solid waste generated. - During operation phase, soil environment will mainly be impacted due to disposal of municipal solid waste, improper storage and disposal of broken solar panels, , accidental spill of transformer oil (Fresh and used oil) and waste water from site office. - Generation of hazardous waste during operation of Solar Park.
Ambient Air Quality	As per baseline monitoring conducted for the Project, ambient air quality parameters (PM₁₀, PM_{2.5},	Dust emissions due to movement of machinery and vehicles;

Environmental and Social features	Status/Availability in and around site (study area)	Justification for Expectation of Potentially Significant Impacts
	SO ₂ , NO _x) were within the prescribed NAAQS limits.	- Fugitive dust emissions due to site clearance activities, excavation and back filling activities etc.; - Air emissions due to operations of D.G. sets.
Ambient Noise Quality	As per baseline monitoring conducted for the Project, the noise levels during night time were observed exceeding the CPCB prescribed limits.	- Noise generation due to construction activities, operation of equipment's, machineries, D.G. sets, movement of vehicles and heavy earth moving machineries. ; - Local communities may get disturb due to higher than anticipated noise.
Water Resources and Quality	- Unit 5 (Susner) is categorized as 'overexploited' (Susner Block) as per CGWB; - Water bodies present in the study are mostly rainfed and are used for domestic purposes as washing of clothes and for domestic animals.	- Stress on local water resources due to water requirement for the foundation activities, establishment of substation, labour camp during construction phase and domestic water use , module cleaning during operations; - Surface water and ground water contamination due to improper disposal of sewage at site and labour camp; - Impact on surface water quality due to runoff from storage area during monsoon; - Soil erosion and sediment transport to nearby water bodies.
Drainage	Project site have water bodies and 3rd or 4th order dendritic drainage channels within the site area.	- Alteration of topography and micro drainage channel due to construction of project site approach road; - Any changes to topography in the area will advertently impact the drainage channels and might result in water logging in adjoining areas of the Project site.
Occupational health and safety	-	- Occupational health hazards due to dust and noise pollution; - Safety risk due to wrong handling of construction machinery, working at heights; and - Exposure of workers to electromagnetic field (EMF) while working in proximity to charged electric power lines during operation and maintenance

Biological Environment

Ecology	Habitats in the study area include agricultural land, open scrub, water bodies and open forest areas	The Project site is located on scrub land and clearance of vegetation may affect the local ecology through the loss of shelter, foraging resources, shade and roosting sites;
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Environmental and Social features	Status/Availability in and around site (study area)	Justification for Expectation of Potentially Significant Impacts
	No forest area within Project footprint	
Social Environment		
Demographics	- The project footprint falls in 11 Project villages, while the Aol comprises 43 villages. The Project villages comprise of 2051 households with a population of 9,236 individuals (as per 2011 Census data while the current figure is expected to have increased significantly). - The average size of the households is 5 in the Study Area	The EPC contractor or its sub-contractors will bring in skilled migrant labour during construction phase of the project that is expected to last for about 21 months; while for most of unskilled and semi-skilled works, preference will be given to local people. Displacement of local people is not envisaged for the proposed Solar Park however there are chances of migration of members of land selling households to cities in search of wage labour jobs, in light of lesser or limited land holdings available in the village.
Economy and Employment	The population is currently engaged in agriculture, animal husbandry and jobs as agricultural labourers	Solar Park will generate employment opportunity for local people mostly during construction phase as well as for select activities (and in smaller numbers) like module cleaning, grass cutting and security related jobs during operation phase.
Land based Impacts	The population is currently engaged in agriculture, animal husbandry and jobs as agricultural labourers	- Land based livelihood may be hampered due to procurement of Private, Patta and Government land for the project. The residents of the project villages are engaged in cultivation in and around the land identified for the project footprint; - There are understood to be more than 600 Project affected people due to land procurement related impacts. - The setting up of project would lead to loss or reduction of agricultural income for Private land owners, patta land holders, squatters and encroachers on Government land, agricultural labourers, Graziers, etc.
Community health and safety	Proposed Project site have settlements in proximity	- Proposed project site have settlements in proximity. - Setting up of labour camps in the proximity of the communities and use of village roads for transportation of material and labour is likely to induce negative impacts such as road accidents, air pollution, noise pollution, potential conflict between the local community and

Environmental and Social features	Status/Availability in and around site (study area)	Justification for Expectation of Potentially Significant Impacts
		labourers, increased risk of gender based violence, etc. ■ Transportation of construction materials and increased vehicular movement will lead to traffic hazards for community residing close to the access roads.
Indigenous People	There is presence of Bhil (ST) households across the Project villages; however, extent of impact by the project needs to be determined through focused consultations	This group is present and is understood to be working as agricultural labourers in private and patta land parcels (perhaps also on encroached Government land parcels) and thus will be economically displaced due to project related land procurement

6.1.2 Impact Matrix

In addition to the screening checklist, various project features and activities that could reasonably act as a source of impact were identified, and these have been listed down the vertical axis of a potential interactions matrix. The resources/receptors in the environment have been listed across the horizontal axis of the matrix. The interaction matrix enables a methodical identification of the potential interactions each Project activity may have on the range of resources/receptors within the Area of Influence i.e. the study area for the Project.

The completed Potential Interactions Matrix for Project activities and likely impacted resources/receptors is presented in **Table 6.2**. The matrix consists of a list of resources/receptors that could be affected against a list of activities for the proposed Solar Park. Entries in the matrix cells are coloured to indicate whether:

- An interaction is not reasonably expected (white);
- An interaction is reasonably possible and the resulting impacts are likely to lead to low effects (grey); or
- The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to medium or high effect (black).

Table 6.2 Activity Receptor Interaction Matrix

	Resources/Receptors																	
Project Activities	Land use and land classification	Soil Environment	Ambient Air Quality	Ground Water Resources and Quality	Surface water Resources and Quality	Topography and Drainage	Noise and Vibrations	Occupational health and Safety	Community Health and Safety	Electromagnetic field	Traffic	Terrestrial Ecology	Aquatic Ecology	Land based Livelihoods/ Economic Displacement	Labor Welfare	Social Infrastructure and Services	Indigenous People	Cultural Heritage
Pre- Construction/Planning Phase																		
Site Survey																		
Project designing and planning																		
Land use change for Solar Park and substations site																		
Construction Phase																		
Widening/ strengthening of access roads																		
Transport of equipment, machinery, materials and labour																		
Establishment of material storage area																		
Establishment of contractor facilities and labour camps																		
Site Clearance																		
Site preparation and levelling																		
Operation of Batching Plant, if any																		
Operation of D.G. set																		

	Resources/Receptors																		
Project Activities	Land use and land classification	Soil Environment	Ambient Air Quality	Ground Water Resources and Quality	Surface Water Resources and Quality	Topography and Drainage	Noise and Vibrations	Occupational health and Safety	Community Health and Safety	Electromagnetic field	Traffic	Terrestrial Ecology	Aquatic Ecology	Land based Livelihoods/ Economic Displacement	Labor Welfare	Social Infrastructure and Services	Indigenous People	Cultural Heritage	
Excavation, foundation and construction works for Solar Park, substations and internal TL																			
Installation of PV modules and other electrical equipment at park and substation																			
Operation Phase																			
Cleaning of PV modules																			
Operation and maintenance of Solar Park and associated facilities																			
Operation and maintenance of Substation																			
Grass Cutting																			



= 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

6.1.3 Prediction of Impacts

Prediction of impacts is carried out with an objective to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in scoping, the impacts to the various resources/receptors were elaborated and evaluated. The list of impacts which were identified from this for detailed assessment for different stages of the project is as follows:

Phase	Impact/Potential Impact Title
Planning Phase	Impact due to Private Land Purchase
	Impacts due to long lease of Government land
Planning and Construction Phase	Land use and Land cover
	Soil environment
	Topography and Drainage
	Water resources and quality
	Ambient air quality
	Ambient noise quality
	Occupational health and safety
	Habitat Modification and Loss
	Impacts due to construction Activities
	Ecosystem Services
	Impacts due to temporary occupation of land for construction activities
	Impact on Community Health and Safety
	Stress on community resources
	Impact on Employment and Entrepreneurship opportunities
	Impact on women
Operation Phase	Soil Environment
	Water resources and quality
	Health and safety
	Collision and Electrocution risks
	Community health and safety
	Impact on employment
	Impact on Indigenous Communities/Vulnerable groups
	Impact on women

6.1.4 Evaluation of Impacts- Impact Significance

Each impact was described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is as shown in **Table 6.3**.

Table 6.3 Impact Characteristic Terminology

Characteristic	Definition	Designation
Type	A descriptor indicating the relationship of the impact to the project (in terms of cause and effect)	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local Regional National Global
Duration	The time period over which a resource/receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the type designations are given in **Table 6.4**. Definitions for the other designations are resource/receptor-specific.

Table 6.4 Impact Type Definitions

Type	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring was designated using a qualitative scale, as described in **Table 6.5**.

Table 6.5 Definitions of Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions (probability less than 20%)
Possible	The event is likely to occur at some time during normal operating conditions (probability greater than 20% and less than 50%)
Likely	The event will occur during normal operating conditions (probability greater than 50%)

Once an impact's characteristics were defined, each impact was assigned a 'magnitude'. Magnitude is typically a function of a combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

In case of unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that was predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the descriptions for these designations vary on a resource/receptor-by-resource/receptor basis. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a positive impact, no magnitude designation (aside from 'positive') was assigned. It was considered sufficient for the purpose of the IA to indicate that the Project was expected to result in a positive impact, without characterising the exact degree of positive change likely to occur.

In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation was followed, but the 'likelihood' factor was considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterising the magnitude of impact, the other principal impact evaluation step was definition of the sensitivity/ vulnerability/ importance of the impacted resource/receptor. There are a range of factors that was taken into account when defining the sensitivity/ vulnerability/ importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors were also considered when characterising sensitivity/ vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value. The sensitivity/ vulnerability/importance designations used herein for all resources/receptors are:

- Low
- Medium

■ High

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact as below:

- **Negligible:** An impact of negligible significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
- **Minor:** An impact of minor significance is one where a resource/ receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards/ guidelines.
- **Moderate:** An impact of moderate significance has an impact magnitude that is within applicable standards/guidelines, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
- **Major:** An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to medium valued/sensitive resource/receptors or medium magnitude impacts occurs to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.
- **Critical:** An impact of critical significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. However, for some aspects there may be critical residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied), which needs to be offset.

Figure 6.2 Impact Significance Matrix

Receptor Sensitivity	Impact Magnitude			
	Negligible	Small	Medium	Large
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Critical

It is important to note that impact prediction and evaluation takes into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IA Process).

6.1.5 Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step was to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, ERM adopted the following Mitigation Hierarchy:

- **Avoid at Source, Reduce at Source:** avoiding or reducing at source through the design of the Project.
- **Abate on Site:** add something to the design to abate the impact.
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site.
- **Repair or Remedy:** some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind, Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries, access, recreation and amenity space).

The priority in mitigation was to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

6.1.6 Preparation of Environmental and Social Management Plan

The final stage in the IA Process is the definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards/ guidelines; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted. The mitigation measures recommended in individual impact assessments were compiled for project construction and operation phases. The ESMP prepared has also taken organization structure of RUMS and context of the project (sectoral, regional, and socio-cultural external environment) to determine practical and effective mitigation measures.

6.2 Impacts on Physical Environment

The proposed Project site is located in a rural setup with no major industrial/ anthropogenic activities. This section outlines the potential impacts on the physical environment due to project activities planned during different phases of the Project lifecycle.

6.2.1 Assessment Criteria

ERM has defined impact assessment standards based on internal parameters that identifies the significance value of the impacts as a matrix between resource/receptor sensitivity or vulnerability and impact magnitude. The internal impact assessment standards for impacts on physical environment has been provided in **Table 6.6** and **Table 6.7** below.

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in **Figure 6.2**.

Table 6.6 Criteria for Resource/ Receptor Sensitivity or Vulnerability

Environmental Attributes	Sub criteria	Low	Medium	High
Land use and Land cover		Land use not of relevant use by Community Negligible visual change.	Land use of local use by communities e.g. grazing, agriculture, but no major dependence Visual Change but common feature	Land use of regional importance. Change would impact Land use classification of the area. Land use of major dependence of local people for agriculture, livestock grazing, settlement etc. Visual Change aesthetically affecting locals.
Soil Environment	<i>Environment</i> The extent to which the soil and its quality plays an ecosystem role in terms of supporting biodiversity. This includes its role as in supporting a lifecycle stage	The soil quality does not support diverse habitat or populations and/or supports habitat or population of low quality	The soil quality supports diverse habitat or population of flora and fauna and supports habitats commonly available in the study area	The soil quality supports economically important or biologically unique species or provides essential habitat for such species
	<i>Social</i> The extent to which the soil and its quality provides a use (agricultural use) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation	The soil quality has little or no role in provisioning of services as agricultural uses for the local community.	The soil has local importance in terms of provisioning services as agricultural services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality i.e. ready availability across the study area.	The soil is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional level for provisioning services.
Topography		Flat topography	Undulating topography	Hilly area
Water Resources - Surface water and ground water (quality/quantity)	<i>Environment</i> The extent to which the water resource plays an ecosystem or amenity role in terms of supporting	The water resource does not support diverse aquatic habitat or populations, or supports aquatic	The water resource supports diverse populations of flora and / or fauna but available in the surface water bodies in the region	The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species

Environmental Attributes	Sub criteria	Low	Medium	High
	biodiversity either directly or indirectly, particularly with respect to dependent ecosystems.	habitat or population that is of low quality.		
	<i>Social</i> The extent to which the water resource provides or could provide a use (drinking water, agricultural uses, washing and other domestic or industrial, use as waterways) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation	The water resource has little or no role in terms of provisioning services as agricultural water source, other domestic uses as washing, bathing, industrial use and waterways for the local community. The groundwater resource is not currently abstracted and used in the vicinity of the Project, but is of sufficient quality and yield to be used for that purpose in the future (and there is a reasonable potential for future use). The ground water block is categorized as 'safe' by CGWB	The surface water resources have local importance in terms of provisioning services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality. The groundwater resource is an important water supply, and is currently used, but there is capacity and / or adequate opportunity for alternative sources of comparable quality. The ground water block is categorized as 'safe' by CGWB.	The surface water resources are wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or transboundary watershed level for provisioning services. The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or national level for water supply or contribution to groundwater dependent ecosystems (e.g. transboundary rivers). The ground water block is categorized as 'semi critical', 'critical' or 'over exploited' by CGWB.
Ambient Air Quality	Human Receptor	Locations where human exposure is transient. ¹	Few Receptors (settlements) within 500 m of the Project site	Densely populated receptors(settlements) within 500 m of Project site
	Ecological Receptor	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection.	Nationally designated sites.	Internationally designated sites.
Ambient Noise Quality	Human Receptor	Industrial area	Residential and Recreational place	Educational/ Religious/ Medical Facilities

¹ As per the NAAQS and World Bank/IFC guidelines, there are no standards that apply to short –term exposure, e.g., one or two hours, but there is still a risk of health impacts, albeit less certain.

Environmental Attributes	Sub criteria	Low	Medium	High
	Ecological Receptor	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the Project ecology team).	Nationally designated sites.	Internationally designated sites.

Table 6.7 Criteria for Impact Magnitude

Magnitude Criteria	Negligible	Small	Medium	Large
Land use and Land cover	An imperceptible, barely or rarely perceptible change in land use characteristics. The change may be short term.	Subtle changes in land use character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.	A noticeable change in land use character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible	A clearly evident, frequently perceived and continuous change in land use characteristics affecting an extensive area. The change may be long term and would not be reversible
Soil compaction and erosion	- Qualitative-No perceptible or readily measurable change from baseline conditions - Scale-Localized area as Particular activity areas Time-Short duration (few days) or one time as temporary	- Perceptible change from baseline conditions but likely to easily revert back to earlier stage with mitigation - Scale- -Project site, activity areas and immediate vicinity not impacting any sensitive receptor Short term-Only during particular activities or phase of the Project lifecycle as civil works or construction phase (few months)	- Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and/or likely difficult or earlier stage with mitigation - Scale- Project site, activity areas and immediate vicinity impacting sensitive receptor/s - Long term-Spread across several phases of the Project lifecycle (few years)	- Major (e.g. order of magnitude) change in comparison to baseline conditions and/or likely difficult or may not to revert back to earlier stage with mitigation - Scale- Regional or international; Permanent change

Magnitude Criteria	Negligible	Small	Medium	Large
Soil contamination	Well within Dutch standard ¹	Well within Dutch standard	Exceeds Target Value but well within Interventional Value	Exceeds Interventional Value and needs intervention.
Topography	An imperceptible, barely or rarely perceptible change in topographical characteristics. The change may be short term	A subtle change in topography character over a wide area or a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.	A noticeable change in topographic character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.	A clearly evident, frequently perceived and continuous change in topographic characteristics affecting an extensive area. The change may be long term and would not be reversible.
Water Resources - Surface water and ground water (quantity/availability)	There is likely to be negligible (less than 1% of lean season flow) or no consumption of surface water by the Project at any time. There is likely to be negligible or no abstraction, use of or discharge to the groundwater by the Project at any time.	The Project will consume surface water, but the amounts abstracted are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation) The Project will consume groundwater or deliver discharge to groundwater, but the amounts abstracted / discharged are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume surface water, and the amounts abstracted are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation) The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume surface water, and the amounts abstracted are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation) The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).
Water Quality	Discharges are expected to be well within statutory limits	Discharges are expected to be within statutory limits.	Occasional breach(es) of statutory discharge limits (limited periods) expected.	Repeated breaches of statutory discharge limits (over extended periods) expected.

¹ Dutch Target and Intervention Values (Soil remediation Circular 2009-2012 Revision), <https://zoek.officielebekendmakingen.nl/stcrt-2012-6563.pdf>.

The assessment of potential impacts to soil and sediment has been considered as per the Dutch Standard as Bangladesh does not have any local standards for soil or sediment quality.

Magnitude Criteria	Negligible	Small	Medium	Large
	Abstractions from or discharge to aquifer(s) are unlikely to cause water quality issues	Groundwater quality be within ambient levels or allowable criteria or may exceed for 1-2 parameters which is common occurrence due to geological regime of the area. Abstraction or discharge to aquifer(s) may cause small but local changes in water quality in the aquifer system. These can be considered potential short-term localized effects on groundwater quality which is likely to return to equilibrium conditions within a short (months) timeframe.	Groundwater quality exceeds ambient levels or allowable criteria for key parameters. Abstraction or discharge to aquifer(s) are expected to cause potential localized effects on groundwater quality which are likely to be fairly long lasting and / or give rise to indirect ecological and / or socio-economic impacts	Groundwater quality exceeds ambient levels or allowable criteria. Abstractions or discharge to aquifer(s) are expected to cause potentially severe effects on groundwater quality which are likely to be long-lasting (e.g. years or permanent) and / or give rise to indirect ecological and / or socio-economic impacts.
Ambient Air Quality	Soil type with large grain size (e.g. sand); and/or No emissions/dust generation due to Project across all phases. Existing ambient air quality of the area is well below the Prescribed NAAQ limits	Soil type with large grain size (e.g. sand); and/or Limited emissions/dust generations for short duration Existing ambient air quality of the area is well below the Prescribed NAAQ limits.	Moderately dusty soil type (e.g. silt); and/or Dust generation and emissions from Projects for long duration Existing ambient air quality of the area is within the Prescribed NAAQ limits but with only differential of 10- 20 microgram/m ³	Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); and Significant process emissions from Project for the entire Project cycle. Existing ambient air quality of the area is exceeding the Prescribed NAAQ limits.
Ambient Noise Quality	Predicted noise levels are at or less than 3 dB (A) above the relevant limits / thresholds.	Predicted noise levels are 3 to less than 5 dB (A) above the relevant limits / thresholds	Predicted noise levels are between 5 and 10 dB (A) above the relevant limits / thresholds.	Predicted noise levels are more than 10 dB (A) above the relevant limits / thresholds.

Magnitude Criteria	Negligible	Small	Medium	Large
	Short term exposure (Few hours in a day and not continuous)		Medium Term Exposure (1 to 6 months)	Long term exposure (> 6 months)

6.2.2 Planning and Construction Phase

6.2.2.1 Impact on Land use and Land Cover

For the purpose of assessment of impacts on land use of the area, following Project activities leading to an alteration in land use of the area during construction phase were considered:

- Construction/ upgradation of access roads (internal);
- Establishment and operation of temporary structures such as temporary site office (portable cabin) and store yard;
- Vehicular movement;
- Establishment of PV modules and associated transformer yard; and
- Construction of Central Monitoring Station, Switching Yard.

Context and Receptor Sensitivity

The proposed Project site is located in a rural setup with no major industrial/ anthropogenic activities. The current land use of the proposed project is mostly scrub land, used for grazing with parcels of agricultural land, some of which are a result of encroachment. In the pre-construction phase, permanent change will occur to the land use (grazing and agriculture) where the project boundary will be established, to prepare for the next phases (construction and operations). In the construction phase, temporary land use changes will occur at contractor facilities and labour camps, material storage areas and there will be a long term change of the land use within the land parcels where the Solar Park and pooling substation will be located. Receptor sensitivity is envisaged to be **medium** considering the land use will change to industrial. It is understood that some avoidance of agricultural areas will be achieved but other areas will need the land use to be changed. All remaining scrub, currently available for grazing will be converted within the project boundary, affecting the dependence of the community on this area, though, it is understood, that some land for grazing will be set aside.

Embedded/In-built Controls

Construction activities will be restricted to within the acquired land and immediate surroundings only. Post construction activities, any land taken for a temporary basis for storage of material would be restored to their extent possible as acceptable to land owners to minimise impacts to land use. Existing roads will be used to the extent possible.

Impact Magnitude

The establishment of the Solar Park will convert scrub land and agricultural land to industrial use for the long term (at least 25 years). The total land area of more than 1,000 ha will undergo land use change, out of which almost 90% is government land. Short term changes in land use are also envisaged from the establishment of the associated facilities such as storage yard, site offices, labour camp and switch yard. However, the impact on land use will only be within the Project boundary and will not affect any of the neighbouring areas. Furthermore, the changes to land use will be reversible. Thus, magnitude of the impact has been assessed to be **medium**. Impacts on land use during construction phase due to establishment of temporary facilities like labour camp, storage area, will be for a shorter period of time.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of medium impact magnitude with medium receptor sensitivity results in impact significance as **moderate**.

Additional Mitigation Measures

- Construction activities should be restricted to designated area;
- On completion of construction activities, land used for temporary facilities such as Contractor office, batching plant (if any), stockyard, labour camp should be restored to the extent possible;
- The land use around permanent Project facilities should not be disturbed; and
- The land should be restored back to the original state to the extent possible after completion of life cycle of the Project and in case there are plans not to continue further at the site.

Residual Impact Significance

The residual impact significance is envisaged to remain **moderate** as changes in land use will be for long term for majority of the Project component (installation of PV modules, access roads, central monitoring station, and switching yard).

Impact	Changes in Land use and land cover				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional	National	International
Impact Scale	Limited to Project site and associated facilities				
Impact Frequency	Construction Stage				
Impact Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered moderate				

6.2.2.2 Soil Environment

The Project site has agricultural land, scrub land and barren land. Following Project activities during construction phase are envisaged that may impact the soil environment:

- Construction/strengthening of access roads;
- Vegetation clearance and top soil removal;
- Storage of oil and lubricants onsite;
- Storage of construction materials; and
- Disposal of different type of waste generated during construction activities, from the temporary site office and labour camp.

Soil Erosion and Compaction

The site clearance activities, excavation and levelling of ground will cause disturbance of the soil strata and impact on soil quality. The Project will also undertake the soil compaction activity to ensure soil stability during the site levelling at site. The project will undertake the soil compaction activity to ensure soil stability during the establishment of storage areas, labour camp, access road, installation of batching plant, establishment of substation, SCADA building etc. During construction activities, there would be compaction of soil in the Project area during movement of vehicles/ construction machinery and work force movement. In addition, laying of electrical wires in the agricultural field during erection of internal electrical lines will also lead to the compaction of agricultural soil to certain extent. Hence, the receptor sensitivity has been assessed as **medium**.

Embedded/In-built Controls

- Vehicles will utilize existing roads to access the site. Existing roads will be widened/ strengthened to have the width and turning radius to accommodate the necessary vehicles for the Project.

Impact Magnitude

The site clearance, excavation, drilling for foundation and access road construction will largely affect the top layers of the soil. Compaction of soil during excavation, transportation of construction material & project components, foundation work, backfilling, erection of structures will lead to temporary effects on natural infiltration of rainwater, but these impacts were temporary and for short term. The baseline data indicates that the bulk density of the soil in the study area is higher and therefore will be compacted less. Further, site clearance will be restricted only in the Project site. Land close to the Project site will not be disturbed. Vehicles will be encouraged to utilize the existing roads with minor strengthening. The usage of existing roads by vehicles and minimal access road construction will reduce the impact from soil compaction in the area.

Based on the above, the Impact Magnitude has been assessed to be **small**.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- The topsoil present in the construction shall be removed and stock piled in separate area;
- The stock pile should be protected from natural elements to prevent from erosion and also degradation;
- Topsoil to be reused on site for landscaping purpose;
- Defined routes for transportation and construction vehicles, workers etc. to minimize soil compaction;
- Good drainage as per the natural slope condition should be provided to reduce surface runoff and associated erosion;
- Back filling and revegetation of the area disturbed will be undertaken phase wise immediately after the completion; and
- Site clearance, piling, excavation and access road construction will not be carried out during the monsoon season to minimize erosion and run-off.

Residual Impact Significance

The significance of residual impacts will lower down to **negligible** taking into account the recommended mitigation measures.

Impact	Soil Erosion and Compaction					
Impact Nature	Negative		Positive		Neutral	
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary	Short-term		Long-term	Permanent	
Impact Extent	Local		Regional		International	
Impact Scale	Limited to Project areas					
Impact Magnitude	Positive	Negligible	Small	Medium	Large	
Resource/ Receptor Sensitivity	Low		Medium		High	
Impact Significance	Negligible	Minor		Moderate	Major	
	Significance of impact is considered Minor .					
Residual Impact Magnitude	Positive	Negligible		Small	Medium	Large
Residual Impact Significance	Negligible		Minor		Moderate	Major
	Significance of impact is considered Negliaible .					

Waste Generation and Soil Contamination due to leaks and Spills

General construction waste generated onsite will comprise of concrete, steel cuttings/filings, packaging materials or plastic. Municipal solid wastes consisting of food waste, plastic, glass and waste paper will also be generated by the construction workforce at canteen facility/ labour camp. A small proportion of the waste generated during construction phase will be hazardous and will include waste fuel, grease, broken modules, paints, chemicals and waste oil containing rags. If improperly managed, solid waste could create impacts on soil quality.

Embedded/In-built Control

- Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill;
- The EPC contractors will have control over the amount and types of waste (hazardous and non-hazardous) produced at the site;
- The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; and
- Workers will be strictly instructed/ trained about random disposal of any waste generated from the construction activity.

Impact Magnitude

The construction contractors will have control over the amount and types of waste (hazardous and non-hazardous) produced at the site. The municipal waste from the labour camp will only be routed through proper collection and handover to local municipal body for further disposal. The hazardous wastes will be temporarily stored in labelled drums on impervious surface at designated area onsite and will be disposed off through approved vendors in accordance to Hazardous Wastes Rules, 2016. The impact magnitude has therefore been assessed as **small**.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- Construction and Demolition Waste should be stored separately and disposed through approved facility/landfill;
- All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels;
- A log book should be maintained for quantity and type of hazardous waste generated;
- Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured;
- EPC Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site;
- Hazardous waste to be disposed through MPPCB authorised vendors;
- In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste;
- The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages;
- Damaged/ discarded solar panels to be disposed with the help of authorised recycling vendors/ module installation contractors/ supplier; and
- Other wastes such as e-waste, used discarded batteries shall be disposed off in accordance to E-waste rules and batteries management and handling rules.

Residual Impact Significance

The significance of impacts due to waste generation after implementation of mitigation measures has been considered as **minor**.

Impact	Impact on soil environment due to waste generation (hazardous and non-hazardous)				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	
Impact Extent	Local		Regional		International
Impact Scale	Limited to Project area				
Frequency	Occasionally				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered minor .				

Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
Significance of impact is considered minor .					

6.2.2.3 Impact on Topography and Drainage

Context and Receptor Sensitivity

The proposed Project Site mainly exhibits undulating topography (varying between 425 msl to 500 msl) being located in the Malwa plateau region and have seasonal water bodies with 3rd or 4th order dendritic drainage channels from the streams of Kanthal River (~2.2 km from boundary in NE direction), Ahu River (~1.8 km from Susner boundary and ~8.1 km from Agar boundary both in West direction) and Lakhunder River (~8 km from Agar boundary in East direction) within the study area which are tributaries of Kali Sindh River. Any changes to topography in the area will advertently impact the drainage channels and might result in water logging in adjoining areas of the project site. The receptor sensitivity has been assessed to be **medium** due to its undulating topography.

Embedded/In-built Control

- Design of the Solar Park will follow the natural topography, efforts will be taken to make limited change the topography.
- Project designing shall be done in a way to utilize existing topography to maximum;

Impact Magnitude

There will be a very limited change in the topographic character of the area within the project footprint. This change will long term and may not be reversible. The alteration in surface drainage pattern of the area due to construction activities will be limited to smaller areas located in project footprint. The natural flow of storm water will not be altered on contiguous larger area. Further, care will be taken to maintain the natural drainage in the area so that rain water can take its path without any restriction by the constructions at site. Hence impact magnitude is assessed to be **medium**

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **moderate**.

Additional Mitigation Measures

- Project shall ensure to avoid any unnecessary changes in the topography especially during the preconstruction and construction phase;
- Micro drainage channel should be particularly avoided when constructing access roads or planning the Transmission Line pathway in order to ensure no change to the topography of the area.
- Storm water drains must be designed in line with the natural topography and eventually drain into the natural seasonal streams in the Site area

Significance of Residual Impacts

The residual impact significance will be **moderate** after implementing above mentioned mitigation measures.

Impact	Change in topography and drainage		
Impact Nature	Negative	Positive	Neutral

Impact Type	Direct		Indirect		Induced			
Impact Duration	Temporary	Short-term		Long-term		Permanent		
Impact Extent	Local		Regional		National		International	
Impact Scale	Limited to Project site and access road							
Impact Frequency	Construction Stage							
Impact Likelihood	Likely							
Impact Magnitude	Positive	Negligible		Small	Medium		Large	
Resource/ Receptor Sensitivity	Low		Medium			High		
Impact Significance	Negligible	Minor		Moderate		Major		
	Significance of impact is considered Moderate							
Residual Impact Magnitude	Positive	Negligible		Small		Medium		Large
Residual Impact Significance	Negligible	Minor		Moderate		Major		
	Significance of impact is considered Moderate							

6.2.2.4 Water Resources and Availability

Context and Resource Sensitivity

During construction phase, water will be primarily required for foundation works for installing solar panels, electrical installations at PSS at Solar Park. Besides this, civil construction activities such as construction of control room, security guard room, utilities, labour camp will also have water requirement.

As detailed in the baseline section (**Section 4.3.7.1**), the overall water resource sensitivity was evaluated as **High** based groundwater and surface water risk. Groundwater risk was estimated based on Block Categorization and Hydrogeology while surface water risk was estimated based on Inter Annual Variability, Seasonal Variability, Availability Index and Total Annual Rainfall. Baseline Water Stress and Baseline Water Depletion were evaluated as risk factors common to both groundwater and surface water risk. For the site, total water risk was evaluated based BWS and BWD while groundwater and surface water risks were evaluated based on the aforementioned individual factors.

- Groundwater resource sensitivity was estimated to be '**High**' due to high risk of availability of resources, high risk from BC.
- Surface Water resource sensitivity was estimated to be '**High**' due to high risk from AI, SV, IAV and TAR.

Embedded/In-built Controls

- Nil.

Impact Magnitude

During construction phase ~250-300 KLD of water will be required for civil construction activities such as foundations for solar panels, switch yards, control room, security guard room etc. and domestic requirements during peak construction activities. As per DPR, August 2020, water requirements for all purposes will be obtained through tanker water. The construction phase will be of duration of 21 months with peak construction period of 6-8 months. Hence, the magnitude of impact is assessed as **medium**.

Impact Significance

The significance of impact for construction phase is assessed as **Moderate**, considering that one unit-Agar block falls under safe category.

Additional Mitigation Measures

Following mitigation measures are proposed for conservation of water resources of the area:

- No ground water abstraction for construction phase;
- Tanker water supply shall be only through authorized sources;
- Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water;
- Regular inspection for identification of water leakages and preventing wastage of is necessary for efficient utilisation of water;
- As part of project designing, SPD shall consider the rainwater harvesting ponds in the open area depending on the topography, slope, natural drainage etc. Accordingly infrastructure such as drains/ piping system/ size of pond etc. shall be designed.
- Similarly, in case water is sourced from surface water bodies, infrastructure requirements shall be identified and planned in project design.

(Refer **Appendix E** for Water Management Plan and section 6.2.3.2 for details)

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts for construction activities will be **moderate to minor**.

Impact	Water resources					
Impact Nature	Negative		Positive		Neutral	
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent	
Impact Extent	Local		Regional		International	
Impact Scale	Limited to Project areas					
Impact Frequency	Construction Stage					
Likelihood	Likely					
Impact Magnitude	Positive	Negligible	Small	Medium	Large	
Resource/Receptor Sensitivity	Low		Medium		High	
Impact Significance	Negligible	Minor	Moderate		Major	
	Significance of impact is considered moderate .					
Residual Impact Magnitude	Positive	Negligible	Small		Medium	Large
Residual Impact Significance	Negligible	Minor		Moderate		Major
	Significance of impact is considered moderate to minor .					

6.2.2.5 Water Quality

Context and Receptor Sensitivity

Major source of wastewater generation during construction phase is labour camp, site office to be established for Solar Park. Approximately 22 KLD of sewage will be generated during construction activities. There is a potential for contamination of surface and groundwater resources resulting from improper management of sewage, accidental spillage of fuel, lubricants and wastes (waste oil / used oil) from storage areas or during the transfer of fuels and wastes.

Three (3) large water bodies were observed to be located adjoining the Site boundary in the north, southeast, and southwest of the Unit 4 (Agar) Site. Similarly, there are small water bodies observed to have been constructed across some of the streams within the Site boundary and adjoining the Site in Unit 5 (Susner). As observed, there are about five (5) artificially constructed non perennial water bodies located within the Site boundary which were observed to be spread over area varying between ~6 to ~22 acres.

Primary monitoring of surface and groundwater suggests that the monitored surface water is satisfactory at all the locations (except SW2- Bijankhedi Lake and SW5- Nahrkheda Lake).

The quality of water in the water bodies could be affected due to surface runoff from contaminated soil (soil contamination due to oil/ fuel spillage and leakages) especially during monsoon season. The surface runoff carrying the loose top soil will lead to increased sedimentation in the receiving water bodies.

The water of these water bodies is used by local villagers for washing, cleaning and irrigation purposes. Hence, receptor sensitivity is assessed as **medium**.

Embedded/ in-built control

- Provision of septic tank and soak pits onsite and in labour camps and at site office for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge.

Impact Magnitude

There is no surface water body located within the project foot print area which could get direct impact due to construction activities. As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office and labour camp. The sewerage system will consist of soak pits for the collection of wastewater from the kitchen and washing areas and Office facility. Sewage from the toilets will be discharged into lined septic tanks.

Further, there is no direct discharge of wastewater in the ground water aquifer of the area. However, ground water quality of the area may get indirectly impacted due to soil contamination. Ground water in the district at many places is saline and due care is needed before its use. The soil type of the area is sandy/loamy. This type of soil allow easy percolation into the subsoil and subsequently the ground water. Any spillage of fuel, wastes, if unprotected, may potentially contaminate the ground water.

Hence magnitude of impact is assessed as **medium**.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of medium impact magnitude with medium receptor sensitivity results in impact significance as **moderate**.

Additional Mitigation Measures

- Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;
- Open defecation and random disposal of sewage will be strictly restricted;

- Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;
- Provision of number of toilets across with easily accessible location as the project site is spread across large area of 2 Units separated geographically;
- Use of licensed contractors for management and disposal of waste and sludge;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets;
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Residual Impact Significance

Residual significance of impacts during construction phase will be **minor**.

Impact	Water Quality					
Impact Nature	Negative		Positive		Neutral	
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary	Short-term		Long-term	Permanent	
Impact Extent	Local		Regional		National	
Impact Scale	Limited to Project area					
Likelihood	Likely					
Impact Magnitude	Positive	Negligible		Small	Medium	Large
Resource Sensitivity	Low		Medium		High	
Impact Significance	Negligible		Minor		Moderate	Major
	Significance of impact is considered moderate					
Residual Impact Magnitude	Positive	Negligible	Small		Medium	Large
Residual Impact Significance	Negligible		Minor		Moderate	Major
	Significance of impact is considered minor					

6.2.2.6 Ambient Air Quality

Context and Receptor Sensitivity

Ambient Air quality impacts in the construction phase will be largely due to the following sources:

- Fugitive dust emissions from site clearance, piling work, handling of construction materials, emission due to movement of vehicles on unpaved roads, plying of vehicles, etc.
- Vehicular emissions due to increased traffic movement on site and on the approach roads;
- Exhaust emissions from construction machinery and other equipment such as batching plant, if any; and
- Emissions from diesel generators required to be run for construction power purposes

The proposed Project site is located in a rural setup. The human receptors for dust emissions are located adjacent to Unit 4 (Agar) and Unit 5 (Susner) Sites such as Karwa Khedi (NE), Nanya Khedi

(E), Madhopur (N) at Agar and Umariya (E) at Susner. There are no ecologically protected areas in vicinity of the site. The receptor sensitivity is assessed as **medium**.

Embedded/in-built control

- Suppression of fugitive dust emissions by spraying water, wetting of the stockpile;
- Pre-identified and covered locations for material stockpiles, especially sand, cement;
- Screening or providing wind breaks for stockpiles, covering of trucks with tarpaulin sheets during transportation of material;
- Diesel generator use shall be restricted to emergencies and power back-up only to minimize air emissions;
- Vehicle engines need to be properly maintained and should have a valid Pollution Under Control (PUC) to ensure minimization in vehicular emissions; and
- Vehicular speed will be regulated (max. 40 km) and enforced to minimise suspended dust emissions.

Impact Magnitude

The major source of emissions in the construction phase is the fugitive dust emissions from construction activities. In addition, operation of DG sets will also cause gaseous emissions. There will be some impacts due to plying of vehicles on the access roads which runs across settlement area.

The ambient air quality analysis reveals that the air shed is unpolluted and the air pollutants- PM (PM₁₀ and PM_{2.5}), SO₂, NO_x and HC are well below the prescribed CPCB and WHO guidelines.

The construction activities will occur for a small period of time (~21 months). The impact magnitude has been categorized as **small** because the soil type is loamy sand and dust emission will be limited to construction phase only for shorter duration.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- The construction site shall be barricaded;
- Keeping areas of open excavation to a minimum;
- Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction activities;
- Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures;
- Speed of vehicles on site to be limited to 10-15 km/hr;
- The emissions from diesel generator shall be by optimised operations, orientation at the site and providing adequate stack height for wider dispersion of gaseous emissions
- Switch off machinery and equipment when not in use;
- Prevent idling of vehicles and equipment; and
- Vehicle engines will be properly maintained and will have a valid Pollution under Control (PUC) to ensure minimization in vehicular emissions.

Residual Impact Significance

The significance of residual impact will be **minor to negligible** after implementing mitigation measures.

Impact	Ambient Air quality – Construction phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	National	International
Impact Scale	Project area and vicinity			
Likelihood	Likely			
Impact Magnitude	Positive	Negligible	Small	Medium
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor .			
Residual Impact Magnitude	Positive	Negligible	Small	Medium
Residual Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor to Negligible .			

6.2.2.7 Ambient Noise Quality

Context and Receptor Sensitivity

The sources of noise in the construction phase include construction activities, operation of equipment's, machineries, drilling, D.G. sets and movement of vehicles. The construction machinery used for the construction activities could be the major sources of noise at site whereas increased noise levels are also envisaged as a result of increased material movement in the area.

It is to be noted that the proposed project site has habitats in close proximity such as Karwa Khedi, Nanya Khedi, Madhopur, Umariya which may get impacted due to noise generated during construction activities and project related vehicular movement through village roads, especially fence line communities. Therefore receptor sensitivity is considered as **medium**.

Embedded/in-built control

- Normal working hours of the contractor will be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it would be limited to activities which do not generate noise; and
- Avoid unnecessary honking.

Impact Magnitude

The operation of construction machinery, DG set will generate noise. Construction works are expected to last for 21 months and construction activities will be limited to daytime only. The increase in traffic volumes during construction activities will also increase noise levels in the area.

The baseline noise monitoring results reveals that the equivalent ambient noise level exceeding the prescribed standards (55 dBA) at almost all locations except NQ8 (Dehariya Nana) while the night time noise levels do not comply with the prescribed CPCB/WHO/IFC standards (45 dBA) at any of the locations.

Hence, the magnitude of impact on ambient noise levels is assessed as **medium** considering the construction period of the project to last for approximately 21 months and proximity to the villages and the construction activities may lead to exceedance of prescribed noise day time limits at receptors.

Impact Significance

The impact significance has therefore been assessed as **moderate**.

Additional Mitigation Measures

- Ensure safe distance of project related activities from schools, hospitals, etc.;
- Only well-maintained equipment to be operated on-site;
- If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components to be carried out to bring down the noise. It is to be ensured that such machinery are kept far away from the households;
- Machinery and construction equipment that may be in intermittent use to be shut down or throttled down during non-work periods;
- Low noise equipment shall be used as far as practicable;
- The number of equipment operating simultaneously shall be reduced as far as practicable;
- Install enclosures around construction area, in order to reduce the extent of noise emanating due to project related activities;
- DG set with acoustic enclosures shall be used;
- Vehicular movement through village roads should be planned to avoid traffic jam and inconvenience to local residents;
- Equipment noise should be 85 dB (A) at 1 m from the source in line with WB/IFC EHS guidelines;
- Minimal use of vehicle horns needs to be encouraged;
- Limit construction related activities to day time in order to restrict the noise related nuisance in the evenings, where permissible noise threshold is lesser;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievances pertinent to noise and dust related issues.

Residual Impact Significance

Significance of residual impact is assessed to be **minor** taking into consideration above mentioned mitigation measures.

Impact	Ambient Noise Quality				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local	Regional		National	International
Impact Scale	Project area and vicinity				
Frequency	Construction Stage				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium		High	

Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be Moderate .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.2.2.8 Occupational Health and Safety

Context and Receptor Sensitivity

The proposed Project will involve several higher risk activities as shown below:

- Construction of support structure for PV module would require operation of pile drivers.
- The installation of solar module will involve operation of cranes and other mechanical lifting equipment.
- Laying of interconnecting cable with require digging.
- The commissioning of the inverter rooms and Transmission Line will also involve live power lines.
- Working on live wires carrying power has dangers of electric shock and electrocution.
- Construction and commissioning of PSS and associated structures will involve multiple hazards i.e., working at height, use of cranes and mechanical lifting equipment, working with high voltage power;
- Besides this, there could be slip and trip hazards especially during monsoon season; and
- The area experiences extreme winter and summer condition. Working during very high and low temperature could cause health hazards.
- The Project site also needs to implement proper measures for fire safety, structural safety and any for emergency situations.
- There are Suzlon Wind Turbines passing through the Project site. Any construction activities nears these turbines will have safety risks.

The occupational health and safety concerns mentioned above would be consistent across the Project life cycle and therefore the impacts would be similar in nature.

During construction phase, it is anticipated that on average 150-250 workers will be deployed at site. The installation of solar panels and associated infrastructure will be done through experienced and trained workers. However, construction of other components will involve local workers who may not have earlier experience. Hence, there will be greater vulnerability for accidents. Therefore, receptor vulnerability is assessed as **Medium**.

Embedded/In-built Controls

- All construction activities should be carried out during daytime hours and vigilance should be maintained for any potential accidents;
- Project specific Health and Safety Management Plan will be put in place;
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs, face shield, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant (FR) clothing and face masks;
- Use of permit to work system (hot work, electrical, work at height)

- Cranes and other lifting equipment are operated by trained and authorised persons;
- Excavated areas should be temporarily fenced to avoid access to outsiders and wildlife;
- An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it;
- Electrical and maintenance work should not be carried out during poor weather and during lightning strikes.

Impact Magnitude

As mentioned above, the majority of activities such as installation of solar panels and associated infrastructure will be done through experienced and trained workers and unskilled workers will be mainly involved in building construction activities. With above embedded controls, the magnitude of impacts will be **small**.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- Health & safety training to be provided during both construction and operation phase;
- Prior to start of work, workers should be informed about the related safety risks and precautions to be taken through tool box meetings;
- Manual lifting by adult men to be less than 55 kg and for women it should be less than 30 kg;
- Adequate PPEs to be provided for all activities at site including for welding, cutting or similar operations which may cause hazard to eyes;
- All persons performing construction work to wear safety shoes and helmets conforming to national standard;
- Every worker engaged in handling sharp objects which may cause injury to hand shall be provided suitable hand gloves;
- While working in hot conditions, measures such as work break at regular intervals, keeping hydrated by drinking water and liquids, covering face with damp cloth etc. shall be used;
- Obtain and check Contractor's safety method statements;
- Monitor health and safety performance and have an operating audit system;
- Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only;
- Appropriate safety harnesses and lowering/raising tools should be used for working at heights;
- All equipment should be turned off and checked when not in use;
- Emergency contact numbers and route to the nearest hospital to be displayed at the construction site;
- The local/ host community to be kept at safe distance from construction site;
- Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations;
- Site specific/ activity specific Hazards Identification and Risk Assessment (HIRA) should be developed prior to start of the activities at site; and
- Provide H&S achievement information to employees.

Residual Impact Significance

After implementation of additional mitigation measures, significance of residual impact will remain **minor**.

Impact	Occupational health and safety					
Impact Nature	Negative		Positive		Neutral	
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary		Short-term	Long-term	Permanent	
Impact Extent	Local		Regional	National	International	
Frequency	Construction stage					
Impact Scale	The construction work involves construction of Solar Park along with construction of internal cabling and O&M activities					
Impact Likelihood	Likely					
Impact Magnitude	Positive	Negligible		Small	Medium	Large
Vulnerability of Receptors	Low		Medium		High	
	The construction of Solar Park and erection of internal cabling will be done through experienced and trained workers. However, construction of other components will involve local workers who may not have earlier experience. Hence, there will be greater vulnerability for accidents.					
Impact Significance	Negligible		Minor		Moderate	Major
	Significance of impact is considered Minor .					
Residual Impact Magnitude	Positive		Negligible	Small	Medium	Large
Residual Impact Significance	Negligible		Minor		Moderate	Major
	Significance of impact is considered Minor .					

6.2.3 Operation Phase

The list of activities during operation and maintenance phase considered for the assessment of impacts on physical environment includes:

- Routine cleaning of PV modules;
- Control of vegetation viz. weeds, bushes etc. within the site and those immediately surrounding it;
- Routine inspection of all PV modules and associated structures viz. cables, transformers, inverters, mounting structures etc.;
- Operation and maintenance of pooling substation; and
- Inspection and maintenance of internal site pathways/access roads

6.2.3.1 Soil Environment

Context and Receptor Sensitivity

During operation phase 250 employees/workers will be deployed at site. Operation phase will generate small amount of municipal waste from site office and waste such as broken solar panels. The hazardous waste generated at substation include used/spent oil, oil soaked cotton and filter

waste, waste containers/tins of paints, used lead acid batteries, nonferrous scrap, insulated aluminium and copper wires/cables, waste dry chemical residues etc. which needs proper storage and disposal.

During operation phase, the large area of the Project site will remain non concrete (beneath solar panels) and will have soil contamination risk due to improper waste management. Further the agricultural land existing in the surroundings may also get impacted due to random disposal of waste in the surroundings. The receptor sensitivity is assessed as **medium**.

Embedded/In-built Control

- Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill;
- The O&M contractors will have control over the amount and types of waste (hazardous and non-hazardous) produced at the site;
- The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; and
- Workers will be strictly instructed/ trained about random disposal of any waste generated from the O&M activities.

Impact Magnitude

The quantity of waste generation will be negligible and O&M contractors will have proper waste management plan for implementation on site. The municipal waste from the site office will only be routed through proper collection and handover to local municipal body for further disposal. There will be only periodic generation of hazardous wastes during any repair and O&M activity. The waste will be disposed off through approved vendors in accordance to Hazardous Wastes Rules, 2016. . The solar panels contains antimony containing glass, hence, improper disposal of used/broken solar panel may cause harm to environment. The impact magnitude has therefore been assessed as **small**.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of negligible impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- SPD shall prepared SOP for storage and disposal of broken solar panels and tie up with an authorized dismantling agency for disposal of panels. MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; ⁽¹⁾
- The broken solar panels shall not be mixed with normal glass.
- RUMSL shall prepare a waste audit checklist as part of their routine site monitoring and auditing plan during operation phase for monitoring of waste management at site.

Residual Impact Significance

After implementation of additional mitigation measures, significance of residual impact will remain **minor**.

Impact	Impact on soil environment due to waste generation (hazardous and non-hazardous)
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(1) <http://164.100.94.214/sites/default/files/webform/notices/DraftBlueprintAntimony.pdf>

Impact Nature	Negative		Positive		Neutral	
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent	
Impact Extent	Local		Regional		International	
Impact Scale	Limited to Project area					
Impact Frequency	Occasional					
Impact Likelihood	Likely					
Impact Magnitude	Positive	Negligible	Small	Medium		Large
Resource/Receptor Sensitivity	Low		Medium		High	
Impact Significance	Negligible	Minor	Moderate		Major	
	Significance of impact is considered minor .					
Residual Impact Magnitude	Positive	Negligible	Small	Medium		Large
Residual Impact Significance	Negligible	Minor		Moderate		Major
	Significance of impact is considered minor .					

6.2.3.2 Water Resources and Availability

Context and Receptor Sensitivity

During operation phase, total water requirement for the Agar Solar Park is estimated as below

- 340 KLD for solar panel cleaning;
- 12 KLD domestic water;
- 7 KLD for green belt maintenance;
- 35 KL for firefighting and miscellaneous

The water requirement for the project will be mainly fulfilled through ground water abstraction and nearby surface water bodies.

As described in **Section 4.3.7.1**, the resource sensitivity for ground water and surface water resources is assessed as **high**.

Embedded/In-built Controls

Nil

Impact Magnitude

The total domestic water requirement during operation phase is estimated as ~ 12 KLD. It is understood that total domestic water requirement will be met by ground water abstraction and bottled mineral water.

The quantity of ground water required for cleaning of solar panels during operation phase is evaluated to be ~11 ham (assuming 2.5 litre per sqm and 12 cleaning cycles in a year, as per DPR).

