NOORo IV Ouarzazate 70 MW Photovoltaic Power Project

Kingdom of Morocco

Specific Environmental and Social Impact Assessment Vol2:

Main Text

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
As	Arsenic
AC	Alternate Current
ACWA	ACWA Power
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CBD	Convention on Biological Diversity
CCR	Central Control Room
CCTV	Closed-Circuit Television
Cd	Cadmium
CESMP	Construction Environmental and Social Management Plan
CN	Cyanide
CNEIE	Comite National des Etudes d'Impact sur L'Environnement
CO	Carbon Monoxide
CO2	Carbon Dioxide
Cr	Chromium
Cu	Copper
CSP	Concentrated Solar Power
DA	Degraded Airshed
DDS	Dust Detection System
DC	Direct Current
DESMP	Decommissioning Environmental and Social Management Plan
D&D	Deactivation and Decommissioning Contractor
dB(A)	A-weighted decibels
dB(C)	C-weighted decibels
EHS	Environmental, Health and Safety
EPC	Engineering, Procurement and Construction
EPs	Equator Principles
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
E&S	Environmental and Social

Abbreviation	Meaning
FESIA	Framework Environmental Impact Assessment
GHG	Green House Gas Emissions
GHI	Global Horizontal Irradiance
GIIP	Good International Industry Practice
HCPV	High Concentration Photovoltaic
Hg	Mercury
H_2SO_4	Sulfuric Acid
IBA	Important Bird Location
IFC	International Finance Corporation
KfW	*Kreditanstalt für Wiederaufbau*
ILO	International Labour Organization
INSAP	Institut National des Sciences de L'Archéologie et du Patrimoine
Laeq	A-weighted Equivalent Continuous Sound Level
Lamax	A-weighted Maximum Sound Level
MASEN	Moroccan Government through the Moroccan Agency for Solar Energy
MASL	Meters Above See Level
MFS	Minimum Functional Specifications
MSDS	Material Safety Data Sheet
MW	Megawatt
MWac	Mega Watt (alternating current)
MWp	Mega Watt (peak)
Ni	Nickel
NOx	Nitrogen Oxides
NO_2	Nitrogen Dioxide
NTP	Notice to Proceed
NTS	Non-Technical Summary
O_2	Oxygen
O&M	Operation and Management
OESMP	Operational Environmental and Social Management Plan
ONEE	Office National d'Electricité et de d'Eau Potable

Abbreviation	Meaning
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PDT	Plan D'Acquisition de Terrain
PL	Power Line
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometers.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometers.
PPA	Power Purchase Agreement
PS	Performance Standards on Environmental and Social Sustainability
PV	Photovoltaic
RO	Reverse Osmosis
Se	Selenium
SEP	Stakeholder Engagement Plan
SESIA	Specific Environmental and Social Impact Assessment
SF^6	Sulfur Hexafluoride
SO_2	Sulphur Dioxide
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compounds
WHO	World Health Organisation
Zn	Zinc
5 Capitals	5 Capitals Environmental and Management Consulting

NON-TECHNICAL SUMMARY

The Non-Technical Summary for the NOORo IV Ouarzazate 70 MW PV is provided in a separate document; SESIA Vol.1 Non-technical Summary.

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1 INTRODUCTION

The Moroccan Agency for Solar Energy (MASEN), the public company that sponsors solar energy in the Kingdom of Morocco, has declared ACWA Power as the preferred bidder to develop the NOORo IV Ouarzazate 70 MW photovoltaic (PV) power project (the Project) within the NOORo Solar Power Complex (the Complex) which currently includes the NOORo I, II, III Concentrated Solar Power (CSP) Projects. The Complex is located within the Ghassate rural commune, 10 km from the city of Ouarzazate, Morocco. ACWA Power will be responsible for the design, engineering, procurement, financing, construction, permitting, completion, start-up, testing, commissioning, operation and maintenance of the PV for a 25-year period.

The proposed Project will be located at the eastern boundary of the Complex, northeast of the NOORo I Parabolic CSP plant currently in operation, and southeast of the NOORo II Parabolic CSP and NOORo III Tower CSP that are now under construction. The specific plot for the project has a total area of 210 ha and has direct access form the existing Complex's road network. The project also includes the construction of a 225 kV Power Line and water pipe to connect the power plant to the existing NOORo Solar Power Complex substation and water tank. No project component will be constructed outside the Complex.

The proposed Project is seeking international funding from *Kreditanstalt für Wiederaufbau* (KfW), a German government-owned development bank. The KfW Sustainability Guidelines acknowledges that the World Bank/International Finance Corporation (IFC) Performance Standards (PS) on Environmental and Social Sustainability (2012), and the IFC (2007) Environmental, Health and Safety Guidelines are internationally recognised environmental and social standards.

5 Capitals Environmental and Management Consulting (5 Capitals), an independent environmental and social consultancy, has been commissioned by ACWA Power to undertake the Specific Environmental and Social Impact Assessment (SESIA) for the proposed Project. 5 Capitals has undertaken this SESIA in line with KfW Development Bank Sustainability Guideline issued in April 2014 (https://www.kfw-entwicklungsbank.de/PDF/Download-Center/PDF-Dokumente_Richtlinien/Nachhaltigkeitsrichtlinie_EN.pdf), World Bank Group Environmental, Health and Safety General Guidelines issued on 30 April 2007, and the Fundamental Conventions, all as in effect on 23 April 2016. This SESIA has also considered the requirements established by the Moroccan regulations, in accordance with Law n°11-03 for the Protection and Improvement of the Environment and Law n°12-03 for the Environmental Study Impact Process of Morocco, and the Framework Environmental and Social Impact Assessment (FESIA) prepared by MASEN for the Complex in 2011 and updated in 2014.

1.1 Assessment Objectives

This SESIA document has several objectives in relation to its preparation, use and application for the NOORo IV Ouarzazate 70 MW PV Project. Such objectives include and are not limited to the following:

- The assessment of baseline conditions prior to development;
- The identification and implementation of national and international regulations applicable to the project;
- The assessment of potential impacts of the project during construction, operation and decommissioning;
- Ensuring that potential impacts are avoided or minimised through the recommendation of mitigation measures;
- Inclusion, information and consultation with affected stakeholders (e.g. public, public bodies and local populations) regarding the project, and
- Exploration of alternatives that can be used for the Project leading to greater social and environmental gains.

1.2 Report Structure

To comply with the requirements for environmental assessment and international best practice, this report is presented in the following format:

Volume 1: Non-Technical Summary

Volume 2: Main Text

Volume 3: Environmental and Social Management Plan (ESMP)

Volume 4: Technical Appendices

Volume 1 contains the Non-Technical Summary, which provides an overview of the main elements of the Power Plant including the proposed PL and summarises the main E&S impacts and recommended mitigation measures.

Volume 2 comprises the Main Text of the report with the issues identified that the project may impact upon each following a similar general structure:

- Introduction and Project Background;
- Legal Framework, Standards and Guidelines;
- SESIA Assessment Method;
- Baseline Information;
- Methodology

- Assessment of Effects/Impacts, Mitigation Measures, and Residual Effects During Construction Phase;
- Assessment of Effects/Impacts, Mitigation Measures, and Residual Effects During Operational Phase; and
- Assessment of Effects/Impacts, Mitigation Measures, and Residual Effects During Decommissioning Phase, where relevant.

Volume 3: provides the framework for the development of the Construction Environmental Social Management Plan (CESMP) by the main contractor (the EPC) and all sub-contractors; and the Operational Environmental and Social Management Plan (OESMP) to be developed and implemented by the Operation and Management (O&M) team. The CESMP and the OESMP include an Environmental and Social Monitoring Program (ESMP). The ESMP will provide procedures to ensure the implementation and monitor the performance of the mitigation measures and other elements.

Volume 4 comprises all Technical Appendices (consultation meeting, baseline survey reports and other technical studies).

2 LEGAL AND ADMINISTRATIVE FRAMEWORK

The proposed Project will adopt and comply with the following regulations and standards:

- National regulations and standards;
- International and Regional Treaties ratified by Morocco, and
- International requirements applicable to the project (Equator Principles. IFC Environmental and Social Performance Standards and IFC Environmental, Health and Safety Guidelines).

