ENVIRONMENTAL IMPACT ASSESSMENT

FOR THE FOR THE PROPOSED CONSTRUCTION AND OPERATION OF A 120 MW SOLAR PV PLANT AT GERUS FARM, OUTJO DISTRICT, OTJOZONDJUPA REGION - NAMIBIA

ENVIRONMENTAL MANAGEMENT PLAN
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DECLARATION

The Environmental and Social Impact Assessment for the Gerus Solar One (Namibia) (Pty) Ltd 120 MW Solar PV Plant at Gerus Farm, Outjo District, Otjozondjupa Region was conducted by Junior Baiano Industrial Consultants cc. This was completed in line with the requirements of the Environmental Management Act, 2007 (Act No.7 of 2007) as well as applicable International Finance Corporation (IFC) Performance Standards as stated in the project Terms of Reference.

The content in this ESIA Environmental Management Plan reflects what was on the ground at the time of the assessments and is also based on the background technical studies data and information provided.

Where any party is of the view that there are changes to be made to the information and data in this document, written permission must be obtained from Junior Baiano Industrial Consultants. Junior Baiano Industrial Consultants has kept a master copy of this document to which alterations can be effected after consultation with the concerned parties.

Any report that is going to be submitted to any interested party shall be a representation of the contents in the master copy.

Signed for Junior Baiano Industrial Consultants cc

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1 ENVIRONMENTAL MANAGEMENT PLAN

In order to address directly the requirements of the Environmental Clearance Process, this Environmental Management Plan, contains seven sections corresponding to the IFC Performance Standards (PS) which have been identified as applicable to the project. These performance standards are:

- IFC PS1: Environmental and Social Impact Assessment
- IFC PS2: Labour and Working Conditions
- IFC PS3: Pollution Prevention and Abatement
- IFC PS4: Community Health, Safety and Security
- IFC PS6: Biodiversity Conservation and Sustainable Natural Resource Management
- IFC PS7: Indigenous Peoples
- IFC PS8: Cultural Heritage

These sections address the requirements of the performance standards and, depending on the significance of project issues and concerns, the standards are discussed at varied levels of detail

Section 1-6 of the ESIA Scoping report form the basis for impact/risk management measures proposed in this Environmental Management Plan. The project description elaborates on what the project entails while the baseline description, legal framework as well as the public consultation sections give biophysical and socio-economic context of the project.

1.1 Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts

Performance Standard 1 establishes the importance of the following:

- integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects;
- effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them;
- the client's management of environmental and social performance throughout the life of the project.

The objectives of the standard include:

- To identify and evaluate environmental and social risks and impacts of the project.
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.
- To promote improved environmental and social performance of clients through the effective use of management systems.
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately.
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

Areas covered in this section include Social Impact Management Plan (including Stakeholder Management Plan and Grievance Redress, Engagement and Management Plan); GHG Assessment and Management Plan; Emergency Preparedness and Response Plan; Visual Impact Assessment and Management Plan; Traffic Impact Assessment and Management Plan; and Environmental Management Plan.

1.1.1 Social Impact Management Plan (SIMP)

Drawing from public consultation findings as well as socio-economic studies (*refer to section 4.1 and 5*) conducted during the ESIA study, a Social Impact Management Plan for the project has been developed. The purpose of the Social Impact Management Plan (SIMP) is to provide a framework for managing the projects potential social impacts. In addition, it should be used in project detailed planning, management and to provide for a record of performance. This SIMP outlines potential significant impacts of the solar project and outlines management plans to guide the company's long-term social performance. It covers social impacts from the perspective of the people/community whose lives, livelihoods and lifestyles may be potentially affected by the project. Tabulated below is the SIMP for the project.

Table 1-1: Social Impact Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
CONSTRUCTION								
1.	• Employment and Procurement for the construction and operation of the solar plant	• Local employment and procurement of goods and services, as well as skills development, capacity building and economic development will have a positive impact. All these impacts will result in a positive contribution to the GDP.	• Use labour-intensive construction methods, where feasible,(e.g. digging of trenches) to increase employment opportunities; • Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; • Local labour, local construction contractors and local and small businesses should be prioritised; • Reserve a percentage of, and promote employment opportunities for woman and the youth; • Ensure that contractors comply with the company's employment policies; • Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be	1	1	**1 LR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			structured around the findings of the skills survey. • Establish a monitoring system to ensure that contractors honour the relevant project employment policies. • Where feasible, offer suitable training and skills development to improve the ability of local community members to take advantage of employment opportunities arising through the project.					
		• Disruption of movement and mobility for people and livestock.	• Involve community structures to assist in communicating labour requirements and other project related aspects to the communities; • Implement an HIV/AIDS and alcohol abuse awareness campaigns in the communities and include such campaigns as a condition of contract for suppliers and sub-contractors; • Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities	4	4	**16 CR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		• Population influx may result as job seekers arrive in the area. Population influx may result in impacts such as pressure on services and resources and potential health, safety and security impacts.	• Implement suitable consultation procedures to ensure that local communities are: - Informed about pending construction activities; - Involved in the formulation of mitigation measures where appropriate; and - Implement appropriate grievance procedures and compensation measures. • Ensure that the alignment of construction roads, pipelines and power lines avoid loss of access to properties, livelihood resources and livestock infrastructure. Where this is unavoidable, alternative access must be provided. Any assets lost as a result must be compensated for in an appropriate manner; • Erect suitable traffic and construction signage to control traffic, raise awareness of potential risks/hazards and indicate alternative access routes;	3	4	**12 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Implement suitable measures to provide continued access to assets and livestock and minimise traffic disruptions. These measures could include temporary pedestrian crossings (on main access roads), road diversions and cattle crossings; • Ensure that access to grazing areas are uninterrupted through providing alternative access routes and/or cattle corridors and access points during construction activities; • Ensure acceptable repair of road networks after construction activities are completed. Where this is not possible, alternative access roads should be constructed; and • Where the fencing of project facilities and infrastructure will be permanent, alternative access must be provided if access to properties is lost.					
2.	• Community Health, Safety and Security	• Air, dust and noise pollution due to construction activities	• Implement the mitigation measures of other relevant specialist studies • Evaluate the project induced risks and impacts to the health and safety of the local communities with the	3	4	**12 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		• Safety risks during the construction of trenches, roads and powerlines • Increased traffic volumes and associated traffic risks and vehicle accidents • Increase in community violence and social pathologies • Increase in spread of communicable diseases, such as HIV/AIDS as a result of the presence of a construction workforce and jobseekers	identified risks and impacts. These measures should favour the prevention and/or avoidance of risks and impacts over minimisation and reduction • Where the project poses risks to, or adverse impacts on, the health and safety of the affected communities, this should be disclosed to enable the affected communities and relevant government agencies to understand these risks and impacts • Engage affected communities and agencies on an ongoing basis. This should include awareness raising of the risks associated with the project. • Design, construct, operate and decommission the structural elements/components of the project in accordance with good international best practice.					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
3.	• Impacts on surrounding farms and property owners	• Construction activities will lead to noise, dust and traffic hazards • Visual impact of surface infrastructure may alter the area's sense of place • Specific health impacts which include exposure to harmful dust fallout, contaminated areas, radiation, etc.	• Planning and design of project facilities and infrastructure should attempt to avoid or minimise negative impacts on adjacent farms. Consult adjacent property owners on additional measures that can be implemented to lessen or compensate for negative impacts • Provide appropriate communication channels and grievance mechanisms to address the concerns and grievances of adjacent farmers and property owners • Successfully implement the mitigation measures to ameliorate hydrological, visual, traffic and health impacts of the project as proposed in the report	3	3	**9 MR**	SHE manager Responsible supervisor	
4.	• Project Induced Population Influx	• On the positive side, population influx could present improved opportunities for local	• Recruitment of employees and contractors should be executed as earlier discussed • Involve local community structures to assist in communicating the intention to give preference to local labour and	4	4	**16 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		entrepreneurs and could offer other benefits for the economy • On the negative side, the presence of a large workforce that does not originate from the project area, may require he establishment of construction camps which can have a variety of negative consequences. • General population influx resulting from increased economic activities in the project area lead	also to assist in identifying the local labour pool • Implement HIV/AIDS and alcohol abuse campaigns in the communities and make AIDS and STD awareness and prevention programmes a condition of contract for suppliers and sub-contractors. Provide adequate supply of free condoms to workers. • A voluntary counselling and testing (VCT) programme must be introduced during construction. • Access to the construction labour force must be controlled to prevent sex workers and petty traders from visiting and loitering at or near workers accommodation and other project sites.					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		to increases in social pathologies, conflict and the growth of informal settlements. • An influx of job seekers will place pressure on local infrastructure and services such as housing, schools, police, clinics and sewage system.						
OPERATION								
5.	• Procurement activities of labour	• Increase of job opportunity and income	• Socialising the recruitment process to the community, especially bout the number of vacancies, qualifications and available positions • Prioritising the local workforce to be employed according to the qualification and requirements needed	3	3	**9 MR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
6.	• Operation of solar plant	• Economic benefits to locals as a result of the project employment and business opportunities	• Prioritising the local workforce to be employed according to the qualification and requirements needed	3	3	**9 MR**	SHE manager Responsible supervisor	
7.	• Vehicle and worker movement safety	• Potential incident with community as a result of increase in project traffic	• Enforce speed limit regulations to all project construction vehicles along with an emergency response procedure should any incidents with other road users or pedestrians occur and • The proposed grievance mechanism should be accessible for all villagers to report concerns associated with health and safety	3	3	**9 MR**	SHE manager Responsible supervisor	
8.	• Operation of solar plant	• Worker interaction with the community	• Compulsory medical examinations for project workers, including contractors to ensure they are fit for work and to monitor the prevalence of communicable diseases • Zero tolerance towards inappropriate behaviour from and among the workforce	3	3	**9 MR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Regular engagement with local authorities relevant to crime (local police) or other social problems					
9.	• Worker termination	• Decrease of income leading to reduced community welfare as the solar plant is no longer in operation	• Maximising the quality of workers that are terminated through training according to agreed contract	3	3	**9 MR**		

1.1.1.1 Social Management and Monitoring Plan

Shown in the table below is the monitoring plan for the stakeholder management plan.

Table 1-2: Social Management and Monitoring Plan

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
Use of local contractors and businesses reduces local industry capacity for other work, impacting on business costs,	Proponent will prepare a Local Industry Participation Plan as part of the construction plan and work with local employers and business groups. Longer-	Community satisfaction	Community attitudes survey	Monthly

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
competitiveness and operations.	term, businesses are likely to scale up to meet the needs of longer-term service contracts.			
Local people do not win jobs with the project, resulting in unmet expectations and tension between local people and project staff.	Gerus Solar One will have a focus on good communication and engagement to explain what jobs are available, help local people obtain them and explain any shortfall in expected local jobs, e.g. through a community reference group.	Number of local people employed Participation and unemployment rates in and around Gerus farm and surrounding local communities Community satisfaction	Census data on participation rates Number of local people with jobs at the project Number of job seekers registered with employment and community development providers Community attitude survey	Quarterly
Local businesses, such as civil contractors, trades and other suppliers, fail to win work on the project, resulting in unmet expectations and negativity towards the project. Potential causes could be lack of capacity or specialist skills or not being able to meet Arafura's quality, safety and financial standards.	Gerus Solar One will prepare a Local Industry Participation Plan and work with the Government, Chamber of Commerce to run industry information sessions with its contractors to help prepare businesses for opportunities and get feedback that may influence how work is packaged. Prime contractors will be expected to commit to local opportunities in their supply chains.	Number and value of contracts awarded in Outjo	Statistics for Local Industry Participation Plan Business survey	Quarterly

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
The project is perceived by adjacent pastoralists as incompatible with existing land use and their operations, leading to tensions and potential for reputational impacts.	Discussions with adjacent land users to provide information on the project, potential effects and proposed mitigation. Establish an exclusion zone around the site to exclude pastoral activity.	Community Satisfaction	Complaints from pastoralists Community Satisfaction Survey	Periodically
Increase in local jobs leads to higher levels of employment, economic participation, improved education outcomes and reduced levels of disadvantage.	Gerus Solar One will implement a number of measures to increase local workforce participation, include a workforce development plan, KPIs and contractors for employment, mentoring and support programs for workers and their families, working with industry groups, procurement strategies and working with schools and job providers to increase transition to jobs and workreadiness. Given the level of entrenched disadvantage and disengagement, it will require a patient and	Participation and unemployment rates Local worker retention rates Number of apprenticeships with the project Level of private home ownership Income levels Levels of overcrowding Other socioeconomic indicators Community satisfaction	Census and labour market data and trends Company data on number of locals employed and whether they had jobs before, proportions of local workers Comparison of wages with average income levels Community attitude surveys	Bi-annually

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
	proactive approach to make a difference.			
Return of people to local communities as well as the 'honeypot' effect of people moving to the area in expectation of work or other benefits, results in a localised population increase, with higher demand for government infrastructure and services	Gerus Solar One can mitigate pressures to some extent by providing medical facilities on site for workers. The immediate impact on services such as housing may be shortterm. Longer-term, increased economic activity provides opportunities for the regional and local growth. While the project may cause these pressures, they are likely to be cumulative with other mining and horticultural projects in the region, so the solutions are largely with government, hence the importance of working with the Government to predict and plan for any increased demand for housing an	Population and community composition Demand for government infrastructure and services Number of medical presentations and evacuations Availability and affordability of housing Level of overcrowding in local communities	Census data Needs analysis to establish baseline data on local services and projected changes in demand Company data on number of local workers, where they are living, family composition Joint planning with Government Housing waiting lists	Quarterly
Community fear of adverse impact to public health and the natural environment as a result of the project, such as dust	Transparent communication and community education, including fact sheets, access to experts, taking account of culturally appropriate means of conveying risk and	Community attitudes	Community attitudes survey Complaints	Quarterly

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
	context. Sharing and explanation of baseline data and monitoring results.			
Increase in prevalence of sexually transmitted diseases (STDs)	Codes of Behaviour	Prevalence of STDs in the region Participation in education programs	Health clinic data Number and participation in education programs	Monthly
Increased crime and antisocial behavior	Codes of Behaviour for workers.	Alcohol-related crime Perceptions of safety Vandalism of project facilities	Police statistics on crime and anti-social behavior Police reports on worker involvement in incidents Community attitude surveys	Monthly

1.1.2 Stakeholder Management Plan

As part of the ESIA for the proposed project, a Stakeholder Management Plan (SEP) has been developed. The SEP's overarching goal is to make that stakeholder engagement:

- is carried out consistently, thoroughly, and in a coordinated throughout the project.
- conducted on the basis of timely, relevant, and accessible information.

In this way, the SEP aims to ensure

- there is an open, inclusive and transparent process of engagement and communication
- stakeholders have the chance to express their thoughts and concerns
- project decisions are influenced by stakeholder views and concerns.
- stakeholder expectations are managed in order to not create, or allow, unrealistic expectations to develop amongst stakeholders about potential Project benefits.
- there is compliance to applicable legal and other requirements that apply to the project.

In addition, the SEP is meant to show Gerus' dedication to using "international best practice" method of stakeholder engagement as the project's developer and primary implementer. The Gerus is dedicated to abiding by all applicable Namibian laws and regulations, as well as to adhering to international best practices, such as the IFC performance standards and environmental health and safety guidelines

1.1.2.1 Stakeholders

Key stakeholders that have been identified include those stated in the table below.

Table 1-3: Identified Stakeholders

Stakeholder Category	Stakeholder Group	Stakeholders
Project Parties	Project Implementation – electricity generation	• Developer • Project employees including contractors
	Project implementation – electricity distribution	• CENORED • NAMPOWER
Government	Regional and local government	• The Ministry of Mines and Energy (MME)

Stakeholder Category	Stakeholder Group	Stakeholders
		• Ministry of Environment and Tourism (MET) • Local authorities – regional council: Otjozondjupa and Kunene • Local authorities – municipalities: Outjo and Otjiwarongo
Directly affected stakeholders and project affected people	Community members, including men, women, youth, and local businesses	• Traditional local authorities e.g. Damara group, Ovashimbas, Hoi-llom tribe, #aodoman, etc. • Neighboring farms • Local community members

The following communication means are available to stakeholders through the project:

- **Verbal feedback**, and also email and telephone contact details will be made available to stakeholders for the project contact person; and
- **Engagement meetings** carried out directly with stakeholders during project operations.

The table below gives details on the stakeholder engagement matrix.

Table 1-4: Stakeholder management matrix

Stakeholder	**Impact** How much does the project impact them? (Low, Medium, High)	**Influence** How much influence do they have over the project? (Low, Medium, High)	**What is important to the stakeholder?**	**How could the stakeholder contribute to the project?**	**How could the stakeholder block the project?**	**Strategy for engaging the stakeholder**
Project Parties - Developer (electricity generator)	High	High	Successful development and implementation of the electricity generation aspects of the project.	As project proponent and owner, it has all the leverage towards successful development and implementation of the electricity generation	As project proponent and owner, it has all the leverage towards successful development and implementation of the electricity generation	Continued reporting and consultation on preparation and implementation issues of the ESIA and any stakeholder concerns
Project Parties – (electricity distributors e.g. CENORED, NAMPOWER)	High	High	Successful development and implementation of the electricity distribution aspects of the project.	As the licensed electricity distributors, they have all the leverage towards successful distribution of the generated electrical energy.	As the licensed electricity distributors, they have all the leverage towards successful distribution of the generated electrical energy.	Continued reporting and consultation on preparation and implementation issues of the project
Project Parties – project employees including contractors	High	High	Successful development and implementation of the electricity generation aspects of the project.	As part of the project implementation that does all the ground work they have the leverage towards successful development and implementation of	As part of the project implementation that does all the ground work they have the leverage towards successful development and implementation of	Put in place system for consultation with employees and addressing their views and concerns

Stakeholder	**Impact** How much does the project impact them? (Low, Medium, High)	**Influence** How much influence do they have over the project? (Low, Medium, High)	**What is important to the stakeholder?**	**How could the stakeholder contribute to the project?**	**How could the stakeholder block the project?**	**Strategy for engaging the stakeholder**
				the electricity generation	the electricity generation	
The Ministry of Mines and Energy (MME)	High	High	Successful development and implementation of the project	As the overall governing body concerning national energy matters, it has all the leverage towards successful development and implementation of the project. This includes issuing appropriate licenses, permits and approvals.	As the overall governing body concerning national energy matters, it has all the leverage towards successful development and implementation of the project	Continued reporting and consultation on preparation and implementation issues of the project
Ministry of Environment and Tourism (MET)	High	High	Implementation of the project development projects in environmentally and socially sustainable way.	The MET will review the ESIA and will supervise the implementation of the Environmental Management Plans.	As regulatory body it has all the mandate to correct unsustainable environmental and social practices of the project	Continued reporting and consultation on preparation and implementation issues of the EMP.
The Ministry of Agriculture, Water	Medium	Medium	Meeting the demand for water supply for the development.	Provision of adequate water for	Allocation of water that is not adequate for project operations	Engaging the stakeholder through

Stakeholder	**Impact** How much does the project impact them? (Low, Medium, High)	**Influence** How much influence do they have over the project? (Low, Medium, High)	**What is important to the stakeholder?**	**How could the stakeholder contribute to the project?**	**How could the stakeholder block the project?**	**Strategy for engaging the stakeholder**
and Forestry (MAWF)				the project and its associated activities.		joint planning and support
The Ministry of Health and Social Services (MHSS)	High	High	Protection of public health and meeting additional demand for health service such as hospitals, health centres, clinics etc.	Availability of sufficient social services such as health facilities is essential to retain workers and staff of the project in the long term.	Lack of basic health services can indirectly affect the operation of the project. Activities of the project affecting public health will be controlled by the office during construction and operation.	Engaging the stakeholder through formal consultation, joint planning and support.
Namibian Roads Authority	Medium	Medium	Availing road infrastructure and keeping traffic flow along the main highway roads in balance with the demand.	Providing main highway road access to the project projects and monitoring traffic along the highways to ensure smooth traffic flow.	The availability of highway road that connects the project site and other parts of the country is essential to its operations. Avoiding traffic jam and accident is also necessary to the	Consult the Authority on existing and future road development plans and traffic flow information.

Stakeholder	**Impact** How much does the project impact them? (Low, Medium, High)	**Influence** How much influence do they have over the project? (Low, Medium, High)	**What is important to the stakeholder?**	**How could the stakeholder contribute to the project?**	**How could the stakeholder block the project?**	**Strategy for engaging the stakeholder**
					operation of the project.	
Regional and local government	Medium	Medium	Implementation of the project development projects in environmentally and socially sustainable way.	Regional and local regulatory bodies responsible to ensure environmental compliance of the development project during construction and operation	• As regulatory bodies they have all the mandate to correct unsustainable environmental and social practices of the project • Absence of any environmentally friendly management infrastructure (e.g. waste disposal sites; health facilities; etc) provided by the office will push the project to develop an alternative solution for its own solution.	Engaging the stakeholder through formal consultation, joint planning and support.

Stakeholder	**Impact** How much does the project impact them? (Low, Medium, High)	**Influence** How much influence do they have over the project? (Low, Medium, High)	**What is important to the stakeholder?**	**How could the stakeholder contribute to the project?**	**How could the stakeholder block the project?**	**Strategy for engaging the stakeholder**
• Traditional local authorities e.g. Damara group, Ovashimbas, Hai-llom tribe, #aodoman, etc. • Neighboring farms • Local community members • Local business and service providers	Medium	Medium	Delivering positive impacts of the project such as job creation, enhanced commercial and economic activities, community health and wellbeing during operation and infrastructure development in the towns and the neighbourhoods such as roads, electricity, water supply etc.	The community representatives can create a bridge of communication with the community to positively contribute towards the project.	Negative attitude of the community in the project area can hamper the construction and operation of the development project.	Active and continuous engagement with community representatives during all stages of the development project.

1.1.3 Grievance Redress, Engagement and Management Plan

A grievance mechanism is presented in this section and it seeks to:

- **Provide** stakeholders with a chance submit their feedback, comments or grievances.
- **Record** Received Grievances and comments – all input received through the engagement process should be recorded via meeting records and the grievance log.
- **Generate Responses** – the project manager will review comments received and generate comments after each phase of engagement.
- **Communicate** Responses to stakeholders who have raised comments – all opinions and concerns noted during stakeholder engagements should be recorded by the project manager and a summary of the feedback and comments is maintained.

The objectives of the grievance mechanism include

- To provide a simple, fair and transparent process for all external parties to submit feedback and to raise grievances. This shall result in outcomes that are fair, effective and lasting.
- To provide a simple process for project personnel to address any issues and concerns raised by stakeholders in a methodical and time efficient manner.
- To mitigate risks and impacts to all external stakeholders due to project operations, demonstrating company care for the wellbeing of its stakeholders.
- To build trust and goodwill as an integral component of the stakeholder's relation activities, and promote trust and respect with stakeholders, particularly at a community level.
- To enable for the systematic identification of emerging issues and trends, facilitating corrective and pre-emptive engagement.

The following communication means are available to stakeholders through the course of the project throughout all its phases:

- **Verbal feedback**, and also email and telephone contact details will be made available to stakeholders for the project contact person; and
- **Engagement meetings** carried out directly with stakeholders .

The Grievance Mechanism takes into account the following:

- **Training** – those who are responsible for addressing grievances, must have detailed knowledge on how the project's grievance mechanism work and who to speak with on each category of issues.
- **Record Keeping** – all aspects of the grievance management process must be comprehensively documented, and accurate records should be maintained.
- **Reporting** - the project personnel will compile information relating to engagement activities as appropriate for the monthly social and environmental reports.
- **Review** - the Grievance Mechanism will be periodically audited and reviewed by project senior management to determine its accuracy and relevance with regard to legislation, education, training and technological changes.

The process flow chart below outlines the grievance mechanism process flow chart.

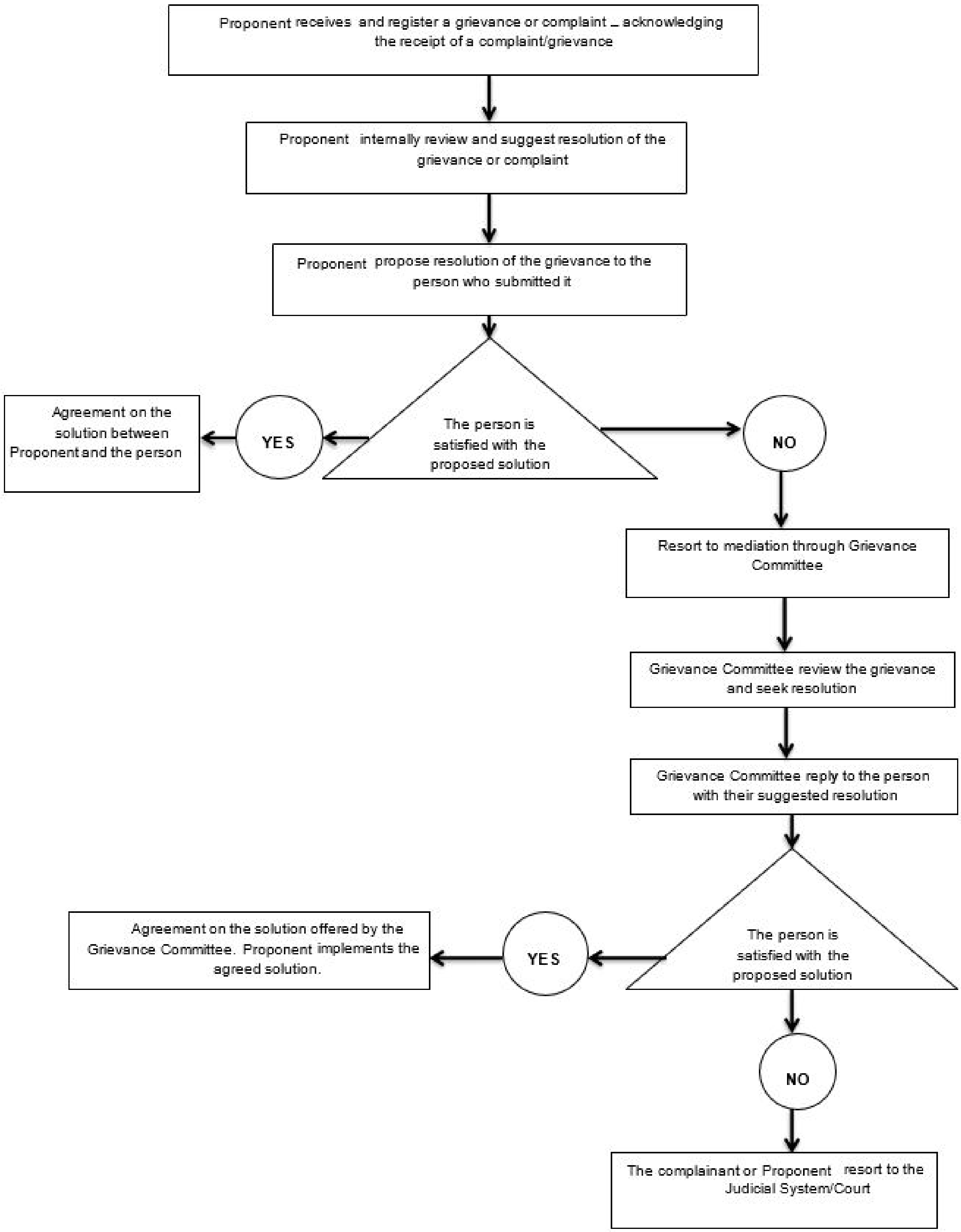

Figure 1-1: Grievance Mechanism Flow Chart

1.1.4 Monitoring and Reporting

Stakeholder engagement should be monitored and reported by the proponent throughout the entire life cycle of the project, which will involve:

- Updates of the stakeholder list;
- Records of all consultations held; and
- Records of all grievances received and dealt with (entered into a Grievance Log on the system or a computer).

1.1.5 Information Management

Every meeting and interaction related to the project engagement should be recorded by the proponent through the following:

- Stakeholder list;
- Grievance Mechanism Log;
- Minutes of all meetings; and
- Meeting attendance registers.

1.1.6 Safety Health and Environmental (SHE) Management System

Along with the Environmental Management Plan it is important to establish and implement a Safety, Health and Environmental Management System. Implementation of a Safety, Health and Environmental Management System is intended to improve occupational health and safety; and environmental performance. The SHE Management system is to be periodically reviewed and evaluated to identify opportunities for improvement and their implementation.

Establishment of the SHE management may follow this four-step approach to environmental, occupational health and safety management is:

- **PLAN** – establish health and safety management standards based on risk assessment and legal requirements.
- **DO** – implement plans to achieve objectives and standards.
- **CHECK** – measure progress with plans and compliance with standards.
- **ACT** – review against objectives and standards and take appropriate action.

The illustrations below depict important elements to be take into account in the establishment of the SHE management system.

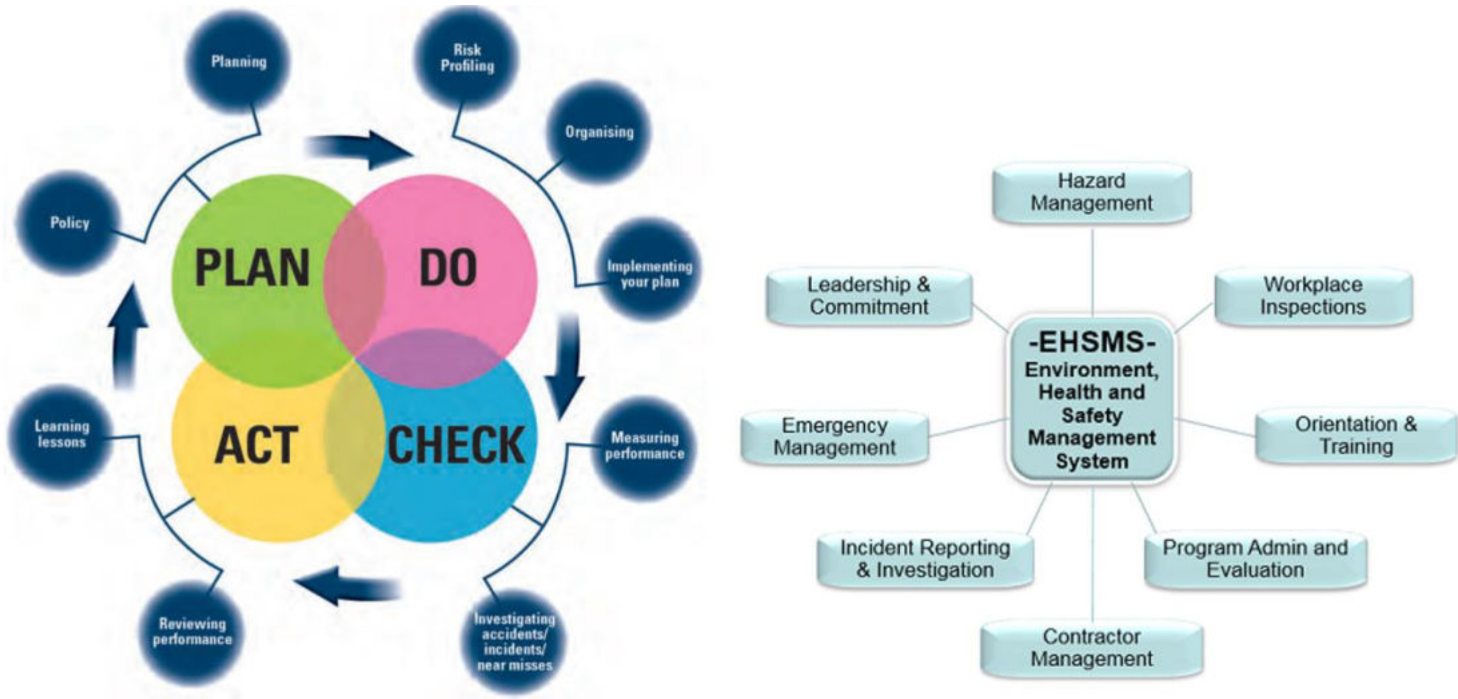

Figure 1-2: Elements of a SHE Management System

The steps to be followed in development of the SHE management system include:

1.1.6.1 Establishment of a SHE Policy

The SHE Policy is the driver of for implementing and improving the project's SHE management system so that it can maintain and potentially improve its SHE performance. The SHE Policy should include the following:

- Top management leadership and commitment necessary for the SHE Management system to be successful and to achieve improved SHE performance;
- Commitment to sustainable development and prevention of injury, ill-health as well as pollution.
- Commitment to continual improvement in SHE management and performance.
- Compliance with legal and other requirements to which the development subscribes.

The policy should also take into account the views of all internal and external parties affected and interested in the activities of the project. It is also important that the policy be communicated to and be understood by all affected and interested stakeholders.

1.1.6.2 Hazard/Aspect identification, Risk/Impact Significance assessment and Determination of Controls

Hazards/Aspects have the potential to cause human injury, ill-health and/or environmental pollution. Therefore these need to be identified, risks/impacts associated with them assessed and appropriate controls put in place. Adopted from ISO standards the diagram below gives an overview of the hazard/aspect identification and risk/significance assessment process that may be used in the establishment of the SHE management system.

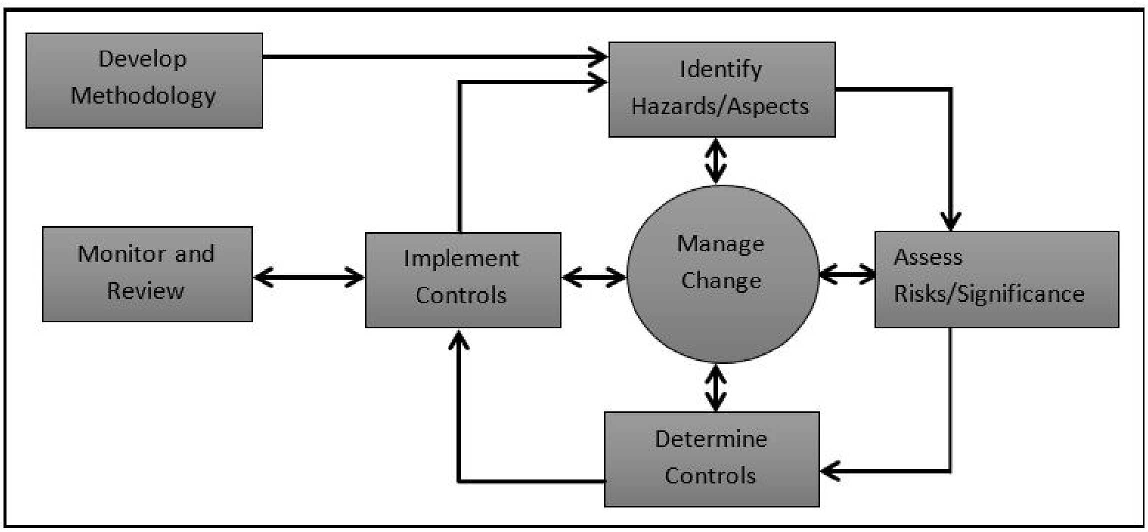

Figure 1-3: Overview of the Hazard/Aspect Identification and Risk/Impact Assessment Process

As part of the project's continual improvement process, this approach is to be used to monitor and review the effectiveness and appropriateness of the mitigation and management measures. Thereafter appropriate action is to be taken to ensure that the levels of risks are reduced to the lowest levels possible taking into account the prevailing circumstances at the project operation.

In considering controls and risk reduction mechanisms the following hierarchy will be considered:

- *Elimination* - modify a design or work area to eliminate the hazard e.g. introduce mechanical lifting devices to eliminate manual handling hazards.
- *Substitution* - substitute less hazardous material or reduce system energy (e.g. lower the force, amperage, pressure, temperature, etc.)

- *Engineering* - e.g. installation of machine safeguards, sound enclosures etc.
- *Signage/warnings and/or administration controls* - safety signs, hazardous area marking, procedures, equipment inspections, access controls, safe systems of working, tagging and work permits, etc.
- *Personal protective clothing* - safety glasses, hearing protection, face shields, safety harnesses and lanyards, respirators and gloves.

In adopting control measures in the SHE management system consideration also include the following:

- Documentation of identified hazards, risks assessment and determined controls. This is to facilitate effective checking and establishment of corrective measures. It also facilitates the continual improvement process.
- Preventing hazards i.e. not allowing hazards to develop

If hazards are not avoidable, it is important to:

- Minimise the size of the hazards
- Contain the hazards within safeguards therefore separating hazard from target or environment.
- To slow action of the hazards
- Use of time/space to separate hazard from target
- Modify shock concentration surfaces e.g. use of rounded corners, blunt surfaces etc.
- Strengthening of target e.g. provision of personal protective clothing, training etc.

1.1.6.3 Identification of Legal and other Requirements to with the project subscribes

This will consider compliance obligations that impinge on the project including:

- Legislation, including statues, regulations and codes of practice.
- Permits, licenses or other forms of authorisations.
- Treaties, conventions and protocols.
- Other requirements to which an organization subscribes may be composed of contractual conditions, non-regulatory guidelines
- Etc.

1.1.6.4 *Identification of priorities and setting of appropriate safety, health and environment objectives and meeting targets*

As part of the SHE management system the project will set objectives to fulfil the commitments established in its safety, health and environment policy, including its commitments to prevention of pollution, injury and ill-health. The process of setting and reviewing objectives, implementing programmes to achieve them, provides a mechanism for the project to improve its SHE management system and to improve its SHE performance.

1.1.6.5 *Establishment of a structure and a programme(s) to implement the policy and achieve objectives and targets*

In order to achieve objectives and targets, structure(s) and action plans should be established. In this process consideration should be given to resources required (financial, human, infrastructures) and tasks to be performed. Responsibility, authority and completion dates for individual tasks should also be assigned to ensure that SHE objectives are accomplished within the overall timeframe.

- KPAs and KPIs should be included for every employee in the appointments and roles on improving SHE and business performance; and reducing or eliminating liabilities and risks.
- Employees and contractors' management is critical and easily followed through a systematically developed, documented and implemented safety, health and environmental management system.
- Competencies profiling is important when running a SHE management system in order to evaluate the system's acceptance and responsibility.

1.1.6.6 *Facilitation of planning, control, monitoring, preventive and corrective actions, auditing and review activities*

This into ensure that the policy is complied with and that the SHE management system remains appropriate and its performance enhanced.

1.1.7 GHG Assessment and Management Plan

1.1.7.1 Background

The Project aims to demonstrate the ability of large-scale solar power to improve the electricity supply and stability of the Government of Namibia national grid, and substitute for planned fossil-fuel power generation in the future. The expansion of solar power generation will help diversify the power generation mix and complement the existing base of power plants to meet daytime peak demand as well as increase the percentage of clean energy supply in line with the Government's stated greenhouse gas (GHG) emissions reduction targets mentioned in its latest NDC. The project will support investments for development of a solar park and transmission interconnection infrastructure.