As per a report of Central Ground Water Board, Ministry of Water Resources 2017 ⁽¹⁾, the status of ground water in the district is as below:

Table 6.8 Status of Ground water in Project District

S. No.	Particulars	Details
1.	District	Agar
2.	Annual Extractable Ground Water Resources (ham)	42,166.9
3.	Annual Ground Water Draft for all uses (ham)	39,149.5
4.	Projected Demand for Domestic uses upto 2025 (ham)	1,746.2
5.	Ground Water Availability for future use (ham)	5,474.8
6.	Stage of Ground Water Extraction (%) in Agar District	92.8
8.	Estimated water requirement for solar panel cleaning (ham)	~11

Source: <http://cgwb.gov.in/GW-Assessment/GWRA-2017-National-Compilation.pdf>

The primary source of water in the area is ground water. Presently, annual ground water extraction for domestic purposes is ~1,272 ham, which is assumed to increase upto 1,746 ham by 2025. The Susner Block falls under Overexploited category whereas Agar is Safe for ground water abstraction. The stage of ground water development in Agar Block is improved from 2013 (Semi critical) to 2017 (safe).

If ground water is abstracted for Project, there will be additional groundwater abstraction of 281 ham over period of 25 years of operational phase of the Project. As it is evident from the above table, overall the stage of ground water extraction is on higher side with ~93% in Agar district, the utilization of ground water for operation phase of the project may compromise with competitive users (drinking water requirement of villages and irrigation purposes) in the district based on ground water availability. Hence, magnitude of stress on ground water resources is assessed as **high** for Susner site and **medium** for Agar site (considering Agar block is in safe category).

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of medium impact magnitude with high receptor sensitivity results in impact significance as **major**.

Additional Mitigation measures

Conserving Water Resources

- Dry robotic cleaning of modules to be explored as recommended by MNRE ⁽²⁾;
- Alternate sources of water shall be explored such as Water supply from large surface water bodies in the area;
- Ground water abstraction, if required shall be done in accordance to CGWB guidelines.
- Implement rainwater harvesting and/or groundwater recharge and replenishment opportunities within Site premises especially near the low-lying and gently sloping area. Feasibility of this shall be checked as part of storm water drainage planning of the site;

⁽¹⁾ <http://cgwb.gov.in/GW-Assessment/GWRA-2017-National-Compilation.pdf>

⁽²⁾ MNRE had issued a letter dated 3 June 2019 to Principal Secretaries of States and Solar Association of all States regarding optimal utilization of water and preferably use Robotic technology for cleaning of modules.

- Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.;
- Maintain logbook for water consumption;
- Implement groundwater and wastewater monitoring vis-à-vis quality/quantity;
- Adopt less water consuming module cleaning methods;
- The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow shall be treated in water treatment unit and recycled in the Project.
- Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations.
- The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be adopted are UN Global Compact's CEO Water Mandate or AWS Standards.
- Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations.

Rain Water Harvesting

The ground water status in Susner has been declared as over exploited area. In order to comply with CGWB guidelines for ground water abstraction, if any, ground water recharge is mandatory in the Project. RUMSL shall plan to provide rainwater harvesting provision at site. For this purpose, rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones. Feasibility of this shall be checked as part of storm water drainage planning of the site.

Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site.

Water Quality

- Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;
- Open defecation and random disposal of sewage will be strictly restricted;
- Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;
- Provision of number of toilets across with easily accessible location as the project site is spread across large area of both the Units;
- Use of licensed contractors for management and disposal of waste and sludge;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets;
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Other Management Aspects

Preparing an inventory of water consumption during construction and O&M activities and all pollution sources from the Project activities is essentially the first step towards managing the impacts. The Management Plan will involve preparation of an up to date inventory of all areas of water consumption and wastewater discharge sources based on the latest Project activity related information. This inventory will help in formulating the following management approaches:

- Source reduction
- Resource recovery options
- Recycle options
- Optimal treatment strategies and technologies
- Post-treatment, resource recovery and recycle options
- Ultimate disposal considering the local environmental sensitivities

The inventory database of discharge sources shall be kept as a living document and updated as and when any new sources are cited at any point in time of the Project period. Any intermittent water requirement and discharge sources shall also be identified and included in the inventory.

A Water Management Plan is provided as **Appendix E**.

Residual Impact Significance

Residual significance of impacts during operation phase will be **moderate**.

Residual Significance of impacts during operation phase will be moderate .					
Impact	Water resources				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional	National	International
Impact Scale	Limited to Project areas and surroundings				
Impact Frequency	Operation Stage				
Impact Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered major .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered moderate				

6.2.3.3 Occupational Health and Safety

Context and Receptor Vulnerability

During operation phase, it is anticipated that on average ~250 employees/ workers will be deployed at site. The staff will be well experienced and qualified for their work. The pooling substation will be managed by RUMSL through O&M contractor having Health and safety team, whereas the Solar Project Developer will be responsible for O&M of Solar Park area and have to deploy qualified H&S team. Receptor vulnerability is assessed as **medium**.

Embedded/In-built Controls

- Project specific Health and Safety Management Plan will be put in place.
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs , face shield, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant (FR) clothing and face masks;
- Use of permit to work system (hot work, electrical, work at height)
- Cranes and other lifting equipment are operated by trained and authorised persons;
- An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it;
- Electrical and maintenance work should not be carried out during poor weather and during lightning strikes;
- Firefighting measures will be maintained at substation.

Impact Magnitude

As mentioned above, the O&M activities will be carried out by qualified team. With above embedded controls, the magnitude of impacts will be **small**.

Impact Significance

As per the impact significant assessment matrix (refer **Figure 6.2**) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- Periodic Health & safety training to be provided to team;
- Activity specific Hazards Identification and Risk Assessment (HIRA) should be conducted and accordingly SOPs shall be prepared for all O&M activities.
- The lock in-lock out system will be followed during maintenance/ repair activities at substation and Transmission Line;
- Records of incident/ accidents shall be maintained;
- Root cause analysis shall be carried out for any incident/ accident
- All persons performing maintenance/repairing work to wear safety shoes and helmets confirming to national standard;
- Appropriate safety harnesses and lowering/raising tools should be used for working at heights;
- All equipment should be turned off and checked when not in use;
- Emergency contact numbers and route to the nearest hospital to be displayed at the construction site;
- The local/ host community to be kept at safe distance from construction site;

- Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations;
- Provide H&S achievement information to employees.

Residual Impact Significance

Residual significance of impacts during construction phase will be **minor to negligible**.

Impact	Occupational health and safety							
Impact Nature	Negative		Positive		Neutral			
Impact Type	Direct		Indirect		Induced			
Impact Duration	Temporary	Short-term		Long-term		Permanent		
Impact Extent	Local		Regional		National		International	
Impact Scale	O&M activities							
Impact Frequency	Operation Stage							
Impact Likelihood	Likely							
Impact Magnitude	Positive	Negligible		Small		Medium		Large
Vulnerability of Receptors	Low		Medium			High		
	The O&M activities shall be carried out qualified and experienced staff/workers							
Impact Significance	Negligible		Minor		Moderate		Major	
	Considering the overall impact magnitude and vulnerability of social receptors, the impact significance is assessed as negligible .							
Residual Impact Magnitude	Positive	Negligible		Small		Medium		Large
Residual Impact Significance	Negligible		Minor		Moderate		Major	
	Significance of impact is considered minor to negligible .							

6.2.4 Photovoltaic Heat Island Effect (PVHI)

The term "heat island" is mostly used with the prefix "urban" and termed as Urban Heat Island Effect (UHI), because it is generally described for the surface structure and overlying atmospheric layers of big cities and metropolitan areas.

PV modules are produced by the electrical assembly of PV cells which provides electricity generation. The most widely-used and commercial PV cells are manufactured from crystalline silicon (c-Si). Because the final products of these cell and module types have the physical and electrical properties that can bring limited conversion efficiencies (15-30%), dark-coloured surfaces, packing density and/or arrays with gaps etc., a possible PVHI can be induced in a similar way to UHIs. The large Solar Parks cover the big and untouched areas in a rural environment. After a large-scale deployment, the large number of PV arrays and the corridors between these arrays may disturb the incoming solar radiation and outgoing IR radiation amounts of the previous land surface by landscape albedo change and alteration⁽¹⁾. This land use change may induce a heat island effect and increase the local temperatures which is termed as Photo Voltaic Heat Island Effect (PVHI).

(1) https://www.researchgate.net/publication/327838950_Impacts_of_a_PV_Power_Plant_for_Possible_Heat_Island_Effect

The localized increase in ambient temperature by 3-4°C in Solar Park area could be due to following reasons^{(1) (2)} :

- PV installations shade a portion of the ground and therefore could reduce heat absorption in surface soils;
- PV panels are thin and have little heat capacity per unit area but PV modules emit thermal radiation both up and down, and this is particularly significant during the day when PV modules are often 20 °C warmer than ambient temperatures;
- Vegetation is usually removed from PV power plants, reducing the amount of cooling due to transpiration; and
- PV panels reflect and absorb upwelling longwave radiation, and thus can prevent the soil from cooling as much as it might under a dark sky at night.

The research studies ^{(3) (4) (5)} reported that

- The degree of PVHI effect varies depending on the season, likely because of changing sun angles and background temperatures;
- Though the PVHI effect are detectable in the day, the real significant warming occurs in the evening hours, partially because these large photovoltaic installations took longer to cool down in the night-time hours;
- The increase in localized temperature may cause discomfort to the habitation and wildlife in the vicinity of Solar Park;
- The heating effect may dissipate after 300 m distance from Solar Park.

It is to be noted that the PVHI is still a less studied aspect for assessing the impact of large Solar Parks on micro climate change and requires further in depth research. Limited empirical data exists regarding the heat island effect resulting from the installation of large scale Solar Parks

Recommendations

Based on limited above understanding, following recommendations are proposed:

- The existing ground vegetation in the Solar Park area shall be disturbed to minimum extent;
- Ground vegetation shall be planted in the buffer areas/open areas available in the Solar Park;
- The feasibility of mixed land use development in the Solar Park shall be explored.

6.2.5 Natural hazards- Flood Likelihood Assessment

ERM has adopted a qualitative risk based categorization to identify potential risks and vulnerabilities associated with flooding, inundation and waterlogging. The risks are defined considering the likelihood of their occurrence and potential severity of the impact broadly following the risk matrix presented in the table below. Refer **Appendix D** for detailed Flood Likelihood Assessment.

Risk = Likelihood of an impact occurring x Potential severity of the impact.

(1) Barron-Gafford, G. A. et al. The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. Sci. Rep. 6, 35070; doi: 10.1038/srep35070 (2016); <https://www.nature.com/articles/srep35070>

(2) <https://pvbuzz.com/photovoltaic-heat-island-effect/>

(3) <https://assets.cleanenergycouncil.org.au/documents/events/event-docs-2019/SIF-2019/Presentations/03-Bronte-Nixon.pdf>

(4) Barron-Gafford, G. A. et al. The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. Sci. Rep. 6, 35070; doi: 10.1038/srep35070 (2016); <https://www.nature.com/articles/srep35070>

(5) <https://pvbuzz.com/photovoltaic-heat-island-effect/>

		Probability of Occurrence		
		Low	Medium	High
Potential Impact	Low			
	Medium			
	High			

Note: The study was carried out to evaluate and understand the likelihood of flood impact on the Site only. Risk categorization has been adopted merely for providing broad level perspective on the potential for impact from floods / inundation / water logging on the Site and to emphasize specific areas for further evaluation prior to developing Site specific mitigation measures only.

A likelihood analysis of potential flooding event in and around the Site has been undertaken. The same has been presented in the Table 6.9 below.

Table 6.9 Likelihood of flood evaluation

Attributes	Unit 4 (Agar) Site Likelihood			Unit 5 (Susner) Site Likelihood		
	High	Medium	Low	High	Medium	Low
Site Setting - Agar and Susner Sites are located ~30 km and ~24 km west from the Kali Sindh River which is the nearest river; - Nearest prominent stream is ~1.35 km west of Susner Site. This stream is non-perennial in nature.						
Watershed Characteristics - Both Agar and Susner Sites are located within the Kali Sindh River Basin. Both Sites are located at the ridge in the west-central portion of the basin and ~30 km west from the Kali Sindh River. - The Susner and Agar Sites are located in a rural setting surrounded primarily by scrub land with some agricultural land, forest land, scattered residential settlements, water bodies. - Few first order streams originate within Agar Site. These are non-perennial streams with shallow depths. - Three (3) large artificially created water bodies are located adjoining the Agar Site boundary with spread area varying between 21 acres to 260 acres. - Several well defined and prominent first order streams originate within Susner Site. Few second order streams also pass through Susner Site. These streams extend along entire breadth of the Site in the central and southeastern portion. - Three (3) large artificially created water bodies are located adjoining the Susner Site boundary with spread area varying between 34 acres to 228 acres.						
Hydro-meteorological Data						

Attributes	Unit 4 (Agar) Site			Unit 5 (Susner) Site		
	High	Medium	Low	High	Medium	Low
■ Average annual rainfall for period of 1980–2019 for Susner was ~951 mm with the highest annual rainfall of 1,814 mm recorded in 2019; ■ Average annual rainfall for period of 1980–2019 for Susner was ~966 mm with the highest annual rainfall of 1,992 mm recorded in 2019; ■ Maximum daily probable rainfall for 25, 50, and 100 year return periods for Agar and Susner Sites are <220 mm, <240 mm, and <280 mm respectively;						
Hydrological and Geomorphological Data						
Catchment Analysis						
■ Topography within the watershed of Susner Site varies between 375 m and 475 m amsl. ■ Topographic elevation of Susner Site was observed to be in the range of 425 m to 475 m amsl. ■ Slope in the Susner Site area ranges between 3 to 8 % categorized as gentle slope. ■ Topography within the watershed of Agar Site varies between 375 m and 500 m amsl. ■ Topographic elevation of Agar Site was observed to be in the range of 425 to 475 m amsl. ■ Slope in the Agar Site area ranges between 3 to 8% categorized as gentle slope. ■ Based on the topography and slope maps, the Site area does not appear to have any pockets of 'low lying areas' with potential for water logging and flooding during rainy season.						
Historical Flooding and Inundation Events						

Attributes	Unit 4 (Agar) Site			Unit 5 (Susner) Site		
	High	Medium	Low	High	Medium	Low
■ Several artificial water bodies have been created within both Agar and Susner Sites for capturing surface runoff. ■ Some of the artificial water bodies are spread over considerable area ranging up to 4 acres in Agar Site and up to 22 acres in Susner Site. These are indicative of significant surface runoff generated within the Site. ■ Besides the artificially constructed water bodies and the non-perennial streams with shallow depths, signs of water logging and inundation were not observed within the Site based on review of historical satellite imagery. ■ Flooding and inundation at the Site may be limited to natural drainage channels, artificially created water bodies and the low lying areas adjoining these features.						
<u>Secondary Data Review – Flooding and Inundation</u>						
■ Per the District Disaster Management Plan – Agar District, the district is prone to floods. It was found the Site is not prone to flooding due to overflow from Gandhisagar Dam (40 km south-east of the Site, along Chambal River). ■ Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Agar and Susner Sites are not prone to flooding; ■ Per the global flood hazard map developed by FM Global, the Agar and Susner Sites are not prone to high or medium flood risk; ■ Based on Aqueduct's global flood hazard map, the Site and its surroundings at both Agar and Susner fall in the “Low” river flooding hazard zone; ■ Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Agar and Susner are not prone to flooding.						

Based on the observations from the above-mentioned table, it appears that the overall likelihood of flooding event and its impact in and around the Site may be considered as **'Low' to 'Moderate'**.

Recommendations

Based on the broad level assessment, following measures are recommended to protect the assets at Site from identified 'high probability attributes' and to prevent/mitigate their impact on the Site:

- Develop a robust "Storm Water Management Plan (SWMP)" to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff.
- Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour;
- Storm water drains must be designed in line with the natural topography and eventually drain into the natural seasonal streams in the Site area;
- Implement an effective flood monitoring and disaster management system in place for effective mitigation of floods at a Site level;
- Coordinate with the district and local disaster management cells to update on flood early warning notifications.

6.3 Impacts on Biological Environment

6.3.1 Assessment Criteria

ERM Impact Assessment Standards define the sensitivity of ecological receptors by determining the significance of effects on species and habitats separately. The significance tables for species and habitats are given in **Table 6.10** and **Table 6.11** respectively.

Table 6.10 Habitat-Impact Assessment Criteria

Habitat Sensitivity/ Value	Magnitude of Effect on Baseline Habitats			
	Negligible	Small	Medium	Large
	Effect is within the normal range of variation	Affects only a small area of habitat, such that there is no loss of viability/ function of the habitat	Affects part of the habitat but does not threaten the long-term viability/ function of the habitat	Affects the entire habitat, or a significant portion of it, and the long-term viability/ function of the habitat is threatened.
Negligible	Negligible	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Critical

Negligible Habitats with negligible interest for biodiversity.

Low Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.

Medium Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.

High Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.

Table 6.11 Species-Impact Assessment Criteria

Baseline Species Sensitivity/ Value	Magnitude of Effect on Baseline Habitats			
	Negligible	Small	Medium	Large
	Effect is within the normal range of variation for the population of the species	Effect does not cause a substantial change in the population of the species or other species dependent on it	Effect causes a substantial change in abundance and/or reduction in distribution of a population over one, or more generations, but does not threaten the long term viability/function of that population dependent on it.	Affects entire population, or a significant part of it causing a substantial decline in abundance and/or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).
Negligible	Negligible	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major

Baseline Species Sensitivity/ Value	Magnitude of Effect on Baseline Habitats		
	Negligible	Small	Medium
High Species on IUCN Red List as CR, or EN. Species having a globally restricted range (i.e. plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km ²), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.	Negligible	Moderate	Major
			Critical

6.3.2 Impact during Construction Phase

The impacts from the construction phase of the Project on the local ecology have been assessed with respect to the following activities:

- Vegetation Clearance and Other Construction Impacts; and
- Barrier Effect and Loss of Resources.

Impact due to Vegetation Clearance and Construction Activities

Context

The Unit 4 (Agar) and Unit 5 (Susner) sites are located primarily in grassland area which are parched dried during the winter and summer months and flourish during the monsoon and post monsoon season. The surrounding agricultural lands/scrub vegetation provide \l habitat for wildlife typically found in the rural agricultural landscape of central India like Northern plains grey langur (*Semnopithecus entellus*)[IUCN(v2020.1)LC], Jungle Cat (*Felis chaus kutas*)[IUCN(v2020.1)LC], Grey Mongoose (*Herpestes edwardsii*)[IUCN(v2020.1)LC] etc. and bird species like Black-winged kite (*Elanus caeruleus*)[IUCN(v2020.1)LC], Common Myna [IUCN(v2020.1)LC], Egyptian Vulture [IUCN(v2020.1)EN] etc. mentioned in the baseline section are dependent directly or indirectly on these land use for food and shelter. So vegetation clearance and construction activity will result in displacement of these species from the project site. Egyptian Vultures use the project site area to feed over the dumped livestock carcasses from the nearby villages. Removal of vegetation from the project site and surrounding areas may result in loss of perching areas and foraging areas with solar park present at the project site

Embedded/ In-built Controls

- Whenever possible mature large trees will be avoided, along the edge of the project boundary and approach road.

Receptor Sensitivity

Grassland and Agricultural Habitat of the study area is found to sustain Endangered and Near Threatened species (IUCN Red List of Threatened Species) having large distribution range. The agricultural habitat is widespread in the study area and beyond study area, so loss of agricultural habitat for project activity will result in negligible loss of such habitat. So based on Species and Habitat Sensitivity Value classification mentioned in **Table 6.10** and **Table 6.11**, both Species and Habitat Sensitivity Values were found to be "**High**".

Impact Magnitude

As mentioned earlier in "Receptor Sensitivity" section, Agricultural habitat is widespread within the study area and outside it, so loss of such habitat for project related activity will be very small, such that no loss of viability/ function of agricultural habitat in the study area is expected. So magnitude of impact is expected to be "**Small**".

As all species found in the study area have vast distribution range and found across multiple habitat types, displacement due to project construction related activity is not expected to cause substantial change in the population of the species or other species dependant on it. So magnitude of impact is expected to be "**Small**".

Impact Significance

Based on "Habitat-Impact Assessment Criteria" (as per **Table 6.10**), as Habitat Sensitivity Value was found to be "High" and Magnitude of Impact on Habitat was found to be "Small", the overall Significance of impact of vegetation clearance and construction activity on habitat is considered to be "Moderate".

Based on "Species-Impact Assessment Criteria" (as per **Table 6.11**), as Species Sensitivity Value was found to be "High" and Magnitude of Impact on Species was found to be "Small", the overall Significance of impact of vegetation clearance and construction activity on habitat was also found to be "Moderate". The Impact Significance is described below.

Mitigation Measures

- Vegetation clearance should be kept restricted to project site only and should be avoided wherever possible.
- It is recommended that the selected EPC contractor should display and educate labourers not to collect fuel wood from adjacent areas and alternate arrangement for fuel, like LPG must be made available in the labour camps for cooking.
- Provision for identifying grazing areas for the livestock village wise and development of grass plots in 5 acre area with local grass species;
- Sufficient arrangement for identifying water holes based on the terrain gradient to tap the surface water runoff during rains
- Strengthening of existing waterbodies in the study area and development of water channels to connect the surface runoff to them.
- Carcass dumping at the project site should be avoided and specific space should be earmarked for carcass dumping in nearby areas away from the transmission line infrastructure of the project.

Impact	Clearance of vegetation				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to construction area and immediate surroundings				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Agricultural lands)	Low		Medium		High
Resource Sensitivity (Species)	Low				
Impact Significance	Not Significant	Minor		Moderate	Major
	Significance of impact is considered Moderate for habitat and species.				

Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Negligible for habitats and species.				

Impact due to Influx of Migrant Labour and Labour Camp

Context

Migrant labours are not aware of the local biodiversity values and there is always risk of hunting and trapping of local wildlife by labours for meat as well as for easy source of money by selling products like skin. Apart from impacts like direct hunting or trapping, careless disposal of kitchen waste like discarded vegetable materials and excess food, may attract scavengers like golden jackal etc. This unwanted interaction with wild animals may lead to human-wildlife conflict. Collection of fuel wood for cooking from outside project area, may result in additional habitat degradation.

Embedded/ In-built Controls

- The Labour Camp will be located within the Project site. So there will be no additional habitat loss.

Impact Significance

As long the labour camp is established within the project area, there will no additional loss of habitat. Moreover agricultural habitat is widespread in the study area and beyond study area, so disturbances due to fuelwood collection will result in negligible loss of such habitat, so as discussed in "Receptor Sensitivity" and "Impact Magnitude" section Habitat Sensitivity Value was found to be "medium" and Magnitude of Impact on Habitat was found to be "Small". So the impact significance on habitat, based on "Habitat-Impact Assessment Criteria" (as per **Table 6.10**) is considered to be "Negligible".

Only "Least Concern" species are found in the study area so species sensitivity value is "Low", and hunting trapping of animals like Chinkara, Grey Mongoose may result in change in abundance and/or reduction in distribution of a population locally over one or more generation, but does not threatened the long term viability/ function of the population, so Magnitude of Impact was found to be "Medium". So based on "Species-Impact Assessment Criteria" (as per **Table 6.11**) the impact significance on species was also found to be "Minor".

Mitigation Measures

- The likelihood of threatened and protected fauna venturing into the Project site is small but proper precautions should be taken to prevent any human-wildlife conflict.
- It is recommended that the selected EPC contractor should display and educate labourers and staff about the hunting, poaching, trapping, injuring or killing of wildlife in the region.
- Any such activity of hunting and poaching should be covered under contractual obligations of the EPC contractor;
- The EPC contractor should in consultation with Forest Department should explore the options to minimize wildlife human interactions in the study area.

The Impact Significance is described below.

Impact	Clearance of vegetation
--------	-------------------------

Impact Nature	Negative		Positive		Neutral					
Impact Type	Direct		Indirect			Induced				
Impact Duration	Temporary		Short-term		Long-term		Permanent			
Impact Extent	Local			Regional			International			
Impact Scale	Limited to construction area and immediate surroundings									
Frequency	Construction phase									
Likelihood	Moderately Likely									
Impact Magnitude	Positive		Negligible		Small		Medium		Large	
Resource Sensitivity (Agricultural lands)	Low			Medium			High			
Resource Sensitivity (Species)	Low			Medium			High			
Impact Significance	Not Significant		Minor		Moderate		Major			
	Significance of impact is considered Minor for habitat and species.									
Residual Impact Magnitude	Positive		Negligible		Small		Medium		Large	
Residual Impact Significance	Not Significant		Minor			Moderate		Major		
	Significance of impact is considered Not Significant for habitats and species.									

6.3.3 Impacts during Operation Phase

Collision and Electrical hazards from Transmission Infrastructure

Context

The power evacuation from the project site from the pooling substation to government substation is considered here. Several species of birds, like Raptors (Family Accipitridae-8 species) use these transmission lines and poles as perching sites and are under threat of collision and electrocution from the transmission lines. Some birds also utilize the transmission towers for nesting.

Embedded/ in-built Control

Large mature trees will be avoided while finalizing the transmission line route.

Receptor Sensitivity

Grassland and agricultural habitat of the study area is found to sustain Least Concern (IUCN Red List of Threatened Species) having large distribution range. Although migratory birds were recorded for the study area, no large migratory congregation was recorded from the study area. Only one species Egyptian Vulture [IUCN (v2020.1) EN] with 6 individuals was observed falling within IUCN threatened category. The agricultural habitat as well as waterbodies are widespread in the study area and beyond study area, so loss of habitat for project activity will be negligible. So based on Species and Habitat Sensitivity Value classification mentioned in **Table 6.10** and **Table 6.11**, both Species and Habitat Sensitivity Values were found to be "High".

Impact Magnitude

All the species listed are Least Concern species and have a large distribution range and likelihood of these species getting electrocuted or hit by transmission line is really low, so it is not expected to substantial change in the population of the species or other species dependent on it. Therefore Impact Magnitude is expected to be **"Small"**

Impact Significance

As both Sensitivity value for Habitat as well as Species were found to be "Low" and Magnitude of impact for both were also found to be "Small". Overall Significance of Impact (as per **Table 6.10** and **Table 6.11**) on both Habitat and Species were found to be **"Moderate"**.

Mitigation Measures

The following mitigation measures will further reduce the impact significance on avifaunal species:

- If possible transmission line should be aligned away from the waterbody.
- Insulators should be suspended in order to reduce the electrocution of bird species;
- Jump connectors should be insulated and of at least 60 cm in length (determined based on the average wing span of common avifauna) to reduce chances of electrocution of species flying through and wing tips coming into contact with the conductors and
- Marking overhead cables using diffractors and avoiding use in areas of high bird concentrations of species vulnerable to collision including bird guards/diverters in low voltage lines/cables also.
- A conservation plan for Egyptian Vulture is provided as part of **Appendix E**.

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts will be **Negligible**. We retain this significance, as while the mitigation measures are likely to reduce mortality, we do not expect complete cessation of mortality.

Impact	Electrocution hazards				
Impact Nature	Negative		Positive		Neutral
Impact Type			Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to electrical components of the solar farm, transmission lines (internal and external) and transmission poles.				
Frequency	Operation phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Species)	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major

	Significance of impact is Moderate for species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Negligible .				

6.4 Impacts on Social Environment

Impacts to the socioeconomic environment from project related activities will be largely sustained in the Project villages, on the land owners, households that are using the land formally and informally as encroachers, agricultural labourers, etc. Specifically, the impacts will be due to purchase of private land and use of Government land identified for the project, within which several uses exist, as elaborated in **Section 4.5.6**. The project boundary finalisation is in process and is understood to have ensured that the need for private land for the project is minimised and no *Abadi* area (area with village habitation and residential structures) are affected as that will lead to community level physical displacement.

6.4.1 Avoidance and optimisation of the Project footprint

As understood from the project documents, there have been multiple optimization exercises, in order to ensure avoidance of private land that is being used for agriculture and habitation in the Project villages.

Table.6.12 Land identified for the Project

Unit	Villages	Government Land (NRED Allotted and Newly Identified)	Private Land	Total land
A	B	C	D	E (C+D)
Unit 4 (Agar)	Pipalia Kumar	34.80	5.06	39.86
	Madhopur	15.77	0.00	15.77
	Ladwan	168.32	2.80	171.12
	Kasai Dehariya	28.30	0.00	28.30
	Karwa Khedi	155.09	0.00	155.09
	Dudhpura	98.38	43.59	141.97
	Bijnakhedi	55.98	0.00	55.98
Sub-total		556.64	51.45	608.09
Unit 5 (Susner)	Palda	119.69	6.48	126.17
	Naharkheda	86.89	62.71	149.60
	Umariya	328.80	13.06	341.87
	Pipliya Nankar	181.36	0.00	181.36
Sub-total	716.74	716.74	82.25	798.99
Grant total	11	1273.38	133.70	1407.352

Source: RUMSL, June 2020

The land optimisation exercise has resulted in reduction of private land requirement to 9.5% of total land off take and a majority of the Project land requirement is of government land. The impacts of land procurement from the 11 villages from both categories of land, including government and private, will potentially affect livelihoods and easements (traditional access and use) but also affect availability of land for future generations. Some impacts may be possible to mitigate or management while others will need to be compensated.

Land required by the project from each village, will result in balance land of 78% across all villages. In 10 out of 11 villages, more than 70% of the current land in their village will remain outside of the Project. However, in Umariya village in Susner tehsil, only 44% of total village land will remain outside of the Project area. Therefore, the impacts of land procurement from these villages will be significantly higher in terms of not only people's livelihoods and easements (traditional access and use) but also on availability of land for future generations.

Table 6.13 Proportion of Village Land Identified for the Project

S. No.	Village Name	Area as per Census 2011 (ha)	Total Land Area required for the Project (Ha) (Govt. Land+ Pvt. Land)	Balance Land (Ha)	Percentage of Land Remaining
1	Pipalya Kumhar	383.51	39.86	343.65	90
2	Madhopur	509.42	15.76	493.66	97
3	Ladwan	590.74	171.12	419.62	71
4	Kesai Dehariya	252.77	28.3	224.47	89
5	Karwa Khedi	587.09	155.37	431.72	74
6	Dudhpura	495.71	141.972	353.738	71
7	Bijnakhedi	709.41	55.98	653.43	92
8	Sub- Total (unit 4)	3528.65	608.362	2920.288	83
9	Palda	801.75	126.17	675.58	84
10	Naharkheda	837.35	149.60	687.75	82
11	Umariya	607.12	341.87	265.25	44
12	Pipalya Nankar	630.81	181.36	449.45	71
13	Sub- Total (Unit 5)	2877.03	798.99	2078.03	72
	Total (Unit 4 + 5)	6405.68	1407.352	4998.318	78

Source: Census of India, Village Directory, 2011

6.4.2 Potential Impacts from Project activities on Stakeholder Categories

The land identified for the Project comprises of 1407.352 hectares. Private land (9.5% of total) of 133.7 hectares and Government land (90.5% of total) of 1273.38 hectares. The total number of land sellers¹ is not known as of now. Considering the fact that average size of the household in the Project area is 4.5, the total number of Project Affected population belonging to private land holding households is nearly 602. Households are also likely to be impacted due to loss of grazing land in their vicinity and loss of income from agricultural activity on land parcels encroached/squatted upon.

¹ As noted earlier in the Project Description, it is assumed that RUMSL will procure all private land for the Project using the MP Mutual Consent Policy for purchase of land.

Additionally, there are likely to be some households whose members work as agricultural labourers on private land and government land (through encroachment) identified for the Project.

The table below describes the potential impacts that are likely to result from Project activities in various stages of the project, comprising of Planning, Construction and Operation, on various socioeconomic and community aspects, including from the land requirements of the Project. Additionally, the table below and sections 6.7.4 to 6.7.16 detail the embedded controls and mitigation measures for specific impacts, as drawn from the ESMF and applicable reference frameworks for the Project and enhanced through specific impacts identified.

Table 6.14 Potential impacts from the project activities

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
■ Planning Phase Impacts Private Land (Purchased through MP Mutual Consent Policy, 2014	About 133.70 hectares of private land (refer Table 2.2 for village wise break up), is being considered for purchase by the project, which forms nearly 9.5% of the total area identified for the project; ■ The private land parcels that are identified are not being used for residential purposes, thus there is no physical displacement due to project; however, economic displacement will occur for the private land sellers whose land parcels will be purchased for project related activities affecting livelihoods and incomes; ■ Landlessness may potentially result due to purchase of private land parcels in some cases. The total land holding and proportion of land remaining with the sellers after the mutual consent based sale, is not known currently, but will be assessed during the RAP survey; ■ Agricultural labourers employed by the land owners of the private land parcels identified for purchase for the project will experience loss of livelihood opportunities; ■ Loss of access or easement for the local community due to diversions/ barricading of areas due to construction phase activities.	■ Private land owners; ■ Agricultural labourers employed seasonally;	■ The private land sellers will be paid at twice the value of land and assets, as per MP Mutual Consent Policy, 2014; ■ After assessing the applicability and need during the RAP Survey, a Resettlement Action Plan-Livelihoods Restoration Plan is required to be formulated to address: - Displacement impacts to people who had encroached/squatted upon government land, based on their status and tenure - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc under the LRP; - Impacts on land users or regular agricultural labourers affected - Other displacement impacts on private and patta land owners

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
			- The general community being impacted due to access restrictions/easements; ■ Preference to members (vulnerable) of the families post selling land to the project for employment opportunities in the Construction/operation phase, small contracts; ■ Timely sharing of project related information with all relevant stakeholders; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.
Government Land (Land Use Permission Agreement between New and Renewable Energy Department, Government of MP and RUMSL): Used Land (permitted uses): Grazing, easements, cultural heritage sites, water sources, fuel wood collection and collection of other resources;	■ Government land being identified for the project from the three project villages amounts to 1273.38 hectares, which forms nearly 90.5% of the total land required for project. ■ This land has different uses by the local community: - Livestock- Livestock grazing in the open as well as within encroached and bounded ‘fodder lots’ created by encroachers(see below); - Easements, access to assets and other resources not within the project boundary, etc. and the change in use and ownership of Government land will affect the users in the community to varying degrees.	■ Households who solely depend on livestock as source of regular income and will lose access to grazing land; ■ Livestock-Livestock Owners or Graziers whose livestock grazes in the identified land for 8 months in a year (except summers), from 3 project villages and other	■ Compensation for assets built as part of investments on land development that includes open well, bore well, standing crops, livestock shed (temporary), fruit/timber trees, etc. ■ Provision for alternate grazing land for livestock near the project village, or confirmation of adequacy of remaining grazing land; ■ Development of community fodder lots may be explored as a Livelihood restoration activity in the area as part of Resettlement Action Plan. This, if feasible, shall serve the purpose of augmentation of grazing land and

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
	- The Impacts on users of this land type comprise the following, and the scale of these impacts will be assessed as a part of RAP study: - Loss of Grazing land for the livestock in the area; - Loss or severance of access for the community, livestock, etc.; - Loss of cultural resources such as sacred sites which are maintained by the villages in the form of stone figurines, smeared with vermilion. These are not permanent temple structures, rather small spots, which are sometimes used as places of worship. There is no appointed priest, no offerings. Usually, the area is marked by a stone boundary.	villages that are sending their livestock for grazing in identified land.	- as an income generating activity for people losing land based livelihoods. - Provision of easements shall be maintained in order to not sever the access to CPRs for the community; - Timely sharing of project related information with all relevant stakeholders; - Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.
Government Land (Land Use Permission Agreement between New and Renewable Energy Department, Government of MP and RUMSL): Informally occupied Land: squatted/encroached for agriculture or grazing, prohibiting use by other people	- Additionally, a portion of this Government land has been informally (and illegally) encroached by local land owners for cultivation of crops, livestock grazing; - It was also reported that the encroachers/occupiers paid fines to the Government (revenue department) on a lump-sum basis, based on yield, which was not yearly, and has an irregular time frame. The encroachers are provided with receipts of fine paid, and the Tehsil office has a record of the encroachment in terms of the khasra encroached, but not the extent/area. The extent of	- Squatters and Encroachers; - Local Community.	- RUMSL shall serve a three months advance notice to the project affected persons (PAPs) to manage the potential losses to standing crops; - In case of crop losses ensuing from project activities, RUMSL shall pay compensation for crops, at full replacement cost; - Timely sharing of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
	encroachment has increased over the years, with availability of canal/pipe water supply from embankment dams for irrigation. ■ Out of the 1273.38 hectares of Government land for the project, anywhere between 15-25% may be encroached and / or squatted upon by land owners, leaving a lesser amount of land for common usage by the larger community. The extent of this category will be assessed in the RAP survey. If captured land is taken for the project it would affect the following groups: - Encroachers/squatters who have occupied (and developed) government land for agriculture (these are all reported to be land owners) and belonging to the three Project villages - Agricultural labour employed seasonally, to work in these fields ■ The community at large, using common grazing land is already deprived of these areas as they are no longer available to them for grazing, so, they will not be affected.		■ Employment to members of such encroacher and squatter households, based on qualification; ■ Skill development of members of such encroacher and squatter households, based on any existing skill set (if any), and self-declared interests. ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.
Construction Phase Impacts			
Community Health and Safety including accident risks for animals	■ The movement of material and machinery would pose health and safety risks to the community and livestock as the vehicular movement will increase in the area and may result in collision and accident risks, and create additional vehicular and dust pollution, affecting people, animals and potentially	■ Local Community; ■ Livestock-Livestock Owners or Graziers;	Stakeholder engagement through the project cycle and an effective Grievance Redressal Mechanism to avoid, mitigate and manage conflicts and disagreements.

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
	affecting crops in the vicinity of the corridor of movement; ■ Labour influx in the area due to construction phase may lead to community health and safety related impacts which may include - Potential spread of communicable diseases (infectious and vector-borne), if external labour will be sourced from outside the region, - The issue of COVID-19 related infections may remain a relevant concern and may need to be especially managed both, within labour camps and in the interactions of workers and the local community ■ Conflicts with local community resulting from disagreements over other issues and local impacts	■ Workers engaged during construction phase	As part of the stakeholder engagement and information disclosure process, ■ The community will be provided with an understanding of the activities to be undertaken and the precautions taken for safety; ■ The project will also propagate health and safety awareness amongst the community; ■ The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety; ■ RUMSL shall maintain safe distance of project components from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents; ■ The Contractor shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan, etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization; ■ The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions,

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
			sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste; ■ The movement of workers from the project site and labour camps should be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible tensions between the migrant workforce and host community; ■ RUMSL shall put in place a grievance redressal mechanism to allow for the workers and community members to report any concern or grievance related to project activities.
Stress on Community resources - Water and Forest, Roads	■ Depletion of water resources in the area may take place due to use for project related activities like construction, use for drinking water, etc. potentially affecting water availability for the local population, that depends on the same resources; ■ Potential loss of common fodder resources due to construction activities, thereby affecting the stock available for the local community; ■ Wear and tear of roads may take place due to movement of heavy machinery on the roads, creating movement problems and risks for local road users.	■ Local Community	■ Provision of easements shall be maintained in order to not sever the access to CPRs for the community ■ There will be a worker Code of Conduct defined by RUMSL that prevents workers and contractors from using the local resources like water, forest. Refer Section 6.2.23 for detailed mitigation measures; ■ An induction session will be organised for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
			include aspects on conservation of community's resources; ■ The contractor shall be asked to use Tanker water supply during the summer months, which are dry months in which water scarcity issues are reported by the community; ■ Periodic maintenance activities for roads used for transportation of goods for the project shall be the undertaken by RUMSL, through its contractors; ■ There will be a set of contractor obligations that require preparation of Traffic Management Plan, Local procurement plan, etc. in order to safeguard community's resources; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources.
Noise Nuisance and Dust	■ The construction activities and movement of increased number of vehicles, envisaged to last for nearly 21 months (construction phase) may lead to increase in noise and dust levels in the project area; ■ An increase in dust and noise during the construction period has the potential to lead to health impacts associated with eye irritation and general disturbance to daily activities.	■ Local Community	■ Ensure safe distance of project related activities from schools, hospitals, etc.; ■ Install enclosures around construction area, in order to reduce the extent of noise and dust emanating due to project related activities; ■ Limit construction related activities to day time in order to restrict the noise related

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
Employment and entrepreneurship opportunities during construction	■ The construction phase will provide a boost to the local employment as a higher number is expected to be engaged as construction labour during construction phase; ■ Development of smaller vendors in the area through petty shops, petty contractors, etc. providing essential goods and services during the construction phase; ■ There will be an impact on local food basket due to increased demand for agricultural products and food items.	■ Members of local community that can be engaged as labours for the construction phase; ■ Existing vendors.	nuisance in the evenings, where permissible noise threshold is lesser; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievances pertinent to noise and dust related issues. Refer Section 6.2.25 for detailed assessment. Enhancement measures ■ The sourcing of local labour wherever possible should be made obligatory for the Solar Project Developers and sub-contractors and in all major procurement activities; ■ Preference should be given to the land losers and vulnerable population in the Project Villages, to the extent practicable; ■ Employment of members of SC-STs and Women Headed households should be encouraged by the Solar Project Developers through documented agreement with contractors/ sub-contractors and may be set at a minimum of 30% of total workers or person-days of employment; ■ Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
			■ The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and access to jobs.
Operations Phase Impacts			
Community Health and Safety	The Operations phase would have very limited activity outside the project site as the construction phase would have been over and the scale of activity and workforce at the project footprint area would have reduced significantly. This would lead to far fewer impacts: ■ Less or negligible noise, ■ Fewer workers at site on near project villages, ■ Reduced traffic load (compared to construction phase) from the movement of people and goods.	■ Local Community; ■ Livestock and Livestock Owners	■ Community engagement and sensitization sessions should be re-organised at the beginning of Operations phase, in order to mention about the new developments in the area and provide an understanding of the precautions to be taken for safety; ■ Additional precautions may be needed to address the COVID-19 related safeguards, as relevant and as prescribed by the government, at that time; ■ Project's Grievance Redressal Mechanism for the community shall still be in implementation to deal with any concerns of community health and safety, being raised by the local community.
Impact on Employment	■ The Operations phase would require much smaller workforce as compared to construction phase and	■ Local Community	Enhancement Measures ■ RUMSL shall ensure that the Solar Project Developers (SPDs) advertise the roles of

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
	the skillset of the required workforce shall be different. ■ The Operations phase would require Engineers, Technicians to manage the Plant operations and amongst the requirement of semi-skilled workers in limited numbers for housekeeping and Security related jobs, on the payroll of RUMSL. Additionally, there may be some vacancies with the private Solar Project Developers (SPDs) that may have some local employment, if feasible		Technical staff required during operations phases, in the local newspapers to enable hiring of competent people from nearby areas, to the extent feasible; ■ Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-skilled jobs like housekeeping or Security Guards.
Impacts on Vulnerable Groups (SC, ST, OBC communities included)	■ Out of the three phases, the Indigenous Communities and vulnerable groups are understood to be impacted the most during Planning phase of the project, on account of loss of livelihoods linked to land being procured for project. Since these agricultural workers are not rightful owners or users of land as per records, the project related compensation measures would not be directly reaching out to this group. ■ Loss of access to grazing land parcels which were used for open grazing of livestock, and collection of firewood	■ SC/ ST communities ■ Vulnerable households	■ To identify and assess the extent of impacts on this group, a review of the scope of RAP, FPIC and IPP, in terms of remaining impacts on IP groups, their traditional livelihoods and customary land use; including dependence on natural resources, will be undertaken; ■ Based on this review, the target groups for the FPIC process will be identified in terms of villages and number of households in each village. ■ It should be noted that the exact number of households may be identified only post the site walk through and social mapping. ■ Review the consultation process carried out as part of allotment process of unoccupied government land through discussions with personnel from the Land Division of District Magistrate office to access the Gram Sabha

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
			resolutions as part of the land allotment process. ■ Relevant details in relation to the Gram Sabha Resolution will be collected to understand implications for any legacy issues. ■ Give the vulnerable communities preference in employment and contracting opportunities generated by the project; ■ As part of the stakeholder engagement, ensure adequate representation of the Indigenous groups and vulnerable groups, and specific engagement activities are undertaken with these groups; ■ Ensure that the grievance management mechanism established is accessible to these groups.
Impact on Women (Construction phase)	At this stage of the Project, the details of land owners are not known. Therefore, assessment of women land owners and associated impacts on livelihood, income, economic dependability, and significance of these impacts compared to other groups who face similar impacts – is based on consultations carried out with women groups. The impacts on women groups can be linked to: ■ Safety and security issues from influx of migrant labourers,	■ Women community members in Project villages; ■ Women Headed households	■ Gender Action Plan is being prepared for the Project where women focussed engagement is detailed (refer Appendix E; ■ Ensure that the employment of women from vulnerable households is ensured in the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
	■ Loss of livelihood and income from agricultural labour work, ■ Loss of access and control over natural resources (grazing land) for firewood and fodder collection; ■ Lower standard of living due to lack of decision making regarding financial matters in the household, ■ Induced impacts of loss of grazing areas on household income, if livestock rearing is affected ■ Increased significance of impacts due to being non-titileholders and dependent upon daily wage labour for income earning etc.		■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same; ■ As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities; ■ Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.
Impact on Women (Operations phase)	■ Access to jobs during the construction phases generally skews in favour of males, thus preventing women from availing project benefits. ■ Women and girls are disproportionately at risk in terms of safety (gender based violence, harassment, curtailed movement, reduced access to resources) during the construction phase, with the arrival of migrant labourers in the construction phase and their accommodation being planned near the project villages. ■ The nature of impacts envisaged on women in the Operations phase will be as following: - The extent of outsiders and migrant population in the area would have reduced along with risk to their safety;		

Impact Categories	Impacts	Impacted Stakeholders	Mitigation Measures
	- There would be limited requirement of labourers jobs or vendor-ship opportunities in Operations phase, which might render them in search of livelihood options again.		

6.4.3 Assessing the Significance of Impacts

For the assessment of social impacts, the sensitivity and magnitude criteria outlined in **Section 6.1** have been used.

The social impacts associated with the construction, operations and decommissioning stages have been assessed qualitatively and in some cases quantitatively (subject to availability of data), using professional judgement and based on past experience from similar projects.

6.4.4 Planning Phase Impacts

6.4.4.1 Impact due to Private Land Purchase

Context and Receptors

Since the preliminary land identification there has been emphasis put on avoidance of as much of private land as possible. At the DPR stage, the total private land admeasured 133 hectares that was around 10% out of total Project land identified. After going through multiple optimisation stages and identification of alternate government land parcels, no additional parcel of private land was added to this statement. However, due to unavailability of more government land, the 133 hectares could not be further reduced.

Although the overall area of private land has remained same; the selection of private parcels has changed. For example, some of the previously identified private land parcels, were part of inhabited settlements. These have been carved out and replaced by other land parcels (government as well as private). Although avoidance of agricultural land was one of the factors considered in land optimisation, it was only selected in case of unavailability of any vacant land. Land parcels with any structure on it were avoided as reported by RUMSL (as per the data shared as of June 2020). Hence, it is understood that the Project will result in economic displacement while, no physical displacement will be involved. This will be confirmed during the RAP survey.

There is agricultural labour engaged at these private agricultural land parcels which comprise of members of households with lesser or no landholdings, which shall also face loss of livelihoods linked to these land parcels; however the estimate of people working as agricultural labour on these land parcels is not currently known.

Furthermore, the area surrounding the private identified land for project would still be used for cultivation and livestock grazing in future and the project may restrict access or make accessibility difficult for the local community, livestock, etc. especially during the construction phase. The potential impacts caused due to procurement of Government land are detailed in the next section of Impacts.

Embedded/In build control

- RUMSL shall procure private land based on the principles of negotiated settlement, to the extent possible, and the price to be paid for the land sale shall be as per the MP Mutual Consent Policy 2014. However, RFCTLARR 2013 Act may only be used for land parcels that either do not have clear titles, or have ownership related disputes
- To clarify, as stated in Section 2, the RAP-LRP will be prepared for all impacted families including the consenting private/patta land owners who are economically displaced wherever negotiated settlement process have been undertaken. The LRP will also cover economic displacement impacts on agricultural labor, working on the procured/purchased private land

- An amount of INR 2 lakhs per MW per annum has been envisaged to be provided to the local District Collector to facilitate development activities in the area and these activities may range from skill development, training, to restoration of local water bodies, and other local development works.

Impact significance

The impact of change in land ownership and use which imposes restrictions to the identified project land and surrounding agricultural land in the construction phase is evaluated to range between **minor** and **moderate** as there is limited private land take in Agar – Susner villages, and majority of the land procurement is government land parcels; however, the nature of change is irreversible.

Additional Mitigation Measures

- The private and patta land holders should be provided with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate payment against land purchase which should be above the prevalent market price, as per the Mutual Consent Policy 2014;
- A Resettlement Action Plan should be formulated to systemically deal with economic impacts on the private land holders:
 - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless;
 - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc under the LRP;
 - Impacts on land users or regular agricultural labourers affected
 - The general community being impacted due to access restrictions/easements;
- Preference to members of the families rendered landless or with sub-optimal holdings post selling land to the project for employment opportunities in the Construction/operation phase and/or small contracts;
- Timely sharing of project related information with all relevant stakeholders;
- Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.

Residual Impact Significance

After the implementation of these mitigation measures, the residual impact significance is expected to be **minor**.

Impact	Impact on private land sellers, agricultural labourers and community due to change in land ownership and use			
Impact Nature	Negative		Positive	Neutral
Impact Type			Indirect	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local		Regional	International
	Project villages			
Frequency	Planning phase			

Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to range between Minor to Moderate .				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.4.4.2 Impacts due to Long Lease of Government Land

Context and receptor

The proportion of Government land identified for the project is 90.5%. The various uses of Government land (discussed in **Section 4.5.6.2**) are encroachment and squatting by private and patta land owners for agriculture, and the community at large, for livestock grazing and collection of firewood grasses, etc.. The Rabaris (a nomadic pastoral community) also visits the project area along with their livestock for 2-3 days in each village, in a year. Their time of visit may change by a month or two (between September and January); however, their travel route remains the same since decades. They make camps in the vacant land and grazing fields outside of the village settlement and graze their animals for that short period on the available pastures. Thus, the stakeholders likely to be impacted by long lease of Government land by RUMSL are local community using the land for access to their assets and Common property resources, livestock owners wherein Government land is used by livestock owning community members for open grazing for approximately 8 months in a year,

Squatters and encroachers, are informal users of the land, and their livelihoods will be affected due to non-availability of the land, that they have prepared by investing in land development to make the fields suitable for cultivation.

Rabaris who have been traditionally visiting the project area annually with free access to graze their livestock during their stay may also have reduced grazing areas and may face community resistance/with potential for conflict, if the village community finds the remaining grazing land inadequate and are unwilling to share the resource.

The impacts caused due to procurement of Government land are detailed in **Table 6.14**. Embedded/ In Built Control

There is a provision that a minimum of 2% of total agricultural land available in the Project villages must be secured for grazing of livestock that will not be used for the Project either temporarily or permanently.