2.1 National Framework

2.1.1 Environmental protection

Law No 11-03 concerning Protection and improvement of the Environment

This law sets the general framework for the protection of the environment in Morocco, by identifying:

- Principles of environmental protection related to human settlements and the protection of nature and natural resources;
- Principle for establishing discharge standards and the definition of nuisances;
- Management tools and protection of the environment that are described within the impact studies, plans and standards;
- Standards of environmental quality and financial and tax incentives. The law also establishes a national fund for the protection and enhancement of the environment; and
- Procedural rules defining the responsibilities and obligations in the event of damage.

Law No. 99-12 on the National Charter of Environmental and Sustainable Development.

This law sets the basic objectives of state action in the field of environmental protection and sustainable development. It aims to: improve the protection and conservation of resources and the natural environment, biodiversity and cultural heritage, to prevent and fight against the pollution, integrate sustainable development in sectoral public policies and adopt a national development strategy, harmonize the national legal framework with international conventions and standards relating to environmental protection and sustainable development, improve measures for climate change adaptation and measures against desertification, and lead institutional, economic, financial and cultural reforms on environmental governance defining State commitments, among others.

2.1.2 Environmental Impact Assessment

Law No 12-03 concerning Environmental Impact Study Process and implementing decrees.

Promulgated by Dahir No. 1-03-06 of 10 Rabii I 1424 (12 May 2003) lists the projects subject, the procedure of implementation and methodology of impact studies.

This Act establishes the creation of a national committee and regional committees entrusted with the review of the environmental impact studies.

The "Décret n° 2-04-563 du 5 kaada 1429 relatif aux attributions et au fonctionnement du comité national et des comités régionaux des études d'impact sur l'environnement" outlines the responsibilities of the National and Regional Committee on the review and approval processes of the environmental impact assessments.

The "Décret n° 2011-2018 du 29 décembre 2011 portant réforme de l'enquête publique relative aux opérations susceptibles d'affecter l'environnement" determines the main requirements on public consultation procedures to be undertaken during the environmental impact assessment phase.

The "Décret sur la police environnementale" defines the mission and organization for the Environmental Police, responsible for the correct application of the environmental regulations in Morocco.

2.1.3 Public Consultation

The "Décret n° 2-04-564 du 5 kaada 1429 (4 novembre 2008) fixant les modalités d'organisation et de déroulement de l'enquête publique relative aux projets soumis aux études d'impact sur l'environnement".

This decree establishes the considerations to follow when undertaken public consultation procedures. Public consultation will include, as minimum, the following:

- Fact sheet outlining the main technical characteristics;
- Nontechnical Summary, and
- Site plan clearly showing the project boundaries.

Permission will be addressed to (and granted by) the regional committee of environmental impact studies (secrétariat permanent du comité régional des études d'impact sur l'environnement). The committee is required to designate a commission for the public consultation process.

This las also establishes the minimum information and timelines that need to be considered during the consultation process.

2.1.4 Ecology and Biodiversity

Law No 11-03 concerning the protection and improvement of the environment provides a framework of legislation under which the Kingdom can meet its obligations as a signatory to the Convention on Biological Diversity (CBD).

Law No 1-11-84 du 29, 1432 (2 July 2011) promulgating the Law no 29-05 with regards to protection of wildlife and trade control.

2.1.5 Air Quality

Law No 13-03 on the Prevention of Air Pollution

Chapter II of the Act, Article 2 states that the Act applies to any person or entity, public or private, who owns or possesses or uses or operates buildings or mining, industrial, commercial, agricultural or crafts. It also applies to motor vehicles, equipment, combustion, waste incineration, heating or cooling.

Chapter III of the Act, Article 4 states that "it is forbidden to release, issue or refuse to allow the release, emission or discharge of pollutants in the air such as toxic gas or corrosive fumes, vapours, heat, dust, odours beyond the quality or concentration allowed by the standards laid down by regulation"

This article states the following "in the absence of standards laid down by regulation, operators of installations referred to in Article II are required to apply the most advanced technologies available to prevent or reduce emissions."

Through Decree No. 2-09-286 of 20 Di Hijja 1430 (8 December 2009), this law sets standards for air quality and air monitoring.

2.1.6 Water Quality

Law 10-95 concerning Water Management. Moroccan Law 10-95 on water and its implementing regulations establish the measures to protect artificial water bodies, the water quality, use of these water systems and protection of the watercourses. This Law the legal basis for the country´s water policy and sets the following objectives:

- Establish a Management Plan on water resource use at a National Level;
- Protect the qualitative and quantitative characteristics of the hydrological resources in Morocco while investing on water project development taking into consideration the economic and social interests of the local population.

Decree No. 2-04-553 concerning Wastewater Management

The Decree 553 paves the way for the effective implementation of reporting procedures for existing discharges and subsequent payment of fees. The implementation of the Decree induces the need to:

- Request authorization to discharge from the concerned water authority;
- Meet the discharge limits set by domestic Order No. 1607-06 (25 July 2006).

Decree 2-97-787 regarding Water Quality Standards defines quality classes to normalize and standardize the assessment of water quality. It also defines orders via quality standards which water must meet depending on the treated water use, including: potable water, irrigation and wastewater for irrigation and aquaculture.

Decree N° 1276-01 concerning Water Quality standards for irrigation

This Decree establishes the standards for water irrigation that will need to be followed for treated sanitary wastewater reuse.

Decree No. 2-97-224: Setting the Conditions Governing the Artificial Accumulation of Water (1997)

Decree No. 2-97-489, February 4 1998. Identifies publicly accessible water bodies, the procedures to manage these waterways, and their safe extraction.

Decree No. 2-04-553. January 24 2005. Identifies measure to prevent spills, leaks, and discharges and protect surface and ground waters from direct or indirect contamination events.

2.1.7 Soil Quality

The "Dahir n° 1-69-170 du 10 joumada I 1389 (25 juillet 1969) sur la défense et la restauration des sols" determines requirements for soil restoration on high erosion risk areas and the creation of creation of buffer areas where appropriate.

2.1.8 Seismicity

Decree No 2-02-177 of February 2002 (RPS 2000) concerning seismicity areas

This regulation was issued by the National Committee of Seismic Engineering (NCSE). The objectives of this Decree are:

- Establishing a seismic zonation within Morocco;
- Improving urban and development planning through seismic micro-zonation.

The "Réglement de construction Parasismique" (RPS 2000) is applicable for new constructions exceeding 50m2 and existing buildings. It covers structures in reinforced and steel concrete.

2.1.9 Protected Areas

Law n° 22-07 concerning Protected Areas

Promulgated by Decree n° 1-10- 123 (16 July 2010), this Law, encourages the environmental protection by the establishment of national protected areas.

2.1.10 Waste Management

Law No 28-00 concerning Waste Disposal and Management

This Law adopted in 2006 aims to prevent and protect human health, fauna, flora, water, air, soil, ecosystems, sites and landscapes and the environment in general against the effects of harmful waste, by ensuring the reduction of harmful waste production; the organization of the collection, transport, storage, waste treatment and disposal in an environmentally sound manner; the recovery of waste by waste hierarchy, planning national, regional and local management and disposal waste; informing the public about the harmful effects of waste on public health and environment as well as measures to prevent or compensate for their adverse effects; and the establishment of a system of control and punishment for offenses.

Consequently, several decrees have been promulgated, which outline the procedures and standards that will be implemented to ensure compliant transport and disposal of wastes based on their classification. With respect to this project the following Decrees have been applied:

- Decree No. 2-07-253 Identifies and lists hazardous wastes by Industrial process.
- Decree No 2-09-538 Identifies hazardous wastes management procedures.
- Decree No. 2-09-683 Identifies non-hazardous wastes management procedures.

2.1.11 Labour

Law n° 65-99 promulgated by Decree 1-03-194 of 11 September 2003

Article 9 of the Moroccan Labour Code prohibits discrimination based on race, colour, gender, handicap, marital situation, religion, political opinion, union participation, national origin, social origin for any employment matters notably hiring, distribution of work, training, salary, promotion, granting of benefits, disciplinary measures and termination.