The proposed 120 MW solar energy facility would consist of the following:

- Photovoltaic components: numerous rows of PV panels and associated support infrastructure to generate electricity;
- DC-AC current inverters and transformers.
- PV module generate DC current (12V, 24V, 48V)
- Transmission corridor: one overhead 19kV transmission line (500m) located within the transmission corridor to connect the proposed onsite substation to the existing main substation, this will follow an existing powerline servitude in the area, to minimise impacts.
- On-site substation: the on-site substation to collect the electricity produced on site and step it up to the correct voltage to transfer via the transmission line to the existing main central substation.
- Buildings: operation and maintenance buildings to house equipment and a guard cabin for security.
- Additional infrastructure: includes a boundary fence for health, safety and security reasons; water supply infrastructure for groundwater abstraction and storm water infrastructure, if required.

All three technologies perform less well in the event of prolonged cloudiness. Where this trend results from climate change, it will be latitude-specific. In general, greater cloudiness can be expected at high latitudes in the future. This is most likely to be a problem for thermal heating technology, which is the only one of the three technologies that is cost-effective at high latitudes. Reduced cloudiness in the future can be expected in mid- and low-latitude regions, which could benefit all three technologies.

Again, these results do not raise any particular red flags. For example, both solar thermal and PV can be damaged by large hailstones, but existing design standards seem to be adequate to ensure minimal damage, and there is no clear evidence that climate change will make hail a greater problem in the future than it is now. However, there may be value in exploring technical options for making PV less heat-sensitive, and for improving the designs of CSP cooling systems.

These results are in qualitative terms and there has been no attempt to model quantitative changes in output or the costs of different technologies. As described, Crook et al. (2011) have conducted a quantitative analysis of PV and CSP efficiency due to projected changes in cloudiness and temperature. Making quantitative projections of the changing vulnerability to extreme events, as a result of climate change, would be fraught with high uncertainty, and we do not engage in that here. At a qualitative level, it appears that the cumulative effects of climate change on the cost, and hence attractiveness, of any of the solar technologies, are likely to be trivial when put into the context of the rapid pace of technological change and the cost reductions related to it.

1.1.7.1.1 Impact, Outcome and Outputs:

The project is aligned with the following impact: cost of electricity in Namibia lowered. The project will have the following outcome: increase in private sector investments in solar PV facilitated.

Output 1*:* A 120MW solar PV plant that will be constructed as an upgrade from 10MW to 120MW. The project is aimed at meeting GRN halfway in reaching its developmental objectives and to supply power to the national grid. The solar power plant will initially consist of an area of 30 hectares (ha) of land; associated construction works (i.e., fencing, roads, and drainage systems); common facilities; and supporting infrastructure to accommodate 100 MW of solar photovoltaic plant capacity.

Output 2*:* Capacity of NAMPOWER in solar power plant construction and operation, project design and supervision, grid integration, and competitive procurement strengthened. The project will strengthen NAMPOWER's capacity to design, construct, and operate solar photovoltaic plants and solar parks (including management of environmental and social safeguards issues). The project will also strengthen NAMPOWER's capacity to procure solar photovoltaic generation capacity through the private sector, and to adopt energy storage systems and other measures to integrate intermittent renewable energy into the national grid.

1.1.7.1.2 Summary of Climate Change Impacts:

The project has been screened for climate change risks using the ThinkHazard! climate risk-screening tool.[1] ThinkHazard! is a simple and quick, yet robust, analytical tool that enables development specialists to determine for a given project location the potential likelihood of 11 natural hazards, and what actions they should take to make their project resilient. The tool analyses hazard under current climate conditions but also provides guidance from IPCC on how climate change may alter hazard frequency and intensity into the future. The project is classified as being at medium risk from future climate change impacts (see figure 1-4).[2]

[1] GFDRR, "Think Hazard!," 2023, https://thinkhazard.org/en/.

[2] GFDRR, "Think Hazard - Namibia," accessed January 11, 2023, https://thinkhazard.org/en/report/172-namibia.

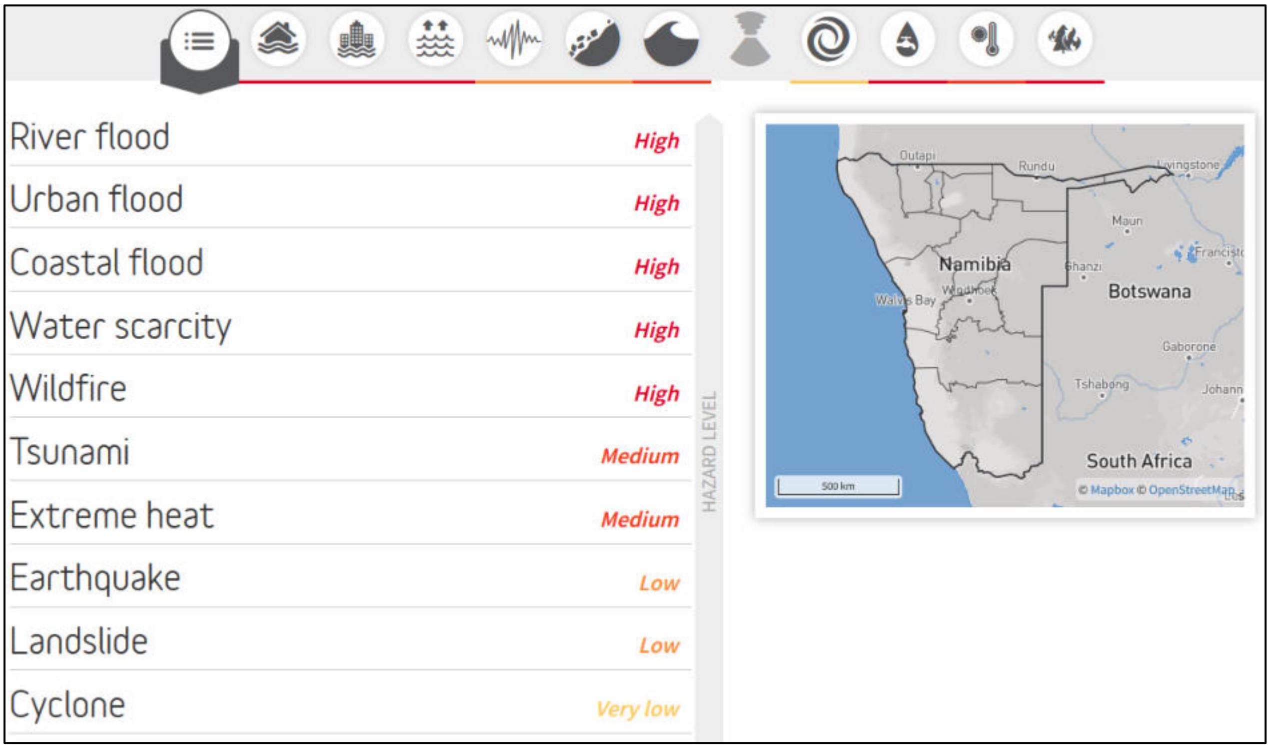

Figure 1-4. Overall, hazard level for Namibia.

The screening indicates that the project is in a region which water scarcity events in the recent past; may be at risk from wildfire events and may experience potential increase in temperature (see figure 1-4).[3] Future water stress and change in solar radiation may affect solar power potential.

[3] GFDRR, "Think Hazard - Outjo," accessed January 11, 2023, https://thinkhazard.org/en/report/22293-namibia-kunene-outjo.

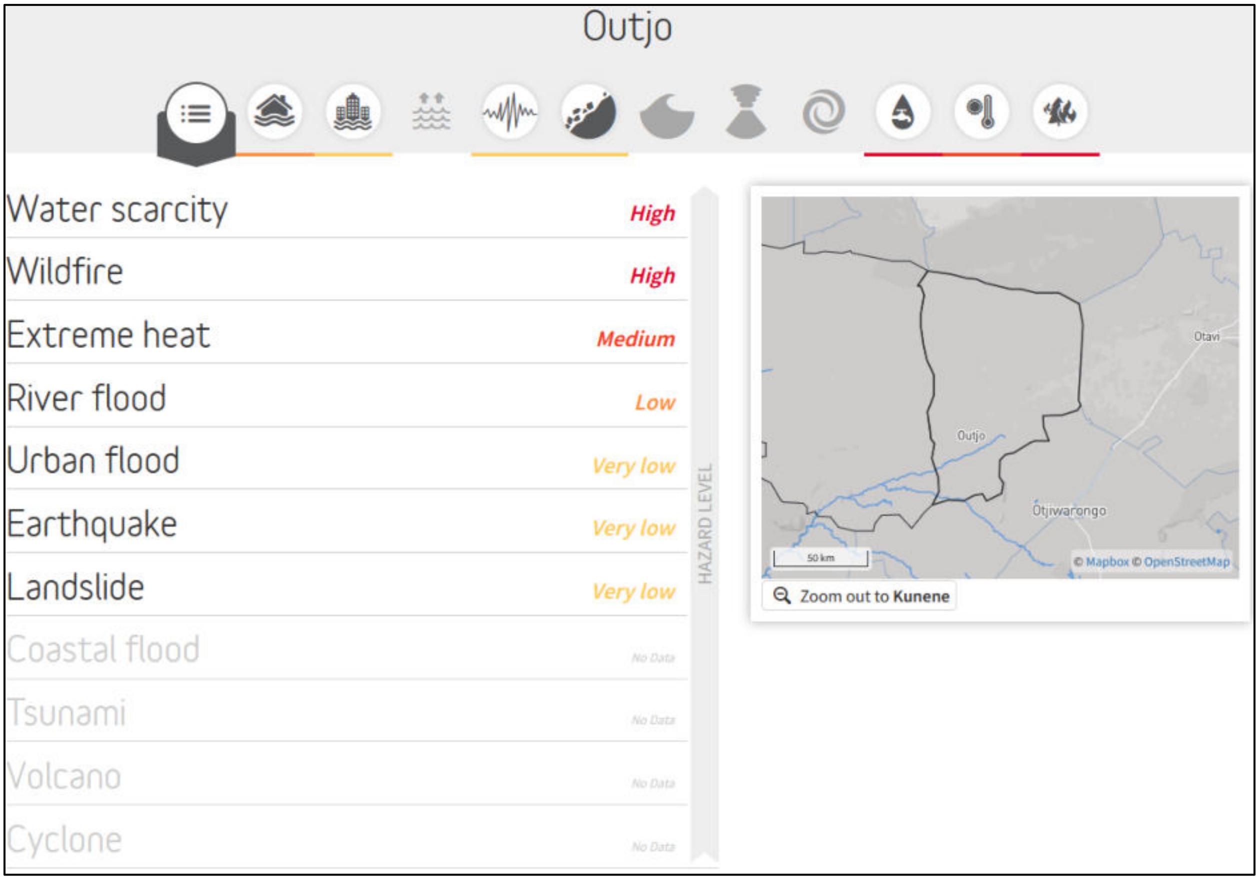

Figure 1-5. Hazard level for Outjo.

While climate change impacts are not anticipated to be significant over the design life of the solar park (25 years), project outputs sensitive to climate change were identified along with climate change risk response (mitigation) measures.

Recommendations include adequate engineering design of sites (e.g., the water scarcity can be dealt with by providing smarter and handy solutions to these solar modules - the main options include waterless cleaning robots for solar panels, fire suppression techniques based on the design, construction and installation of plant, design maximum ambient temperature components, improved ventilation systems, etc.)

The key climate vulnerable project components as well as surrounding community will be subject to further analysis during the project detailed engineering design to ensure they take account of projected increases in water scarcity, wildlife and extreme heat; measures that will permanently become part of the solar project infrastructure will be included within the main civil work contract costs.

The impacts of climate change on surrounding communities are of great concern. These impacts can have far-reaching consequences on the economy, social and environmental systems. In the case of the Outjo and Otjiwarongo community in the Otjozondjupa Region of Namibia, climate change has been observed to have significant effects on various aspects of their livelihoods. In this context, it is important to understand the specific impacts of climate change on the community and to develop strategies to address them. An overview of the likely impacts of climate change on the surrounding communities are given below, highlighting key areas such as agriculture, water resources, and biodiversity:

1. Agricultural impacts: Otjiwarongo is a rural community that relies heavily on agriculture, which is particularly vulnerable to climate change impacts such as droughts, floods, and pests. According to the Namibia Agronomic Board, droughts in recent years have led to significant crop losses and reduced livestock productivity, which has had a negative impact on the local economy and food security. For example, in 2019, the maize harvest in the Otjozondjupa Region was estimated to be only 25% of the normal yield due to drought.
2. Water resources: Climate change is affecting water availability in the region, with decreased rainfall and increased evaporation rates. According to the Ministry of Agriculture, Water and Forestry, the Otjozondjupa Region has experienced a decline in surface water and groundwater resources, which has impacted both human and animal water needs. For example, in 2018, the Namibia Red Cross Society reported that more than 3,000 households in the Otjozondjupa Region were facing water shortages due to drought.
3. Health impacts: Climate change is also affecting the health of the community in Otjiwarongo. According to the Namibia Meteorological Service, the region is experiencing more frequent and intense heatwaves, which can have significant health impacts such as heat stroke, dehydration, and respiratory illness. For example, in 2020, the Ministry of Health and Social Services reported that there was an increase in heat-related illnesses in the Otjozondjupa Region during a particularly intense heatwave.

4. Biodiversity impacts: Climate change is also affecting the biodiversity of the region, with changes in temperature and rainfall patterns impacting the distribution and abundance of species. According to the Ministry of Environment and Tourism, the Otjozondjupa Region is experiencing changes in the timing and duration of rainfall, which is impacting the growth and survival of plants and animals. For example, the Ministry reports that the distribution of the mopane tree, an important food source for elephants, has shifted in recent years due to changes in rainfall patterns.

These examples highlight the diverse impacts of climate change on the communities surrounding project area and Region. The impacts are expected to intensify in the future, highlighting the urgent need for adaptation and mitigation measures to address climate change and build resilience in the community.

1.1.7.2 Climate Change Trends and Projections

Namibia is situated in the south-western region of the African continent, between latitude 17°S and 29°S and longitude 11°E and 26°E. The country is predominantly arid with two deserts, the Namib and the Kalahari, taking over large portions of the country's land to the east and west, respectively. Aridity reduces towards the central plateau regions and the great escarpment located between the central plateau and the Namib desert. Namibia's climate consists of persistent droughts, unpredictable and variable rainfall patterns, high temperature variability, and scarcity of water.[4]

The climate is generally hot and dry with sparse and erratic rainfall. 92% of the land area is defined as very-arid, arid or semi-arid. The country ranks second in aridity after the Sahara Desert. The dryness of the country is largely a function of the northward flowing Benguela current, which brings cold air to the western shores, driven by a high-pressure system. This combination generally suppresses rainfall. However, during the summer periods, the Inter-Tropical Convergence Zone (ITCZ) draws moisture from the equator to

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[4] Republic of Namibia, "Namibia's Updated Nationally Determined Contribution to the UNFCCC" (Windhoek, Namibia, 2021).

the northern and eastern regions of the country, leading to the rainfall season between October and April.[5]

1.1.7.2.1 Historical Trends and Projected Changes in Temperature and Rainfall

Historically, rainfall in Namibia is extremely variable. Mean annual rainfall is only 278 millimetres (mm), with a variation from 650 mm in the northeast to less than 50 mm in the southwest and along the coastal areas. In the Namib Desert, rainfall is extremely scarce. Rainfall peaks in January, February, and March where mean monthly rainfall averages approximately 62 mm, 66 mm, and 55 mm respectively. From a hydrological point of view, Namibia is an arid, water deficient country. High solar radiation, low humidity, and high temperature lead to very high evaporation rates, which vary between 3,800 mm per annum in the south to 2,600 mm per annum in the north. Over most of the country, potential evaporation is at least five times greater than average rainfall.6

Namibia is characterized by high temperatures, with mean annual temperatures ranging from 14.3°C to 24. 2°C. Mean annual temperatures are high in continental regions, reaching above 22°C in the north and lower in the coastal areas (this is moderated by the Benguela current), reaching below 16°C in the southern coast. Apart from the coastal zone, there is a distinct seasonal temperature regime, with the highest temperatures occurring just before the wet season in the wetter areas or during the wet season in the more arid parts of the country. The lowest temperatures occur during the dry season months of June to August.[7] Daily maximum temperatures of above 40°C are recorded regularly and average temperatures do not fall below 0°C.19 In the continental regions, relative humidity averages between 25% and 70%. Both rainfall and temperature in Namibia are sensitive to the El Niño–Southern Oscillation (ENSO) effect, and rainfall is below average during El Niño conditions.[8]

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[5] World Bank, "Namibia - Climate Change Overview," 2020, https://climateknowledgeportal.worldbank.org/country/namibia.
[6] World Bank.
[7] Republic of Namibia, "Namibia's Fourth National Communication to the United Nations Framework Convention on Climate Change" (Windhoek, 2020).
[8] Hannah Reid et al., "Climate Change Impacts on Namibia's Natural Resources and Economy," *Climate Policy*, 2008, https://doi.org/10.1080/14693062.2008.9685709; Republic of Namibia, "National Climate Change Strategy & Action Plan 2013 – 2020," 2015.

Analysis of data from the World Bank Group's Climate Change Knowledge Portal (CCKP) (Table 1) shows information for the latest climatology, 1991–2020.[9] Mean annual temperature for Namibia is 20.6°C, with average monthly temperatures ranging between 24°C (November to March) and 16°C (June, July). Mean annual precipitation is 269.2 mm. Rainfall occurs from October to April, with minimal rainfall in May and September, across the latest climatology, 1991–2020 (Figure 1-5).[10]

Table 1-5. Summary Climatological data for Namibia 1901 - 2021.

Category	Min-Temperature	Mean-Temperature	Max-Temperature	Precipitation
Jan	17.98	24.53	31.14	64.78
Feb	17.83	24.04	30.29	65.54
Mar	16.69	22.98	29.32	54.49
Apr	13.92	20.84	27.80	18.57
May	9.86	17.70	25.58	3.46
Jun	6.88	14.97	23.11	1.06
Jul	6.37	14.68	23.05	0.62
Aug	7.87	16.44	25.06	0.74
Sep	11.11	19.61	28.16	2.02
Oct	14.34	22.25	30.22	9.20
Nov	15.92	23.29	30.72	22.28
Dec	17.10	24.27	31.50	34.81

[9] CCRP, "Namibia - Climatology - Climate Change Knowledge Portal," 2021, https://climateknowledgeportal.worldbank.org/country/namibia/climate-data-historical.
[10] CCRP.

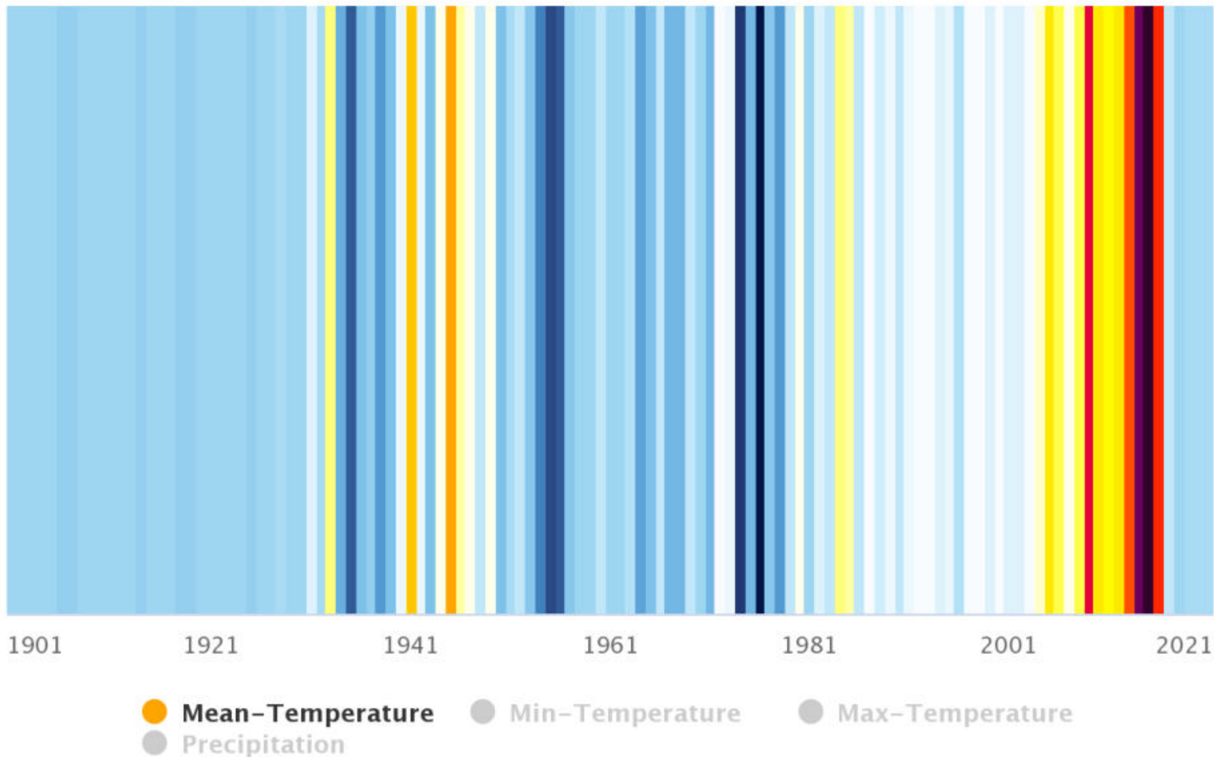

Figure 1-6. Observed annual mean - temperature, 1901 - 2021 Outjo.

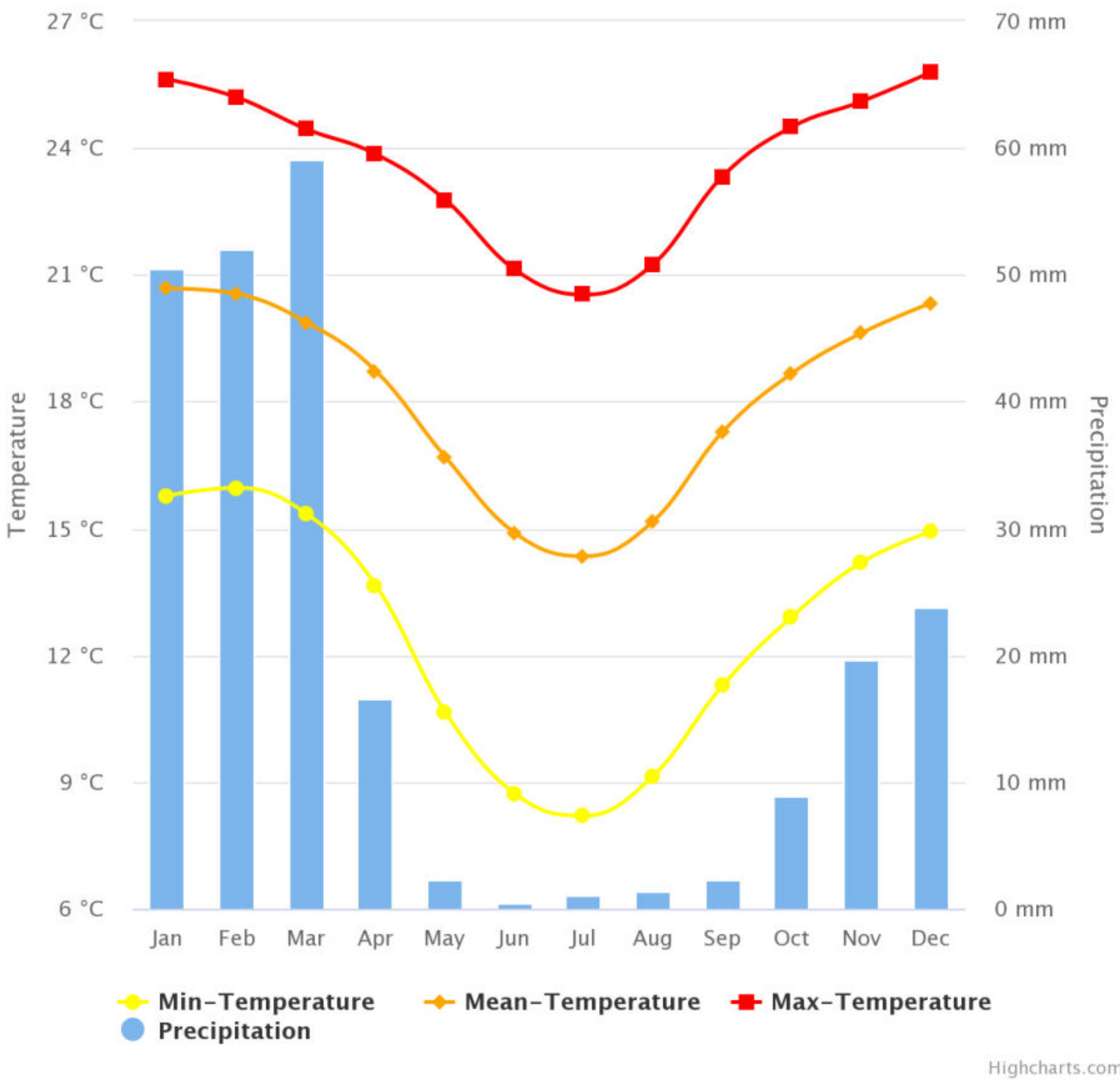

Figure 1-7. Monthly climatology of Min- Temperature, Mean- Temperature, Max- Temperature & Precipitation 1991 – 2020 Outjo.

Figure 1-8 shows the historical observed annual mean temperature from 1901 – 2021.[11]

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[11] CCRP.

1.1.7.2.2 An analysis of changes compared to the historical baseline following the IPCC guidance notes.

The Intergovernmental Panel on Climate Change (IPCC) has established several guidance notes to help explain the impacts of climate change. Explaining these guidance notes in the context of the Otjozondjupa Region in Namibia, these include:

1. Historical trends in temperature: The Otjozondjupa Region has experienced a significant increase in temperature over the past century. According to data from the Namibia Meteorological Service, the average temperature has increased by 0.8°C over the last century, with most of the warming occurring in the last few decades.
2. Projected changes in temperature: The IPCC has projected that under a high-emissions scenario (RCP8.5), the Otjozondjupa Region could experience a further increase in temperature of between 1.5°C and 4.5°C by the end of the century, compared to the average temperature between 1986 and 2005. This temperature increase could have significant impacts on the region's agriculture, water resources, and ecosystems.
3. Impacts on natural and human systems: Climate change is already having significant impacts on the Otjozondjupa Region, including changes in agricultural production, water availability, and biodiversity. These impacts are expected to intensify in the future and could have significant economic and social consequences for the region's residents.
4. Mitigation options: To mitigate the impacts of climate change, the region could focus on reducing greenhouse gas emissions by transitioning to renewable energy sources, improving energy efficiency, and implementing other measures to reduce emissions.
5. Adaptation options: To adapt to the impacts of climate change, the region could implement a range of measures such as improving water management practices, developing drought-resistant crops, and building infrastructure to protect against extreme weather events.
6. Interactions between mitigation and adaptation: There are potential synergies and trade-offs between mitigation and adaptation measures. For example,

renewable energy sources could provide both emissions reductions and improved energy security, while afforestation could both sequester carbon and provide other ecosystem benefits.

7. Uncertainty and risk management: There are significant uncertainties associated with climate change projections, and the region will need to manage the risks associated with these uncertainties through measures such as building resilience and diversifying its economy.

These guidance notes provide a framework for understanding the impacts of climate change on the Otjozondjupa Region in Namibia and the potential solutions to address it. The region will need to implement a range of mitigation and adaptation measures to manage the risks associated with climate change and build a more resilient and sustainable future.

Using the Intergovernmental Panel on Climate Change (IPCC) established guidance notes it can help us understand how climate change is affecting specific regions, such as the Otjiwarongo Region in Namibia. Historical trends in temperature refer to the long-term changes in average temperatures over a period of at least 30 years. In the case of the Otjiwarongo Region, data from the Namibia Meteorological Service shows that the average temperature has increased by 0.8°C over the last century, with most of the warming occurring in the last few decades. This increase in temperature is consistent with global climate change trends, which are primarily driven by human activities such as the burning of fossil fuels.

The IPCC has developed different scenarios, called Representative Concentration Pathways (RCPs), which describe different levels of greenhouse gas emissions and their potential impacts on the climate. In the case of the Otjiwarongo Region, the IPCC projects that under a high-emissions scenario (RCP8.5), the region could experience a further increase in temperature of between 1.5°C and 4.5°C by the end of the century, compared to the average temperature between 1986 and 2005.

To put this in perspective, a temperature increase of 4.5°C would have significant impacts on the region's agriculture, water resources, and ecosystems, and would pose serious challenges for the region's adaptation to climate change. The IPCC guidance notes on historical trends and projected changes in temperature can help us understand the impacts of climate change on specific regions such as the Otjiwarongo Region in Namibia. The historical trend of temperature increase in the region is consistent with global trends, and the projected changes highlight the urgent need for action to mitigate greenhouse gas emissions and adapt to the impacts of climate change.

1.1.7.2.2.1 Temperature

Namibia is characterized by high temperatures. Apart from the coastal zone, there is a marked seasonal temperature regime, with the highest temperatures occurring just before the wet season in the wetter areas or during the wet season in the drier areas. The lowest temperatures in the country occur during the dry season months of June to August. Since the 1960s, increased mean, maximum, and minimum temperatures have been observed, with a more rapid increase in night-time, minimum, temperatures (Figure 1-8). Warming in Namibia and in Outjo has been higher than the global average. There have been significant increases in the frequency of days with maximum temperatures above 25°C and 35°C, with decreases in the frequency of days with minimum temperatures below 5°C.[12]

[12] CCRP.

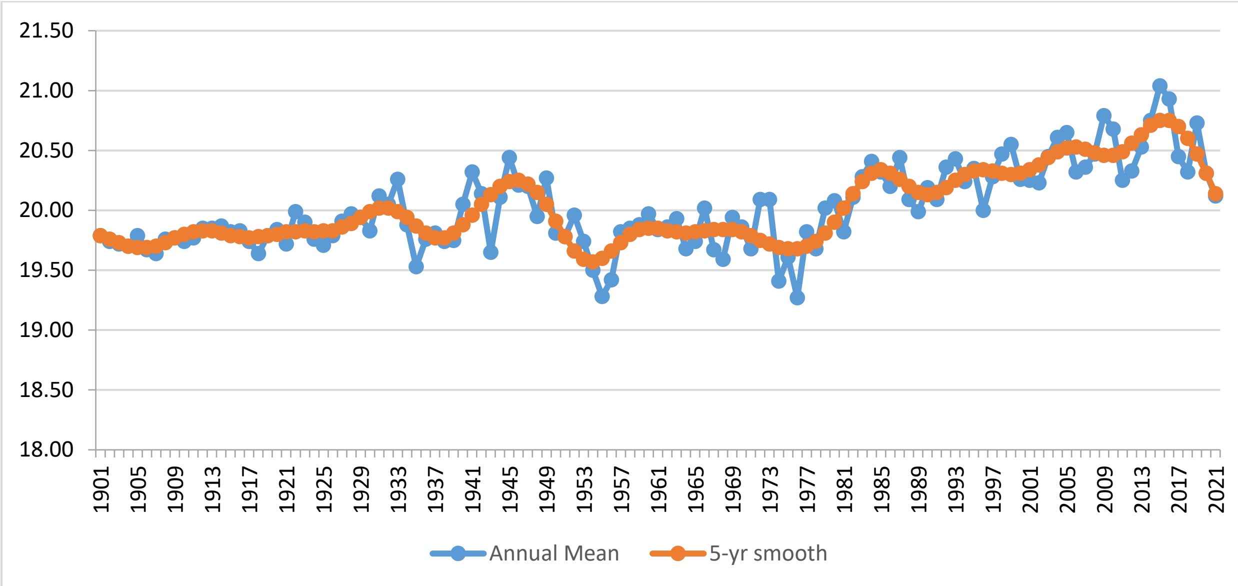

Figure 1-8. Observed average annual temperature - Outjo, Namibia 1901 - 2021.

1.1.7.2.2.2 Precipitation

The movement of the ITCZ towards the south during the Namibian summer results in the rainy season, November through April. In the far south, the Temperate Zone moves northwards during the winter, resulting in the winter rains that occur in the far southwest of the country. Small variations in the timing of these movements result in considerable differences in the weather experienced in Namibia year on year. The country's 'maize triangle' of Tsumeb, Grootberg, and Otavi typically receives more rainfall than would be expected in that geographic location. Since the 1960s summer precipitation is expected to increase, however changes in onset, duration, and intensity of rainfall have been observed, indicating an increase in heavy rainfall events

1.1.7.2.3 Climate Future

The main data source for the World Bank Group's CCKP is the CMIP5 (Coupled Model Inter-Comparison Project Phase5) data ensemble, which builds the database for the global climate change projections presented in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Four Representative Concentration Pathways (i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5) were selected and defined by their total radiative forcing (cumulative measure of GHG emissions from all sources) pathway and level by 2100. The RCP2.6 for example represents a very strong mitigation scenario, whereas the RCP8.5 assumes business-as-usual scenario. For more information, please refer to the RCP Database. For simplification, these scenarios are referred to as a low (RCP2.6); a medium (RCP4.5) and a high (RCP8.5) emission scenario in this profile. Table 3 provides CMIP5 projections for selected essential climate variables under high emission scenario (RCP 8.5) over 4 different time horizons. Figure 6 presents the multi-model (CMIP5) ensemble of 32 Global Circulation Models (GCMs) showing the projected changes in annual precipitation and temperature for the periods 2040–2059 and 2080–2099.[13]

Table 1-6. CMIP5 Ensemble Projection.

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Average Temperature Anomaly (°C)	**+0.6°C to +1.8°C** (+1.2°C)	**+1.5°C to +2.9°C** (+2.1°C)	**+2.5°C to +4.5°C** (+3.2°C)	**+3.3°C to +6.0°C** (+4.3°C)
Annual Precipitation Anomaly (mm)	-11.8 to +10.2 (−1.2 mm)	-15.7 to +6.9 (−3.4 mm)	-17.7 to +5.9 (−4.3 mm)	-21.3 to +5.2 (−6.1 mm)

Note: *The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).*

[13] IIASA, “Models, Tools, and Data,” 2022, https://iiasa.ac.at/models-tools-data.

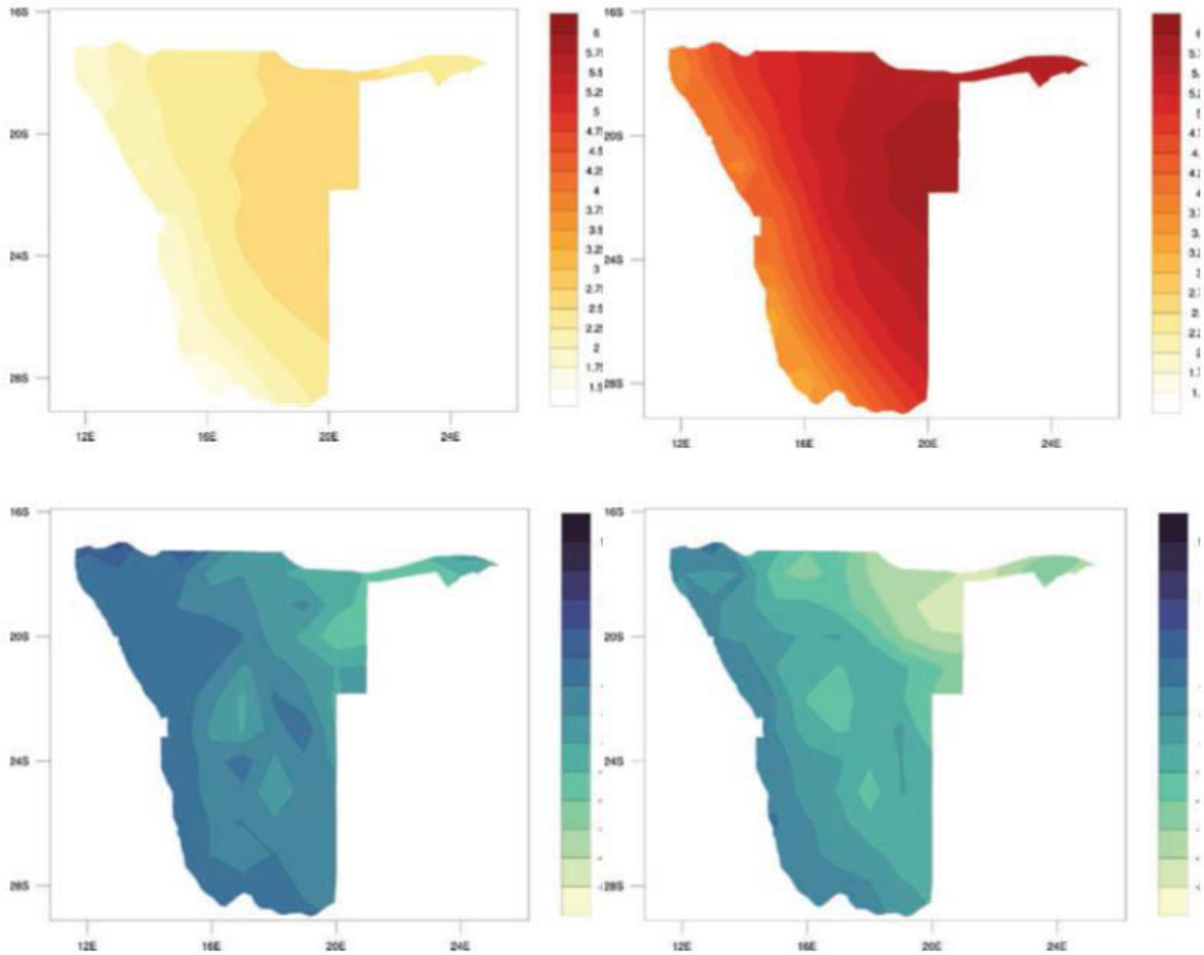

Figure 1-9: Multi-Model (CMIP5) Ensemble Projected Changes (32 GCMs) in Annual Temperature (top) and Precipitation (bottom) by 2040–2059 (left) and by 2080–2099 (right), Relative to 1986–2005 Baseline under RCP8.5.