Grazing rights on areas -Charnoi/charagah- designated in government records are not allotted for projects. However, in some villages, it may be the case that less than 2% land is available for grazing (charnoi/charagah) even before the project allotment. In such cases, the District Collector can designate other government land as charagah and charnoi, for grazing. However, the functional adequacy will be more a function of quality and access.

Impact Significance

The impact of long terms lease of Government land by RUMSL imposes restrictions to the current economic activity, impacts access and easements for the community and affects livestock grazing significantly, as it is a large area (1274 hectares approximately). Thus the significance of this impact is

evaluated to be **Moderate to Major** as the dependence of households to be impacted from the change is understood to be high given that all the households in the project villages own livestock and need land for grazing, and secondly, the 2% allocation needs to take into account the following;– the land parcel should involve minimum travel distance for grazing (less than 3 km) to reduce time cost for the grazers, and secondly, the grazing land parcels identified for allocation, need land development investments to make it arable to the extent that livestock can graze and the fodder is replenished..

Additional Mitigation Measures

- Provision for alternate grazing land for livestock shall be made near the project villages or confirmation of adequacy of remaining grazing land to be confirmed during the RAP survey (including the assessment of access and quality of the remaining area);;
- Development of a program to include grazing area improvement and fodder intensification (cultivation) in designated areas, as agreed with the Tehsil office and the local dependent community of graziers. This may include the development of community fodder lots under the Livelihood restoration activity in the area as part of Resettlement Action Plan. This, if feasible, shall serve the purpose of improving the quality of the grazing land, ensuring access and as an income generating activity for people losing land based livelihoods.;
- The project developer is also encouraged to explore identifying unused areas within the solar park boundary and a part of the area with solar panels (10% area), for fodder cultivation, or controlled and managed open grazing of goats, or agriculture (selected crops), to explore the potential of 'mixed land use' areas in solar parks that benefit the local community too. This may be done with the agreement of RUMSL and in partnership with domain specialist agencies and local organisations working in the region. Additional positive effects may include countering the 'heat island effect' described in Section 6.2.4
- Provision of easements shall be maintained in order to not sever the access to CPRs for the community as well as the traditionally visiting Rabari community;
- Preference of members of Project affected households (PAH) as identified in the RAP, in employment opportunities during construction phase;
- In case of Squatters and encroachers, RUMSL shall serve a three months advance notice to the project affected persons (PAPs) to manage the potential losses to standing crops;
- In case of crop losses ensuing from project activities, RUMSL shall pay compensation for crops, as defined in the RAP (entitlement matrix);;
- Timely sharing of project related information with all relevant stakeholders in order to serve advance notice and reduce the extent of impacts and losses;
- Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.

Residual Impact Significance

After the implementation of these mitigation measures, the residual impact significance is expected to be **Moderate**

Impact	Impact due to long lease of Government land		
Impact Nature	Negative	Positive	Neutral
Impact Type	Direct	Indirect	Induced

Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Frequency	Project villages			
Impact Magnitude	Positive	Negligible	Small	Medium Large
Vulnerability of social Receptors	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate to Major .			
Residual Impact Magnitude	Positive	Negligible	Small	Medium Large
Residual Impact Significance	Negligible	Minor	Moderate**	Major
	Significance of impact is considered Moderate**			

**If additional enhancement measures are included by the project developer, with RUMSL's consent, it may provide positive benefits to the community over the life of the project, further reducing the residual impact significance to minor or negligible.

6.4.5 Construction Phase Impacts

6.4.5.1 Impacts on Community Health and Safety

Context and receptor

The receptors for impacts on community health and safety include the local community within the Study Area who may be present in the vicinity of the project activities, for grazing purposes or while commuting. The construction phase activities, laying down of transmission line towers and construction of substations and movement of material and personnel may result in impacts on the health and safety of the community. These activities will involve the use of machinery and power transmission lines. Furthermore, the movement of material and personnel via the access roads may result in damage to human life or livestock due to accidents. Review of the project boundary and site assessment shows that existing access roads to villages may be disrupted/blocked, and this will lead to higher time costs associated with accessing markets, schools, and hospitals, for the villages.

Additionally, the influx of migrant workers may lead to spread of infections and diseases due to interactions between the migrant workers and local community, improper management of waste, and underdeveloped sanitation facilities of the labour accommodation etc. The situation of infections due to the spread of COVID19 require special provisions of safety and sanitisation for engagement and management of migrant labourers for the period that this threat is considered active. All government prescribed safety measures will have to be ensured by the contractors. The Community health and safety impacts in construction phase are detailed in Table 6.14.

Embedded/ In Built Control

The embedded controls, as derived from the ESMF comprise the following:

- Migrant workforce should be prohibited from disturbing the flora, fauna including hunting of animals, Wildlife hunting, poaching and tree felling or using common resources (wells, forests etc);
- Treated Potable Water shall be made available at Site (for all workers) as well as at Accommodation facilities for drinking purpose;

- The movement of heavy machinery and equipment's shall be restricted to defined routes and agreed hours during the day, with no night-time activities that will cause disturbance to the community;
- Proper signage's to be displayed at major junctions.

Impact Significance

Based on the above the impact is assessed to be **Moderate**.

Additional Mitigation Measures

In addition to the embedded measures, the following risk mitigation measures are suggested to minimize the risks/hazards of construction activities to community:

Responsibilities of RUMSL

- Ensuring stakeholder engagement through the project cycle and provision of an effective Grievance Redressal Mechanism to avoid, mitigate and manage conflicts and disagreements;
- As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions to be taken for safety;
- RUMSL shall maintain safe distance of project components from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents;
- The Contractors to be engaged by RUMSL shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan (including for managing COVID 19 related risks), etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization;
- The contractor shall be required to adhere to IFC's Workers' Accommodation: Processes and Standards, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste;
- RUMSL shall put in place a grievance redressal mechanism to allow community members to report any concern or grievance related to project activities. The contractors engaged shall also be contractually required to put in place a similar mechanism to deal with concerns raised by the community (or external stakeholders) and the workers engaged during construction phases.

Responsibilities of Contractors

- The contractor shall induct migrant workers on health and safety awareness and practices to be followed at site during construction phase;
- The contractors shall cordon off areas that are under construction and put relevant safety signs to restrict movement of local community members or workers engaged at site, which may become safety threats;
- The Contractors shall prepare a Traffic Management Plan and traffic movement due to the project in the area will be regulated to ensure road and pedestrian (including livestock) safety. The travel and stay of Rabari community once a year for 2-3 days near village on the route should be considered in this Plan;
- Additionally, training on vehicular safety shall be organised for the transport workers.

- The movement of workers from the project site and labour camps shall be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible interactions leading to conflicts or tensions between the migrant workforce and host community;
- Contractors shall ensure that regular health check-ups are conducted for the construction phase workers (especially migrant workers staying in temporary labour accommodation) and any major illnesses are reported in the Block level medical authorities at the earliest; The labour accommodation should be clean and hygienic and disposal of kitchen waste and food waste shall be done on a daily basis in an appropriate manner;
- Proper sanitation facilities shall be provided, taking into account the number of labourers that will be using the facilities, both at construction site, as well as labour accommodation;

Residual Impact Significance

The significance of impact will be reduced to **minor** on implementation of mitigation measures.

Impact	Impact on Community Health and Safety				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional	International	
Impact Scale	Limited to Project Footprint area				
Frequency	Project lifecycle but focused on Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate		Major
	Significance of Residual Impacts is considered Minor				

6.4.5.2 Impacts due to Loss of access to other Common Natural Resources

Context and receptor

The community resources like water collection and storage areas, forest resources will be the prime receptors for the impact caused by project activities. The project related construction activities are understood to span across 21 months and would require water for drinking, cooking and sanitary purposes. This might affect the water table in the area, especially during the summer months, where water scarcity is reported over the last few years.

If the movement of migrant labour is not channelized, and arrangements for fuelwood, sanitation facilities is not made, their unregulated movement and use of forest and forest resources can increase the burden on local ecosystem and might damage the local flora and fauna.

In addition, there are multiple watershed scheme projects (in form of percolation ponds) implemented across the project area villages. Based on site visit during December 2019 and January 2020 of the previous land requirement and based on satellite imagery observations of the revised land state in June 2020, all water bodies (except for the parcel 70, 76, 74 in Karwa Khedi, Agar wherein a part of the larger embankment dam is in the project footprint) are carved out of the Project area. However, access to the existing ponds will be difficult once the project is built, and since these water resources are used for tending to livestock, the access will also have to take into account space for livestock.

The roads used by the community would also face wear and tear due to transportation of heavy machinery and material, which shall lead to early damages than their anticipated life span. The Impacts due to stress on community resources in construction phase are detailed in Table 6.14 Embedded/Built-in Controls

The same control measures as suggested in section 6.2.2 of this report will also remain applicable here. In addition, the following embedded controls have been identified:

- Undertaking rain water harvesting activities to provide more water holding bodies around the villages

Additional Mitigation Measures

- In carving out access spaces to existing water bodies, movement of large livestock needs to be taken into account
- Create water recycling systems that can reduce water use for cleaning the panels of the plants

Impact Significance

The significance of impact from the above activities is understood to be **Moderate**.

Additional Mitigation Measures

RUMSL responsibilities

- There will be a worker Code of Conduct defined by RUMSL that prevents workers and contractors from using the local resources like water, forest, which will be shared with private SPDs for onward sharing with sub-contractors and its workers;
- An induction session will be organised for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources;
- The contractor shall be asked to use Tanker water supply during the summer months, which are dry months in which water scarcity issues are reported by the community;
- Periodic maintenance activities for roads used for transportation of goods for the project shall be the undertaken by RUMSL, through its contractors;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources.

Furthermore, the mitigation measures suggested in section 6.2.2 will also be applicable here.

Residual Impact Significance

The significance of impact will be reduced to **Negligible** on implementation of mitigation measures.

Impact	Impact on Community Resources				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional	International	
Impact Scale	Limited to Project Footprint area, Project villages and Study area for transportation related activities				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered as Negligible				

6.4.5.3 Impact on Local Economy and Employment

Context and Receptor

The social baseline conditions in the Study area suggest that major working population the Project villages are cultivators and agriculture labours. The existing scenario of agriculture in the Study Area as well as the increasingly stressed ground water scenario also indicates that it is not sufficient to meet requirements of the people dependent on agriculture. In absence of any industries and other sources of employment in the Study Area, people dependent on land based livelihoods will face issues with diminished household income and will have to resort to either agriculture or will migrate to other places for work. Migration for work may also not be a preferable option during the COVID 19 situation, which may prevail for at least another year or so.

The project needs skilled and unskilled workers, in larger numbers in construction phase, while the number will be reduced once the project becomes operational. The construction phase will provide a boost to the local employment, as a higher number of unskilled labourers is required to be engaged for construction activities. Furthermore, there would be some skilled labour required that would be brought in from other states (if not present in local area) that would also lead to spike in economic activity in the area, during construction phase. This would lead to better business opportunities for smaller vendors in the area owning petty shops, petty contractors firms, etc. for providing essential goods and services to the project.

Additionally, there would be increased demand for agricultural products, animal based food products, etc., that may require enhanced production of associated items and opportunities for traders.

During operation phase of the project, employment opportunities would be lesser compared to construction phase. They could be restricted to requirement of few security personnel and few housekeeping staff at site office.

Impact Significance

The significance of this impact is understood to be **Moderate**.

Enhancement Measures

The project is recommended to have the following enhancement measures in place:

- The sourcing of local labour wherever possible should be made obligatory by RUMSL (through contractual provisions) for the Solar Project Developers and sub-contractors and in all major procurement activities;
- Preference should be given to the land losers and vulnerable population in the Project Villages, to the extent practicable;
- Employment of members of SC-STs and Women Headed households should be ensured by the Solar Project Developers through documented agreement with contractors/ sub-contractors;
- Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase;
- The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and opportunities for vendor-ship.

6.4.6 Operational Phase Impacts

6.4.6.1 Impacts on Community Health and Safety

Context and receptor

The Operations phase would have very limited activity at the project site as the construction phase would have been over and the scale of activity and workforce at the project footprint area would have reduced significantly. This would lead to less or negligible noise, lesser workers at site on near project villages, reduced traffic load (compared to construction phase) and the general material supply related traffic would reduce.

However, the community shall still be a receptor of the impacts due to increased traffic, compared to the pre-project phase. There would be additional Transmission lines installed/ erected and may create access issues for the community movement, if necessary precautions are not taken by the local residents.

As discussed in Section 6.2.4, communities that are residing close to the Solar Park may experience the Heat Island Effect due to the expanse of the PV solar panels (based on local conditions, for a few days in the year), but this is understood to dissipate over a 300m distance.

Impact Significance

Based on the above understanding, the impact is assessed to be **Minor**.

Additional Mitigation Measures

In addition to the embedded measures, the following risk mitigation measures are suggested to minimize the risks/hazards of construction activities onsite:

- Where community residential clusters are closer to the project boundary, keep a safety setback (as relevant) to mitigate the heat island effect.
- Community sensitization sessions should be re-organised at the beginning of Operations phase, in order to mention about the new developments in the area and provided an understanding of the precautions to be taken for safety;

- Project's Grievance Redressal Mechanism for the community shall still be in implementation to deal with any concerns of community health and safety, being raised by the local community.

Residual Impact Significance

The significance of impact will be reduced to **negligible** on implementation of mitigation measures.

Impact	Impact on Community Health and Safety				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional	International	
Impact Scale	Limited to Project Footprint area				
Frequency	Operations Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered as Negligible				

6.4.6.2 Impacts on Local Employment

Context and Receptors

The Operations phase would require much smaller workforce as compared to construction phase and the skillset of the required workforce shall be different. The Operations phase would require Engineers, Technicians to manage the Plant operations and amongst the requirement of semi-skilled workers in limited numbers for housekeeping and Security related jobs, on the payroll of RUMSL. Additionally, there may be some vacancies with the private Solar Project Developers (SPDs) that may have some local employment, if feasible.

Impact Significance

The significance of this impact is understood to be **Minor**.

Enhancement Measures

- The private SPDs shall advertise the roles of Technical staff required during operations phases, in the local newspapers to enable hiring of competent people from nearby areas, to the extent feasible;
- Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-skilled jobs like housekeeping or Security Guards.

6.4.6.3 Impact on Vulnerable Groups (SC, ST)

Context and Receptors

Vulnerability in the society is defined on the basis of the economic status of the households, and the difference in access to social, economic and political power between men and women. Thus households with limited landholdings and resources are relatively vulnerable to changes in the immediate surroundings, affecting their livelihoods.

As discussed in **Section 4.5.4** the Study Area is characterised by a SC population of 31.1% and ST population of 0.55%. Among SC community in the 11 villages, people belong to sub-castes Chamar, Nat, Balai, Malvia, Sutar etc. The ST population consists of Bhils and Banjara ethnic groups, with a majority formed by Bhil community. The SC and ST households are amongst the smaller land holding groups compared to other social groups, as understood. Their land ownership ranges between 0-.55 ha per household. Some of the OBC households also have smaller land holding. Many of the SC and OBC households were allotted 5 bigha (0.55 ha) of patta land each for livelihood by GoMP on the account of their landlessness and lack of ability to earn gainful living.

The livelihood opportunities that they engage in comprises of wage labour work, livestock rearing etc. Similar to SC community, the OBC community also is largely dependent for income on agricultural labour, daily wage labour, and/or tending to livestock animals of other households of the village. While Census data for 2011 does not give separate information for OBC community, the SC and ST population in the Project villages is presented in the table below.

Table 6.15 Population of SC and ST Communities in Project Villages

Villages	Total Population	Scheduled Caste	Schedule Tribe
Pipalya Kumar	631	42	
Madhopur	852	11.2	0
Ladwan	829	30.2	5.8
Kesai Dehariya	651	21	0
Karwa Khedi	715	57.6	0
Dudhpura	424	0.23	0
Bijnakhedi	1216	26.7	0
Palada	837	36.4	0.35
Naharkheda	1148	29.2	0
Umariya	610	44.1	0
Pipalya Nankar	1323	33.63	0
Total	9236	31.03	0.55

Source: Census of India 2011, PCA.

Out of the three phases, the Indigenous Communities and vulnerable groups are understood to be impacted the most during Planning phase of the project, on account of loss of livelihoods linked to private land being procured for project. However, the Project has completely avoided identification of any patta land, therefore, avoiding impacts on a group SC an OBC vulnerable households by doing so. Some of the SC and ST households (either with or without any land holding) depend upon agricultural labour work. Since these agricultural workers are not rightful owners or users of land as per records, the project related compensation measures would not be directly reaching out to this group or may be reaching in a diminished manner.

The ST community in Ladwan village, Agar own very little land and depend on agricultural labour work to sustain their livelihood. When agricultural work is not available, they migrate to cities in neighbouring states (Gujarat, Rajasthan) for work. They hold some livestock, and their access to grazing land is further restricted due to encroachment by dominant and influential community in the village. The ST community has shifted towards reliance on the legal system, and local government bodies (Panchayat) in resolving matters relating use of customary land/ land use.

Embedded/In Built Control

- As part of the Community Development Activities in the local villages, the Project proponent will identify specific programmes for SC/ST groups and vulnerable groups.

Impact Significance

Based on the above the impact after implementing the embedded controls is assessed to be

Moderate.

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified:

- Implementing the FPIC process, as agreed, to seek consent for the project in the identified village- Ladwan
- Implementation of an Indigenous Peoples Plan (IPP) that will provide livelihood programs specific to these communities, also in Ladwan
- One of the assessments undertaken during the RAP survey will be identification of such vulnerable groups and assigning appropriate livelihood measures for them
- To identify and assess the extent of impacts on this group, a review of the scope of FPIC and IPP, in terms of remaining impacts on IP groups, their traditional livelihoods and customary land use; including dependence on natural resources, will be undertaken;
- Based on this review, the target groups for the FPIC process will be identified in terms of villages and number of households in each village.
- It should be noted that the exact number of households may be identified only post the site walk through and social mapping.
- Review the consultation process carried out as part of allotment process of unoccupied government land through discussions with personnel from the Land Division of District Magistrate office to access the Gram Sabha resolutions as part of the land allotment process.
- Relevant details in relation to the Gram Sabha Resolution will be collected to understand implications for any legacy issues;
- Give the vulnerable communities preference in employment and contracting opportunities generated by the project;
- As part of the stakeholder engagement, ensure adequate representation of the Indigenous groups and vulnerable groups, and specific engagement activities are undertaken with these groups;
- Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the social groups and identify community development and CSR programmes in accordance to the same;
- Ensure that the grievance management mechanism established is accessible to these groups.

Residual Impact significance

The significance of impact will be reduced to **Minor** after implementation of mitigation measures suggested.

Impact	Indigenous Communities/Vulnerable Groups				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional	International	
Impact Scale	The SC/ST Community and vulnerable groups may be negatively impacted by the project, in case the economic or developmental opportunities generated by the project are not equally accessible to them in comparison to other social groups.				
Frequency	Project life cycle				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small		Medium Large
Resource/Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered to be Moderate				
Residual Impact Magnitude	Positive	Negligible		Small	Medium Large
Residual Impact Significance	Negligible	Minor		Moderate	Major
	Significance of Residual Impacts is considered Minor				

6.4.7 Impact on Women – Construction Stage

Context and Receptors

At this stage of the Project, the details of land owners are being assessed in the RAP study. Therefore, assessment of women land owners and associated impacts on livelihood, income, economic dependability, and significance of these impacts compared to other groups who face similar impacts – will be determined as part of RAP study. Other than this, impacts on women as an affected stakeholder category, can be assessed as follows:

Land purchase related payments of the private land procurement is likely to be transferred to the men, as most owners are likely to be men. Even as women have participated to improve and cultivate land, tended to livestock and been responsible for household work, they have little decision-making power in the households especially relating to financial matters of land and assets. During consultations in the Project villages both in Agar and Susner, very few women were aware of the total land holding of their household or average income of the household. Therefore, it is highly likely that women may not directly be benefited from the payments distributed against purchase of private land for the Project. Moreover, they may not be able to take decisions related to how to use or invest the money or other benefits extended by the Project to their Project Affected Household. Lack of decision making power makes them vulnerable to loss of income (resulting out of misuse of compensation by other members of their household) and induced impacts of opportunity costs of the received money being misused. This coupled with the loss or reduction in land holding can lower the household's standard of living.

Women's share in Main workers is lower compared to men. There are 22.7% of women main workers in the Project villages, compared to 45.4% of men main workers. Whereas, among marginal workers, the women worker share is higher at 13.4% and 18.5% respectively. This indicates that employment opportunities for women throughout the year are very limited.

Currently, it has been observed and also revealed through discussions that the role of women in agriculture is valued lower, reflected in the monetary remuneration for agricultural labour work. Their role is more important in livestock management, and firewood collection. Loss of access to grazing land, will reduce access to those common property resources, and given the social stratification, and dominance of certain social groups over others, poorer families and women-led households in particular stand to lose more, whether in terms of control over the decision making on use of such common resources, or reduced incomes resulting from poorer grazing resources, if not well mitigated and managed.

There also are single, widowed, older adult women in these villages. They generally engage in agriculture labour work. In case the project's land purchase results in loss of agricultural land upon which their livelihood depends, it creates a significant negative impact on their livelihood and opportunities for seasonal or regular employment.

Women and girls are disproportionately at risk in terms of safety (gender based violence, harassment, curtailed movement, reduced access to resources), with arrival of migrant labourers in the construction phase and their accommodation being planned near the project villages.

The impact analysis and planning of development activities must be based on the two key gender concepts:

- Practical gender needs – things that both men and women require to undertake their daily activities or fulfil responsibilities according to traditional division of labour across genders
- Strategic gender needs – forward looking interests that can enable women to transform existing power imbalances into a greater equality space for men and women, with regards to economic opportunities.

Embedded/In Built Control

- As part of the Community Development Activities in the local villages, the Project proponent will identify specific programmes for women groups and Women Headed households.
- The migrant workforce engaged during construction phase shall be inducted in the initial phases on the Do's and Don'ts during their stay, which shall include limited engagement with local community, not causing disturbances to the community, etc.
- Provide alternative arrangements for land, and create access for ease of use to collect fuelwood, and fodder.

Impact Significance

Based on the above the impact after implementing the embedded controls is assessed to be **Moderate**.

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified:

- Provide alternative grazing land, and create access for ease of use to collect fuelwood, and fodder. Include focus on women in the development of the Fodder Development and intensification initiatives to address the grazing issue.

- A Gender Action Plan is being prepared for the Project where women focussed engagement and detailed in **Appendix E**;
- Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken;
- Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same;
- As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities;
- Include provisions of coverage of women under skill training and Financial literacy training programs, as part of livelihood restoration activities by the project or through developmental programs of SPDs
- Empowering the dormant SHGs to undertake livestock management activities (including fodder management), and making their current role of tending to livestock, as an economic activity
- Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.

Residual Impact Significance

The significance of impact will be reduced to **Minor** after implementation of mitigation measures suggested in construction phase.

Impact	Women				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional	International	
Impact Scale	The women in the Project villages are understood to be impacted during Planning and Construction phases.				
Frequency	Planning and Construction Phases				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered to be Moderate				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor		Moderate	Major
	Significance of Residual Impacts is Minor				

6.4.8 Impact on Women – Operations Stage

Context and Receptors

The nature of impacts are envisaged on women in the Operations phase will vary from construction phase as the extent of presence of migrant population in the area would have reduced along with risk to their safety. Furthermore, there would be limited requirement of labourers' jobs or vendor-ship opportunities in Operations phase in the Project, which might render them in search of livelihood options again.

Embedded / In built Measures

The duration (months) and nature of employment (temporary) shall be communicated in advance to this group in order to manage impacts due job reductions.

Impact Significance

Based on the above the impact after implementing the embedded controls is assessed to be **Minor**.

Additional Mitigation Measures

The SPDs shall ensure appropriate measures for hiring of women, as per required skill set, are put in place, during the Operations phases.

Residual Impact Significance

The significance of impact will be reduced to **Minor** after implementation of mitigation measures suggested in construction phase and **Negligible** in operations phase.

Impact	Women				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local		Regional	International	
Impact Scale	The women in the Project villages are understood to be impacted during Planning and construction phases				
Frequency	Operations Phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low		Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be Minor				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be Negligible				

6.5 Summary of Impact Assessment

The table below presents the summary outcome of the comprehensive assessment of identified impacts pre and post mitigation during various phases of the Project.

Table 6.16 Summary of Impacts

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase		
Impact due to private land purchase	Minor to Moderate	Minor
Impact due to long lease of Government Land	Major to Moderate	Moderate
Construction Phase		
Land use and Land cover	Moderate	Moderate
Soil compaction and erosion	Minor	Negligible
Waste generation and soil contamination	Minor	Minor
Topography and Drainage	Moderate	Moderate
Water resources and availability	Moderate	Moderate to Minor
Water quality	Moderate	Minor
Ambient air quality	Minor	Minor to Negligible
Ambient noise quality	Moderate	Minor
Occupational health and safety	Minor	Minor
Vegetation Clearance and Construction Activities	Moderate	Negligible
Impacts due to Influx of Labour and Labour camp	Minor	Not Significant
Community Health and Safety	Moderate	Minor
Impacts due to Loss of access to other Common Natural Resources	Moderate	Negligible
Impact on Local Economy and Employment	Moderate (Positive)	
Operation Phase		
Soil Environment	Minor	Minor
Water resources and availability	Major	Moderate
Health and safety	Minor	Minor to Negligible
Collision and Electrocutation risks from transmission infrastructure	Moderate	Negligible
Community Health and Safety	Minor	Negligible
Impact on Employment	Minor (Positive)	
Impacts on specific stakeholder categories		

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Impact on Indigenous Communities (Construction and Operations Phases)	Moderate	Minor
Impact on Women (Construction Phase)	Moderate	Minor
Impact on Women (Operation Phases)	Minor	Negligible

7. ANALYSIS OF ALTERNATIVES

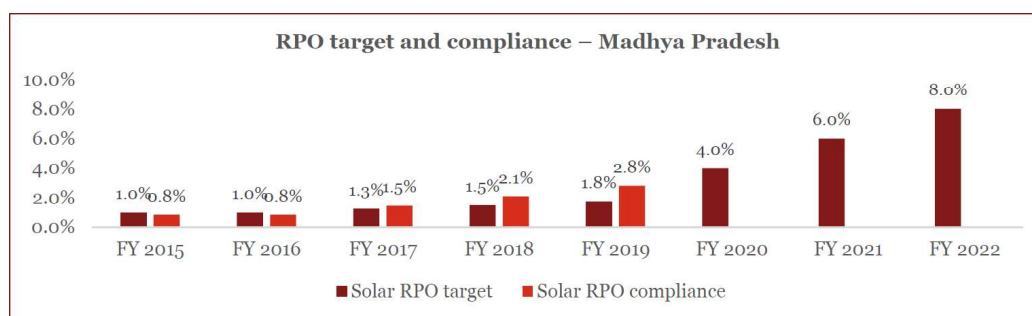
An analysis of probable alternatives for the chosen technology and location of Project site along with other similar factors that contribute to the Project as a whole has been carried out. The following scenarios have been taken into consideration:

- Project vs No Project scenario;
- Alternate Source for Power Generation;
- Location for Project Site.

7.1 Project vs No Project scenario

The state of Madhya Pradesh is endowed with high solar radiation with around 300 days of clear sun. The state offers good sites having potential of more than 5.5 kWh/ sq.m/per day for installation of Solar based power projects. State wise targets by MNRE requires MP to achieve 5,675 MW of Solar power by 2022. As on July 2018, the State has commissioned solar capacity of 1,358 MW and under-construction capacity of 685 MW. Renewable Purchase Obligation (RPO) target and current status for the state of Madhya Pradesh is as presented in **Figure 7.1 below**.

Figure 7.1 RPO target and compliance status of Madhya Pradesh



Source: Detailed Project Report, 550 MW Agar Solar Park, August 2020

The proposed project will enable state to meet their target for solar power and renewable purchase obligations. In addition, the clean power generated by these solar projects play a role for reducing India's carbon footprint, promote high-end technical investments and empower local communities.

7.2 Alternate Source for Power Generation

There are different modes for power generation depending upon the source of energy such as coal energy, natural gas energy, wind energy, solar energy, nuclear energy, geothermal energy and waste to energy. Solar energy is the eco-friendly mode of power generation providing a non-polluting source of energy that can displace greenhouse gas emissions from conventional power. Besides this:

- Negligible emissions from the operation (mainly vehicular emissions);
- No fuel required for operation of the Solar Park;
- The gestation time required for solar energy projects is comparatively less than conventional power generation and requires short lead time to design, install, and start-up.

Manufacturing of parts, related up-stream and downstream activities in a typical solar energy development projects, are associated with emissions due to consumption of fossil fuels which contributes to Green House Gases (GHGs). The lifecycle emissions from various power sources is shown in **Table 7.1**.

Table 7.1 Life-cycle Emissions from Power Sources

LCA Emissions (g CO ₂ equivalent/kWh)	Wind	Solar	Nuclear	Coal
Implementation	13.7	37.5	1.2	3.6
Operation	4.7	12.0	12.4	918.8
Decommissioning	0.6	0.5	0.4	52.2
Total	19	50	14	975.3

Source: Report on developmental impacts and sustainable governance aspects of renewable energy Projects, Ministry of New and Renewable Energy, 2013

As evident from the above table, the emission of CO₂ per kWh of energy generated from a Coal based power plant is more than that of the emission from a solar based power plant. The only emissions from the Renewable energy technologies are the emissions from fossil sources used in the production and manufacturing of equipment, waste disposal during construction, recycling etc. These life-cycle emissions are significantly lower as indicated in the table above.

The advantages and disadvantages of various power generation systems are shown in table below.

Table 7.2 Environmental Advantages and Disadvantages of Power Generation System

Mode	Disadvantage	Advantage
Thermal Power Plant	- High fossil fuel consumption. - Large quantities of water requirement for cooling - High volume of emissions from operation - Accumulation of fly ash (in case of coal powered installations) - Upstream impact from mining and oil exploration - GHG emission estimated as 228gCeq/kWh	- Large scale production potential - Moderate gestation period - Relatively inexpensive - Wider distribution potential
Hydropower Plant	- Site specific, dependent on reservoir/river etc. - Downstream impact on flow - Long gestation period - Acute and chronic social and ecological impacts	GHG emission estimated as low as 1.1gCeq/kWh for run of river Projects

Mode	Disadvantage	Advantage
Nuclear Power	■ Availability of fuel source ■ Hazards associated with radioactive material ■ High cost of Project ■ Long gestation period ■ Risk of fallout and meltdown scenarios and its impacts on the local populace and environment.	■ Cheaper power generation ■ GHG emissions as low as 2.5gCeq/kWh
Wind Power	■ Overall land requirement is large ■ Site specific (associated to wind pattern) ■ Expensive installation	■ Pollution levels are insignificant ■ Inexpensive power generation ■ Inexhaustible source ■ GHG emissions as low as 2.5gCeq/kWh for the Production Chain
Solar Power	■ Large land requirement ■ Site specific to solar insolation ■ Expensive installation ■ Concrete foundation on larger area	■ Pollution levels are insignificant ■ Inexpensive power generation ■ Inexhaustible source ■ GHG emissions as low as 8.2gCeq/kWh for the Production Chain

Source: International Atomic Energy Agency (IAEA)

Table 7.3 Green House Emissions from Different Electricity Production Chains

Technology	Mean tonnes (CO ₂ e/GWh)	Low tonnes (CO ₂ e/GWh)	High tonnes (CO ₂ e/GWh)
Lignite	1054	790	1372
Coal	888	756	1310
Oil	733	547	935
Natural Gas	499	362	891
Solar PV	85	13	731
Biomass	45	10	101
Nuclear	29	2	130
Hydroelectric	26	2	237
Wind	26	6	124

Source: World Nuclear Association (WNA); http://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working_Group_Reports/comparison_of_lifecycle.pdf

Further to the above mentioned reasons, it can be conclude that:

- The Project is environment friendly with minimal greenhouse gas emissions;
- It is the most feasible choice of power generation in the State of Madhya Pradesh; and
- It will contribute towards the state of Madhya Pradesh attaining self-sufficiency in power supply.

7.2.1 Location for Project Site

7.2.1.1 Availability of Solar Radiation

Solar Projects are non-polluting energy generation Projects, which are site specific and dependent on the availability of solar irradiance resource. Solar irradiance mapping, in India is the responsibility of the Solar Energy Centre (SEC) of India and the National Renewable Energy Laboratory (NREL) of the United States of America as part of the initiatives of the U.S.-India Energy Cooperation /Partnership to Advance Clean Energy (PACE), which is mapped and quantified based on which potential areas that are notified by the SEC, based on hourly data.

Based on the review of data obtained from The US National Aeronautics and Space Administration (NASA), NREL, Meteonorm; the average daily and monthly Global Horizontal Irradiance (GHI) values at Agar are presented in table below.

Table 7.4 Daily and Monthly GHI at Agar Solar Park Site

Month	GHI (kWh/m ² / day)			GHI (kWh/m ² / month)		
	NASA	NREL	Meteonorm 7	NASA	NREL	Meteonorm 7
January	4.47	4.39	4.29	139	136	133
February	5.24	5.55	5.21	147	155	146
March	6.09	6.42	6.45	189	199	200
April	6.59	7	6.57	198	210	197
May	6.62	7.07	6.84	205	219	212
June	5.64	6.15	5.8	169	185	174
July	4.25	5.16	4.55	132	160	141
August	3.81	4.84	4.35	118	150	135
September	4.84	5.48	5.23	145	164	157
October	5.12	5.37	5.23	159	166	162
November	4.63	4.62	4.4	139	139	132
December	4.18	4.27	4.1	130	132	127
Annual Average	5.12	5.53	5.25	155	168	159

Source: Detailed Project Report, 550 MW Agar Solar Park, October 2019

The site selected has average Global Horizontal Irradiance of 5.25 kWh/m²/day and annual GHI of more than 1,918 kWh/m² is observed at the project site which is appropriate for a Solar PV project development.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Introduction

The purpose of an Environmental and Social Management Plan (hereinafter referred as ESMP) is to ensure that social and environmental impacts, risks and liabilities identified during the ESA process are effectively managed during the construction and operation of the proposed project. The ESMP specifies the mitigation and management measures to which the Proponent is committed and shows how the Project will mobilize organizational capacity and resources to implement these measures. The ESMP also shows how mitigation and management measures will be scheduled.

The key objectives of the ESMP are to:

- Formalize and disclose the program for environmental and social management;
- Provide a framework for the implementation of environmental and social management initiatives.

The ESMP describes the mitigation measures for all the identified potential impacts associated with the proposed project during its construction and operation phases. The ESMP delineates the monitoring and management measures to avoid and/or minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures. Also the ESMP shall ensure a continuous communication process between RUMSL, EPC contractor, workers (including sub-contractors), local community and other stakeholders. RUMSL have an obligation to ensure compliance to all the commitments towards Environment, Social, Health and Safety Standards while executing all the project related activities for the proposed Project.

8.2 Environmental and Social Management Plan

This section outlines the potential impacts, mitigation measures, monitoring and management responsibilities during construction and operation phases of the Project. ESMP measures already embedded/ in-built are not included in the ESMP presented in Table below. As a part of ESMP specific management plans including waste management plan, water management plan, occupational health & safety plan, disaster management and emergency response plan, contractor and labour management, gender action plan and stakeholder engagement plan has also been prepared for the project which are provided in **Appendix E**.

Table 8.1 Planning Phase ESMP

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Land Procurement	Impacts due to Private land purchase	■ The private land sellers should be provided with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate compensation at twice the value of land and assets, as per MP Mutual Consent Policy, 2014; ■ A Resettlement Action Plan shall be formulated to address the following: - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc under the LRP; - Impacts on land users or regular agricultural labourers affected - Other impacts on private and patta land owners - The general community being impacted due to access restrictions/easements; ■ Preference to members of the families rendered landless or with sub-optimal holdings post selling land to the project for employment opportunities in the Construction/operation phase and/or small contracts; ■ Timely sharing of project related information with all relevant stakeholders;	RUMSL	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		
	Impact due to long lease of Government Land	■ Provision for alternate grazing land for livestock shall be made near the project villages or confirmation of adequacy of remaining grazing land; ■ Development of community fodder lots shall be explored as a Livelihood restoration activity in the area as part of Resettlement Action Plan. This, if feasible, shall serve the purpose of augmentation of grazing land and as an income generating activity for people losing land based livelihoods. ■ Provision of easements shall be maintained in order to not sever the access to CPRs for the community; ■ Preference of members of Project affected households (PAH) in employment opportunities during construction phase; ■ In case of Squatters and encroachers, RUMSL shall serve a three months advance notice to the project affected persons (PAPs) to manage the potential losses to standing crops; ■ In case of crop losses ensuing from project activities, RUMSL shall pay compensation for crops, at full replacement cost; ■ Timely sharing of project related information with all relevant stakeholders in order to serve advance notice and reduce the extent of impacts and losses;	RUMSL	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		
	Impact on Women	■ A Gender Action Plan shall be prepared for the Project where women focussed engagement shall be detailed; ■ Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken; ■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same; ■ As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project Developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities; ■ Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.	RUMSL along with SPDs	Monthly reports on number of women engaged in the project activities
Water Resources		■ As part of project designing, SPD shall consider the rainwater harvesting ponds in the open area depending on the topography, slope, natural drainage etc. Accordingly infrastructure such as drains/ piping system/ size of pond etc. shall be designed.	SPD	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		Similarly, in case water is sourced from surface water bodies, infrastructure requirements shall be identified and planned in project design.		

Table 8.2 Construction Phase ESMP

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Site preparation - Site clearing, excavation and levelling	Change of topography and disturbance to drainage pattern.	- Project designing shall be done in a way to utilize existing topography to maximum; - Project shall ensure to avoid any unnecessary changes in the topography especially during the preconstruction and construction phase; - Micro drainage channel should be particularly avoided when constructing access roads or planning the Transmission Line pathway in order to ensure no change to the topography of the area.	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Vegetation Clearance and Other Construction Impacts; and Barrier Effect and Loss of Resources	- Vegetation clearance should be kept restricted to project site only and should be avoided wherever possible. - It is recommended that the selected EPC contractor should display and educate labourers not to collect fuel wood from adjacent areas and alternate arrangement for fuel, like LPG must be made available in the labour camps for cooking. - Provision for identifying grazing areas for the livestock village wise and development of grass plots in 5 acre area with local grass species; - Sufficient arrangement for identifying water holes based on the terrain gradient to tap the surface water runoff during rains	EPC Contractor/Sub Contractor in association with RUMSL Planning Team	Monthly Report to RUMSL Planning Team

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Construction Activities at Site	Change in land use	- Strengthening of existing waterbodies in the study area and development of water channels to connect the surface runoff to them. - Construction activities should be restricted to designated area; - On completion of construction activities, land used for temporary facilities such as Contractor office, batching plant (if any), stockyard, labour camp should be restored to the extent possible - The land use in and around permanent Project facilities should not be disturbed; and - The land should be restored back to the original state to the extent possible after completion of life cycle of the Project and in case there are plans not to continue further at the site.	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Influx of Migrant Labour and Labour Camp	- The likelihood of threatened and protected fauna venturing into the Project site is small but proper precautions should be taken to prevent any human-wildlife conflict. - It is recommended that the selected EPC contractor should display and educate labourers and staff about the hunting, poaching, trapping, injuring or killing of wildlife in the region. - Any such activity of hunting and poaching should be covered under contractual obligations of the EPC contractor; - The EPC contractor should in consultation with Forest Department should explore the options to minimize wildlife human interactions in the study area.	EPC Contractor/Sub-contractor	

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
	Soil Compaction and Erosion	■ The topsoil present in the construction shall be removed and stock piled in separate area; ■ The stock pile should be protected from natural elements to prevent from erosion and also degradation; ■ Topsoil to be reused on site for landscaping purpose; ■ Defined routes for transportation and construction vehicles, workers etc. to minimize soil compaction; ■ Good drainage as per the natural slope condition should be provided to reduce surface runoff and associated erosion; ■ Back filling and revegetation of the area disturbed will be undertaken phase wise immediately after the completion; and ■ Site clearance, piling, excavation and access road construction will not be carried out during the monsoon season to minimize erosion and run-off.	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Soil Contamination	■ Construction and Demolition Waste should be stored separately and be periodically collected by an authorized treatment and storage facility; ■ All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels; ■ Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured; ■ The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; ■ A log book should be maintained for quantity and type of hazardous waste generated; ■ EPC Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site; ■ Hazardous waste to be disposed through MPPCB authorised vendors; ■ In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste; and ■ E waste, used discarded batteries shall be disposed off in accordance to e waste management rules and batteries management and handling rules.		
	Impact on Water Resource and Availability	■ Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water; ■ No ground water shall be abstracted for construction activities; ■ Regular inspection for identification of water leakages and preventing wastage of is necessary for efficient utilisation of water; ■ Maintain logbook for water consumption	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Impact on Water Quality	■ Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		- Open defecation and random disposal of sewage will be strictly restricted; - Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels; - Provision of number of toilets across with easily accessible location as the project site is spread across large area of 3 units; - Use of licensed contractors for management and disposal of waste and sludge; - Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage will be strictly restricted; - Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and - Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.		
	Impact on Air Quality	- The construction site shall be barricaded; - Keeping areas of open excavation to a minimum; - Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction activities; - Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures; - Speed of vehicles on site to be limited to 10-15 km/hr;	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		- The emissions from diesel generator shall be by optimised operations, orientation at the site and providing adequate stack height for wider dispersion of gaseous emissions - Switch off machinery and equipment when not in use; - Prevent idling of vehicles and equipment; and - Vehicle engines will be properly maintained and will have a valid Pollution under Control (PUC) to ensure minimization in vehicular emissions.		
	Impact on Noise Quality	- Only well-maintained equipment to be operated on-site; - If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components to be carried out to bring down the noise. It is to be ensured that such machinery are kept far away from the households; - Machinery and construction equipment that may be in intermittent use to be shut down or throttled down during non-work periods; - Low noise equipment shall be used as far as practicable; - The number of equipment operating simultaneously shall be reduced as far as practicable; - DG set with acoustic enclosures shall be used; - Vehicular movement through village roads should be planned to avoid traffic jam and inconvenience to local residents; - Equipment noise should be 85 dB (A) at 1 m from the source in line with WB/IFC EHS guidelines; and	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
	Impacts due to construction activities	Minimal use of vehicle horns needs to be encouraged through induction training and periodic toolbox training sessions.	EPC Contractor/Sub-contractor	Report to RUMSL Construction Team
		No hunting, trapping or injuring of local fauna should be communicated to labourers through a workshop or formal training exercise. The training should also communicate presence of species protected under Wildlife Protection Act, 1972 Schedule I and the penalties associated with contravention on the identified law;		
		Noise control measures such as acoustic enclosures for DG sets, noise attenuation barriers in areas near sensitive habitat and proper maintenance of the vehicles used for the Project site should be implemented to reduce the effect of construction noise on local ecology;		
		Set routes, consolidation of trips and no off-roading policies should be introduced by the EPC contractor to reduce the impact from noise and human-wildlife conflict;		
		Adequate toilets, gas/firewood and space should be provided in any anticipated labour accommodation and the labourers should be informed not to enter or utilize any resources from surrounding forest land over the course of the construction period;		
		Local semi-skilled and unskilled labourers should be used to the extent possible to reduce demography influx into the Project site and therefore reduce the risk of disturbance to local fauna;		
		Waste that is generated from the Solar Park during construction and operation should be stored in covered		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		containers within the site premises. Uncovered waste may attract fauna to the Solar Park; ■ Excavated areas should be adequately fenced and security should be deployed to prevent wildlife intrusion into these areas; ■ Construction work and anthropogenic movement should be restricted near any major water bodies (including all water bodies identified in baseline section to reduce the impact on aquatic bird species (resident or migratory); ■ Construction activities and transportation should be avoided during peak ecological activity i.e. dawn (5:30 am to 7:30 am) and dusk (5:00 pm to 7:00 pm). Night-time activities should be kept to a minimum and if essential, should be done with prior intimation to the neighbouring communities; ■ Areas with pre-existing nests, ground-roosting sites and burrows should be avoided for construction related work to reduce the impact on local fauna; and ■ Hazardous materials and waste should not be stored near any drainage channels or cliff-sides to prevent contamination of the surrounding environment and impact on local flora/fauna. ■ The area around the water bodies should be avoided for the siting of any ancillary facilities including access roads, contractor facilities or labour accommodation and even temporary siting of equipment (e.g. DG set, waste storage area and material storage area) should not be undertaken adjacent to the water body or its drainage channels.		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
	Occupational Health & Safety	■ Health & safety training to be provided; ■ Prior to start of work, workers should be informed about the related safety risks and precautions to be taken through toolbox meetings; ■ Manual lifting by adult men to be less than 55 kg and for women it should be less than 30 kg; ■ Adequate PPEs to be provided for all activities at site including but not limited to welding, cutting or similar operations which may cause hazard to eyes; ■ All persons performing construction work to wear safety shoes and helmets confirming to national standard; ■ Every worker engaged in handling sharp objects which may cause injury to hand shall be provided suitable hand gloves; ■ While working in hot conditions, measures such as work break at regular intervals, keeping hydrated by drinking water and liquids, covering face with damp cloth etc. shall be used; ■ Obtain and check Contractor's safety method statements; ■ Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only; ■ Appropriate safety harnesses and lowering/raising tools should be used for working at heights; ■ All equipment should be turned off and checked when not in use;	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		- Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; - The local/ host community to be kept at safe distance from construction site; - At a minimum, implement all COVID-19 related safety and emergency response measures, as relevant and as prescribed by the government - A Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations; - Site specific/ activity specific Hazards Identification and Risk Assessment (HIRA) should be developed prior to start of the activities at site; and - Provide H&S achievement information to employees.		
	Photovoltaic Heat Island Effect	- The existing ground vegetation in the Solar Park area shall be disturbed to minimum extent; - Ground vegetation shall be planted in the buffer areas/open areas available in the Solar Park; - The feasibility of mixed land use development in the Solar Park shall be explored	SPD and RUMSL	-
	Flood Risk	Develop a robust “Storm Water Management Plan (SWMP)” to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff.	SPD and RUMSL	Monthly report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		- Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour; - Storm water drains must be designed in line with the natural topography and eventually drain into the natural seasonal streams in the Site area; - Implement an effective flood monitoring and disaster management system in place for effective mitigation of floods at a Site level; - Coordinate with the district and local disaster management cells to update on flood early warning notifications		
Social impacts due to ongoing construction activities	Temporary occupation of land for construction phase activities	- Provision of adequate lease on rental amounts to the land owners shall be ensured by RUMSL; - The land leased/ rented shall be restored to its original state (or made better) at the time of handing it back to the owners; - Provision of compensation for the loss of livelihoods to the users of the land required for temporary use as this will temporarily economically displace them; - Timely dissemination of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts; - Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.	RUMSL	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
	Impact on Community Health and Safety	<u>Responsibilities of RUMSL</u> ■ Ensuring stakeholder engagement through the project cycle and provision of an effective Grievance Redressal Mechanism to avoid, mitigate and manage conflicts and disagreements; ■ As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions to be taken for safety; ■ RUMSL shall maintain safe distance of project components from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents; ■ The Contractors to be engaged by RUMSL shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan, etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization; ■ The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste, special measures may be required to additionally manage the risk of the COVID-19 related infections and emergency response; ■ RUMSL shall put in place a grievance redressal mechanism to allow community members to report any concern or	RUMSL along with Contractors	Monthly reports to RUMSL from EPC contractors

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		grievance related to project activities. The contractors shall also be contractually required to put in place a similar mechanism to deal with concerns raised by the community (or external stakeholders) and the workers engaged during construction phases. <u>Contractors</u> ■ The contractor shall induct migrant workers on health and safety awareness and practices to be followed at site during construction phase; ■ The contractors shall cordon off areas that are under construction and put relevant safety signs to restrict movement of local community members or workers engaged at site, which may become safety threats; ■ The Contractors shall prepare a Traffic Management Plan and traffic movement due to the project in the area will be regulated to ensure road and pedestrian (including livestock) safety; ■ Additionally, training on vehicular safety shall be organised for the transport workers. ■ The movement of workers from the project site and labour camps shall be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible interactions leading to conflicts or tensions between the migrant workforce and host community; ■ Contractors shall ensure that regular health check-ups are conducted for the construction phase workers (especially		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		migrant workers staying in temporary labour accommodation) and any major illnesses are reported in the Block level medical authorities at the earliest; ■ The labour accommodation should be clean and hygienic and disposal of kitchen waste and food waste shall be done on a daily basis in an appropriate manner; ■ Proper sanitation facilities shall be provided, taking into account the number of labourers that will be using the facilities, both at construction site, as well as labour accommodation.		
	Stress on Community Resources	■ There will be a worker Code of Conduct defined by RUMSL that prevents workers and contractors from using the local resources like water, forest, which will be shared with private SPDs for onward sharing with sub-contractors and its workers; ■ An induction session will be organised for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources; ■ The contractor shall be asked to use Tanker water supply during the summer months, which are dry months in which water scarcity issues are reported by the community; ■ Periodic maintenance activities for roads used for transportation of goods for the project shall be the undertaken by RUMSL, through its contractors; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources.	RUMSL along with contractors	Monthly reporting by contractors

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
	Impact on Employment	Enhancement Measures ■ The sourcing of local labour wherever possible should be made obligatory by RUMSL (through contractual provisions) for the Solar Project Developers and sub-contractors and in all major procurement activities; ■ Preference should be given to the land losers and vulnerable population in the Project Villages, to the extent practicable; ■ Employment of members of SC-STs and Women Headed households should be ensured by the Solar Project Developers through documented agreement with contractors/ sub-contractors; ■ Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase; ■ The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and opportunities for vendor-ship.	RUMSL	-
	Impact on Women	■ Include provisions of coverage of women under skill training and Financial literacy training programs, as part of livelihood restoration activities by the project or through developmental programs of SPDs;	RUMSL along with SPDs	Monthly reports on number of women engaged in the project activities

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken; ■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same; ■ Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.		

Table 8.3 Operation Phase ESMP

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Solar Park operation leasing to use of water	Water Resource	Conserving Water Resources ■ Dry robotic cleaning of modules to be explored as recommended by MNRE (1); ■ Alternate sources of water shall be explored such as water supply from nearby large water bodies; ■ Ground water abstraction, if required shall be done in accordance to CGWB guidelines. ■ Implement rainwater harvesting and/or groundwater recharge and replenishment opportunities within Site premises especially at pooling substation and near the low-lying and gently sloping area. ■ Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.; ■ Maintain logbook for water consumption; ■ Implement groundwater and wastewater monitoring vis-à-vis quality/quantity; ■ Adopt less water consuming module cleaning methods; ■ The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow shall be treated in water treatment unit and recycled in the Project. ■ Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also	O&M Contractor RUMSL	Annual Report to RUMSL

(1) MNRE had issued a letter dated 3 June 2019 to Principal Secretaries of States and Solar Association of all States regarding optimal utilization of water and preferably use Robotic technology for cleaning of modules.