2.1.12 Socio-Economic

Moroccan Labour Law no 65-99 concerning the Labour Code, is applicable to this project. Other legislation relating to the social and health sector includes:

- 17-08 (dahir 1-08-153 du 18 février 2009) regarding the Communal Charter
- Dahir 1-60-063 (25 June 1960) for the development of rural communities Order 23 November 1950. Ensures that medicinal products and medical equipment should

be provided on-site, where 100 workers are permanently stationed or where projects are located more than 10 km from a supply centre.

- Decree 2-70-510 (8 October 1970) identifies preventive measures that should be implemented on construction sites.

2.1.13 Cultural Heritage

Law 22-80 (1981) regarding the conservation of Cultural Heritage

This Law establishes measures for the protection of Historic Monuments and sites.

2.1.14 Traffic and Road Safety

The following national laws have been considered:

- Decree No. 2-03-169 of 22 Muharram 1424 (26 March 2003) on the transport of goods by road;
- Law 52-05 relating to traffic.

Dangerous goods must be transported by vehicles or trailers appropriately equipped. The characteristics of these vehicles must be established by a statutory instrument, which will in turn respect those outlined in the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).

2.1.15 Landscape and Visual

No standards exist with regard to landscape or visual impact in the guidance. In the absence of specific standards with regards to landscape or visual impact, the existing visual characteristics of the Project site have been assessed using professional judgment and experience.

2.1.16 Urban Planning

- Loi 12-90 relative à l'urbanisme (dahir 1-92-31 du 17 juin 1992) ;

Dahir n° 1-92-31 du 15 hija 1412 (17 juin 1992) portant promulgation de la loi n° 12-90 "relative à l'urbanisme".

2.1.17 Project Development

Law No. 13-09 regarding Renewable Energy

The key objectives of this law are to:

- Reduce the oil-dependency of the Kingdom of Morocco;
- Diversify the sources and resources of energy production;
- Use an indigenous natural resource; and
- Reduce CO2 emissions to the atmosphere.

Law no. 37-16 for the creation of the Moroccan Agency for Sustainable Energy

Provides the legal framework for the NOOR IV Project and outlines how it aligns with the national economic and social development strategy.

Law no. 16-09 for the creation of the "l'Agence nationale pour le développement des énergies renouvelables et de l'efficacité énergétique".

2.2 International and Regional Conventions

The international and regional conventions and protocols ratified by the Kingdom of Morocco that are relevant to protection of the environment will be acknowledged in relation to the environmental impact assessment of the proposed NOOR IV project are provided below:

The international and regional conventions and protocols that are relevant to protection of the environment are summarised below:

Berne Convention (1979):

The Bern Convention on the Conservation of European Wildlife and Natural Habitats, also known as the Bern Convention, is a bindings international legal instrument on the filed of Nature Conservation. It covers the natural heritage in Europe, as well as in some African countries. The Convention was open for signature on 19 September 1979 and came into force on 1 June 1982. It is particularly concerned about protecting natural habitats and endangered species, including migratory species.

Bonn Convention on Migratory Species of Wild Animals (1983).

This global convention created in 1979 by the United Nations Environment Program (UNEP) is an agreement for the conservation of migratory species of wild animals. Two appendices list migratory species that require conservation measures.

Under the Bonn Convention Morocco has signed several agreements including the Agreement on the Conservation of Migratory Waterbirds in Africa - (AEWA). To this end the Contracting Parties "... investigate problems that arise due to human activities and endeavor to implement remedial measures including restoration and habitat rehabilitation and compensatory measures for loss of habitat. "

Washington Convention on International Trade in Endangered Flora and Wildlife (CITES 1975).

Morocco has signed the Convention in 1975 and entered into force in 1976. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it accords varying degrees of protection to more than

34,000 species of animals and plants. This convention is regularly cited as a reference to the threat level of the species.

Protecting the ozone layer: the Montreal Protocol (1992);

As a party to the Montreal Protocol, has the obligation to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations and bearing in mind the developmental needs of developing countries.

RAMSAR convention on the protection of Wetlands of International Importance (1971, updated 1980).

Morocco has committed to maintain the ecological character of its Wetlands of International Importance and to plan for the sustainable use, of all of the wetlands in its territories.

The Convention uses a broad definition of the types of wetlands covered in its mission, including lakes and rivers, oases, estuaries, and human-made sites such as fish ponds, and reservoirs, to name a few.

Climate Change Framework: United Nations Convention on Climate Change (1995) and protocol of Kyoto (2002)

Morocco has committed to develop national inventories of anthropogenic emissions and removals of greenhouse gases, consider climate change in policies and actions and adopt methods such as impact assessments, and formulate mitigation measures.

Biodiversity Convention of Rio Janeiro on Biological Diversity (1995)

Morocco has committed to the conservation and maintenance of biological diversity alongside economic development.

Vienna Convention and the London amendment (1995)

Morocco was committed to adopt appropriate legislative or administrative measures and co-operate in harmonizing appropriate policies to control, limit, reduce or prevent human activities under their jurisdiction or control should it be found that these activities have or are likely to have adverse effects resulting to the depletion of the ozone layer.

African Convention on the Conservation of Nature and Natural Resources whose acts were reaffirmed at Earth Summit in Johannesburg in South Africa in 2002

This agreement was signed in Algiers on 15 September 1968, replacing the London Convention 1933. Its objectives include the conservation of species, the creation of

protected areas and conservation, utilization and development of soil, water, flora and fauna. The Convention establishes three categories of protected areas in parks, reserves and special reserves and introduces the concept of optimal handling for sustainable wildlife resources.

The International Convention for the Protection of Birds

Replaces and enhances the Convention for the Protection of Birds Useful to Agriculture, held in Paris in 1902. The updated convention is essentially based on ecological considerations, even if Article 5 introduces an ethical argument and it prohibits the infliction of unnecessary suffering to birds. This Convention shall be applied without exception to all wild birds and designed specifically to protection of all species during their breeding and migration.

The World Heritage Convention

The World Heritage Convention was adopted by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) General Conference, in Paris 1972. It aims to promote cooperation among nations to protect heritage around the world that is of such outstanding universal value that its conservation is important for current and future generations. It is intended that, unlike the seven wonders of the ancient world, properties on the World Heritage List will be conserved for all time.

The Kingdom of Morocco has also signed 54 International Labour Organisation (ILO) conventions, including the following:

- Unemployment Convention, 1919 (No. 2)
- Night Work (Women) Convention, 1919 (No. 4)
- Workmen's Compensation (Agriculture) Convention, 1921 (No. 12)
- Holidays with Pay Convention, 1936 (No. 52)
- Labour Inspection Convention, 1947 (No. 81)
- Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- Equal Remuneration Convention, 1951 (No. 100)
- Abolition of Forced Labour Convention, 1957 (No. 105)
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- Employment Policy Convention, 1964 (No. 122)
- Workers' Representatives Convention, 1971 (No. 135)
- Minimum Age Convention, 1973 (No. 138)
- Minimum age specified: 15 years
- Termination of Employment Convention, 1982 (No. 158)

- Asbestos Convention, 1986 (No. 162)
- Maternity Protection Convention, 2000 (No. 183)

2.3 International Requirements

2.3.1 IFC Requirements

ACWA Power's Policy ascertains that all power assets will be designed, constructed, operated and decommissioned in accordance with the E&S requirements stabilised by the Word Bank Group - International Finance Corporation.

This SESIA has been prepared in accordance with the Performance Standards on Environmental and Social Sustainability (2012) and the General Environmental, Health and Safety Guidelines (2007).

Performance Standards on Environmental & Social Sustainability

The IFC Environmental and Social Sustainability Framework defines the IFC approach towards sustainability and the environment, and the IFC describes the best practices for managing the environmental and social risks associated to asset development. The Performance Standards and how they apply to the proposed Project are outlined below.