1.1.7.2.4 Key Trends

1.1.7.2.4.1 Temperature

Compared to the baseline (1995), temperature is projected to increase progressively in Namibia throughout the end of the century and will increase across the whole country. The greatest increases being projected for inland regions (esp. Omaheke and Zambezi Regions). The greatest increase in temperatures will be over the period September–

October–November. The seasons with the smallest projected increase in temperature are December– January–February and March–April–May.[14]

According to analysis from the German Climate Service Centre (GERICS) of 32 Global Climate Models (GCMs), temperatures across Namibia are expected to increase by 1.7°C to 5.4°C by the 2080s. Maximum temperatures are expected to increase by 2.0°C to as much a 5.4°C. with minimum (night-time) temperatures are expected to increase from 1.5°C to 4.9°C by the end of the century. The duration of heat waves is expected to increase by 6 to 29 days by the 2080s; the number of cold days will significantly reduce.[15]

Across all emission scenarios, temperature increase for Namibia will continue to rise throughout the end of the century. As seen in Figure 1-9 , under a high-emission scenario, average temperatures are expected to increase rapidly by mid-century. Temperatures are expected to increase throughout the end of the century. Across the seasonal cycle, temperature is supposed to increase throughout the year. Increased heat and extreme heat conditions will result in significant implications for human and animal health, agriculture, and ecosystems.

Although the temperature does not affect the amount of sunlight a solar cell receives, it does affect how much power is produced. The output of most solar panels is measured under Standard Test Conditions (STC) – this means a temperature of 25°C and according to the manufacturer standards, 25 °C temperature indicates the peak of the optimum temperature range of photovoltaic solar panels. In figure 1-9 the predicted temperature falls within the limit for optimal peak temperatures (24.6 °C). Since hotter solar panels produce less energy from the same amount of sunlight, this will not affect the project for the next 100 years (Figure 1-10).

Being aware of the effect higher temperature has on the energy output, installers can take steps to support natural cooling of the solar system. Since the project site is in a hot

[14] Republic of Namibia, "Namibia's Fourth National Communication to the United Nations Framework Convention on Climate Change."
[15] GERICS, "GERICS Country Climate Fact Sheets - Namibia," 2015, https://www.climate-service-center.de/finder/index.php.en?topics=0&continents=Africa&countries=80_58.

climate, the project should consider ground-mounted solar panels, because this way they get the most airflow to keep their temperature lower. The best option is to get solar panels with temperature coefficient as close to zero as possible. The difference in total power output throughout the year can be significant.

For example, if solar panels with a coefficient of minus 0.4 percent are used, their output on hot days will drop nearly twice that much compared to the output of a panel with a coefficient of only minus 0.2 percent per one degree Celsius.

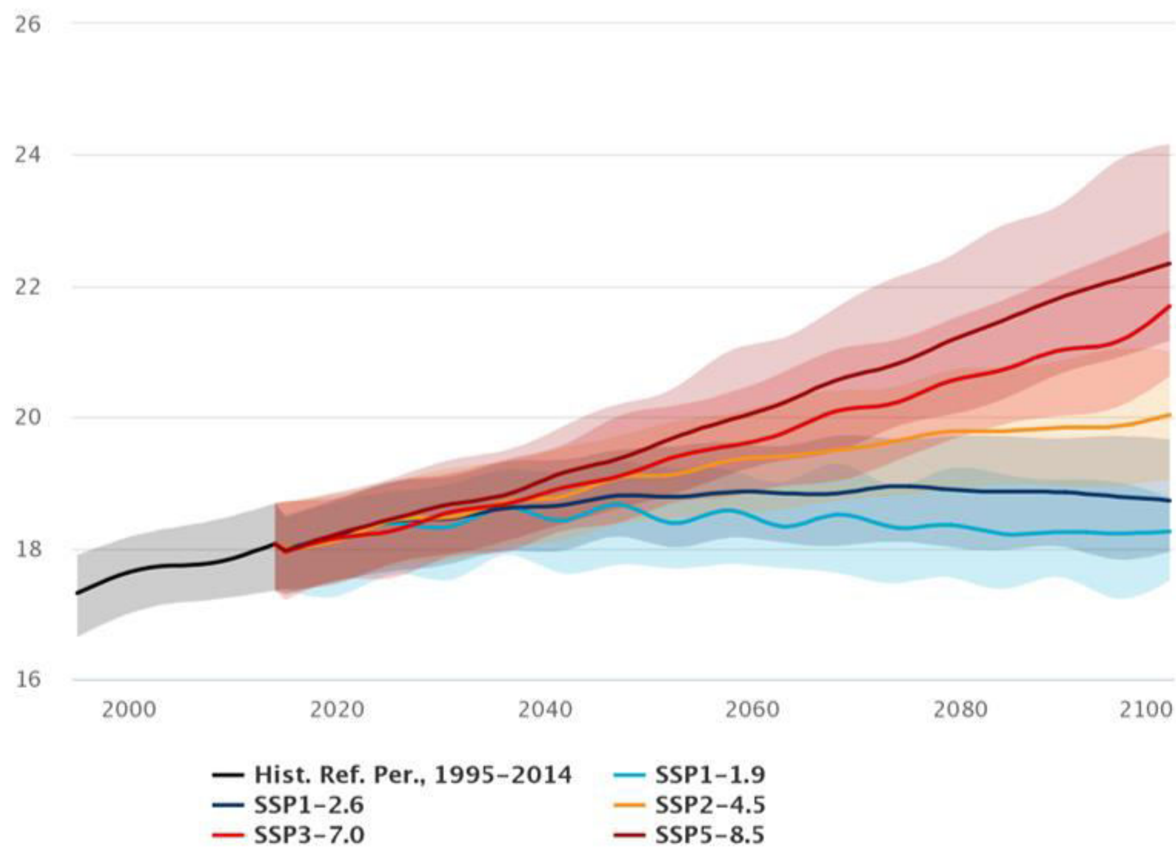

Figure 1-10. Projected Mean- Temperature, Outjo, Kunene, Namibia; Ref. Period: 1995-2014), Multi-Model Ensemble.

1.1.7.2.4.2 Precipitation

While changing rainfall trends in Namibia is highly variable, GERICS analysis indicates total precipitation rates are likely to reduce by as much as 19% by the 2080s. The largest decrease is projected for the typical dry season, April to October, with likely reductions from 5% to as much as 65%. The country’s typical wet season, November to March, are expected to receive a small increase in precipitation.[16] The greatest reduction for the interior of the country will occur from December to February. Other projections indicate that the northern and central parts of the country may experience a decline in rainfall to a more significant degree than other parts of the country.[17] Similarly, seasonal precipitation trends are expected to alter over the coming century and there will likely be an increase in rainfall over the periods September-October-November and March–April–May; occurring at the end of the usual rainy season.

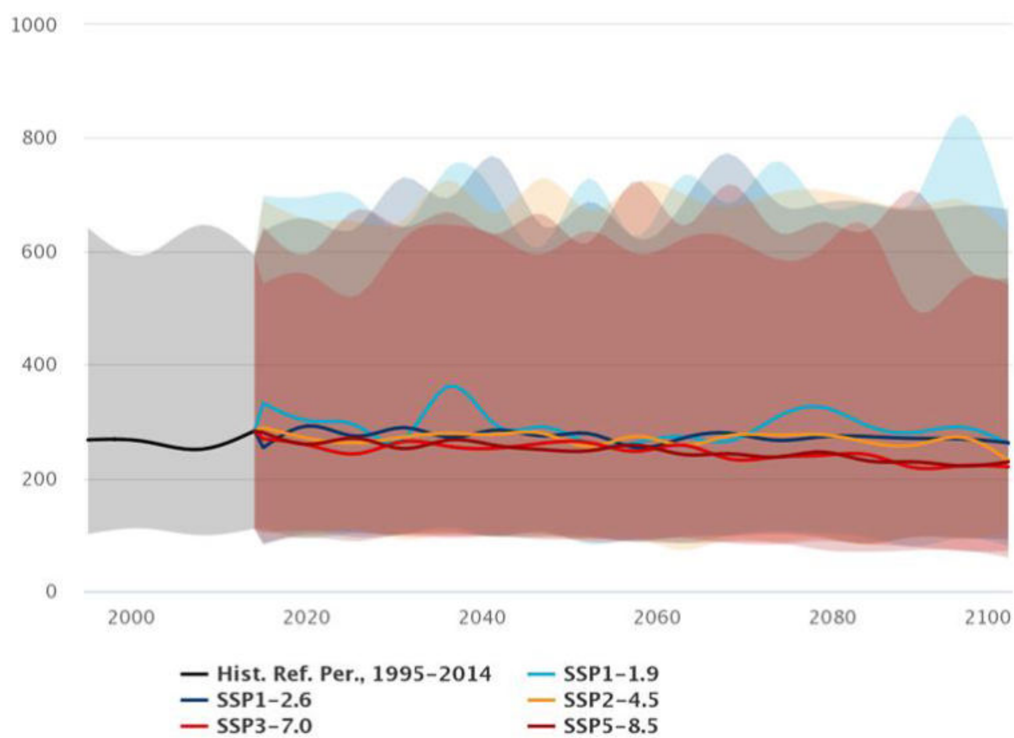

Figure 1-11. Projected Annual Average Precipitation in Outjo, Kunene, Namibia (Reference Period, 1986-2005).

Figure 1-12 shows the change in the projected annual average precipitation for Namibia. At a nationally aggregated scale, annual average precipitation is expected to remain similar to historical observations, but under the highest emissions scenario, RCP8.5, will decrease the most drastically. Water routing, storage and other management options can

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[16] GERICS.
[17] CCRP, "Namibia - Climatology - Climate Change Knowledge Portal."

be highly varied depending if the precipitation input comes frequently or with long periods of aridity in between rainfall.[18]

1.1.7.2.5 Assumptions, Data Limitations and Uncertainty

The future is by definition uncertain. Using models to project probable futures based on current information and understanding entails additional uncertainties. Some of these uncertainties are due to the assumptions underlying a modeling approach; to the extent that these assumptions are violated, uncertainty in the model projections is increased. But there are other sources of uncertainty as well.

There are three main sources of uncertainty in projections of climate: that due to future emissions (scenario uncertainty, green), due to internal climate variability (orange), and due to inter-model differences (blue).[19]

1.1.7.3 Climate Related Natural Hazards

Namibia is highly vulnerable to natural disasters such as droughts, flooding, water scarcity, extreme heat, and wildfires.[20] The population is at most at risk from floods, drought, and disease outbreaks. Namibia is prone to recurrent drought conditions and wildfires due to its hot and dry climate and erratic rains. Forest and wildfires are common, especially in the north-eastern part of the country. It is estimated that fires damaged between 3 and 7 million hectares of land annually.

1.1.7.3.1 Key Trends

Climate change trends in Namibia are expected to increase the risk and intensity of extreme events and natural hazards, such as heat waves, droughts, floods, and wildfires.[21] It is likely that climate change trends will lead to an increase in drought frequency and intensity as well as an increase in the physical area of drought proneness in Namibia; this will likely impact water scarcity.[22] The incidence of wildfires is also likely

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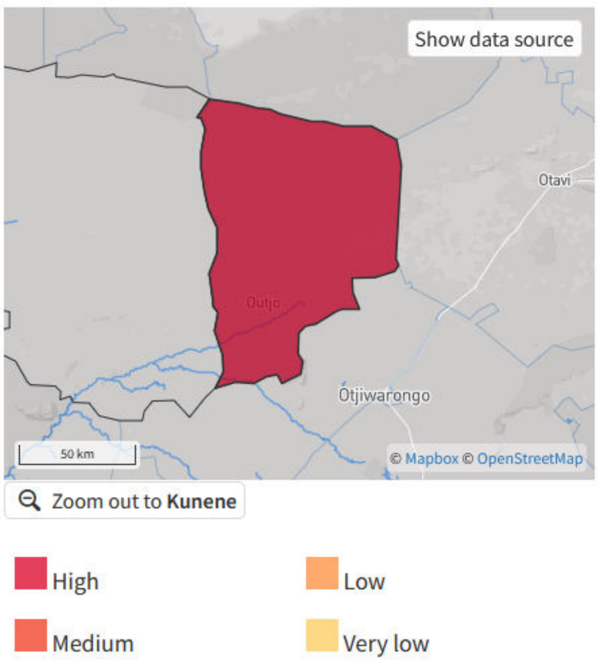
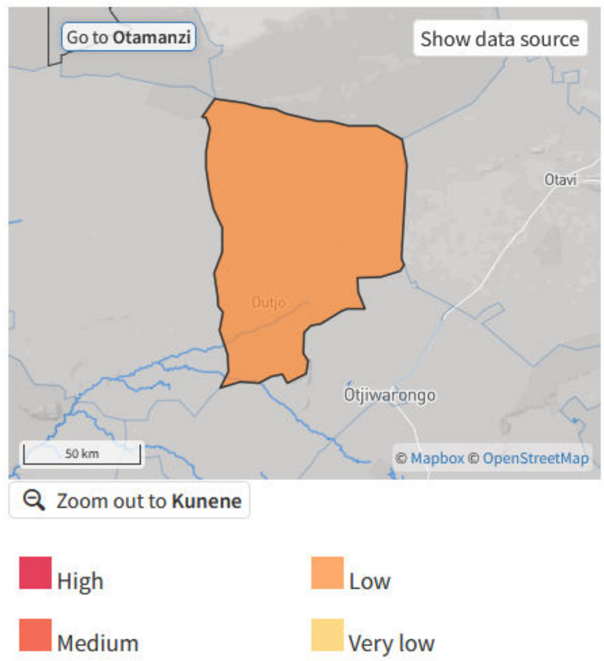
[18] CCRP.
[19] CCRP; IIASA, "Models, Tools, and Data."
[20] GFDRR, "Think Hazard - Namibia."
[21] Republic of Namibia, "Namibia's Fourth National Communication to the United Nations Framework Convention on Climate Change."
[22] GFDRR, "Think Hazard - Namibia."

to increase as the climate changes, largely due to the rising temperatures and erratic rainfall. The country's fire season is likely to increase in duration and include a greater number of days with weather that could support fire spread because of longer periods without rain during fire seasons. Climate projections indicate also that there could also be an increase in the severity of fire.[23]

Risk of Water Scarcity



Risk of River Flood



[23] Republic of Namibia, "Capacity Assessment Report of the National Disaster Risk Management System in Namibia" (Windhoek, Namibia, 2016).

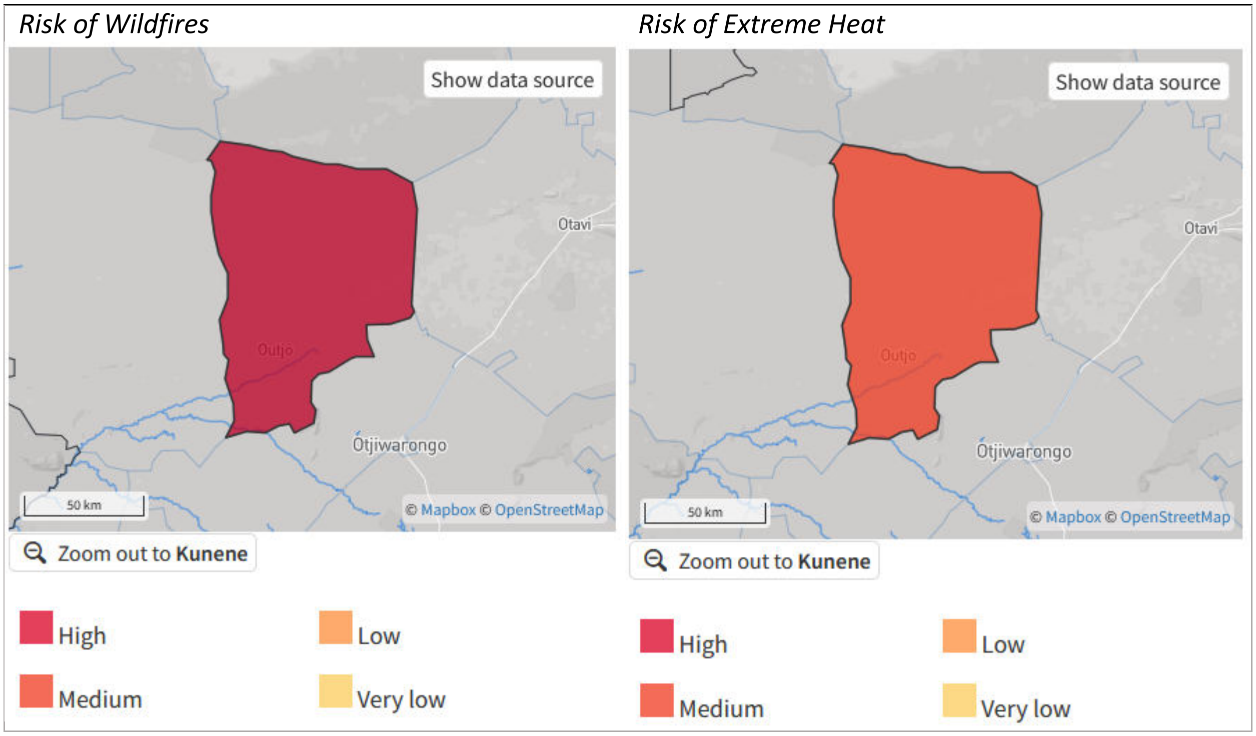


Figure 1-12: Risk hazard mapping for Outjo, Kunene, Namibia

1.1.7.3.2 Climate Change Impacts in the Energy Sector

Namibia has high potential for solar, wind, and biomass generation. Brush is widely spread in the country's northern areas, which allows a large-scale bioenergy-based production capacity. the current trend is to replace these with solar energy sources. Namibia is at risk to disrupted and/or limited power supply due to climate change trends of reduced precipitation, reduced river flow, and thus decreased hydropower generation. As Namibia is dependent upon energy supply from southern Africa, regional trends can be highly impactful.

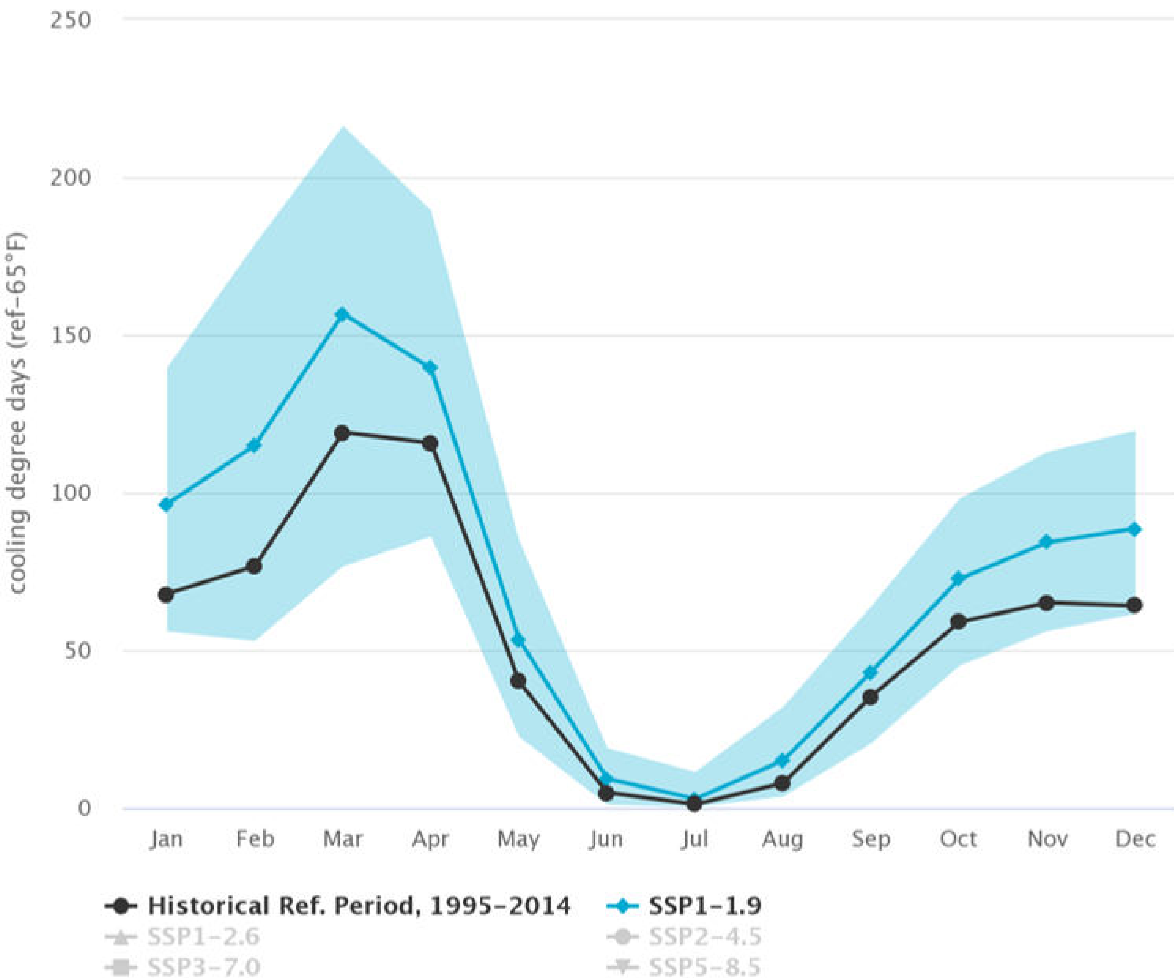


Figure 1-13. Projected Climatology of Cooling Degree Days (ref-65F) for 2020-2039, Outjo, Kunene, Namibia; (Reference Period: 1995-2014), SSp1-1.9, Multi-Model Ensemble.

Increased temperatures are likely to increase energy demand, especially during peak heat periods. The relationship of daily heat with the demand for electricity can be estimated through Cooling Degree Days (Figure 1-14). This quantity accumulates the temperatures above 18°C threshold, which broadly represents a comfortable living environment. Cooling Degree Days capture the amount of heat that society would like to get rid of by period through some form of active cooling, be it through air conditioning or through evaporative processes that generally require pumps for water. The monthly changes provide insight into potentially extended seasons of power demand for cooling or highlighting when during the year likely power demand increases might occur. The figure below shows the increase in cooling days across the seasonal cycle. Sharp increases in temperature are expected during the country's typical hot seasons across all RCP scenarios.

1.1.7.3.3 Adaptation options

The Namibian government has made addressing the need to increase access to energy however a significant share of current energy demand remains unmet. The current grid is unable to reliably serve the existing industrial and urban customer base. The country has committed to improving its energy situation by increasing the share of renewable energy (hydro, solar, wind, and biomass) in electricity production from 33% in 2010 to approximately 70% in 2030; implementing an energy efficiency program to reduce consumption by 10% in 2030.[24]

1.1.7.4 Climate Change Risk Management Response

The project will support the upgrade and climate proofing of solar plant infrastructure. The design, operation and maintenance standards for the solar plant infrastructure integrate measures to improve heat and flood resilience. Change in temperature and solar radiation are not anticipated to be significant over the design life of the solar project (+25 years).

The study recommends the following measures to be integrated into detailed design to maximize heat and flood resilience and minimize impacts on local drainage patterns:

- Consider solar modules with a higher temperature coefficient
- Consider selection of appropriate tilt panel angle to clean dust
- Consider selection of module surface conducive to self-cleaning
- Where extreme weather conditions are expected, adopt higher design standard for the transmission line including building a resilient high capacity transmission system
- Consider highest flood level and suitable slope in project detailed design – site preparation and civil works for the solar plant and placement of tower footings for

[24] GFDRR, "Think Hazard - Namibia."

the transmission line; and type of road surface (all weather) and embankment height for access road construction

- Design improved flood protection measures for all equipment mounted at ground level
- Strengthen existing drainage canals at the solar plant site
- Design water retention pond for controlled inflow and overflow and use for operation and maintenance (e.g. landscaping, washing of PV panels, etc.)

Table 1-7. Summary of key vulnerabilities and climate projections

	PV	***Future trend***
Heat waves	Reduced output and potential material damage	*Increase*
Hail	Potential material damage	*No clear trend*
Strong wind	Material damage from debris, and need for cleaning	*Potential increase, but regionally variable*
Dustiness	Reduced output	*May increase in semi-arid environments that are growing drier*
Prolonged cloudiness	Reduced output	*Increase at high latitudes, decrease at low latitudes*

Heat waves are projected to increase in the future, but the threat is relatively small in the context of anticipated cost reductions for PV. At the same time, the greatest change in temperature anomalies will be in terms of warmer nights, which are largely unproblematic for solar energy generation.

Strong winds may prove to be a problem for PV technologies. There is a potential trend, in many locations, for an increased incidence of high winds. These can cause damage like flying debris and also dust deposition, the latter necessitating the cleaning of solar collectors and mirrors.

1.1.7.4.1 Greenhouse gas (GHG) emissions profile (Country and sector)

1.1.7.4.1.1 Trends and emissions on the country based on the updated NDC report for Namibia

The updated NDC presents a progressive shift above the 2015 pledge to reduce emissions from 89% to 91% by 2030. Namibia's mitigation commitment is in the form of a decrease in GHG emissions compared to the Business as Usual (BAU) baseline over the 2015-2030 period. This update presents an improvement in the commitment of the devotion of Namibia to meeting the Paris Agreement goal and following the road to net zero emissions by 2050.

1.1.7.4.1.2 Sector related GHG emissions

In the energy sector, the national sustainable energy strategy of Namibia looks to introduce new emissions-reducing technologies and encourage healthier practices that are more energy efficient.[25] In the energy sector, Namibia's National Renewable Energy Policy aims to drive emerging technologies that reduce emissions and support cleaner practices. The goal is the substitution of existing higher emission technologies with cleaner, more efficient, and lower-cost technologies. Namibia's efforts in renewables will contribute to a 30% reduction equivalent in the quantity (2.668 TWh) of electricity imported in 2018 which would result in 0.8 TWh (800 GWh) in new RE generation of 330 MW of Solar PV per annum until 2030.

1.1.7.5 GHG Mitigation Response and Reduction Benefit Assessment

When the anticipated 120 MW of solar PV capacity is operational, it is expected that the plant will avoid at least 153,212 tons of carbon dioxide-equivalent (tCO2e) annually or approximately 3.83 million tCO_2e over a 25-year project lifetime. These GHG emissions savings will be counted by the project financiers of the solar PV power plant. Starting from construction to operation phase a total emission, 6.8 tCO2-e/ha/yr.

1.1.7.5.1 Project Elements

A list of the identified elements of the proposal and the phases in which they occur are provided in Table 7-5.

[25] Ministry of Mines and Energy, "National Renewable Energy Policy for Namibia," 2017.

Table 1-8. Identified project elements and phases

Project Element	Project Phase
Vegetation clearing	Construction
Vehicles and equipment (including stationary)	Construction & Operation/Maintenance
Transmission line	Construction & Operation/Maintenance
Substation	Construction & Operation/Maintenance
Access tracks	Construction & Operation/Maintenance
Earthworks (cut to fill, imported fill)	Construction
Transmission and Distribution	Operation

An understanding of associated operational GHG emissions is also critical in enabling the Horizon Power to assess its operational climate related impacts and direct progress toward reducing their carbon footprint.

The GHG emissions assessment includes estimates for scope 1, scope 2 and scope 3 emissions attributed to the construction and operation (including maintenance) of the proposal. For the operation elements, scope 2 and 3 emissions have been modelled showing annual predicted emissions.

The estimates include GHG emissions related to both direct (scope 1) and indirect (scope 2 and scope 3) emissions as defined in Table 7-6.

Table 1-9. GHG emissions scope definitions

Principle	Description
Scope 1	Direct emissions from owned or controlled sources resulting from the combustion/consumption of fuels (e.g., combustion of diesel in engines, transmission losses, use of synthetic gasses)
Scope 2	Indirect emissions from the generation of purchased energy (e.g., purchased electricity)
Scope 3	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions (e.g., purchase of goods and services)

1.1.7.5.2 Carbon Accounting and Reporting

Carbon accounting is the process of identifying and measuring the amount of GHG, measured in t CO_2-e, emitted by an entity or project. Carbon reporting is the process of reporting on that accounting.

1.1.7.5.2.1 GHG emissions

The carbon account is inclusive of the following GHG emissions covered by the United Nations Framework Convention on Climate Change (UNFCCC) Reporting Guidelines and in line with the GHG Factor Guideline:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous dioxide (N_2O)
- Sulphur hexafluoride (SF_6)
- Perfluorocarbons (PFCs)
- Hydrofluorocarbons (HFCs)

While all the above-mentioned GHG's have been considered, GHG's relating to infrastructure developments are primarily limited to CO_2, CH_4 and N_2O.

1.1.7.5.2.2 GHG Assessment Boundaries

In estimating GHG emissions for the proposal, the assessment boundary has been considered to include all the emission sources that were deemed to potentially be impacted by decisions made by designers, constructors, managers, operators of the transmission line and associated infrastructure.

The identified project elements and phases which have been included in the assessment boundary are listed in Table 7-5.

For the purposes of this GHG assessment all activities and project elements where data was available have been estimated. The activities and projects elements captured likely represent the most emissions intensive over the construction and operation phases.

1.1.7.5.2.3 Policy and Reference Documents

The following documents have been used for the purposes of defining appropriate methods for quantification of emissions from individual sources:

- Namibia Greenhouse Gas Inventory 1,2, & 3.
- IPCC GHG Inventory Guidelines
- Updated Nationally Determined Contributions (2022)
- National Communications 3 & 4

1.1.7.5.2.4Methodology

The calculation methodologies used to estimate the GHG emissions attributable to the construction, operation, and maintenance of the proposal are in alignment with GHG Protocol Corporate Accounting and Reporting Standard (GHG Protocol) and have been based on the principles outlined in Table 7-7.

Table 1-10. GHG accounting and reporting principles

Principle	Description
Relevance	Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of internal and external stakeholders
Completeness	Account for and report on all GHG emission sources and activities within the chosen inventory boundary, disclosing and justifying any specific exclusions from the emissions assessment
Consistency	Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors
Transparency	Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used
Accuracy	Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information

Emissions estimated are represented in CO2-e using current global warming potential (GWP). The GWPs from the IPCC Fifth Assessment Report (AR5) have been used in this assessment and are listed in Table 7-8.

Table 1-11. Greenhouse gases and 100-year global warming potentials

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28

Nitrous Oxide (N_2O)	265

The scope 1, scope 2, and scope 3 emission factors used in the estimation of GHG emissions have been taken from the National Greenhouse Inventory Factors 2021.[26]

1.1.7.5.2.5 Assumptions

The assumptions used in the GHG emissions assessment are presented in Table 8. These assumptions have been developed from information available, default Ex-ante Tool assumptions and previous project experience.

Table 1-12. Assumptions used in the estimation of GHG emissions

Activity	Assumption
Vegetation clearing (construction)	• Vegetation removal will be conducted using conventional plant (i.e., graders and dozers). • Class 1 equivalent to 0-50 t dry matter/ha. • The vegetation types selected were based on the ecological survey undertaken for the project. • The vegetation types identified were apportioned to the clearing area based on their occurrence within the project site/area in its entirety.
Construction materials	• Construction material data was collected for steel, concrete and plastic and was estimated based on similar project experience and dimensions. • Estimated emissions are based on cradle-to-gate embodied emissions.[27]
Liquid fuel – transport & stationary (construction)	• Fuel consumption was estimated based on similar project experience and dimensions. • All construction related liquid fuel emissions were assumed to be from the consumption of diesel.
Employee transport to site	• Employee workforce has been estimated at 30 for the entire duration of the construction period • Short-haul average passenger emissions factor (person.km) has been applied to estimate emissions
Liquid fuel – transport & stationary (operation and maintenance)	• Liquid fuel emissions have been based on vehicle/equipment type, fuel efficiency of each vehicle (0.124 L/km for mobile and 16.8 L/hr for stationary), hours

[26] Sophia Huyer, "Gender Equality in National Climate Action: Planning for Gender-Responsive Nationally Determined Contributions," 2016.
[27] Dario Gómez and William Irving, "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories," vol. 2, 2019, https://doi.org/10.21513/0207-2564-2019-2-05-13.

Activity	Assumption
	of operation (8 hr per day) and estimated average vehicle speed (100km/hr) • All operation (incl. maintenance) related liquid fuel emissions were assumed to be from the consumption of diesel

1.1.7.5.3 Greenhouse Gas Emissions Inventory

The GHG emission inventory included construction and operation activities, including maintenance works, to provide an overview of the impact of the proposal during its full life cycle.

1.1.7.5.3.1 Construction

Emissions associated with construction have been broken down by various construction activities. The estimates have been based on 18 months of construction activities.

Table 1-13. Construction emissions breakdown by activity

Activity	Scope 1	Scope 2	Scope 3	Total [t CO_2-e]
Construction material	-	-	1873	1873
Liquid fuel (diesel) consumption	305		21	326
Vegetation clearing - lost sink	1426	-	-	1426
Employee travel to site	-	-	436	436
Total				**4061**

Emissions associated with construction have been broken down by various construction activities. The estimates have been based on 18 months of construction activities.

Total GHG emission from construction for the proposal have been estimated to be **4,061 t CO2-e,** with approximately 46% of total emissions being attributed to embodied emission in construction materials. Lost carbon sink from vegetation clearing and fuel consumption contributed to approximately 43% combined, with vegetation clearing accounting for an estimated 35% of the total construction related GHG emissions.

1.1.7.5.3.2 Operation

Total GHG emission from operation and maintenance for the proposal have been estimated to be **1,659 t CO2-e,** with approximately 98% of total emissions being attributed to transmission and distribution losses. Annual emissions associated with operation, including maintenance, have been summarised by source and the annual totals presented in Table 7-11.

Table 1-14. Annual operation emissions breakdown by source

Activity	Scope 1	Scope 2	Scope 3	Total [t CO_2-e]
Transmission losses	-	-	1911	1911
Mobile diesel	6	-	-	5
Stationary diesel	2	-	-	2
Total				**1918**

Total worst-case annual GHG emission from operational activities relating to the proposal have been estimated to be **1,918 tCO2-e,** with approximately 98% of total operational emissions being attributed to transmission and distribution losses.

1.1.7.6 Conclusion

The proposal construction is expected to last 18 months with total emissions of **3,716 t CO2-e** while annual operational (including maintenance) GHG emission have been estimated to be **1,659 t CO2-e**. Embodied emissions in construction material and lost carbon sink from vegetation clearing, were the biggest emission source during construction phase with a combined total of **3,079 t CO2-e** (83%) of total emissions, while approximately 98% of total annual operational emissions was associated with transmission and distribution with **1,623 t CO2-e.**

Scope 1 emissions were attributed to approximately 7% of total construction emission while scope 3 contributed the reminder. Operational scope 1 and 2 emissions consisted of approximately 98% of total emissions, whereas scope 3 accounted for the remaining 2% of operational emissions.

1.1.8 GHG Management Plan

Tabulated below is the GHG management plan for the project.

Table 1-15: GHG Management Plan

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
					Consequenc	Likelihood	Risk Rating		
1. Technical									
1.1	Performance of technology	Lower yield = lower revenues Losses = lost MWh x tariff	• Proven technology • Quality components correctly dimensioned • Manufacturer warranties and performance guarantees and terms	• Technology to be provided by Manufacture and full performance guarantees by the manufacturer and contractor to be made.	5	D	**24 LR**	Manufacturer, Contractor, Responsible Supervisor	
1.2	Technical Availability	Lower yield = lower revenues Losses = lost MWh x tariff	• Proven technology • Quality components correctly dimensioned • Manufacturer warranties and performance guarantees and terms O&M guarantees	• Technology to be provided by Manufacturer. Full performance guarantees by the manufacturer and O&M contractor.	5	D	**24 LR**	Manufacturer, Contractor, Responsible Supervisor	
1.3	Equipment defect /decreasing yield (degradation)	Lower yield = lower revenues Losses = lost MWh x tariff	• Manufacturer warranties and performance guarantees and terms O&M guarantees	• Risk transferred to manufacturer and the Degradation rate guaranteed by the manufacturer	4	B	**14 MR**	Manufacturer, Contractor, Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
					Consequenc	Likelihood	Risk Rating		
1.4	Reduced yield due to dusty panels	Lower yield = lower revenues Losses = lost MWh x tariff	• O&M guarantees	• Risk transferred to O&M Contractor Would reduce the yield severely, guaranteed by O&M contractor	5	C	**22 LR**	Manufacturer, Contractor, Responsible Supervisor	
2. Energy Resource									
2.1	Variability of irradiation data	Uncertain yield	• Use of different data bases, on-site irradiation measurements	• Several irradiation data and models to be used by the developer, using reputable consultants to perform the feasibility studies. Theoretical data to be combined with on-site measurements.	5	C	**24 LR**	Manufacturer, Contractor, Responsible Supervisor	
2.2	Quality of irradiation data	Overestimation of yield	• Use of proven databases with well correlated theoretical and empirical data. Use of on-site measurements.	• Several irradiation data and models to be used by the developer, using reputable consultants to perform the feasibility studies. Theoretical data to be combined with on-site measurements.	5	C	**19 LR**	Manufacturer, Contractor, Responsible Supervisor	
2.3	Simulation Model	Overestimation of yield	• Use of proven models. Use of conservative P90 values.	• Several irradiation data and models to be used by the developer, using reputable consultants to perform the	5	C	**15 MR**	Manufacturer, Contractor,	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
					Consequenc	Likelihood	Risk Rating		
				feasibility studies. Theoretical data to be combined with on-site measurements.				Responsible Supervisor	
3. Severe Weather									
3.1	Lightning Strike	Damage of installation	• Use of technical protection measures	• Appropriate measures to be incorporated in the installation's design, Insurance	1	B	**2 CR**	Manufacturer, Contractor, Responsible Supervisor	
3.2	Extreme wind conditions	Damage of installation	• Use of technical protection measures	• Appropriate measures to be incorporated in the installation's design, Insurance	3	C	13 MR	Manufacturer, Contractor, Responsible Supervisor	
3.3	Extreme temperatures	Low performance/ damage	• Use of technical protection measures	• Appropriate measures to be incorporated in the installation's design, Insurance, good resistance of Manufacturer module performance to high temperature	3	B	9 HR	Manufacturer, Contractor, Responsible Supervisor	
3.4	Flood	Damage of installation	• Site selection	• Appropriate measures to be incorporated in the installation's design, Insurance	4	C	18 LR	Manufacturer, Contractor, Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
					Consequenc	Likelihood	Risk Rating		
3.5	Earthquake	Damage of installation	• Site selection	• Appropriate measures to be incorporated in the installation's design, Insurance	2	D	12 MR	Manufacturer, Contractor, Responsible Supervisor	
3.6	Hailstorm	Damage of installation	• Site selection	• Appropriate measures to be incorporated in the installation's design, Insurance	2	D	12 MR	Manufacturer, Contractor, Responsible Supervisor	
3.7	Wildfire	Damage of Installation – problems for PV production	• Use of technical protection measures	• Appropriate measures to be incorporated in the installation's design, Insurance, good resistance of Manufacturer module performance to high temperature	2	4	8 HR	Manufacturer, Contractor, Responsible Supervisor	
4. Environmental and Social									
4.1	Unacceptable environment al impacts	Loss of endangered species, pollution etc.	• Full Environmental and Social Impact Assessment ("ESIA") will be performed and use of stringent safety protection measures.	• Stringent environmental procedures to be followed at construction and operations in accordance to agreed Environmental Action Plan	3	11	**11 MR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
					Consequenc	Likelihood	Risk Rating		
4.2	Environment al impact during construction	Pollution to the construction area and surroundings. Destruction of local habitat.	• Full Environmental and Social Impact Assessment ("ESIA") will be performed as a part of the FS&D process. • Use of stringent safety protection measures. Environmental Action Plan agreed and prepared.	• The Project will make its best endeavours to select land for the projects that shows no agricultural use and also where no resettlement is required. In the event that the selected land displays such impacts, appropriate mitigation measures will be established.	3	12	**15 MR**	Responsible Supervisor	

1.1.9 Emergency Preparedness and Response Plan

1.1.9.1 Purpose

The Gerus Solar Project Emergency Preparedness and Response Plan (EPRP) highlights the possible hazards as well as measures to ensure the safety of the Project employees, emergency personnel serving the project, and the community in case of an emergency. The EPRP also provides contact information for emergency personnel and outlines procedures for reporting, mitigating, and responding to incidents on the Project should they occur. Workers on site can use this plan as a guide to responding to emergencies in an orderly and effective manner. Among its contents are roll call procedures, roles, responsibilities, training, exercises, muster points, etc. Contractors are responsible for communicating the Emergency Plan to all participating companies and workers, as well as visitors before entering the site.