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations. ■ The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be adopted are UN Global Compact's CEO Water Mandate or AWS Standards. ■ Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations. Rain Water Harvesting Rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones. Feasibility of rainwater harvesting ponds in the open area shall be explored during project designing. Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site. Water Quality ■ Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body; ■ Open defecation and random disposal of sewage will be strictly restricted; ■ Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Provision of number of toilets across with easily accessible location as the project site is spread across large area of both the Units; ■ Use of licensed contractors for management and disposal of waste and sludge; ■ Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets; ■ Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and ■ Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages. Other Management Aspects Preparing an inventory of water consumption during construction and O&M activities.		
Solar Park operation leading to waste generation and leaks & spill	Soil contamination	■ Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured; ■ The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; ■ A log book should be maintained for quantity and type of hazardous waste generated; ■ O&M Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site;	O&M Contractor	Annual Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Hazardous waste to be disposed through MPPCB authorised vendors; ■ In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste; ■ The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages; ■ Damaged/ discarded solar panels to be disposed with the help of authorised recycling vendors/ module installation contractors; ■ A SOP shall be prepared for storage and disposal of broken solar panels. MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; (1); ■ The broken panels shall not be mixed with normal glass and kept separately in accordance to HW Rules; and ■ Other wastes such as e-waste, used discarded batteries shall be disposed off in accordance to E-waste Rules and batteries management Rules.		
Solar Park operations	Occupational Health and Safety	■ At Substation, SOPs will be prepared for all O&M activities; ■ H&S training to be imparted; ■ Work permit system to be developed and implemented; ■ Appropriate PPEs for electrical work and other O&M work to be provided; ■ First aid kit to be provided;		

(1) <http://164.100.94.214/sites/default/files/webform/notices/DraftBluePrintAntimony.pdf>

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Social Impacts during Operations Phase		- Records of incident/ accidents shall be maintained; - Root cause analysis shall be carried out for any incident/ accident; - Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; - A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations; and - Provide H&S achievement information to employees.		
	Collision and electrocution risk	- If possible transmission line should be aligned away from the waterbody. - Insulators should be suspended in order to reduce the electrocution of bird species; - Jump connectors should be insulated and of at least 60 cm in length (determined based on the average wing span of common avifauna) to reduce chances of electrocution of species flying through and wing tips coming into contact with the conductors and - Marking overhead cables using diffractions and avoiding use in areas of high bird concentrations of species vulnerable to collision	O&M Contractor	Report to RUMSL Team
	Community Health and Safety	- Community sensitization sessions should be re-organised at the beginning of Operations phase, in order to mention about the new developments in the area and provided an understanding of the precautions to be taken for safety; - Project's Grievance Redressal Mechanism for the community shall still be in implementation to deal with any concerns of community health and safety, being raised by the local community.	Solar Project Developers (SPDs)	Monthly

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
	Impact on Employment (General, Vulnerable and Indigenous groups and women)	Enhancement Measures: ■ The private SPDs shall advertise the roles of Technical staff required during operations phases, in the local newspapers to enable hiring of competent people from nearby areas, to the extent feasible; ■ Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-skilled jobs like housekeeping or Security Guards; ■ Preference to Indigenous and Vulnerable groups shall be provided to the extent possible for semi-skilled jobs, like housekeeping, security guards, etc., and as Technicians and more, if there is a skill set match. The SPDs shall ensure appropriate measures for hiring of women, as per required skill set, are put in place, during the Operations phases.		

8.3 Institutional Structure for Implementation

To ensure the efficacy of Environmental and social management plan, certain institutional mechanism with well-defined roles and responsibilities is essential for effective implementation of identified mitigation measures both during construction and operation phases.

8.3.1 Project Implementation- SPPD and SPD

The proposed Solar Park project will be owned by RUMSL and will be established jointly by Solar Power Park Developer (SPPD), i.e. RUMSL and Solar Project Developers (SPD). SPDs will be selected through bidding process. RUMSL had appointed PGCIL as PMC to oversee the project development. Presently, bidding process for selection of SPD is in planning stage.

8.3.1.1 Responsibilities of SPPD and SPD

The scope of SPPD and SPD is given in **Table 8.4** below.

Table 8.4 Responsibilities of SPPD and SPD

Project Phase/Scope	SPPD	SPD
Name of Agency	RUMSL	To be selected through bidding process
Permissions	- Land Acquisition, Gram Panchayat NOC, - NA Conversion - Support in obtaining permissions such as - Geology & Mining NOC - PTCC Approval - CEIG Approval - Commissioning Certificate - Open Access Approval - Approval from Irrigation department - Registrations/ permissions required for work (to be executed by RUMSL)	- Registrations/ permissions required for work to be executed by SPD such as CTO for batching plant, Registration under Contract Labour Act and other labour laws (as applicable), NOC from Gram Panchayat, Geology & Mining NOC etc - PTCC Approval - CEIG Approval - Commissioning Certificate - Open Access Approval - Approval from Irrigation department
Solar Park	- Common facilities - Access roads, roads within Solar Park to provide access to individual plots and other common facilities - lightening to the common area such as utility area, street lighting of the roads - The Fire Fighting & Protection System for common infrastructure such as the Pooling Substation	- Site levelling activities for individual units - Development of Units - Development of internal roads within each unit - Labour camps

Project Phase/Scope	SPPD	SPD
Substation and Transmission Line	■ Development of internal evacuation infrastructure including 33/220 kV substations ■ Erection of Transmission Line from Unit substations to PGCIL substation proposed at Pachora village, Agar ■ O&M of Transmission system and switching/pooling substation	■ 33 kV cable circuit to evacuate the generated power from each unit to Unit substation. ■ O&M of Unit substation
Water Requirement	■ RUMSL shall make available the construction water by way of water tankers including facilitating required necessary approvals	■ Payment of construction water cost. ■ Arrangement of water requirement during operation phase.
Construction power	■ Infrastructure for construction of power through DG set or temporary supply from Distribution Company	■ Cost of construction power to be paid by SPD.
Operation and Maintenance	■ O&M of common facilities provided like pooling substation, shall be undertaken by RUMSL	■ O&M of each unit

Source: DPR, August 2020

RUMSL will appoint EPC contractor for their scope of work such as construction of external roads, substations, common facilities etc. PGCIL will be responsible to oversee the EPC contractor activities.

8.3.1.2 Power Grid Corporation India Limited (PGCIL)

PGCIL will be responsible for providing grid connectivity to the Solar Park for power evacuation. For this purpose PGCIL will construct a 220kV /400 kV ISTS substation at Agar.

RUMSL has also appointed PGCIL as Project Management Consultant. Under this role, the responsibilities of the PGCIL includes supervision of EPC contractor to be hired by RUMSL for construction of common infrastructure of Solar Park such as roads, control room etc. and construction of internal evacuation infrastructure, i.e. 33kV/220 kV Pooling substations at each Unit and 220 kV Transmission Line connecting Pooling substations to ISTS substation.

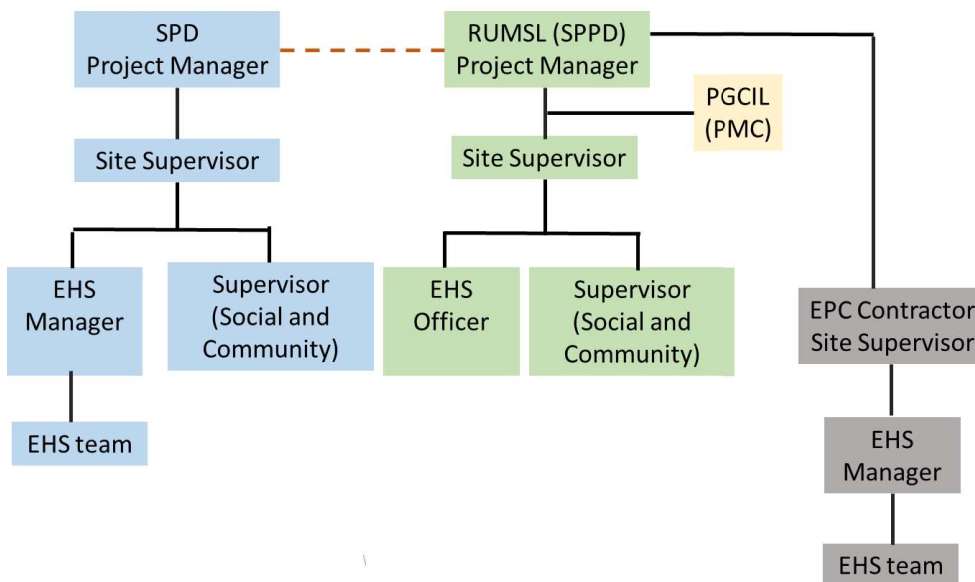
8.3.2 Implementation of ESMP

RUMSL will have ultimate responsibility for implementing the provisions of the ESMP. This role will include the on-going management of environmental and social impacts, monitoring of contractor performance as well as development of mechanisms for dealing with environmental and social problems. RUMSL will also ensure that the activities of its contractors are conducted in accordance with good practice measures, implementation of which will be required through contractual documentation.

The organizational structure of RUMSL with respect to management of EHSS issues across the project life cycle is shown in **Figure 8.1** below. The overall management and coordination of the Project will be the responsibility of Project Manager of RUMSL. RUMSL will engage EPC contractors to undertake construction activities for pooling substation and common infrastructure at all the Units, i.e. Unit 4, and Unit 5. The project level activities will be managed at the Site by Site Supervisor(s) of respective Units. At project level, implementation of management plans and corrective actions are the

responsibilities of Site Supervisor in coordination with EHS Manager, hired by the respective Unit EPC contractor. In construction and operational phase, EHS Manager of each respective Unit will supervise the Contractor HSE Engineer's performance to implement the management action plans in coordination with Site Supervisor.

Figure 8.1 Proposed Organisation Structure for ESMP Implementation



As the project is being developed on some private land also; it is envisaged that SPD need to appoint an onsite social/admin officer to manage social (including labour and community) issues. The name and contact number of the appointed person should be displayed at the site office.

8.3.2.1 Roles and Responsibilities

This section describes the roles and responsibilities of the key persons responsible for management of onsite activities for the proposed project:

Project Manager /Site In charge

The Project Manager of RUMSL will be responsible for overall management of the project and ESMP implementation during construction and operation phase. The following tasks will fall within his/her responsibilities:

- Monitor site activities on a daily basis for compliance during construction phase and weekly during operation phase;
- Conduct internal audits of the construction site against the ESMP;
- Confine the construction site to the demarcated area;
- Reporting EHSS related issues & incidents to Chairman of RUMSL;
- Conducting meetings with Site Supervisor of Unit Developers regarding EHSS issues;
- Oversee activities of Site Supervisor and will coordinate with him for updates on the project; and
- Reviewing and updating of ESMP for its effective implementation.

Site Supervisor

Site Supervisor will be appointed by the SPD/EPC Contractor and will be responsible for the following scope of work:

- Meet the labour requirements during construction phase;
- Hiring and management of different contractors for civil, mechanical and electrical works;
- Supervise the daily activities occurring on the site during construction and operation phase; and
- Plan the traffic route for movement of material and solar panels and will communicate the same to RUMSL officials.

EHS Manager

EHS Manager as appointed by SPD/EPC Contractor shall be responsible for checking compliance of the contractor(s) with the requirements of this EMP and any other relevant environmental legislation for all activities associated with the contract. The general duties of the EHS Manager are as follows:

- Be familiar with the environmental management requirements contained in this ESMP;
- Regular auditing of the contractor(s) with the view of ensuring that all activities on the site are undertaken in accordance with the ESMP;
- Issuing regular audit reports to the Site Supervisor and contractor(s) regarding compliance with this EMP with help of Safety Officers; and
- Advising on environmental legal requirements regarding issues that may arise during the project to the Site Supervisor and the contractor(s).

Safety Officer

Safety Officers appointed by SPD/EPC Contractor will also be responsible for conducting an EHS audit during the construction phase of the project on a weekly basis according to the provisions of the Environmental and Social Management Plan. The major responsibilities will be:

- Stay at ground levels on daily basis and will coordinate with Contractor's representatives for all construction activities;
- Provide tool box trainings to labour and will also issue relevant PPEs to them;
- Develop formats for work permit system and will ensure its implementation;
- Conduct independent environmental audits; and
- Submit audit reports to the EHS Manager and Site Supervisor of respective Units.

Supervisor (Social and Community aspects)

A supervisor shall be appointed by RUMSL to manage social and community aspects on site

- The Supervisor (S&C) shall be responsible for maintaining category wise records of those eligible for priority hiring of labourers by the contractors at the time of Construction activity initiation, based on the lists provided based on RAP-LRP eligibility for priority employment.
- Additionally, the Supervisor (S&C) shall be responsible for maintenance and upkeep of records related to liaison with local community including awareness and communications on construction phase activities by the project personnel, on various topics, and also be responsible for maintaining stakeholder engagement records.
- The Supervisor (S&C) shall also be designated as the Grievance Officer for the project, who is liable to maintain records of all incoming grievances, maintain grievance trackers and drive the communication to the aggrieved on receipt and resolution of grievances and also in cases of any delays that are anticipated in resolution of grievances.

HSE Engineer

The SPD/EPC Contractor's HSE officer shall be responsible for implementation of the ESMP and any other environmental requirements that may be identified by the Site Supervisor during the course of the contract. The Contractor(s) HSE officer shall have received basic HSE training either as part of the

contract or previously. In addition to any other responsibilities, the general duties of the Contractor's HSE officer shall be:

- Ensure that all personnel (including sub-contractors) are duly informed of the requirements contained in this ESMP, and the associated responsibilities and implications of this ESMP;
- Consult with the Safety Officer of SPD/EPC Contractor regarding interpretation of the EMP and any other aspects of the contract that may impact significantly on the environment; and
- Ensure that all records needed to demonstrate compliance with the EMP requirements are obtained, filed and readily available for inspection by the Site Supervisor of Module or the Project Manager of RUMSL.

8.3.3 Monitoring and Reporting

RUMSL through the respective PMC will monitor the project to ensure conformity to the requirements of the ESMF. The monitoring will cover construction and operation phases. The list of performance indicators as provided in **Table 8.5** will be used to monitor project objectives.

The monitoring will be carried out through the environmental and social safeguard compliance reports that will form a part of Monthly Progress Reports (MPR) for the project during construction phase and monthly and annual reports during operation phase. Besides this, regular visits by the EHS Manager shall also be carried out for monitoring of ESMP implementation on site. Delegated personnel shall require to fully complying with the reporting programme in terms of both timely submissions of reports as per acceptable level of detail.

Reporting: Reporting is the process of measuring actual performance or how well the mitigation measures have been implemented, including the format, timing and responsibility for reporting of the monitoring results. This needs to be undertaken in form of environmental, health, safety and social check list, incident record register, environmental, health, safety and social performance reports. RUMSL shall develop and implement a programme of reporting through all stages of the project construction and commissioning, operation and maintenance.

8.3.3.1 Monitoring Indicators

Regular monitoring of critical environmental parameters is of immense importance to assess the status of environment during construction and operation stage. The monitored data can serve as an indicator for any change in environmental quality due to the Solar Park with respect to baseline environmental conditions, so that suitable mitigatory steps could be taken in time to safeguard the environment.

The monitoring action plan covering various performance indicators, frequency and institutional arrangements of the project in the construction and operation stages is given in have been presented in the following **Table 8.5**.

Table 8.5 Monitoring Action Plan

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
A Construction Phase					
1	Compliance to Statutory Norms	Permission for borrow area/ stone quarry/ explosive permit Availability of required regulatory permissions; Compliance to applicable environmental and labour laws	SPD and EPC Contractor	RUMSL	Quarterly

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
2	Air Quality	PM10, PM2.5, SOx, NOx, CO at 3 locations covering all the 3 Units	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
3	Noise Quality	Leq Day and Night at 5 locations	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
4	Water Quality	Suspended Solids (SS), Total dissolved solids (TDS), oil, grease, Heavy metals (Fe, Cr, Pb, etc.) Biological Oxygen Demand (BOD), Total coliforms, Faecal coliforms at 2 locations	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
5	Soil Quality	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K. at 2 to 3 locations covering all the 3 Units	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
6	Personnel Safety	Total supply of PPEs vs number of workers working Number of workers working using PPEs Safe access Safe working platform for work site Incident investigation Number of near misses Number of incidents	SPD and EPC Contractor	RUMSL	Daily
7	Site Restoration	Visual Observation of sites including plant site, borrow area, camp site	SPD and EPC Contractor	RUMSL	After completion of works & before demobilization of the contractor
8	Debris Management	Removal of debris from site (visual Observation)	SPD and EPC Contractor	RUMSL	After completion of works & before issuing completion certificate

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
9	Habitat Modification and Loss	Visual observation of Project site to ensure that any mature trees that are set aside and vegetation around water bodies is being avoided by construction team	SPD and EPC Contractor	RUMSL	Monthly visits during the construction phase to ensure documented information is being followed.
10	Labour Camp	■ Availability of adequate potable water in labour camp and at construction site ■ Adequate toilet and bathing facilities and their maintenance ■ Adequacy of process of waste water disposal ■ Source of cooking fuel ■ Use of wood as a cooking fuel ■ Adequate lighting and ventilation in labour camp ■ Is an emergency response plan in place for the site and are the emergency contact details displayed in the camp ■ Number of first aid kit available and required first aid medicine filled ■ Key Health (Malaria/ dengue/fever/ any other) issues reported during the last month	SPD and EPC Contractor	RUMSL	Monthly
11	Social	Implementation of GAP, SEP, GRM	SPD and SPPD	RUMSL	Quarterly
B	Operation Phase				
1	Regulatory Compliances	Availability of the regulatory permissions and its compliance	O&M contractor	RUMSL	Annual
2	Waste generation	Quantity of hazardous waste generated and its disposal	O&M contractor	RUMSL	Quarterly
3	Water reuse and recycling	Water consumption reports and wash water reuse and recycling	O&M contractor	RUMSL	Monthly

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
4	Disposal of Batteries	Number of batteries disposed	O&M contractor	RUMSL	Annual
5	Ground water level	Monitoring of ground water level fluctuation	RUMSL through External Agency	RUMSL	Half Yearly
6	Soil Quality	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Contractor through Approved Environmental Laboratory	RUMSL	Half yearly
7	Health & Safety	■ Availability of PPEs; ■ Availability of procedures for preventive maintenance along Transmission Line and substation; ■ Records of incident/ accidents and their root cause analysis; ■ Display of emergency contact numbers; ■ Availability of firefighting equipment at substation.	Contractor	RUMSL	Monthly
8	Biodiversity	Maintenance of carcass registry and records of any bird nesting/roosting along Transmission Line Infrastructure	O&M Contractor	RUMSL	Half-yearly visits to check register and records and confirm the findings with local communities who can comment on presence/absence of carcasses in the area.
9	Community health and safety	The implementation of the SEP and GRM formulated for the project and monitoring against the indicators identified in it	O&M Contractor	RUMSL	Monthly

External Reporting and Communication

EHS Manager shall be responsible for ensuring that communication with government agencies and stakeholders are maintained as per the requirement. All complaints and enquiries to be appropriately dealt with and records be maintained in a Complaint/Enquiry Register.

The reporting to external agencies on Environmental and social performance of the project shall be done as agreed in contract.

8.3.3.2 Indicative Environmental Monitoring Budget

Indicative cost of environmental monitoring for the project have been presented in Table below.

Table 8.6 Environmental Monitoring Budget

Component	Item	Unit	Approx.. Unit Cost (Rs.)	Quantity
Construction Phase				
Ambient Air Quality	Quarterly monitoring of AAQ comprising of PM10, PM2.5, SOx, NOx, CO at nearby villages	Per sample	4000	3 locations covering both Units
Ambient Noise Level	Quarterly ambient noise level monitoring near D.G. sets/ batching plant/ nearest receptors	Per sample	3000	5 locations covering both Units
Surface Water Quality	Quarterly monitoring of surface water quality Parameters as per CPCB Use-class	Per sample	7000	2 locations (nearby water bodies)
Soil Quality	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Per sample	8000	2 to 3 locations covering both Units
Operation Phase				
Ambient Noise Level	Leq Day and Night to be monitored on six monthly basis	Per sample	3000	3 locations comprising to nearest receptors to both Units
Surface Water Quality	Six monthly monitoring of surface water quality Parameters as per CPCB Use-class	Per sample	7000	2 locations (nearby water bodies/lakes)
Soil Quality	Six monthly monitoring of Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Per sample	8000	3 locations (near storage area of both units)
Ground Water Level Monitoring	Ground water level to be monitored once in a year	Per sample	200000	One per Unit

8.4 ESMP Budget

The project will have its own budget for implementation of ESMP and RAP. The budget heads for Construction and O&M stage will include cost towards

- Dust Control (Construction Phase)
- Wastewater treatment;
- Waste management;
- Personal protective equipment;
- Health & Safety; and
- Hazardous material transportation & disposal

An indicative budgetary allocation for ESMP implementation during construction and O& M stage is provided in **Table 8.7**.

Table 8.7 Indicative Budgetary allocation for ESMP Implementation

S. N.	Particular	Capital Cost (INR in lakhs)	Recurring Cost (INR in lakhs) per annum
A.	Construction Phase		
1	Dust Suppression with sprinkling of water, covers of the vehicles transporting construction material. (During moderate operations 10-20 tankers will be required on daily basis depending on the season of the year)		10
2	Wastewater treatment - septic tank and soak pits	8	2.5
3	Waste Management - Construction of suitable masonry bins with concrete floors for waste collection and for further disposal as per applicable norms	8	5
4	Environment, health and safety and EMP implementation	50	10
5	Environmental monitoring		3
6	Landscaping	10	
7	Labour camp cleanliness		5
8.	RAP, LRP, FPIC measures etc.	To be decided after completion of these studies	
	Subtotal A	76	35.5
B.	Operation and Maintenance Phase		
1	Wastewater treatment- septic tank and soak pits	10	2.5
2	Rainwater harvesting (for roof top at pooling substation) The cost of rainwater harvesting pond in the open area shall be determined on land available, topography, slope, piping system required etc.)	20	2.0

S. N.	Particular	Capital Cost (INR in lakhs)	Recurring Cost (INR in lakhs) per annum
3	Waste Management - Municipal solid waste and hazardous waste storage area sheds (impervious shed for hazardous waste storage)	5	1.5
4	Environment, health and safety training and ESMP evaluation	25	4.0
5	Dry Robotic cleaning	depends on Robot make and capacity	depends on Robot make and capacity
6	Horticulture and landscaping (including seeding of native plants around the Solar Park and adjacent to water bodies)	20	2
7	RAP, LRP, FPIC measures etc.	To be decided after completion of these studies	
	Subtotal B	80	12
	Total (Subtotal A+ Subtotal B)	146	47.5

Note: The above cost does not include cost of manpower needed for the EMP implementation

8.5 Training and Capacity Building

Successful implementation of the Project will depend on the effective implementation of the environmental and social management measures outlined in the ESMPs, RAPs, etc. Training and capacity building will be necessary for the key stakeholders in order to ensure effective implementation of the Environmental and Social Management Framework (ESMF).

Project Manager will ensure that the training needs are identified and conducted.

Training needs will be identified based on the specific requirements of ESMP and existing capacity of site and project personnel (including the EPC Contractors and Sub-contractors) to undertake the required ESMP management actions and monitoring activities.

Also general environmental awareness will be created among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance.

RUMSL in coordination with the educational / research institutions in the country who have substantial experience in the environmental and social management sector including a good understanding of the WB/IFC safeguard requirements, shall conduct classroom training sessions for all staff likely to be involved in sub-project planning & implementation. The EH&S officer can also be one of the resource persons for conducting such training programs.

An environmental management training programme will be conducted for project related activities. This will ensure capacity building for effective implementation of the management and control measures on various project activities. The training shall focus on the environmental, health and safety and social issues. The contents will basically focus on the ESMF concept, regulatory requirements, Environment and Social priority issues, project cycle, outline of Environmental Assessment / Social Assessment and report formats in respect of the Environmental aspects.

The typical training modules for formal class room training could cover the following:

- *Module 1* - ESMF Profile (Concept, regulatory requirements, ESA, reports and formats)
- *Module 2* - Environmental Assessment Process (Environmental Laws & Regulations, EIA process, Identification of Environmental Impacts, Impact Identification Methods, Identification Mitigation Measures, Formulation of Environmental Management Plan, Implementation and Monitoring, Institutional Mechanism)
- *Module 3* - Social Assessment Process (Description of R&R, tribal and gender frameworks and procedures and National requirements, LA process, Necessity for RAP and its preparation process)
- *Module 4* – List of protected and threatened species found in and around the Project site and the provisions of no hunting, trapping and injuring of the species in accordance to the Wildlife Protection Act, 1972.

The program should be structured in such a way that it clearly brings out the value addition and enhancement benefits of proper management of environmental and social issues.

Also general environmental awareness will be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the project

9. GRIEVANCE REDRESSAL MECHANISM

Grievance management is an important component of any project's implementation. Over the duration of a project lifecycle, it encounters numerous instances of conflicts, allegations and dissatisfaction within the working and associated human capital and their interactions. Some of the areas of grievances for the project may include issues regarding land procurement, payment of compensation for land or wages to the workers, issues arising due to allotment of alternate land parcels with diminished productivity or higher upfront costs required for making it fit for cultivation, failure to fulfil commitments, poor management of construction activities, accidents due to inappropriate planning of vehicle movement, etc.

Presently, RUMSL does not have a formal grievance redressal mechanism in place for external stakeholders. In order to manage these risks, it needs an internal mechanism to allow the aggrieved party/s to lodge their complaints and get them amicably settled prior to approaching the formal legal mode of solutions.

Based on discussions with the village community, and consultations undertaken with Tehsildar of Agar and Susner, public meetings of RUMSL with the local community in the project area had not been organized yet. Of the eleven (11) villages in the PFA, four (4) villages (two in each tehsil) were aware of the project due to previous visits of SGURR team and had scattered information from the Patwaris of their village, regarding the project.

During site visit, ERM team provided project information note to representatives of Gram Panchayat of respective villages. However, a formal communication channel was yet to be established by RUMSL. It is expected that a formal GRM will be put in place for the project lifecycle, once the project footprint area is finalized and demarcation is complete.

9.1 Objectives of the Grievance Redressal Mechanism

The primary objective of the GRM shall be to provide an accessible mechanism to the stakeholders of the project and resolve any social and environmental related grievances. For this purpose, a Grievance Redressal Cell (GRC) shall be established, to resolve non-judicial disputes arising out of various matters related to the implementation of the ESMP, as well as other aspects of the project, as deemed fit to be raised before the GRC.

9.2 Composition of the GRC

The GRC will be driven internally by the Project team and shall have representation from the following teams to ensure fair and timely solution to the grievances:

- Site Manager/Project Manager;
- E&S Officer;
- OHS Officer
- Community engagements in-charge;
- Administrative in-charge at site
- Senior representation on behalf of the Project Company;
- Members of the Gram Panchayat (including women members); and

- Any other concerned person with decision making authority in relevance to the grievance or aggrieved party.

The GRC shall be led by a Grievance Officer, who can either be the site EHS officer or the Administrative in-charge. The aggrieved party shall register their grievances with the GRC. The GRC shall be empowered to take a decision which is to be considered final and binding on the Project. However, the decision of the GRC is not binding on the aggrieved person and he or she may take the grievance to the administrative setup in case any grievance channel is available at that level or take a legal course, in case not satisfied with the outcome of GRC decision.

9.2.1 Functioning of the GRC for Grievance Redress

The GRC meetings will be held on a regular basis (at least monthly) at the Project's site office, or any other designated place near the fenceline of the project. The key responsibilities of the GRC shall be as follows:

- Receive, review, consider and resolve grievances related to the social and environmental aspects of the project;
- Entertain grievances of indirectly affected persons and/or persons affected during project implementation;
- Resolve grievances within a period of two weeks at the GRC level and communication of the resolution to the aggrieved party;
- The GRC shall not engage in any review of the legal standing of an "awardee" nor shall deal with any matters pending in the court of law;
- Arrive at decisions through consensus, failing which resolution will be based on majority vote. Any decision made by the GRC must be within the purview of Environmental Management Plan, Corporate EHS and Social Policies or any such documents of relevance of that matter;
- In case the grievance relates to environmental monitoring results or engineering matters, the GRC will validate the information available to it, as provided by the Project Company's Project management team/ environmental monitoring team. However, GRC will not be in a position to question the validity of the data provided to it.
- If needed, may undertake field visits to verify and review the issues, disputes or other relevant matters.

9.3 External Grievance Redressal Mechanism of RUMSL

The medium of receiving Grievances from external stakeholders, comprising fence line community, private land sellers, encroachers, vulnerable groups, etc., shall be documented and displayed at relevant locations outside the Solar Park, near entrances, at the Project Site Office, at applicable Gram Panchayat Office, etc. The external grievances may be submitted through various mediums, comprising the following:

- Verbally communicated through Walk in at Site Office;
- In written form to the address displayed by RUMSL;
- Through a toll free phone line or through direct calls to concerned officials, as set up by RUMSL; and
- Online – through website.

The Social and Community Supervisor in the SPPD team shall be responsible for coordination of grievance/complaints received. The person in-charge, based on nature of complaint, will forward the same to the concerned official. A ticket or a unique number will be generated for all such calls and messages based complaints. The complainant will follow up based on that unique number.

9.3.1 Receipt and Recording

An acknowledgement shall be sent to the aggrieved, either on the spot, or through mail. RUMSL shall maintain records of all grievances received as part of Grievance management process, in the form of a tracker, along with date of receipt of Grievance, nature and details of Grievance, concerned department or personnel linked to Grievances, resolution details and date of closure. Additionally provision of communication of resolution to the aggrieved shall also be maintained by RUMSL, during project lifecycle. The format to be used for recording of grievances is presented below.

GRIEVANCE REGISTRATION FOR EXTERNAL STAKEHOLDERS		
Case No.:	Date:	
Name:		
District:	Village:	
Contact number:		
Details of grievance:		
Name of person recording the grievance:		
Designation of recording person:		
Proposed date of response:		
Signature of the recording person	Signature of complainant	
Date of Resolution :		
Decision of the GRC (give full details):		
Complainant accepts the outcome:	Accepted	Not accepted
Signature of the complainant		
Signature of the S&C Supervisor		

Additionally, the format to be used for an external Grievance Tracker is provided below.

Table 9.1 Format for External Grievance Tracker

S. No	Date	Individual Name	Village	Medium of Communication	Details of Issue	Grievance within	Investigation	Concerned Department	Timeline for Closing	Present Status	Remarks

9.3.2 Resolution and Communication

All grievances lodged by the aggrieved, shall be responded within two weeks. If response is not received within 15 days, the complaint will be escalated to next level. The staffing of GRC will include Social and Community Supervisor of SPPD; and two representatives from community / beneficiary / affected persons. The head of the cell will be a person of repute but not continuing in the government service. Any project affected person however is free to approach judiciary system of the country if he or she is not satisfied with the verdict given by GRC.

9.4 Internal Grievance Redressal Mechanism

The grievances that shall be treated as "Internal Grievances" by RUMSL, may arise from private Solar Project developers, staff, contractors and contractual workers or RUMSL, staff and workers of private Solar Project Developers, etc.

The mode of receipt of grievances for labour and other internal staff will be the same, as described for external stakeholders.

9.4.1 Receipt and Recording

An acknowledgement shall be sent to the aggrieved, either on the spot, or through mail. RUMSL shall maintain records of all grievances received as part of Grievance management process, in the form of a tracker, along with date of receipt of Grievance, nature and details of Grievance, concerned department or personnel linked to Grievances, resolution details and date of closure. Additionally provision of communication of resolution to the aggrieved shall also be maintained by RUMSL, during project lifecycle. The format to be used for recording of grievances is presented below.

GRIEVANCE REGISTRATION FOR EXTERNAL STAKEHOLDERS

Case No.:	Date:
Name:	
District:	Village:
Contact number:	
Details of grievance:	
Name of person recording the grievance:	

GRIEVANCE REGISTRATION FOR EXTERNAL STAKEHOLDERS

Designation of recording person:

Proposed date of response:

Signature of the recording person

Signature of complainant

Date of Resolution :

Decision of the GRC (give full details):

Complainant accepts the outcome:

Accepted

Not accepted

Signature of the complainant

Signature of the S&C Supervisor

Additionally, the format to be used for an external Grievance Tracker is provided below.

Table 9.2 Format for Internal Grievance Tracker

S. No	Date	Individual Name	Department/SPD/Contractor	Medium of Communication	Details of Issue	Grievance within	Investigation Requirement	Concerned Department	Timeline for Closing	Present Status	Remarks

9.4.2 Resolution and Closure

The GRC will organize an inspection/review of the grievance received, to check the validity and severity of the grievance. The inspection will be undertaken in no later than seven days of receiving the grievance. The assigned individual will work with immediate supervisors/ managers of the concerned department or contractors to investigate the problem and identify measures to resolve the grievance as appropriate, within 15 days. This could involve provision of information to clarify the situation, undertaking measures to remedy actual problems or compensate for any damage that has been caused. Where a grievance is found to be not a real problem a clear explanation will be provided to the complainant.

A formal response detailing how the grievance has been resolved shall be provided to each complainant once a resolution is reached. Where resolution is delayed the complainant will be provided with regular updates on progress.

Once a resolution is decided and agreed upon internally, it is communicated to the aggrieved.

If the GRC along with the concerned department head are not able to resolve the grievance adequately within 15 days, the same may be escalated.

9.5 Monitoring and Evaluation

Like the other project components, the GRM shall be regularly monitored to ensure that the stakeholders are having no or limited issues with the project and in case there are concerns, they are being adequately addressed as per the mandate. In order to keep track on the effectiveness of GRM, it is the responsibility of the Project Company's Environment and Social team to compile and maintain database on grievances for periodic review. The mechanism shall be based on two components, internal monitoring and reporting and external monitoring and reporting which shall run simultaneously. Mostly this shall be aligned with simultaneous process monitoring rather than doing it separately all the time.

9.6 Budgeting

RUMSL shall ensure adequate budgeting and resource allocation for implementing the GRM.

10. CONCLUSION

The ESIA has assessed the overall acceptability of environmental and social impacts likely to arise as a result of construction and operation of Agar-Susner Solar Park.

To summarize,

- Project's potential environmental impacts will be mostly confined to construction phase and site-specific. These impacts include change in land use, stress on ground water resources, increase noise & vibration and air quality, etc. during the site preparation of Solar Park, pooling substations and community health and safety during material transportation.
- The proposed project will require water for cleaning of solar modules during operation phase. The Unit 5 (Susner) falls under over exploited category in terms of ground water availability. Water requirement for the project will be met mainly through ground water. Considering the stress on water resources in the area, it is recommended to evaluate alternate sources or plan for dry robotic cleaning.
- The usable land area for the project is 1108.63 hectares for Solar Park. Potential social impacts due to loss of access to land for farming, grazing, loss of land-based livelihood sources for the households in the PFA can be mitigated through the RAP-LRP for the Project. Impact on common property resources will be limited and can be avoided by providing access to the villagers to continue their existing use of such occupied land parcels/water bodies, etc.
- The impact on community resources and community health and safety is limited to construction phase, while on the other hand, short term employment will also be generated.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to Project activities and also discuss implementation mechanism. Project specific management plans are also provided for certain Project activities such as waste management, occupational health & safety, contractor and labour management plan, gender action plan, stakeholder management plan, grievance redressal, etc. This ESIA study together with mitigation measures and follow up of recommendations on management actions will help RUMSL in complying with the environmental standards.

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Wildlife Institute of India - ENVIS Centre

APPENDIX A PHOTO DOCUMENTATION



View of Susner site



View of Susner site



View of Susner site

View of Agar site



View of Vultures in the area

View of Wind Turbines in Agar Project area



Gail pipeline in Naharkheda village



Disclosure of project to community



Disclosure of project to community



Disclosure of project to community

APPENDIX B DETAILS OF CONSULTATIONS UNDERTAKEN DURING AGAR SOLAR PARK ESIA PREPARATION

S. No	Location	Meeting with	Topics of discussion
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Date: 18th December, 2019

1.	Tehsil Office, Agar	Tehsildar in Agar Tehsil along with Mr. Prakash Salunke (RUMSL)	- General information regarding the project, in the presence of Mr. Prakash Salunke (RUMSL) - Current state of activities; - Explanation provided regarding the drone survey being carried out to map the extent of land area to be required for the solar park; - The tehsildar was also informed regarding the consultations to be carried out in the villages associated with Agar and Susner tehsil as a part of SIA process; - Intimation was provided to the tehsildar regarding further rounds of consultations to be carried out with the Patwari of Kerwa Kedi and Ladwan villages, and with the tehsildar as a part of the SIA process
	Tehsil Office, Susner	Officials at the Tehsil office	In the absence of the Tehsildar, a brief of the project was shared with other representative officials at the Tehsil office, and the contact details of the Tehsildar was collected, for future consultations

Date: 19th December, 2019

2.	Kerwa Khedi village	Discussion with village groups comprising of Sarpanch, and elderly members of the village	- Discussions were held regarding the general land holding patterns in the village, social group wise, and share of landless households in the village; - The villagers shared details regarding the process of encroachment of government land or leased land (patta land) for residential structures, and grazing activities; - Concerns were raised regarding the amount of land parcel to be utilized for the project and whether it will affect the area of grazing land; - The villagers differentiated between <i>atikraman</i> and <i>kabza</i>, where the former is defined as the extension of private land boundary while the latter refers to the government land for livestock grazing; - Discussions also focussed on agricultural activity and the impact of watershed department led activities in the past 20 years which has increased farm output and water availability; - Crops grown in the area include soyabean, wheat, chana, corn, masoor - Landless households and household with less 0.22 -0.33 ha of holding work as daily wage agricultural labour - There are 10 Women-headed households in the village who either depend on sharecropping arrangement with a tenant farmer (if in possession of farm land), or rely on wage labour for sustaining family income; - The village has had a history of encroachment, where the process is a primary right of those households with sufficient land holdings
3.	Ladwan village	Discussion with women group, Bhil community representative, Land holding class	- Majority of the households in the village are of <i>Scheduled Caste</i> (SC) community (80% of the households) - Land holding is concentrated among few households (about 50 households) who, in turn hold a position of dominance in the village; - Landless households, and households with uneconomic land holdings work as wage labour in the agricultural fields of the land owning class, and there exists a mild form of feudal system; - Encroachment is common practice of the land owning households; - Encroached government land is used for grazing, grass cutting; - In migration is common phenomena in this village, wherein households migrate with livestock to Ladwan for temporary period of time;

S. No	Location	Meeting with	Topics of discussion
			- Self-Help Groups (SHGs) are prevalent with 9 SHGs in the village, each having 12-13 members; - The Adivasi community (Bhils) have been lease lands from the government (patta land) which they use it for agriculture;
4.	Pipaliya Kumar village	Discussion with ASHA worker, youth group	- Consultations were held with youth groups regarding the project and the prospects of the local employment being generated due to the project; - Discussion with AHSA worker of the village revealed that a physical record of all health related cases is maintained with the ASHA worker; - Elderly people of the village shared positive opinion regarding the project, particularly on prospective employment opportunities; - Discussions revealed that there is a lack of employment opportunities and most of the youth are engaged in farm activities, after dropping out from secondary level of education.
5.	Tehsil Office, Agar	Consultation with Patwari	- Short consultation was held with the Patwari of Kerwa Khedi and Ladwan villages regarding the details of encroachment to be obtained for each Khasra number - The Patwari was aware of the drone survey being undertaken for land delineation and subsequently land demarcation; - According to the Patwari, the process of delineation will include identification of land parcels under watershed department, land under grazing, patta land, etc;

Date: 20th December, 2019

6.	Pipaliya Nankar village	Discussion with SC and OBC community of the village	- The village comprises of SC and OBC community, with the SC households having higher proportion of land holding; - There are 3-4 households of OBC community which are landless; - Encroachment is limited in the village, and about 4-5 households have encroached land parcels which is used for grazing; - Boundaries are demarcated with restricted access to such land parcels which have been encroached upon by the households; - Most of the households earn their livelihood through daily wage agricultural labour; some also work as herders for tending to livestock of others on a verbal rental agreement; - Watershed department led activities were undertaken 10 years ago to increase agricultural productivity which included digging of canals, construction of embankments, plantation of trees; - There has been no change in agricultural output from the land parcels in spite of irrigation activities undertaken in the past; - Fuelwood is gathered from leased land (patta land); - Out-migration is prevalent with 5-10 households migrating to nearby cities or town (Ujjain or Agar); - Community hygiene and sanitation conditions are poor with no garbage collection undertaken by local authorities, incineration of waste by locals, open sewers; - Water for drinking and portable use is available through hand pumps, there are no borewells
7.	Umariya village	Discussion with SC and OBC community of the village	- Discussions with the OBC and SC community revealed that encroachment is undertaken by landless households; - The encroached land is barren and is used for single cropping with rain-fed as the only source of irrigation; - Private owned land is used for multi-cropping with bore-well as a source of irrigation;

S. No	Location	Meeting with	Topics of discussion
			■ The village has a lot of abandoned livestock which have been destroying the grazing lands meant for other livestock; ■ The youth are engaged in farm activities such as working as tractor drivers on rental basis of 300 Rs/bigha (one bigha is 0.11 ha); ■ Lack of employment opportunities in nearby towns and cities, coupled with security of land holding has led to the youth being engaged in farm activities; ■ Consultations revealed that there has been land lease (patta land) in the village; ■ Dairy activities are commonly practiced which includes selling of livestock products and animals at weekly hats organized in Susner

Date: 28th January, 2020

8.	Tehsil office, Susner	Meeting with the Tehsildar, and the Patwari of Palda	Discussion with the Patwari provided an explanation into the process of land parcel demarcation (<i>tarmeem</i>) and the subsequent land survey process. The same is detailed below: ■ Government land, as per their classification in land records are first physically verified by the Patwari; ■ Once the land parcel is physically verified, the land parcels are mapped out on paper with their khasra numbers. This process takes two days to a week. ■ The allocation of the parcels is then undertaken on the traced out maps, highlighting whether the entire khasra or a part of it has been allocated, in a manner that makes the allotment area a contiguous land area; ■ Based on the land issue allotment letter received at the Tehsil office, the Patwari does the land survey based on the map prepared for each khasra to check the area of encroachment (if any) on the allotted government land parcels; ■ The allotment document with the map is put for verification to the Tehsildar. The Tehsildar approves it and forwards it to the Revenue Inspector for further verification; ■ The Revenue Inspector then initiates the demarcation of the allotted land ■ Panchvan land in Umariya and Naharkheda has been transferred from the Panchayat to RUMSL ■ The demarcation process was underway in Pipalya Nankar and Umariya
9.	Palda village	Discussion with SC and OBC community of the village	■ The village comprises of SC and OBC community households, with the OBC community households having higher proportionate share of land holding; ■ Patta land is available with Scheduled Caste households which is used for a single harvest of soybean during monsoon; ■ Encroachment reported in the village is less as none of the land owning households have high amount of land area to be able to include government land parcel into private agricultural land area without making it apparent; ■ Abandoned cows are in high proportion (83%) of private owned cows which have been eating the standing crops; ■ Agricultural labour and daily wage labour is common with all households having at least one member undertaking casual jobs in lean agricultural period; ■ Labour migration to neighbouring state of Gujarat, and even as far as Andhra Pradesh and Tamil Nadu; ■ Education facility is available till 8th standard in the village, and school going children complete upper primary level of education. However, further learning is limited due to heavy dependence on

S. No	Location	Meeting with	Topics of discussion
			labour based income activities, and no observable opportunities of permanent jobs in the region; The village has a system of hiring livestock herder on rent at the rate of INR 500 per cow for a period of 5 – 6 months

Date: 29th January, 2020

10.	Bijnakhedi village	Discussion with SC, OBC and Open category community of the village	- Discussions with the community revealed that the Rajput clan led households have the highest land holding in the village; - The Rajput households, because of their upper position in the caste hierarchy employ agricultural labourers from SC households; - Encroachment of charnoi and charagah land has been in practice by the Muslim and Rajput households; - Grazing land has also been encroached by households from other villages; - Watershed department activities undertaken, which includes construction of lake for supply of irrigation water and tree plantation has improved farm productivity; - There is a government operated Gaushala in Agar where livestock animals are kept for a rental fee. However, the gaushala is always in full capacity and mostly unresponsive to any new submissions; - Wheat and soybean are two crops grown around the year with the latter fetching a higher income; - The minimum land holding in the village, as reported, is of 10 bigha (1.12 hectare) while the maximum land holding is of 50 bigha (5.6 hectares)
11.	Dudhpura village	Discussion with OBC community of the village	- The entire village comprises of OBC community households. Of the total households (60) in the village, 30% of the households are landless; - The village has access to forest land for grazing activities; - All the households owning land have encroached land parcels used for farming, and there are about 15 households with patta land; - The village does not have a school in the same village and the children have to access government school in Chikliya (till 8th standard); - Daily wage labour work is undertaken in the neighbouring cities and out-migration to other states has declined over the years; - The village has benefited from Watershed Department activities like stop dams, lake constructed for Dudhpura and Jhikidya village, tree plantation (neem, ratanjot); - The village has as Vriksh Utpadak Sahakari Sanstha (Gram Van Samiti) which undertakes plantation activities, constructs check dams, and trenches every year
12.	Pipalya Kumhar village	Discussion with SC and OBC community of the village	- Discussions with the village respondents revealed that the entire village comprises of SC and OBC households with only one Brahmin household, and one Muslim household; - The average land holding in the village is of 5 bighas (0.55 ha); - The village has access to charagah land which is also used for grazing by abandoned cows since the last 10 years; - There is a private dairy in the village where the village supplies milk on an average of 30 litres per day at the rate of about 86 Rs, based on fat content; - The youth in the village are not eager to take up jobs in cities as they are content with daily wage labour jobs; - There are 5 – 6 SHGs in the village which have access to credit from microfinance institutions;

S. No	Location	Meeting with	Topics of discussion
			■ The village is a major producer of onions and supplies it wholesale government mandi in Agar; ■ About 50% of the population in the village works as daily wage labour

Date: 30th January, 2020

13.	SLR office, Agar	Meeting with the Superintendent of Land Records of Agar-Malwa district	■ Meeting was held with the SLR, to understand the different government land categories; ■ It was also understood how the government land allotment works, starting from the process of demarcation to final allotment; ■ Discussion was also undertaken on the allocation of private land under Mutual Consent Policy of the state government (2014) and the legal course of action the private land owner undertakes in case of non-agreement on the compensation terms; ■ During the meeting with SLR, the RUMSL land team was also present to finalize the land allocation process and ERM team had the chance to view the same. The understanding developed is that after the issue of land allotment letters to the District Office by RUMSL, the Patwaris for each of the villages on which the project footprint is based conducts the physical verification, traces out the khasra maps on paper, while at the same time update the land record details regarding transfer of ownership to RUMSL.
14.	Naharkheda village	Discussion with the OBC community of the village	■ Discussion with villagers revealed that women participation in agricultural labour work is high in the village. Women are responsible for taking care of the household as well as contribute on the field; ■ Women are involved in sowing, cutting, threshing, watering, collecting wood, and tend to livestock; ■ The youth undertakes construction work in Susner after finishing upper primary level of education (8th standard); ■ Men of the village migrate to Rajasthan to work in stone crushing units and Gujarat to work in factories. Approximately 100 persons from the village migrate each year; ■ The village has about 15 – 20 hectares of panchvan land, however the exact extent of the land is not known to the villagers; ■ There is an Anganwadi centre in the village and an ASHA worker who provides vaccination facilities for new born children and nutritional requirement to the women.
15.	Madhopur Kheda village	Discussion with Banjara caste (OBC) community of the village	■ The village comprises about more than half of Banjara households who have been in the village for about 200 years now; ■ The Banjara men have a peculiar migration pattern of purchasing blankets from Haryana and selling them in Tamil Nadu. They migrate for 3 – 6 months in a year for the same; ■ The village has access to 150 bigha (16.5 ha) of grazing land; ■ The households hire agricultural labour from the village to look after the agricultural land parcels when the farmers migrate to Tamil Nadu. The labourers are hired for INR 30,000 for a period of 10 months; ■ Like other villages, encroachment (kabza) of government land for agricultural use has been existence for about 10 years; ■ There are 10 – 12 women headed households in the village who depend on agricultural labour work or cultivate farm lands of their own for livelihood

Date: 31st January, 2020

S. No	Location	Meeting with	Topics of discussion
16.	Kesai Dehariya village	Discussions with the Sarpanch of the village	■ Land holding is concentrated among few households (about 50 households) who, in turn hold a position of dominance in the village; ■ Landless households, and households with uneconomic land holdings work as wage labour in the agricultural fields of the land owning class, and there exists a mild form of feudal system; ■ Encroachment is common practice of the land owning households; ■ Encroached government land is used for grazing, grass cutting; ■ SHGs and ASHA workers are active in the village

APPENDIX C ENVIRONMENTAL MONITORING RESULTS

AMBIENT AIR MONITORING

Location : Kharakhedi

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM ₁₀ (µg/m³)	PM _{2.5} (µg/m³)	SO ₂ (µg/m³)	NO _x (µg/m³)	HC (ppm)	
1	16-12-2019	60.2	20.9	7.1	17.8	6.3	NIL/AA/12/19/286
2	19-12-2019	57.1	21.7	7.5	18.2	5.6	NIL/AA/12/19/288
MDL		10.0	5.0	6.5	4.0	<0.5	---
CPCB Limits		100	60	80	80	---	
Minimum		57.1	20.9	7.1	17.8	5.6	
Maximum		60.2	21.7	7.5	18.2	6.3	
Average		58.65	21.30	7.26	18.00	5.95	
90 th Percentile		59.89	21.62	7.42	18.16	6.23	
95 th Percentile		60.05	21.66	7.44	18.18	6.27	
98 th Percentile		60.14	21.68	7.45	18.19	6.29	

Location : Umariya

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM ₁₀ (µg/m³)	PM _{2.5} (µg/m³)	SO ₂ (µg/m³)	NO _x (µg/m³)	HC (ppm)	
1	16-12-2019	71.3	26.8	10.2	29.7	10.4	NIL/AA/12/19/290
2	18-12-2019	67.5	25.8	8.3	24.7	18.0	NIL/AA/12/19/292
MDL		10.0	5.0	6.5	4.0	<0.5	---
CPCB Limits		100	60	80	80	---	
Minimum		67.5	25.8	8.3	24.7	10.4	
Maximum		71.3	26.8	10.2	29.7	18.0	
Average		69.40	26.30	9.27	27.20	14.20	
90 th Percentile		70.92	26.70	10.01	29.20	17.24	
95 th Percentile		71.11	26.75	10.11	29.45	17.62	
98 th Percentile		71.22	26.78	10.16	29.60	17.85	

Location : Piplay Kumar

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM ₁₀ (µg/m³)	PM _{2.5} (µg/m³)	SO ₂ (µg/m³)	NO _x (µg/m³)	HC (ppm)	