Performance Standard 1: covers several types of environmental and social management instruments. These standards require that the environmental and social assessment (SESIA) is undertaken to a high standard and compliant with International Best Practice, and that an Environmental and Social Management System (ESMS) is implemented. Specifically, the objectives required by the PS1 are:

- Establish an overarching environmental and social policy;
- 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 implementation of a management program.
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

The PS1 also requires the assessment of cumulative impacts that result from incremental impacts on areas or resources used or directly impacted by the project, from other existing,

planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

Performance Standard 2: Labour and Working Conditions aims to promote the fair treatment, non-discrimination, and equal opportunity of workers; to establish, maintain, and improve the worker-management relationship; to promote compliance with national employment and labour laws; to protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain; to promote safe and healthy working conditions, and the health of workers and to avoid the use of forced labour. This Performance Standard requires overall alignment to the following conventions:

- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
- ILO Convention 98 on the Right to Organize and Collective Bargaining;
- ILO Convention 29 on Forced Labour;
- ILO Convention 105 on the Abolition of Forced Labour;
- ILO Convention 138 on Minimum Age (of Employment);
- ILO Convention 182 on the Worst Forms of Child Labour;
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 111 on Discrimination (Employment and Occupation);
- UN Convention on the Rights of the Child, Article 32.1; and
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.

Performance Standard 3: Resource Efficiency and Pollution Prevention, aims to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities, to promote more sustainable use of resources, including energy and water and to reduce project-related GHG emissions.

Performance Standard 4: Community Health, Safety, and Security aims to anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances and to ensure 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.

The IFC's Guidance Note 4 requires that the exacerbation of impacts caused by natural hazards, such as landslides or floods that could arise from land use changes should be avoided or minimized.

Performance Standard 5: Land Acquisition and Involuntary Resettlement. This PS focuses on project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. A Land Acquisition Review / Plan and a Livelihood Restoration Plan will be prepared to assess, or anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; and to ensure that there is a restoration and improvement of the livelihoods and standards of living of the economically displaced persons.

Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. This IFC performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard are guided by the Convention on Biological Diversity.

This standard aims to:

- Protect and conserve biodiversity;
- Maintain the benefits from ecosystem services; and
- Promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

The SESIA will follow the requirements of this standard for the assessment of the project impact on the ecosystem.

Performance Standard 7: Indigenous Peoples. This PS focuses on the protection of indigenous communities. None of the communities around the project site can be classified as indigenous, so this standard is not applicable.

Performance Standard 8: Cultural Heritage. The PS aims to protect cultural heritage from the adverse impacts of project activities and support its preservation and to promote the equitable sharing of benefits from the use of cultural heritage. This standard will be taken into consideration to determine whether the project affects any cultural heritage.

General EHS Guidelines

The IFC EHS Guidelines 'are technical reference documents with general and industry specific examples of good international industry practice'. In addition to this the EHS Guidelines specify limit values for environmental aspects and pollution sources, upon which quantitative project impacts can be assessed.

The updated EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards, particularly in those aspects related to Performance Standard 3: Pollution Prevention & Abatement, as well as certain aspects of occupational and community health and safety.

When Moroccan regulations differ from the levels and measures presented in the EHS Guidelines, the Project will be expected to achieve whichever is the more stringent.

2.3.2 Equator Principles

Equator Principle	Details
Principle 1	Review and Categorisation of a project proposed for financing based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC). These categories are: *Category A*- Projects with potential significant adverse social or environmental risks and/or impacts that are diverse, irreversible or unprecedented; *Category B* – Projects with potential limited adverse social or environmental risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and *Category C* – Projects with minimal or no social or environmental risks and/or impacts.
Principle 2	Environmental and Social Assessment For all Category A and Category B Projects, the EPFI (Equator Principle Financial Institution) will require the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment ESIA (SESIA). One or more specialised studies may also need to be undertaken. Furthermore, in limited high risk circumstances, it may be appropriate for the client to complement its Assessment Documentation with specific human rights due diligence. For other Projects, a limited or focused environmental or social assessment (e.g. audit), or straight-forward application of environmental siting, pollution standards, design criteria, or construction standards may be carried out

Equator Principle	Details
Principle 3	Applicable Environmental and Social Standards The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. EPFIs operate in diverse markets: some with robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment; and some with evolving technical and institutional capacity to manage environmental and social issues. The EPFI will require that the Assessment process evaluates compliance with the applicable standards as follows: 1. For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines). 2. For Projects located in Designated Countries, the Assessment process evaluates compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. Host country laws meet the requirements of environmental and/or social assessments (Principle 2), management systems and plans (Principle 4), Stakeholder Engagement (Principle 5) and, grievance mechanisms (Principle 6). The Assessment process will establish to the EPFI's satisfaction the Project's overall compliance with, or justified deviation from, the applicable standards. The applicable standards (as described above) represent the minimum standards adopted by the EPFI. The EPFI may, at their sole discretion, apply additional requirements.
Principle 4	Environmental and Social Management System and Equator Principles Action Plan For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree an Equator Principles Action Plan (AP). The Equator Principles AP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.
Principle 5	Stakeholder Engagement For all Category A and Category B Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an on-going process

Equator Principle	Details
	in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation. To facilitate Stakeholder Engagement, the client will, commensurate to the Project's risks and impacts, make the appropriate Assessment Documentation readily available to the Affected Communities, and where relevant Other Stakeholders, in the local language and in a culturally appropriate manner. The client will take account of, and document, the results of the Stakeholder Engagement process, including any actions agreed resulting from such process. For Projects with environmental or social risks and adverse impacts, disclosure should occur early in the Assessment process, in any event before the Project construction commences, and on an on-going basis. EPFIs recognise that indigenous peoples may represent vulnerable segments of project-affected communities. Projects affecting indigenous peoples will be subject to a process of Informed Consultation and Participation, and will need to comply with the rights and protections for indigenous peoples contained in relevant national law, including those laws implementing host country obligations under international law. Consistent with the special circumstances described in IFC Performance Standard 7 (when relevant as defined in Principle 3), Projects with adverse impacts on indigenous people will require their Free, Prior and Informed Consent (FPIC).
Principle 6	Grievance Mechanism For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. The mechanism should not impede access to judicial or administrative remedies. The client will inform the Affected Communities about the mechanism in the course of the Stakeholder Engagement process.

Equator Principle	Details
Principle 7	Independent Review Project Finance For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance. The Independent Environmental and Social Consultant will also propose or opine on a suitable Equator Principles AP capable of bringing the Project into compliance with the Equator Principles, or indicate when compliance is not possible. Project-Related Corporate Loans An Independent Review by an Independent Environmental and Social Consultant is required for Projects with potential high risk impacts including, but not limited to, any of the following: • adverse impacts on indigenous peoples • Critical Habitat impacts • significant cultural heritage impacts • large-scale resettlement In other Category A, and as appropriate Category B, Project-Related Corporate Loans, the EPFI may determine whether an Independent Review is appropriate or if internal review by the EPFI is sufficient. This may take into account the due diligence performed by a multilateral or bilateral financial institution or an OECD Export Credit Agency, if relevant.
Principle 8	Covenants An important strength of the Equator Principles is the incorporation of covenants linked to compliance. For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects. Furthermore, for all Category A and Category B Projects, the client will covenant the financial documentation: a) to comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects; and b) to provide periodic reports in a format agreed with the EPFI (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts) document compliance with the ESMPs and Equator Principles AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country environmental and

Equator Principle	Details
	social laws, regulations and permits; and c) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan. Where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance to the extent feasible. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, as considered appropriate.
Principle 9	Independent Monitoring and Reporting Project Finance To assess Project compliance with the Equator Principles and ensure on-going monitoring and reporting after Financial Close and over the life of the loan, the EPFI will, for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFI. Project-Related Corporate Loans For Projects where an Independent Review is required under Principle 7, the EPFI will require the appointment of an Independent Environmental and Social Consultant after Financial Close, or require that the client retain qualified and experienced external experts to verify its monitoring information, which would be shared with the EPFI.
Principle 10	EPFIs Reporting Client Reporting Requirements The following client reporting requirements are in addition to the disclosure requirements in Principle 5. For all Category A and, as appropriate, Category B Projects: • The client will ensure that, at a minimum, a summary of the SESIA is accessible and available online. • The client will publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually. Refer to Annex A for detailed requirements on GHG emissions reporting. EPFI Reporting Requirements The EPFI will report publicly, at least annually, on transactions that have reached Financial Close and on its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations. The EPFI will report according to the minimum reporting requirements detailed in Annex B.