1.1.9.2 Emergency preparedness and response

As part of the emergency preparedness plan, the contractor and the client will hire the professional services of security guards/officers to mane the site day and night. The emergency response plan will be designed to address several types of emergencies for example natural disasters, the release of hazardous material, fires, and explosions. The following elements are considered in preparing the emergency response plan:

- Roles and responsibilities of leadership and administration for emergency management.
- Arrangements for communication for warnings, notifications, and requesting outside assistance.
- Various types of lighting and standby power for combat operations.
- Planning and implementing escape routes and evacuation methods.
- Providing medical care to victims and responders.
- Establishment of procedures for systematic shutdowns.
- Maintaining regular training programs for all employees.
- Testing the level of preparedness of workers and material at the workplace through mock drills.

1.1.9.3 Institutional arrangements of the key Emergency Response Team

Key persons must be identified to guide the emergency and response activities. Their roles and responsibilities must be clearly defined. The key persons in emergency preparedness and response include the project manager, the Safety, Health and Environment (SHE) manager, the Emergency response manager, the security manager, the incident commander and the spokesperson. All these will work together towards the implementation of the EPRPs.

1.1.9.4 Roles and responsibilities of key Emergency Response Team

Listed below are the roles and responsibilities of the members of the Emergency Response Team.

1.1.9.4.1 Project manager:

- Understanding the Company's HSE Policy and the responsibilities assigned to each grade.
- Assigning responsibilities to subcontractors and others.
- Coordinating off-site agencies during an emergency e.g., fire brigade and ambulance services.
- Assisting with establishing a working method, explaining the sequence of operation, highlighting possible hazards, and indicating precautions to take.
- Ensuring the construction regulations and other pertinent legislation must be observed once the work has been started at the site.
- Discipline personnel who repeatedly violates the HSE rules.

1.1.9.4.2 SHE manager:

- Coordinating, delivering, and implementing safety and health services for the production workforce.
- Promoting good housekeeping.
- Review disease prevalence data and recommendations for addressing disease prevalence and severity on site and in the surrounding communities.
- Investigates and analyse community safety incidents and escalate findings and remedial measures to management when necessary.

- Protecting the safety of the community by ensuring safe behaviour by Project personnel.
- Assesses the effectiveness of community health programs by conducting inspections and audits.
- Identifying ways to improve safety and health programs' performance and compliance by collecting and analysing data, preparing reports, and making recommendations.

1.1.9.4.3 Emergency response manager:

- Oversee, develop, implement, and maintain the Gerus solar power plant’s emergency preparedness and disaster relief programs.
- Implement changes to systems and procedures based on monitoring program performance.
- Training sessions on emergency management should be developed and conducted with the workers and other response agencies.
- Establish relationships with external organisations, such as the local emergency services, the fire brigade, the red cross, school districts, and utilities.
- Work closely together to ensure a rapid and coordinated response in an emergency.
- Supervise and direct community education programs related to emergencies, including emergency preparedness.
- Develop public awareness materials on emergency risk.
- Prepare and file emergency preparedness reports and maintain records regarding new or ongoing programs and their effectiveness; prepare statistical reports as necessary; maintain disaster relief programs.
- Preparing and administering assigned budgets, submitting budget recommendations and monitoring expenditures.

1.1.9.4.4 Security manager:

- Coordination and management of the Project's security guards.
- Managing security incidents that occur both on and off project sites.

1.1.9.4.5 Incident commander:

- Overseeing the response and relief efforts of all agencies involved when an emergency occurs.
- Determining immediate priorities in responding to emergencies.
- Approving the execution of the response plan.
- Implementing appropriate safety precautions.
- Coordinating with key respond workers and stakeholders.

1.1.9.4.6 Spokesperson:

- Regular media briefings on disaster response.
- Organising media conferences and press releases.
- Update situation reports and consolidate disaster risk management reports.

1.1.9.4.7 All workers and contractors:

- Maintain the highest level of safety in all their duties.
- Comply with the requirements of relevant legislation.
- Adhere to all site safety procedures and rules.
- Stay alert at all times to potential fire hazards.
- Contribute to the identification and elimination of hazards.
- Maintain knowledge of how to identify hazards, assess risks, and control risks using hazard identification, risk assessment, and risk control techniques.
- Be knowledgeable about emergency response procedures, such as evacuation protocols and bushfire action statements.
- Participate actively in safety meetings and programs, including training.
- Participating actively in rehabilitation programs.

1.1.9.5 Communication systems

As in other areas of disaster management, communication is crucial for an effective response to an emergency. During high-impact emergencies, when communication networks are most affected, it is crucial to consider effective ways of communication.

In large and small emergencies, an amateur radio which is also known as a ham radio can provide backup communication resources. Communication arrangements will be done to ensure prompt response to emergencies. Equipment such as walkie-talkies, cell phones and PA systems will be made available for easier and faster communication.

1.1.9.6 Site Layout Plan

Layout plans for the site will indicate:

- Access gates
- Roads
- Site offices
- Assembly points
- First aid room
- Fire extinguisher and other firefighting equipment locations

The contact details of local emergency services and authorities should be readily available, and these include the police station, fire brigade and ambulance services.

The project personnel will meet with local emergency response groups to discuss the type of work to be done, review the emergence and response plan and the duration of the project schedule.

1.1.9.7 Emergency response procedures

The person who first notices an incident informs others by raising an alarm and the incident commander calls outside emergency responders to be on standby if the emergency is manageable or to come instantly. Workers are usually the first responders to an incident.

The following are the steps to be taken if an emergency develops:

- The person who discovers an incident must raise the alarm.
- All personnel must meet at a designated assembly point on receiving warning signals for evacuation.
- The Evacuation Plan includes evacuation procedures and assembly instructions.
- After identifying the situation and any potential casualties, the site Safety, Health, and Environment (SHE) manager will contact the emergency services as needed.

- As soon as emergency personnel are notified, an employee will be assigned to guide the emergency personnel to the incident location.
- The total number of employees should be counted at the assembly point and any missing persons must be reported to the SHE manager. Whenever safe, an emergency rescue team will look for them.
- To accommodate the health needs of employees and workers, a first aid centre will be provided on-site.
- In case of an emergency, routine staff will have access to all necessary equipment and instruments for expert first aid and resuscitation.
- The company conducts a thorough investigation following an incident not later than 24 hours.

1.1.9.8 Emergency Resources

The development planning and budget for emergency preparedness and response activities are guided by the National Disaster Risk Management Policy (Republic of Namibia 2009). The contractor will avail finances to facilitate emergency response operations before, during and after emergencies. The fund will be used for emergency response, relief, and rehabilitation efforts, as well as raising awareness and preparing for and mitigating emergencies. A budget will also be done to cater for training workers on how to respond to emergencies and regular conduct of drills. School safety awareness programs and hospital readiness plans can benefit from this funding, as well as sectoral emergency preparedness efforts. Below is a checklist that must be used to guide in purchasing equipment that will be used in emergency preparedness and response.

1.1.9.9 Checklists

As part of preparing for emergencies, the unit must be properly equipped with safety equipment and facilities.

The equipment includes:

- a Public Address system for announcements,
- personal protective equipment,
- different types of fire extinguishers,
- emergency alarms,

- fire sand buckets,
- fire blankets,
- And first aid kits.

Frequent monitoring of equipment like fire extinguishers must be done to ensure they are suitable and reliable. Safety measures include human and material resources such as firefighting facilities, protective equipment, and health services. The resources for responding to emergencies must be well maintained to avoid or reduce the number of casualties on-site.

1.1.9.10 First aid

The contractors shall ensure that qualified first aid providers shall be always present. A healthcare facility shall be constructed, and a room will be set apart for the provision of first aid. Equipment and materials that are necessary for providing first aid must be available in rooms meant for that purpose and must be easily accessible with stretchers. The provisions for safety and health signs at work require that the health care facility be marked accordingly. Local first aid posts must have their addresses and phone numbers indicated.

1.1.9.10.1 First Aid Kits

All working points should have first aid materials available, as the working conditions demand. There should be appropriate markings on the first aid kits, and they should be easily accessible. Subcontractors must ensure that every work area, including workshops, maintenance and repair facilities has enough first aid kits, and that they are well taken care of against dust, moisture, and any other contaminant present in the workplace. Additionally, periodic checks of these first aid kits should be implemented for example the expiry dates of drugs, instructions, and stocks.

First aid kits will be available as per the following:

- There should be one first aid box for every 30 employees (the local regulations will determine the contents of the first aid box).
- Every vehicle must have a basic first aid kit together with standard safety or emergency equipment such as high visibility triangles, jackets, and fire extinguishers.

- The minimum contents for the first aid kits shall be those specified in the application as per the Labour Act, 1992: Regulations relating to the Health and Safety of employees at work. The employer shall assign a person to ensure these first aid kits are in good condition permanently.

1.1.9.11 Training and updating

The importance of training cannot be overstated in emergency management. The client and the contractor will ensure that inception training will be offered to all employees before they start work. Training will be done to make workers know the hazards that may affect them, the risks involved and how to avoid or reduce risk if an emergency occurs. Mock drills will be used for training workers in firefighting and responding to any other emergency.

1.1.9.12 Business continuity, contingency planning, and emergency recovery

The key difference between all these plans is when they are implemented but they are equally important.

- Business continuity: Continuing operations during an incident with a temporary solution.

  It is essential to have a business continuity plan to ensure that, in case of a disaster or inaccessibility, business operations continue smoothly or with very little downtime.
- Contingency planning: preparing for potential future events in advance.

  In contingency planning, the contractor identifies the most significant risks to the business operations. It could be anything from natural disasters to the loss of a key supplier or employee. At the Gerus solar plant, the baseline and flood risk assessments showed a very minimal likelihood of being affected by major disasters such as floods. Safety health regulations are highly considered to prevent loss of life.
- Emergency recovery: restoring normal operations after an emergency.

Upon interruption of normal business operations, a disaster recovery plan will help you resume normal operations. The recovery plan will show the roles and responsibilities of personnel carrying out recovery tasks including a backup in the event of failure of infrastructure or data loss. It is essential to hire a professional in creating some recovery plans for example in the Information and Technology (IT) field.

1.1.9.13 Operational Contacts

The contacts of the people responsible for the operation, maintenance and safety of the Gerus Solar Project will be provided. The Operator monitors the site regularly. The operations can also be monitored remotely and whenever an issue arises, local operations personnel will be dispatched to the site.

1.1.9.14 Emergency Contacts

In case of an emergency dial:

Otjiwarongo fire brigade services: +264 64 304444

NAMPOL: +264 67 304444

Ambulance services: +264 64 300900

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1.1.9.15 Emergency Preparedness and Response Management Plan

The table below details the emergency preparedness and response plan for the proposed project.

Table 1-16: Emergency Preparedness and Response Management Plan

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
1	**Intruders** Thieves Terrorism	Loss of equipment Damage to property Injury	• Site security will be provided at the Gerus solar plant to control the access of workers, visitors, or any other intruders. • Sufficient levels of protection will be provided for personnel, sensitive items, goods, and access controls depending on the security assessments. • Secure the site with a fence. • Install security cameras as they deter people from entering the site. • Ensure that all access points are adequately lit at night. • Place warning signs to deter unauthorised visitors. • Check the site regularly before closing each day. • Track all expensive materials and equipment.	• By capturing everything that happens in real time, construction cameras will allow operators and security guards to respond quickly to crimes. • The person who discovers an incident must raise the alarm. • The police or security guards can respond to any situation quickly.	1	3	**3 LR**	Responsible Supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			• Avoid leaving materials and tools out on the site when not in use. • If a vehicle is not in use, lock it up and remove all the keys. • Procedures and standards defined for this purpose must be followed by all personnel. Site security and access controls usually follow these primary elements: ✓ Maintain a record of all personnel and vehicles accessing and leaving the site. ✓ Make sure all walkways and access points are marked and accessible. ✓ Enforce parking restrictions where appropriate. ✓ Incoming and outgoing vehicle speed control. ✓ Enhance site safety through health and safety checks. ✓ On-site surveillance of persons and vehicles.					

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			✓ Prevent unauthorised items from being brought on-site or taken from the site. ✓ Maintain a minimum standard of personal protective equipment (PPE) for all individuals who access the site including the drivers of delivery vehicles and visitors. ✓ Regular security patrols on site and in surrounding areas to prevent fires or flooding environmental spills, and breaches to perimeter fence security. • Monitoring telephones outside normal working hours, including alerting alarm response to fires or other emergencies. • Coordinate with local authorities, police, and stakeholder groups as needed.					

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
2	**Fire**	Injury Loss of life Damage to property Damage to equipment	• Contractors must develop and implement fire hazard identification and risk assessment to reduce fire hazards and eliminate fire risk. • This shall consider in its widest sense the generic and site-specific controls of the four elements necessary for a fire which include: ✓ fuel. ✓ heat (ignition source). ✓ oxygen (oxygen suspended in air is enough). ✓ continual chemical (chain) reactions. • The purpose of preparing against the fire hazard is to reduce the likelihood of fires and/or eliminate their causes and save lives and property from fire. • The company will prepare a designated storage place for	• Responsibilities and Procedures in responding to fires ✓ Everyone on site has a responsibility to ensure safety. ✓ The person who discovers an incident must raise the alarm. ✓ All employees must go to the assembly point when an emergency alarm goes off. ✓ It may be necessary to de-energize/isolate the solar system remotely in case of an emergency however, local disconnects require manual operation by qualified personnel. ✓ Due to the risk of an arc flash, emergency responders must not assume that the system is de-energised, nor should they attempt to de-energise equipment. A lock shall be placed on the DC Disconnect Switch once the system has been shut down to prevent it from being re-energised.	5	3	**15 HR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			storing equipment on site for the prevention and/or control of fires. • Inspections of fire hazards and fire detection, prevention, and control measures should be performed daily before work begins. Deficiencies shall be eliminated or reported immediately to the SHE officer. • Training of personnel to maintain and service these systems and identifying the individuals responsible for maintenance and service will be done. • Fireguards will be created along the perimeter of the fence on either side. In general, there won't be much combustible vegetation on the site except for a ground cover of maintained vegetation adjacent to and beneath the solar tracker. The solar plant	✓ Depending on the type and magnitude of the fire, trained workers may try to put out the fire using the right fire equipment. ✓ Roll calls should be done at the assembly point to see if anyone is missing. ✓ Rescue operations for missing persons shall be done by qualified personnel with proper PPE. ✓ Do not enter the site until the fire or police department has indicated that the fire has died down and people can re-enter.				

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			and all access roads will be cleared of vegetation. • Fire rules on the site shall be shared with every employee. • Training in the fire safety plan relevant to their duties shall be provided to all employees. Ensure all employees understand the fire safety plan's function, including types of possible emergencies, reporting procedures, evacuation plans, and shutdown procedures. This training is mandatory for all employees before they begin work. • It is recommended that training include: ✓ Roles and responsibilities of employees. ✓ The identification of potential fire hazards. ✓ System of alarms and evacuation routes.					

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			✓ Location and operation of manually operated equipment e.g., fire extinguishers, shovels, sandbags. ✓ Procedures for responding to an emergency. ✓ Protocols for emergency shutdowns. ✓ Employees should be informed about the specific materials they may be exposed to. ✓ Maintenance of equipment and good housekeeping practices for fire prevention. • The training received by each employee must be documented in writing. • The training of outside responders is important to ensure they are aware of the hazards within the project area and that any potential risks to their lives during a response are mitigated.					

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			• First responders who could be dispatched to the project in an emergency will be trained before its commencement and periodically thereafter. • The Operator of the Gerus solar plant will work with the Otjiwarongo Fire brigade, ambulance service providers and other line ministries as proper, and provide site-specific orientations to emergency response leaders and staff every two years. • **Fire Detection** • The company will: ✓ put mechanisms put for detecting fires on site such as the smoke detector installation. ✓ do fire inspections and enforce codes. ✓ monitor veld fires around the site and on-site. ✓ Shutoff Procedures and Locations					

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			✓ Entry of the Project should only be attempted at the direction of the Operator. Contact information for the Operator will be provided in the contacts list. • **Fire safety equipment** ✓ Spark arresters are required for all internal combustion engines, both stationary and mobile. It is necessary to maintain spark arresters in good working condition. ✓ At least one portable extinguisher should be available within 60 metres of the working area. ✓ Monthly inspections are recommended for fire extinguishers. ✓ If an extinguisher is under-pressured, not full, or has broken or missing seals, it should be immediately replaced with an inspected					

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			or serviced extinguisher of the same type and size. ✓ The location of fire extinguishers must be conspicuous and not obstructed. ✓ Registers will be kept documenting the fire extinguishers on site. ✓ All inspection documents will be filed in the Site HSE File. • **Internal Site Access Roads** ✓ There will be 20' wide compacted dirt roads on the internal site access roads. ✓ Each of these access roads will provide access to the inverter skids (also known as power conversion stations) at each site. It is at this location that the solar inverters and step-up transformers will be installed.					

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			✓ The internal access roads are primarily for the use of operational and maintenance personnel who will also act as fireguards.					
2a	**Vegetation Fire**	Injury Loss of life Damage to property Damage to equipment	• Create fireguards to prevent a quick spread of the fire. • Have firefighting equipment in store e.g., fire extinguishers, water cans, and fire beaters. • Always check weather conditions.	• If a vegetation fire occurs near or under the modules or inverters, take the following steps: ✓ Never use water or other chemicals to extinguish the flames as an electric shock or arc could result. ✓ Try to disable the inverter's power using the DC disconnect if possible. ✓ Allow vegetation to burn and the fire to self-extinguish. ✓ Extinguish flames if they persist away from modules or inverters.	5	3	**15 HR**	SHE Officer Responsible supervisor
2b	**Class A Combustibles** Common materials (wood, paper, cloth,	Injury Loss of life Damage to property	• The following steps must be taken to safely handle Class A combustibles: ✓ Ensure daily waste disposal (i.e., cardboard, wood	• A variety of fire extinguishing agents is approved for use in firefighting Class A Combustibles including water, multipurpose dry chemical (ABC) and halon.	5	3	**15 HR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
	rubber, and plastic) that can act as fuel and are usually found on most work sites.	Damage to equipment	pallets, packing materials etc.). ✓ Be sure to use trash receptacles that are covered. ✓ Keep work areas free from combustible materials. ✓ Use the right storage containers to store materials. ✓ Verify the handling of combustibles on the job site periodically.					
2c	**Class B Combustibles** Flammable and combustible liquids (oil, grease, tar, oil-based paints) Flammable aerosols Flammable gases.	Injury Loss of life Damage to property Damage to equipment	• The following steps must be taken to safely handle Class B combustibles: ✓ Dispense liquids from tanks only with approved pumps (with suction from the top), drums, barrels, or similar containers (or use approved self-closing valves or faucets). ✓ Class B flammable liquids should not be dispensed into containers unless the	• In the case of Class B fires caused by flammable liquids, water should not be used to extinguish them, since it can worsen the fire by making the burning liquid spread. • To put out a fire caused by flammable liquids, exclude the air around them. • Locate and know how to use the nearest Class B portable fire extinguisher.	5	3	**15 HR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			nozzle and container are compatible or when electrical contacts or bonding wires are used to connect them. Tanks and containers must be grounded. ✓ Class B combustibles should only be stored, handled, and used in approved areas where open flames, mechanical sparks, or electrical equipment cannot ignite them. ✓ Cleaning with flammable liquids is not recommended inside a building (the only exception is when used in a closed machine approved for such cleaning). ✓ Use, handle, or store Class B combustibles away from exits, stairs, or any other areas normally used as exits.	• Class B combustibles can be extinguished with carbon dioxide, multi-purpose dry chemical (ABC), halon 1301, and halon 1211. (The manufacture of Halon has ceased due to its designation as an ozone-depleting substance).				

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			✓ Keep Class B combustibles away from welding, cutting, grinding, and other unsafe electrical appliances and equipment. ✓ Avoid generating heat, allowing an open flame, or smoking near combustible Class B materials.					
2d	**Class C Combustibles** A Class C fire is a fire that involves electrically energized equipment. Loose ground wiring, wiring with bad insulation, and overloaded fuses, circuits, motors, and outlets.	Injury Loss of life Damage to property Damage to equipment	• Always follow safety procedures for using electricity when on site. • Ensure that all fuses are appropriately rated as specified by the manufacturer. • Ensure that all electrical equipment is properly grounded and insulated. • Maintain adequate spacing when performing maintenance. • The wiring of equipment should be inspected before each use. • Be familiar with the location of shut-off switches and/or circuit	• It is always important to de-energise the circuit causing the fire when a Class C fire occurs. • Class C fires can be put out by a multi-purpose dry chemical (ABC) extinguisher or a non-conductive extinguishing agent such as carbon dioxide or Halon 1211. • Firefighters should avoid using water or foam to fight electrical fires. • The fire becomes a standard combustible fire once the electricity is shut off to the equipment involved. • Electric shock can cause unconsciousness in a victim.	5	3	**15 HR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			breaker panels and how to operate them. • Use extension cords to a minimum. • Multi-plug adapters must have circuit breakers or fuses. • Inspect electrical cords for sufficient insulation before use to prevent direct contact with wires. • Switch off equipment when not in use.	• Before administering aid, turn off the live power source or press the emergency power cut-off button if the victim is still in contact with it. • It is dangerous to touch anyone still connected to a live power source, as you could also be electrocuted.				
3	**Hazardous materials**	Injury Loss of life Damage to property	• The Gerus solar project does not anticipate using many hazardous materials for its operation. • **Management of containers** ✓ Containers containing hazardous substances must be in good condition and compliant with the materials stored within. ✓ Hazardous substance containers must be	• The following measures will be employed in case of a chemical spill or oil spill: ✓ Notify the Supervisor and the Health and Safety Officer. ✓ Do not attempt to contain or clean up spills unless it can be performed safely. ✓ Eliminate sources of ignition near spilt material if it is flammable.	4	3	**12 HR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			accessible and well-spaced apart to give sufficient room to perform periodic inspections. ✓ All markings and labels must be removed from the empty hazardous substance containers (drums) and they must be labelled empty. ✓ The container must be cleaned immediately if there are any spills on the exterior. ✓ To prevent static sparks, drums or totes must be grounded while storing or dispensing flammable materials. ✓ Avoid overfilling waste drums. • **Good Housekeeping** ✓ The storage of hazardous substances must be done inside buildings or under cover.	✓ Ensure that employees and neighbours are evacuated if they are at risk. ✓ Establish perimeter control at a safe distance from the spill and secure the area. • Oil Spill Response Options ✓ All materials contaminated by oil spills should be collected and removed immediately. • The following actions must be employed: ✓ If any oil remains on the ground, it should be collected using an oil spill kit. Oil will be absorbed using absorbent pads and later the absorbent agents will be stored and disposed of. ✓ Contaminated material should be collected and appropriately stored and must be treated as a hazardous material. This will be collected by a hazardous waste vendor. ✓ Plastic barrels with tight-closing lids will be used to store				

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			✓ A funnel must be used for transferring all chemicals from larger containers to smaller ones. ✓ Close all hazardous substance containers when not in use. ✓ Collect drips or leaks from dispensing containers with drip pans or other collection devices. ✓ All spills and leaks should be cleaned up immediately. ✓ Ensure there are no leaks or spills in equipment and hazardous substance storage areas by periodically inspecting them. ✓ Mark storage areas and waste collections with signage. ✓ Ensure that all work areas and storage areas for hazardous substances are clean and well maintained.	contaminated materials. The barrels should be stored in a concrete-lined bund if available or a double plastic-lined bund if not available which is a short-term storage alternative. ✓ In-situ cleaning of contaminated materials is required where they cannot be collected and disposed of. Approved service providers should perform this cleaning.				

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
4	**Chemicals and biological hazards** A release of LPG and underground storage tanks, along with other chemical containers, can pose hazards downstream. Direct contamination of floodwaters by untreated raw sewage, rotting food or dead animals may also lead to biohazards. Viruses, bacteria etc.	Infection Intoxication Illness	• It is important to avoid contact with flood waters. • Practice good personal hygiene. • Create an all-hazards supply kit.	• Monitor the health of affected individuals. • Discard any food that gets in contact with flood waters. • The following should be done if you encounter a hazardous chemical: ✓ Remove chemical-laden clothing as soon as possible. Clothing that must be pulled over your head should be cut off rather than pulled over. ✓ You should avoid touching any contaminated areas when helping others remove their clothing. ✓ Wash your skin with a lot of water as soon as possible if you have been exposed to chemicals of soap and water. ✓ Rinse your eyes with plain water for 10 to 15 minutes if your eyes are burning or your vision is blurry.	3	3	**9 MR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
5	**Natural disasters**: Flooding	Injury Loss of life Damage to property Equipment damage	• There is a potential for minor flooding or high winds but the flood risk assessment on the site showed that flooding is very unlikely and there is no history of flooding in the area. • Have an evacuation plan in place. • Follow weather forecasting. • To keep up with changing conditions, emergency preparedness and response activities will be reviewed and revised periodically.	• Notify the local authority and emergency services. • Provide first aid to casualties and transfer them to the hospital if necessary. • Arrange for passenger vehicles and start the evacuation. • Switch off all electrical equipment.	1	3	**3 LR**	SHE Officer Responsible supervisor
6	**Heat stroke**	Illness Loss of life	• Every employee must undergo first aid training as they will always be the first responders in any emergency. • Employees are encouraged to do the following to prevent heat stroke: ✓ Lightweight, loose-fitting clothing is recommended. ✓ Take precautions against sunburn e.g., wearing sunhats.	• First responders to sufferers of heatstroke can provide first aid. • First aid actions may include applying cool water to the person, misting the person with cool water while fanning them, putting ice packs on the neck, armpits, and groin, and applying cool wet towels. • When the person is conscious and able to swallow, give them cool water to drink. Otherwise, do not give the person fluids to drink.	3	3	**9 MR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			✓ Keeping hydrated by drinking plenty of fluids. ✓ Certain medications require extra precautions.	• Place an unconscious person on their side and make sure they are breathing normally. • Immediately call an ambulance to transport the patient to the hospital.				
7	**Workplace Accidents/ Incidents**	Injury Loss of life Damage to property Equipment damage	• Put good choices of risk controls. • Adequate training for a job. • Adequate supervision. • Good maintenance of equipment. • Ensure that machinery is guarded. • Follow procedures for the safe use of plants, materials, and substances. • Have realistic work schedules to prevent fatigue. • Practice good housekeeping. • Consider feedback from workers and act on the causes of previous incidents.	• The person who is responsible or who discovers the incident should notify the incident controller. • The responsible supervisor will assess the situation. • Conduct first aid to the victim if there is one and call for medical attention if there is a need. • Ensure the workmen are at a safe distance/assembly point. • Prevent unauthorised entry by barricading the area. • The SHE department to conduct investigations on what caused the accident in 24 hours.	3	3	**9 MR**	SHE Officer Responsible supervisor
8	**Electrical shock/ electrocution**	Injury Loss of life	• Inspect the extension cord for damages before use. • Never use a defective electrical device.	• Turn off the power and raise an alarm. • If there is fire, use a fire extinguisher to extinguish the fire.	3	3	**9 MR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			• Do not plug too many things into the same outlet. • Follow safe work procedures.	• Wear PPE such as safety shoes or stand on wooden planks or rubber/synthetic mat when responding to electric shock. • You should never touch an electrocuted victim barehanded. • Call for medical assistance if the victim is breathing. • Conduct cardiopulmonary resuscitation if the victim is not breathing. • Investigate the incident later within 24 hours.				
9	**An incident related to Snake, insect bites**	Injury Illness Loss of life	• Observe your surroundings. • Back away slowly if you encounter a snake. • Never try to provoke, handle, trap, or kill a snake. • Snakes are usually active at night and in warm weather. • Wear PPE such as boots and long pants when working outdoors. • Handle brush and debris with leather gloves.	• Remembering the colour and shape of the snake can help in treating the snake bite. • Ensure that the bitten person remains calm and still. • Immediately seek medical attention. • Don't expose yourself or the victim to the risk of a second bite. • Immediately remove any jewellery or tight clothing near the bite to prevent swelling. • The heart should be level with the bitten arm or leg.	3	3	**9 MR**	SHE Officer Responsible supervisor

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to
					Consequence	Likelihood	Risk Rating	
			• Put on insect repellents on exposed skin.	• If medical assistance is more than 30 minutes away, tie an elastic bandage two inches above the bite. It should be loose enough for a finger to slide underneath it. • It is advisable to limit liquid intake because the body pumps the fluids to the bite site, increasing swelling, which can be painful. • Remember that most bites even from poisonous snakes are not fatal. • Avoid cutting an 'X' or sucking out the venom with the mouth. The wound area is subjected to increased trauma due to this ineffective treatment. • It is ok to take painkillers for pain relief except for Aspirin tablets.				

1.1.9.16 Monitoring and Evaluation Plan

Monitoring and evaluation (M&E) of the emergency preparedness and response plan will be done on monthly basis at the initial phase of the project to measure the progress and outcomes of implementing the plan. The gaps in the plan are identified and recommendations are given to address them. As needs evolve, preparedness and response plans are modified to meet those needs. Resources can be reallocated to other areas of need as earlier targets are achieved.

The key actions in monitoring and evaluation include:

- Monitoring the quality of communication responses.
- Regularly holding review meetings.
- Giving feedback concerning the results.
- Adapt activities based on monitoring results.
- Identify lessons learned and best practices.
- Share findings.

Prevent future crises by using findings as a basis for future activities

1.1.10 Visual Impact Assessment and Management Plan

This VIA is one of many specialist studies that have been undertaken by specialists as part of the ESIA. This assessment report should be read in conjunction with the relevant ESIA Report and other specialist studies. This report has been preceded by a Visual Scoping Study that was undertaken in the first phase of the assessment.

The objective of the VIA is not to predict whether individual receptors will find the solar project attractive or not. Instead, the goal is to identify important visual characteristics of the surrounding landscape, especially the features and characteristics that contribute to scenic quality, as the basis for determining how and to what degree the proposed project will affect those scenic values.

1.1.10.1 Methodology

The following methodology was applied:

1. All the required data were collected, which included data on topography, existing visual character and quality, plans of the proposed development and other background information;
2. Fieldwork (2 seasonal site visits) were conducted, in December 2022 and January 2023. The objectives of the fieldwork were to:
    - familiarise the author with the site and its surroundings;
    - to identify key viewpoints/ corridors and visual receptors;
    - ground truth the sensitivity of the landscape; and
    - determine the distance from which visual impacts are likely to become discernible.
3. Landscape characterisation was done by mapping the site location and context and describing the landscape character and sense of place. This considered geological and topographical features, vegetation, and land-use.
4. Visual sampling was undertaken using photography from a number of points within the site. The location of the viewpoints was recorded and mapped on Google Earth Pro and photographs were taken. A selection of these is used in the assessment phase of the VIA to illustrate the likely zone of influence and visibility.

5. The sensitivity of the landscape was analysed, taking the following factors into consideration:
    - Slope and elevation;
    - Proximity of visual receptors (farmsteads and towns);
    - Proximity of major roads and scenic routes;
    - Nature reserves and National Parks; and
    - Other relevant features and buffer guidelines.
6. Visual concerns and potential impacts were identified;
7. The potential magnitude of visual impacts were evaluated using standard VIA criteria and rating methodologies and combined requirements of international best practice.

1.1.10.2 Description of the affected environment

1.1.10.2.1 Geological, geomorphological and climatic setting of the study area

The study area is located on the part of the western margin of the Kalahari (Figure 1-15). During the summer months (September–April), there is 350–450 mm rainfall, which is very variable in space and time. As indicated in the National Atlas of Southwest Africa (Namibia)28, the potential natural vegetation is an open thornbush savanna with transitions to a more humid, but seasonally dry savanna, in which the trees are larger. Extensive cattle farming is the dominant land use.

[28] Johannes Hermanus Van der Merwe, *National Atlas of South West Africa (Namibia)* (National Book Printers Cape Town, 1983).

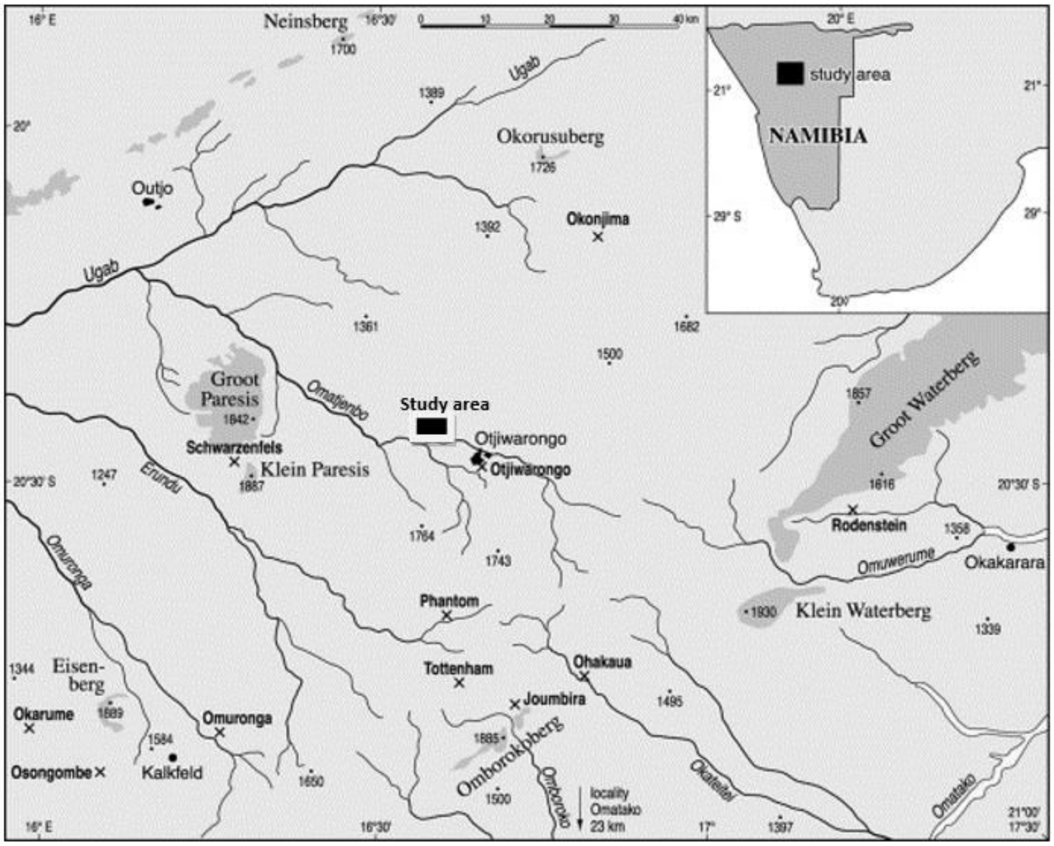

Figure 1-14: Map of the study area and the Otjiwarongo region. The crosses indicate localities of typical soil profiles.[29]

The study area is located on the western rim of the Kalahari Basin. East of Otjiwarongo at an altitude of about 1600 m a.s.l. lies the watershed between the Ugab River, which crosses the coastal Namib Desert and discharges into the Atlantic Ocean, and the Omuramba Omatako, which terminates endoreically in shallow valleys (plural: omurambo) of the Kalahari Basin. Both of these rivers are ephemeral, and most of their tributaries flow into shallow valleys due to their watershed position.

The Damara Schists (Precambrian to Lowest Palaeozoic basement) occur widely north and west of Otjiwarongo. A Cretaceous granite complex forms the prominent Great Paresis Mountains. To the south of Otjiwarongo, widespread Palaeozoic Damara Granite intrusions form an inselberg relief. From northeast to southwest, Mesozoic sedimentary

29 Bernhard Eitel, Joachim Eberle, and Ralf Kuhn, “Holocene Environmental Change in the Otjiwarongo Thornbush Savanna (Northern Namibia): Evidence from Soils and Sediments,” CATENA 47, no. 1 (2002): 43–62, https://doi.org/https://doi.org/10.1016/S0341-8162(01)00170-9.

rocks (primarily sandstones, siltstones, and mudstones of the Karoo Sequence) cross the area, forming cuestas that resulted from the Waterberg–Omboroko–Etjo lineament, which is at least partly a graben[30].