1	16-12-2019	60.5	17.4	7.3	17.8	5.8	NIL/AA/12/19/2 87
2	19-12-2019	57.5	21.3	8.6	21.3	8.1	NIL/AA/12/19/2 89
MDL		10.0	5.0	6.5	4.0	<0.5	---
CPCB Limits		100	60	80	80	---	
Minimum		57.5	17.4	7.3	17.8	5.8	
Maximum		60.5	21.3	8.6	21.3	8.1	
Average		59.00	19.35	7.93	19.55	6.95	
90 th Percentile		60.20	20.91	8.47	20.95	7.87	
95 th Percentile		60.35	21.11	8.53	21.13	7.99	
98 th Percentile		60.44	21.22	8.57	21.23	8.05	

Location : Pharaspuri

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM ₁₀ (µg/m³)	PM _{2.5} (µg/m³)	SO ₂ (µg/m³)	NO _x (µg/m³)	HC (ppm)	
1	16-12-2019	58.0	17.0	6.9	16.9	10.9	NIL/AA/12/19/2 91
2	18-12-2019	60.3	21.3	7.1	21.3	12.5	NIL/AA/12/19/2 93
MDL		10.0	5.0	6.5	4.0	<0.5	---
CPCB Limits		100	60	80	80	---	
Minimum		58.0	17.0	6.9	16.9	10.9	
Maximum		60.3	21.3	7.1	21.3	12.5	
Average		59.15	19.15	7.02	19.10	11.70	
90 th Percentile		60.07	20.87	7.10	20.86	12.34	
95 th Percentile		60.19	21.09	7.11	21.08	12.42	
98 th Percentile		60.25	21.21	7.12	21.21	12.47	

TRAFFIC MONITORING

Location :Bajinath Mahadev Road to Ladvan
Date of monitoring : 18.12.2019

Location :Ladvan to Mahadev Road Bajinath
Date of monitoring : 18.12.2019

TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)					TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)				
	TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED		TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED
06:00 - 07:00	3	0	0	2	0	06:00 - 07:00	0	0	0	0	0
07:00 - 08:00	7	0	5	6	0	07:00 - 08:00	2	0	2	2	0
08:00 - 09:00	13	4	7	1	0	08:00 - 09:00	2	0	1	0	0
09:00 - 10:00	13	1	4	3	1	09:00 - 10:00	4	0	1	1	0
10:00 - 11:00	15	0	1	4	0	10:00 - 11:00	20	0	7	15	0
11:00 - 12:00	18	2	13	7	0	11:00 - 12:00	35	0	2	7	0
12:00 - 13:00	33	3	2	12	0	12:00 - 13:00	20	1	12	4	1
13:00 - 14:00	17	1	18	5	0	13:00 - 14:00	26	1	10	14	0
14:00 - 15:00	13	0	4	10	0	14:00 - 15:00	2	0	2	0	0
15:00 - 16:00	8	0	1	8	0	15:00 - 16:00	8	0	5	5	0
16:00 - 17:00	18	4	17	18	1	16:00 - 17:00	24	0	0	0	0
17:00 - 18:00	14	3	10	12	0	17:00 - 18:00	33	0	9	3	0
18:00 - 19:00	33	0	16	7	0	18:00 - 19:00	19	1	3	1	1
19:00 - 20:00	14	1	0	5	1	19:00 - 20:00	11	0	7	1	0
20:00 - 21:00	13	1	6	5	1	20:00 - 21:00	9	0	1	1	0
21:00 - 22:00	11	1	2	4	0	21:00 - 22:00	3	0	1	0	0
22:00 - 23:00	0	0	3	2	0	22:00 - 23:00	2	0	1	0	0
23:00 - 00:00	6	0	3	2	0	23:00 - 00:00	1	0	1	1	0
00:00 - 01:00	0	0	1	0	0	00:00 - 01:00	2	0	2	2	0
01:00 - 02:00	0	0	1	1	0	01:00 - 02:00	4	0	4	3	0
02:00 - 03:00	0	0	0	0	0	02:00 - 03:00	2	0	0	0	0
03:00 - 04:00	0	0	3	3	0	03:00 - 04:00	2	0	1	1	0
04:00 - 05:00	0	0	2	1	0	04:00 - 05:00	0	0	0	0	0

Location :SH14 to Umariya

Date of monitoring :

Location :Umariya to SH14

Date of monitoring :

TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)					TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)				
	TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED		TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED
06:00 - 07:00	7	0	1	8	0	06:00 - 07:00	4	0	0	1	0
07:00 - 08:00	5	0	11	16	0	07:00 - 08:00	2	2	5	9	0
08:00 - 09:00	17	2	1	17	0	08:00 - 09:00	15	4	11	2	0
09:00 - 10:00	34	4	14	10	0	09:00 - 10:00	0	4	2	3	0
10:00 - 11:00	46	1	15	14	0	10:00 - 11:00	12	3	2	8	0
11:00 - 12:00	11	3	8	4	0	11:00 - 12:00	34	2	18	8	0
12:00 - 13:00	8	0	7	16	0	12:00 - 13:00	5	1	4	7	0
13:00 - 14:00	19	0	13	14	0	13:00 - 14:00	20	0	15	4	0
14:00 - 15:00	9	0	8	8	1	14:00 - 15:00	1	0	5	17	0
15:00 - 16:00	10	0	11	18	1	15:00 - 16:00	5	1	2	5	0
16:00 - 17:00	22	1	11	16	0	16:00 - 17:00	27	0	12	26	1
17:00 - 18:00	18	1	5	10	0	17:00 - 18:00	2	2	14	11	0
18:00 - 19:00	31	4	0	12	0	18:00 - 19:00	46	1	24	11	0
19:00 - 20:00	20	2	14	15	0	19:00 - 20:00	3	1	0	5	1
20:00 - 21:00	11	0	3	4	0	20:00 - 21:00	7	1	11	9	1
21:00 - 22:00	1	0	1	15	0	21:00 - 22:00	5	1	14	8	0
22:00 - 23:00	9	0	0	2	0	22:00 - 23:00	0	0	5	0	0
23:00 - 00:00	3	0	8	4	0	23:00 - 00:00	6	0	3	2	0
00:00 - 01:00	0	0	2	3	0	00:00 - 01:00	0	0	1	0	0
01:00 - 02:00	1	0	0	2	0	01:00 - 02:00	0	0	1	0	0
02:00 - 03:00	0	0	4	4	0	02:00 - 03:00	0	0	0	0	0
03:00 - 04:00	0	0	9	2	0	03:00 - 04:00	0	0	3	3	0
04:00 - 05:00	3	0	0	1	0	04:00 - 05:00	0	0	1	1	0
05:00 - 06:00	5	0	2	6	0	05:00 - 06:00	2	0	2	3	0

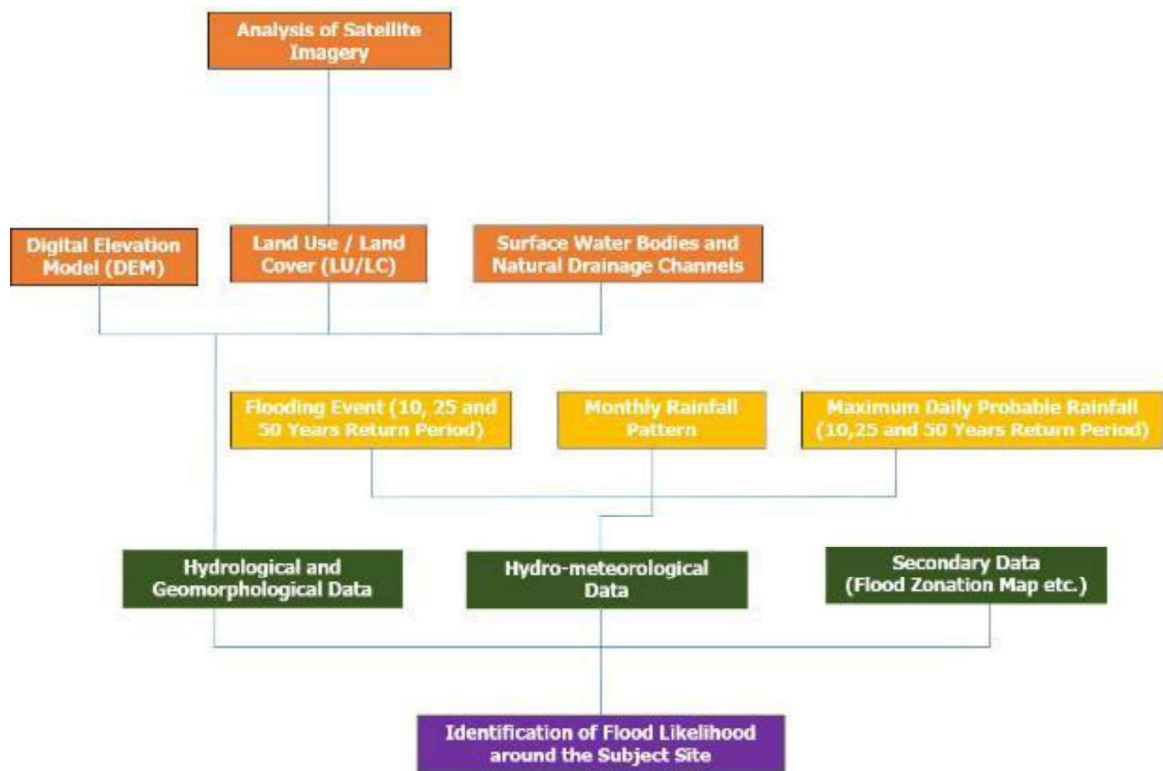
APPENDIX D FLOOD LIKELIHOOD ASSESSMENT

FLOOD LIKELIHOOD ASSESSMENT (FLA)

Approach and Methodology

The study includes a high-level review of the hydrology and flooding characteristics of the Site and the surrounding areas. The assessment was done using Site Level assessment and desktop analysis. The Site level assessment was conducted by reviewing the data collected during the Site visit and community consultation. Desktop analysis include review of satellite data, geospatial data analysis, thematic mapping based on ArcGIS, and review of secondary available in public domain. Based on this review, a flood likelihood matrix will be developed with the various attributes to which the Site and area is likely to be sensitive to inundation and flooding. Figure D.1 illustrates the methodology to perform FLA.

Figure D.1 Methodology of flood likelihood assessment



Risk Categorization

ERM has adopted a qualitative risk based categorization to identify potential risks and vulnerabilities associated with flooding, inundation and waterlogging. The risks are defined considering the likelihood of their occurrence and potential severity of the impact broadly following the risk matrix presented in the table below.

Risk = Likelihood of an impact occurring x Potential severity of the impact.

		Probability of Occurrence		
		Low	Medium	High
Potential Impact	Low			

		Probability of Occurrence		
		Low	Medium	High
	Medium			
	High			

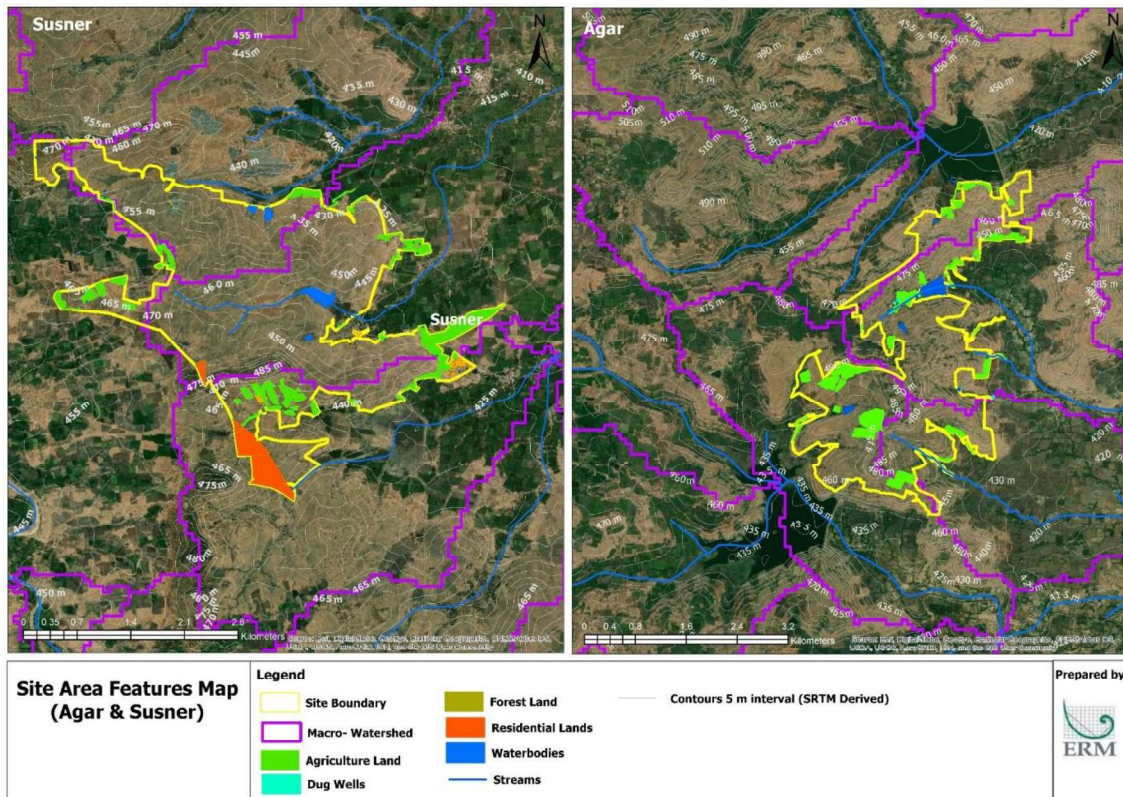
Note: The study was carried out to evaluate and understand the qualitative likelihood of flood impact on the Site only. Risk categorization has been adopted merely for providing broad level perspective on the potential for impact from floods / inundation / water logging on the Site and to emphasize specific areas for further evaluation prior to developing Site specific mitigation measures only.

Hydrological Setup

The natural waterbodies and Site area setting of Susner and Agar is presented in Figure D. 2. Some of the salient features of both the Sites are described below:

- The core zone (2 km radius) around the Site is largely occupied by open lands, scrubland, agricultural land along the stream and low lying areas, forest land, scattered residential settlements and river channels of the Kali Sindh River and its tributaries.
- Kali Sindh River is located at distances of ~10.5 km to the east and northeast of the Agar Site; and ~19 km east and northeast to the Susner Site respectively. The River flows from south to north whereas Site- level streams flow from west to east and north-east direction for Agar and Susner Sites.
- The desktop review of the Site and its surrounding area indicates that the Agar Site lies between two (2) artificially created perennial waterbodies/lakes. However, both of these lakes are located downstream from the Site in respective micro-watersheds. Surface runoff from southwestern portion and far north of the Agar Site drain into these lakes. Susner Site is located on the ridge of the watershed. Few streams originates with a maximum length of 2 km catchment and flow through the Sites.
- All the streams are seasonal in nature and eventually drain into Kali Sindh River.

Figure D. 2 Natural Waterbodies and Site Area Setting for Susner and Agar



Topography and Drainage of Site

The catchment level topography and drainage patterns were discussed in Section 2. This section will mainly cover the topography and drainage patterns at the Sites and their immediate surroundings.

Topography Map

Figure 1.3 presents the topographic map of the Susner Site along with the micro-catchments of the Site. The Agar Site was observed to comprise of three (3) different sub-catchments or micro-watershed labelled as Cat-1, Cat-2 and Cat-3. The general topography within the Susner Site varies between 425 and 475 m, amsl. Topographic highs were mainly observed along the western part of the Site while topographic lows were observed along the eastern part of the Site. In general, the Site topography is conducive to facilitate drainage of the surface water from west to north and north-east part of the Site.

Figure D. 3 Topographic Map of the Susner Site

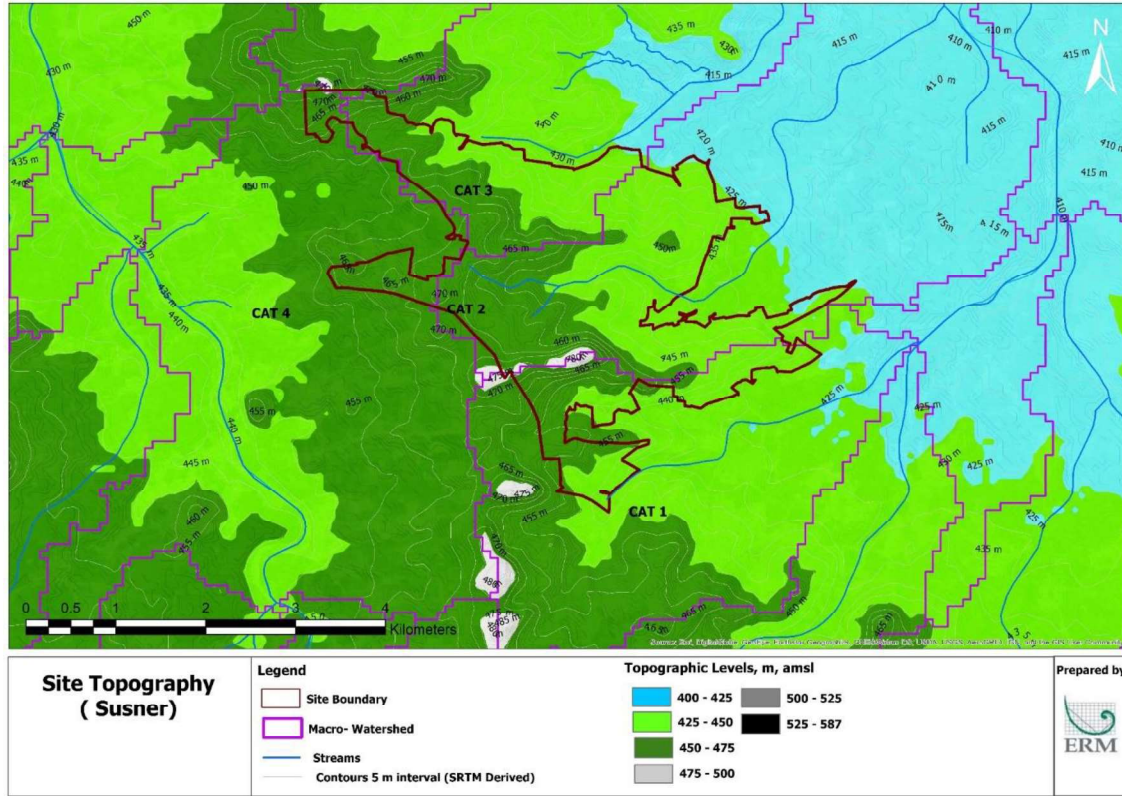
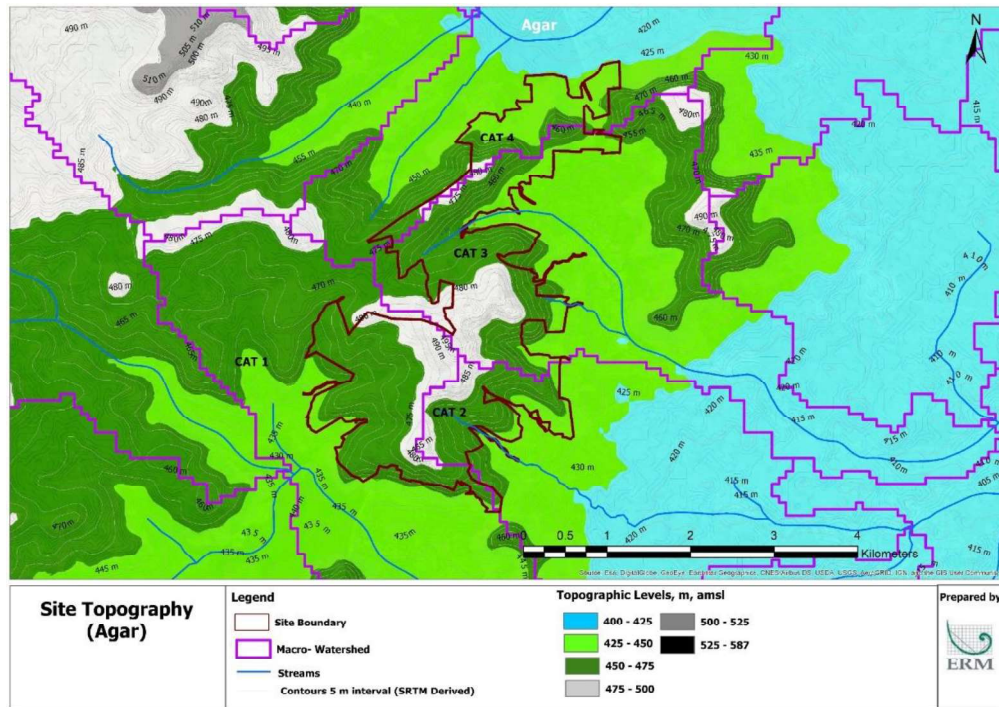


Figure 1.4 presents the topographic map of the Agar Site along with the micro-catchments of the Site. The Agar Site was observed to comprise of four (4) different sub-catchments or micro-watershed labelled as Cat-1, Cat-2, Cat-3 and Cat-4. The general topography within the Agar Site varies between 425 and 500 m, amsl. Topographic highs were mainly observed in form of the ridge located in the southern part of the Site. The ridge is responsible for draining surface water along the north-east and southern direction within the Site indicating high likelihood of drainage of surface water in different directions from the Site in general and ridge area in particular during rainy season. In general, the Site topography is conducive to facilitate drainage of the surface water from the Site and hence reduces the likelihood of surface water stagnation/ inundation during the rainy season.

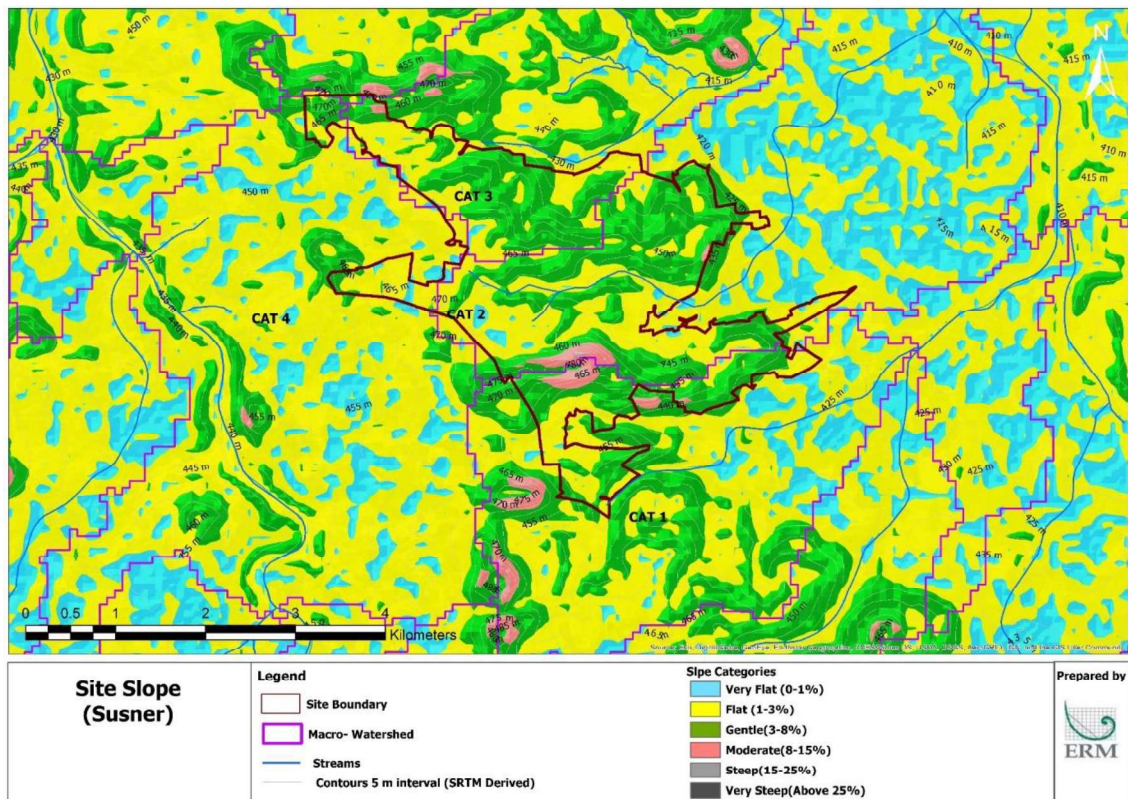
Figure D.4 Topographic Map of the Agar Site



Slope Map

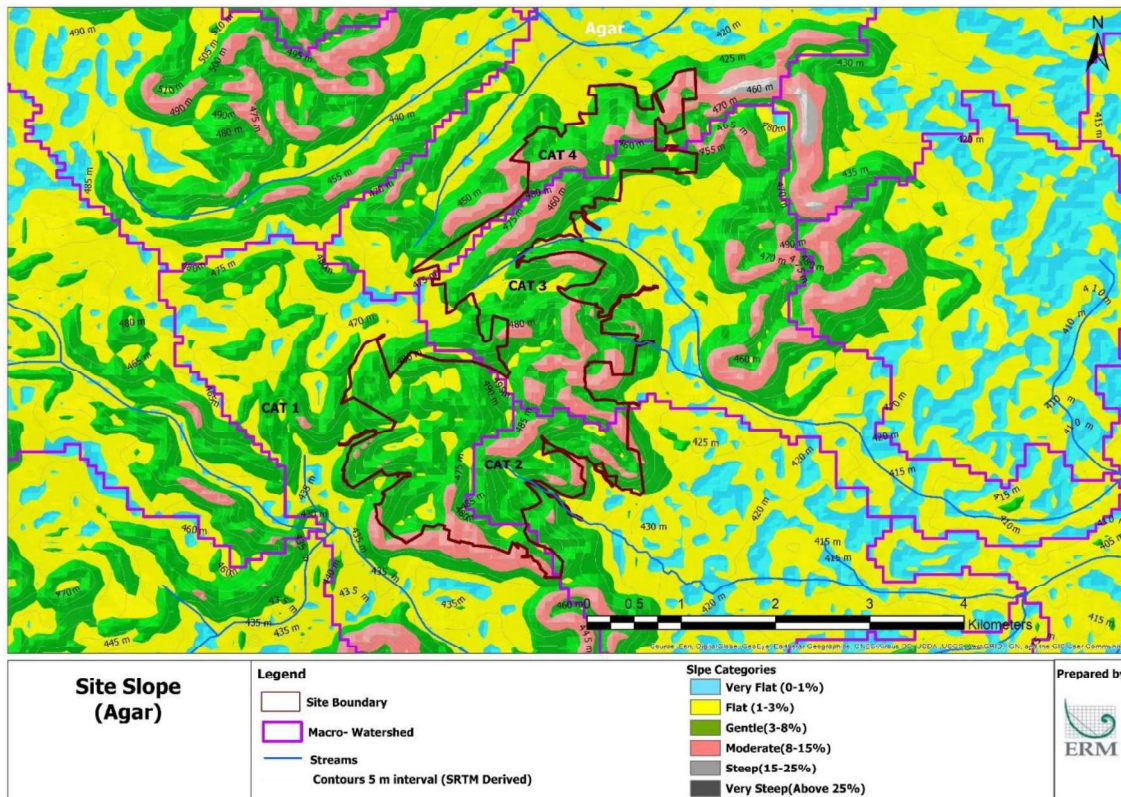
The slope map for the Susner Site is presented in Figure 1.5. The slope at Site and its surrounding ranges from very flat (0-1 %) to moderate (8- 15 %). Slope at the Susner Site varies from flat (1-3 %) to moderate (8- 15 %). Moderate slope was only observed along a patch in the south. Flat slope was mainly observed in patches along the central, northern and southern parts of Site indicating potential for surface water logging and inundation during rainy season. The presence of gentle slope in large parts of the Site is also conducive for drainage of surface water from the Site.

Figure D.5 Slope Map of the Susner Site



The slope map for the Agar Site is presented in Figure 1.6. The slope at Site and its surrounding ranges from very flat (0-1 %) to moderate (8- 15 %). Slope at the Susner Site varies from flat (1-3 %) to moderate (8- 15 %). Moderate slope was observed in patches in north-western, southern and eastern parts of the Site facilitating drainage of surface water from the Site. Flat slope was only observed in few patches indicating limited potential for surface water logging and inundation during rainy season. The presence of gentle and moderate slope in large parts of the Site is also indicative of low likelihood of flood hazard at the Site.

Figure D6 Slope Map of the Agar Site



Analysis of Historical Satellite Imagery

ERM analysed the historical satellite imagery of the Site and its surrounding area to identify any events of flooding or inundations.

For assessing potential for impacts from flood, inundation and waterlogging at Site, ERM reviewed satellite imagery of Site and surrounding area as available from GoogleEarth Pro from 2005 till present. Review of historical satellite imagery do not indicate any major developmental activity or significant change in land use.

Historical satellite imagery of Agar and Susner Sites are presented in Figure D.7 and Figure 1.8. Clear and high resolution satellite images were not available for monsoon and post-monsoon season. Hence, extent of submergence areas within both Sites could not be defined clearly. However, based on certain evidential observations such as erosion pattern, water marks, and artificially built structures relatively low lying areas and potential extent of submergence area were delineated as presented in Figure 1.7 and Figure 1.8.

Agar Site

In Agar Site, few first order streams were observed to originate within the Site boundary. Artificial water retaining structures were observed to be constructed across some of these streams. As observed, there are about 7 to 8 artificially constructed non perennial water bodies located within the Site boundary which were spread over area varying between ~1 to ~4 acres. Actual extent of land submergence from these water bodies could vary depending on peak flows from heavy downpour. Besides these, artificially constructed water bodies and minor non-perennial streams with shallow depths, signs of water logging and inundation were not observed within the Site based on review of historical satellite imagery. Further, three (3) large artificially created water bodies were observed to be located adjoining the Site boundary in the north, northcentral, and southwest of the Site. These were observed to spread over 162, 21, and 260 acres respectively with stagnant water as observed in

imagery from pre-monsoon season. However, their submergence area were observed to be largely restricted to area outside the Site boundary.

Based on review of historical satellite imagery, risk associated with flooding and inundation at the Site may be limited to natural drainage channels, and artificially created water bodies and the low lying areas adjoining these features. A robust “Storm Water Management Plan” must be developed for the Site which must consider management of these water features to effectively drain the Site area. As such, risk associated with flooding and inundation may be considered as ‘Low’.

Susner Site

In Susner Site, several well defined and prominent first order streams were observed to originate within the Site boundary and few second order streams pass through the Site which may be indicative of significant flow typically during rainfall. These streams extend along the entire breadth of the Site in the central and southern portion.

Further, several artificial water retaining structures were observed to have been constructed across some of the streams within the Site boundary and adjoining the Site. As observed, there are about five (5) artificially constructed non perennial water bodies located within the Site boundary which were observed to be spread over area varying between ~6 to ~22 acres. Actual extent of land submergence from these water bodies could vary depending on peak flows from heavy downpour. Some of these water bodies were observed to retain water till pre-monsoon period. Besides these artificially constructed water bodies and non-perennial streams with shallow depths, signs of water logging and inundation were not observed within the Site based on review of historical satellite imagery. Three (3) large artificially created water bodies were observed to be located adjoining the Site boundary in the north, southeast, and southwest of the Site. These were observed to be spread over 34, 228, and 12 acres respectively with stagnant water as observed in imagery from pre-monsoon season. Water bodies located adjacent to the Site boundary in the north and southeast were observed to extend into the Site area. However, these extensions were largely part of the drainage channel that feed into the water bodies and are likely to be inundated during peak monsoon period. Based on review of historical satellite imagery, risk associated with flooding and inundation at the Site may be limited to natural drainage channels, artificially created water bodies and the low lying areas adjoining these features. As such, risk associated with flooding and inundation may be considered as ‘Low’. Hence, a robust “Storm Water Management Plan” must be developed for the Site which must consider management of these water features to effectively drain the Site area and prevent any localized inundation.

Figure D.7: Historical Satellite Imagery for Agar Site

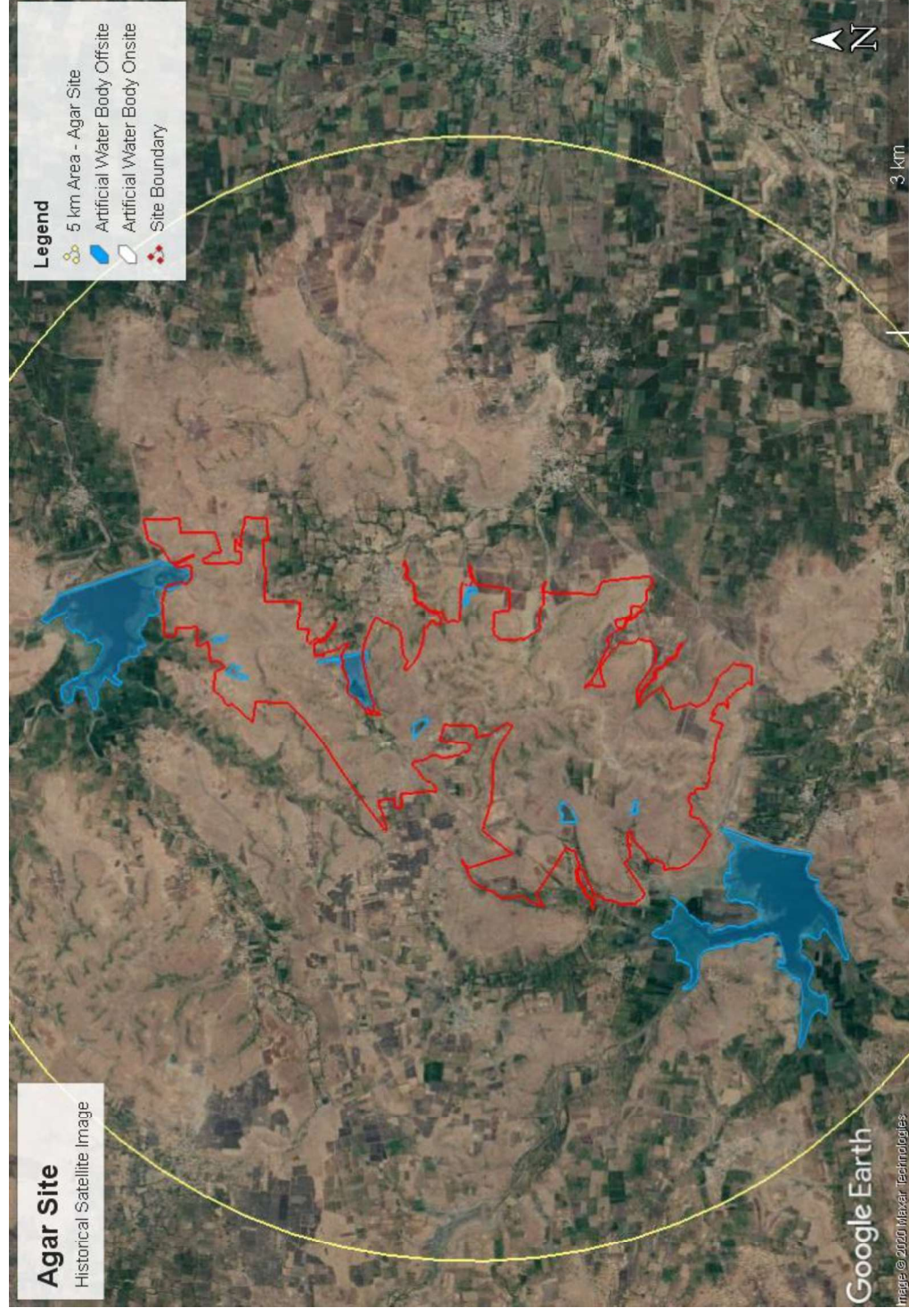
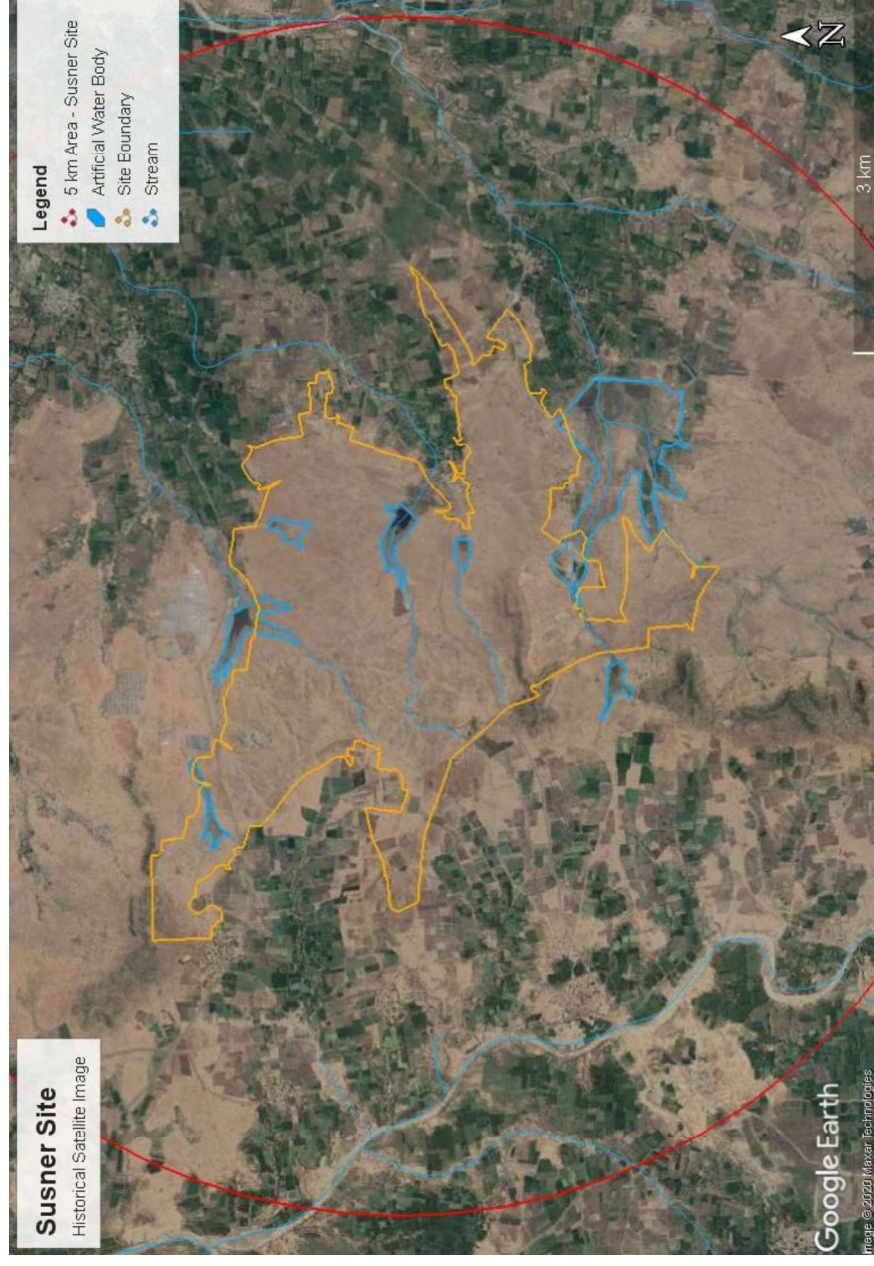


Figure D. 8: Historical Satellite Imagery for Susner Site



Hydrometeorology

Both the sites (Agar and Susner) are currently located under the Agar Malwa district in Madhya Pradesh. However, Agar Malwa district was only formed in the year 2013, and was carved out from Shajapur district. The CGWB published the groundwater report for the entire Shajapur district (prior to formation of Agar Malwa district) in 2013. Hence the data reported in this section is based on the report published for Shajapur by CGWB.

The climate of Shajapur district is generally dry, except during the southwest monsoon season. The annual climate can be divided into four (4) seasons:

- Winter commences from December and lasts till the end of February.
- The period from March to middle of June is the summer season with May being the hottest month of the year.
- The southwest monsoon starts from middle of June and lasts till end of September.
- October and November constitutes the post monsoon.

The normal maximum temperature recorded during the month of May is 39.90 °C, while the minimum during the month of January is 9.60 °C. The normal annual mean maximum and minimum temperature is reported as 35.50 °C and 31.3 °C respectively. Summer is the driest period of the year. The relative humidity generally exceeds 88% in the month of July/August.

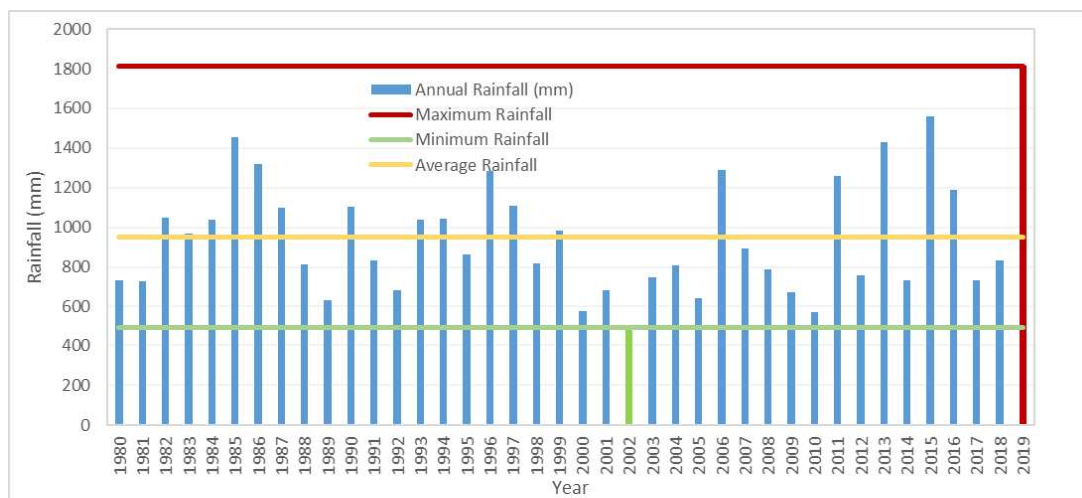
Rainfall Pattern near Susner Site

Annual Rainfall Pattern for the Site near Susner

Southwest monsoon (i.e. June to September) is considered the most predominant and important climatic feature in Agar Malwa district and about 92.3% of the annual rainfall is received during the monsoon season. As per the CGWB publication, the normal annual rainfall of the District (formerly Shajapur district) is ~1,020 mm.

For the Site near Susner, the long term average data for annual rainfall indicates that the annual rainfall in the area during 1980-2019 was ~951 mm. The lowest annual rainfall of ~490 mm was received in the year 2002 and maximum rainfall of ~1,814 mm was received in year 2019. The annual rainfall pattern at near Susner Site during 1980-2019 is illustrated in Figure 1.9.

Figure D.9 Annual Rainfall at Site near Susner (1980-2019)



Source: India Meteorological Department (IMD)

Monthly Rainfall Pattern for the Site near Susner

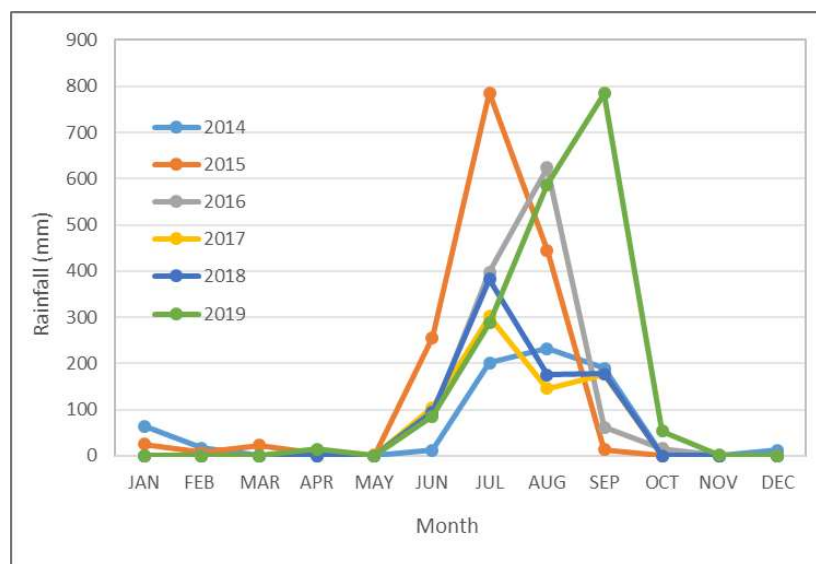
The monthly variation of the rainfall for the Site near Susner in Agar Malwa District was studied for the period of 2014-2019 using the India Meteorological Department gridded total monthly rainfall data. The data is summarised in Table 1.1 and illustrated in Figure 1.10. It is evident that May-September months receive substantial monsoon rains.

Monthly Rainfall Pattern at Site near Susner for the Period 2014-2019

Year	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2014	64.5	16.5	0	1.4	0	12.7	201.9	232.2	190.1	3.2	0	11.8	734.3
2015	25.6	7.7	23.1	4.6	0	255.8	786.3	445	13.3	0.5	0	0	1,561.9
2016	0	0	0	0	0.4	88.9	397.5	624.2	62.1	15.8	0	0	1,188.9
2017	0.4	0	0	0	1.3	103.9	301.6	146	176.9	0	0	0	730.1
2018	0	0	0.4	0	0.6	94.8	383	175.3	178	0	0	0	832.1
2019	0	0.7	0	14.7	0	85	287.6	586.9	784.5	53.6	1.4	0	1,814.4

Source: IMD, All values in mm.

Figure D.10 Monthly Variation of Rainfall at Site near Susner (2014-2019)



Source: IMD, All values in mm

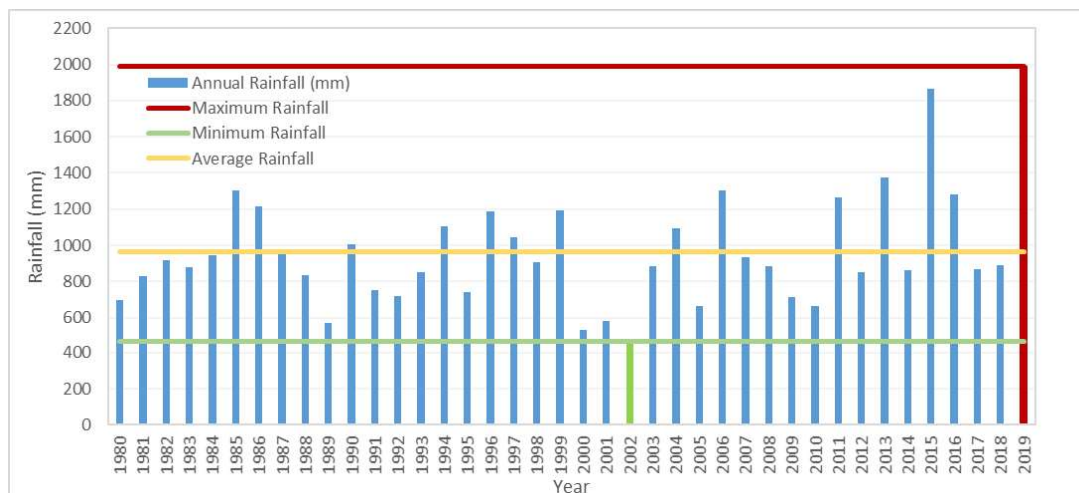
Rainfall Pattern near Agar Site

Annual Rainfall Pattern for the Site near Agar

For the Site near Agar, the long- term average annual rainfall during the period 1980-2019 was reported as ~966 mm. The lowest annual rainfall of ~464 mm was received in year 2002 and

maximum rainfall of ~1,992 mm was received in year 2019. The annual rainfall pattern near Agar Site in Agar Malwa District during 1980-2019 is illustrated in Figure 1.11.

Figure D.11 Annual Rainfall at Site near Agar (1980-2019)



Source: India Meteorological Department (IMD)

Monthly Rainfall Pattern for the Site near Agar

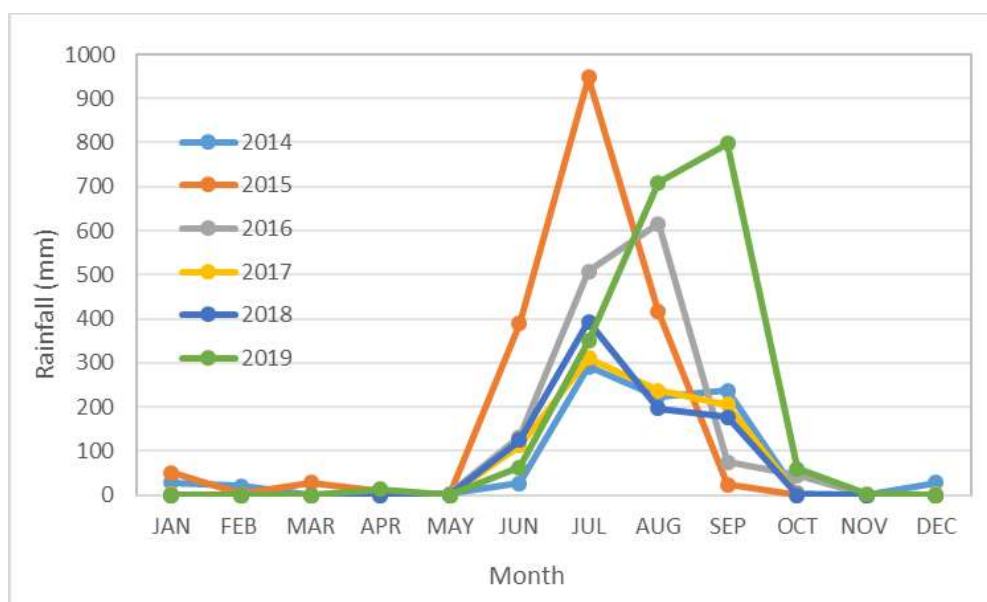
The monthly variation of the rainfall for the Site near Agar in Agar Malwa District was studied for the period of 2014-2019 using the India Meteorological Department gridded total monthly rainfall data. The monthly rainfall variation observed for the Site near Agar Site in Agar Malwa District for the period (1980-2019) is summarised in Table 1.2 and illustrated in Figure 1.12. It is evident that May-September months receive substantial monsoon rains.

Monthly Rainfall Pattern at Site near Agar for the Period 2014-2019

Year	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2014	27.7	21	0	0.9	1.9	27.1	291.2	223.8	237.1	3.8	0	27.5	862
2015	50.2	2.7	27.4	8.4	0.3	388.5	947.7	416.1	24.1	0.2	0	0	1865.6
2016	0.2	0	0	0	2.3	131.8	506.9	615.1	74.7	44.5	0	0	1375.5
2017	0.3	0	0	0	0.1	111.6	311.3	237	205.2	0	0	0.5	866
2018	0	0	0.1	0	0	124.8	392.7	196.6	176.9	0	0	0	891.1
2019	0	0	0	12.4	0	62.2	349.9	709	797.7	59.1	1.8	0	1992.1

Source: IMD, All values in mm.

Monthly Variation of Rainfall at Site near Agar (2014-2019)



Source: IMD, All values in mm

Maximum Daily Probable Rainfall (25, 50 and 100 Year Return Period)

As per the Central Water Commission's (CWC) report titled 'Flood Estimation Report for Chambal Sub-Zone -1(b)'¹, maximum daily probable rainfall for different return periods for the watershed of Agar and Susner Sites is presented in Table 1.3.