2.4 Standards and Guidelines

2.4.1 Soil Quality

National Requirements

There are no specific Moroccan standards and guidelines for soil protection.

International Requirements

The IFC EHS regulations do not specify pollutant standards for soils. In light of this, sector-specific guidance documents on pollution prevention and good practices produced by the IFC (e.g. IFC 'Environmental Health and Safety Guidelines (EHS) Guidelines: Contaminated Land' (2007)) will be referred to in the assessment. Such guidance includes the following:

The General EHS guidelines detail that the '…Transfer of pollutants to another phase, such as air, soil, or the sub-surface, will be minimized through process and engineering controls.'

Section 1.8 of the IFC's General Guidelines details the specific requirements with regards to contaminated land. It notes that: "*Contamination of land will be avoided by preventing or controlling the release of hazardous materials, hazardous wastes, or oil to the environment. When contamination of land is suspected or confirmed during any project phase, the cause of the uncontrolled release will be identified and corrected to avoid further releases and associated adverse impacts*."

Internationally recognized assessment values for soil contamination set by the Dutch Ministry of Housing, Spatial Planning and Environment have been applied. The baseline results have been compared against standard values and guidelines.

In the Netherlands, environmental quality values have been established based on the philosophy of protecting ecosystems, environmental functions and ensuring the multi-functionality of soil and groundwater quality. These are discussed below:

- Target Value: average background concentration or detection limit; exceeding this value indicates a possible diminishing of the functional abilities of the soil for humans, plants or animals.
- Intervention Value: concentration level above, which there is a serious or threatening diminishing of the functional abilities of the soil for humans, plants or animals.

The following Table provides a list of the Dutch Soil and Groundwater standards that the proposed project will be required to comply with.

Table 2-1 Dutch Soil Standards

Contaminant	Dutch Soil mg/Kg dry weight	
	Target	Intervention
Beryllium	1.1	30
Cadmium	0.8	12
Chromium (total)	100	220
Cobalt	20	180
Copper	36	96
Lead	85	530
Nickel	35	100
Mercury	0.3	10
Molybdenum	3	190
Selenium	0.7	100
Thallium	1	15
Vanadium	42	250
Zinc	140	350
Benzene	0.05	2
Total PAH	1	40
The values listed above will be adapted to the soil type at the site. Further information is provided on Chapter 10, Soil and Groundwater. Constituent levels greater than the target value indicate that the soil has lost some of its multi-functional properties and can be considered as contaminated soil. If the contamination level is exceeding the intervention value, further investigation will be carried out. The soil intervention values indicate when the functional properties of the soil are seriously impaired or threatened.		

It will be noted that the target values are not specific clean up criteria. They represent targeted objectives. Also, in the latest (2009) version of the Dutch Standard, Target values for soils have been removed for all compounds except Metals.

2.4.2 Water and Wastewater

National Requirements

The Water Act, Law 10-95 on water and its implementing regulations, was promulgated on 16 August 1995. It aims to ensure the rational use of water and access to this resource throughout the Kingdom. The main decrees implementing this law published to date are:

- Decree No. 2-04-553 of 13 Hijja 1425 (24 January 2005) relating to spills and direct and indirect discharges into surface or groundwater (O.B. No. 5292 of 17 February 2005). The discharge values are specified below in table 2-4.
- Dahir 2-97-787 on the establishment of water quality standards

This decree regulates water discharges, including runoff and direct or indirect discharges to surface water or groundwater.

As a result of the implementation of this decree an authorization has to be requested for water discharges from the relevant authorities.

In addition, domestic discharge standards set by Order No. 1607-06 (July 25, 2006), are shown in table 2-5.

- Decree No. 2-05-1533 covers wastewater discharges from rural settlements.
- Decree No. 2-97-875 of 6 Shawwal 1418 (4 February 1998) on the use of wastewater (O.B. 5 February 1998). This Decree regulates the reutilization of wastewater. An authorization is required for wastewater reuse except for onsite reutilization.
- Decree No. 2-97-657 of 6 Shawwal 1418 (4 February 1998) on the delimitation of protected areas (B.O. February 5, 1998), which regulates zoning around public waters.
- Decree No. 2-97-787 of 6 Shawwal (4 February 1998) on water quality standards and water pollution inventories (O.B. No. 4558 of 5 February 1998). This Decree defines, inter alia, the necessary parameters for the assessment of water quality and the quality standards that water must meet depending on its use.

To date, the legislations enacted based on this decree are:

- Decree n ° 1277-1201 enacted on the 17th of October 2002 on quality standards for water used for the production of drinking water. These standards are specified below in table 2-3;
- Order 1276-01 enacted on the 17th of October 2002 on quality standards for irrigation water. These standards are specified below in table 2-2;
- Decree n ° 1275-1201 enacted on the 17th of October 2002 on quality of surface waters;
- Decree No. 2028-03 enacted on the 10th of November 2003 on quality standards for fishing waters.

Table 2-2 Water Standards for irrigation

Parameters	Units	Value	Specifications
Biological Parameter			
Faecal Coliform	ml	1000/100	100ml for agricultural products eaten raw

Parameters	Units	Value	Specifications
Salmonella		Absence	in 5 litres
Vibrio cholera		Absence	in 450ml
Parasitological Parameter			
Pathogenic parasites		Absence	
Parasite cysts		Absence	
Larvae of Ankylostomides		Absence	
Fluococercaires of Schistosoma haemotobium		Absence	
Toxic Parameters			
Mercury	mg/l	0.001	
Cadmium	mg/l	0.01	
Arsenic	mg/l	0.1	
Total Chromium	mg/l	1	
Lead	mg/l	5	
Copper	mg/l	2	
Zinc	mg/l	2	
Selenium	mg/l	0.02	
Fluorine	mg/l	1	
Cyanides	mg/l	1	
Phenols	mg/l	3	
Aluminium	mg/l	5	
Beryllium	mg/l	0.1	
Cobalt	mg/l	0.5	
Iron	mg/l	5	
Lithium	mg/l	2.5	
Manganese	mg/l	0.2	
Molybdenum	mg/l	0.01	
Nickel	mg/l	2	
Vanadium	mg/l	0.1	
Physical and Chemical properties			
Salinity			

Parameters	Units	Value	Specifications
Total salinity	mg/l	7680	
Electrical conductivity	mS/cm	12	at 25°C
Infiltration			
- Sodium Absorption Ratio 0-3	EC	< 0.2	
- Sodium Absorption Ratio 3-6		< 0.3	
- Sodium Absorption Ratio 6-12		< 0.5	
- Sodium Absorption Ratio 12-20		< 1.3	
- Sodium Absorption Ratio 20-40		< 3	
Toxic Ions (affecting sensitive agricultural product receptors)			
Sodium			
- Surface Irrigation	mg/l	69	
- Overhead irrigation	mg/l	9	
Chloride			
- Surface Irrigation	mg/l	350	
- Overhead irrigation	mg/l	15	
Boron	mg/l	3	
Effect drivers (affecting sensitive agricultural product receptors)			
Temperature	°C	35	Temperature
pH		6.5 to 8.4	pH
Suspended solids			Suspended solids
- Gravitational Irrigation	mg/l	200	- Gravitational Irrigation
- Localised overhead irrigation	mg/l	100	- Localised overhead irrigation
Nitrate (N-NO3-)	mg/l	30	Nitrate (N-NO3-)
Bicarbonate (HCO3) [overhead irrigation]	mg/l	518	Bicarbonate (HCO3) [overhead irrigation]
Sulphates (SO42-)	mg/l	250	Sulphates (SO42-)