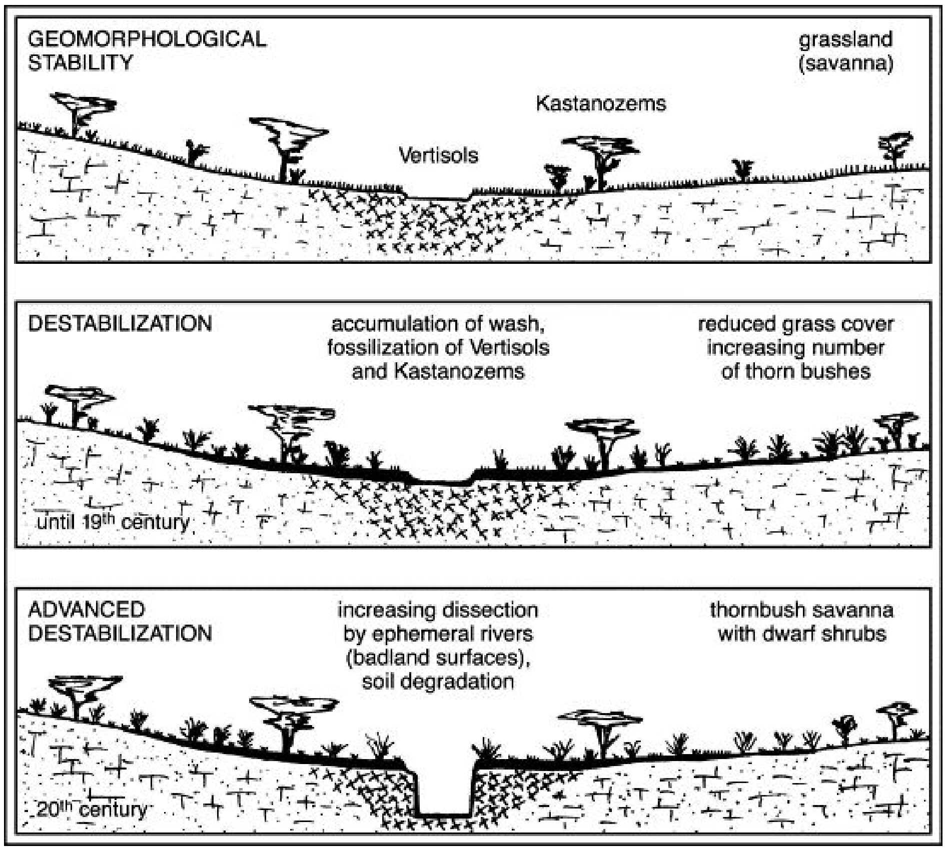

Figure 1-15: Sequence of schematic profiles illustrating the degradational phases indicated by soils of the Otjiwarongo region.[31]

During a period of geomorphic stability the soil associations formed (above). Early soil degradation is documented by slope wash and accumulations in the basins and shallow valleys, burying the Kastanozems and Vertisols (central profile)[32]. At present, ephemeral rivers incise and erode the soils. The processes are linked to a transition from dense

30 B Eitel, "Großräumige Epirogenese Und Bruchtektonik Östlich Der Großen Randstufe in Namibia: Überblick Und Mögliche Beziehungen Zu Neotektonischen Leitlinien Im Südlichen Afrika," Die Erde 127 (1996): 113–26.
31 Eitel, Eberle, and Kuhn, "Holocene Environmental Change in the Otjiwarongo Thornbush Savanna (Northern Namibia): Evidence from Soils and Sediments."
32 Eitel, Eberle, and Kuhn.

grassland to more thorn bushes which indicates primarily human impact (heavy stocking with cattle) (Image 1-1).

Image 1-1: At Randveld Farm, exposed rocks and soils covered by very young sediments.

Human impact can explain the environmental change described above. At present in the study area, which is in the Otjiwarongo Region, the natural vegetation can support only one large animal per 8–10 ha33. Overstocking would have reduced the grass cover, favoured establishment of bushes34 and caused erosion of surface soil horizons. Under intense rainfall, erosion on the upper slopes can lead to burial of soils on the lower slopes. Also, erosion can cause the plant cover to become more diffuse, especially grasses. The overgrazing of the slopes and soil burial are the first signs of landscape alteration in the study area.

At present, most of the soils are affected by erosion. Pedological and geomorphic investigations distinguish separate degradational stages in space and time caused by different periods of human impact. Landscape degradation seems to have started in pre-colonial times most likely as a consequence of cattle farming and was increased by farming since the end of the 19th century by European settlers. The area continues to be shaped by recent changes in settlement and land use patterns. The project site is

33 Van der Merwe, National Atlas of South West Africa (Namibia).
34 Heinrich Walter, Vegetation Und Klimazonen (Ulmer, 1979).

considered highly disturbed due to the agricultural activities taking place. At present, most of the soils show features of degradation. There are no designated or registered landscapes within the project area.

View of the site showing grassland and disturbed woodland.

View of the site showing grassland and disturbed woodland.

View of the site showing the predominance of grassland

View of the site showing Acacia bushes

View of the site showing disturbed bushland with termite mound

View of the site showing disturbed bushland

Image 1-2: Photographs showing typical land cover of the project area in the dry and wet seasons.

1.1.10.2.2 Land use and Landscape character

At the project site, 30ha of the area is currently used for cattle grazing. No surface water resources are located within the site, however; the southern boundary has a borehole.

Landscape character is the description of the pattern of the landscape, resulting from combinations of natural (physical and biological) and cultural (land use) factors, as discussed above. It focuses on the inherent nature of the land.

Consultation with the community throughout the ESIA stages has identified that in the context of the development level of the Region, visual impacts arising from such mega projects are considered by the local community receptors to be positive in general. This is because the structures represent to the overall development of the towns.

The site is surrounded by very farmland areas, with dwellings being dispersed, and dense bushland areas. The site's landscape is flat, with some undulations sloping outward from the centre. The general topography of the area west of the site continues to slope gently downhill into the valley in which the Omatjene River flows. Farming activities are limited to the east of the site. Additionally, due to the Gerus substation, visibility of the site is limited from the west.

To the west of the site the landscape slopes gently westward to a drainage line that runs in an east-west direction parallel to the site. The area then slopes upwards to a ridge line approximately 3km eastwards of the site. The ridgeline rises above the level (1350 m a.s.l) of the site in certain places making the site visible from certain areas from the east. The ridgeline has a dense shrubland, further limiting the visibility of the site.

To the north and south of the site the areas slope gently away from the site. The site is also bordered to the north, east and south with Eucalyptus plantations and dense shrubland. Image 1-3 provides photographs depicting the landscape features of the area surrounding the site.

1.1.10.2.3 Visibility from viewpoints

The potential visibility of the proposed project was further gauged by photographs, taken from 4 viewpoints.

 Looking to the Southeast from the project site.	 Looking to the West from the project site.
 Looking to the East from the project site.	 Looking to the East from the project site.

Image 1-3: Photographs depicting the landscape features in the study area.

Despite current land uses, natural visual character has not been significantly altered, and the study area is sparsely populated. With few dwellings and other manmade structures, the livestock farming practice create a sense of openness and naturalness. This character is likely to change with the expansion of the Otjiwarongo and Outjo towns. In addition to the proposed low-level structures, adjacent horizontal infrastructure will add to the immediate visual landscape by creating a more modern appearance.

1.1.10.2.4 Sensitivities

Visual constraints or sensitive features have been mapped. These included:

- Topographic Features
- Steep slopes (gradients steeper than 1:5) are visually sensitive as construction activities (building of roads, warehouse construction etc.) require cut and fill which can result in scars that are visually prominent on steep slopes.
- Surrounding dwellings

- There are dispersed dwellings located around the site. These residential areas are of very low density within farms.
- Towns/urban areas
- The closest town, Otjiwarongo is situated approximately 33km to the southeast of the site, separated from the site by a low ridge line. The site is not visible from the town.
- Roads
- The site is situated approximately 3km northeast of the highway C38 which runs through the town of Outjo from Otjiwarongo (note: the site is approximately 5km from the highway via the existing road network).
- Smaller dirt access roads occur across the area. These roads are private access routes and carry very low traffic volumes.

1.1.10.3 Assessment of impacts (findings)

The following potential impacts were identified.

1.1.10.3.1 Construction phase

1. Construction equipment and dust: As construction activities progress, new machinery and landforms will be introduced to the landscape. As a result of earthworks, mounds of soil will be stored around the Project area. Vehicles, dust, and equipment associated with construction will have an impact on viewers and general visibility (clarity of air) near the site. During construction, there will be temporary visual impacts for a limited time period.
2. Clearing: By removing vegetation, more exposed soil will be visible, resulting in changes to the colours and textures of the site. The removal of vegetation will also increase windblown dust, which will reduce visibility during high wind periods.
3. Physical impact on landforms: Earthworks may affect steeper slopes' landscape form.

These changes will have a limited visual impact on the adjacent area and those on the ridge to the east of the site, even though the view will be obscured by the topography of the site and adjacent vegetation due to the location of the site mostly on the lower portions of the ridge.

The severity of the effect is assessed as low negative (Table XXX), as these effects are largely confined to the construction period. The project's ongoing effects are addressed under the heading 'operation'.

1.1.10.3.2 Operational phase

1. Intrusion on the sense of place and scenic landscape: The naturalness character of the area is typical of the region. The area is characterised by undulating topography with dense acacia bushland and with farmland and low-density dwellings. The presence of low-lying sprawling industrial infrastructure will differ from the current visual landscape and will have an impact on the current nature of the landscape. However, the impact is considered positive as the low level warehouse structures and associated horizontal infrastructure will create a more modern character which may positively dominate the immediate visual landscape. The visual impact of the project is seen as positive, representing progress and advancement in the energy sector through industrialisation as well as the growth and development of the towns.
2. Lighting: Observations of the landscape at night differ from those at day because there is less visible context and lights can be more easily seen in isolation. White lights contrast with the night sky, but they match the colours typical of the night landscape. However, use of artificial light will result in light pollution in an area with no artificial light now. 'Light pollution' or 'obtrusive light' can be a source of annoyance to people, harmful to wildlife, undermine enjoyment of the countryside or detract from enjoyment of the night sky. However, the project is located to the west of an elevated ridge limiting its visibility to potential receptors. The largest impact is deemed to be on the northern areas immediately surrounding the site as well as those located on the to the southeast of the site.
3. Access roads and/or road widening could also have an impact on visual impact during operations. Roads may create long-term visual contrasts within the landscape in addition to vegetative clearing.

The visual effects of these changes will be restricted to the adjacent areas, although the view will be obscured due to the nature of the site's topography and adjacent vegetation as the dwellings. The severity of the effects vary from moderate Negative to Moderate Positive as these effects are related to daytime and night-time.

1.1.10.3.3 De-commissioning phase

Construction equipment and dust: It is expected that the decommissioning process will have a similar visual impact as the construction phase, with visual receptors and landscape character expected to be affected in the same way as during construction.

1.1.10.3.4 Cumulative impacts

In terms of cumulative effects, they are the changes in perception of character resulting from the visibility of the proposed development in conjunction with other developments within the study area. During the construction and operational phases of the project, these cumulative effects would be expected to occur.

There is limited information available regarding the proposed or future planned developments in the vicinity. The visual isolation of the site due to the general topography and the pockets of dense vegetation and adjacent Gerus substation and its related infrastructure (power distribution lines) limits the chances of cumulative visual impacts.

No existing development is being undertaken within close vicinity of the site, however it is anticipated that additional developments will take place within the area once operational. The proposed development will therefore ultimately have a cumulative positive impact for the area. During construction the impacts will be negative and will be related to dust and noise and will be temporary in nature. During the operational stage the IAIP and associated developments will have a positive impact in adding to the development of the area in terms of growth of the industrial nature of the area.

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1.1.10.3.5 Visual Impact Assessment and Management Plan

Table 1-17: Visual Impact Assessment and Management Plan

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
1.	**Construction stage**								
1.1	Construction equipment and dust	• Construction activities will introduce new machinery and landforms into the landscape. Earthworks will mean that there will be mounds of soil stored around the Project area. • Construction vehicles, dust and equipment	The visual impacts during construction are over a limited time period and will be temporary.	• These effects are temporary and assessed as minor to negligible. The effects are predominantly associated with dust impacts, these are addressed within the Air Quality Impact Assessment, as such no additional mitigation measures are proposed for the construction phase.	3	B	**9 HR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
		will have a visual impact on viewers and general visibility (clarity of the air) within close proximity to the site.							
1.2	**Site clearing**	Areas of vegetation will be cleared, so there will be areas of exposed ground, increasing the visibility of contrasting soils, resulting in changes to the colour and texture of the site. Clearing vegetation will also result in	• The visual impacts during construction are over a limited time period and will be temporary.	• These effects are temporary and assessed as minor to negligible. The effects are predominantly associated with dust impacts, these are addressed within the Air Quality Impact Assessment, as such no additional mitigation measures are proposed for the construction phase.	5	B	**19 LR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
		increased windblown dust, reducing visibility of both day and night skies.							
	Physical impact on landforms	Earthworks may impact on the physical landscape form particularly of steeper slopes.	• The visual impacts during construction are over a limited time period and will be temporary.	• These effects are temporary and assessed as minor to negligible. The effects are predominantly associated with dust impacts, these are addressed within the Air Quality Impact Assessment, as such no additional mitigation measures are proposed for the construction phase.	3	C	**13 MR**	Responsible Supervisor	
2.	**Operational stage**								
2.1	**Intrusion on the sense of place and scenic landscape**	The presence of low-lying sprawling industrial warehouses behind the	• Good design, correct installation	• These effects are temporary and assessed as minor to negligible.	5	B	**19 LR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
		compound wall structure will differ from the current visual landscape and will have an impact on the current nature of the landscape.							
2.2	**Light Pollution**	Artificial light being used by the IAIP for night-time security and safety to the occupants will result in light pollution in an area that currently has no artificial light.	• Good design, correct installation	• Light spills can be completely avoided by careful lamp design selection and positioning. • Lighting near or above the horizontal should be avoided to reduce glare and sky glow (the brightening of the night sky). • Good design, correct installation and ongoing maintenance are essential to the effectiveness of lighting schemes.	5	B	**19 LR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
				• Lighting schemes should be designed to ensure unnecessary or superfluous lighting is turned off when not needed. Apply 'part-night lighting' to reduce any potential adverse effects e.g., when a business is closed or, in outdoor areas, switching-off at quiet times between midnight and 5am or 6am. • Impact on sensitive wildlife receptors throughout the year, or at particular times (e.g., on migration routes), may be mitigated by the design of the lighting or by turning it off or down at sensitive times.					
2.3	**Roads and / or road widening**	Access roads and on-site roads could also	• Follow hazard management plan during road	• Establish vegetative screens /shelterbelts along highly visible roads.	3	C	**15 MR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
		contribute to visual impacts during operations. In addition to vegetative clearing, roads may introduce long-term visual contrasts to the landscape colour and texture.	construction and follow prescribed designs with less impact on the environment. • The handling and transportation of materials which may generate dust must be avoided during high wind conditions following prescribed operational procedures.	• Natural vegetation must be re-established on disturbed areas after construction. • • Roads and drainage for runoff should be appropriately stabilised to avoid erosion and visual scars.					
3.	**Construction/decommissioning stage**								
3.1	**Construction equipment and dust**	There are no existing construction activities taking place in the area, should additional activities occur, the development will have a	• A detailed rehabilitation plan must be prepared.	• Mitigation measures applicable to the construction phase are also applicable to decommissioning	3	C	**11 MR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
		cumulative negative impact on the areas directly surrounding the site and to the east on the ridge. The impacts will be related to dust and noise and will be temporary in nature.							
3.2	**Operation - Visibility**	During the operational stage additional developments will be in keeping with the storage warehouses of the project and will be marginally noticeable. The			5	B	**19 LR**	Responsible Supervisor	

No.	Hazard/ Risk	Consequences	Preparedness measures	Response Measures	Initial Risk Score			Action assigned to	
					Consequence	Likelihood	Risk Rating		
		increased development will add to the overall development of the area.							

1.1.10.4 Conclusion

The following findings and recommendations are pertinent:

- The proposed facility is situated in a farming area northwest of the town of Otjiwarongo. The area is of low visual value. The visual absorption capacity is relatively good primarily due to the smooth undulating nature of the topography. The visual isolation of the site due to the general topography and the pockets of dense vegetation and adjacent infrastructure limits the chances of visual impacts.
- There will be a number of lesser visual impacts caused by roads and associated infrastructure.
- All negative impacts are minor before mitigation, and they are negligible after mitigation, except for light pollution, which could generate community nuisances. This impact is considered to be of moderate significance without mitigation which can be reduced to minor with mitigation.
- This project has two positive impacts, one relating to sense of place, during operation and one cumulatively. Overall, community consultation conducted in the context of this ESIA revealed overwhelming support for the project even from those directly affected by it. The community believe that a development of this scale, offering many job opportunities, will benefit the entire community. The visual impact of the project is seen as positive, representing progress and advancement in the energy sector.
- After decommissioning, the visual impacts can be completely reversed if all structures are removed and the land is properly rehabilitated, making it critical that the process of decommissioning and rehabilitation is well managed and enforced.
- Natural resource evaluations are complex, requiring balancing competing interests and values. It is possible to mitigate potential adverse visual impacts to a level considered acceptable, which is considered minor and below acceptable.

1.1.11 Traffic Impact Assessment and Management Plan

The traffic impact assessment (TIA) is concerned with the handling and operation of vehicular traffic around the main site and other associated remote sites related to the project. The execution of the project is expected to generate a significant and concentrated amount of traffic likely in the form of light delivery vehicles (LDVs) as well as heavy construction motorized plant and equipment in a relatively concentrated area (project footprint). This will be due to the transportation of:

- Materials: building materials for earthworks (gravel) as well as panels and related infrastructure,
- Equipment: heavy construction equipment will be transported to site by means of low bed trucks and
- Personnel: Personnel will be transported from daily from and to site to carry out construction activities for as labour services, management and supervision.

A TIA is an essential consideration on a project of this nature given the human traffic interaction and the increased potential of traffic related incidents. Uncontrolled and unmanaged traffic operations may result in disabling or fatal injuries which should be prevented and avoided at all cost and which may negatively affect the project deliverables and timelines.

The Traffic Impact Assessment (TIA) will consider the following:

- Routes to be taken by traffic;
- Effect on existing infrastructure as far as can be determined from the available information such as roads and intersections;
- Possible measures to mitigate the impact of traffic on the environment.

The TIA will be based on the existing known information and reasonable assumptions will be made where detailed information is unavailable to be verified when this becomes available.

1.1.11.1 Available information and assumptions

The Consultant has idealized to potential broad stages of the project execution to be as follows:

Table 1-18: Idealised project phases for TIA

Phase	Description	Anticipated relative traffic behaviour and volumes
Phase 0	Planning and detailed design	Mostly LDVs, engineering and specialist investigations. Traffic load: Very low traffic activity.
Phase 1	Construction: Earthworks and substructures (buried services)	Mostly earthmoving equipment (graders, rollers, tipper trucks, water carts); contractor staff transporters (buses), contractor management (LDVs) and labour, engineering consultants and supervisors with LDVs.
Phase 2	Construction: Superstructures	Limited heavy equipment, cranes for erection and off-loading, delivery vehicles. LDVs. Traffic load: Medium.
Phase 3	Operations: Post commissioning	Monthly maintenance visits by staff and crews (LDVs). Traffic load: Very light activity.

There are broadly two types of setups when it comes to solar plants. The panels are typically either installed on supports built on pile foundations or pad foundations on an earthworks elevated platform. The earthworks requirements for the options differ significantly. Ultimately, the choice of method will depend on site geotechnical conditions and costs.

The proposed measures herein should be broadly applicable to a range of possibilities dependent on the final detailed design and may be expanded upon to cater to project specifics that may become apparent at a later stage.

The potential earthworks requirements would depend on the minimum required stormwater depth calculated by the final design in addition to the minimum freeboard required.

The source of the gravel material is currently unknown, and this may have an impact on the route and travelled distance by heavy traffic.

1.1.11.2 Site access and road network

The project site is accessible via a low volume access road directly off the B1 route which link connects the towns of Otjiwarongo and Otavi.

Figure 1-16: Road network around proposed project area

The access road off the B1 is established and connects the existing Nampower Gerus Substation to the road network. Ordinarily, the PV Plant would be located nearby an existing substation. The access road would need to be extended to total a potential length of 1.5km. The interior road reticulation will be subject to the detail design. It is unknown whether the internal road network will be paved or gravel.

The approaches to the Gerus turnoff are straight which is desirable as horizontal safe sight distances are optimised.

A number of photos are shown below depicting site access conditions.

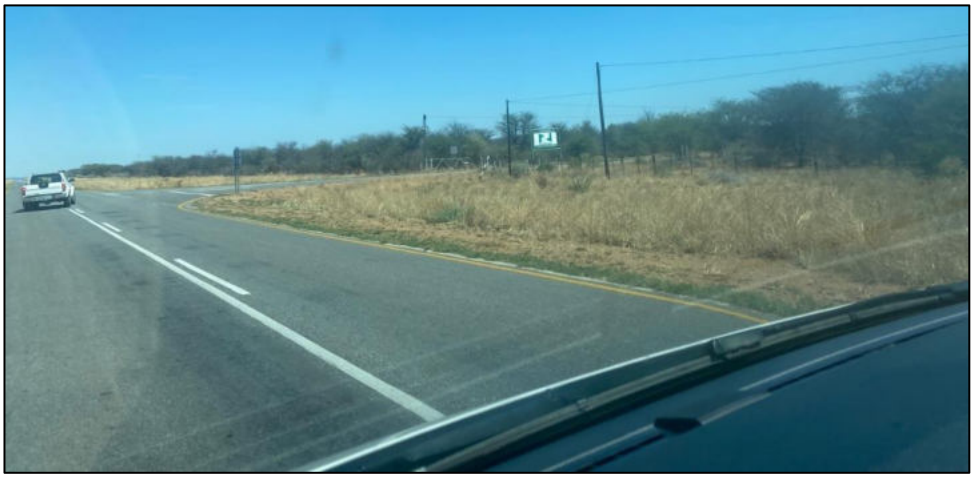


Image 1-4: B1 approach to Gerus Substation turnoff

Image 1-5: Paved access from B1 turnoff

Image 1-6:Entrance to Nampower substation (straight ahead) and new entrance to PV Plant (to the right)

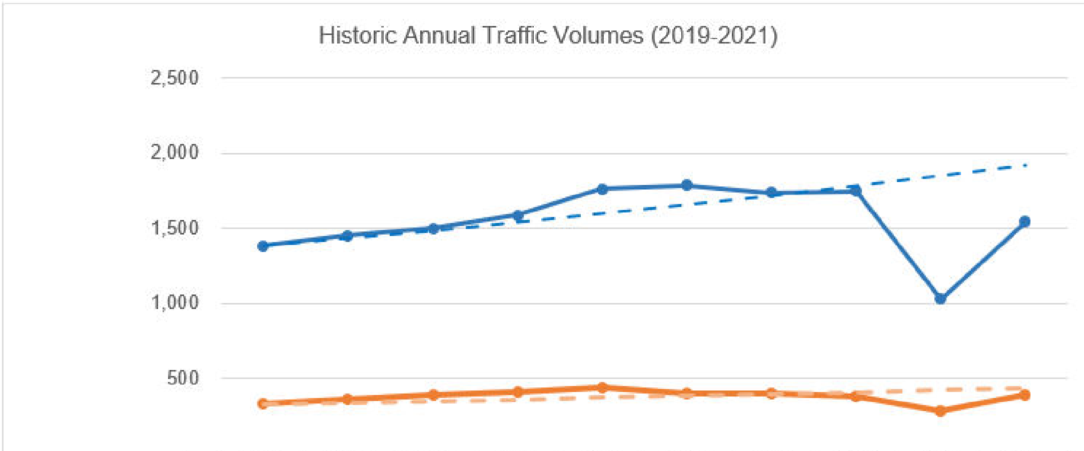
Image 1-7: Earth track from Gerus turnoff

Image 1-8: Existing overhead powerlines

1.1.11.3 Traffic Analysis

1.1.11.3.1 Status quo

Historical traffic data from the Roads Authority's Traffic Surveillance System (TSS) for the relevant link (Annexure A) where the Gerus turnoff is located was obtained for the purpose of understanding the volume of traffic that may potentially be impacted by the development.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Light	1,381	1,451	1,496	1,584	1,761	1,786	1,736	1,745	1,029	1,543
Heavy	325	357	383	411	436	398	399	380	282	387
LT grwth	1,381	1,432	1,485	1,540	1,597	1,656	1,717	1,781	1,847	1,915
HT Growth	325	335	346	357	369	380	393	405	418	432

Figure 1-17: Historical traffic volumes and growth rate

The historical traffic data from 2012 to 2021 shown in Figure 1- above indicates that there was a steady rise in traffic volumes up until 2020. The dip may be attributable to the COVID pandemic which resulted in the general reduction in economic output and productivity not only locally but internationally as well. The data indicated an average annual growth of 3.7% and 3.2% per annum for light and heavy traffic respectively.

1.1.11.3.2 Traffic forecast and modelling

The data was then projected and forecasted forward for a period of 20 years from an assumed plant commissioning year of 2023 to 2043.

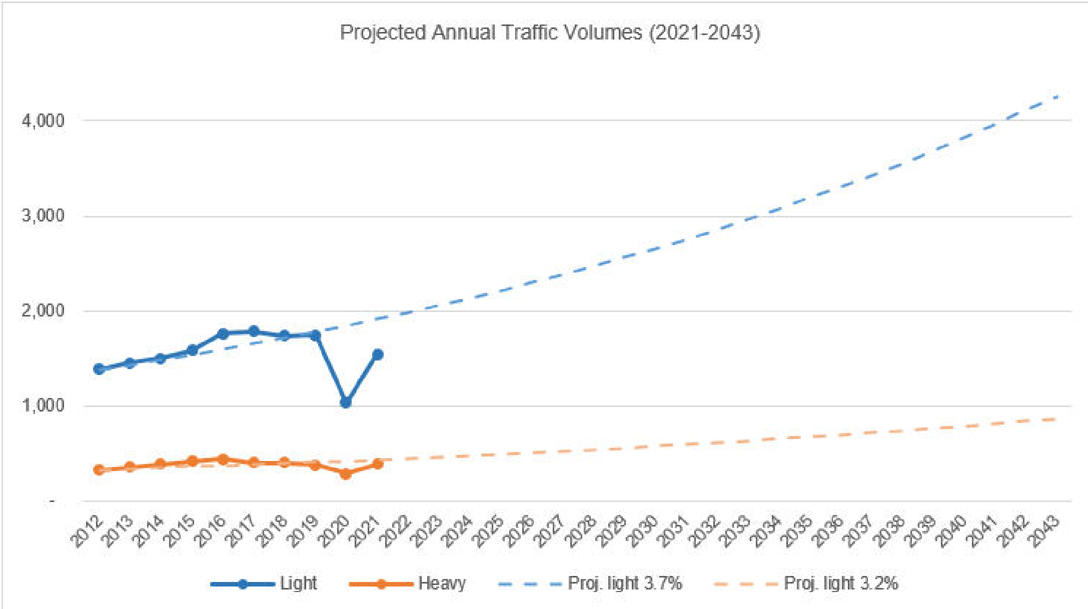


Figure 1-18: Projected traffic volumes

The projected traffic indicates that the total combined traffic (light and heavy vehicles) on the link will potentially grow to above 5,000 vehicles per day.

1.1.11.3.3 Impact of project traffic

Depending on the location of material sources, particularly borrow or quarry areas (for gravel which will be required in large quantities), the haulage traffic (tipper trucks) may have to regularly utilise portions of the B1 up to and before the Gerus turnoff. The turning movements and presence of slow-moving traffic will need special provisions to ensure safe conditions for project traffic as well general road users. Special provisions will involve demarcated intersections as well as alighting points as special zones with safety personnel and temporary road furniture to alert drivers and create traffic calming conditions to mitigate prevent traffic incidents in a manner that ensures continuous production as well as a smooth flow of general road traffic.

The projected amount of heavy traffic on the trunk road to the analysis year (2023) is in the order of not more than 100 vehicles per day. The anticipated project heavy traffic volume is estimated to be around 150,000 loads *2 trips per load which yields a total volume of approximately 300,000 vehicles per day (Average Daily traffic (ADT)) which represents 146% of annual additional generated heavy traffic or 32% total traffic over a limited length of road the extent of which will depend on the location of the borrow or quarry sources.

The project traffic would therefore cause a temporary yet significant increase in the road volumes for the duration of the project. The cumulative damage to the road would slightly increase maintenance on those portions of road affected. The Roads Authority is accountable for the maintenance of the national road network and thus becomes a major stakeholder in the project as far as transportation and traffic is concerned. The RA would inevitably need to be informed of the development to be able to provide the required support.

Alternatively, the earthworks materials may be sourced from the surrounding farms adjacent to the site which may not require the use of the surrounding road infrastructure. This may present an opportunity that would limit the traffic impact.

1.1.11.4 Traffic Management Plan

The Traffic Management Plan (TMP) in the form of a risk assessment is attached in the table below and will put forth recommended measures to mitigate the impact of the project generated traffic on the environment, surrounding infrastructure and personnel. The typical measures related to traffic are to be managed on a daily basis and shall be the responsibility of the assigned contractor or project HSE Officer and monitored by the Site Supervisor or Resident Engineer accountable for the supervision of the works.

The works contractor(s) is/are expected to be equipped with internal controls and systems to manage a project of this magnitude and that this would have been one of the major selection criteria.

In general, it is expected that traffic safety be a standing daily agenda item at toolbox talks and other key project discussions. Near miss incident reporting should also be encouraged as far as possible to create a culture of active safety management and incident prevention. Education and ongoing awareness training in addition to the project's greater risk management programme which will be detailed at the execution stage and continuously improved and monitored during construction.

1.1.11.4.1 Traffic Impact Management Plan

Table 1-19: Traffic Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
1	• Untrained operators and drivers operating vehicles and equipment	• Traffic accidents; damage to equipment and property; loss of production	• Only trained and licensed operators and drivers to be employed and allowed on site	3	3	9	Contractor	
2	• Inebriated personnel (general workers, staff and drivers/ operators)	• Traffic accidents; damage to equipment and property; loss of production	• Resource and allocate correct vehicles and plant for the works; strict employee code of conduct	3	3	9	Contractor	
3	• Lack of traffic management, direction, and signage	• Traffic accidents, disgruntled road users, dangerous road conditions	• Dedicated team to ensure traffic management is continuously present and active on site; contract to clearly indicate procedures and penalties for neglecting active traffic management at all areas. Liaison with RA personnel	3	3	6	Project Owner/ Design Consultant	
4	• Lack of fatigue management for operators and drivers	• Traffic accidents; damage to equipment and property; loss of production	• Ensure roster of sufficient operators and reasonable shift periods	2	1	2	Design Consultant	

1.1.13 Administration of Environmental Management Plan

To guarantee that the EMP is completely implemented, it is imperative to explicitly define the roles and responsibilities of all stakeholders. To ensure the effective execution of the EMP, the proponent must additionally designate an accountable individual (project manager), as shown below.

Table 1-20: EMP Administration

ROLE	ENVIRONMENTAL RESPONSIBILITIES
Gerus Solar One (Namibia) (Pty) Ltd	Responsible to enforce EMP implementation to contractors
Environmental Control Officer	• Implement, review and update the EMP. • Ensure all reporting and monitoring required under EMP is undertaken, documented and distributed as needed • Conduct environmental site training (toolbox talks) and inductions with the support of an environmental consultant. • Conducts environmental audit at work site with the support of environmental consultant. • Close out all non-conformances. • Ensure materials being used on site are environmentally friendly and safe.
The Department of Environmental Affairs	• Approve the EMP and any amendments to the EMP. • Approve reports of environmental issues and non-conformances as issued. • Review and approve environmental reports submitted as part of EMP implementation
Environmental Consultant	• Conduct and monitor actions required by the EMP if required • Conduct environmental site training (toolbox talks) and inductions if assistance is required • Conducts environmental audit at work site • Ensure materials being used on site are environmentally friendly and safe.

ROLE	ENVIRONMENTAL RESPONSIBILITIES
Site Technical Team	• Control and monitor actions required by the EMP. • Report all environmental issues to Environmental Control Officer. • Ensure documented procedures are followed and records kept on site. • Ensure any complaints are passed onto the management within 24 hours of receiving the complaint.
Workers	• Follow requirements as directed by site technical. • Report any potential environmental issues to site engineer/project manager, indicating spilt oil, excess waste, excessive dust generation, dirty water running off the site and other possible non-conformances

1.2. Performance Standard 2: Labor and Working Conditions

PS2 acknowledges that an organisation's employees are its most precious resource. Any business must have a healthy relationship between workers and management in order to succeed. Organizations must adhere to PS2's requirements for treating employees fairly, providing them with safe and healthy working conditions, refraining from using child or forced labor, and identifying hazards in their work environments. The objectives of PS2 include to:

- Promote the fair treatment, non-discrimination, and equal opportunity of workers.
- Establish, maintain, and improve the worker-management relationship.
- Promote compliance with national employment and labor laws.
- Protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client’s supply chain.
- Promote safe and healthy working conditions, and the health of workers.
- Avoid the use of forced labor.

A work health and safety management plan for the proposed project has been created in order to achieve these objectives, and it is described in this section.

1.2.1 Purpose of Worker Health and Safety Management Plan

This plan is intended to establish and maintain an effective work health and safety management system. In order to achieve consistently high standards of safety performance, Gerus Solar One (Namibia) (Pty) Ltd, has committed to implementing a structured approach to workplace health and safety. This plan will enable Gerus Solar One (Namibia) (Pty) Ltd in complying with work health and safety legislation. The plan applies to all temporary and permanent work personnel at Gerus solar plant workplaces, and to any other persons who could be at risk because of the solar plant's activities ands operations.

1.2.2 Occupational Safety & Health Policy

Gerus Solar One (Namibia) (Pty) Ltd, is committed to ensuring, the health and safety of its workers (employees, contractors, labour-hire workers, outworkers, apprentices, students or volunteers) and that the health and safety of other persons (e.g., visitors) is not put at risk from our operations. Therefore, top management shall establish, implement and maintain an Occupational Health and Safety Policy. Commitments of the policy include:

- providing a safe and healthy work environment through safe work practices, safe systems of work, and safe plant and equipment.
- maintaining a safe workplace, ensuring that there are no health risks, and providing safe access and egress to workplaces.
- ensuring that Gerus Solar One (Namibia) (Pty) Ltd maintains effective, cooperative relationships with its workers and other duty-holders on health and safety issues
- assessing the effectiveness of safety measures taken.
- educating all workers about workplace safety and their responsibilities.
- assisting in WHS matters where necessary.
- instructing and/or training employees in work processes as appropriate.
- establishing and implementing strategies for workplace assessment, hazard identification, and mitigation actions to eliminate or control hazards.
- developing and maintaining appropriate reporting, information, and statistical systems.

1.2.3 Administrative requirements

An occupational health safety management system is to be established, implemented and maintained. This is to take into account the following: the OHS policy; hazard identification, risk assessment and controls; compliance obligations; setting OHS objectives and targets; resources, roles, responsibility and accountability; competencies, training and awareness; worker participation and consultation; communication and consultation with contractors and external parties; emergency preparedness and response; incident investigation, corrective action and preventive action; monitoring and review; etc.

Work will only begin after Occupational Health and Safety (OSH) requirements have been approved. Legal documentation required under OSH legislation will be done before work begins together with conducting a Baseline Risk Assessment. The Client, Project Manager, Contractor and Safety, Health, and Environment (SHE) manager will work together to have all the documentation needed to start work. Appropriate inductions are to be undertaken for all employees as well as any persons at the plant. OSH trainings are to be carried out periodically and appropriate first aid facilities are to be ensured that they are onsite.

An authorised permit to work will also be granted before starting work. The permit ensures that all parties involved are aware of:

- The type of work to be done, the location, and any equipment or plant required.
- Duration of the work.
- Hazards that may be present.
- Tests and checks are to be conducted before the work begins, and precautions are to be taken.
- Standby equipment to be used or to be made available.
- Worker personal protective equipment.
- Periodic testing and checking requirements.
- Those authorised to perform the work.

1.2.4 Worker Health and Safety Management Plan

Tabulated below is the Worker Health and Safety Management Plan for the proposed project.