Maximum Daily Probable Rainfall at Agar and Susner Sites

Return period in years	Maximum daily probable rainfall in mm
25	< 220
50	< 240
100	< 280

Source: CWC (<http://cwc.gov.in/sites/default/files/chambal20subzone201b.pdf>)

Flood Review Based on Secondary Sources

Several secondary data sources and maps were reviewed to understand the vulnerability of the Site to flooding due to various storm events and scenarios. These are presented below:

Secondary Data Analysis of Flood Risk Map - WRI Aqueduct

As part of the assessment, Aqueduct's riverine flood risk map² developed by World Resources Institute (WRI) in collaboration with several research partners³ was used to ascertain the flooding risk calculated using 50 years of data spanning from 1960 to 2014 for the study region. WRI Aqueduct defines riverine flood risk as the percentage of population expected to be affected by riverine flooding in an average year, accounting for existing flood protection standards. Higher values indicate greater

¹ <http://cwc.gov.in/sites/default/files/chambal20subzone201b.pdf>

² <https://www.wri.org/resources/data-sets/aqueduct-global-maps-30-data>

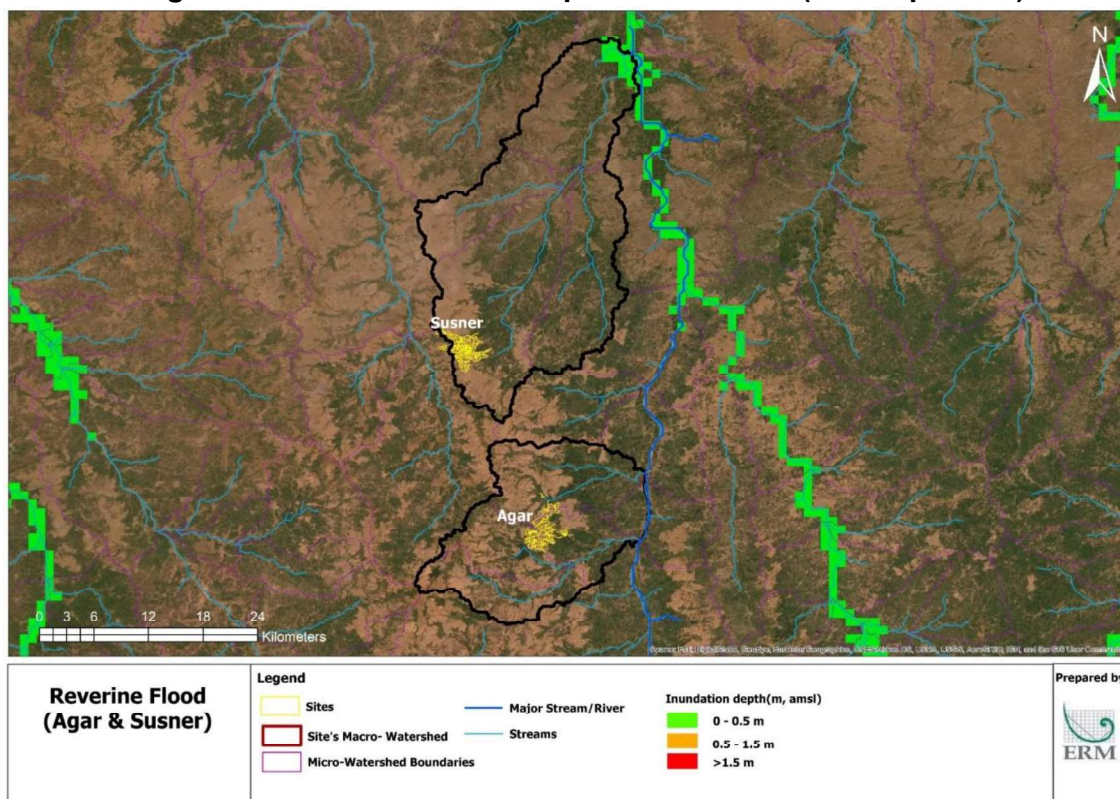
³ Delft University of Technology, Deltares, Utrecht University, Institute for Environmental Studies (IVM), International Food Policy Research Institute (IFPRI), PBL Netherlands Environmental Agency, and RepRisk.

proportion of the population is expected to be impacted by riverine floods. Riverine flood risk are classified into five (5) categories based on probability of flooding as:

- Low: flooding probability is 0 to 1 in 1000;
- Low-Medium: flooding probability is 1 in 1000 to 2 in 1000;
- Medium-High: flooding probability is 2 in 1000 to 6 in 1000;
- High: flooding probability is 6 in 1000 to 1 in 100; and
- Extremely High: flooding probability is more than 1 in 100.

Figure D.12 presents the Site boundary and River Basin superimposed over WRI's Aqueduct's riverine flood risk map. Per the map, riverine flood hazard is limited to River Kali Sindh which is located ~30 km east of Agar Site and ~24 km northeast of Susner Site. Based on review of riverine flood hazard map from WRI Aqueduct, flooding risk at the both Agar Site and Susner Site is considered 'Low'.

Figure D.12: Flood Hazard Map of River Basin (WRI Aqueduct)



Source: WRI-Aqueduct Water Risk Atlas 3.0 (<https://www.wri.org/resources/data-sets/aqueduct-global-maps-30-data>)

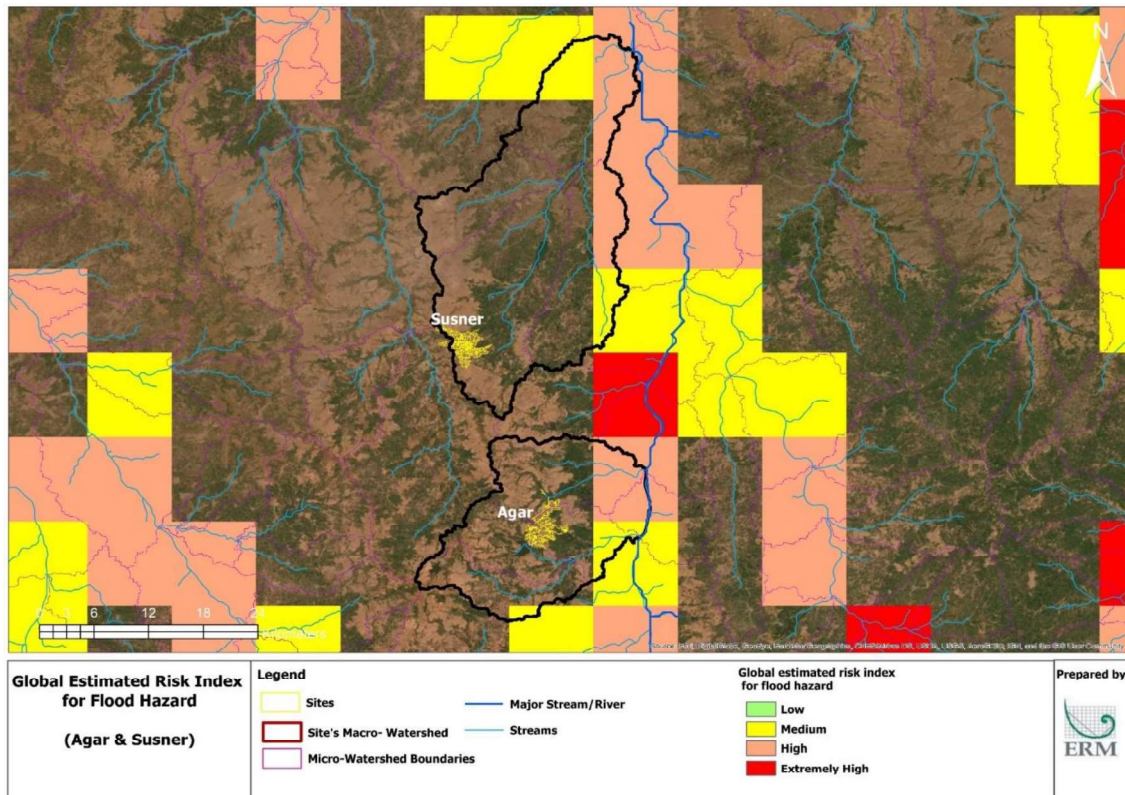
Secondary Data Analysis of Flood Hazard Map - UNEP/GRID-Europe

For the purpose of this assessment, Global estimated risk index for flood hazard dataset¹ developed by United Nations Environmental Programme (UNEP) was reviewed. As the name suggest, this dataset includes an estimate of the global risk induced by flood hazard. Unit is estimated risk index from 1 (low) to 4 (extreme). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modelled using global data.

¹ <https://preview.grid.unep.ch/index.php?preview=dataandevents=floodsanddevcat=5andlang=eng>

Figure D.13 presents the Site boundary and Kali Sindh River Basin superimposed over UNEP's flood hazard map. Patches of flood hazard risk ranging from medium to extremely high were observed along the periphery of major watershed particularly in east. However, both Agar Site and Susner Site as well as microwatershed within which both Sites are located do not fall in flood hazard risk as observed from UNEP/GRID. Flood risk for both Agar Site and Susner Site may be considered as 'Low'.

Figure D.13: Global Estimated Risk Index for Flood Hazard Map - UNEP



Source: UNEP/GRID Europe (<http://ihp-wins.unesco.org/layers/geonode:fl1010irmt>)

Secondary Data Analysis of Flood Hazard Map - FM Global

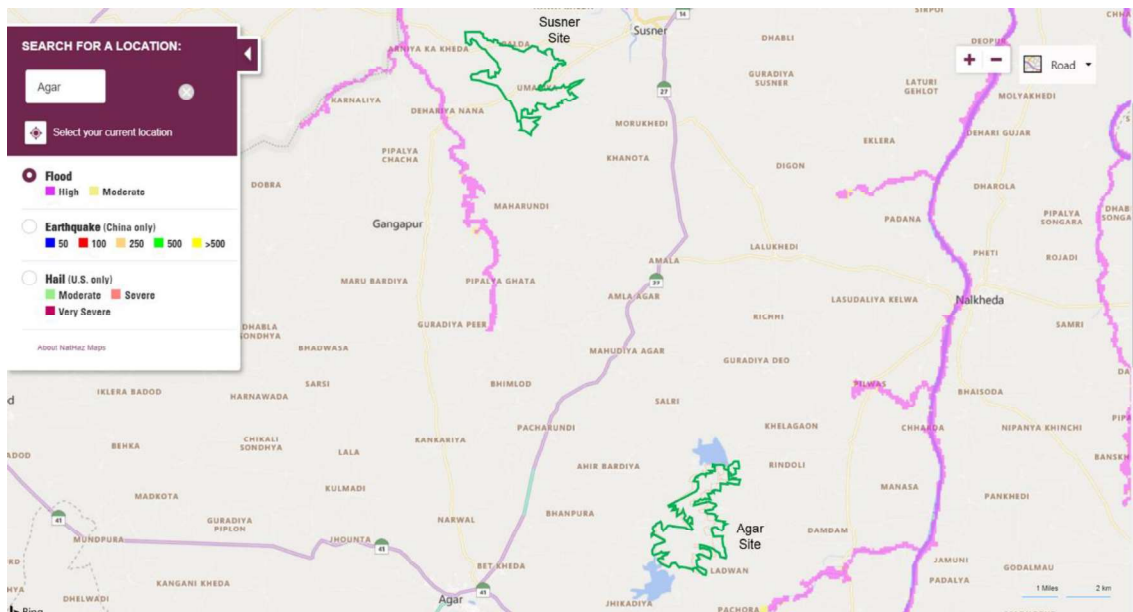
The Global Flood Map is prepared by FM Global¹ using historical data, hydrology and hydraulic scientific data accounting for variable external factors such as rainfall, evaporation, snowmelt and terrain. The Global Flood Map currently displays two (2) hazard flood zones via a 90 x 90 meter grid namely:

- High Hazard (Pink): Locations in a 100-year flood zone have at least a 1 percent chance of experiencing a flood each year; and
- Moderate Hazard (Yellow): Locations in a 500-year flood zone have at least a 0.2 percent chance of experiencing a flood each year.

Figure D.14 presents the approximate Site location superimposed over the FM Global's flood hazard map. Per the map, both Agar and Susner Sites are **not prone to** High or Moderate flood risk.

Figure D.14: Flood hazard map (FM Global)

¹ <https://www.fmglobal.com/research-and-resources/nathaz-toolkit/about-global-flood-map>



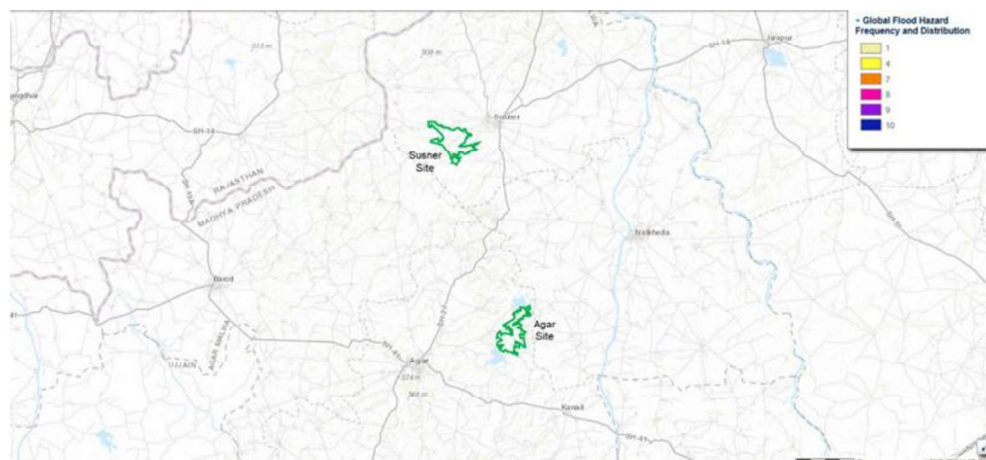
Source: FM-Global Flood Hazard Map (<https://www.fmglobal.com/research-and-resources/nathaz-toolkit-and-map/flood-map>)

Secondary Data Analysis of Flood Hazard Frequency and Distribution Map – Data Basin

Global Flood Hazard Frequency and Distribution is a 2.5 by 2.5 minute grid derived from a global listing of extreme flood events between 1985 and 2003 (poor or missing data in the early/mid 1990s) compiled by Dartmouth Flood Observatory and georeferenced to the nearest degree. The resultant flood frequency grid was then classified into 10 classes of approximately equal number of grid cells. The greater the grid cell value in the final data set, the higher the relative frequency of flood occurrence.

Figure D.15 illustrates the approximate Site location superimposed on the flood hazard frequency and distribution map developed by Data Basin. Per the map, both Agar and Susner Site are **not prone** to flooding.

Figure D.15: Flood Hazard Frequency and Distribution Map (Data Basin)



Source: Data Basin Global Flood Hazard Frequency and Distribution
(<https://databasin.org/datasets/e5190023c8194691b5b233df41955417>)

Likelihood of a Flooding Event

Based on the above-mentioned findings, a likelihood analysis of potential flooding event in and around the Site has been undertaken. The same has been presented in the Table 4.4 below.

Attributes	Likelihood of flood evaluation					
	Agar Site Likelihood			Susner Site Likelihood		
	High	Medium	Low	High	Medium	Low
<u>Site Setting</u>						
- Agar and Susner Sites are located ~30 km and ~24 km west from the Kali Sindh River which is the nearest river; - Nearest prominent stream is ~1.35 km west of Susner Site. This stream is non-perennial in nature.						
<u>Watershed Characteristics</u>						
- Both Agar and Susner Sites are located within the Kali Sindh River Basin. Both Sites are located at the ridge in the west-central portion of the basin and ~30 km west from the Kali Sindh River. - The Susner and Agar Sites are located in a rural setting surrounded primarily by scrub land with some agricultural land, forest land, scattered residential settlements, water bodies. - Few first order streams originate within Agar Site. These are non-perennial streams with shallow depths. - Three (3) large artificially created water bodies are located adjoining the Agar Site boundary with spread area varying between 21 acres to 260 acres. - Several well defined and prominent first order streams originate within Susner Site. Few second order streams also pass through Susner Site. These streams extend along entire breadth of the Site in the central and southeastern portion. - Three (3) large artificially created water bodies are located adjoining the Susner Site boundary with spread area varying between 34 acres to 228 acres.						

Attributes	Agar Site Likelihood			Susner Site Likelihood		
	High	Medium	Low	High	Medium	Low
<u>Hydro-meteorological Data</u>						
■ Average annual rainfall for period of 1980-2019 for Susner was ~951 mm with the highest annual rainfall of 1,814 mm recorded in 2019; ■ Average annual rainfall for period of 1980-2019 for Susner was ~966 mm with the highest annual rainfall of 1,992 mm recorded in 2019; ■ Maximum daily probable rainfall for 25, 50, and 100 year return periods for Agar and Susner Sites are <220 mm, <240 mm, and <280 mm respectively;						
<u>Hydrological and Geomorphological Data</u>						
<u>Catchment Analysis</u>						
■ Topography within the watershed of Susner Site varies between 375 m and 475 m amsl. ■ Topographic elevation of Susner Site was observed to be in the range of 425 m to 475 m amsl. ■ Slope in the Susner Site area ranges between 3 to 8 % categorized as gentle slope. ■ Topography within the watershed of Agar Site varies between 375 m and 500 m amsl. ■ Topographic elevation of Agar Site was observed to be in the range of 425 to 475 m amsl. ■ Slope in the Agar Site area ranges between 3 to 8% categorized as gentle slope. ■ Based on the topography and slope maps, the Site area does not appear to have any pockets of 'low lying areas' with potential for water logging and flooding during rainy season.						
<u>Historical Flooding and Inundation Events</u>						
■ Several artificial water bodies have been created within both Agar and Susner Sites for capturing surface runoff.						

Attributes	Agar Site Likelihood			Susner Site Likelihood		
	High	Medium	Low	High	Medium	Low
- Some of the artificial water bodies are spread over considerable area ranging up to 4 acres in Agar Site and up to 22 acres in Susner Site. These are indicative of significant surface runoff generated within the Site. - Besides the artificially constructed water bodies and the non-perennial streams with shallow depths, signs of water logging and inundation were not observed within the Site based on review of historical satellite imagery. - Flooding and inundation at the Site may be limited to natural drainage channels, artificially created water bodies and the low lying areas adjoining these features.						
<u>Secondary Data Review – Flooding and Inundation</u>						
- Per the District Disaster Management Plan – Agar District, the district is prone to floods. It was found the Site is not prone to flooding due to overflow from Gandhisagar Dam (40 km south-east of the Site, along Chambal River). - Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Agar and Susner Sites are not prone to flooding; - Per the global flood hazard map developed by FM Global, the Agar and Susner Sites are not prone to high or medium flood risk; - Based on Aqueduct's global flood hazard map, the Site and its surroundings at both Agar and Susner fall in the "Low" river flooding hazard zone; - Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Agar and Susner are not prone to flooding.						

Based on the observations from the above-mentioned table, it appears that the overall likelihood of flooding event and its impact in and around the Site may be considered as '**Low**' to '**Moderate**'.

Conclusions

Based on the observations from the above-mentioned table, it appears that the overall likelihood of flooding event and its impact in and around the Site can be considered to be '*Medium*'. The main high probability attributes are as follows:

- Agar and Susner Sites are located ~30 km and ~24 km west from the Kali Sindh River which is the nearest river. Nearest prominent stream is ~1.35 km west of Susner Site. This stream is non-perennial in nature;
- Both Agar and Susner Sites are located within the Kali Sindh River Basin. Both Sites are located at the ridge in the west-central portion of the basin and ~30 km west from the Kali Sindh River;
- The Susner and Agar Sites are located in a rural setting surrounded primarily by scrub land with some agricultural land, forest land, scattered residential settlements, water bodies;
- Three (3) large artificially created water bodies are located adjoining the Agar Site boundary with spread area varying between 21 acres to 260 acres;
- Several well defined and prominent first order streams originate within Susner Site. Few second order streams also pass through Susner Site. These streams extend along entire breadth of the Site in the central and southeastern portion;
- Three (3) large artificially created water bodies are located adjoining the Susner Site boundary with spread area varying between 34 acres to 228 acres;
- Several artificial water bodies have been created within both Agar and Susner Sites for capturing surface runoff. Some of the artificial water bodies are spread over considerable area ranging up to 4 acres in Agar Site and up to 22 acres in Susner Site. These are indicative of significant surface runoff generated within the Site;
- Besides the artificially constructed water bodies and the non-perennial streams with shallow depths, signs of water logging and inundation were not observed within the Site based on review of historical satellite imagery. Flooding and inundation at the Site may be limited to natural drainage channels, artificially created water bodies and the low lying areas adjoining these features;
- Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Agar and Susner Sites are not prone to flooding;
- Per the global flood hazard map developed by FM Global, the Agar and Susner Sites are not prone to high or medium flood risk;
- Based on Aqueduct's global flood hazard map, the Site and its surroundings at both Agar and Susner fall in the "Low" river flooding hazard zone;
- Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Agar and Susner are not prone to flooding;

Considering the above mentioned attributes, the Site is '*Low*' to '*Moderately*' susceptible to flooding.

Recommendations

Based on the broad level assessment, following measures are recommended to protect the assets at Site from identified 'high probability attributes' and to prevent/mitigate their impact on the Site:

- Develop a robust "Storm Water Management Plan (SWMP)" to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of

natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff.

- Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour;
- Storm water drains must be designed in line with the natural topography and eventually drain into the natural seasonal streams in the Site area;
- Implement an effective flood monitoring and disaster management system in place for effective mitigation of floods at a Site level;
- Coordinate with the district and local disaster management cells to update on flood early warning notifications.

APPENDIX E ESMP- MANAGEMENT PLANS

1. Waste Management Plan
2. Water Management Plan
3. Occupational health and Safety Plan
4. Disaster Management and Emergency Response Plan
5. Egyptian Vulture Conservation Plan
6. Construction and Labour Management Plan
7. Gender Action Plan
8. Stakeholder Engagement Plan

WASTE MANAGEMENT PLAN

All project generated wastes will need to be managed and disposed of in a manner to prevent potential impacts on the environment and risks to human health. A Waste Management Plan for the proposed Project has been developed. This has to be updated by the Solar Project Developer (SPD)/EPC contractor before start of activity.

Objectives

The construction and operation of the proposed project will generate various type of waste which will need appropriate collection, transportation, primary treatment and disposal. Hence, to serve the purpose, a Waste Management Plan has been formulated to demonstrate:

- Inventorisation of waste in different type of categories like garbage, rubbish, hazardous, waste etc.;
- Maintain the site in a clean and tidy state to reduce the attraction of pest species, impacts on the local environment and negative impacts on visual amenity;
- Suggestion of options for waste handling and disposal during construction and operation phase of the project
- Establish compliance to various national waste management related regulations
- Establish an appropriate training programme for contractors, workers and other stakeholders
- Define the roles and responsibilities for implementing the measures

Scope

This plan shall be applicable to the Solar Project Developers or EPC contractors engaged by RUMSL for the construction and operation and maintenance phase of the proposed project. The elements of the plan will be directly implemented by the Developers and contractors hired by the Developers while overall management and responsibility will lie with RUMSL. The Plan also identifies the individuals currently assigned to the various roles designated in this Plan.

Type of Waste and Source

The table below provides the list of type of waste likely to generate at site during construction and O&M phases.

Details of Type of Waste

S. No	Waste Type	Source
Construction Phase		
	Non Hazardous Waste	
1.	Domestic solid waste	Temporary site office, storage area, labour activities
2.	Construction debris	Construction activities within Solar Park including construction of access road, substation, storage yard etc.
3.	Packaging waste containing wood, cardboard and other recyclables.	Packaging material from solar panels, cables and accessories
4.	Sludge from Septic Tank	Site Office and labour camp

S. No	Waste Type	Source
5.	All non-recyclables waste	Construction activities
6.	Plastic waste	Packaging material
7.	Biomedical waste	First aid kits kept at construction site and site office
8.	Broken solar panels and other electronics waste (E waste)	Solar Park, PSS and Site Office
9.	Batteries	Solar Park, PSS and Site Office
	Hazardous Waste	
1.	Used oil/waste oil, lubricants and oil contaminated rags	DG set, construction machinery
2.	Bio medical waste	First aid centre
Operation Phase		
	Non Hazardous Waste	
1.	Domestic solid waste and office waste	Site Office
2.	Metal Scrap	Site Office and PSS
3.	Damaged PPEs	Site Office and PSS
	Hazardous Waste	
1.	Used oil/waste oil, lubricants and oil contaminated rags	Maintenance activities at site
2.	Broken solar panels, batteries (dry type or wet type), electronics	Site office and PSS

Regulatory Context

The regulatory context for waste management in India has been provided below.

National Regulations for Waste management

Waste Stream	Regulation	Requirements for the waste generator(s)- (SPD/EPC Contractor)
Construction and Demolition Waste	Construction and Demolition Waste Rules, 2016	- Waste generator shall be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules; - Waste generator shall ensure that other waste (such as solid waste) does not get mixed with this waste and is stored and disposed separately;

Waste Stream	Regulation	Requirements for the waste generator(s)- (SPD/EPC Contractor)
		- Waste generator shall keep the construction and demolition waste within the premise or get the waste deposited at collection centre so made by the local body or handover it to the authorised processing facilities of construction and demolition waste; - Waste generator shall ensure that there is no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains; - In case, quantum of C&D waste generating at site is estimated 20 tons or more in one day or 300 tons per project in a month, the Waste Generator shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar and shall submit waste management plan and get appropriate approvals from the local authority before starting activities.
Solid Municipal Waste	Solid Waste Management Rules, 2016, as amended	- Waste generated at the site should be segregated into biodegradable and non-biodegradable wastes; - Horticulture and garden waste generated within site should be stored separately and disposed as per the directions of the local body; and - Waste should not be thrown, burned or buried on streets, open spaces, outside the site premises or in drains/water bodies.
Hazardous Waste	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended	- Waste generator should be responsible for safe and environmentally sound management of hazardous waste; - Hazardous and other wastes should be sold to an authorised actual user or disposed authorized disposal facility; - Waste generator should take steps while managing hazardous and other wastes to contain contaminants, prevent accidents and limit consequences to human beings and the environment; - Waste generator should provide persons working in the site with appropriate training, equipment and information necessary to ensure their safety; - Waste generator should make an application to the State Pollution Control Board to obtain an authorization for managing hazardous and other wastes; - Waste generator should maintain a record of hazardous and other wastes managed by him/her in Form 3 of the HW Rules; - An annual return containing the details of the waste generated should be submitted through Form 4 of the HW Rules on or before the 30th day of June following the financial year to which the return related; - Waste generator may store the waste for a period not exceeding ninety days; - During transportation of hazardous waste, the waste generator should provide the relevant information as shown in Form 9 of the HW rules;

Waste Stream	Regulation	Requirements for the waste generator(s)- (SPD/EPC Contractor)
		■ If waste has to be transported across state borders for disposal then an NoC is required from both State Pollution Control Boards; ■ The waste generator should prepare copies of the manifest of hazardous and other wastes before transportation and as given in Form 10 and provide a copy to the transporter, State Pollution Control Board and retain a copy; and ■ When an accident occurs at a facility handling hazardous waste, the operator should intimate the State Pollution Control Board through telephone or email about the accident and subsequently send a report.
Electronic Waste	E-waste (Management) Rules, 2016, as amended	■ Bulk consumers of electrical equipment should be channelized through collection centers or dealers of authorized producer or dismantler or recycler or through a designated take back service provider; ■ Bulk consumers should maintain records of e-waste generated and make these records available to the State Pollution Control Board; ■ E-waste containing radioactive material should not be mixed; and ■ Bulk consumers should provide annual returns to the State Pollution Control Board before the 30th day of June following the financial year to which the return relates.
Plastic Waste	Plastic Waste Management Rules, 2016, as amended	■ Waste generator should take steps to minimize generation of plastic waste and if generated, then segregate plastic waste from municipal solid waste; and ■ Plastic waste should not be littered and handed over to urban local body or gram panchayat or approved agencies, registered recyclers or waste collection agencies.
Battery Waste	Batteries (Management and Handling) Rules, 2001, as amended	■ Batteries should not be disposed in any manner other than depositing with dealer, manufacturer, importer, assembler, registered recycler, reconditioner or at designated collection centres; and ■ Bulk consumers should file half-year return to the State Pollution Control Board.
Bio-medical waste	Bio-Medical Waste Management Rules, 2016	■ The bio-medical waste shall be segregated into containers or bags at the point of generation in accordance with Schedule I prior to its storage, transportation, treatment and disposal. ■ Obtain (one time) authorisation from the prescribed authority under BMWM Rules, 2016 ■ Maintain record pertains to quantum of category wise bio-medical waste generated and treated

Waste Handling, Management & Disposal

Construction Phase

All wastes produced from the Project activities on site will be temporarily stored in designated waste storage areas. All wastes that cannot be reused or recycled will be collected by approved waste

contractors and transferred to an appropriately licensed waste management facility for treatment and disposal. Following steps will be taken to manage the waste generation during construction phase:

- Fuel will be stored on site in temporary aboveground storage tanks and will be stored in a locked container within a fenced and secure temporary staging area;
- Trucks and construction vehicles will be serviced off site;
- All concrete mixing be undertaken on impermeable plastic lining to prevent contamination of the soils and surrounding areas;
- Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation;
- The use, storage, transport and disposal of hazardous materials used for the project will be carried out in accordance with all applicable regulations;
- All hazardous waste to be disposed off to MPPCB approved vendors;
- Material Safety Data Sheets (MSDS) for all applicable materials present on site will be readily available to on-site personnel;
- The construction debris will be placed in appropriate on-site storage containers and periodically disposed of by a licensed waste contractor;
- The construction contractor will remove refuse collected from the designated waste storage areas at the site at least once a week; and
- Empty fuel containers will also be stored at a secured area designated for scrap and sold to authorized vendors. All packaging material will also be collected at the storage area and sold to scrap dealers.

Operation Phase

Damaged cells would need to be characterized and managed as hazardous waste. Following measures to be taken for management of waste:

- Developers need to have buy back agreements for defunct solar panels;
- A designated area needs to be demarcated within the premises for storage of defunct and broken solar panels with restricted access and on impervious surface;
- A SOP shall be prepared for storage and disposal of broken solar panels. MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; ⁽¹⁾;
- The broken panels shall not be mixed with normal glass and kept separately in accordance to HW Rules;
- All fuel storage should be equipped with secondary containment and spillage trays;
- All used oil is required to send off to MPPCB approved vendors and recyclers; and
- Transportation of defunct solar panels is required to be undertaken as per the procedures specified by the Manufacture of Solar Panels.

Handling of Broken Solar Modules generated due to cleaning and other maintenance activities

Impact	Mitigation Measure
Land Contamination (Soil Quality)	■ Broken or damaged solar panels are required to be shifted to a designated area in scrap yard to avoid any type of land contamination.

(1) <http://164.100.94.214/sites/default/files/webform/notices/DraftBlueprintAntimony.pdf>

Impact	Mitigation Measure
	■ The designated area should be isolated and to be established on an impervious surface. ■ A photograph is to be taken of the broken panel at the site to cater to Insurance settlement claims
Risk on Health of Workers	■ Proper PPE are provided to the workers handling the broken solar panels. ■ The workers at site are also on regular basis apprised about the potential health risks associated with handling of solar panels.

Roles and Responsibilities

Site Supervisor (SPD/ EPC Contractor)

Site Supervisor will be responsible for the following activities

- Management of onsite waste generation associated with construction works to help avoid excessive generation where practicable;
- Maintaining all records of waste type which are construction waste and debris, hazardous waste;
- Liaising with Madhya Pradesh Pollution Control Board (MPPCB) approved vendors for disposal of hazardous waste generated;
- Renewal and Management of Buy Back Agreements for defunct solar panels with the Manufacturers;

EHS Manager (SPD/ EPC Contractor)

The following responsibilities are entrusted to the EHS Manager:

- Demarcation of area within the module area for keeping of segregated wastes;
- Labelling of the drums containing hazardous wastes like used oil;
- Maintaining of receipts for hazardous waste management records;
- Notifying the Site Supervisor of any activity that may generate a large amount of waste to allow appropriate controls to be put in place to manage waste generated; and
- Ensure safe transportation of defunct solar panels as per specified procedures.

WATER MANGEMENT PLAN

The construction and operation & maintenance activities will require water. A Water Management Plan has been prepared for the Project to support the ESIA process. The Plan was developed to meet the objectives of water management during the construction and operation of the Solar Park. Plan is based on the assessment of impacts on water resources, quality, which would occur during the site preparation and operation phase of the Project.

Objectives

The Water Management Plan aims to ensure that water consumption during the project life cycle do not result in unacceptable impacts on the water resources and surrounding community. It focuses on the strategies to be used to monitor the water quantity, conservation measures, and recycling of water within the Project. The objective of this Water Management Plan (WMP) is

- Monitoring water consumption in the Project during construction and O&M activities;
- Delineate mitigation/management measures to be implemented during construction and O&M phases;
- Establish compliance of National Standard for Discharges
- Establish an appropriate training programme for contractors, workers and other stakeholders
- Define the roles and responsibilities for implementing the measures

Scope

This plan shall be applicable to the Solar Project Developers or EPC contractors engaged by RUMSL for the construction and operation and maintenance phase of the proposed project. The elements of the plan will be directly implemented by the Developers and contractors hired by the Developers while overall management and responsibility will lie with RUMSL. The Plan also identifies the individuals currently assigned to the various roles designated in this Plan.

Water Resources

Surface Water

The natural waterbodies and Site area setting of Susner and Agar is described below:

- The core zone (2 km radius) around the Site is largely occupied by open lands, scrubland, agricultural land along the stream and low lying areas, forest land, scattered residential settlements and river channels of the Kali Sindh River and its tributaries.
- Kali Sindh River is located at distances of ~10.5 km to the east and northeast of the Agar Site; and ~19 km east and northeast to the Susner Site respectively. The River flows from south to north whereas Site- level streams flow from west to east and north-east direction for Agar and Susner Sites.
- The desktop review of the Site and its surrounding area indicates that the Agar Site lies between two (2) artificially created perennial waterbodies/lakes. However, both of these lakes are located downstream from the Site in respective micro-watersheds. Surface runoff from southwestern portion and far north of the Agar Site drain into these lakes. Susner Site is located on the ridge of the watershed. Few streams originates with a maximum length of 2 km catchment and flow through the Sites.
- All the streams are seasonal in nature and eventually drain into Kali Sindh River.

Ground Water

Groundwater was reported as the primary source of water in Agar Site and its surrounding area with some seasonal streams contributing for domestic use as secondary source of water. At the Susner Site, groundwater was reported as the primary source while surface water bodies in form of lakes and ponds contribute as the secondary source. Water availability was reported in some of these water bodies at Susner Site all through the year. Groundwater bore wells were also reported at Susner and Agar Sites.

Water Requirement

The tables below provides details with respect to water requirement at site during construction and O&M phases.

Details of Water Requirement for the Project

S. No	Particulars	Water Requirement
Construction Phase		
1.	Domestic Purposes	80-90 KLD
2.	Construction Activities	250-300 KLD
Operation Phase		
1.	Cleaning of Solar Panels	340 KLD
2.	Domestic Purposes	12 KLD
3.	Landscaping	7 KLD
4.	Firefighting and Miscellaneous	35 KL

The water requirement for the Project will be met through tanker water supply during construction phase. Whereas, during O&M phase, ground water will be used for domestic purposes and solar panel cleaning activities.

Waste water Generation

Wastewater will be generated from the following sources:

- Construction Phase
 - Sewage: site office, labour camp.
 - Surface runoff from site
- Operation Phase
 - Sewage: site office
 - Wastewater from solar panel cleaning activities

The domestic wastewater generated from the site will be collected through septic tank and followed by soak pit.

Regulatory Context

The regulatory context for water management in India has been provided below.

National Regulations for Water management

Regulation	Requirements
The Water (Prevention and Control of Pollution) Act, 1974 and its amendment, 1988	■ This Act provides for the prevention and control of water pollution and maintaining or restoring good water quality for any establishment. ■ Any waste water discharge shall be within the discharges limits prescribed by CPCB.
Guidelines/Criteria for evaluation of proposals/ requests for ground water abstraction by CGWB	Permission from CWGB shall be taken prior to any ground water abstraction for O&M activities. The Unit 5 (Susner) block is categorized as overexploited by CGWB. As per guidelines, groundwater withdrawal may be permitted subject to ■ Undertaking of ground water recharge measures. The withdrawal should not exceed 100% of the recharged quantity. ■ The recharge should be implemented within the premises and/or same water shed/assessment unit. Detail project proposal shall be included along with the application for NOC.

Impact Avoidance and Impact Mitigation

Conserving Water Resources

- Construction Phase
 - Optimum use of water during sprinkling on roads for dust settlement, washing of vehicles, concrete mixing for foundation etc.;
 - Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers, camp area.
 - Construction labour deputed onsite to be sensitized about water conservation and encouraged for optimal use of water;
 - Minimum use of water in cleaning/washing of equipment's and vehicles;
- Operation Phase
 - Feasibility of dry cleaning of solar panels shall be examined;
 - Use of water-efficient technologies for cleaning the solar panels and domestic consumption nodes;
 - The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow shall be treated in water treatment unit and recycled in the Project.
 - Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.;
 - Maintain logbook for water consumption;
 - Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations.

- The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be adopted are UN Global Compact's CEO Water Mandate or AWS Standards.
- Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations.

Rain Water Harvesting

The ground water status in Susner has been declared as over exploited area. In order to comply with CGWB guidelines for ground water abstraction, ground water recharge is mandatory in the Project. RUMSL shall plan to provide rainwater harvesting provision at site. For this purpose, rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones.

Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site.

Water Quality

- Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;
- Open defecation and random disposal of sewage will be strictly restricted;
- Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;
- Provision of number of toilets across with easily accessible location as the project site is spread across large area of both the Units;
- Use of licensed contractors for management and disposal of waste and sludge;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets;
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Other Management Aspects

Inventory of Water Consumption and Pollution Sources

Preparing an inventory of water consumption during construction and O&M activities and all pollution sources from the Project activities is essentially the first step towards managing the impacts. The Management Plan will involve preparation of an up to date inventory of all areas of water consumption and wastewater discharge sources based on the latest Project activity related information. This inventory will helps in formulating the following management approaches:

- Source reduction
- Resource recovery options
- Recycle options
- Optimal treatment strategies and technologies
- Post-treatment, resource recovery and recycle options
- Ultimate disposal considering the local environmental sensitivities

The inventory database of discharge sources shall be kept as a living document and updated as and when any new sources are cited at any point in time of the Project period. Any intermittent water requirement and discharge sources shall also be identified and included in the inventory.

Responsibilities and Accountabilities

EHS Manager

The EHS Manager of SPD/EPC contractor will be responsible for:

- Implementing the mitigation measures mentioned in this management plan;
- Maintain a database which will record the water consumption quantities and waste water generation at different locations;
- Monthly review of water consumption and waste water generation in the project;
- Conducting regular audits around the Project site to inspect water management practices;
- Conducting regular audits for rainwater harvesting;
- Review conditions of storage location and records related to hazardous wastes as per the conditions of authorization

All employees and sub-contractors will be provided with environmental awareness training through a site induction process. All employees and contractors will have a responsibility to manage operations in an environmentally responsible manner and report any visible emission/ discharge/ accidental spillage. All pollution related environmental incidents will be reported to the EHS manager.

OCCUPATIONAL HEALTH AND SAFETY PLAN

The section below presents an overview of the potential occupational health and safety risks on the proposed project. It defines the various risks involved during the construction and operation phase of the project. The occupational health and safety plan (OHSP) will address the following:

- Evaluation and Identification of hazards;
- Elimination and removal of hazards;
- Control of Hazards which cannot be eliminated; and
- Recovery from accidents.

Purpose and Scope

This plan provides guidance with respect to occupational risks (for both construction and operation stage) and aims to achieve the following:

- Identification of hazards, associated risks and control measures for each activity;
- Defining responsibilities to ensure effective implementation of health and safety (H&S) risk control measures;
- Avoid and/or minimise the impacts on workers and local communities' health due to various project activities;
- Provide and maintain safe working procedures and operations for workers; and
- Reduce human injury and damage to property and environment in case of an emergency.

Definitions

Competent Person: any person having the knowledge, training and experience specific to the work or task being performed.

Confined Space: "Confined space" means a compartment of small size and limited access which by its small size and confined nature can readily create or aggravate a hazardous exposure.

Emergency: An unforeseen occurrence, a sudden and urgent occasion for action

First aider: A person who has received training and who holds a current first aid certificate from an organization or employer whose training and qualification for first aiders are approved by authority.

Hazard: A source, situation or act with a potential for harm in terms of:

- ill Health
- damage to property, plant, ships etc.
- production losses or increased liabilities

Hazardous Substance: The term "hazardous substance" means a substance which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritant, or otherwise harmful is likely to cause injury.

Health and Safety Plan: A documented plan which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified.

Hot Work: The term "hot work" means riveting, welding, burning or other fire or spark producing operations.

Incident: An event or occurrence occurring at work or arising out of or in connection with the activities of persons at work, or in connection with the use of plant or machinery.

Risk: the probability that injury or damage will occur

Safe: free from any hazard

Roles and Responsibilities

Site Supervisor (SPD/EPC Contractor)

Following tasks will fall within his/her responsibilities:

- Monitor site activities on weekly basis for compliance;
- Supervise the performance of the work being carried out within the project boundary;
- Conduct internal audits of the construction site against the ESMP;
- Confine the construction site to the demarcated area; and
- Keeping a check on operation and maintenance services of solar project components required during operation phase.

EHS Manager (SPD/EPC Contractor)

Responsibilities of an EHS Manager shall include the following:

- Ensure that the operations are in compliance with EHS requirements at all times;
- Conducting HS&E Audits on regular basis & advice management for necessary action;
- Maintaining first aid facilities and personal protective equipment as demanded by the nature of the work/Material Safety Data Sheets;
- Review of investigation of all type of accidents & reporting to Site Supervisor;
- Training of workers and ensuring that they are issued with adequate instructions and creating awareness of safe work practice among them;
- Carrying out Job Safety Analysis to determine “Hazards of the operations/activity” and facilitating suitable solutions; and
- Participate in the preparation of, all Safety instructions, procedures and activities.

Safety Officer(s)

The developer shall ensure appointment of safety officer(s) for employees and workers working at site, to:

- Review the effectiveness of health and safety measures;
- Identify potential hazards and potential major incidents;
- Examine the causes of incidents in collaboration with his employer,;
- Investigate complaints by any employee /workers relating to that their health or safety on the site;
- Inspect the site with a view to, the health and safety of employees, at regular intervals;
- Participate in any internal health or safety audit.

First Aider

- Initial emergency response resuscitation and stabilization of critically ill or injured personnel;
- First Aid of non-emergency medical conditions;
- Implementation of site health plans and preventive medicine activities including first aid training of employees and workers; and

- Undertake regular health and hygiene inspections.

Workers

- Use the correct tools and equipment for the job;
- Use Safety equipment and protective equipment/clothing supplied, e.g. Safety helmets, shoes, harness, goggles, etc.; and
- Report all defects in plant or equipment to health and safety representatives.

Risk Assessment

Contractor shall before the commencement of any work on site and during construction work, ensure to undertake risk assessment by a competent person. Such an assessment shall as a minimum :

- Identify the risks and hazards to which persons may be exposed to;
- Analyse and evaluate the identified risks and hazards;
- Document a plan of safe work procedures, including the use of any personal protective equipment or clothing and the undertaking of periodic "tool box talks" or inductions before undertaking hazardous work, to mitigate, reduce or control the risks and hazards that have been identified;
- provide a monitoring plan; and
- Provide a review plan.

Risk assessment is an important step in protecting workers. It helps to focus on the potential risks in a particular workplace. Workers and others have a right to be protected from harm caused by a failure to take reasonable control measures.

Training

Site Supervisor shall ensure that every employee/worker (direct or contractual) is aware of the EHS risks associated with the work being carried out at the site and is trained and competent in the relevant work practices and maintenance procedures.

Procedures to identify training needs to be established and adequate safety training to be provided to all the employees/ workers on site. The safety training should provide staff with the knowledge and skills necessary for organising and managing occupational safety and health programmes; team leaders with leadership skills and knowledge to lead, implement and apply occupational safety and health activities; and workers with the knowledge, skills and right attitudes to enable them to work safely.

HSE trainings proposed for the project to include:

- Induction training on HSE
- Tool Box Training or pre-task briefings, highlighting hazards and the method of dealing with them
- Special Job Hazard Training including entry into confined space and other hazardous environment
- Hot work;
- Working at height;
- Electrical safety;
- Fire Safety
- First Aid

-
- Emergency Response
 - Use of PPEs

Documentation and Record Keeping

Site Supervisor should maintain data and records concerning the identification of hazards, assessment and control of risks of the ongoing activities. The document should establish and maintain procedures for controlling all relevant EHS documents and data. Such documents can include but not limited to:

- Hazard Identification Record;
- Risk Register;
- Legal Register;
- Licenses, Certificates, Permits;
- Control Methods including process control and machine design, safe work procedures, in-house work rules;
- Work Permit System;
- Training Reports;
- Drill Reports;
- MoM of HSE meetings;
- Inspection and Audit Records; and
- Medical and Health Surveillance Records

Communication and Information Dissemination

Supervisor(s) should communicate and inform any persons affected by the risks about:

- The nature of the risks involved; and
- The control measures or safe work procedures to be taken to address the risks involved.

Safe Work Practices

Construction and operation of the Solar Park involves many on job hazards which needs to be identified and eliminated or minimised to an expectable level in order to achieve a safe and healthy work environment. Following safe working practices should be established for site works (not limited to):

- Lockout/Tagout (LOTO)
- Crane and Hoist Safety
- Electrical
- Heat Stress
- Personal Protective Equipment

Lockout/Tagout (LOTO)

LOTO refers to specific practices and procedures to safeguard employees from start-up of machinery and equipment, or the release of hazardous energy during service or maintenance activities. Many workers face the greatest risk of injury if lockout/tagout is not properly implemented. Solar energy equipment can generate electrical energy and may be connected to electrical circuits. Workers may be exposed to electrical hazards from solar panels, PSS/ SCADA inverter room activities and from

electrical circuits. LOTO is required to be implemented while working in PSS, SCADA and inverter room. While installing or servicing solar panels, employers should assure that workers cover the solar panels, in addition to protecting workers from electrical circuits. Workers performing servicing or maintenance of solar panels may be exposed to injuries from the unexpected energization or release of stored energy in the equipment.

The following are some of the significant requirements of a Lockout/Tagout procedure required under a Lockout/Tagout program.

- Only authorized employees may lockout or tagout machines or equipment in order to perform servicing or maintenance;
- Lockout devices (locks) and tagout devices (tags) shall not be used for any other purposes and must be used only for controlling energy;
- Lockout and Tagout devices (locks and tags) must identify the name of the worker applying the device;
- All energy sources to equipment must be identified and isolated;
- After the energy is isolated from the machine or equipment, the isolating device(s) must be locked out or tagged out in safe or off position only by the authorized employees;
- Following the application of the lockout or tagout devices to the energy isolating devices, the stored or residual energy must be safely discharged or relieved;
- Prior to starting work on the equipment, the authorized employee shall verify that the equipment is isolated from the energy source, for example, by operating the on/off switch on the machine or equipment;
- Lock and tag should not be removed from the machine until the work is completed; and
- Only the authorized employee who placed the lock and tag must remove his/her lock or tag.

Electrical

Solar energy workers while working in PSS, SCADA and inverter room are exposed to potential electrical hazards present in their work environment, which makes them more vulnerable to the danger of electrocution and arc flash hazards. Workers may be exposed to electric shocks and burns when hooking up the solar panels to an electric circuit.

Workers must pay attention to overhead power lines and stay at least 10 feet away because they carry extremely high voltage. Fatal electrocution is the main hazard, but burns and falls from elevations can occur while installing solar panels. Another hazard is from using tools and equipment that can contact power lines.

Heat Stress

Solar energy workers often work in very hot weather where hazards include dehydration, heat exhaustion, heat stroke, and death. Employers should monitor employees and workers should be trained to identify and report early symptoms of any heat-related illness.

Heat Stroke occurs when the body's system of temperature regulation fails and body temperature becomes abnormally high. If a worker shows signs of possible heat stroke, medical treatment should be obtained immediately.

Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

Personal Protective Equipment (PPE)

Using personal protective equipment is often essential, but it is generally the last line of defence after engineering controls, work practices, and administrative controls. Solar energy employers must assess their workplace to determine if hazards are present that require the use of protective equipment. Solar energy workers can be exposed to many hazards that may require the use of safety glasses, hard hats, gloves, respirators, or other personal protective equipment used to protect against injuries and illnesses. Workers exposed to potential electrical hazards must be provided with appropriate electrical protective equipment, and workers must use them. Electrical protective equipment must be maintained in a safe and reliable condition. They must be periodically inspected or tested for their workability.

General Working Conditions

Housekeeping

- Work areas should be maintained in a neat and orderly condition;
- Scrap material, such as rags, bolts and wedges should not be allowed to accumulate in the site area; Spills of oil, grease, paint and other slippery substances should be cleaned up immediately;
- Walkways should be kept clear of tripping hazards at all times;
- All personal protective equipment required for a procedure must be worn;
- Maintain a free access to all safety equipment including firefighting equipment, electrical panels and boxes, etc.;
- Proper barricades, safety rings and safety wires should be used. Barricades must be properly lighted for visibility;
- Operating equipment, tools or machinery without proper guards and/or signalling devices is prohibited;
- Observe all warning signs in the yard; and
- Before leaving the job, always check the area for any sparks or smouldering materials.

First Aid

- All work areas must be provided with adequate first aid facilities with a trained first aider during working hours; and
- Developer(s) must provide or ensure that there is provision of adequate and appropriate facilities for enabling first aid to be rendered to their employees if they are injured or become ill at work.

EMERGENCY RESPONSE AND DISASTER MANAGEMENT PLAN

The primary objective of formulating Emergency Response and Disaster Management Plan (ERDMP) is to undertake immediate rescue and relief operations and stabilize the mitigation process as quickly as possible. A site specific ERDMP shall be prepared by SPD/EPC Controller for the site.

The basic concept of the plan is to allow for smooth coordination of activities during an emergency. All employees and contractors shall be familiar with the plan. This plan shall be reviewed and amended when needed to ensure that all parties concerned are furnished with up-to-date information. The site supervisor with support of EHS team shall carry out exercises of part of the emergency plan at a regular interval as deemed necessary. The lesson learnt from these exercises shall be documented and used during the updating of this emergency response plan.

Objectives

The key objectives of the Plan are to:

- To localize the emergency and if possible eliminate it;
- To avoid confusion, panic and to handle the emergency with clearly defined actions;
- To reduce the incidence and severity of injury during mining operations;
- Identify the designated personnel and responsibilities for dealing with emergencies on and off-site;
- To take remedial measures in a quickest possible time to contain the incident and control it with minimum damage; and
- To mobilize the internal resources and utilize them in the most effective way.

Identification of Hazards and Emergency Categorization

Identification of all the hazards and risks associated with each activity which may lead to an emergency and anticipate the actions to be taken before or after the emergency arises. This section identifies the hazardous areas and activities in both construction and operation phases. Probable emergencies that might arise due to these hazards for the duration of the project have been listed below.