Table 2-3 Drinking Water Standards

Parameter	Units	A1-G	A1-I	A2-G	A2-I	A3-G	A3-I
Toxic Substances							
Arsenic	µ g/l	-	50	-	50	-	100
Cadmium	µ g/l	1	5	1	5	-	5
Chromium (total)	µ g/l	-	50	-	50	-	50
Cyanides	µ g/l	-	50	-	50	-	50
Lead	µ g/l	-	50	-	50	-	50
Mercury	µ g/l	-	1	-	1	-	1
Nickel	µ g/l	-	50	-	50	-	50
Selenium	µ g/l	-	10	-	10	-	10
Pesticides, per substance	µ g/l	-	0.1	-	0.1	-	0.1
Pesticides, total	µ g/l	-	0.5	-	0.5	-	0.5
HPA	µ g/l	-	0.2	-	0.2	-	0.2
Undesirable Substances							
Boron	mg/l	-	1	-	1	-	1
Ammonia	mg/l	0.05	0.5	1	1.5	2	4
TKN	mg/l	1	-	2	-	3	-
Nitrates	mg/l	-	5	-	50	-	50
Phosphorous	mg/l	0.4	-	0.7	-	0.7	-
Barium	mg/l	-	1	-	1	-	1
Copper	mg/l	-	1	-	2	-	2
Zinc	mg/l	-	50	-	5	-	5
Manganese	mg/l	-	0.1	0.1	0.1	1	-
Dissolved iron	mg/l	-	0.3	1	2	1	3
Fluorides	mg/l	0.7	1.5	0.7	1.5	0.7	1.5
Dissolved hydrocarbons	mg/l	-	0.05	-	0.2	0.5	1
Phenols	mg/l	-	0.01	-	0.05	-	0.1

Parameter	Units	A1-G	A1-I	A2-G	A2-I	A3-G	A3-I
Anionic detergents	mg/l	-	0.5	-	0.5	-	0.5
Physical-chemical Parameters							
Temperature	°C	20	30	20	30	20	30
pH		6.5-8.5	-	6.5-9.2	-	6.5-9.2	-
Conductivity at 20° C	μ S/cm	1300	2700	1300	2700	1300	2700
Chlorides	mg/l	300	750	300	750	300	750
Sulfates	mg/l	200	-	200	-	200	-
Suspended materials	mg/l	50	-	1000	-	2000	-
Dissolved Oxygen	mg/l	7 (90%)	-	5 (70%)	-	3 (50%)	-
BOD5	mg/l	3	-	7	-	10	-
COD	mg/l	-	-	25	-	40	-
Oxydability	mg/l	2	-	5	-	10	-

Category A1: Water requiring a simple physical treatment and disinfection, including filtration, to be drunk.

Category A2: Water requiring normal physical and chemical processing and disinfection, including pre-chlorination, coagulation, flocculation, sedimentation, filtration and disinfection (final chlorination), to be drunk.

Category A3: Waters requiring physical treatment, chemical pushed refining and including disinfection by chlorination, coagulation, flocculation, sedimentation, filtration, adsorption and disinfection (ozone, final chlorination), to be drunk.

Within each category, there are two columns:

Column G (guideline values): correspond to the recommended values that surface water to be used for the production of drinking water.

Column I (mandatory values): values that are shown are the requirements that any surface water used for the production drinking water must meet to be classified in one of three categories.

Table 2-4 Domestic Discharge Standards

Parameters	Units	Value
BOD5	O2/l	120
COD	O2/l	250
Suspended Materials	mg/l	150

Table 2-5 Sanitary wastewater treatment plan discharge limits (as per the Minimum Functional Specifications, MASEN, 23-Feb-2016)

Parameter	Recommended Limits
BOD5	25 mg/l
COD	125 mg/l
TSS	35 mg/l
Total Nitrogen Compounds (as N)	15 mg/l

International Requirements

Two sections of the IFC general HSE guidelines, namely section 1.3 'Wastewater and Ambient Water Quality' and section 1.4 'Water Conservation' have been considered for this project.

Table 2-6 Indicative Values for treated Sanitary Sewage Discharge

Pollutants	Units	Guideline Value
pH	pH	6 – 9
BOD	mg/l	30
COD	mg/l	125
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total coliform bacteria	MPNb / 100 ml	400a
Notes: a Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation. b MPN = Most Probable Number		

2.4.3 Air Quality

National Requirements

Moroccan Law No. 13-03 establishes the regulations for prevention of air pollution. The law identifies and addresses the sources and types of air pollution, and stipulates that in the absence of any defined national regulations, the polluter is required to integrate and implement the latest technology available to reduce or prevent pollution to the air.

- Decrees No. 2-09-286 establishes the national ambient air quality standards and monitoring mechanisms. These are presented in Table 2-7.
- Decree No. 2-09-631 establishes point source and non-point source emission levels, and the mechanism to control these emissions. These are presented in Table 2-8.

International Requirements

The following IFC EHS guidelines have been considered for the air quality assessment:

- IFC Environmental, Health and Safety General Guidelines (2007) and specifically sections relating to Ambient Air quality.

The assessment of air quality primarily ensures compliance with Moroccan regulations and standards. Where national regulations differ from the guidelines and standards presented in the IFC/WB guidelines, the project will be required to achieve whichever is the more stringent. As per the IFC/WB EHS Guidelines, the WHO ambient air quality standards are applicable in the absence of any national ambient air quality standards.

The following tables present the air emission standards that must be achieved, including those described above, extracted from: Decree 286 and 631 and World Bank/IFC EHS Guidelines.

Table 2-7 Ambient Air Quality Standards (µg/m³ unless otherwise specified)

Parameter	IFC EHS General GLs/WHO GLs		Moroccan		
	24 hour	Annual	1 hour	24 hour	Annual
PM10	150 (Interim target 1)	70 (Interim target 1)	-	90.4 50%centile	-
	100 (Interim target 2)	50 (Interim target 2)			
	75 (Interim target 3)	30 (Interim target 3)			
	50 (guideline)	20 (guideline)			
PM2.5	75 (Interim target 1)	35 (Interim target 1)	-	-	-

Parameter	IFC EHS General GLs/WHO GLs		Moroccan		
	24 hour	Annual	1 hour	24 hour	Annual
	50 (Interim target 2)	25 (Interim target 2)			
	37.5 (Interim target 3)	15 (Interim target 3)			
	25 (guideline)	10 (guideline)			
Nitrogen Dioxide	200 (1 hour)	40	98 200%centile	-	50 health 30 vegetation
Sulphur Dioxide	125 (Interim target 1)	500 (10 minute guideline)	-	99.2 125%centile	20 (ecosystem)
	50 (Interim target 2)				
	20 (guideline)				
	150 (Interim target 1)				
Ozone	100 (8 hour daily maximum guideline)	-	110 for 8hr	65 vegetation	-
Carbon Monoxide	-	-	10mg/m^3 for 8hr	-	-
Cadmium	-	-	-	-	5ng/m^3 Health
Benzene (C6H6)	-	-	-	-	10 Health
Pb	-	-	-	-	1 Health

2.4.4 Noise and Vibration

National requirements

Currently no noise regulations or standards have been enacted within the Moroccan environmental regulatory system.

MFS Requirements

The MFS dated on the 23rd of February 2016 included the maximum noise levels applicable to the site boundary during the construction and operational phases of the project.

Table 2-8 Permissible Noise Levels as per the MFS

Location	Maximum Noise Level dB(A) – 1 hour
At one (1) meter outside the Plant fence/boundary during night time (22:00 – 7:00)	45
At one (1) meter outside the Plant fence/boundary when all equipment is running (7:00 – 22:00)	50
Within the central control room	45

The MFS also requires compliance with the guidelines values established by the World Health Organization (WHO) in 1999. However, there are no specific limits for the setting that represents the project area. Nonetheless, the noise levels established above and below are more stringent than those established by the WHO and therefore, will be used as the permissible noise limit.

International Requirements

Noise

The proposed plant will be required to comply with the noise limits as specified by the IFC EHS General Guidelines (2007).