Table 1:21: Worker Health and Safety Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
1.0	**PERSONAL PROTECTIVE EQUIPMENT (PPE)**							
	• Not wearing PPE	• Injury • Illness • Financial implications	• Provide and maintain certified PPE to employees. • Wearing fully certified protective clothing and equipment relevant to the activity. • Monitor the correct use of PPE. • Employers should ensure that PPE is properly stored, maintained, and replaced. • Personnel must receive training on the selection, use, cleaning, maintenance, and disposal of personal protective equipment. • Disciplinary action will be taken against workers who do not wear PPE. • High visibility vests and jackets, safety helmets, work boots, gloves, and goggles/glasses are mandatory for all personnel.	4	2	**8 MR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
2.0	**STACKING**							
2.1	• Stacking of pipes, frames, prefabricated elements, and scrap items	• Injury • Damage to equipment	• Materials should be stored or placed so that they cannot collapse, fall, or rollover. • All suspended parts must be transported using a movable crane that meets all requirements outlined in the machinery section. • Workers must never stand or walk under suspended loads, so guiding ropes must be long enough to allow loads to be handled outside this area. • Stockpiling surfaces must be levelled and resistant. • Pile heights must not exceed those established by the manufacturer. • Materials of different shapes or vessels with different sizes cannot be piled together in the same pile.	3	3	**9 MR**	Responsible supervisor	
2.2	• Stockpiling of soil and aggregates	• Injury	• It is mandatory to fence or mark out the whole stockpile area if the pile is higher than 1,8 m.	3	3	**9 MR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		• Damage to equipment	• Never place piles over roads or accessways. • Loose aggregates must be stacked in the form of mounds limited by boards.					
2.3	• Stacking of paints, release agents and fuels	• Fire • Injury/burns • Loss of life	• Store fuels or toxic products for the project in a covered and independent warehouse. • No smoking around warehouses. • Regular inspections of vents within facilities must be conducted if materials are emitting toxic vapours. • Respirator filters must be provided to workers accessing such facilities. • Storage facilities must be far from stream beds to minimise the effects of possible accidental spillage. • Install fire extinguishers appropriate to the flammable product in warehouses. • Regularly maintain fire extinguishers. • Document regulations regarding toxic and hazardous substances especially those that require hiring a safety advisor specialised in such field.	4	3	12 HR	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Transferring fuel must be done in places with adequate ventilation, away from sparks and ignition sources. • Soil or sand must be readily available in case of spills.					
2.4	• Storage and handling of flammable materials	• Fire • Injury/burns • Loss of life	• Contractors must submit a list of flammable materials, including quantities and hazards. • The Material Safety Data Sheet (MSDS) of every material to be used must be provided. • Any changes to the materials must be updated on the list. • Store and handle flammable materials and substances according to the manufacturer's instructions. • Ensure that flammable materials, fuels, and thinners are stored in appropriate containers that are protected from direct sunlight and ignition sources. • Return all flammable materials and substances to their secured storage areas at the end of the close of a working day.	5	3	15 **HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• All oily rags and similar materials must be disposed of as contaminated waste. • Storage quantities of flammable materials and substances should be kept at a minimum. • Put clear safety signs for all storage areas for flammable materials and substances. • No naked flames, sources of ignition, or smoking are permitted within the vicinity of all flammable materials and substances. • Store all flammable fluids in a protected area away from drains, pits, sewers, and excavations where fumes may accumulate. • An appropriate delivery tanker shall be used for the bulk refuelling of vehicles and plants.					
3.0	**HOUSEKEEPING**							
3.1	• The site is not in a clean state with debris or scrap material • Trip/fall/slip	• Fire • Injury/burns	• Always keep work areas clean and free of trash, rubbish, and debris. • Scraps and debris must be collected, segregated, and removed from the	4	3	**12 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		• Loss of life	Site on a regular or weekly basis as required by environmental regulations. • Supplies and materials should be kept in a location that facilitates easy cleaning and will not block access. • Store materials and equipment neatly in controlled stacks and accessible locations. • Do not scatter materials all over the Site. • A minimum period must be allowed for excavations to be open, and they must be barricaded while they are open. • Keep walkways, stairs, and ladder bottoms free of tripping hazards. • Flammable or hazardous substances must be stored in clearly marked safety containers. • Only designated areas will be used for eating and drinking. • Clean canteens, sanitary kitchens, and potable drinking water are all required for a hygienic work environment.					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Site roads must be maintained and repaired regularly. Use metal containers for storing flammable and other hazardous materials (oil rags, etc.).					
4.0	**BARRICADES, SAFETY SIGNS AND LABELLING OF EQUIPMENT**							
4.1	• No warning and caution of hazards • Trip/fall/slip	• Injury	• Barricades and safety signs shall be used to prevent exposure to personnel from potentially hazardous situations. • Safety signs will be used for danger warnings. • Examples of barricade signs: Yellow/black, red/white barricade tapes, and traffic cones. • Containers with hazardous materials shall be labelled or colour coded accordingly.	3	3	**9 MR**	SHE manager Responsible supervisor	
5.0	**NOISE**							
5.1	• Activities with excessive noise such as grinding	• Hearing loss	• Using acoustic insulating materials, isolating the noise source, and implementing other engineering controls should be investigated and implemented before the issuance of	3	3	**9 MR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			hearing protective devices as the final control mechanism. • Enforce PPE for hearing where necessary. • Employees exposed to excessive noise undergo medical hearing check-ups regularly.					
6.0	**VIBRATION**							
6.1	• The vibration of hand-arm joints caused by hand and power tools	• Damage to nerves, tendons, muscles, bones and hand and arm joints. • Disruption of the circulation system in the arm of the person.	• Choose the right equipment for use in certain works. • Install vibration-dampening pads or devices. • Limit the duration of exposure.	3	3	**9 MR**	SHE manager Responsible supervisor	
7.0	**ELECTRICAL**							
7.1	• Electricity usage	• Electrocution • Injury/burns • Loss of life	• All energised electrical devices and lines should be marked with warning signs. • All work will be performed on dead systems. Permits shall always be	5	3	**15 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			required for live works when strictly necessary. • Inspect all electrical cords, cables, and hand power tools for frayed or exposed cords before use. • Ensure the portable hand tools are operated at the maximum voltage recommended by the manufacturer. • Electrical equipment must be double insulated or grounded. • Shielding or suspending power cords and extension cords above traffic areas prevents damage from traffic. • Training must be offered to employees who may be exposed to hazardous energy before work to ensure that they have skills to apply, use, and remove energy controls. • A retraining program will be provided annually to ensure that employees understand the energy control policy.					
8.0	**WELDING/ HOT WORKS**							
8.1	• Welding • Flame cutting • Soldering	• Damage to equipment	• Fire-fighting equipment must always be on hand when there is a risk of fire.	5	3	**15 HR**	SHE manager	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
	• Brazing • Grinding • The use of other equipment incorporating a flame, e.g., tar boilers, etc. • Fire hazard	• Injury/burns • Loss of life	• Protect your eyes by wearing welder goggles and/or full-face eye shields. • Limit exposure to noxious fumes from welding. • Proper ventilation and air circulation must be ensured • Always keep fire blankets in good condition. • Whenever possible, hot work operations should be conducted outdoors, away from critical operations and combustible materials. • Identify designated locations to undertake hot work. • Work within safe time limits. • Make sure the work is properly supervised. • Precautions must be taken to prevent fire or explosions when doing hot work, including removing all flammable products from the working area.				Responsible supervisor	
9.0	**PILING AND DRILLING**							

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
9.1	• Heavy rigs and difficult to manoeuvre • Possible groundwater contamination	• Injury • Illness	• All pile-driving equipment is to be inspected weekly by a trained and competent person. • Before commencing the piling operation, the ground shall be checked by a trained and competent person to confirm its suitability to provide a stable platform. • A visual check of the surrounding strata is to be undertaken to confirm a firm foundation.	4	3	**12 HR**	Responsible supervisor	
	• Trial pitting, window sampling, dynamic probing, boring, piling, rotary coring, shell and auger drilling, and open hole drilling are the most common drilling operations.	• Injury	• An approved method statement is required. • It is important to investigate any underlying hazards, such as warm/steaming ground, shafts/cavernous ground, and contaminated ground, using a detailed desktop study.	3	3	**9 MR**	Responsible supervisor	
10.0	**EXPLOSIVES AND BLASTING**							
10.1	• Chemical reaction. • Fire • Electromagnetic radiation	• Injury • Burns	• An approved method statement is required. • All permits, procedures, and controls must be set before blasting activities begin.	5	3	**15 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Trained employees must do blasting and use explosives.					
11.0	**WORKING ENVIRONMENT TEMPERATURE**							
11.1	• Extreme temperatures indoor or outdoor	• Injury related to stress • Loss of life • Dehydration • Heat exhaustion • Heat stroke	• Use of personal protective equipment (PPE). • Implement engineering controls and ventilation where possible. • Monitoring and scheduling outdoor work based on weather forecasts to protect workers from extreme weather. • Temporary shelters are provided to protect workers from extreme weather during their working activities or for resting. • Providing easy access to adequate hydration such as drinking water or electrolyte drinks and avoiding consumption of alcoholic beverages. • Employees should be monitored and trained to identify and report heat-related illnesses as soon as possible.	5	3	**15 HR**	SHE manager Responsible supervisor	
12.0	**MANUAL HANDLING**							

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
12.1	• Moving, lifting, pushing, pulling, carrying, or putting down. • Using mechanical aids, such as wheelbarrows, bucket loaders, and trolleys	• Injury-sprains or strains, usually to the back.	• Worker training in lifting and material handling. • Provide training on back protection and prevention measures to the workforce. • Mechanical assistance is used to lift, hold, and work with materials, tools, and work objects to reduce or eliminate physical exertion. • Enhancing posture and reducing force requirements by selecting and designing tools. • Rotating jobs and incorporating rest and stretch breaks into the work process.	4	3	**12 HR**	Responsible supervisor	
13.0	**WORKING AT HEIGHTS**							
13.1	• Any work above 1.8 m • The risk of the work considers frequency, duration, height, the task involved, weather, etc.	• Falling • Injury • Property damage • Equipment damage	• An approved permit is required before working at heights. • A method statement is required. • A fall protection plan is required before starting work. • Employees' physical and psychological fitness must be evaluated and meet the	5	3	**15 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			requirements to work at elevated positions and their records. • Training for employees must be done. • Fall protection equipment must be inspected, tested, and maintained. • Fall prevention may include: ✓ Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. ✓ Proper use of ladders and scaffolds by trained employees. ✓ Use of fall prevention devices, including safety harness and lanyard travel limiting Devices. ✓ Training in the use of necessary PPE.					
13.2	• Working on ladders	• Falling • Injury • Loss of life	• Inspect all ladders before and after use and keep records in the SHE File on site. • Three-point contact must always be maintained on ladders.	4	3	**12 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Whenever ladders are used, they need to be tethered at the top of the structure.					
14.0	**STORAGE AND HANDLING OF HAZARDOUS SUBSTANCES**							
14.1	• Single acute exposure or chronic repetitive exposure to toxic, corrosive, sensitizing or oxidative substances. • Uncontrolled reaction. • Fire and explosion	• Injury • Loss of life	• Substituting less hazardous substances for hazardous substances. • The number of employees exposed, or likely to be exposed, should be kept to a minimum. • Workers exposed to hazardous conditions should have easy access to written communication in an easily understood language. • Products should never be transferred to food-grade bottles. • Comply with all relevant legislation. • Maintain and test equipment regularly. • Staff and visitors should receive appropriate and sufficient information, instruction, training, and supervision.	5	3	**15 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Worker training regarding safe work practices, MSDSs, and personal protective equipment (PPE). • Should any material need to be changed, the list must be updated. • Ensure that flammable materials and substances are stored and handled according to the manufacturer's instructions. • Store flammable substances, fuels, and thinners away from direct sunlight. • The use of cigarettes and naked flames are prohibited near any flammable substance or material.					
15.0	**FIRE AND EXPLOSIONS**							
15.1	• Ignition of flammable materials or gases	• Injury • Loss of life • Loss of property	• Keeping flammables away from ignition sources and oxidisers. • Further, the flammables storage area should be: ✓ far from entry and exit points into buildings. ✓ kept away from facility ventilation intakes and vents.	5	3	**15 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			✓ Provide floor and ceiling level ventilation as well as explosion vents. ✓ Use spark-proof fixtures. ✓ Be equipped with fire extinguishers and self-closing doors, as well as constructed of flame-resistant materials. • A fire hazard area should be identified and labelled to warn of special rules (e.g., prohibiting the use of smoking materials, cellular phones, or other potential spark generators). • The training of workers in fire prevention and suppression, as well as the handling of flammable materials.					
16.0	**RADIOLOGICAL HAZARDS**							
16.1	• Exposure to radiation	• Injury • Serious illness	• Workplaces involving occupational and/or natural radiation exposure should be established and operated according to recognised international safety standards.	4	3	**12 HR**	SHE manager Responsible supervisor	
17.0	**CONFINED SPACE**							

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
17.1	• Work in wholly or partially enclosed space not designed or intended for human occupancy.	• Illness • Injury	• The Entry Permit system and PPE are required before entering confined spaces. • An area adjacent to a confined space should be large enough to accommodate emergency and rescue operations. • It is important to provide self-contained breathing apparatus (SCBA), lifelines, and safety watch workers outside the confined space with rescue equipment and first aid supplies always. • Mechanical ventilation is commonly used in confined spaces. • Evaluate hazards before entering a confined space. space. • Before entering a permit-required confined space: ✓ The feed or process lines into the space should be disconnected, drained, and blanked. ✓ The mechanical equipment in the space should be disconnected, de-energised,	4	3	**12 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			locked out, and braced if necessary. ✓ The oxygen content should be between 19.5% and 23.5%, and any flammable gas or vapour should not exceed 10%. ✓ It is recommended that the confined space be ventilated until a safe atmosphere is achieved.					
18.0	**CIVIL WORKS**							
18.1	• Excavation, concrete pouring, form/false work, rebar pilots, sheet piles, etc.) • Formwork and support work	• Falls from height. • Falling objects. • Formwork collapse (before, during and after pouring of concrete) • Slips and trips. • Noise. • Dust. • Manual tasks.	• Civil work must be done by competent personnel under appropriate supervision under the applicable SHE Plan/regulations/procedures. • The mooring and unmooring of cramps by means of ladders must be performed if the formwork is not placed horizontally on the natural ground. • There must be bracing on the access tubular ladder to meet safety requirements.	4	3	**12 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		• Sharp edges on metal decks.	• Climbing the formworks or standing on them while maintaining balance is prohibited. • The formwork panels must be properly stabilized before they can be unhooked. • Panels must be stabilized according to their size and manufacturer's instructions. • Struts and winches should be used only when stabilizers are not possible due to space constraints or other reasons. • Instructions established by the manufacturer must be followed for assembly, disassembly, and maintenance. • There must be a proper orderly stacking of formwork elements away from transit areas in a horizontal position. • Work must be stopped if there are strong winds or very strong winds. • Always maintain a clean and tidy worksite.					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
19.0	**SCAFFOLDING**							
19.1	• Tube and fitting scaffolds	• Injury • Loss of life • Property damage • Equipment damage	• A competent person should design a scaffold based on calculation. • Do not overload the scaffold at any time. • The maximum load labels need to be always displayed. • Inspect all scaffolding structures before authorising their use. • Maintain scaffolds in safe conditions. • The scaffold must be repaired or dismantled immediately if it is damaged or weakened. • Tags should denote scaffold status, i.e., green tags for complete scaffolds, and red tags for incomplete scaffolds. • Scaffolds cannot be modified or changed. • Access ladders or equivalent safe access shall be provided on scaffolds. • Inspections will be performed by competent personnel before every shift.	4	3	**12 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Safety harnesses must be worn by workers on suspended scaffolds, and they must be attached to a point above their working height that is independent of the scaffold's suspension. • Any slippery material on the rungs, steps, or feet of scaffolds and ladders must be removed. • A scaffold's footing or anchorage must be rigid, sound, and capable of carrying the intended load without settling or shifting. • Using a self-supporting ladder as a single ladder or partially closed is not recommended. • It is not advisable to place ladders or scaffolds on boxes, barrels, or other unstable bases to increase height. • Ladders and scaffolds should not be moved or shifted while someone or equipment is on them.					
20.0	**LIFTING OPERATIONS AND LIFTING EQUIPMENT**							
20.1	• Use of Cranes, Forklift trucks, Mobile elevating work	• Injury • Loss of life	• A third party must certify all lifting equipment before it arrives on site.	5	3	**15 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
	platforms (MEWP), and Lifting accessories such as chains, slings, eyebolts, etc. • Failure of lifting equipment.	• Property damage • Damage to equipment	• Safe working loads must be indicated. • Equipment must be examined before use. • All lifting operations involving lifting equipment must be: ✓ planned by a competent individual. ✓ supervised appropriately. ✓ done safely. • Avoid suspending loads over occupied areas. • Lifting restrictions must be followed by contractors. There could be several restrictions, including weather, winds, equipment condition, ground instability, rigging equipment, etc.					
21.0	**HAND TOOLS AND PORTABLE POWER TOOLS**							
21.1	• Using tools with defects • Noise, vibration, electrical, moving parts and projectiles.	• Serious injury • Loss of life	• Tools must be for the intended use and have proper safeguards. • Inspect tools for good operating conditions and defects. • Daily visual checks, regular inspections, and servicing schedules	4	3	**12 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			should be established according to the manufacturer's instructions and the associated risks for each machine guard. • Operators should be encouraged to report defects or problems.					
22.0	**LOCK OUT / TAG OUT**							
22.1	• Applicable whenever isolation of energy systems; mechanical, electrical, process, hydraulic and others, is necessary for work to proceed safely.	• Electrocution • Serious injury	• The method of cut-off and discharge of stored energy are agreed upon and executed by competent personnel. • Equipment and machinery should be shut down, isolated from all energy sources, and properly locked and tagged. • Discharges of stored energy. • System of locks and tags used as isolation points. • Tests are conducted to ensure the isolation is effective. • Monitoring of isolation effectiveness.	5	3	**15 MR**	Responsible supervisor	
23.0	VEHICLE MOVEMENT							

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
23.1	• **Accidents**	• Injury • Loss of life • Property damage • Equipment damage	• Pedestrian and traffic movement should be planned and controlled in workplaces for safety reasons. • Follow the instructions of the flagmen or traffic controllers. • Employees, contractors, and visitors must be trained on vehicle and road safety. • Observe all warning signs installed. • Follow flashing lights and audible reversing alarms. • Use appropriate, high-visibility PPE (reflective vests in particular). • Parking should only be done in designated areas. • Unauthorised areas must not be entered. • Speed limits must be adhered to. Reduce vehicle speed internally to 15 km/h. • Regular driver testing following the approved Drug, Alcohol, and Substance Abuse Policy. • Employees, contractors, and visitors must be trained on vehicle and road safety.	5	3	**15 HR**	Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Wide, marked safe routes for large vehicles should be available. • Road surfaces should be suitable for vehicles and pedestrians, e.g., firm, even and properly drained. • Maintain vehicles in good working order. • Regular inspections are an essential part of preventative maintenance. • Considerations that the vehicle must have include: ✓ Vehicle monitoring system. ✓ Fire extinguishers, first aid kit, emergency roadside triangles. ✓ Details of emergency contacts. ✓ Audible reverse alarms. • Medical tests, including eye tests and colour-blindness tests, and a valid driver's license are necessary for fitness to operate. • There must be a system in place to manage fatigue among drivers.					
24.0	**WELFARE ARRANGEMENTS**							
24.1	• Facilities to use on site	• Illness	• The following welfare facilities will be provided on-site:	3	3	**9 MR**	Client	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
	• Availability of clean water and toilets		✓ There will be an office on site for site management, meetings, and inductions. ✓ Welfare facility areas will have prefabricated toilet units. ✓ There will be canteens on site for operatives and potable water and heating means will be provided. ✓ Borehole drilling for clean water.				Contractor Responsible supervisor	
25.0	**TRAINING/FIRST AID**							
25.1	No first aiders No training	• Injury • Delays in responding to accidents	• Every department must have workers trained in first aid. • First aid equipment should be marked and accessible easily. • All personnel shall undergo induction training completed. • All accidents, incidents and near misses must be reported to the site SHE manager immediately for investigation.	4	3	**12 HR**	SHE manager	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Accident Investigation Reports are kept for all accidents involving injuries.					
26.0	**INCIDENT REPORTING**							
26.1	No reporting of injuries	• Injury	• It is the project management team's responsibility to conduct or assign a team member to conduct on-site investigations. • HSE manager may help with investigations that involve serious injury or major equipment/environmental damage. • First Aid/Emergency Services should be the first responders. • A prompt and efficient response is usually the key to a successful investigation. • Work will be stopped immediately in affected areas, and people will be restricted from entering the area until the investigation is complete. • Collect evidence such as equipment inspection. • Identify possible contributors to the incident by reviewing all records	3	3	**9 MR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			(training, maintenance, schedule of work practices, and job procedures). • Interview witness soon after the site has been secured, witnesses must be interviewed. • Analyse the findings of the incident by noting down all facts, and listing those that contradict one another. • Document the findings.					
27.0	**SITE ACCESS CONTROL**							
27.1	• No security on the premises	• Intruders/theft • Equipment damage • Injury	• Security guards, equipment, and facilities necessary to manage the site's security shall be provided. • Personnel appointed to the security guard force must be qualified and licensed. • Following a site induction, identification cards will be provided to all personnel working on site. • Access to the site shall only be via the designated security gate entrance(s) where the identification card of all personnel will be shown. • Personnel on site are required to always carry their ID cards.	1	3	**3 LR**	Client Contractor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• To gain access to the sites, vehicles must possess a relevant Vehicle Access Pass obtained through the site manager. • Training, drills, and exercises shall be conducted to increase readiness and identify opportunities to improve the System continually. • Following entry, visitors must be informed about site evacuation in case of emergency and receive a visitor badge containing the rules for visitors.					
28.0	**MONITORING AND REVIEW**							
28.1	• No monitoring and evaluation	• Financial implications	• Employers need to: ✓ establish a safety management system which they should regularly review and monitor its effectiveness. ✓ keep your safety management up to date by making necessary adjustments. Workers should: ✓ participate actively in safety monitoring and review.	1	3	**3 LR**	Client Contractor SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			✓ report safety issues. • Some monitoring techniques include: ✓ Workplace Inspections: Workers, equipment, and work areas are observed. ✓ Equipment inspections: Regular preventative maintenance (PPM) or 'per-use' checks by the operator. ✓ Safety tours: Checking specific areas of work, such as a permit to work system, or a specific part of the manufacturing process, by a management team. ✓ Safety surveys: A method of assessing the risk of a process by competent personnel. It helps determine if existing assessments are effective, it looks at the specific hazards and associated risks. ✓ Behavioural sampling: An observation of work followed by a discussion with the workers to understand why they approach tasks a certain way. Managers					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			and supervisors encourage workers to suggest improvements themselves. ✓ Environmental sampling: Sampling and assessing the working environment for hazardous substances and calculating exposure times. A benchmark will be established against industrial tolerance levels and legal requirements ✓ Audits: A formal evaluation of the health and safety management system by trained and competent personnel. Health and Safety policies and procedures are audited, along with incidents, accidents, and other lagging indicators					
28.2	• Review	• Continual improvement implications	• Actions for improvement should be developed based on the assessment and presented to workers in all areas for their feedback. • All workers should be informed about reviews in a variety of ways, such as through safety committees, union	1	3	**3 LR**	Client Contractor SHE manager	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			representatives, noticeboards, emails, appraisals, etc. By doing this, everyone will be informed that monitoring processes are taken seriously by the organisation. • A senior management team can then review and approve any new proposals. • Specific, measurable, achievable, realistic, and time-bound improvements should be made. • The Health and Safety budget should provide sufficient resources, as well as access to any competent specialists required for implementation.				Responsible supervisor	

1.3 Performance Standard 3: Resource Efficiency and Pollution Prevention

Performance Standard 3 (PS 3) recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. The objectives of the standard include

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

In response to the requirements of the PS 3 the following have been developed:

- Water Management Plan
- Storm water Management Plan
- Waste Management Plan
- Energy Management Plan

The management plans indicated above are described in more detail in the ensuing subsections.

1.3.1 Water Management Plan

Taking into account the geohydrological baseline conditions detailed in *section 4.3* of this report a water management and monitoring plan for the project has been developed and this tabulated below.

Table 1.22: Water Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
1.	• Over abstraction of ground water	• Water shortage • Soil alteration • Erosion	• Establish water balance for the project • Conduct periodic water audits • The site must have an adequate and effective ground water management system in place. • Ground water measures should be inspected on a regular basis in order to ensure that the ground water structures are functional and not causing soil alteration and erosion. • Contaminated runoff must be prevented from entering the streams, measures include oil and grease traps and other chemicals, cleaning up spills immediately and proper disposal of contaminated material.	4	2	**8 MR**	Site manager/ Supervisor	
2.	• Accidental spills of hazardous chemical substances including fuel, greases and oils used onsite	• Water pollution • Soil contamination	• Identify all hazardous chemical substances used onsite including fuel, greases and oils. • Train staff on the use of chemicals • Keep a stock inventory register of all chemicals in the store. • Proper storage of chemicals in a lockable, well ventilated building.	4	2	**8 MR**	Site manager/ Supervisor	

			• Ensure adequate access control for the storage area. • Storage areas for hazardous chemicals should comply with standard fire safety regulations. • Safety signage including "No Smoking", "No Naked Lights" and "Danger", and product identification signs, are to be clearly displayed in areas housing chemicals. • Appropriate equipment to deal with emergency spill incidents is must be readily available on site. This includes fire extinguishers, spill kits for hydrocarbon spills, drip trays for equipment and/or machinery leaks, drums or containers for contaminated water. • Chemicals are to be properly labelled and handled in a safety conscious manner. • Personnel handling hazardous chemicals and hazardous materials are to be issued with the appropriate Personal Protective Equipment (PPE). • Immediately clean all spillage of fuels, lubricants and other petroleum-based products. • No hazardous chemicals must be discarded in the sewage or storm water system. • Soil contaminated with hazardous chemical substances shall be treated as hazardous waste and removed from site.					
3.	• Ecological disturbances (both fauna and flora)	• Deforestation • Habitant destruction • Rangeland disturbance	• Acquire permits from relevant authorities for the removal of protected plants • Relocate wildlife to suitable areas	4	2	**8 MR**	Site manager/ Supervisor	

		• Species extinction						
4.	• Water pollution	• Ground water Contamination by Oil spill • Runoff contamination • Accidental spills of hazardous chemical substances including fuel, greases and oils used onsite. • soil, storm water and groundwater pollution from leaking or broken sewerage pipes	• Contaminated runoff must be prevented from entering the streams, measures include oil and grease traps, • Cleaning up spills immediately and proper disposal of contaminated material. • Keep a stock inventory register of all chemicals in the store. • Proper storage of chemicals in a lockable, well ventilated building. • Ensure adequate access control for the storage area. • Chemicals are to be properly labelled and handled in a safety conscious manner. • Ablution facilities should be maintained to prevent blockage and leakages	4	2	**8 MR**	Site manager/ Supervisor	
5.	• Reduction of groundwater recharge	• Compaction of the soil by heavy machineries that may reduce ground water recharge and runoff infiltration.	• Light duty machineries to be used during operations.	4	2	**8 MR**	Site manager/ Supervisor	
6.	• Poor waste management	• soil, and groundwater pollution due to poor waste management	• Building and demolition waste must be disposed of at a licensed landfill site. If applicable, Steel should be taken to a licensed recycling facility. • The management of waste must be in accordance with the regulations of the village council Solid Waste policy (if available) • Installation of sufficient waste bins, skips or bulk containers. Containers must be present on site at all times.	4	2	**8 MR**	Site manager/ Supervisor	

			• All containers (bins, skips or bulk containers) shall be kept in a clean and hygienic manner. • Containers (bins, skips or bulk containers) utilized for the disposal of general and hazardous waste must be demarcated accordingly. • Waste material may only be temporarily stored at areas demarcated for such storage practices. • General waste shall be stored in a manner that prevents the harboring of pests. • General waste material should be stored or disposed of separately from hazardous waste material (e.g., oil, diesel), into appropriately demarcated bins Skips or bulk containers should be removed to a licensed landfill site on a weekly basis or more often if required. • No littering is permitted and site clean-ups must be undertaken regularly.					
7.	• Broken sewer pipes	• Soil contamination • Groundwater and surface water pollution	• Ablution facilities should be maintained to prevent blockage and leakages. • Should toilets become blocked, it should be reported and the cause investigated. This could be due to a blocked or broken pipe leading from the toilets to the sewerage system. • Create employee awareness about the proper use of ablution facilities and hygiene. No cigarette butts, fats, oils, paper towels etc. may be disposed of into toilets or wash basins. • Toilets should have properly closing doors and be supplied with toilet paper and air refresher.	4	2	**8 MR**	Site manager/ Supervisor	

Table 1-23: Water Management Monitoring Plan

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
Surface and ground water pollution through runoff and seepage from the project site during the construction phase.	Environmental Manager/Project Hydrologist; Contractor	• Wastewater Management Plan • Quantity of liquid waste generated • Quantity of liquid waste correctly disposed to Approved disposal sites • Number of Waste storage facilities at the site • Number of Sanitation facilities on site • Number of completed inspection missions	• General visual inspections • Staff training records • Spill incident records • Number of completed inspection missions • Number of spill kits onsite • Field testing and laboratory analysis of a range of parameters with relevant regulatory limits should be undertaken for each primary watercourse, and specifically following heavy rainfall events • Develop a Wastewater Management Plan for use at the site in line with wastewater management regulations and water quality regulations • Ensure proper storage of wastewater at the site	Weekly, monthly and event based

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
			before disposal to a designated facility by a registered waste handler • Prohibit illegal disposal of wastewater into water resources around the project site • Ensure regular inspection of wastewater management practices within the solar farm to check for compliance • Ensure there are proper and adequate sanitation facilities at the site during construction. • Ensure that the sanitation facilities are inspected regularly and kept in good working order. • Ensure that liquid wastes (including sanitary waste) is disposed of at registered waste disposal facilities by licensed waste contractors and that waste transport vehicles	

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
			used are appropriate for the type, class and quantity of waste being	
Increased demand for water in local area	Proponent Contractor	Water Meter	• Water Audits, Water Balance • Liaise with Nam Water Ltd, and local community on water sourcing options • Avoid sourcing water from local village water supply • Install rainwater tanks onsite • Apply water efficiency measures	Daily
Inefficient water usage	The Construction Manager who is on the project payroll is to ensure that a water conservation and management plan is developed and adhered to. He/she is to ensure that all project employees are aware of their respective responsibilities as far as	Develop a Water Use Management Plan that provides information of the amount of water to be used, its sourc es and its quantity and quality monito ring activities	Water use management plan	Daily

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
	the implementation of the plan is concerned. All project personnel who are on the project payroll are to ensure that they use water sparingly and that the project water management plan is adhered to			
Surface Water Drainage / Soil Erosion and Sediment Loading	Contractor Proponent	Drainage Design Plan Number of completed inspection missions	• Inspections • Reduce erosion by scheduling construction activities to avoid heavy rainfall periods and high winds • A Drainage Design Plan is to be prepared to intercept run-off from the Project area and direct it to an appropriate settlement pond/wetland constructed for that purpose • The route of the access tracks is to be optimized to reduce the need for cut-and-fill material and run-off and erosion	Continuous

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
			control features are to be incorporated in designs. • To reduce the potential for erosion of drainage channels during road construction, routes will be selected to avoid ephemeral drainage channels • A buffer distance of 50m is to be applied to hydrological features. • Culverts or other drainage control features are to be installed where crossings of drainage routes are unavoidable • Reduce soil erosion by contouring and minimizing length and steepness of slopes • Provide adequate road drainage based on road width, surface material, compaction and maintenance • Ensure that drainage channels are vegetated with native grasses as	

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
			soon as is practically possible following initial construction to stabilize areas of bare earth. • Reduce off-site sediment transport through use of settlement ponds, silt fences. • Salvage and store topsoil and subsoil before areas are excavated, with topsoil stripped and stockpiled separately. • Segregate excavated soils into stockpiles dependent on material type and provide erosion control while stockpiled. • On completion of earthworks, backfill material in the same stratigraphic sequence. • Once construction and road-building are complete, scarify all areas compacted by off-road vehicle / equipment movements and establish native grasses.	

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
			• Confine all vehicles and equipment to the roadway and, to extent possible, minimize activities during wet conditions. When activities must occur in wet conditions, control stormwater by using fabric, straw bales and other measures to impede storm water flow and prevent erosion. • When damage to wet soil occurs, repair once dry conditions return. • Native grassland seeding should be undertaken following completion of construction across the site where vegetation has been lost. Once established, vegetation should be maintained and managed throughout the operational period to ensure that re-vegetation is appropriately established and erosion	

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
			is minimised. A strategy for landscaping and associated management will be established prior to operations commencing	

1.3.2 Stormwater Management Plan

The development and undertaking of this project may result in the disruption of the existing natural drainage systems and this my affect stormwater behaviour. Hence the need to assess potential stormwater flow patterns, taking into account, the design and layout of the solar plant. Ultimately the end goal is to develop a Stormwater Management Plan. The Stormwater Management Plan (SWMP) is intended to mitigate the effect of the development on the natural environment during design, construction and during the life of the facility.

The SWMP is primarily based on concluded and preceding analysis included in a report titled "*Gerus Solar PV Plant: Flood Risk Assessment by Solarcentury Africa Ltd November 2022*". This report has been attached in the Appendix 6. The report undertook a deep study of the risk posed by stormwater to the site to ensure that the design process takes cognizance of the potential risk related to flooding as well as stormwater and that acceptable measures are taken to sufficiently mitigate or eliminate this risk.

The Consultant is satisfied with the flood risk assessment and the analysis undertaken therein, and thus ties this SWMP to those findings and recommendations. It therefore not the aim of this section of the report to reanalyse the foregoing study.

1.3.2.1 Flood Risk Report

The flood report makes the following assessment and recommendations:

- The most significant surface water risk to the project is a potential flood hazard;
- No observable or obvious surface water channels across the site although ephemeral channels may form during stormwater events;
- A network of channels designed to collect storm water and convey water off site would be appropriate;
- Lateral drainage should be considered around the perimeter of the scheme to intercept catchment runoff and divert it away from the site designed to convey the calculated flows from the report;
- Drainage design to be based on the Namibia Roads Authority Drainage Manual;

- Design flows of up to 186.47m^3/s (100-year return period) should be able to be safely conveyed by the network of channels around the site;
- The worst probable case scenario flow depth determined (Table 8-1 of the Flood Risk Report) by the analysis is approximately 200mm (0.2m with Manning's coefficient of 0.10).

It is worth noting that the Solarcentury report is based on online (Google Earth) topographical information and not site-specific topographical survey data. The analysis ordinarily would need to be revisited during the detail design phase of the project with the detailed and more reliable topographic survey as the source and input data to perform the design analysis.

Nevertheless, the measures laid out here will remain largely applicable albeit with minor adjustments as may be necessitated following the detail design process. The probable catchment area, and channel are indicated in the figure below.

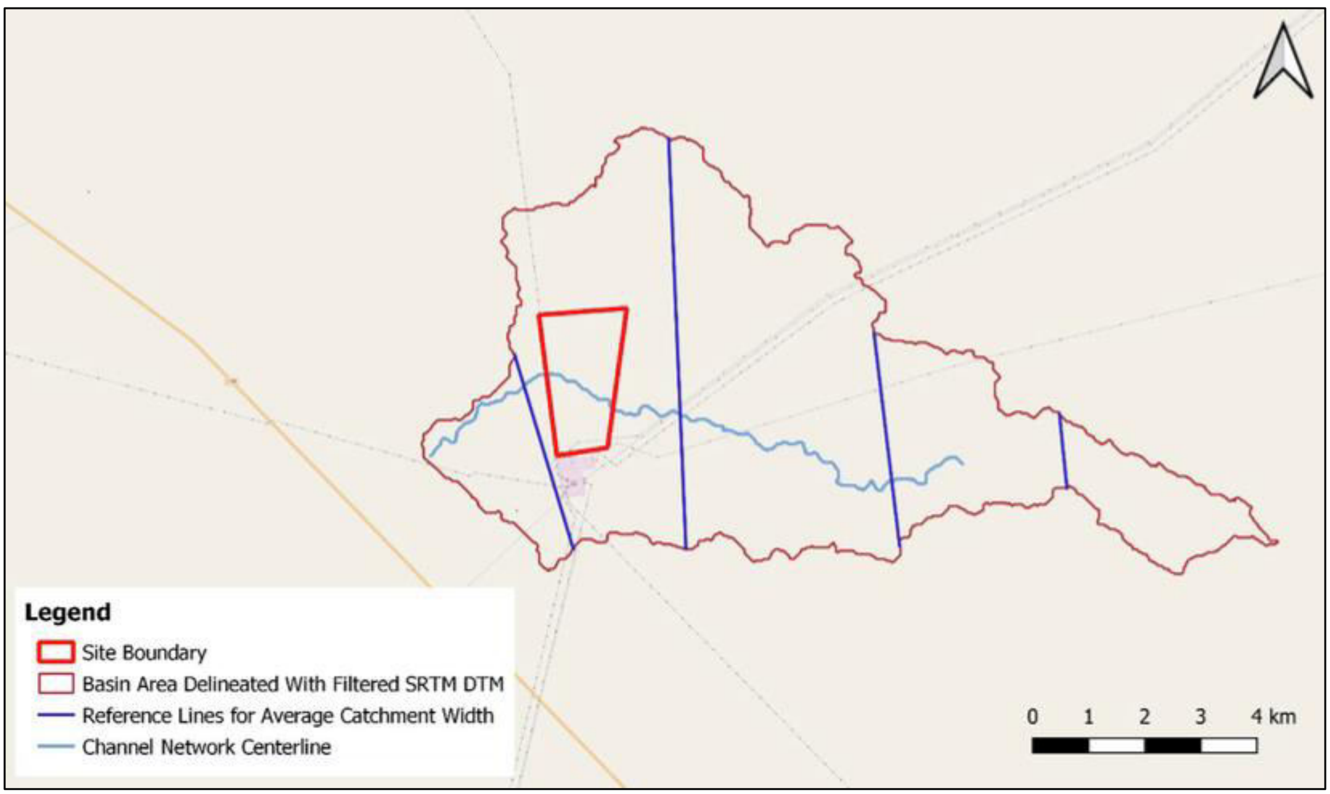


Figure 1-19: Modelled Catchment (Solarcentury Africa, Nov 2022)

1.3.2.2 Practical stormwater effects on the project

Rainfall will have an expected effect on the project with potential contractual claims implications to be catered for in the construction contract which will need to predict a degree of disturbance to the works.

There may mitigating factors to limit the effect of stormwater on the project as part of the SWMP as follows:

- Routine maintenance on haul roads to ensure that these are trafficable as far as practicable;
- Make use of all-weather construction vehicles capable of withstanding reasonable stormwater conditions;
- Ensure that haul roads to borrow and quarry areas cater for natural stormwater channels crossed by said haul roads;
- Covering of gravel and construction material stockpiles to avoid excessive wetting where necessary;
- Keeping rain gauges at main and satellite sites (borrow areas and quarries) to record spot rainfall to trigger possible recommended management actions as may be required (such as maintenance of haul roads);
- There may be a need to halt works temporarily during or following rainfall events due to poor visibility or poor road (slippery) conditions which may result in traffic incidents and loss of production;
- Maintain existing drainage infrastructure to be able to convey normal and anticipated stormwater runoff inclusive of cleaning of debris and unblocking blocked stormwater ways;
- Ensure that recommended drainage design is implemented accordingly;
- Prevent contamination of streams during construction and operation from runoff from equipment with the required bunding where necessary.

The design with regards to the top structures and associated infrastructure including the switchgear and generation equipment and is not known in detail at the moment. However, any consumables, chemicals, and products (such as oils etc.) that may be washed up during runoff, dissolved and or carried by stormwater that may be harmful to the environment will need to be intercepted and captured in a manner that permits its collection and ultimate safe disposal away from site.

Table 1-24: Stormwater Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
1.	• Unmaintained haul roads	• Poor traffic conditions, inaccessibility, accidents, loss of production	• Ensure haul and access roads are maintained routinely by dedicated teams	5	2	**10 HR**	SHE manager/ Responsible supervisor	
2.	• Unsuitable vehicles for the terrain/ purpose	• Vehicle immobility, loss of production, blocked access	• Resource and allocate correct vehicles and plant for the works	3	3	**9 MR**	SHE manager/ Responsible supervisor	
3.	• Working during heavy storm downpours	• Poor visibility, safety incidents	• Halt works during inclement weather events. Allocate contingencies for standing time due to inclement weather on contract, Measure and maintain rainfall records.	3	3	**9 MR**	SHE manager/ Responsible supervisor	
4.	• Site is susceptible to flooding	• Poor drainage design	• Ensure design caters for the sufficient return period to elevate site site sufficiently; ensure provision for natural stormwater runoff	3	3	**9 MR**	SHE manager/ Responsible supervisor	
5.	• Blocked drainage paths	• Build/ damming up of stormwater and flooding of site	• Ensure drainage paths routinely inspected and are free of debris; train personnel and operators on best practices	3	3	**9 MR**	SHE manager/ Responsible supervisor	

1.3.3 Waste Management Plan

The proposed project throughout all its phases will produce in a variety of waste materials which may be categorized as non-hazardous, E-waste (electronic waste) and hazardous waste. This section of the report gives an overview of the following:

- Waste categories and streams that are anticipated to be generated over the Project's lifespan
- Waste management strategy
- Assessment and evaluation of possible environmental, health and safety impacts throughout the project phases i.e., planning, construction, operations and decommissioning.
- Potential mitigation measures that may be applied in order to prevent, minimize and manage identified potential impacts.

1.3.3.1 Objective of the Waste Management Plan

The objectives of the waste management plan include to:

- Reduce and eliminate adverse impacts of waste on human health and the environment.
- Identify possibilities for the application of waste prevention, minimisation and mitigation measures in line with the Waste Management Hierarchy principles in an effort to lessen any negative effects that could arise during each stage of the proposed project.
- Increase recycling and reuse as well as to convert the remaining waste into a beneficial resource.
- Minimize the use of landfills for solid waste disposal.
- Ensure the protection of the environment through an effective waste management system.

1.3.3.2 General Waste Management Philosophy

The waste management plan compilation process has also taken into account the prevention, minimisation and management of waste that is to be generated by the project. The ***Institute of Chemical Engineers, UK*** in their publication ***Waste Minimisation, A***

Practical Guide state various waste management practices and minimisation techniques. These management practices and techniques have been considered in the development of the project's waste management plan.