Hazardous Areas

Following potentially hazardous areas and activities have been identified at the construction site:

- Fuel storage areas
- Kitchen arrangement in labour camps
- Electrical installations – improper laying of cables
- Scaffolds

Emergency Situations

The possible emergency situations identified for the construction and operation phases of the Project are as listed below:

Fire and Explosion

- Leakage of fuel from storage areas; and
- Short-circuit at campsite/Project site.

Mechanical and Electrical Hazards

- Structural Collapse;
- Accidentally dropped object;

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- Loss of stability; and
 - Electrocution.

Occupational Hazards

- Outbreak of Disease / Illness/injury;
- Handling of chemicals;
- Accidents due to vehicle movement/ vehicle collision; and
- Vandalism.

Other emergencies

- Flooding;
- Earthquake;
- Cultural Conflict;
- Terrorism;
- Bomb Threat.

Categorization of Emergencies

Level 1 (Minor Emergencies)

All events with no escalation potential and which can be controlled and contained by the action of Safety Officer at the site will be considered as Level 1. In such cases of local alert, EHS Manager of RUMSL will be notified. Some typical incidents are:

- Vehicle collision (involving no loss of life);
- Medical Evacuation (not very serious cases);
- Minor localized fires.

Level 2 (Serious Emergencies)

All events with escalation potential, depending on the effectiveness of the local response will be considered as Level 2. These incidents may impact the entire construction activity/ project operations or have cascading effect. For such type of incidents Site Supervisor will take the lead. Some typical incidents are:

- Substantial security incident / Vandalism;
- Structural collapse;
- Minor Flooding;
- Serious damage to structures;
- Substantial fire; and
- Cultural conflict.

Level 3 (Major Emergency)

The crisis that requires assistance from external resources in order to save lives, minimize damage and to bring the abnormal situation back under control are Level 3 emergencies. These incidents have the potential to impact beyond the project footprints and affect the community. In such cases appropriate government / regulatory authorities will be informed and involved. Some typical Level 3 incidents are:

- Major fire/explosion;

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- Fatality;
 - Severe flooding;
 - Terrorism;
 - Bomb Threat

Personnel on site will know that a Major Emergency has been declared if the site fire alarm siren and /or the local fire alarm systems are activated. The Emergency Siren Modes will be demonstrated and shared with all workers to identify with them.

Level 2 and level 3 will be declared using emergency siren and evacuation shall be done.

Codification of Sirens

Following codes of siren are proposed during emergencies:

- ON SITE EMERGENCY (ALERT) for evacuation - 120 seconds Continuous Whelming Sound
- EMERGENCY CONTROLLED - 30 + 30 + 30 seconds sound with an interval of 5 seconds each

Emergency Facilities

Emergency Control Centre (ECC)

For the purpose of handling emergency, separate emergency control centre should be established. All communications to and from should originate from this control centre. The site office has been identified for establishment of ECC. All the key personnel such as Site Controller/ Incident Controller Officers, Senior Personnel would be located here or have access to the ECC. The ECC will also coordinate with offsite District Emergency Operation Centre (DEOC).

Infrastructure at Emergency Control Centre

Emergency control centre should therefore contain the following:

- A copy of on-site emergency plan;
- A copy of evacuation plan;
- An adequate number of internal and external telephones lines;
- Layout of fire-fighting system including locations of fire extinguishers with their type,
- Location of assembly points;
- Information on additional sources of water;
- List of important telephone numbers such as Police, Fire Brigade, Hospitals, and other outside Emergency Services, etc.;
- List of key Personnel with addresses and telephone numbers;
- List of Personal Protective Equipment;
- First Aid box;
- Alarm Control system.

Assembly Areas and Evacuation Routes

Safe assembly areas shall be identified and marked and employees to be instructed to gather at the assembly area during emergencies. The evacuation routes/plans shall be displayed at all strategic locations across the site.

Emergency Equipment

The following should be implemented to tackle emergency situations:

- Onsite emergency equipment such as first aid boxes, firefighting equipment, PPEs etc. shall be maintained at project site;
- The adequacy and availability of emergency equipment shall be assessed at periodic intervals by the EHS Manager;
- Inventory and locations of respective emergency equipment shall be displayed at project office building, construction areas and other work areas;
- It is to be ensured that the site staff is trained on usage of each type of emergency equipment.

First Aid Boxes

First aid boxes shall be provided at identified locations within the Project premises. A first aid box shall contain, but not limited to the following articles:

- Cotton wool
- Sterile gauze
- Antiseptic lotion
- Box of adhesive dressing (Plasters) for small wounds
- Blunt-ended scissors
- Tweezers for removing splinters
- Triangular bandages (for making a sling or emergency bandage)
- Safety pins
- Sterile eye dressings
- Crepe bandages
- Skin creams for treating burns
- Anti-histamine cream for insect bites and stings

Fire Fighting Equipment

The fire extinguishers and sand buckets will be provided at critical areas such as fuel storage area, waste storage area, labour camps, kitchens, areas with electrical installations and project office.

Other firefighting systems to be installed should include:

- Heavy-duty ABC powder type fire extinguishers kept at important electrical equipment areas;
- Portable CO2 extinguishers provided throughout the plant;

Provision of Personal Protective Equipment (PPE)

Onsite workers and site staff should be provided with adequate number of personal protective equipment (PPEs) to deal with emergency situations. The PPEs shall be stored at the designated Emergency Control Centre (ECC) in the site premises and will be easily accessible during times of emergency. Training of proper use of PPEs shall be provided to all working personnel on periodic basis.

Stretchers, and general first aid materials for dealing with burns, burns, fractures etc. would be maintained in the Medical Centre as well as in the ECC. A range of medicines should be maintained in the ECC/ Medical Centre. Other emergency medical equipment as suggested by local

administration for COVID pandemic should be provided and maintained. Apart from first aid facilities, external facilities would be augmented. Checklist of name of medical personnel, medical facilities available in the surrounding area to be prepared and updated.

Incident Management System

Emergency Response Team

The Emergency Response Team (ERT) shall be set up for construction phase and shall be revised for commencement of plant operations.

Each personnel identified as part of the ERT shall be designated specific roles and responsibilities for handling emergency situations.

The ERT at the operating site under its control will have following role:

- Control the emergency and render the facility premises safe by the application of local resources; and
- Support the local response effort by co-ordinating additional equipment, personnel, and other external resources for the direct response effort.

Following Emergency Response Team (ERT) is proposed:

- **Site Controller:** The site supervisor would be designated as site controller during emergency.
- **Incident Controllers/Disaster response coordinator:** Health and safety team responsible for different activities would be designated as incident controller/disaster response coordinator. All incident controllers shall report to site controller.
- **Emergency Coordinators:** Emergency coordinators would be appointed who would undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and support services. For this purposes, security in-charge, personal department, essential services personnel would be engaged.

Site Supervisor

The Site Supervisor or personnel nominated by him shall be the Site Controller and responsible for overall management. The following tasks will fall within his/her responsibilities:

- Assess the magnitude of the situation
- Maintain a continuous review of possible development and assess in consultation with Incident Controller and other Key personnel
- Review monthly and annual incident reporting
- Review disaster response drill outcomes and work with EHS Manager and safety officers to identify necessary improvements
- Appoint a Disaster Response Coordinator tasked with responding to emergencies
- Overall coordination during emergency
- Communication with the District Disaster Management Authority and other external agencies
- Issue authorised statements to news media, and ensure that evidence is preserved for inquiries to be conducted by statutory authorities

EHS Manager

EHS Manager will be part of Incident Controller team. The duties of an EHS Manager shall include the following:

- Direct all operations within the affected areas with the priorities for safety of personnel, minimise damage to the property and loss of materials
- Pending arrival of Site Controller, assume the duties of his post and, in particular
- Direct the shutting down and evacuation of areas likely to be adversely affected by the emergency
- Provide advice and information to the Fire squad & Security Officer and the local fire service as and when they arrive
- Ensure that all non-essential workers/staff of the areas affected are evacuated to the appropriate assembly points, and the areas are searched for casualties
- To set up communication point and establish contact with Emergency Control Centre
- Distribution of the DMP to all parties with responsibilities in implementing the plan (including contractors);
- Review monthly and quarterly reports of accidents/incidents and reviews of contractor practices;
- Training and Planning mock drills;
- Receive all notifications of incidents/accidents and ensure proper response is being followed including reporting and review.

Safety Officer

Safety officer will be part of Incident Controller team. Responsibility of Safety Officer includes:

- Support the EHS Manager as required in disaster response planning and in development of training and management plans to ensure environmental concerns are addressed;
- Provide regular incident reporting;
- Schedule monthly inspections and audits and resolve issues identified;
- Schedule emergency response training sessions for relevant staff;
- Prepare monthly incident reports.

Emergency Coordinators

- Ensure they are easily recognizable to their colleagues/visitors and the emergency services during any evacuation;
- Responsible for all occupants' safety during evacuation and to ensure the safety for personnel to re-enter the site;
- Keep an updated list of employees and visitors on site and carry the name list with them during evacuation;
- Ensure all occupants have evacuated the area where the incident has taken place (including people in rest rooms, site office rooms etc.);
- To be fully trained in the provision of first aid.

Employees/Workers

- All persons employed or under service contract (e.g. contractor, transporter etc.), who witnesses or cause an incident are responsible for immediate reporting of the incident to his/her supervisor.

Emergency Response Procedure

Effective command and control starts with a clear definition of the overall command and control structure, and description of the duties of key personnel with specific responsibilities for emergency response. The control of emergencies will consider the minimum number of persons required to provide an adequate response to emergencies.

All emergencies occurring as a result of project activities shall be managed according to the following order of priorities:

- Preservation of Life (self, team, community);
- Protection of the Environment;
- Protection of Property/assets; and,
- Preservation of Evidence.

Emergency procedure to be followed in the event of any emergency are provided below:

Emergency	Procedure
Medical Emergencies	■ If a person finds someone injured, he shall immediately tell his shift In charge about the accident; ■ The shift In charge shall inform the ECC and First Aid Team about the injury and location of accident. ■ On receiving the information, First Aid Team should go to the accident site immediately; ■ First Aid team shall provide the first aid to the injured person and make necessary arrangements for taking him to the hospital, if required; ■ After this, First Aid Team shall report the ECC and make entries in the register about the incident, its cause and measures taken ■ Medical emergencies can be classified as life threatening or non-life threatening. If there is any doubt, assume that the emergency is life threatening.
Fire	■ The Incident controller must be notified; ■ Personnel in the immediate vicinity of the fire, including the designated Evacuation personnel must be immediately notified; ■ All persons located in the area in which the fire is located must be evacuated. Evacuation must be carried out as per the Evacuation Procedure; ■ The fire must be contained with the correct extinguisher only by those trained to do so; ■ Those requiring assistance must be assisted and first aid must be rendered only by those trained to do so; ■ Those confined to an area where there is smoke, must move under the level of the smoke and cover their nose/mouth.
Building Collapse	■ The Incident Controller must be notified; ■ Personnel in the immediate vicinity of the collapsed building move away from the building to a safe location - there could be a secondary collapse;

Emergency	Procedure
	■ Enter and rescue others only by those trained to do so; ■ If you know the identity or location of someone who is trapped, notify emergency personnel; ■ All persons located in the area must be evacuated. Evacuation must be carried out as per the Evacuation Procedure.
Earthquake	Actions during earthquake ■ Keep self and other calm; ■ Do not rush to doors or exit; ■ Keep away from loose articles/ furniture; and ■ Protect yourself by staying under the rental of an inner door, in the corner of a room, under a table. Action after an earthquake ■ Keep calm; ■ Expect aftershocks; ■ If there is a fire, try to put it out. If required call the fire brigade; ■ If people are seriously injured, do not move them unless they are in danger; ■ Do not enter badly damaged buildings; and ■ Do not go near damaged structures. Further Action ■ All person to assemble at assembly area; ■ Attendance of everyone present including direct and non-direct staff and visitors; ■ Rescue management to be initiated, if required additional help to be sought from authorities; and ■ RUMSL management to be briefed about the situation.
Flooding	■ The Incident Controller must be notified; ■ All personnel onsite, including the designated Evacuation Personnel must be immediately notified; ■ All equipment must be safely shutdown and all electrical equipment must be isolated. ■ During monsoon season, all emergency supplies to be kept handy at ECC and assembly point, such as flashlights, portable battery operated radios, extra batteries, emergency food and water, essential medicines, first aid kits etc.; ■ ECC should keep track on rainfall intensity and local weather forecast during the monsoon season; ■ The site controller should get into communication with DEOC and informing about the current situation at the site; ■ The onsite Emergency Response Team to help the Government Relief team in guiding them about the site and rescuing the people in the affected areas
Terrorism	Actions to be taken in response to terrorism include: ■ Run to a safe place, if there is nowhere to go; ■ Turn your phone to silent and turn off vibrate. Barricade yourself in if you can ■ Call for police help, when it is safe to do so.

Emergency	Procedure
	Further actions: ■ Help others with first aid, if it is safe to do so; ■ Tell the police what all you saw.
Bomb Threat	Actions taken in response to such a threat should be prompt and assure the safety of all. While a bomb threat may be a hoax, all such threats should be treated seriously. Procedure is as follows: ■ Do not touch anything electrical equipment including turning lights on or off. ■ Do not take a phone off the hook or replace it. ■ Do not use radios or cellular telephones. ■ Do not move anything that looks out of place. If a suspected bomb device is found, take note of the location, but do not touch it. Notify the police regarding the whereabouts of suspected bomb device. Once it is determined that a bomb threat has been made, the Safety Office will coordinate evacuation of the area.

Evacuation Procedure

All staff must be aware of the possible escape routes prior to the emergency situation. Always assure safety of the assembly point prior to evacuation. The procedure associated with an evacuation event is detailed below:

- The Disaster Response Coordinator will give instruction or the alarm sound to evacuate specific assembly areas;
- All staff appointed as Evacuation Officers must assist with the evacuation;
- All personnel onsite must follow the instructions of the Evacuation Officer;
- Personnel must follow the directional pointers to the nearest assembly points;
- Evacuation must be undertaken in accordance to the emergency lay out plan;
- Mobile employees must be the first to be evacuated followed by the frail and the injured;
- Evacuation personnel must work in pairs where possible to assist one another lifting injured employee (if any);
- Mobile employees who are struggling or appear unsure must be assisted;
- Personnel must evacuate by walking briskly and must not run;
- Evacuating personnel must stay calm and must not panic. Panic can spread and cause unnecessary chaos;
- Evacuating personnel must always keep left along the evacuation routes;
- In the case where the emergency situation results in fire or smoke, evacuating personnel must consider crawling, as this may be better than walking;
- Visitors that are not familiar with the evacuation procedure must be assisted;
- A daily record of staff and visitors must be kept;
- The task of the professional Emergency Services must not be obstructed;
- If necessary, a search / check for all unaccounted personnel must be undertaken before leaving the area;

- The evacuation officer must be the last one to leave the area;
- All personnel onsite must report directly to the allocated assembly point;
- Personnel must not leave the assembly point until it has been deemed safe to do so.

Post Emergency Analysis and Evaluation

When the emergency is over, the Emergency Response Team will carry out a detailed analysis of the causes of the accident, evaluate the influence of various factors and minimize them for future. At the same time, the adequacy of the Disaster Preparedness Plan will be evaluated and shortcomings will be rectified for subsequent improvement of the plan.

Reporting and Documentation

The following aspects need to be communicated for the emergency reporting:

- While witnessing or receiving notification of an emergency, as much information as possible should be taken and/or conveyed to the relevant emergency activation authority;
- Where possible, all information should be logged in written form with time and date included and provided to EHS Manager;
- Personnel working on the site may, at any time, be exposed to an emergency which could take many forms, for example (but not limited to):
 - Injuries and/or fatalities
 - Fires and/or explosions
 - Extreme weather
- When an emergency occurs, an appropriate and prompt response is required, providing precise action to control, correct and return the site to a safe condition. Timely action will also be required to protect people, the environment and property from damage;
- All near misses and unsafe acts will be written in logbooks / reported in the 'near miss, unsafe acts, hazards and sub-standard conditions report' and verbally communicated to the concerned Site Supervisor within a reasonable time. All accidents and incidents will be immediately reported to the EHS Manager, and requisite forms completed.

Co-ordination with External Agencies

Site Supervisor shall coordinate with the following departments:

- Fire brigade;
- Police department;
- Hospitals/ Ambulance Services;
- Utility departments (electricity and water);
- Technical departments such as Madhya Pradesh State Pollution Control Board, Factory Inspectorate etc.
- Local Authorities and District Administration
- District Disaster Control Room, Agar

Training and Education

Major emergency procedure should be laid down clearly and convincingly to everyone on site particularly Key Personnel. For this purpose, on site training and mock drills should be conducted

periodically and documented. The duties and responsibilities of each person and the emergency procedure to be followed by him should be very clear.

Procedure for Mock Rehearsal

Mock drills on Disaster Management shall be conducted twice in a year as preparedness exercise.

- Inform all the employees about mock drill;
- Fix the date for mock drill;
- Observers (senior personnel) will not be involved in the exercise. They will monitor the Mock drill;
- Emergency Siren / alarm will be raised;
- After hearing the Siren /alarm, Emergency procedure will be followed as mentioned in the Onsite Emergency Plan;
- Observer will note down the activities with respect to the time and identify any gap

Verification and Monitoring

The EHS Manager has been tasked with the responsibility for auditing the project and implementation of emergency response procedures associated with all phases of the project.

Reporting and monitoring requirements for the ERDMP will include:

- Monthly inspections and audits;
- Quarterly report of accidents/incidents;
- Reporting at the time of any incidents;
- Bi-annual disaster response drills; and
- Annual reporting on trainings.

Disaster response drills and reporting maintained by the EHS Managers will provide information regarding required revisions to training or the disaster response actions. Each incident reported will be reviewed and investigated upon occurring. Actions will be identified where possible to improve the site's overall response to disasters.

Training

All employees and contractors will be trained in disaster response procedures within one month of their start-date. The EHS Manager shall distribute the ERDMP (together with the associated Evacuation Plan) to all parties in charge of ensuring the plans implementation. All relevant information in the DMP shall be communicated to employees and contractors. This information shall include information on potential emergency risks/threats, appropriate first person response/contact to incidents/emergencies and notification procedures.

All site personnel, including contractors, are to be trained in the appropriate responses for possible disasters. The training is mandatory and is to be conducted on a regular basis. The frequency and timing of training is to take place at least quarterly.

Awareness programs for community should also be arranged to apprise them about the potential emergencies that can arise in construction and operation phase.

Training is to include, but not limited to the following:

- Basic Fire Safety and Rescue;
- Basic Life Safety and First Aid;
- Emergency Evacuation and Response; and
- Medical Emergencies

EGYPTIAN VULTURE CONSERVATION PLAN

Background

- The primary ecological survey at Agar and Susner Sites have recorded 6-8 individuals from the project site. Since Egyptian Vulture (*Neophron percnopterus*) [IUCN (v2020.1) EN is presence at the project site is opportunistic and present on during and event of carcass disposal from the nearby villagers. No roosting or nesting sites has been identified in the project site and surrounding 5 km area.
- Presence of Vulture in the Project Site



Egyptian Vultures feeding on Livestock carcass

Scope of the Plan

- Scope of the Plan is to minimize the impacts of the project activities on the Egyptian Vulture.

Egyptian Vulture – a priority species in study area

- Three subspecies of the Egyptian Vulture *Neophron percnopterus* are currently recognized as *N. p. percnopterus* (Linnaeus 1758), *N. p. ginginianus* (Latham 1790) and *N. p. majorensis* (Donazar et al. 2002). Two subspecies *N. p. percnopterus* and *N. p. ginginianus* of the Egyptian Vulture are found in India as illustrated by Naoroji, R. (2006) and (Mishra et al 2018).

Species Dimension

- Two subspecies *N. p. percnopterus* and *N. p. ginginianus* of the Egyptian Vulture are found in India

N. p. percnopterus

- Wing Span Male- 470-53 mm/Female 460-545 mm
- Tail: Male- 220-251 mm/Female 240-267 mm
- BeakColour: Yellowish beak terminates with a black tip

N. p. ginginianus

- Wing Span Male- 393-490mm/Female 455-505 mm
- Tail: Male- 228-251 mm/Female 240-267 mm
- BeakColour: Yellowish beak with slightly pale pinkish tip

Population Status

- Given the consistent decline in their population throughout its range, their status was changed from Least Concern to Endangered on the IUCN Red List in 2007 (Birdlife International 2008). Their current global population is estimated at 12,000 – 38,000 mature individuals (Birdlife International 2020). In India, the population has declined by > 90% whereas in Europe they have declined by 50-79% (Birdlife International 2020). Populations in Africa and Arabian Peninsula has also appeared to be on a rapid decline (Jennings 2010).

Site Observations

- A total of 6 numbers of Egyptian Vultures (2 Mature and 4 Sub Adult) were recorded near the Village Umariya feeding on a livestock carcass. The location of the carcass was within the project boundary. The carcass was dumped by the villagers (Umariya). In absence of a permanent dumping site the carcass was dumped little away of the village to avoid the foul odours of the decaying carcass.

Risk

- Since the project site and immediate surrounding areas are predominantly open scrub/grasslands, it is used by the local villagers as grazing areas. In an event of livestock mortality, the carcass is dumped at the specific location and left for the scavengers as food. Scavengers such as village dogs, jackal, Bengal Fox and Egyptian Vultures feed on these carcasses.
- Since, the presence of the Egyptian Vultures were observed at the project site, any nesting sites of these vultures was enquired by the local villagers. They confirmed that the forest areas in the north of the project site outside the 5 km radius areas may have vulture nest. No nesting was reported within the project site and its immediate vicinity. Presence of the vulture species close to the project site may pose electrocution and collision risk with the transmission line infrastructure of the project.

Mitigation and Management Plan

- In the present scenario, there is a clear requirement of a, “Carcass Management Plan” which ensures the safe disposal of all the carcass for the areas surrounding the project site and transmission line infrastructure.
- The plan should be executed in following 3 stages
- **Stage 1: Reporting of Carcass:** A network of volunteers should be identified in each of the surrounding villages who, upon receiving the information from the local sources should alert authorities of the presence of the carcass/mortality of the livestock in their respective village.
- **Stage 2: Collection of Carcass:** Project proponent/nominated authority should arrange for the collection of Carcass from the respective locality with the help of the villagers.

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- **Stage 3: Disposal of Carcass:**A safe disposal site should be identified with th help of the local authorities were no transmission line infrastructure is present. This could be ideally closer to a forest areas to ensure the presence of natural scavengers
 - Project developer should share the responsibility of implementation of the plan in coordination with the local Authorities and RUMSL.

CONTRACTOR AND LABOUR MANAGEMENT PLAN

Objective

The contractor and labour management plan has been developed with the objective of defining the procedures to manage and regulate the standards of labour and working conditions for the labourers hired through Solar Plant Developer or contractors (and in case they are being hired directly by RUMSL).

The Agar Solar Park will be developed by RUMSL and individual Solar Plants within the park will be developed by Independent Power developers. These Solar Power Plant Developers will hire contractors and sub-contractors, who will be responsible for all on-ground activities for the project; however Project proponent will monitor the progress of the project on regular basis and will be responsible to oversee that the labour conditions.

In the context of the project, Agar Solar Park requires a management plan that could provide guidance and become monitoring tool to assess and align the labour and working conditions of the contractors with the applicable regulatory as well as World Bank requirements.

Scope

This plan applies to the construction, operational and decommissioning phases of the project. This plan will be applicable for all the contractors and their workers that are going to be engaged in the three phases of the project. The scope of the present labour management plan has been broadly categorised into two components:

Aspects for Ensuring Proper Labour Management

There shall be a well-documented set of policies defined for the project and the workforce to be engaged for it. The indicative set of policies to be developed is enlisted below.

- Human resource Policy
- Working Relationship Policy
- Working Conditions & Terms of Employment Policy
- Workers' Organizations
- Non-Discrimination & Equal Opportunity
- Retrenchment
- Grievance Mechanism
- Child Labour
- Forced Labour
- Occupational Health & Safety
- Non-Employee Workers

Setting up and management of Labour Camps

Setting up and management of labour camp has been dealt with separately as they are considered to be an integral part of any construction project involving influx of migrant workers travelling alone or with their families including the children in some of the cases. Following are the major steps in the process:

- Site Selection and construction

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- Facilities at the labour camp including safety, amenities etc.
 - Usage and maintenance;
 - Dismantling and reinstatement of labour camp occupied land.

Applicable Legislations

There is a wide array of central and state level regulations that cover every aspect of labour related issues. These acts are further supplemented by the rules, notifications and standing orders of the state government. Aspects like minimum wage rate, working hours, and welfare benefits get revised and updated from time to time. Therefore, it is important to keep a track for the most recent developments in amendments of labour laws and rules. Acts and regulations pertaining to the migrant workers assume much more importance especially in the Indian context, wherein migrant workers constitute a huge section of the building and construction industry, or for that matter any form of labour intensive industry. The plan therefore, captures almost all the existing laws and regulations pertaining to the management of labour issues in the country.

National & State legislations regarding Contractor labour relationship

There are several laws and rules governing labour issues in India. The local legislations likely to get triggered for the contractor labour relationship are

- The contract labour (Regulation and abolition) Act, 1970 and Rules
- The child labour (Prohibition and Regulation) Act, 1986
- The Bonded Labour (Abolition) Act 1976:
- The Trade Union Act, 1926:
- Workmen's Compensation Act 1923.
- Minimum Wages Act, 1948
- The Payment of Wages Act, 1936, amended in 2005.
- The E.P.F. and Miscellaneous Provisions act, 1952
- Public Provident Fund Act, 1968
- Payment of Gratuity Act, 1972
- Employees State Insurance Act, 1948 (ESI)
- Employer's Liability Act, 1938 (as amended).
- The Industrial Employment (Standing Orders) Act, 1946 (as amended).
- The Industrial Disputes Act, 1947 (as amended).
- Payment of Bonus Act, 1965 and Amendment Act No.43 of 1977 and No.48 of 1978 and amendments
- The Personal Injuries (Compensation Insurance) Act, 1963 (as amended).
- Factories Act 1948.
- Shops and Establishment Act
- Interstate Migrant Workers Act 1979
- Maternity Benefit Act 1961
- Equal Remuneration Act 1976
- Building and Other Construction Workers Act 1996, amended in 2020

Rules include:

- Industrial Disputes (Central) Rules, 1957
- Minimum Wages (Central) Rules, 1950
- Payment of Bonus Rules, 1975
- The Personal Injuries (Compensation Insurance) Rules, 1972
- Standing Orders Rules 1946.
- Madhya Pradesh BOCW Rules, 2002
- Madhya Pradesh Industrial Employment (Standing Orders) amended in 2020

References and Recommended further reading

For the purpose of detailed reading on best practices related to the labour management, some of the regulations/ guidance notes which can be further referred are:

- The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998 made thereunder stipulates that all establishments employing more than ten (10) workers will have to meet the provisions of the act and rules made thereunder;
- For engaging twenty or more labour on contract on any day the Contractor shall also abide by the provisions laid down in the Contract Labour (Regulation & Abolition) Act, 1970. Under this Act, the Contractor shall secure a license from the Labour Commissioner after certification from the Employer (RUMSL). The contractor shall maintain all wage, attendance, PF, leave registers as applicable under the Act and shall keep them available for any inspection by the Employer.;
- Similarly the provisions of Interstate Migrant Workmen Act 1979 shall become applicable in case 5 or more interstate migrant workmen are engaged by the Contractor;
- Child labour prohibition Act shall be universally applicable to the Contractor which prohibits employing of any workmen/labour below the age of 14 years. In addition compliance to labour laws like payment of wages, payment of PF, equal remuneration, hours of work, overtime, weekly holiday etc. shall be observed by the contractor as per applicable laws; and
- Chapter 6 of The Building and other Construction Workers Act and Chapter 28 of Central rules stipulate the basic welfare measures that are to be provided by the employer or establishment. Similarly Chapter 5 of Contract Labour Act stipulates the basic welfare measures. The stipulations shall be reviewed and followed.

Recent State and Central level Amendments in labour Rules

In view of recent developments in labour issues, particularly of contractual labour due to the health pandemic situation created by the Covid – 19 virus, states have introduced various relaxations to the existing state and central laws/rules to boost economic opportunities and reduce burden of compliance.

The reforms introduced by the Madhya Pradesh government and as applicable on RUMSL and the SPD are listed below:

- The Contract labour (Regulation and Abolition) MP Rules, 1973

Amendment to rule 27 (validity of license) wherein the validity of the contract license of the labour supply contractor will be for the entire period of the contract. Earlier, the license was for one calendar year (till December) for the year in which the license was granted and had to be renewed. This

amendment requires the fees to be paid for the number of years for which the application is to be made¹.

- MP Industrial Employment (Standing Orders) Act, 1961

In amendment to rule 26 clause (as), the threshold for the applicability of the Act has been increased from 50 to 100 employees (Gazette, 2020).

- MP Industrial Relations Act, 1960

To regulate the relations between employer and employees, and to make provisions for settlement of disputes as outlined in the Central Act of 1947; the latest amendment excludes certain industries from the provisions of the Act that includes electricity generation, transmission and distribution² (Department of Labour, 2020).

Contractor and Labour Management- Specific issues

The challenges that the project is likely to encounter during construction and operational phases regarding the maintenance of labour standards could be:

- Lack of defined terms of employment for some worker or labour by sub-contractors might be possible;
- Likelihood of child labour at varying scale, particularly during development/construction phase on account of migrant labour;
- Discrimination in remuneration between male and female labour or between local & outside labour; and
- Inappropriate living arrangement in labour colony or workers colony;
- Conflict with local population.

Defined Human Resource Policy, working conditions and terms of employment

Management Plan

The contractors will be required to take following mentioned measures to regulate and manage the workforce engaged during construction as well as the operational phase of the project.

- Adequately cover the contract labourers that will be engaged in the construction phase of the project within the HR policy;
- Maintain consistency with the applicable labour laws;
- The Policy should be commensurate with the size and type of workforce;
- Policy should be clear and in a language understandable to workers;
- Procedure to make provisions of the policy very clear to each worker at the outset of joining;

¹ <https://www.mondaq.com/india/employee-rights-labour-relations/936170/giant-leap-to-woo-investors-mp-up-announce-radical-labour-relaxations?signup=true>

² https://prsindia.org/files/covid19/notifications/4989.MP_exemptions%20under%20labour%20laws_May05.pdf

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- Working condition⁽¹⁾ and terms of employment⁽²⁾ should be documented and communicated properly to all workers;
 - Wages and benefits must be clearly communicated and understood by the workers;
 - Provide all workers with a contract in a language understood by them;
 - Routinely provide workers with a clear record of wage calculation and deduction;
 - On-going internal verification that all workers are receiving wages and benefits as prescribed by law;
 - On-going communication and training on legal labour rights and company personnel policies;
 - Worker representatives meets regularly with HR and company management;
 - Training on minimum legal benefits for all workers, including contractors, and employment agencies;
 - Cooperation with local labour ministries.

(1) Working condition is defined as the conditions in the workplace and treatment of workers. Condition in workplace includes the physical environment, health and safety precautions, and access to sanitary facilities. Treatment of workers includes disciplinary practices, reason and process for termination of workers and respect for workers personal dignity.

(2) Terms of employment includes wages and benefits, wage deduction, hours of work, rest days, overtime arrangements, overtime compensation, medical insurance, pension, leave for illness, vacation, maternity and so on.

Aspects for Ensuring Proper Contractor and Labour Management

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
1	Human resource Policy ■ RUMSL & its contractors will have a documented policy and procedure related to Human resources. ■ RUMSL its contractors will inform workers of their rights under national labour and employment law ■ Policy must be clear and understandable to all workers	■ Centrally organize all policies and procedures; ■ Identify and record responsible person and last date modified; ■ Conduct an annual review of all policies and procedures; ■ Prominently display policies and procedures in all local languages, especially which the staffs and workers understand; ■ Appoint a person responsible for monitoring policies and procedures related to labour law implementation; ■ Implement standardized routine training	■ The contractors will be required to put in place a well-defined and documented Human Resource policy at the outset of the project in order to ensure efficient and fair management of workers engaged in the overall process of work. In case the contractor has existing HR policy, the same can be made applicable for the workers to be engaged for the project.	■ Complete review of all policies and procedures ■ Review of management-worker committee meeting minutes ■ Communications (memos, letters, etc.) to workers, suppliers, contractors and multi-stakeholder groups ■ Interviews with management and workers ■ Interviews with external stakeholders ■ Budgets related to implementing labour policy ■ Training curricula and logs
2	Working Relationship Policy ■ RUMSL & its contractors will document and communicate working conditions and terms of employment to all workers ■ Wages and benefits must be clearly communicated and understood by all workers	■ Provide all workers with a contract in their native language ■ Provide documented training on contracts, wages, benefits and deductions for all workers ■ Routinely provide workers with a clear record of pay calculations in the form of wage slips	■ The working relationship policy can be a separate document or it can be integrated with the HR policy. The working relationship policy will essentially ensure ■ Coverage of each category of workers including direct workers, contract workers and supply chain workers who will be engaged in operation; ■ Consistent with regulatory requirements on labour as per the national and state labour regulations;	■ Contracts for all workers ■ Policies and procedures related to worker contracts and wages ■ Communication and training on wage calculation, including local laws ■ Payroll records, time sheets ■ Piece rate or performance pay calculations verified against minimum wage ■ Worker interviews
3	Working Conditions & Terms of Employment Policy ■ If there is a collective bargaining agreement, RUMSL & its contractors will respect its terms	■ On-going internal verification that all workers are receiving wages and benefits as prescribed by law	■ Defined Terms of Employment and procedure for sharing the same with each new worker in a transparent manner; and	■ Collective bargaining agreement (if one exists) ■ Worker contracts

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
	■ RUMSL & its contractors must provide reasonable working conditions and terms of employment, at a minimum complying with the various local laws as described in this plan	■ On-going communication and training on legal labour rights and company personnel policies ■ Worker representatives meets regularly with HR and company management ■ Training on minimum legal benefits for all workers, including contractors, and employment agencies	■ Procedure for establishing and updating records of employment relationship conditions.	■ Policies and procedures related to wages, benefits, hours and leave ■ Wage calculations as they relate to local laws ■ Worker and external stakeholder interviews ■ National law as it relates to wage and benefit minimums ■ Employment and termination records
4	Workers' Organizations			
	■ RUMSL & its contractors will recognizes workers' rights to form and to join workers' organizations ■ RUMSL & its contractors cannot interfere with or discriminate against workers who choose to organize ■ Worker representatives must have access to management ■ Worker organizations are expected to fairly represent the workforce	■ Clear communication to workers on their rights to collective bargaining ■ Allow workers to raise workplace related issues; ■ Regular training on worker-manager communications ■ Regular meetings of management and worker representatives ■ Periodic documented communication with local unions and NGOs	■ The purpose of forming a trade union/workers organisation is to create a platform for collective bargaining to protect the interest and rights of the workers with regard to working conditions and the terms of employment. The contractors will have to abide by the Indian regulations on provision for trade union and the workers should not be restricted by the contractors to form trade union, if they wish. ■ The construction phase is likely to engage migrant labour and is expected to be over in one-two years after getting started. During this phase, the labourers should be provided a suitable mechanism to raise their grievances and genuine work related issues, alternatively allow them to create a platform for collective bargaining. ■ During operational phase of the project, contractors will be required to consider following mentioned measures to ensure freedom of association for workers and provide them an alternate grievance mechanism ■ The contractors shall have clear communication with the workers on their right to form trade union and collective bargaining;	■ Documented policy regarding collective bargaining ■ Minutes and records from collective bargaining sessions, reviews or other actions ■ Procedure for workers to select worker representative without management interference ■ Interviews with workers, NGOs and trade unions ■ Collective bargaining agreements ■ Grievance mechanism

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
5	Non-Discrimination & Equal Opportunity ■ People should be hired, promoted and compensated solely based on their ability to do the job ■ All workers should have equal access to training, tools and opportunities for advancement ■ All workers should be free from harassment by management or other workers ■ Positive discrimination may be allowable in cases where it protects disadvantaged or excluded groups and provides them special opportunities	■ Clearly define anti-discrimination policy in hiring, training, promotions and compensation ■ Regularly review worker and manager demographics ■ Develop long term remediation plan to address past discrimination ■ Provide regular training to workers and managers ■ Establish confidential and secure communication channels for workers to reach managers ■ Actively promote a harassment-free workplace	■ The contractors will be required to make employment decisions on the principle of equal opportunity and fair treatment and will not discriminate with respect to aspect of the employment relationship like recruitment and hiring, compensation, working conditions and terms of employment, promotion etc. ■ Contractors however will have to give preference to the project affected people during the recruitment process as part of the R&R policy which has a provision for employment to one member of each affected family.	■ Discrimination policy and related employment policies and procedures ■ Company policy and procedure to address and manage discrimination issues when found ■ Comparative demographics of workers and managers ■ Documentation of handled discrimination cases ■ Diversity training curriculum and attendance log ■ Interviews with workers and managers, including those who may be likely to be discriminated against ■ Interviews with local NGOs and trade unions ■ Hiring, promotion and termination records ■ Local laws related to discrimination ■ Hiring of the local residents/ PAFs in the various jobs
6	Retrenchment ■ RUMSL and its Solar Plant developers will develop and implement a plan to mitigate the adverse impact of retrenchment if it anticipates a large number of layoffs	■ Policy and procedure for workforce reduction, including worker selection ■ Analysis of alternatives to workforce reduction	■ The contractors may be asked to prepare such a lay off plan especially if the local community is engaged as labourers, as most of the migrant labourers are shifted to other sites for work by the contractor itself.	■ Policy and procedure related to workforce reduction, severance and transition ■ Analysis of alternatives employed for workforce reduction.

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
	The plan will incorporate non-discrimination principles and include the input of workers, their organizations, where appropriate, the government	- Engage workers in discussions with workers related to workforce reduction early as possible - Communication to all workers about why and how the reduction will take place - Discussions with local NGOs about how the community impact of workforce reduction could be minimized		- Procedures for selecting workers impacted by workforce reduction - Documentation of prior instances of workforce reductions - Minutes from management meetings and discussions - Communications with workers related to workforce reduction - Communications with external stakeholders and community groups
7	Grievance Mechanism - RUMSL & its contractors will establish a transparent process for workers to express concerns and file grievances - There will be no retaliation or discrimination against those that express grievances - RUMSL & its contractors will treat the grievances seriously and take appropriate action - RUMSL & its contractors grievance mechanism does not replace other channels as defined by law or collective bargaining agreements	- Establish clear policies and procedures for grievances - Communicate the grievance process to all workers in a clear, understandable manner - Provide on-going training to all workers - Document all grievances and the resulting actions - Make worker representatives a key part of the process	- For a healthy work environment, contractors should create an atmosphere where workers feel safe expressing their concerns and the grievances are settled mostly through informal channel and workers don't feel the need to lodge the complaint. However there should be a formal grievance redress mechanism which is simple and secure; free from fear of retaliation; responsive and fair, and allow workers to file anonymous complaints as well. The grievance mechanism system should not impede the aggrieved to access to court in case he/she is not satisfied with the outcome derived from the formal system. - For an effective grievance redress system, the contractors will have to - Establish clear policies and procedures for grievances based on above outlined principles; - Communicate the grievance process to all workers in a clear, understandable manner; - Document all grievances and the resulting actions; and - Make worker representatives a key part of the grievance redressal process.	- Documented policy and procedure for worker grievances - Worker and manager interviews - Training curriculum and log on grievance handling - Communications to workers, supervisors and managers - Records of complaints lodged and actions taken on grievances - Employment and termination records

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
8	Child Labour - RUMSL & its contractors will not employ workers under the minimum age for employment as defined by national law (i.e. below 18 years of age) - Workers between the minimum age and 18 will not be employed in dangerous work or work that interferes with their education or development - The Indian regulation recognises a person as a child who has not completed his/her 14 years of age. The World Bank ESS 2 requirements say that company cannot employ workers under the minimum age (completed 14 years in Indian context) and workers between the prescribed minimum age and 18 years may be employed in non-hazardous working conditions with certain terms and conditions.	- Write clearly defined policies and procedures for age verification – make them publicly available - Develop remediation plan for use in cases where children are unknowingly employed despite RUMSL's Anti Child Labour policies and procedures (ex: child presents false ID) - Engage with local stakeholders to develop proactive plans to address child labour issues - Communicate child labour policies to RUMSL's suppliers and contractors – and provide them with the training and tools to address the issue	- The migrant contract labourers may be expected to bring their family along during the construction phase of the project. The family might also accompany the labourer to their work place thus enhances the possibility of child labour at varying scale. Further during the operational phase of the project, the possibility of adolescent workers (between 14 to 18 years) entering into hazardous working conditions cannot be ruled out. - The contractors will need to adopt suitable proactive mechanisms to prevent child labour in any form. Some of the measures in this regard could be as follows; - Identify the types of activities during the entire project operation that could have a possibility of child labour; - Clearly defined policies and procedures for age verification; - Visual observation and verification thereupon; - Develop remediation plan for use in cases where children are unknowingly employed despite the clear policy and procedure of contractors on no-child labour.	- Policies and procedures for age verification in hiring - Interviews with workers, local children, trade unions and NGOs - Visual observation - Pay records, medical records, birth certificates, panchayat certificate
9	Forced Labour - RUMSL & its contractors will not employ forced labour - Workers have the right to retain their personal documents and money - Workers are free to leave the workplace after work - Workers have the right to resign	- Clearly define worker's freedom in employment contract - Provide employment contracts to all workers in their language - direct or contracted - Define and enforce policy regarding use of employment agencies and expectations	Any involuntary work which is performed under threat of force or penalty, is considered as forced labour. It can be in form of bonded labour, indentured labour or similar labour arrangement, slavery or slavery like situation. There can be a possibility of forced labour by sub-contractors or petty contractors during the construction or operational phase of the project; however the likelihood of forced labour is expected to be negligible for the regular workers during operational phase in	- Employment contracts in all appropriate languages - Contracts with employment or recruitment agencies - Payroll records, timesheets and wage deduction calculations - List of permanent workers and contracted workers at RUMSL facility - Worker IDs

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
		■ If employment agencies are used, audit relationship between the agency and the workers ■ Provide training for all workers to explain their rights ■ Pay all job related training and equipment expenses	view of hiring system structures in place and an adequate HR management department.	■ Interviews with all workers, employment agencies and external stakeholders ■ Interviews with security guards
10	Occupational Health & Safety ■ RUMSL & its contractors will take all reasonable precaution actions to protect the health and safety of workers ■ Ensure that workers are not exposed to unnecessary or unreasonable risks at the workplace, dormitories etc. ■ Implement an OHS management system consistent with international standards such as OHSAS 18001. ■ Systematically assess all of the OHS risks, conducting a comprehensive job safety or job hazard analyses. ■ Implement preventive and protective measures according to the order of priority: - Eliminating the hazard, - Controlling the hazard at its source, Minimizing the hazard, Providing appropriate personal protective equipment ■ Document, investigate and report all accidents and occupational diseases.	■ Structuring an OHS team and an OHS accountability framework (including production area) ■ Conducting a comprehensive job safety or job hazard analyses ■ Developing a Corrective OHS Action Plan based on the likelihood and severity of the consequence of exposure to the identified hazards ■ Proper equipment design, maintenance and procedures, such as: Designing machines and equipment's like stairs, to eliminate trap hazards ■ Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts or being serviced ■ Marking and checking all energized electrical devices, cords and lines with warning signs ■ Implementing proper monitoring systems of hazardous agents and proper control measures (eliminating risk, PPC, PPE)	■ RUMSL and its Solar Plant developers is expected to have its own system. Either the MDO/ contractor will have to completely follow RUMSL's OHS system or in case it has its own, it needs to be reviewed by RUMSL, before the starting of the work during construction or operations. ■ <u>Some examples of things to be done include:</u> ■ Integrity of Workplace Structures – reachable, easy to clean, fore resistant, floors ■ Workspace and exits – unobstructed, clearly marked, consider disabilities ■ Fire Precautions ■ Amenities- toilets, potable water, lighting ■ Safe Access –even pathways, falling objects, railings ■ First Aid- training ■ Fresh air supply ■ Physical Hazards- Working at heights, Vibrations, Electrical, Ergonomics, Illumination ■ PPEs ■ Communication- Induction orientation, training	■ Visual observation ■ Exposure to hazardous agents monitoring log ■ Manager and worker interviews ■ Accident and medical treatment logs ■ Equipment maintenance logs ■ Fire and safety drill logs ■ Health and safety risk analysis ■ Health and safety inspection logs with test results ■ Government health inspection reports ■ Training curriculum and logs

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
	- Investigate and identify the root causes of all accidents with working time loss, and implement appropriate corrective actions - Note: This can be done through the involved contractors also.			
11	Non-Employee Workers of RUMSL - RUMSL will extend the previously discussed indicators to contractors hired directly or through employment agencies. - RUMSL will not use contracting as a means of circumventing labour rights and laws. - Employment and recruitment agencies will be monitored to verify their adherence to labour rights and laws.	- Provide employment contracts to all workers in their language - direct or contracted - If employment agencies are used, audit relationship between the agency and the workers - Provide training for all contracted workers to explain their rights - Include contracted workers in grievance process access and training		- Contracted labour contracts in all appropriate languages - Contracts with employment or recruitment agencies - Payment records, timesheets and wage deduction calculations for contracted workers - Listing of direct employees and contracted workers at RUMSL's Solar Park site - Interviews with managers, employment agencies and external stakeholders - Interviews with contracted workers - directly contracted and through agencies

Worker's Accommodation

The requirement of workers accommodation stems from the type of workforce that will be required during the construction and operations phase of the project.

RUMSL & its contractors will have to adopt the following approach to handle the issues of workers accommodation and it should be dealt step by step in following manner:

- Assessment of the type and number of workers who will be requiring accommodation facility;
- Impact assessment of workers accommodation on local community and accordingly plan mitigation measures;
- Identify applicable regulatory requirements on establishment of workers colony; and
- Determining the standards to apply to the location of facilities, the construction of housing and provision of facilities
- Managing accommodation.

Apparently local working population of the project area cannot meet total project workforce requirement, therefore it is likely that workers from outside will need to be recruited. Given the remote location of the project, the outside workers will require adequate accommodation arrangements.

Types of workers requiring accommodation arrangement can be classified in following categories:

- Migrant labourers during construction phase
- Supervisors and executives of the contractors engaged in construction phase
- Regular workers, supervisors and executives during operational phase.

Housing standards for workers accommodation

Labour Colony:

The contractors would be recommended to prepare temporary accommodation facilities for the construction labourers preferably within the lease boundary, away from existing local community so as to leave minimum possible adverse impact upon local community. The standards that are to be maintained for labour colonies will be:

- Allocation of minimum space per person or per family;
- Supply of safe water in the workers' dwelling in sufficient quantity;
- Adequate sewage and garbage disposal systems;
- Adequate sanitary and washing facilities, ventilation, cooking and storage facilities and natural and artificial lighting;

If the contractors are required to provide accommodation for single labour or labour separated from their family, following standards should be suitably applied;

- A separate bed for each worker;
- Separate accommodation for families and bachelors;
- Adequate sanitary conveniences;

- Common dining rooms, canteens, rest and recreation rooms and health facilities, where not otherwise available in the community.

Further as per the Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act 1996, the contractors will have to provide temporary accommodation facilities to the construction labourers free of cost and as soon as construction work is over, the employer at his own cost will remove/destroy the temporary structures and restore ground in good level and clean conditions.

Workers Colony

The contractors will have to abide by all applicable rules and regulations pertaining to the design and construction of the building as well as facilities to be provided therein while planning for the accommodation arrangements for the workers. Further a suggestive guideline for workers accommodation arrangement based on international standards is prescribed below.

Standards for Workers Colony

Standards Parameter	Requirements as well as Monitoring indicators
Location	Reasonable distance from Project Site Adequate Transportation arrangement
Drainage	Proper drainage system Avoid accumulation of stagnant water
Ventilation	Adequate ventilation and air conditioning system Natural lighting available Artificial lighting available
Water	Adequate and convenient water supply Drinking water meeting national and WHO standards Regular monitoring of drinking water
Waste water and solid waste	Proper discharge of waste water and sewage Establish Sewage Treatment Plant (STP) if required Solid waste management system Pest control mechanism
Bachelor Accommodation	Separate bed for each worker Minimum space available Storage for personal belongings Separate storage for PPEs
Family Accommodation	Adequate space Other suitable housing facilities described in this table
Toilet facilities	Adequate number of toilets Convenient location Constructed of good materials Easily cleanable Kept in working condition Separate for male and female except for family accommodation
Bathrooms and other sanitary facilities	Made of anti-slip hard washable materials Adequate number of bathroom and hand wash facilities Kept in working condition Convenient location. Separate for male and female except for family accommodation Adequate supply of cold and hot running water

Standards Parameter	Requirements as well as Monitoring indicators
Canteen and cooking arrangement	Adequate space Constructed of good and easy to clean material Option for separate cooking Adequate space for separate cooking Hygiene in canteen/dining halls and cooking facilities Adequate facilities for cleaning, disinfecting and storage of cooking utensils and equipment Adequate food waste disposal
Laundry	Provide laundry facility
Nutrition and food safety	Appropriate level of nutrition value Consideration of religious and cultural background of workers in food selection Workers could have choice of food
Medical facilities	First aid facility Own dispensary
Recreational, social and market facilities	Community centre for social gathering Market complex Provide possible recreational facilities like tennis court, swimming, park etc.

- Considering the current pandemic situation, RUMSL is recommended to follow the SOPs on COVID 19 below. The Site team and EHS personnel shall closely monitor and take the responsibility of proper implementation of the given below SOP.

Box F.1 SOP on CoVID 19 Pandemic

CoVid 19 SOP to be followed in Labour Camps

The speed of CoVid 19's spread, and the nature of virus, has given rise to concerns with respect to safety of workers as well as that of members of the public with whom workers may come into contact. To better understand physical & economic risks to workers, RUMSL should ensure that these considerations are properly integrated into the emergency response plan. A brief and non-exhaustive overview of prevention and response measure has been provided below though the understanding and medical advice is being updated frequently, and the measures must be updated to the most recent advice, including central, state and district level guidelines:

- Providing information about CoVid 19 to engaged staff & workers at site level
This process will include awareness campaigns, training or the establishment of specific communication channels. No practice of discrimination against or stigmatization of person affected, or his family;
- Encourage workers to stay at home, in-case they report symptoms of CoVid 19.
 - In this case, a RUMSL shall ensure a separate accommodation facility for the affected/ or CoVid symptomatic person;
- Awareness about proper cough hygiene should be given, also a proper use of soap, frequent hand wash, sanitizers should be given;
- Staff & workers to strictly follow social distancing at work place;
 - Shall ensure that workers maintain a safe distance of 2 meters at workplace, limit gatherings and work in shifts, up to large extent;
- Cleaning and dis-infecting protocols should be extended to food preparation facilities, kitchen staff should be strictly prohibited if they discover any symptoms of CoVid;
 - Shall improve ventilation or air- filtration, when not in open space. The accommodation facilities provided, should be ensured to have proper ventilation and air-filtration facility;
- Usage of PPEs at workplace;
 - This involves usage of gloves, mask, facemask etc. at workplace. Especially when they are working in a large number during construction phase. Proper disposal of PPE kits at daily basis should be monitored;

Responsibilities and Accountabilities

The overall responsibility of aligning the contractor labour relationship as well as maintaining labour standards as per the regulatory and international standards would be vested with the Human Resource department of the key contractors. These key contractors would also be held responsible for regulating labour issues of their sub-contractors or petty contractors.