These guidelines represent maximum noise values that must be achieved at surrounding/nearby receptors. It is stated within the IFC EHS Noise Level Guidelines that noise impacts will not exceed the levels which are presented in Table 2-9, or result in a maximum increase in background levels of 3dB at the nearest off-site point of reception.

Table 2-9 IFC EHS General Noise Guidelines at off-site receptor

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 – 22:00	Night time 22:00 – 07:00
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

Vibration

None of the above standards set out specific standards in relation to vibration impacts at either the construction or operation phase. The IFC's General EHS Guidelines (2007) do however reference potential impacts from vibrations due to the use of hand held power tools and other equipment, as below:

"Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, will be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure.. Exposure levels will be checked on the basis of daily exposure time and data provided by equipment manufacturers."

3 PROJECT LOCATION, OBJECTIVES AND ALTERNATIVES

3.1 Key Project Objectives

The proposed NOORo IV Ouarzazate 70 MW PV Project is aligned with the national energy policy objectives outlined in law No. 13-09 regarding renewable energy. This renewable energy project is aligned with the following key objectives of this law:

- Reducing oil-dependency and energy imports of the Kingdom of Morocco;
- Diversifying the sources of energy production while meeting increasing demand;
- Promoting a competitive energy market;
- Avoiding CO_2 emissions to the atmosphere. Specifically, the NOORo IV Ouarzazate Project will prevent the generation of 103,293.54 tonnes of CO_2 greenhouse gases, helping to offset the effects of Global Warming;
- Creating a sustainable local industry, and
- Generating local employment opportunities.

3.2 Project Location

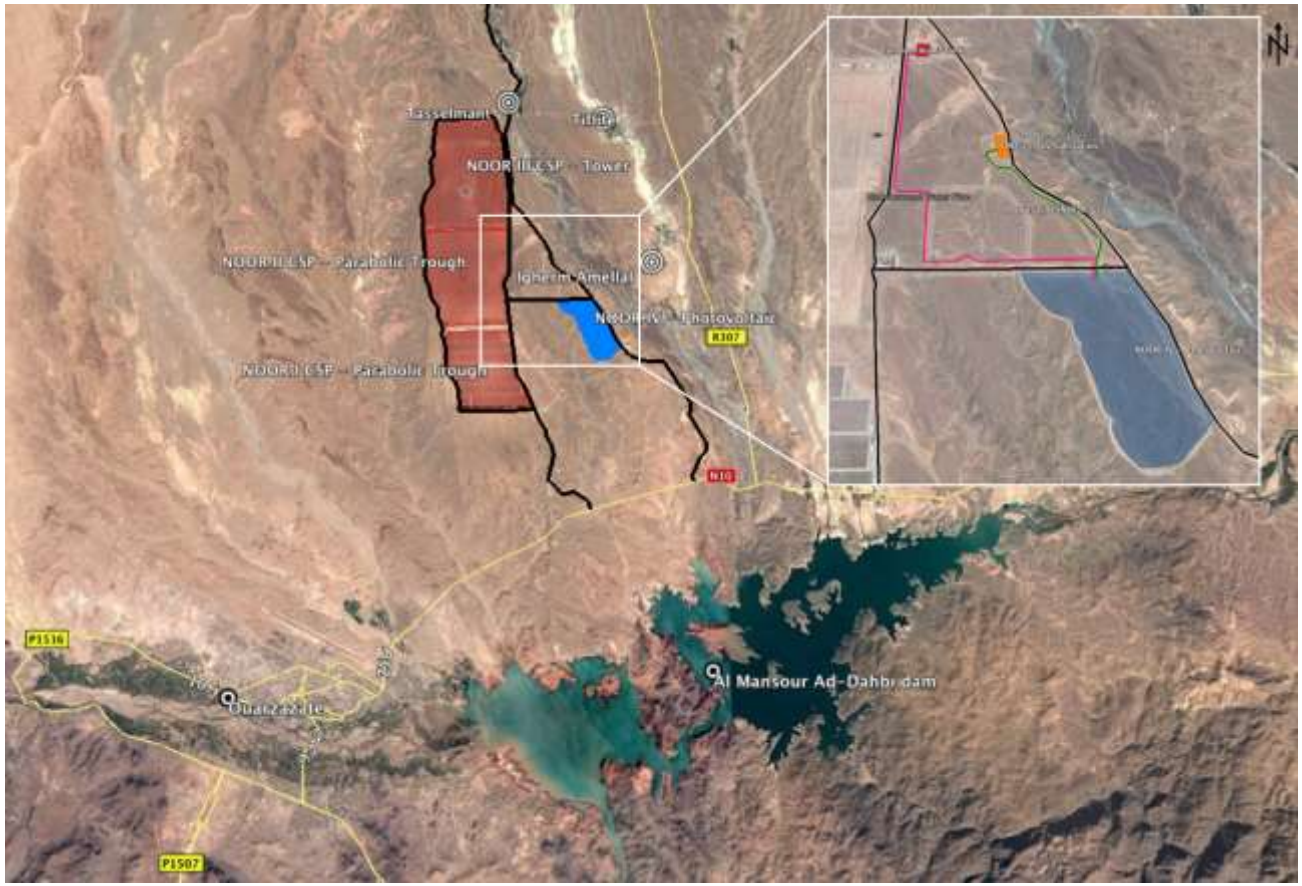
The Solar Power Complex formed by NOORo I, II, and III is located within the Ghassate rural commune in Morocco, along the national highway N10 connecting Ouarzazate and Errachidia. The Complex is approximately 10 km north east of the city of Ouarzazate and 6 km north of the N10. A detailed map of the area is included below.

The NOORo IV PV will be located within the Complex. The specific plot for NOORo IV is located at the eastern boundary of the Complex, northeast of the NOORo I Parabolic CSP plant currently in operation and southeast of the NOORo II Parabolic CSP and NOORo III Tower CSP that are now under construction.

The total area of the proposed NOORo IV PV site is 210 hectares and is on a sparsely vegetated flat rocky plateau. The site has direct road access through the existing road network, as such no new road infrastructure is required to access the plot.

A detailed map of the area and the project is included in Figure 3-1.

Figure 3-1 Location of NOORo Solar Power Complex and NOORo IV 70 MW PV



Note: Yellow – National Road System, Black - Complex Road System, Red – Current Projects in the NOORo Complex, Blue – NOORo IV

Detailed NOORo IV: Blue– NOORo IV, PINK – underground water pipe, RED - existing common water tank, Green- power line, Orange - Existing substation.

The following are the central coordinates of the proposed project site: Easting: 707108.82, Northing: 3433859.10 (Zone 29R).

The table below provides the coordinates of the proposed NOORo IV Ouarzazate 70MW PV project site.

Table 3-1 Proposed Project Site Coordinates

NOORo IV 70 MW PV	X	Y
	LAMBERT Coordinates ZONE I	
1	362188.0064	9225.5591
2	362348.9286	49021.1314
3	362356.3386	49022.8797
4	362392.6071	49020.5983
5	362410.9749	8974.3663
6	362413.2643	48927.1797
7	362424.2955	48923.7344
8	362607.0728	48873.9444
9	362653.0009	48868.4912
10	62666.7759	48851.2232
11	362763.2778	48597.8952
12	362776.3474	48504.6312
13	362921.2796	48125.7265
14	362990.6235	47958.1323
15	363026.8155	47950.5199
16	363049.9723	47923.7443
17	363079.1250	47887.5450
18	363062.9252	47838.2708
19	363126.2051	47633.0219
20	363331.8926	47445.4464
21	363550.0424	47444.2006
22	363675.0099	47521.4519
23	363909.4970	47785.7354
24	363823.7357	47990.3463
25	363720.3511	48238.4553

NOORo IV 70 MW PV	X	Y
	LAMBERT Coordinates ZONE I	
26	363569.1768	48552.6679
27	363465.4042	48762.1737
28	363244.8767	49092.6942
29	363060.2329	49130.8933
30	362976.0090	49179.4006
31	362704.8205	49199.6812
32	362309.5762	49234.1900
33	362201.2417	49246.1901

All temporary equipment, vehicles and materials required during the construction phase of the project will be placed within the Project boundary.