The table below shows the waste management approach that has been considered.

Table 1.25: Waste Management Approach

Elimination	Complete elimination of waste
Reduction at source	The avoidance, reduction or elimination of waste, generally within the confines of the project's operational unit, through changes in processes or procedures.
Reuse/Recycling	The reuse and recycling of wastes for the original or some other purpose such as input material, materials recovery or energy production.
Treatment	The destruction, detoxification, neutralisation, etc of waste into less harmful substances.
Disposal	The release of waste to air, water or land in properly controlled or safe ways so as to render them harmless; secure land disposal may involve volume reduction, encapsulation, leachate containment and monitoring techniques.

↑ **Highest priority** — **Lowest priority** ↓

The solar plant is to strive to elevate waste management practices that are in line with the highest priority options. The goal for the operation is zero waste generation, where feasible.

The diagram and table below shows the waste minimisation techniques that have been also considered in the development of the project's waste management plan throughput all its phases.

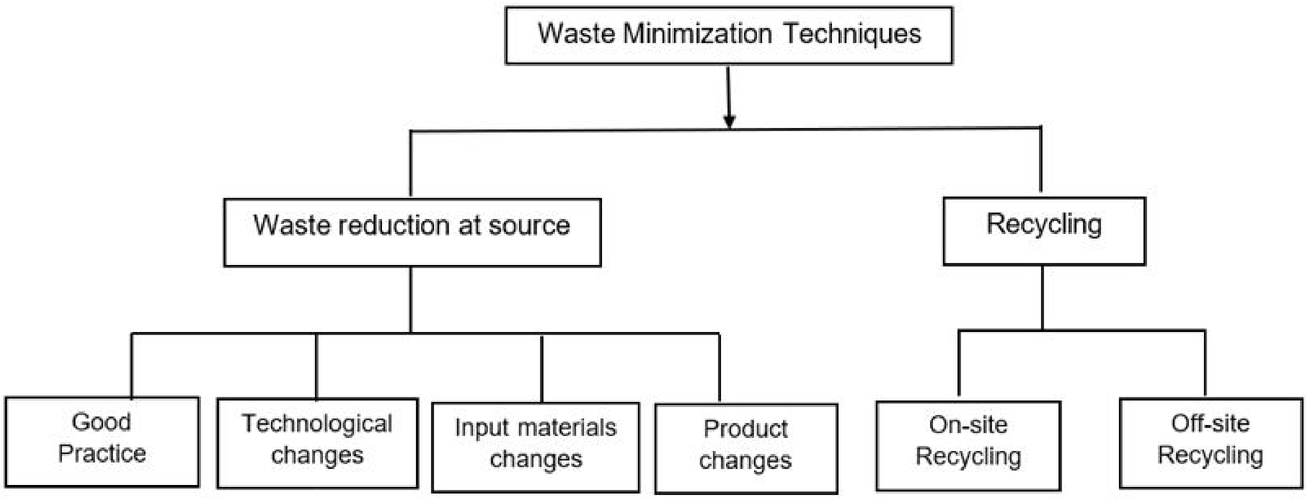


Figure 1-20: Waste Minimisation Techniques

Table 1-26: Waste Minimisation Techniques and Examples

Waste minimisation Technique	**Examples**
Good Practice	• Clear specification of good housekeeping and materials handling procedures. • Implementing Quality Assurance techniques • Conduct material Life Cycle Assessment (LCA) • Incorporation of green purchasing principles in procurement processes e.g. identify potential agreements with suppliers (back to providers and suppliers for re-use, refurbishment and recycling); ensure proper handling and storage of materials; avoid the following - over ordering, damage during loading operations, ordering standard lengths rather than lengths required, accepting incorrect deliveries, specifications, or quantities, etc. • Regular auditing of materials purchased against material used. • Avoidance of over ordering.

Waste minimisation Technique	Examples
	• Regular preventative maintenance. • Segregation of waste streams to avoid cross-contamination of hazardous and non-hazardous materials and to increase recoverability. • Reduction in the volume of wastes by drying and compaction. • Elimination of poor storage conditions • Improvement of maintenance scheduling, record-keeping and procedures to increase efficiency • Revaluation of shelf life characteristics to avoid unnecessary disposal of long-life materials. • Improvement of inventory and management control procedures • Changes from small volume containers to bulk or reusable containers • Introduction of employee training and motivation schemes for waste reduction. • Collection of spilled or leakage material for reuse • Rescheduling of operations to reduce frequency and number of equipment cleaning operations. It is important that proper attention be given to eliminating or minimising spills, leaks and contamination during the storage of raw materials, products and process wastes, and the transfer of these within operations. Examples requiring attention include: • Leaking values, hoses, pipes and pumps. • Leaking tanks and containers. • Overfilling of tanks; inadequate, poorly maintained or malfunctioning high level protection. • Leaks and spills during materials (e.g. fuel) transfer • Inadequate bunding • Equipment and tank cleaning operations

Waste minimisation Technique	Examples
	• Lack of regular maintenance, inspection and operator training
Technical changes	• Introduction of new process or equipment which produce less waste/less harmful waste-that is clean technologies • Fundamental change to or better control of process operating conditions to reduce waste and consume less raw materials and energy • Redesign of equipment and piping to reduce the amount of material to be disposed of during startups, shut downs, product changes and maintenance programmes • Changes to mechanical cleaning to avoid the use of solvents and the generation of dilute liquid wastes, provided such changes are not detrimental • Use of more efficient motors and speed control systems to reduce energy consumption.
Input material changes	• Replacement of chlorinated solvents in cleaning and degreasing operations by non-chlorinated solvents, water or alkaline solutions • Substitution of a more durable coating to increase coating life • Increase in the purity of purchase draw materials to eliminate the use of trace quantities of hazardous impurities • Reduction of phosphorus in wastewater by reduction in use of phosphate containing chemicals.
Product changes	• A change in product's specification in order to reduce the quantity of chemicals • A modification of the composition or final form of a product to make it environmentally benign • Changes to reduce or modify packaging

1.3.3.2.1 Waste Handling and Storage

The following waste handling and storage are to be taking into account:

1.3.3.2.1.1 Waste segregation

Segregation practices are to be established and implemented. This involves sorting and separation of waste types to facilitate reuse, recycling and correct ultimate disposal. This reduces the risk of the waste streams from being incorrectly classified and ensures that the correct procedures are followed from the point of generation through to final treatment or disposal options.

Liquids must be kept apart from solid waste, and non-hazardous and inert waste must be kept apart from hazardous waste to produce effective segregation systems to:

- Prevent unwanted or potentially dangerous reactions;
- Reduce the rate of accidental exposure to potentially hazardous substances;
- Ease handling and disposing of wastes;
- Increase the diversion of waste for the purposes of recycling; and
- Keep the cost of waste disposal to a minimum.

1.3.3.2.1.2 Waste storage

Storage areas will be strategically located to eliminate or minimise the double handling of waste. They are to be clearly marked and signed with regard to the quantity and hazardous characteristics of the wastes stored therein.

The following are to be ensured:

- Waste streams do not get mixed and that no waste other than the normal waste stream, approved for the container, is placed in the collection container.
- The waste components are correct and complete for each waste container.
- Accurate records are maintained to ensure compliance with onward transportation of the waste and to minimise analytical costs associated with disposal.
- All leaks, spills, and releases are recorded.
- Major leaks, releases or spills sufficient to pose a threat to human health or the environment are brought to the attention of the relevant local authorities.

- All major hazardous spills are reported immediately to the relevant local authorities and the appropriate evacuation action taken.

Storage areas are to be constructed in such a way that any spillage or loss of containment of a particular waste type cannot spread to other waste streams. This is particularly important where flammable materials are involved. The total maximum storage capacity of the storage areas must be clearly and unambiguously stated in writing, accompanied with details of the method used to calculate the volumes held against this maximum. The stated maximum capacity of storage areas must not be exceeded.

The storage arrangements must be marked on a site plan which clearly illustrate:

- Waste types to be stored in particular areas;
- Separation arrangements;
- Any fire breaks proposed; and
- The maximum storage capacity of each storage area.

Storage area drainage infrastructure must ensure all contaminated runoff is contained and that drainage from incompatible wastes cannot come into contact with each other. There must be vehicular access, for example trucks, and pedestrian access at all times to the whole of the storage area such that the transfer of containers is not reliant on the removal of impediments which may be blocking access, other than drums in the same row. Containers must be stored in such a manner that leaks and spillages cannot escape over bunds or the edge of the sealed drainage areas.

1.3.3.2.1.3 Key Performance Indicators

In order to monitor performance of the waste management plan it is important to put in place performance measures that facilitate achievement of waste targets. Determining the effectiveness of waste management activities will be facilitated by setting waste targets and carrying out ongoing assessment and monitoring.

These may include quantification of the following:

- Wastage of raw materials
- Individual waste streams generated

- Waste materials directed for re-use
- Waste materials directed for recycling
- Waste materials directed for landfilling

This also takes into account evaluation of effectiveness of

- waste handling and storage methods.
- Roles and responsibilities instituted for implementation of the waste management plan

1.3.3.3 Receptors of Waste Impacts

Sensitive receptors of project can be described as follows:

- Soil and groundwater - potentially sensitive receptors include soil and groundwater within the proposed project footprint area which could be adversely impacted by contamination events due to inadequate handling arrangements and storage provisions;
- Construction workers - potentially sensitive receptors that may be exposed to hazardous waste (e.g. solvents, excavated contaminated soil etc.) if adequate procedural and engineering control measures have not been implemented; and
- Operational staff - similar as construction workers, the future operational staff may be exposed to hazardous waste during working hours if the waste management system for the facility is not properly implemented
- Waste infrastructures - the main sensitive receptor relating to hazardous, non-hazardous, inert waste and E-waste generated by the proposed Project will be the waste infrastructures utilised for the treatment, recycling and disposal of the waste streams generated by the project, both during the construction, operational and decommissioning phases;

1.3.3.4 Waste Classification

The project waste streams have been classified into three general categories as shown in the table below.

Table 1-26: Waste Classification

NATURE OF WASTE	DEFINITION	EXAMPLES
Hazardous Waste	• Waste streams that could be unsafe or possibly detrimental to the environment or human health. • Hazardous waste are characterises according to four factors: toxicity, ignitibility, corrosiveness and reactivity. • Hazardous wastes can be liquids, solids, gases, or sludge.	Asbestos, aerosols, fuel, oils, paint, solvents, contaminated soil, asphalt, batteries, treated wood, packaging contaminated by hazardous waste etc.
Non-hazardous and inert waste	• Waste streams which can degrade chemically or biologically into the environment without any harm to the environment or human health. • Waste streams which cannot breakdown in the environment as it is neither chemically or biologically reactive, but excludes E-Waste.	Food waste, vegetation, wood (non- treated), metals, plastics etc. Cement, sand, glass, excavated soil (not contaminated) etc.
E-Waste	• E-Waste describes discarded electrical or electronic devices. • Used electronics which are destined for reuse, resale, salvage, recycling, or disposal are also considered e-waste. • Informal processing of e-waste can lead to adverse human health effects and environmental pollution.	PV Solar panels, mobile phones, base stations, desktop computers, laptop computers, mobile phones, headsets, switches, CD/DVD media, antenna network systems, keyboards, empty toners, processor, random access memories (RAMs), and radio equipment.

In order to prevent dangers to the environment and human health, distinct categories of solid waste streams would need particular storage and handling methods, followed by recycling and disposal arrangements.

Waste that is expected to be generated by the proposed project can be further categorized as shown in the table below.

Table 1-27: Waste Categories

WASTE CATEGORY	DESCRIPTION
Excavated waste	As the project site has already been cleared and graded, minimal excavations are expected to occur. However, as part of the pre-construction site activities, some further excavation activities may be required across the project footprint area requiring the disposal of bulk excavated soils. The excavated waste generated as part of this project will be more likely to be associated with trenching activities for example for drainage channels.
Domestic/Municipal solid waste	This refers to the general waste that will be generated mainly during both construction and operational phases of the project by construction workers and future operational employees of the facility.
Inert waste	During the construction phase, an assortment of inert waste streams is likely to be generated. The likely range of waste streams associated with infrastructure, building construction and site preparation would include but not limited to: • packaging made of paper, cardboard, plastic, wood, metal, composite; • concrete and bricks; • mixtures of concrete, bricks, tiles and ceramics (non-hazardous); • wood; • glass; • plastic; • iron and steel;

WASTE CATEGORY	DESCRIPTION
	• aluminium; • mixed metals; • cables; • soil and stones; • insulation materials; • mixed construction and demolition wastes.
Hazardous waste	Hazardous waste is a waste with properties that make it potentially dangerous or harmful to human health or the environment. Hazardous wastes can be liquids, solids, or gases. The likely range of waste associated with infrastructure, building materials in the course of the life cycle of the project may include: • waste oil; • paints; • oils; • tyres; • acid; • used spill kit materials; • contaminated soils; • coating substances; • batteries • capacitors; • used chemical drums; • hydrocarbon waste
Demolition Waste	Demolition waste streams are anticipated to be generated as a consequence of temporary structures expected to be erected during the construction phase, and during the decommissioning phase of the project including but not limited to: • asphalt; • concrete;

WASTE CATEGORY	DESCRIPTION
	• wood; • gravel; • scrap metal.
Landscape Waste	Green waste is anticipated to be generated from necessary vegetation clearing activity during pre-construction work and during the operational phase of the project, however, as the project footprint area currently supports undeveloped disturbed land, it would anticipated that the associated volume would not be significant.
E-Waste	While E-Waste streams, including PV solar panels, are expected to be generated during the construction (damaged materials) and operation (repair activities) phases, it is envisaged that the main generation of this specific waste stream would occur in the course of the decommissioning phase of the Project.
Wastewater	This refers to • sewerage which will be typically disposed of into septic tanks, prior to removal by approved waste management service providers. • effluent from workshops. This is to come from treatment facilities such as oil separators.

1.3.3.5 Anticipated Waste Streams

The anticipated proposed project waste streams can be mainly arranged as follows:

- Construction waste stream
- Operation waste stream

The tables give a description of the waste streams.

Table 1-28: Construction Waste Stream

Waste	Description of Waste Sources
Asphalt	Construction of project infrastructure such as access roads, parking, etc
Concrete and cement	Construction of the temporary buildings and auxillary structures.
Soil	Site clearance and excavation activities

Waste	Description of Waste Sources
Metals	Off-cuts and scrap metals e.g. structural steel (used for PV frames and other framed structures), reinforced bars for reinforced concrete ("RC"), security fence, columns, main beams, struts, vertical and horizontal braces, wires, cables, sign board etc.
Wood/Timber and plasterboard	Packing material and temporary offices.
Chemicals and hazardous waste	Fuels, hydrocarbons & oils, solvents, waste, contaminated soil, sludge, acid, paints, coating substances including elastomeric polyurethane and epoxy type, coal tar and epoxy resin blends, extruded polystyrene board insulation, used chemical drums, used spill kit materials, batteries / capacitors, fluorescent tubes etc.
Glass and plastics	Establishment of administration offices, the eating areas which include mostly food packaging, office elements, etc.
PV Solar Panels and E-waste	Accidental damage sustained during transportation or mounting stages
Electronic	Operation of the construction administration office, camp which include computers, printers, refrigerators, mobile phones etc.
Cardboard and paper	Operation of the construction administration office which include office documents, printing, boxes etc.
Domestic/Municipal Solid/Organic Waste	Landscape waste –from site clearance Food waste – generated from daily operations at construction site

Table 1-29: Operation Waste Steam

Waste	Description of Waste Sources
PV Solar Panels	Maintenance operations related to damaged PV solar panels
E-waste	Maintenance operations related to electrical and electronic modules
Metals	Maintenance operations related to electrical and electronic modules
Green Waste	Landscaping and bush clearance activities
Hazardous Waste	Spent solvents, cleaning agents, oils from vehicles or transformers

Waste	Description of Waste Sources
Domestic/Municipal Solid Waste	Project personnel and administrative activities

It must be noted that although it is not expected to occur project planning has taken into account the possibility of a decommissioning phase. The main waste material that expected during this phase include:

- hazardous waste and E-waste associated with the removal of the PV solar panels
- non-hazardous inert waste streams associated with building and amenity infrastructures

1.3.3.6 Waste Management Flow Chart

A waste management flow chart for the project has been compiled and this depicted in the diagram below.

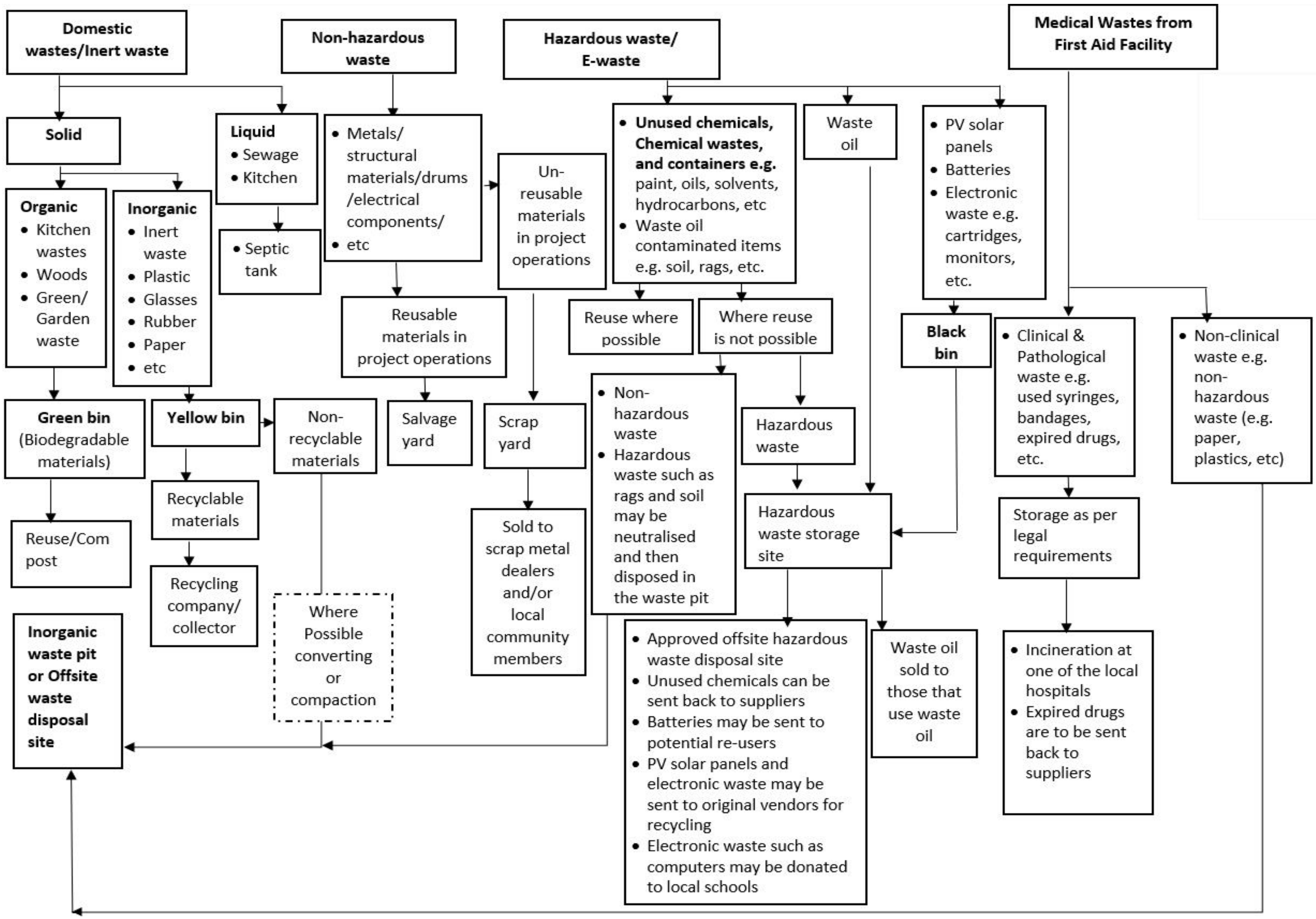


Figure 1-21: Waste Management Flow Chart

1.3.3.1 Waste Management Plan

The waste management plan for the project is tabulated below.

Table 1-30: Waste Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
1.	**Planning**							
1.1	Improper and inadequate planning and design of project waste management system	• Unaccountability and lack of well-defined waste management roles and responsibilities • Operational inefficiency • Non-compliance to applicable legal requirements • Environmental pollution • Injury/ill-health • Employee lack of knowledge and	• Ensure consideration of applicable legal requirements • During implementation (construction and operations) ensure proper understanding of how the waste management plan will be applied to the project throughout all its phases. This should take into account life cycle assessments of project inputs; expected and actual waste streams; waste composition and quantities; waste generation rates; evaluation of waste handling and storage methods; identification of opportunities for waste segregation, minimization at source, reuse,	5	5	**25 CR**	Project Manager/ SHE manager	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		competencies in waste management acceptable practices • Inadequate budget for waste management plan	recycling etc; setting waste management objectives/targets and quantifying waste materials sent for re-use, recycling and landfill disposal – this should be compared against set objectives/targets; etc. • Ensure that procurement process considers green purchasing and sustainable procurement principles and guidelines • Ensure the following area in place (i) acceptable waste segregation procedures/practices; (ii) appropriate waste waste receptacles for the segregation of waste streams for future recycling at licensed facilities; (iii) appropriate dedicated waste storage areas in order to minimise pollution events and local nuisance; etc • Clearly assign and communicate responsibilities - ensure that those involved in the construction are					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			aware of their responsibilities in relation to the waste management plan • Engage and educate personnel - be clear about how the various elements of the waste management plan will be implemented and ensure staff have an opportunity to provide feedback on what is/is not working • Monitor - to ensure the plan is being implement, monitor on-site. • Consider certification to internationally recognised environmental and safety management systems such the ISOs (International Organization for Standardization). • Put in place provision for adequate waste management budget					
1.2	No monitoring and evaluation	• Ineffective waste management plan/system	• Put in place system regularly monitor and review performance of waste management plan.	3	3	**9 LR**		

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		• Financial implications	• Where necessary Appropriate corrective/preventive action plans are to be established and implemented • Specific, measurable, achievable, realistic, and time-bound improvements should be made.					
2.	**Construction**							
2.1	Generation of hazardous waste materials. These include asphalt, concrete and cement, Chemicals (e.g. fuels, hydrocarbons & oils, solvents, waste, contaminated soil, sludge, acid, paints, coating substances, etc.)	• Injury/ill-health to work personnel as well as neighbouring farm workers and livestock • Environmental pollution • Financial implications	• Treatment of contaminated materials and reuse/recycle e.g. contaminated soils with hydrocarbons may be treated and reused on site for landscaping and gardening activities • Where possible return waste materials to suppliers for recycling • Identify appropriate hazardous waste disposal site and dispose waste materials • Ensure secure storage of waste materials. • Storage areas of waste must be far from drainage areas to minimise the	4	3	**12 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			effects of possible accidental spillage. • Establish Material Safety Data Sheet (MSDS) of waste materials. • Ensure that waste materials are stored in appropriate containers that are protected from direct sunlight and ignition sources. • Put clear safety signs for all storage areas for waste materials. • Store all hazardous wastes in a protected area away from drains, pits, sewers, and excavations.					
2.2	Non-Hazardous and Inert Waste Generation e.g. food waste, vegetation, wood (non-treated), metals, plastics etc. Cement, sand, glass, excavated soil (not contaminated) etc.	• Land degradation • Water pollution • Increased pressure on regional waste management facilities	• Reuse construction waste e.g. roads construction aggregate. This applies materials such as concrete and cement • Reuse construction waste for rehabilitation of any disturbed areas e.g. filling-in of gullies • Find uses for cut down trees and vegetation e.g. firewood, construction material etc	3	3	**9 MR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			• Compost biodegradable materials and use resultant material as soil enrichment/fertilising material. • Dispose all un-reusable and un-recyclable materials at an approved waste disposable site.					
2.3	E-Waste including PV solar panels e.g. PV Solar panels, mobile phones, base stations, desktop computers, laptop computers, mobile phones, headsets, switches, CD/DVD media, antenna network systems, keyboards, empty toners, processor, random access memories (RAMs), and radio equipment	• Injury/ill-health to work personnel as well as neighbouring farm workers and livestock • Environmental pollution	• Reuse and/or Recycling (e.g. diversion of the damaged PV solar panels and other E-waste to the original manufacturer for repair and future re-use; diversion of the PV solar panels and E-waste to approved E-waste recyclers, etc) • Store E-waste streams in secure • E-waste at an approved hazardous waste disposal site	4	3	**12 HR**	SHE manager Responsible supervisor	
2.0	**Operation**							
2.1	Hazardous waste e.g. from spent solvents, cleaning agents, oils from vehicles or transformers, etc	• Injury/ill-health to work personnel as well as neighbouring farm	• Treatment of contaminated materials and reuse/recycle e.g. contaminated soils with hydrocarbons may be treated and	4	3	**12 HR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		workers and livestock • Environmental pollution • Financial implications	reused on site for landscaping and gardening activities • Where possible return waste materials to suppliers for recycling • Identify appropriate hazardous waste disposal site and dispose waste materials • Ensure secure storage of waste materials. • Storage areas of waste must be far from drainage areas to minimise the effects of possible accidental spillage. • Establish Material Safety Data Sheet (MSDS) of waste materials. • Ensure that waste materials are stored in appropriate containers that are protected from direct sunlight and ignition sources. • Put clear safety signs for all storage areas for waste materials. • Store all hazardous wastes in a protected area away from drains, pits, sewers, and excavations.					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
2.2	Non-Hazardous and Inert Waste e.g. domestic waste, garden wastes, waste (e.g. papers, plastics, etc) from administrative activities	• Land degradation • Water pollution • Increased pressure on regional waste management facilities	• Find uses for cut down trees and vegetation e.g. firewood, construction material etc • Compost biodegradable materials and use resultant material as soil enrichment/fertilising material. • Dispose all un-reusable and un-recyclable materials at an approved waste disposable site.	3	3	**9 MR**	Responsible supervisor	
2.3	E-Waste including PV solar panels from repairs and maintenance activities	• Injury/ill-health to work personnel as well as neighbouring farm workers and livestock • Environmental pollution	• Reuse and/or Recycling (e.g. diversion of the damaged PV solar panels and other E-waste to the original manufacturer for repair and future re-use; diversion of the PV solar panels and E-waste to approved E-waste recyclers, etc) • Store E-waste streams in secure • E-waste at an approved hazardous waste disposal site	4	3	**12 HR**	SHE manager Responsible supervisor	

7.3.4.1. Waste Management Monitoring Plan

The table below shows the waste management monitoring plan.

Table 1-31: Waste Management Monitoring Plan

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
Surface water and Groundwater	SHE Manager	Surface and groundwater contamination.	Monthly, initially, every other month and quarterly	Collect surface and groundwater samples for analysis at a reputable laboratory. Check results for signs of pollution.
Soil	SHE Manager	Soil contamination	Regularly	Check for soil contamination/ littering in and around the site.
Aesthetic environment	SHE Manager	Littering	Regularly	Checking for litter in and around the project site
Legal Compliance and Conformity	SHE Manager	Attending to Complaints, Conflicts Disagreements	Regularly	Compile legal register and periodically inspect for compliance

1.3.4 Energy Management Plan

The energy management plan will consider energy reticulation, balances and targets; usage of energy efficient and saving equipment and technologies; metering and monitoring; periodic reviews and comparison against benchmarks. This section of the report gives an overview of the following:

- Energy categories and streams that are anticipated to be generated over the Project's lifespan.
- Energy management strategy
- Assessment and evaluation of possible environmental, health and safety impacts throughout the project phases i.e., planning, construction, operations, and decommissioning.
- Potential mitigation measures that may be applied to prevent, minimize and manage identified potential impacts.

The objectives of an Energy Management Plan may vary depending on the organization, project, or location. However, here are some common objectives of an EMP:

- Reduce energy consumption and related costs: One of the primary objectives of an EMP is to reduce energy consumption and related costs through the implementation of energy-saving measures, such as energy-efficient equipment and technologies, behaviour change, and energy management practices.
- Improve energy efficiency: the plan aims to improve energy efficiency by reducing energy waste and losses, optimizing energy use, and reducing the environmental impact associated with energy consumption.
- Promote sustainability: Another objective of the plan is to promote sustainability by reducing the carbon footprint associated with energy consumption, conserving natural resources, and minimizing environmental impacts.
- Enhance energy security: the plan seeks to enhance energy security by reducing dependence on fossil fuels, promoting the use of renewable energy sources, and implementing energy storage systems.

- Ensure compliance with regulatory requirements: the plan aims to ensure compliance with regulatory requirements, such as energy efficiency standards, emissions regulations, and environmental regulations.
- Engage stakeholders: the plan seeks to engage stakeholders, such as employees, suppliers, customers, and the community, in energy conservation and sustainability efforts.
- Monitor and report energy performance: the plan aims to monitor and report energy performance metrics, such as energy consumption, energy costs, and carbon emissions, to track progress and identify areas for improvement.

By setting clear and measurable objectives for an energy management plan, the project can develop a comprehensive strategy to manage the energy supply and demand of a project, reduce energy consumption, and promote sustainability. Additionally, by regularly monitoring and evaluating the performance of the energy management plan, the project can identify areas for improvement and adjust their strategies accordingly.

1.3.4.1 The Energy Context

Namibia is a country that relies heavily on imported electricity, which accounts for approximately 60% of the total electricity generation. As a result, Namibia is exposed to significant energy security risks and high electricity costs, which can affect economic development. Renewable energy resources, such as solar energy, are an important alternative to address these challenges and increase energy security and independence. In this context, this energy management plan aims to provide guidance for the solar project in Outjo, Namibia, following the International Finance Corporation (IFC) 2.3 Performance Standard 3: Resource Efficiency, following the steps presented below.

Energy Reticulation, Balances and Targets

The first step in developing an energy management plan is to understand the energy reticulation system and the energy balances. In the case of a solar project, energy reticulation refers to the distribution of energy from the solar panels to the loads, such as buildings and equipment. The energy balance is the difference between the energy generated by the solar panels and the energy consumed by the loads. The energy balance can be positive (i.e., surplus energy generated) or negative (i.e., energy deficit).

To ensure efficient energy reticulation, it is important to design and implement an appropriate distribution system. The distribution system should be designed based on the load requirements and the capacity of the solar panels. The design should take into consideration factors such as voltage drop, cable size, and the number and type of loads. It is important to use energy-efficient equipment, such as energy-efficient pumps and motors, to minimize energy losses during distribution.

To set energy targets, it is important to understand the energy requirements of the loads. The energy requirements can be estimated based on historical data, load surveys, or simulations. The energy targets can be set based on energy requirements, the solar panel capacity, and the energy balance. The energy targets should be reviewed periodically and adjusted if necessary to ensure they are realistic and achievable.

Usage of Energy Efficient and Saving Equipment and Technologies

Energy-efficient and saving equipment and technologies are essential components of a sustainable energy management plan. These technologies can help reduce energy consumption, increase energy efficiency, and lower energy costs. In the case of a solar project, energy efficient and saving equipment and technologies can be used to optimize the use of the solar energy generated and minimize energy losses.

Some examples of energy-efficient and saving equipment and technologies that can be used in a solar project include:

- LED lighting: LED lighting is a highly efficient lighting technology that can significantly reduce energy consumption compared to traditional lighting technologies, such as incandescent and fluorescent lighting.
- Variable frequency drives (VFDs): VFDs are devices that can be used to control the speed of motors and water pumps, which can help optimize energy consumption and reduce energy losses within the water reticulation system of the project.

Energy storage systems: Energy storage systems can be used to store surplus solar energy generated during the day and used during peak energy demand periods or when solar energy is not available.

Metering and Monitoring

Metering and monitoring are essential components of an effective energy management plan. Metering refers to the measurement of energy consumption and generation, while monitoring refers to the continuous observation and analysis of energy data.

Metering and monitoring can provide valuable information on energy usage patterns, energy efficiency, and energy losses. This information can be used to identify opportunities for improvement and to track progress towards energy targets.

To implement effective metering and monitoring, it is important to install energy meters at strategic locations to measure energy consumption and generation. The data collected from the energy meters should be analyzed and used to identify energy efficiency opportunities and optimize energy consumption.

Periodic Reviews and Comparison against Benchmarks

Periodic reviews and comparisons against benchmarks are essential components of a sustainable energy management plan. Periodic reviews can help identify areas for improvement and ensure that the energy management plan is aligned with the organization's goals and objectives.

Comparison against benchmarks can help determine the organization's energy performance relative to industry standards and best practices. Benchmarks can be established based on historical data, industry benchmarks, or regulatory requirements.

To implement effective periodic reviews and comparisons against benchmarks, it is important to establish a review schedule and allocate resources for the review process. The review process should involve stakeholders from different departments and should include an analysis of energy data, identification of improvement opportunities, and development of action plans.

1.3.4.2 General Energy Management Philosophy

The project follows a general Energy Management Philosophy which outlines the principles and values that guide the project's approach to managing energy. Below is a list of examples of a General Energy Management Philosophy:

a) Commitment to sustainability: the project will commit to promoting sustainability and reducing our carbon footprint through the efficient use of energy, conservation of natural resources, and responsible energy management practices.
b) Continuous improvement: the project will seek continuous improvement of energy management practices, through the implementation of innovative solutions, adoption of new technologies, and ongoing evaluation of our performance.
c) Collaboration and engagement: the project will recognise the importance of collaboration and engagement with stakeholders, including employees, suppliers, customers, and the community, to achieve its energy management goals.
d) Compliance with regulations: the project will commit to complying with all applicable energy efficiency standards, emissions regulations, and environmental regulations, and ensuring that our energy management practices are aligned with regulatory requirements.
e) Measurement and reporting: the project will recognise the importance of measuring and reporting our energy performance metrics, including energy consumption, energy costs, and carbon emissions, to track progress, identify areas for improvement, and communicate our energy management efforts to stakeholders.
f) Cost-effective solutions: the project will recognise the importance of cost-effectiveness in our energy management practices and strive to identify and implement solutions that balance environmental sustainability with financial sustainability.

By adopting this general Energy Management Philosophy, the project can establish a clear and consistent approach to managing energy, promote sustainability, and engage stakeholders in the energy management process. The philosophy provides a framework for decision-making and helps to guide the development and implementation of specific energy management strategies and plans.

The table below shows the energy management approach that has been considered for the project.

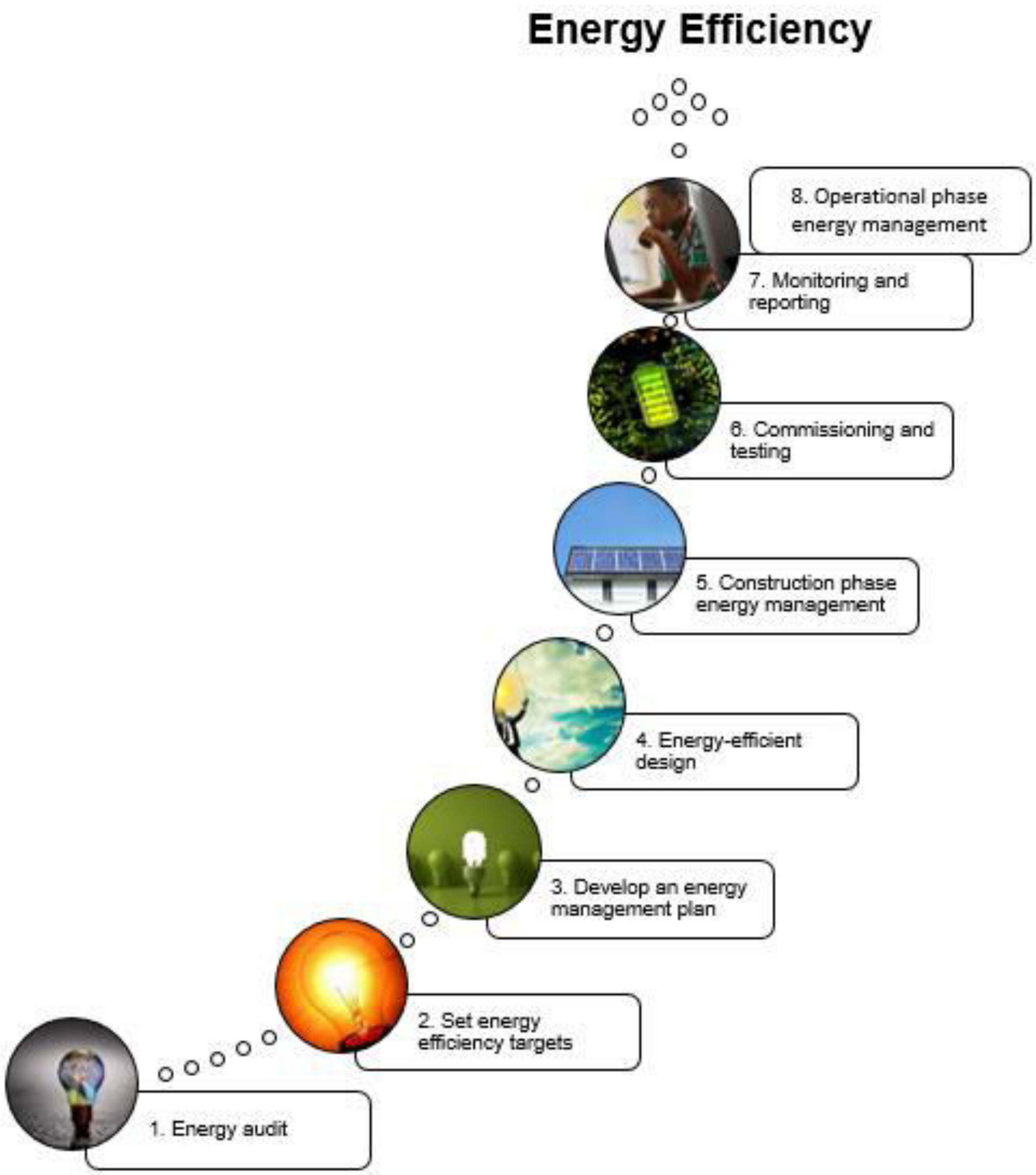
Table 1-20: Energy Management Approach Plan

Energy Management Approach	Description
Energy Audits and Assessments	Conduct regular energy audits and assessments to identify energy waste, opportunities for improvement, and cost-saving measures. Perform a comprehensive analysis of energy usage, demand, and supply to determine the organization's energy profile and identify areas for improvement.
Energy Efficiency and Conservation	Implement energy-efficient technologies and practices to reduce energy consumption and costs. This may include lighting retrofits, HVAC system upgrades, insulation improvements, and behaviour change programs. Encourage employees and stakeholders to adopt energy-saving practices and promote a culture of energy conservation throughout the organization.
Renewable Energy and Storage	Consider energy storage solutions to manage fluctuating energy supply and demand and develop a plan to integrate renewable energy into the organization's energy mix.
Energy Monitoring and Reporting	Monitor and report energy performance metrics, including energy consumption, costs, and emissions, to track progress and identify areas for improvement. Establish a system for data collection and analysis, and develop performance indicators to measure the success of the energy management program. Communicate energy management results to stakeholders, such as employees, customers, and the community, to promote transparency and accountability.