The role of RUMSL will be limited to periodic monitoring and provide direction in case of any deviation from the standards. RUMSL will also be empowered to take strict steps against contractors in case any serious violation of labour issues like child labour, bonded labour and so on is observed in monitoring process.

However, the overall responsibility of ensuring the compliance to the standards rests with RUMSL, and to ensure that contractors are abiding by the same.

RUMSL will therefore need to put especially some staffs dedicated to the labour management and OHS issues:

1. Supervisor (S&C);
2. EHS specialist
3. EHS supervisors

Contractors of RUMSL will put in similar corresponding staff for the direct implementation of the labour management plan:

1. Dedicated Health & Safety supervisors
2. Dedicated labour officer
3. Dedicated supervisor for HR, HR policy and working conditions, wages & labour related issues.

Contractor's responsibility

Within 30 days from the appointed date, the Contractor shall prepare and submit 4 hard copies and 1 soft copy of Labour Influx and Worker's Camp Management Plan to the concerned PEA that addresses specific activities that will be undertaken to minimize the impact on the local community, including elements such as worker codes of conduct, training programs on HIV/AIDS, etc. A Workers' Camp Management Plan addresses specific aspects of the establishment and operation of workers' camps. This Labour Influx and Worker's Camp Management Plan will include:

- mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;
- informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;
- introducing a Worker Code of Conduct as part of the employment contract and including sanctions for non-compliance (e.g., termination), manual scavenging, engagement with local residents, child labour, non-discrimination, harassment of co-workers including women and those belonging to SC and STs and other minority social groups;
- contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence;
- training programs on HIV/AIDS and other communicable diseases;

-
- workers' Camp Management Plan addressing specific aspects of the establishment and operation of workers' camps provided the Local Body/ Executing Agency is unable to cater to the demand for affordable housing for this additional workforce in terms of rentals, hostels, apartments, etc.; and
 - complaint handling Mechanism at the project level.

Monitoring and Evaluation

RUMSL will put in place a robust mechanism for the purpose of monitoring and evaluation of the Labour management practices for its project. The monitoring would not only help keeping track of labour related management practices on ground, but also to improve the existing identified gaps which will require to be addressed while meeting the need to comply with the regulatory and International standards. RUMSL will ensure setting up of both internal and external monitoring systems to assess the progress and evaluate the performance on the labour management practices.

Internal Monitoring

Internal monitoring of the labour management implementation will be done by the Social and Community Supervisor of RUMSL in case the labour officer is not appointed; however preferably a labour officer will be appointed. The labour officer will coordinate with the EHS officer and representatives from the sub coordinator part to conduct internal monitoring from time to time. Internal monitoring will also be done through regular submission of the reports from the sub-contractor side on various monitoring indicators as mentioned in tables above.

Apart from daily or weekly reporting, monitoring will also be carried out on quarterly basis to assess the performance on the various labour related issues. The findings of these internal monitoring and will be documented and brought before the advisory committee for review and guidance.

External Monitoring/Evaluation

External monitoring of the labour management practices being carried out under the project will be done independently by a third party at the end of each financial year to monitor the labour management practices. External monitoring will also be based on various monitoring indicators as mentioned earlier.

Allocation of finances

The sub-contractor will be responsible for the financial allocation of resources to implement the contractor and labour management plan. Sub-contractors for the various aspects of the project will be responsible for incorporating the cost of implementing the construction and labour management plan at the bidding stages itself. RUMSL and its contractors in their quotation request from the contractors will be responsible for putting up the requirements from its contractor regarding the labour management plan. The cost of the labour management plan will therefore be already included in the bidding document, especially with regard to provision of the health and safety PPEs, safety managers and construction of the labour camp as required.

GENDER IMPACT ASSESSMENT AND ACTION PLAN

Background

This gender assessment intends to outline the gender situation in the Study Area and specifically in the Project villages. It also aims to identify the socio-cultural factors contributing to the gender issues that are relevant to the project, to analyze and evaluate the potential gender mainstreaming opportunities that can be adopted by the project during the course of its operation. This gender assessment is largely based upon the stakeholder consultations conducted by ERM during site visit in the month of November 2019, supported by Census 2011, which assists in presenting the current social context in the area.

There are various constitutional and legal provisions for gender equality and women's empowerment that the Government of India has charted. Some of the key such initiatives are enlisted below.

- Principles of Gender Equality are enshrined in the Indian Constitution;
- The Indian Constitution not only grants equality to women but also empowers the State to adopt positive discrimination in favour of women;
- In terms of Legal Provisions, the crimes directed specifically against women are characterised as Crimes against women and identified under Indian Penal Code.

Legal Regulations supporting Gender Mainstreaming

There are various Gender focussed legal regulations in India and the same are presented below.

- **Equal Remuneration Act, 1973** provides for payment of equal remuneration to men and women workers for the same work of similar nature without any discrimination. In order to ensure social security to the workers including women in the unorganised sector, the Government has enacted the Unorganised Workers' Social Security Act 2008.
- **The Maternity Benefit Act, 1961 and The Maternity Benefit (Amendment) Act, 2017** regulate employment of women in certain establishments for a certain period (26 weeks) before and after childbirth and provides for maternity and other benefits.
- **The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act (POSH), 2013** has been enacted, which covers all women, irrespective of their age or employment status and protect them against sexual harassment at all workplaces both in public and private sector, whether organised or unorganised.

Additionally, India has also ratified various international conventions and human rights instruments committing to secure equal rights of women. Key among them is the ratification of the Convention on Elimination of All Forms of Discrimination against Women (CEDAW) in 1993.

Understanding Women's role in Society, in the Project context

Role in Livelihood and Economic activities

According to the discussions undertaken during the ESIA It is understood that women make significant contributions in terms of time and effort within the household and in economic activities, especially agriculture, and non-farm labour. They have nearly equivalent participation in agricultural field based activities, including tending to livestock although it is not accounted for in terms of a remunerative activity; however the men lead the sale and purchase related tasks related to agriculture, and livestock products and all other key decisions. The role of women is predominant in livestock herding, and collection of firewood/fodder, particularly among the households with marginal landholding and/or landless households.

Role in Agriculture and Livestock

The role of women in agriculture is viewed as supplementary in nature, and their main responsibility is towards tending to livestock. Labour work in agriculture is associated with sowing, harvesting, cutting, collection of fuelwood, and loading/unloading activities. The difference in nature of activities is also reflected in the remuneration, as women are generally paid 100 – 200 INR lesser, as compared to men, for daily agricultural labour work.

With regards to livestock, although the responsibilities are shared by both men and women, women are involved major share of the activities – stall feeding, washing of the animals, preparation of dung cakes, milking the animals, while the men are involved in open grazing. If the men of the household are occupied in agricultural activities, then open feeding is undertaken by either youth of the households, or by a rented herder/grazer. However, the sale of livestock/livestock products (milk) is controlled by men. There are also socio-economic variations as women from SC/Muslim and poor households tend to be employed for tending to livestock of upper caste households.

In Ladwan village of Agar, which have a an active presence of SHGs, the women of the households have oragnized into a collective entity and are involved in collective decision making in the village. The SHG provides microcredit facilities for purchasing income generating assets such as livestock, which by and large, is the responsibility of the women folk. As highlighted, grazing and tending to livestock is primarily the responsibility of women, and children in the household and hence they have certain decision making power in matters involving access to grazing land, reduction in grazing land area of the village due to developmental projects.

Role in household activities

Similarly, the responsibility of women in household activities is higher in proportion to that of the men, except in case of decision making regarding purchase of assets and household expenditure. Control over ownership of assets and property is limited.

A typical day for women of the household, as described during consultations with women groups is described here - Women divide time between household and agricultural work: They wake up at 5 a.m. and finish all household chores, including tending to livestock of the household by 11 a.m. and then leave to work on field. On the field, they are involved in cutting, sowing, threshing, watering, and collecting fuel wood. They return by 4 – 5 pm, and once back, prepare meals for the family members. The role of women, is restricted care givers for the elder members of the family, children and livestock, firewood collection, cow dung cakes preparation, etc.

Role in decision making

The men lead in the decision making process at the household and community level, although the participation of women is understood to be crucial, especially at the household level. According to the consultations undertaken, the women are reported to have limited say in the financial decision making or land transactions; however, in aspects such as agricultural activity and the education of the children, women are reported to take more decisions than men

Gender Lensing of Socio-economic impacts of the project

The detailed social baseline for the project is presented in **Section 4** of ESIA and the understanding of the same in project's context has led to assessment of potential impacts of the project. As per the land data provided by RUMSL,

The potential social impacts that can be caused by the project on women can be broadly categorized as the following.

- Reduction of Land-holdings and loss of agricultural income to the Private and Patta Land Holders, agricultural labourers, etc.
- Reduced availability of government land currently used by women for grazing, collection of fodder/firewood, and also loss of the access spaces
- Community Health and Safety related impacts;
- Impacts on Community Resources like Water, Roads, Forests and temporary use of land during construction phase; and
- Potential positive impacts due to availability of short-term employment opportunities in the project as housekeeping staff; due to development activities that can be undertaken with the existing SHGs

The receptors of these socio-economic impacts is focused on female residents in the project area, whereas in the general nature of operations, the mitigations are implemented in a gender-agnostic manner.

In cases where the land from Women Headed households are procured, there is a chance that the household is rendered landless and thus special assessment of the situation needs to be done. The impact on Women due to project activities is detailed in **Section 6.4.8**, which comprises the mitigation measures as well as assesses the Impact significance.

The detailed Gender Action Plan has been devised for implementation of the action items identified, which is presented in Table below.

The mitigation measures that will be derived on Gender aspects during RAP and LRP surveys, shall also be guided by this Gender Action Plan.

Gender Action Plan

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
Loss of Land Related Impacts					
Ensure that the land sellers inform and disclose the sale of land parcels for the project to their household, including women	Ongoing till completion of land procurement	RUMSL along with Tehsil Administration	Review of Sale Deed	NA	Public disclosure of the timelines, with a focussed women's meeting at the village level to disclose land procurement activities and time lines
It is recommended that the proceeds from the sale of land should get deposited in a joint bank account with the spouse, if feasible	Ongoing till completion of land procurement	RUMSL along with Tehsil Administration	Review of Bank account ownership documents prior to release of payments	There might be an existing bank account with single user's name and the key member of the family will be reluctant to make the changes	- Put across this requirement during the initial stages of land related discussion. - Require the presence of the spouse at the time of hand-over of the cheque or sale agreement papers.
If the land is purchased from a Woman Headed household, then special provision for confirming the bank account use (by the women and not other family member) needs to be done to ensure against fraud	Within 6 months of initiation of construction	RUMSL	Review of Sale Deeds and bank account name and access by actual holder.	NA	Liaise with the bank branch to ensure against misuse. Financial literacy training programs should be conducted for women in the project area and

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
					specifically for the ones belonging to PAHs.
As part of the livelihoods restoration plan, development of a fodder intensification program and creation of fodder lots for ease of access and availability of fodder and firewood near project villages	Within 6 months of initiation of construction	RUMSL	Allocation of grazing land parcels and providing demarcated access routes to the same; disclosure of the same to women groups	Lack of use due to distance issue of the parcel and power relations in the village may prevent women from households considered to be "lower" castes in accessing such land	Assist in creation of a village level committee with representation from project, for smooth functioning and decision making over access and control of such collective/common resources
Access to other Common Property Resources (surface water bodies, firewood collection, etc)	Within 3 months of initiation of construction	RUMSL	Creating common fodder lots, providing access to existing water bodies; disclosure of the same to women groups.	Appropriate access to women (including from "lower" caste to alternative CPRs; increase in time, due to more distance to access may result in lack of use	
Employment related impacts					
During planning and construction phases, all community consultations shall have a target of at least 50% female participation in all the Project Villages, particularly in Kerwa Khedi, Binakhedi and Dudhpura where women were not present during the consultations for baselines	Ongoing till construction phase	RUMSL, EPC contractor representative (during the construction phase) Project operator (operations phase)	- Sex disaggregated data of attendees shall be documented in records of Stakeholder Consultations; - Photo documentation and signatures of attendees	- Reduced participation of women due to socio cultural norms; - Silent presence of women during consultations due to cultural norms of women not speaking up in a village	Organize separate women's consultations or FGD with women's groups to understand their perspective, provide project updates Require sign-off on key information disclosure,

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
studies to ensure that women are not only involved and aware but also have the opportunity to participate in decision-making. Organize separate women consultations or FGD with women's groups to understand their perspective, if the women do not express opinions as part of larger groups				gathering in front of men.	and community decisions through the construction phase
Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development, community investment and CSR programmes in light of the same, to ensure that benefits also target women	Within 6 months of initiation of construction related activities	RUMSL along with SPDs	- Need Assessment Report; - Monitoring of progress of action plan	Sustainability of the CSR programs might be an issue, in terms of long term benefits	- Clear communication on objective and duration of CSR programs; - Selection of Implementation partners that can provide linkages to livelihood programs that are sustainable and include methods to target women's benefits.
Ensure that the contract agreements with contractors contains clauses on requirement for contractors to hire at least 20% women as staff and workers for the	Within 3 months from Plan implementation, up to completion of construction related activities	RUMSL	- Review of sex disaggregated pay sheet records of each month; - Cross verification of the select workers on periodic basis.	Contractor considers it is hard to source women	Advertisements for job vacancies for women should be posted at key locations near the project area,

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
project and ensure equal pay for women for same nature of work as added as clauses in the contract agreements for the contractors.					comprising bus stops, Government schools, Government hospitals, dispensaries, etc.; Talk about the potential job opportunities for women during community consultations and get a feedback on the women with required key skills that are interested.
Contractor shall provide safety gear and protective equipment to keep both men and women workers safe on the job	Ongoing up to completion of construction activities	RUMSL along with Contractors	Visual observations/ audits	Contractor may site financial constraints	Include these provisions as part of contract agreements with contractors to set expectations initially
Provide segregated toilet and sanitation facilities for men and women with reliable water supply, proper lock and lighting.	Ongoing	RUMSL along with Contractors	Site visits and site maps should include separate male and female toilets	Contractor may site financial or logistical constraints	Include these provisions as part of contract agreements with contractors to set expectations initially

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
Ensure that a crèche is established if the women engaged at the project are 50 or more, as per provisions of Maternity Benefit (Amendment) Act, 2017	Prior to commencement of construction activities and ongoing till completion of construction	RUMSL along with Contractors	Physical verification	Contractor may site financial or logistical constraints	Include these provisions as part of contract agreements with contractors to set expectations initially
The staff and workers recruited for the project, including the EPC and O&M contractors and their sub-contractors shall undergo periodic trainings on Prevention of Sexual Harassment as per the corporate POSH policy of the project (developed by RUMSL), which will be applicable for the project. Additionally train the staff and workers on provisions of GRM that are applicable for them and ways to use the GRM for the project	Start of Construction phase activities and ongoing on monthly basis	RUMSL	- Records of Trainings in terms of number of staff and workers trained in each session; - Photo documentation of training session	None foreseen	NA

STAKEHOLDER ENGAGEMENT PLAN

Background

Rewa Ultra Mega Solar Limited (RUMSL) is a Public Undertaking Company incorporated on 10th July 2015 as a 50:50 joint venture (JV) company between Solar Energy Corporation of India Limited (SECI) and Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL). Its primary objective is to develop and facilitate development of large scale solar power projects in the state of Madhya Pradesh.

RUMSL is planning to develop three Solar Parks in Madhya Pradesh and their associated internal evacuation infrastructure and transmission lines. This Stakeholder engagement plan is developed as part of the Environmental and Social Impact Assessment report for proposed 550 MW Agar-Susner Solar Park.

The proposed 550 MW Solar Park is proposed to be developed on allotted 1407.362 Ha of land area spread across eleven villages of which seven villages comprise the land area of Unit -4 in Agar tehsil, and four villages comprise the land area of Unit -5 in Susner tehsil, both of which are Agar-Malwa district of Madhya Pradesh. The Solar Park lies between 23°44'38.58"N latitude and 76° 7'1.26"E longitude for Unit 4, and between 23°55'28.07"N latitude and 76° 2'21.30"E longitude for Unit 5.

An ESIA has been prepared for this site and this document, is a management plan for stakeholder engagement activities.

Objective and Scope of SEP

This document presents the Stakeholder Engagement Plan, which is applicable all activities proposed to be undertaken for the RUMSL Agar Solar Park, as well as other stakeholder engagement that is conducted by the project proponent (RUMSL), the private Solar Project Developers (SPD) or other parties contracted by RUMSL, that engage with the key stakeholders identified as part of this Plan.

The main objective of this document is to guide stakeholder consultations across various stages of the project, while meeting the requirements of the applicable reference framework for the Project. Overall, this SEP will enable stakeholder engagement to be undertaken in a systematic and meaningful manner, where the various stakeholder groups are able to express their individual views, opinions and concerns, while allowing the Project to appropriately respond to them.

The objective of the Stakeholder Engagement Plan are as follows:

- Identification of the stakeholder groups in the project location and analysis of their profiles, interests, issues/impacts and concerns relevant to the project;
- Identification of specific measures to allow meaningful engagement with different stakeholder groups identified in a manner that is transparent and accessible and using culturally appropriate communication methods with a specific focus on the stakeholders with high influence/impact ;
- Facilitate adequate and timely dissemination of information to the stakeholder groups in a culturally appropriate manner;
- Provide systems for prior disclosure/dissemination of information and consultation including seeking inputs from affected persons, incorporation of inputs, as applicable, providing feedback to affected persons/groups on whether and how the input has been incorporated; and
- Providing a mechanism for documentation of the activities undertaken and the reporting and monitoring of the same.

Scope

The Stakeholder Engagement Plan document applies to the entire project lifecycle (planning or pre-construction, construction and operations phases) and shall be considered as a live document that shall be updated regularly, as required. This stakeholder engagement plan (SEP) will be used and updated by the project proponents and its various teams (internal as well as contracted), performing various tasks linked to the project, comprising ESIA, RAP and FPIC processes, through interactions with various stakeholder groups like Tehsil level officials, Revenue Inspector, Patwari, officials from RUMSL, etc.

Methodology

The stakeholder engagement plan is guided by the Stakeholder Engagement strategy developed for internal use at ERM, to ensure consistency in the message and communication being undertaken with the identified stakeholders, by all teams that are involved in ESIA, RAP and FPIC/IPDP preparation.

During the environmental and social impact assessment consultations process, ERM conducted various activities as part of the development of the public consultation program to determine the relevant stakeholders. From the ESIA field-consultations, ERM has identified approximately key stakeholder groups and categorised them as Primary and Secondary stakeholders, based on the nature and extent of impact of project and influence of stakeholders on the project

There may be cases where additional stakeholder categories are identified during the RAP-LRP and FPIC/IPDP survey processes, and/ or the profile of these stakeholder groups (Primary or Secondary) is updated based on detailed assessment from impacted entities by the project. The details of these engagement activities and key points of discussion are captured in **Appendix B** of the document.

Furthermore, the surveys for the Resettlement Action Plan and Livelihoods Restoration Plan (RAP-LRP) and FPIC/IPDP preparation are planned July 2020 onwards in the project villages of Pipalya Kumhar, Karwa Khedi, Kesai Dehariya, Dudhpura, Ladwan, Madhopur, and Bijnakhedhi of Agar Tehsil and Pipalya Nankar, Naharkhedha, Umariya, and Palda of Susner Tehsil, which will primarily comprise the following stakeholder categories. Separate meetings with women and men may be held, as required:

- Private Land Owners;
- Users of the affected land categories, including agricultural labour, graziers, users of government land for grazing, etc;
- Indigenous Groups present in the Project village of Ladwan in Agar;
- Other groups or institutional entities that are identified at the time of detailed RAP surveys.

Applicable Reference Framework

This Stakeholder Engagement Plan is prepared as per the requirements of the following regulations and standards:

- Relevant environmental, land labour and other relevant policies, laws, regulations and rules of the state of MP, and the Government of India;
- World Bank Environmental and Social Management Framework for Solar PV Park, February 2017;
- IFC Performance Standards, 2012

Stakeholder Mapping

Stakeholder Identification and Categorisation

A stakeholder is defined as “any identifiable group or individual who can affect the achievement of an organization’s objectives or who is affected by the achievement of an organization’s objectives”. Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as **Primary Stakeholders**, those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders**.

During the ESIA process, a stakeholder identification and prioritization was conducted for identifying the key stakeholders of the project, while keeping in mind the nature of the project and its setting. Furthermore, consultations were conducted with these identified stakeholders through a participatory approach. The table below presents the key stakeholders of the project.

Stakeholder Group Categorisation

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Individual and Community	■ Private Land Owners from the Project Area villages ■ Encroachers on government land ■ Squatters for agriculture on government land ■ Farm and non-farm labourers ■ Graziers ■ Banjara households sustaining direct impacts(IP) ■ Women groups ■ Livestock holding households who use the government land for open grazing for their livestock ■ EPC Contractors ■ Potential unskilled labourers to be engaged during the construction phase of the Project	■ Fence Line Community ■ Vulnerable Social Groups ■ Other Indigenous people
Institutional Stakeholders	■ Gram Panchayats of the Project Villages ■ Agar and Susner Tehsildars; ■ Patwaris	■ Local Political Groups ■ Civil Society/Local Non-governmental organizations (NGOs) ■ Local Media
Government Bodies/Regulatory Authorities	■ Regulatory Authorities comprising the following: - MP Pollution Control Board; - Central Pollution Control Board (CPCB) - Ministry of Environment Forest and Climate Change (MoEFCC)	

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	- Local Fire Authority; - Ministry of Road Transport and Highways - State Transport Authority; - District Collector and Revenue Department; - Central Electrical Authority through C.E(P&D) Jabalpur; - Department of Telegraph – Communication, Govt. of Madhya Pradesh; - Department of Panchayati Raj, Madhya Pradesh; - Labour Department; - Wildlife Warden, State Forest Department; - District and State Forest Department, MoEFCC.	
	■ District Administration	

11.1.1 Stakeholder Analysis

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale and frequency) or degree of influence (power and proximity) of stakeholder group and urgency/likelihood of the impact associated with the particular stakeholder group in the project context.

The magnitude of stakeholder impact/influence is assessed taking the power/responsibility and proximity of the stakeholder group and the group is consequently categorized as negligible, small, medium or large. The urgency or likelihood of the impact on/influence by the stakeholder is assessed on a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in table below.

Stakeholder Significance and Engagement Requirement

		Likelihood of Influence on/ by Stakeholder		
		Low	Medium	High
Magnitude of Influence/ Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

The coverage of stakeholders as stated above includes any person, group, institution or organization that is likely to be impacted (directly or indirectly) or may have interest/influence over project. Keeping this wide scope of inclusion in stakeholder category and the long life of project, it is difficult to identify all potential stakeholders and gauge their level of influence over project at the outset of the project. Therefore the project proponent is advised to consider this stakeholder mapping as a live document which should be revised in a timely manner so as to make it comprehensive for any given period of time.

Stakeholder Analysis

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Primary Stakeholder					
Private Land Owners from the eleven villages in the Project Footprint Area (PFA)	- Private Land Owners comprise of those households, whose land parcels are falling within land footprint of the solar park; - This group is dependent on their land parcels for their livelihood needs; - Among the communities in the villages of PFA, majority of the land holding is with the Sondhiyas, Rajputs, Gurjars, and Thakurs. While Scheduled Caste and Banjaras have the lowest or no landholding, as reported during consultations; - Among the land owning households, the average land holding reported is of 0.55 – 1.1 ha;	- The project will be set up on 51.45 ha of private land in Agar across seven villages and 82.25 ha of private land across four villages in Susner; - The dependence on land for agriculture and livestock in the area is high, as depicted in the Census data and reported during initial consultations; - The purchase of land for the project development activities will affect the livelihood of this stakeholder group due to reduced/no land holdings; - Additionally, if this stakeholder group is provided with an alternate land parcel, the quality of alternate land parcels and the effort	- The stakeholder groups' influence on the project is important to ensure their consent to sell land as per the MP Mutual Consent Policy 2014 - Their support is key for the smooth functioning of the project related activities in the area, even after land purchase, in the operations phase.	- Concerns regarding private land being procured by the Project and whether people will get a fair price, because there has been significant cost and effort expended in the preparation of the land for making it cultivable; - The community at large wants minimal disturbance with regards to access issues, pollution, health and safety risks and influx of migrant workers - This Stakeholder group may expect income generating activities or employment as construction labourers, masons, drivers, etc. during the construction phase of the Project; - Access to the GRM established for the project; - Clarity in terms of scope of work, expectations, key performance indicators,	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
		and investment required to make it fit for cultivation, is also of key concern, as the entire terrain is rocky, uneven and requires sufficient amount of top soil to make the land fertile; The private land owners also work as agricultural labourers on private agricultural land as daily wage labour. The impact on livelihood will be therefore two-fold – loss of income from reduced land holding of self, and loss of income from agricultural labour work due to reduced land holding of others.		responsibilities and timelines for the project;	
Encroachers/occupiers (for agriculture)	- Encroachment differs in Agar and Susner tehsils- - In Agar, large private land owners who are relatively economically well-off in the village, have used	This stakeholder group has been using the land for livelihood activities; though does not have legitimate claims or ownership of the land. In	The influence of this stakeholder group on the project is moderate, considering they do not have legal rights on the land; however there have	Adequate compensation for the encroached/squatted upon government land being procured for the project activities as users have made improvements to the	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	encroachment as a practice to increase the area under private control, and used for agricultural, livestock practices. This practice has been in existence for more than ten (10) years due to which the land owning class has amassed large parcels for farm-related use - In Susner, the landless households and households with patta land have relied on encroachment for seasonal cropping, and grazing. The landless households of Scheduled Caste and the Sondiya community have been practicing encroachment on government land which is barren and mountainous terrain	fact, they are well aware of their illegal status; ■ The project would lead to disruption of economic activities and incomes to these households, particularly the households in Susner tehsil who have marginal land holding and rely on encroached land for farm-based income.	influence in the village by virtue of their economic power, as in the case of households having access to encroached land in Agar tehsil who belong to the wealthier strata and have a dominant position in the villages.	land without any formal rights (encroachers, squatters); ■ ; ■ Additionally, their concern is for the proportion of land parcels under their (informal) possession are undeclared; ■ This stakeholder group might expect employment in the project and/or support for income generation activities	

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	When the encroachment related practices are identified by the Government officials, this individuals are willing to pay fines against the use of Government land;				
Squatters on government land (for agriculture)	- Squatting for agriculture has been reported by households wherein arable land parcels/land classified as grazing land is used for farming at a location which is not adjoining their patta/private parcels. - In squatting for agriculture, the parcel is sub-divided among the households that make up a larger family. Typically brothers of a family separate their farming land in the larger squatted area demarcated by either timber trees, stone boundary, etc.	The project would lead to disruption of economic activities of these households, where the squatted land parcel is falling in project boundary. As reported from consultations, the households have undertaken investments for land improvement, and sometimes depend on squatting as a source of substantial income, that supplements labour work	The influence of this stakeholder group on the project is moderate, considering they do not have legal rights on the land.	- The concerns of this stakeholder group is similar to that of encroachers - - Another major concern is loss of grazing land for livestock, and if alternative grazing land is being provided, the time taken to cover long physical distance and the limited usability of such alternate land remains a concern.	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Farm and non-farm labourers	■ Agricultural labour work and non-farm labour is a prominent economic activity for all the villagers. ■ Almost all private land owners and patta land holders work as farm and non-farm labourers; ■ Households owning marginal land (less than one bigha) work as farm labour for other land owners for daily wages. They are employed by large land parcel owners and those who are higher in the caste hierarchy in the village; ■ Farm labour work is also undertaken by women of the land owning households as well as single-women headed households. As understood from consultations, women working in their own land consider the work as a	■ This stakeholder group has been using the land for livelihood activities; ■ Both men and women derive income from agricultural labour; ■ There also exists sharecropping arrangement where the farm labour work is paid in terms of share in crop output; ■ The project would lead loss of income for this stakeholder group, and also force them to shift to non-farm labour; ■ The impact is two-fold-one loss of daily income from farm labour, and second higher dependence on non-farm labour which is majorly seasonal in nature	The influence of this group on the project is minimal, considering they are a subset of the private land owning group and/or belong to landless households	■ The key concern of this stakeholder group is of losing the access to land parcels from which they derive daily wage farm income; ■ There is expectation however that they will be deriving some form of temporary employment from the project;	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	part of their household duties; ■ Non-farm labour is sought in towns of Ujjain and Susner, and sometimes in neighbouring villages. It comprises of construction work, manual labour work; ■ Non-farm work is primarily undertaken by men of the village because it involves more physical labour. Women are involved in loading and unloading of materials only; ■ Even though the payment is higher in non-farm work, people tend to prefer farm work as the former involves uncertainty of finding work on a daily basis; ■ Out migration to cities in MP and to Gujarat and Rajasthan has also been reported during consultations, as a part of non-farm labour work.				

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	- The wages in farm labour is as follows: - Rs 200 – 250 /day (for men) - Rs 100 – 150 /day (for women) The wages in non-farm labour is at a minimum of Rs 200/day				
Banjara households	- There are certain pockets of banjara settlements in the PFA (Dudhpura village, Agar tehsil) who depend on income from livestock and are primarily squatters for agriculture on government land. - There is no specific/distinct customs or practices of these households that is separate from the general community. - They have settled in the villages for more than three generations	- The project would lead loss of income for this stakeholder group, and also force them to shift to non-farm labour; - The impact is two-fold- one loss of daily income from farm labour, and second higher dependence on non-farm labour which is majority seasonal in nature	The influence of this group is similar to encroachers/squatters and their concerns are of similar nature. Although this group forms part of the larger category of encroachers/squatters their concerns and impacts are to be treated separately as their livelihood profile and location profile is relatively unique compared to the overall profile of the village	- Losing access to land for farming and grazing of livestock; - Whether the proposed alternative livelihood arrangements cater to their needs and treat them uniquely	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ However, their location of living is distinctly separate from the larger community				
Women groups	■ There are Self-Help Groups (SHGs) who are provided with microfinance assistance, and loan grants. The women associated with the SHGs in the village invest on buying livestock and are responsible for the tending to livestock animals, milking them and supplying milk to dairy. ■ SHGs were reported to exist and currently active in Pipalya Kumhar, and Ladwan in Agar tehsil. The SHG activities are limited to loan disbursement.	■ Due to potential loss of grazing land, the available livestock will be faced with short supply of fodder. The investments made in purchase of livestock animals will, in such scenario, won't provide the expected returns from sale of animal/animal products	■ The influence of this group on the project is limited, given that they have no control over the purchase of land for the project; ■	■ This Stakeholder group may expect employment as loaders, housekeeping activities, and skill-based training for starting self-employment initiatives; ■ Access to the GRM established for the project; ■ Clarity in terms of scope of work, expectations, key performance indicators, responsibilities and timelines for the project	Low
Livestock holding households/Graziers of livestock on government land	■ Livestock holding is an economic activity to support farm income, and for landless households, the major income source.	■ This group, which is a part of the private land owners group as well as households without any land holding will be impacted by loss of	■ This group also has minimal influence on the project as they have no direct control on the land purchase; however they can	■ Concerns regarding loss of access to fodder from government land (common property resource), and access to forest land;	Low

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	All households, whether holding large land parcels, small/marginal land parcels, or landless own some amount of livestock; - As reported, the landless households will at least have goats for milk consumption, while the land owning households have a mix of cows, buffaloes, goats; - Almost all the communities reported during consultations the issue of abandoned cows – cows which were purchased 5 – 10 years back and then were replaced with buffaloes which are used as farm animals. Such cows do not have any designated area of grazing and as a result, have caused damage to crops, and grazing land meant for other livestock; - Livestock holding gives rise to various earning	available government land for grazing The impact of such loss will be higher for landless households with livestock who rely on government grazing land for fodder	raise concerns regarding the loss of common property resource (CPR) of the village which was being used for grazing	- Concerns over lack of space for animals to graze; - The issue of abandoned animals and how they will be accommodated in the constrained land space;	

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	sources such as hired herder for cows, sale of fodder, and sale of animal/animal products.				
Owners of land required for temporary occupation or use	- Some of the project components would require short term leasing of land available, largely from Private and/ or Patta land owners; - This requirement would be better understood during the time of initiation of construction activity.	- The short term leasing of land by the project may bring in additional income from lease, if the land is not being used for any other commercial purposes; - The project related activities on these land parcels may be for purposes of storage, set up of labour camps, etc. and may result in change in land use/ land cover due to construction activities, contamination issues, etc.	This stakeholder group is critical for availability of land parcels that are conveniently located in the vicinity of project footprint (based on the needs) and are available without disturbances or issues during the lease period.	- The expectations of this stakeholder group is clear communication of lease terms and amount and timely payments, as necessary; - Restoration of land to its original state, or better, at the time of handing it back to the owners.	Medium
EPC Contractor	This stakeholder group comprises of the EPC contractors and other sub-contractors who will be involved in the Project for various tasks, like access	The Project will create employment opportunities for the staff associated with the contractors	This stakeholder group is critical for the smooth functioning and timely	Continued economic opportunities, and employment generation;	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	roads construction, building of the solar plant, laying down of Transmission Line towers, civil and electric works for the power plant, etc.	- The contractor(s) will be impacted by the grievances that will arise as a part of construction activities from the local community - The project will create demand among the existing labourers (both farm and non-farm) in the PFA to be recruited for project activities. The contractor will be impacted to meet the need of local employment demand	implementation of the Project; This group may also play an important role in the formation of public opinion towards the project	- Sharing of responsibilities between the SPD, and the EPC contractor - Level of information disclosure to the community and local authorities - Adhering to EHS Standards specified in the agreement, and reporting on the same - Undertake project activities in keeping with the contractual agreements and applicable regulations in place - Establishing an external Grievance Redressal Mechanism (GRM) for the community	
Unskilled contractual workers	- This group is comprised of skilled and semi-skilled workers, who will be involved in the project on a contractual basis during the construction phase. - The activities will include, but not limited to	- The project will have a high level of impact on this group in terms through: - As a source of employment	The stakeholder group will be critical during construction phase in forming public opinion of the project due to their conduct in and around site premises,	The primary concerns and expectations of the stakeholder group pertaining to the project is as follows: the role of the project in continued economic	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	transmission tower erection, laying of lines, land levelling, erection of solar panels, security, logistics, etc ■ The number of such workers during the operation phase generally reduces, and is limited to maintenance activities, site security, etc. Most of the workers are likely to be migrants.	– Interaction with the local communities – Safety and security at work ■ A Labour force Management Plan (LMP) will be required for management of the impacts arising out of their employment at site, and due to influx of migrant labour	and are also responsible for timely completion of the project	opportunity, and a source of income ■ Legal compliance in accordance to the labour laws in the labour agreements, and payment of income and insurance coverage ■ Health and Safety at work ■ Extended work opportunities beyond the construction period. ■	
Gram Panchayats	■ This stakeholder group is comprised of Sarpanch, ward member and Gram Sewak of Panchayats of Palda, Naharkheda (including Umarya village), and Pipalya Nankar in Susner Tehsil, and Pipalya Kumhar, Ladwan (including Karwa Khedi village), Kesai Dehariya (including Dudhpura village), and Bijnakhedi (including	■ The influence of project on this stakeholder group is minimal due to limited control that the project can exert on the functioning of this group.	■ This group has the ability to influence the perception of the community in regards to the Project and its activities	■ Involvement of this group in decision making process for the project, especially related to the land taking process ■ Involvement in the formulation and implementation of the community development activities for the project; ■ Adequate communication of project information, in terms of timelines of key activities and their potential impacts.	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	Madhopur village) in Agar Tehsil.				
Agar and Susner Tehsildars	This group is comprised of the regulatory authorities at the tehsil level that are responsible for land demarcation for the project and for various permits and licenses pertaining to the project.	- The project should comply with the requirements of the Tehsil regarding approvals and verification of allotted land parcels; - Secondly, the tehsildars should have complete information on the project, and awareness of the land-based impacts the project can create in the villages falling under their tehsil.	- This stakeholder group is high in priority as this group provides the land demarcation and permits and licenses essential for the functioning of the project; - Noncompliance to conditions laid down in permits issued by this group stakeholders group can result in penalties and fines being levied on the Project.	- Developmental activities in the project area; - Smooth operations of the project related activities by causing minimal impacts on the community;	High
Patwaris	This stakeholder group is critical because the physical verification of the allotted land parcels, verification of encroachment on the	None	This group has high impact because of their role determining the land parcels but of low influence due to their position in the	- Information disclosure regarding the project timelines; - Disclosure of project footprint area;	Low

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	allotted land parcels, and demarcation of the parcels is undertaken by the Patwaris;		lower order of government machinery		
District Administration	The District administration is the nodal administration that approves land allotment, directs the lower level government bodies and finalizes the project footprint area	None	The District Collectorate (DC) is a high impact and high influence stakeholder due to their pivotal role in land allotment approval, oversight on private land purchase, and acting as the final authority on compensation, solatium for private land purchase	- Information disclosure of the project; - Approvals and regulations undertaken by the project proponent; - GRM of the project; - Compensation principles followed by the project proponent; - Engagement undertaken with local level bodies (Tehsil office, Panchayat)	Low
Regulatory Authorities at state and central levels	- This stakeholder group is comprised of the central, state and district level regulatory authorities; - These authorities influence the project in terms of establishing policy, granting permits and approvals for the	The main concerns of the Regulatory Authorities from the Project Proponents is abidance to all applicable guidelines, policies and laws	These authorities influence the project in terms of establishing policy, granting permits and approvals for the project, monitoring and enforcing compliance with the	- Concerns regarding necessary approvals for use of panchwan land (if any); - Use of community forest, and provision of alternative land for creation of such forest	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	project, monitoring and enforcing compliance with the applicable rules and regulations.		applicable rules and regulations;		
Secondary Stakeholders					
Fence Line Community	- This stakeholder group is comprised of the local population in the eleven villages, coming under the project boundaries; - This stakeholder group has been using the land identified for the Project for grazing of their livestock, accessing their agricultural fields or using the land for other common activities.	- The project will use land which is currently being used by this stakeholder group in accessing their farms, lakes and other common areas, grazing their livestock, etc.; - Some of the community members also use this land for cultivation (through encroachments) or work on the farm lands as agricultural labourers, etc. These activities will be disrupted after the project related activities commence on the identified land	This stakeholder group shall play a critical role in the smooth functioning of the Project.	- Adequate provisions of easements while designing various project features in order to ensure minimal access restriction for this group; - Minimal disturbance to this group due to various activities of construction, operation and decommissioning phases.	High
Vulnerable social groups such as	This stakeholder group is comprised of	The influence of project on this group is similar in	The involvement of this stakeholder	Priority in economic benefits and development	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
women headed households, Landless households, households depending solely on grazing of livestock	groups/households that are considered to be vulnerable due to their social, or economic status in the society. For the project, the vulnerable groups are identified as women headed households, landless households and those with less than 1 ha of land and families in the Below the Poverty Line (BPL) Category.	nature as the entire fence line community, as it is a subset of the same.	group is expected to be as part of the larger local community; This stakeholder group should be specifically consulted to ensure adequate provisions in the RAP and LRP for the differential impacts expected on this group	opportunities created by the project; Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	
Indigenous People (apart from Banjara households)	While the project is not located in a scheduled V area, there are two villages a small presence of ST population – Ladwan in Agar and Palada in Susner, with the former having a larger share	The influence of project on this group is included in the group of private land owners, and farm/non-farm labour as they undertake similar livelihood activities as of other communities in the villages	- The involvement of this stakeholder group is expected to be as part of the larger local community; - In keeping with the requirements of the IFC PS 7, the project will require to obtain Free Prior Informed Consent from this stakeholder group	- Priority in economic benefits and development opportunities created by the project; - Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Local Political Groups	- This stakeholder group is comprised of the political parties and local politicians active in the region; - This group might be active in the area and may play an important role in the polarisation of public opinion towards the Project.	The project is expected to have minimal or no impact on this stakeholder groups	- This group can influence the project life cycle by polarising public opinion of the local communities (within PFA and fenceline); - The political groups/parties can capitalize on certain negative sentiment regarding the project site/construction activities and make it a tool of propaganda against the project	The main expectation and concern of the stakeholder group from the project includes the project's role in the development of the area in keeping with the broader agenda of the projects and keeping the expectations of the parties at the forefront.	Medium
Civil Society/Local NGOs	This stakeholder group comprises of NGOs and Civil Society Organizations of a local level who may be active in the area. Most of the NGOs and CSOs working in the region are district level NGOs, involved in	The level of influence of project on this stakeholder group is limited as it does not affect the functioning of this group	- The stakeholder group may play an important role in the development of public opinion for the project; - This stakeholder group may also be	The main expectations and concerns of the stakeholder group from the project is likely to include the development of the project, in keeping with current development activities (if any) and expanding on the same, while minimizing the	Low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	literacy, holistic development, children, health and nutrition, agriculture, family welfare. The key NGOs and CSOs working in the region include the following: ■ Astha Gramathan Samiti ■ Agar Malwa Sri Rajlaxmi Mahila Evam Bal Kalyan Samiti ■ Baijanath Nipaniya Samajik Kalyan Samiti		involved in the implementation of the community development plans	impacts on the local population; ■ Contributing towards the overall development of the area; ■ The interest of this stakeholder group primarily pertains to the roles of the project in implementing community development activities in the area; and ■ Involvement in the formulation and implementation of the community development activities for the project.	

11.2 Detailed Stakeholder Engagement Plan

Some of the most common tools of engagement are discussions, consultations and meetings. These modes of engagement can be undertaken in the forms of groups or at individual levels. These serve the purpose of allowing the project proponents to gain an understanding of the viewpoint of the other stakeholders involved in regards to the functioning of the Unit/project, the implementation of various provisions in the Project.

Based on the stakeholder identification and analysis undertaken, a detailed plan is prepared that guides the engagement process with each stakeholder group. The Social and Community Supervisor shall be responsible for maintenance of the records of along with the members that engage with stakeholders during construction and operations phase, along with addition of addition of any new categories identified.

Stakeholder Engagement Plan

Stakeholder Group	Objective	Method/time of Engagement	Teams
Planning Phase:			
Private Land Owners	- Information sharing regarding the project, including the background of the project and capacity of the project; - To understand the key concerns related to the projects; - Understand the socio-economic profile of land owners and the details of income generated through agricultural activities in order to arrive at details for compensation for crop damage, etc. - Effort required by the land owners to make the land cultivable; and - Understanding expectation from the project. - Inclusion in the Grievance Redressal Council (GRC) to be established for management of external grievances	- Face to face discussion and/or Focus Group Discussion; - RAP-LRP surveys and consultations	- ESIA - RAP - RUMSL - FPIC/IPDP
Encroachers on government land (for agriculture)	- Understanding the extent of land encroached for agriculture, and current legal land holding of this group; - Source of income from land (both owned, and encroached), and variation of dependence across the two categories, if any - Understanding other sources of livelihoods of the household, and dependence of their households and others; - Understand the history of encroachment and difference in trend of encroachment across Agar and Susner tehsils; - Understanding expectation from the project.	Face to face discussion and/or Focus Group Discussion during RAP-LRP and FPIC consultations	- ESIA - RAP - FPIC/IPDP
Indigenous Groups – Bhil community in Ladwan village, Banjara community in Dudhpura village (and any other, as identified)	- To understand existing rights, dependence and use of Nistar allotted land - To understand the ownership rights and income earning opportunities - To understand the nature and extent of impacts; - To ascertain if FPIC is required - If FPIC is required, the process to be followed will be contained in the FPIC document and must be applied; - Inclusion in the Grievance Redressal Council (GRC) to be established for management of external grievances	- Face to face discussion and/or Focus Group Discussions - Separate discussions with women, if required	- RAP - FPIC/IPDP - RUMSL

Stakeholder Group	Objective	Method/time of Engagement	Teams
Agricultural Labourers and Graziers	■ Understanding the dependence on identified private, and Government land parcels for labour work and livestock grazing activities; ■ Evaluation of alternate grazing land – proximity and adequacy ■ Access routes and easements ■ Other sources of livelihoods, if any; ■ Engagement in community development activities; ■ Understanding of expectations from the project. ■ Inclusion in the Grievance Redressal Council (GRC) to be established for management of external grievances	Open Meetings; Separate discussions with women, if required	■ RAP; ■ FPIC/IPDP ■ RUMSL and Solar Power Developers
Gram Panchayat	■ Information given regarding the project, including the background of the project and capacity of the project; ■ To understand the key concerns related to the projects; ■ Understand the socio-economic profile of land owners ■ Understanding the potential impact of the project on the stakeholder; and ■ Expectation from the project. ■ In coordination with the GP, establish a GRC for external GRM at the village level (the GRC will comprise of members from the primary stakeholder groups, in association with few GP members)	■ Consultations, meetings (FGD and individual interview) and Discussions; ■ Sharing of documents as part of the disclosure mechanism; ■ Grievances Redressal Mechanism (GRM); ■ For issues concerning Grievances Redressal Mechanism (GRM)	■ ESIA; ■ RAP; ■ RUMSL; ■
Local Community from project villages	■ Information given regarding the project, including the background of the project and capacity of the project; ■ To understand the key concerns related to the projects; ■ Understanding the potential impact of the project on the stakeholder; and ■ Expectation from the project; ■ Engagement in developmental activities	Focus Group Discussion and/or Open Public Meetings	■ ESIA; ■ RAP; ■ FPIC/IPDP ■ RUMSL/SPD along with EPC contractors and subcontractors
Tehsil Officials (Revenue Inspectors and Tehsildar)	■ Understand the working of revenue department; ■ The process adopted for demarcation of land; ■ The land transfer process from Revenue department to RUMSL; and ■ Different type of land present which are coming under the project footprint. ■ Minimum Support Price for the crops given to the land owners and to the encroachers ■ Process of collection of fines for encroached land in the area,	Face to face discussion	■ ESIA; ■ RAP; ■ IPDP ■ RUMSL along with EPC contractors

Stakeholder Group	Objective	Method/time of Engagement	Teams
	■ On land allocation for Government land by RUMSL; ■ On understanding of land procurement process followed, by ERM ESIA Team; ■ On maintaining compliance to regulatory requirements; ■	■ Face to face discussion; ■ Through applications, letters, etc.	- and subcontractors ■ RUMSL along with EPC contractors and subcontractors; ■ SPD
Construction Phase			
Contractors	■ Information dissemination, including information regarding labour laws, local employment opportunities, safety measures and discussion on grievances; ■ For negotiation on contract clauses as per requirements stated in ESIA and Management plans for the project; ■ EHSS Audits by project proponents ■ Establishment of an internal GRM process for management of labour issues at site, and an external GRM for management of community relations around the site area	■ Signed contracts with requirement to implement the ESMP ■ Meetings and monthly reporting in the operations phase; ■ Documentation as agreed in the contract	■ RUMSL
Potential unskilled labour to be used for construction phase of the project	■ Advertising of job vacancies for the project at village level in local newspaper and media; ■ During screening of applicants by contractors of RUMSL, in coordination with RUMSL on list of project affected households; ■ Induction on Code of Conduct and Internal Grievances Redressal Mechanism (GRM)	■ Through face to face discussion at the time of hiring for construction phase	■ RUMSL oversight ■ SPD and their contractors and subcontractors
Local Community from project villages	■ To identify labour class in the village and site area; ■ To identify their skill set and adequacy for engaging them in the on-going construction activity, i.e. as construction worker, security guard, cook, technician etc.; ■ To understand more about their expectation from project; ■	■ Focus Group Discussion and/or Open Public Meetings	■ RUMSL and EPC contractor and other Sub-contractors engaged for construction phase
Gram Panchayat	■ To seek permission for labour camps and carry out construction activities; ■ To understand their expectation from then ongoing construction activity; ■ To identify and document, if there is any grievance, query or recommendation of Gram Panchayat or local community ■ Orient the GP towards the established external GRM process	■ Individual/ Group consultations with Gram Panchayat members	■ RUMSL ■ EPC Contractor

Stakeholder Group	Objective	Method/time of Engagement	Teams
Operations Phase			
Gram Panchayat (for Community Development Activities and other Project related Grievances)	■ Discussion with Gram Panchayat regarding community development activities; ■ Engagement of Gram Panchayat & local community in identifying the much needed skills to be developed in youth and local community; ■ To identify the vulnerable community/ family and synchronizing their demand and need with project activities; ■ To seek cooperation of local community and Gram Panchayat members for smooth and timely execution of development activities; ■ Also, to liaison with Gram Panchayat regarding any query, grievance from then ongoing project activities and staff/ security guards. ■	■ Consultations, meetings with Gram Panchayat members and local community, individual meeting/ discussion; ■ Sharing of documents, ideas pertaining to development activities; ■ Grievances Redressal Mechanism (GRM); ■ For issues concerning Grievances Redressal Mechanism (GRM)	■ RUMSL; ■ SPDs; ■ O&M Contractor ■
Local community & Youth	■ To identify the occupational pattern of the village; ■ Understand the role and engagement of women in the workforce; ■ Understanding the livelihood/ employment opportunities at village level; ■ To understand, if there is any need based demand from youth especially women/ girls, regarding skill development, typology of skill development etc.	■ Consultation with local community especially youth; ■ Separate consultations with school and college going girls and adult women regarding skill development demand.	■ RUMSL; ■ SPDs; ■ O&M Contractor ■

There is a Grievance Redressal Mechanism that is developed to receive, record, resolve and track grievances raised by both internal and external stakeholders, as part of the ESIA report. The provision of SEP and GRM are also referenced as mitigation measures in the relevant sections of the Environmental and Social Management Plan.

Implementation Arrangements

Monitoring and Evaluation

Like the other project components, the SEP shall be regularly monitored to ensure that the engagement with various stakeholders are getting properly documented, in order to ensure transparency in communication and decision making processes, wherever applicable.

A Social and Community Supervisor shall be appointed by RUMSL, who will be responsible for implementation of the SEP, along with other related plans like Gender Action Plan, Grievance Redressal Mechanism of the project, and identified roles in monitoring of labourers during construction and operations phases of the project. The S&C Supervisor shall play a key role in implementation of the SEP and other plans in construction and operations phases of the project.

The S&C Supervisor shall coordinate with other relevant team members of RUMSL and its contractors, SPDs, etc., on maintaining and update of documentation of stakeholder engagement details, across the construction and operations phases.

The S&C Supervisor shall additionally be responsible for identifying and tracking training needs, maintenance and update of documentation, reporting and monitoring requirements for the effective implementation of SEP.

Budgeting

RUMSL shall ensure that proper budgetary allocations are made for the activities related to stakeholder engagement, like meetings, trainings, addressal of needs identified and found reasonable through the stakeholder engagement process

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