Energy Management Approach	**Description**
Behaviour change	Provide training and education to employees and stakeholders on energy management principles, practices, and technologies. Develop a comprehensive training program to promote energy conservation and efficiency, and provide resources and support to encourage behaviour change.
Financing and Incentives	Identify funding and financing options to support energy management initiatives. Evaluate the financial feasibility of energy management projects, including the cost of implementation and potential savings, and develop a plan to secure funding and financing for energy-saving measures.

The table provides an overview of the various components of an effective energy management program. The table can serve as a useful reference tool for stakeholders to understand the different elements involved in Energy Management.

The diagram below shows the energy management flowchart that can be considered for the project.



Designing an energy management system for a solar plant involves considering various factors that influence the plant's energy efficiency and sustainability. Here are the steps involved in designing an energy management system for a solar plant from the construction phase to the operational phase:

1. Energy audit: Conduct an energy audit to identify the plant's energy consumption patterns and areas of inefficiency. This should be done during the construction

phase to ensure that energy-efficient measures are integrated into the plant's design and construction.

2. Set energy efficiency targets: Based on the energy audit findings, set energy efficiency targets for the plant's construction and operational phase. The targets should be specific, measurable, achievable, relevant, and time-bound (SMART).
3. Develop an energy management plan: Develop an energy management plan that outlines the strategies and measures to achieve the energy efficiency targets. The energy management plan should cover energy reticulation, balances, and targets; usage of energy-efficient and saving equipment and technologies; metering and monitoring; periodic reviews and comparison against benchmarks.
4. Energy-efficient design: During the construction phase, ensure that the plant is designed to maximize energy efficiency. This includes factors such as orientation, shading, insulation, and ventilation. Energy-efficient materials and technologies should also be used, such as high-efficiency solar panels, LED lighting, and efficient HVAC systems.
5. Construction phase energy management: During the construction phase, implement energy-efficient practices, such as using energy-efficient equipment and tools, and managing waste and emissions.
6. Commissioning and testing: After construction, commission and test the plant's energy systems to ensure that they are operating efficiently and as intended. This includes testing solar panels, inverters, battery storage systems, and other components.
7. Monitoring and reporting: Implement a monitoring and reporting system to track energy consumption, energy production, and energy efficiency. This includes monitoring energy consumption by different parts of the plant, identifying areas of inefficiency, and implementing measures to address them. Reports should be regularly generated to track progress towards energy efficiency targets.
8. Operational phase energy management: During the operational phase, continue to implement energy-efficient measures and monitor energy consumption. This includes measures such as regular maintenance of equipment, optimizing energy

consumption during peak hours, and implementing energy management systems to reduce energy wastage.

By implementing an energy management system for the proposed solar plant, the project can reduce energy costs, improve energy efficiency, and minimize their environmental impact. An effective energy management system should be flexible, adaptable, and continuously monitored and reviewed to ensure that it is meeting its objectives.

1.3.4.3 Energy Consumption Analysis during Construction and Operation Phases of a 120MW Solar PV Plant in Namibia

Energy Source	**Amount (kWh)**
Diesel Generators	500,000
Electric Grid	2,000,000
Solar PV	0
Total	**2,500,000**

Data sources:

- *Information from the project documents/ design of the project and,*
- *Electricity generation mix and tariffs from NamPower, the Namibian power utility.*

During the construction phase, the energy consumption of the solar plant project will be primarily from diesel generators and the electric grid. The table shows an estimated total consumption of 2.5 million kWh, with 20% coming from diesel generators and 80% from the electric grid. The estimated operational phase energy consumption is shown below.

Energy Source	**Amount (kWh)**
Solar PV	420,000,000
Electric Grid	10,000,000
Total	**430,000,000**

Data sources:

- *Solar PV production estimates from the solar panel manufacturer and NamPower*
- *Electricity generation mix and tariffs from NamPower*

During the operational phase, the energy consumption of the solar plant project will primarily come from the solar PV system. The table shows an estimated total production of 420 million kWh per year, with any excess being fed back into the electric grid. The estimated electricity consumption from the grid is 10 million kWh per year, which accounts for times when the solar PV system may not be generating enough energy to meet demand. Shown below are energy efficiency improvement opportunities

Equipment/System	Improvement Opportunity	Potential Energy Savings
Lighting	Upgrade to LED	50% reduction in lighting energy consumption
HVAC	Replace HVAC units with high-efficiency models	20-30% reduction in HVAC energy consumption
Insulation	Improve the insulation of building envelopes	10-20% reduction in heating and cooling energy consumption
Building Automation System	Install a centralized building automation system	Up to 15% reduction in energy consumption through improved control and automation
Water Heating	Replace electric water heaters with solar water heaters	Up to 80% reduction in water heating energy consumption
Motors and Drives	Upgrade to high-efficiency motors and drives	20-30% reduction in energy consumption for motors and drives
Compressed Air System	Conduct regular maintenance and repair leaks	Up to 20% reduction in compressed air energy consumption
Renewable Energy Sources	Install solar PV panels on rooftops	Potential to generate electricity on-site and reduce reliance on grid power

Note: *Potential energy savings are estimates and may vary depending on specific equipment, usage patterns, and other factors. Actual energy savings may be higher or lower.*

Lighting: By upgrading lighting to LED, energy consumption for lighting can be reduced by up to 50%. This estimate is based on industry data and studies, as well as the specific energy usage patterns of the facility.

HVAC: Replacing HVAC units with high-efficiency models can result in energy savings of 20-30%. This estimate is based on industry data and studies, as well as the specific energy usage patterns of the facility.

Insulation: Improving the insulation of building envelopes can result in energy savings of 10-20% for heating and cooling. This estimate is based on industry data and studies, as well as the specific building construction and climate of the facility.

Building Automation System: Installing a centralized building automation system can result in energy savings of up to 15% through improved control and automation. This estimate is based on industry data and studies, as well as the specific energy usage patterns and building layout of the facility.

Water Heating: By replacing electric water heaters with solar water heaters, energy consumption for water heating can be reduced by up to 80%. This estimate is based on industry data and studies, as well as the specific water usage patterns and climate of the facility.

Motors and Drives: Upgrading to high-efficiency motors and drives can result in energy savings of 20-30% for motor and drive systems. This estimate is based on industry data and studies, as well as the specific equipment and usage patterns of the facility.

Compressed Air System: Conducting regular maintenance and repairing leaks can result in energy savings of up to 20% for compressed air systems. This estimate is based on industry data and studies, as well as the specific equipment and usage patterns of the facility.

Renewable Energy Sources: Installing solar PV panels on rooftops can generate electricity on-site and reduce reliance on grid power. The amount of energy generated will depend on factors such as the amount of sunlight, panel efficiency, and system design.

Note: The potential energy savings and sources of data are based on industry data and studies, and are provided as estimates only. The actual energy savings and feasibility of implementing each improvement opportunity will depend on the specific equipment, usage patterns, and other factors at the facility.

1.3.4.4 Potential Energy Savings Estimates Analysis for Solar PV Plant in Outjo, Namibia

The table on Potential Energy Savings Estimates presents several energy efficiency improvement opportunities for the solar PV plant project in Outjo, Namibia. The potential energy savings have been estimated for each opportunity, and the implementation costs have also been estimated.

The first opportunity is the installation of LED lighting systems, which has a potential energy savings estimate of 300 MWh/year. The source of data for this estimate is likely energy audits or previous experience with LED lighting systems. The implementation cost of this opportunity is estimated to be NAD 1.2 million.

The second opportunity is the installation of variable frequency drives (VFDs) on the plant's pumps, which has a potential energy savings estimate of 280 MWh/year. VFDs are devices that can vary the speed of an electric motor to better match the load requirements, resulting in energy savings. The source of data for this estimate is likely engineering calculations based on the pumps' load characteristics. The implementation cost of this opportunity is estimated to be NAD 800,000.

The third opportunity is the installation of solar thermal collectors for hot water production, which has a potential energy savings estimate of 180 MWh/year. The source of data for this estimate is likely engineering calculations based on the hot water demand and the efficiency of the solar thermal collectors. The implementation cost of this opportunity is estimated to be NAD 2 million.

The fourth opportunity is the installation of energy-efficient air conditioning systems, which has a potential energy savings estimate of 70 MWh/year. The source of data for this estimate is likely energy audits or previous experience with energy-efficient air conditioning systems. The implementation cost of this opportunity is estimated to be NAD 1 million.

The fifth opportunity is the installation of a building automation system, which has a potential energy savings estimate of 50 MWh/year. The source of data for this estimate is likely engineering calculations based on the potential energy savings from optimizing HVAC and lighting systems with a building automation system. The implementation cost of this opportunity is estimated to be NAD 1.5 million.

The total potential energy savings estimate from these five opportunities is 880 MWh/year. The implementation costs a total of NAD 6.5 million. The payback period, or the time it would take for the implementation costs to be recouped through energy savings, would depend on the cost of electricity and other factors. Overall, the table highlights the potential for significant energy savings through targeted energy efficiency improvements and provides a starting point for further analysis and planning.

1.3.4.5 Energy Management Plan

The energy management plan for the project is shown below.

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
3.	**Planning**							
3.1	Incorrect site selection	• Reduced energy output, increased costs	• Conduct a site assessment, review local climate data, consult with experts	5	5	**25 CR**	Project Manager/ SHE manager	
3.2	Inadequate budget	• Delays, cost overruns	• Develop a comprehensive budget, review regularly with stakeholders	3	3	**9 LR**	Project Manager, Budget Team	
3.3	Incomplete or inaccurate data	• Inefficient plant design, poor performance	• Conduct a thorough data analysis, verify data with multiple sources			**12 HR**	Technical Team, Data Analysis Team	
4.	**Construction**							
4.1	Accidents on site	• Injury or death to workers, project delays	• Implement strict safety protocols, provide training and equipment, hire experienced contractors	4	3	**12 HR**	SHE manager Responsible supervisor	
4.2	Weather events	• Damage to equipment, delays	• Monitor weather forecasts, implement contingency plans	3	3	**12 HR**	SHE manager	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
							Responsible supervisor	
4.3	Improper installation	• Reduced energy output, equipment failure	• Hire experienced contractors, implement quality control measures, conduct regular inspections	4	3	**12 HR**	Technical Team, Responsible supervisor	
2.0	**Operation**							
2.1	Equipment failure	• Reduced energy output, increased maintenance costs	• Implement a preventative maintenance program, conduct regular inspections	4	3	**12 HR**	Maintenance Team, Technical Team	
2.2	Poor energy management	• Increased energy costs, reduced efficiency	• Implement an energy management system, conduct regular energy audits, train staff on energy efficiency	3	3	**9 MR**	Technical Team Responsible supervisor	

1.3.4.6 Energy Management Monitoring Plan

The energy management monitoring plan for the project is shown below.

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
Energy Consumption	Responsible supervisor/ Energy Manager	Energy bills, energy meters	Monthly	Review and analyze energy bills and meters to identify trends and areas for improvement, track progress towards energy reduction targets
Solar Panel Performance	Responsible supervisor/ Technical Team	Solar panel output, efficiency, temperature	Quarterly	Conduct regular inspections of solar panels to ensure proper performance, track output and efficiency, monitor temperature to prevent overheating
Waste Management	SHE Manager	Waste generation, recycling rates, hazardous waste disposal	Bi-annual	Monitor waste generation and recycling rates, ensure proper disposal of hazardous waste, identify opportunities to reduce waste and increase recycling
Water Management	Site Manager	Water usage, water quality	Monthly	Monitor water usage and identify opportunities to

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
				reduce consumption, ensure water quality meets standards, implement water recycling and reuse where feasible
Emissions Reduction	SHE Manager	GHG emissions, air quality	Annual	Track GHG emissions and implement strategies to reduce them, monitor air quality and implement mitigation measures as needed
Employee Training	HR Manager	Employee training hours, training completion rates	Quarterly	Track employee training hours and completion rates, ensure all employees receive training on energy management practices and procedures
Stakeholder Engagement	Stakeholder Engagement Team	Stakeholder feedback, community outreach activities	Semi-annual	Engage with stakeholders to gather feedback and address concerns, implement community outreach

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
				activities to promote sustainability and energy efficiency

This monitoring plan is designed to track various aspects and impacts related to energy management throughout the project's lifecycle. By assigning responsibility for each aspect to a specific team or department, and defining clear indicators and activities, the plan ensures that monitoring is consistent and effective in identifying areas for improvement and tracking progress towards energy efficiency targets.

1.4 Performance Standard 4 Community Health, Safety and Security

PS 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. The objectives of the PS standard include

- Anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances.
- Ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

In order to address the requirements of the standard a community health safety and security management plan has been complied.

1.4.3 Purpose of the Community Health and Safety Management Plan

The purpose of the Community Health, Safety and Security Management Plan is to anticipate and avoid adverse impacts on the health and safety of the surrounding communities during the project's life cycle. Infrastructure, equipment, hazardous materials safety, natural resource issues, exposure to disease, and project activities can expose communities to increased risks and impacts. A targeted prevention program and effective monitoring and evaluation program are necessary for reducing risks and achieving safer communities. As part of the process, the client will identify risks and impacts and propose mitigation measures that are appropriate to their nature and magnitude. A greater emphasis will be placed on avoiding risks and impacts than on minimizing them.

Table 1-32: Potential risks to the community and mitigation measures

No.	Hazard/ Risk to the community	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
1	**Air quality, noise, and vibration:** • Vehicle emissions (mainly diesel) and those from equipment such as temporary generators. • Impacts of dust emissions from unpaved roads. • There will be very limited construction of buildings and associated groundworks for foundations	• Illness • A direct impact on residential areas is unlikely because of the distance.	• Monitor environmental conditions (air emissions, noise, water, etc.) • Hazardous wastes should be managed according to international practices	1	2	**2 LR**	SHE manager	
2	**Community exposure to hazardous materials.** • Accidental spills, leaks, and releases from Project facilities or activities. • Leakages contaminate the soil, plants, water, etc.	• Injury • Illness	• Assess the possibility of substituting hazardous materials with safer ones. • Ensure that spills do not affect communities by implementing preventative measures. • Ensure that hazardous materials are delivered, transported, and disposed of safely.	1	3	**3 LR**	SHE manager Responsible supervisor	

No.	Hazard/ Risk to the community	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
3a)	**Soil, water, and sanitation-related diseases.** • Increasing faecal-oral diseases due to overflow of Project Sewage Treatment Plant. • Open defecation by the workforce leads to an increase in faecal-oral diseases. • Water-related outbreaks (e.g., cholera) in nearby communities.	• Illness	• Operate and monitor Sewage Treatment Plants according to specifications. • Monitor the system and provide surge capacity. • Implement an infectious disease outbreak management program as a means of reducing the chances of outbreaks and, if they occur, containing them and reducing the risk of spreading to the local community. • Ensure that all work areas have an adequate number of mobile sanitation facilities.	1	3	**3 LR**	SHE manager Responsible supervisor	
3b)	**Soil, water, and sanitation-related diseases.** • Soil and water contamination caused by project wastes.	• Illness	• Maintain and expand water management processes. • Assure that worker accommodation camps and work areas have adequate potable water facilities and conduct monitoring and surveillance activities to ensure that water is safe to drink. • There must be a capability to screen for sanitation-related diseases which	3	3	**9 MR**	SHE manager Responsible supervisor	

No.	Hazard/ Risk to the community	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			may pose an infectious risk to the workforce, as well as the surrounding community, and prevent outbreaks.					
4	**Vehicle movement** • The increase in traffic on the roads and the associated accidents (both human and livestock)	• Injury • Loss of lives • Lost productivity • Legal and compensation claims	• Safety training should be conducted for drivers. • Involve impacted communities in safety awareness and education programs, including school programs. • Drivers must possess a driver's licence and know safety requirements. • Setting speed limits and monitoring driver behaviour as part of a project. • A policy to manage emergencies and accidents in the community directly resulting from the Project's activities must be developed and effectively communicated. • Enforce drug- and alcohol-free workplaces, including contractor transport vehicles. • Management of employees and contractors for Project transport vehicles including specific requirements for driver training, rest	4	3	**12 HR**	SHE manager Transport and logistics supervisor	

No.	Hazard/ Risk to the community	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			periods, vehicle roadworthiness, speeding, etc.					
5	**Staff housing** • TB and other communicable diseases associated with living conditions.	• Increasing disease burdens in communities due to population growth (workforce and migration) and crowded living conditions (communities and camps). • Increased occupancy per room. • Worker-to-community transmission of disease. • Increasing demand for community health services.	• Create a Workforce TB program that includes project employees, contractors, and local labourers, while considering the resources needed to expand the workforce. • Make sure that TB prevention and control programs are implemented with medical confirmation before assignment. • Workers should be educated about TB and its prevention so that they can pass that knowledge on to their communities.	3	3	**9 MR**	SHE manager Responsible supervisor	

No.	Hazard/ Risk to the community	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
6	**Vaccine-preventable diseases** • Potential increase in measles, COVID-19, and typhoid outbreaks in the community related to population influx or the introduction of personnel who are not immunised.	• Illness • Increasing demand for community health services.	• Determine and implement pre-employment medical requirements (per project health requirements). • Ensure that the workforce is actively vaccinated as required. • Implement infectious disease outbreak management programs for workers and the community also.	3	3	9 **MR**	SHE manager	
7	**Sexually transmitted diseases** • There is the potential for work camp personnel to contribute to the spread of STIs and HIV/AIDS. • (Entry and exit of workers could attract service and sex workers, increasing the likelihood of an increase in STIs).	• Illness	• STI education for workers, including condoms and femidoms available to workers to prevent STI transmission. • Provide voluntary counselling and testing at the plant. • Workplace HIV policies and programs should be clearly defined. • Establishing the HIV management framework at an early stage will ensure that the programs are operational before construction begins. • Engage community/traditional leaders to report any increasing high-risk sexual behaviour in the	3	8	**9 MR**	SHE manager	

No.	Hazard/ Risk to the community	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
			workforce and the development of commercial sex work in communities especially those connected to the Project.					
8	**Workforce** • In theory, Outjo's local community could provide some of the temporary labour force depending on the skills required and the strategies used by individual developers. • Social determinants of health • Tribal mixing in Project camps could lead to cross-cultural violence • Increased income by some community members disrupts social cohesion, increases drug and alcohol use, and increases violence	• Inter-tribal issues • Community impacts of worker influx • Injury from violence	• Conduct worker education on cultural sensitivity, violence, harassment etc. • Indirectly advocating awareness through partnerships with community-based organisations.	1	3	**3 LR**	Contractor Responsible supervisor	

No.	Hazard/ Risk to the community	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
9	**Fire hazards and control** • Potential of veld fires • Electrical fires caused by faults and failures • Fires are caused by poor practices at the site offices, such as poor storage of flammable materials and smoking in prohibited areas.	• Injury, burns • Damage to property • Loss of flora and fauna	• Community members are encouraged to create fireguards around their homes or farms. • Landscaping with lowly flammable plants is encouraged. • Roads should be wide enough and maintained to accommodate emergency vehicles. • Mowing and weed are encouraged. • Use of approved herbicides to kill weeds at the base of the perimeter fence, around the exterior vegetative buffer, on interior dirt roads, and near the panel support posts. • Training of workers and community members on firefighting methods. • Communities must have contact details of emergency service providers like the fire brigade and ambulance.				Responsible supervisor	

1.5 Performance Standard 6: Biodiversity Management Plan

The objectives of the PS 6 include to:

- protect and conserve biodiversity.
- maintain the benefits from ecosystem services.
- promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Taking into account the project description, biodiversity baseline environment as well as the PS 6 objectives a biodiversity management plan for the project has been developed. The plan as well as the monitoring plan are tabulated below.

Table 1-33: Biodiversity Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
1.	• Destruction of flora and fauna during the Construction Phase	• The clearing of vegetation will result in the breaking of the ecosystem processes in the area. • Loss of aesthetic value of the proposed project area.	• The proposed project area is a greenfield project, hence there is an opportunity to conserve vegetation that can be affected by the development. • Ground disturbance will only be limited to the boundary area to avoid affecting a large area. • Upon completion of construction activities more regreening of the construction footprint affected area is recommended. A local landscaper can be engaged. • Prevent the destruction of protected tree species. • Encourage the regrowth and regeneration of trees with exposed roots at the site. • The excavation at the proposed construction site should incorporate existing trees . • The Contractor should compile a Tree Management Plan which	5	2	**10 HR**	•Environmental Control Officer •Contractor •Site Manager	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
			should include the following as a minimum: • [1]Trees if not already accounted for in an existing Geographic Information System (GIS), should be surveyed, co-ordinates/location incorporated into the Contractor's GIS, marked with paint (or other means so as to be readily visible) and protected; • Trees, which are impossible to conserve, need to be identified and their location recorded on a map; • The Contractor should apply to the relevant authority (Ministry of Environment, Forestry & Tourism) for a permit to remove these trees. • A list should be compiled of all trees to be removed detailing the location of the tree, the species as well as which trees will be					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
			planted to replace these. The nursery where these trees will be sourced from should also be included; • Each tree that is removed needs to be replaced with an indigenous tree species; • Some of these trees can be obtained at the nearest forestry office or at a commercial nursery such as the Forestry office in Otjiwarongo or Outjo. Assistance can be sought from the nearest forestry office regarding nearby nurseries where additional trees may be bought and advice sought. • Only a limited width +/- 5 m on the side of the Prevent the destruction of protected tree species. • Encourage the regrowth and regeneration of trees with exposed roots at the site.					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
			• The excavation at the proposed construction site should incorporate existing trees . • The Contractor should compile a Tree Management Plan which should include the following as a minimum: • Trees if not already accounted for in an existing Geographic Information System (GIS), should be surveyed, co-ordinates/location incorporated into the Contractor's GIS, marked with paint (or other means so as to be readily visible) and protected; • Trees, which are impossible to conserve, need to be identified and their location recorded on a map; • The Contractor should apply to the relevant authority (Ministry of Environment, Forestry &					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
			Tourism) for a permit to remove these trees. • A list should be compiled of all trees to be removed detailing the location of the tree, the species as well as which trees will be planted to replace these. The nursery where these trees will be sourced from should also be included; • Each tree that is removed needs to be replaced with an indigenous tree species; • Some of these trees can be obtained at the nearest forestry office or at a commercial nursery such as the Forestry office in Otjiwarongo. Assistance can be sought from the nearest forestry office regarding nearby nurseries where additional trees may be bought and advice sought.					

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
			• Only a limited width +/- 5 m on the side of the access roads may be partially cleared of vegetation. • Workers are prohibited from collecting wood or other plant products on or near the 120 MW PV site. • No alien species may be planted on or within the existing site. • Prevent contractors from collecting wood and veld food such as amphibians, migrating birds, etc. during the construction phase. • Prevent contractors from fishing in the nearby ephemeral rivers or catching aquatic species.					
2.	• Loss of Biodiversity	• Vegetative plants on site will be removed. • Habitat destruction for	• Eliminate environmental damage through reclamation. • Site restoration through regeneration of the forest. • Restore chemical, biological and physical stability of site. • Allow productive land use.	5	2	**10 HR**	•Environmental Control Officer •Contractor •Site Manager	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequenc	Likelihood	Risk Rating		
		both ground dwelling species and tree dwelling species. • Soil disturbance on and around the site. • The few small animals still habiting the place such as small rodents and birds will be forced away.						

Table 1-35: Biodiversity Management Plan

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
Vegetation	• Project Manager • Contractor	Depletion of vegetation cover.	Quarterly & documented in the biannual reports	Establishment of open spaces with vegetation in the project area
Fauna	• Project Manager • Contractor	• Bird Kills • Presence of skeletal remains • Absence of feacal matter in the vicinity of the periphery of the project area boundaries	Quarterly & documented in the biannual reports	Recording of bird kills and monitoring of wildlife mortalities and aerial avifauna activities at site.
Biodiversity conservation	• Project Manager • Contractor	• No animals are injured. • No setting of snares • No employees enter the no-go areas. • No alien vegetation establishment.	Quarterly & documented in the biannual reports	To prevent unnecessary disturbance to natural flora and fauna. • Employ a qualified Environmental Control Officer during the construction phase to ensure the appropriate management of the wildlife and ecological processes.

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
		• Implement speed limits and temporary speed humps. • No off-road driving • No setting of open fires • Establish an appropriate refuse Removal policy. • No domestic pets on site allowed		• Implement and maintain speed control with maximum speed limits (e.g. 40km/h). Temporary speed humps could also be used to limit the speed at which people travel but care must be taken to ensure these do not cause erosion. • Avoid off-road driving and unnecessary nocturnal driving in the area. • Prevent and discourage the setting of snares (poaching), illegal collecting of veld foods (e.g. tortoises, etc.), indiscriminate killing of perceived dangerous species (e.g. snakes, etc.) and the collection of wood in and surrounding the project area. • Initiate a policy of capture, removal and relocation of fauna (e.g.

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
				slow moving species such as tortoises and chameleon) encountered serendipitously within the project site. •Avoid the removal of bigger trees (especially protected species –e.g. *Clospherpemum mopani* [Forestry Ordinance No. 37 of 1952) – during the construction phase(s) – including the development of access routes and other infrastructure developments. • Prevent planting of potentially alien invasive plant species (e.g. *Pennisetum setaceum*) for decoration purposes. • Any alien plants within the control zone of the company must be

Aspect/ Impact	Responsibility	Indicator	Frequency	Activities
				immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used. Disposal of cleared alien vegetation must be to a licenced landfill site in Outjo or Otjiwarongo. • Normal agricultural activities must continue in the unaffected areas of Farm Gerus. • Land rehabilitation and re-vegetation must commence immediately upon completion of construction.

1.6 Performance Standard 7: Indigenous Peoples

As part of the ESIA study an indigenous peoples study was carried out however no indigenous peoples were identified in and around the project. Review of project documentation and stakeholder consultation revealed that the area and around the project does not have indigenous people. The project is situated in private farmland. The closest indigenous people (the Himbas and Dhembas) are reported to be about 200km away from the project area. They are said to be in areas such as Kamanjab, Opuwo and Sessfontein.

1.7 Performance Standard 8: Cultural Heritage

Performance Standard 8 acknowledges the value of cultural legacy for both the present and the future generations. The performance standard strives to ensure that project proponents safeguard cultural heritage throughout their project operations as well as phases in accordance with the Convention Concerning the Protection of the World Cultural and Natural Heritage. The objectives of the performance standard 8 include:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

A cultural heritage study was carried out as part of the ESIA study in order to meet the requirements of PS8 objectives. As stated in section 4.11 the desktop assessment and subsequent field investigation yielded no heritage resources of significance in the project site. However, provision has been provided for any chance findings that may be found on site during all phases of the project.

1.7.3 Natural and Cultural Heritage Management Plan

The table below details the natural and cultural heritage management plan for the proposed project.

Table 1-36: Natural and Cultural Heritage Management Plan

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
1.	The general area where the proposed project is situated is a historic landscape, which may yield archaeological, cultural property, remains. There are possibilities of encountering unknown archaeological sites during subsurface construction work which may disturb previously unidentified chance finds.	Possible damage to previously unidentified archaeological and burial sites during construction phase. • Unanticipated impacts on Archaeological sites where project actions inadvertently uncovered significant archaeological sites. • Loss of historic cultural landscape;	In situations where unpredicted impacts occur construction activities must be stopped and the heritage authority should be notified immediately. Where remedial action is warranted, minimize disruption in construction scheduling while recovering archaeological data. Where necessary, implement emergency measures to mitigate. • Where burial sites are accidentally disturbed during construction, the affected area should be demarcated as no-go zone by use of fencing during construction, and access thereto by the construction team must be denied. • Accidentally discovered burials in development context should be salvaged and rescued to safe	4	2	**8 MR**	SHE manager Responsible supervisor	

No.	Hazard/The risk associated with Hazard	Consequences	Existing Control Measures	Initial Risk Score			Action assigned to	Acceptance of responsibility
				Consequence	Likelihood	Risk Rating		
		• Destruction of burial sites and associated graves • Loss of aesthetic value due to construction work • Loss of sense of place • Loss of intangible heritage value due to change in land use	sites as may be directed by relevant heritage authority. The heritage officer responsible should secure relevant heritage and health authorities' permits for possible relocation of affected graves accidentally encountered during construction work					

1.7.4 Natural and Cultural Heritage Monitoring Plan

Table 1-37: Natural and Cultural Heritage Monitoring Plan

Impact	Responsibility	Indicator	Monitoring Activities	Frequency
Loss/damage to items of natural and cultural heritage	SHE manager Responsible supervisor	Findings	Checklist/Progress report. In the event of possible extension of the current area proposed for the solar plant will require another assessment by a heritage consultant.	Periodic during construction or any project excavation works

2 RECOMMENDATIONS AND CONCLUSION

The ESIA for Gerus Solar One (Namibia) (Pty) Ltd was carried out in line with the provisions of the Environmental Management Act, 2007 (Act No.7 of 2007) and the regulations for Environmental Impact Assessment as set out in the Schedule of Government Notice No. 30 (2012). It has also been carried out in line with applicable IFC performance as stated in the Terms of Reference provided by the Gerus Solar One (Namibia) (Pty) Ltd.

Considering available data as well as information assessed and analyzed, the following can be deduced that:

- The overall socio-economic impact of the project is positive as it will facilitate the following improved energy supply; reduction in foreign energy expenditures; creation of much needed employment opportunities; utilisation of a renewable and low emission energy source (solar).
- Adequate energy supply is a long-standing challenge that the Namibia has been facing. This is due to the huge discrepancy between demand and supply. The generation facilities within the country rarely if ever produce at full capacity. Namibia, therefore, relies largely on imported power from South Africa (Eskom), however, South Africa's own economic challenges have put pressure on its ability to export as well as generate domestic electricity. thus the project implementation is expected to contribute to the alleviation of this undesirable situation.
- After an analysis of project alternatives, other options are restricted and not viable. The project site is the only piece of land that Gerus Solar One (Namibia) (Pty) Ltd has managed to secure for this development initiative. Additionally, Gerus Solar One (Namibia) (Pty) Ltd has already injected a substantial amount of time and financial resources into the preliminary stages of the project – this includes purchase of land, planning and design of project infrastructure, obtaining land use approvals by the relevant government departments, etc. Therefore, relocation and/or re-planning and re-design of the project will lead to loss of all the resources (time and money) that have already been invested. Any delays and rescheduling

of the project also have the implication of denying beneficiaries of the anticipated positive impacts of the project.

- The opportunity cost for the implementation of the project is comparatively low. This is because the project site is in one of the least agriculturally (livestock) productive areas of the Gerus farm. Therefore, establishment of the solar farm, has more socio-economic benefits than the current landuse activities. In light of the above and the project's associated short, medium and long term benefits, implementation of the project is a more favourable developmental action to take instead of continuing with the current land-use at the proposed project site.
- The Environmental Management Plan indicates that the operation has impacts which can be addressed to acceptable limits. Mitigation measures have been proposed in order to manage the project's negative impacts. The project is to also result in positive impacts such as employment creation and contributing to addressing the deficit in energy supply in Outjo, Otijiwarongo as well as Namibia as a whole.

It is crucial to note that implementation and adherence to the Environmental Management Plan is essential in order to keep the project impacts/risks within acceptable limits and to enhance positive outcomes. Moreover, the plan is to be reviewed and updated periodically factoring any project changes and/or additions. Legal obligations that impinge on the project must also be complied with in order to reduce liabilities, incidents/accidents and any negative impact on environmental and human well-being.

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4 APPENDICES

4.1 Appendix 1: Public Consultation Documents

1. Background Information Document
2. Newspaper Adverts
3. Site Notice
4. Meeting Attendance Register
5. Meeting Minutes
6. Questionnaires

4.2 Appendix 2: Site Information

1. Land ownership
2. Locality Map

4.3 Appendix 3: AIA Report

4.4 Appendix 4: GHG Reference Materials

EX-ANTE tool is used for calculating GHG emissions associated with land use change.

GROSS FLUXES

In tCO2-e over the whole period analysis

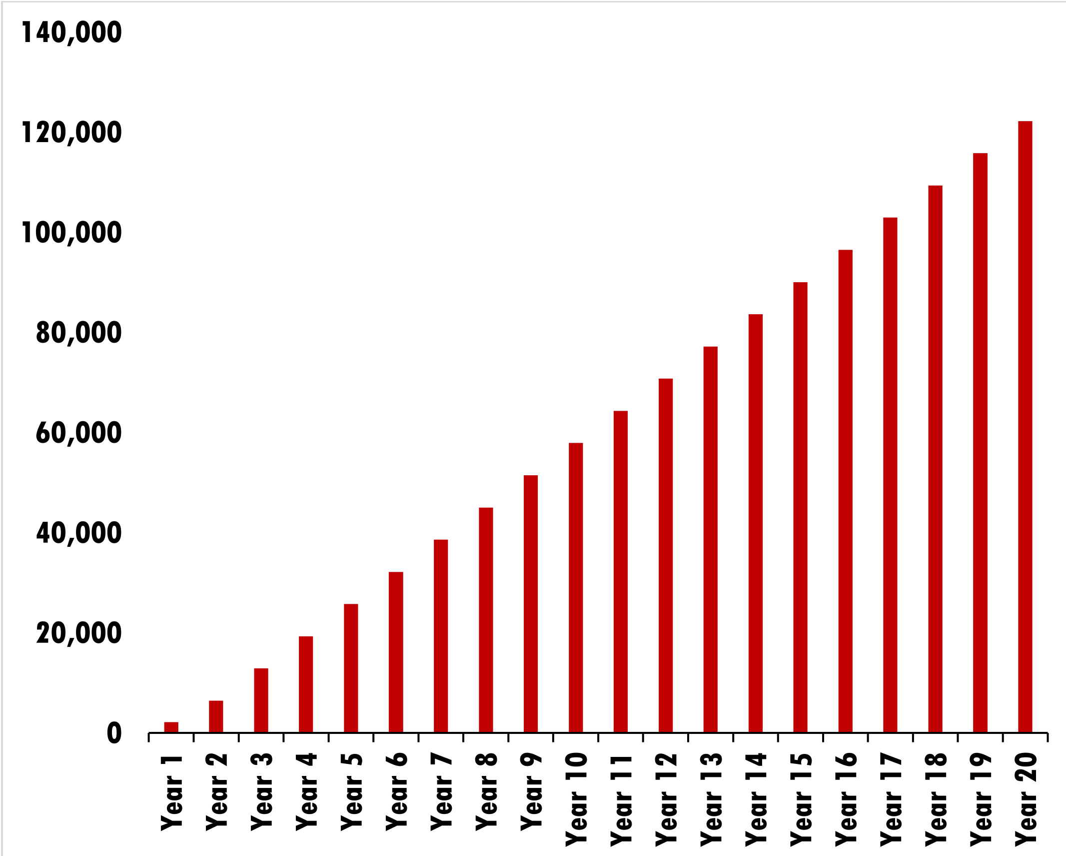
PROJECT COMPONENTS		WITHOUT	WITH	BALANCE
Land use changes	Other land-use	0	35,574	35,574
	Forest mngt.	0	-2,469	-2,469
	Inputs & Invest.	0	89,123	89,123
Total emissions, tCO2-e		**0**	**122,229**	**122,229**
Total emissions, tCO2-e/ha		**0.0**	**382.0**	**382.0**
Total emissions, tCO2-e/ha/yr		**0.0**	**19.1**	**19.1**

SHARE PER GHG OF THE BALANCE

In tCO2-e over the whole period analysis

CO2 BIOMASS	CO2 SOIL	N_2O	CH_4	ALL NON-AFOLU EMISSIONS*
38,500	-2,926	0	0	
-2,469	0	0	0	
	0	0		89,123
36,031	**-2,926**	**0**	**0**	**89,123**
112.6	**-9.1**	**0.0**	**0.0**	**278.5**
5.6	**-0.5**	**0.0**	**0.0**	**13.9**

Cumulative carbon balance per year, in tCO2-e (20 years)


140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
Year 11
Year 12
Year 13
Year 14
Year 15
Year 16
Year 17
Year 18
Year 19
Year 20

4.5 Appendix 5: Traffic Impact Assessment Reference Materials

ADT Per Lane Per Annum

Traffic Surveillance System

System: Traffic Surveillance System **Network:** Network 12 (2018/07/23 - 2019/02/27)

Survey: TSS Survey for 2021

ADT Per Lane Per Annum

Station **70** **Base** Lanes: F1 - B1

Road Number: T0103 **Start - End Links:** **Telephone Number:**

KM from Start Road: **From - To Town:** Otjiwarongo - Otavi **Equipment Position:** Left

	Total Road				Lane 1				Lane 2				Lane 3				Lane 4				Count
Year	Light	Heavy	% H	ADT	Light	Heavy	% H	ADT	Light	Heavy	% H	ADT	Light	Heavy	% H	ADT	Light	Heavy	% H	ADT	Days
2012	1381	325	19.0 %	1706	676	160	19.1 %	836	705	165	18.9 %	870	0	0		0	0	0		0	362
2013	1451	357	19.8 %	1808	714	174	19.6 %	888	737	183	19.9 %	920	0	0		0	0	0		0	296
2014	1496	383	20.4 %	1879	739	190	20.4 %	928	757	193	20.3 %	950	0	0		0	0	0		0	308
2015	1584	411	20.6 %	1995	771	203	20.9 %	974	813	208	20.3 %	1,021	0	0		0	0	0		0	254
2016	1761	436	19.8 %	2197	873	217	19.9 %	1,090	888	219	19.8 %	1,107	0	0		0	0	0		0	366
2017	1786	398	18.2 %	2184	879	198	18.4 %	1,076	907	200	18.0 %	1,106	0	0		0	0	0		0	183
2018	1736	399	18.7 %	2135	863	200	18.8 %	1,063	873	199	18.6 %	1,072	0	0		0	0	0		0	330
2019	1745	380	17.9 %	2125	870	188	17.8 %	1,058	875	192	18.0 %	1,067	0	0		0	0	0		0	351
2020	1029	282	21.5 %	1311	493	140	22.1 %	633	536	142	21.0 %	675	0	0		0	0	0		0	247
2021	1543	387	20.1 %	1930	789	194	19.7 %	983	754	193	20.4 %	948	0	0		0	0	0		0	218

RMS: Traffic Surveillance System *Page 1 of 1* *Printed on 20 January 2023*

4.6 Appendix 6: Flood Risk Assessment

4.7 Appendix 7: Consultancy Team Resumes