3.3 Site Conditions and Land Use

The proposed PV site is located in a greenfield area that has been inside the Complex fence for several years. There are no residential or agricultural facilities or archaeological or biological sites of special interest in or to adjacent the proposed site.

There are no permanent surface or superficial underground water reservoirs/flows in the proposed site.

The plate below depicts the proposed project site (February 2016).

Plate 3-1 Proposed Project Site

3.4 Potential Sensitive Receptors

Socio-economic sensitive receptors would include the nearest city, residential communities, or villages, arable lands and other privately or communal land uses that may be positively or negatively affected by the project development. The closest residential area is the village of Igherm Ammellal, which is approximately 2.1 km to the northeast.

The proposed Project will be built within an existing solar power complex in which one solar CSP project is in operation and two CSP projects are currently under construction. MASEN's office is located ~1.3 km west from the northwester corner of the Project.

There are no permanent surface water bodies within the project boundary, however one chaaba (ephemeral streams that flow after rain events), is located within the project boundary, and runs from north to south. Equally, another ephemeral river is located approximately 700 m east of the project boundary. The villages within a 10 km buffer zone of the project (i.e. Tasselmant, Tiflite, Igherm Amellal) grow crops at the base of ephemeral river valleys.

Ecological sensitivities include the physical, biological and ecological aspects of the site and surroundings that may be positively or negatively affected by the project development. These sensitivities will be identified and discussed in detail within the specific sub chapters of this SESIA.

The figure below shows an aerial image of the project site with 5km and 10 km buffers zones.

Figure 3-2. 10 Project location and nearby area (5 and 10 km buffer)

3.5 Project Alternatives

Under Moroccan and international guidelines for environmental impact assessments, the evaluation of various project design and activity alternatives were considered, in order to ensure that the objectives of the proposed project have accounted for social, ecological, economic and technological options.

3.5.1 No Project Scenario

The "No Project" option is not a viable alternative, as the objective of the renewable energy law is to diversify the sources and production measures of power for the Kingdom of Morocco. Therefore, the development of the PV Project will contribute to the target of providing 25% of 2,000 MW national production by 2020. The project will prevent the generation of up to 103,293.54 tonnes of CO_2 greenhouse gases. The "No Project" alternative would have a higher contribution to Global Warming, as other polluting sources of electricity would need to be used to generate the 70 MW that the Project will generate.

Furthermore, the "No Project" option would not promote a competitive energy market that diversifies the sources of energy production while meeting increasing power demand or prevent national oil-dependency rates and energy imports from improving.

Finally, from a local perspective, the "No Project" option would not contribute to creating a locally sustainable industry nor generate local employment opportunities in the field of solar production or contribute to establishing a more attractive and sustainable economy in the region.

3.5.2 Alternative Solar Power Technology

The FESIA identified and assessed four technologies for solar power production in relation to ecological and social settings of the proposed site. The alternative photovoltaic technologies considered and the main findings of the comparative assessment are included in the table below:

Table 3-2 Technological alternatives

Technology		Efficiency	Area (m2) needed per kW	State of Commercialisation	Other Remarks
Crystalline Silicon	Monocrystalline Modules	22 to 25 %	7	Mature with large scale production	The most efficient yet most expensive on the market. They require the highest purity silicon and have the most involved manufacturing process
	Polycrystalline Modules	17 to 21 %	8	Mature with large scale production	Most common solar panels on the market, being less expensive than monocrystalline silicon. They are also less efficient, though the performance gap has begun to close in recent years
Thin-Film Solar Cell	Amorphous Silicon Modules	10 to 13%	15	Early deployment phase, medium scale production	It can be deposited in thin layers onto a variety of surfaces and offers lower costs than traditional crystalline silicon, though it is less efficient at converting sunlight into electricity
	Copper, Indium, Gallium, Selenide (CIGS) Solar Cell	12 to 19%	10	Early deployment phase, medium scale production	It has only recently become available for small commercial applications, and is considered a developing PV technology
	Cadmium Telluride (CdTe) Solar Cell	18 to 21%	11	Early deployment phase, small-scale production	They are the most common type of thin film solar panel on the market and the most cost-effective to manufacture. CdTe panels perform significantly better in high temperatures and in low-light conditions
High Concentration Photovoltaics (HCPV) modules		36 to 41%	N/A	It has only recently become available for commercial applications	
Dye-sensitized modules		1-5%	N/A	R&D Phase	
Organic or Polymermodules		1%	N/A	R&D Phase	

Source: International Renewable Energy Agency

As a result of the analysis undertaken on the FESIA, two parabolic CSP plants, one tower CSP and one PV plant were selected for the NOORo Complex. While other alternatives could have been considered, the current mix provides a sustainable solution while avoiding overreliance on a single solar technological solution.

3.5.3 Alternative Project Location

The proposed site has been selected for the following reasons:

- Unoccupied land;
- Existing Infrastructure (within an existing Solar Power Complex);
- Lack of biological features of significant concern;
- No significant cumulative impacts foreseen resulting from the operation of the Complex,
- No economic or physical displacement required;
- Convenient topographic conditions;
- No surface water bodies in the project site;
- No areas or archaeological sensitivity;
- Availability of fresh water from the existing Complex's water tank, and
- Significant solar radiation (2,100 to 2,250 kWh/m^2 GHI).

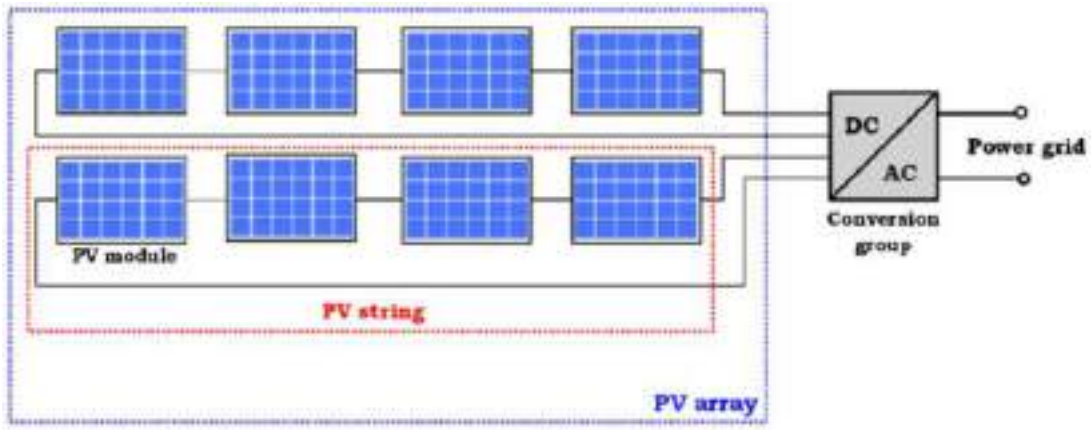
Alternative locations are unlikely to offer all the advantages listed above.

4 PROJECT DESIGN

4.1 PV Station

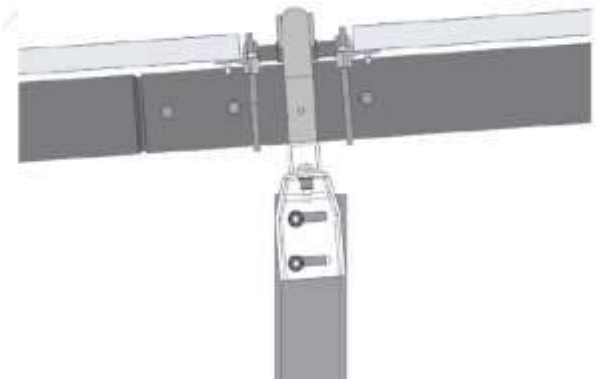
The PV Station will generate 71.5 MW_p (55 MW_{ac}). The PV arrays will occupy a total of 432,236 m^2 and consist of 223,440 modules distributed in 11,172 strings (see figure below). The PV Station will also include 16 inverters to change direct current (DC) to alternating current (AC). DC is the electricity produced by PV cells while AC is suitable to be transported through the power lines.

Figure 4-1 General PV Assembly



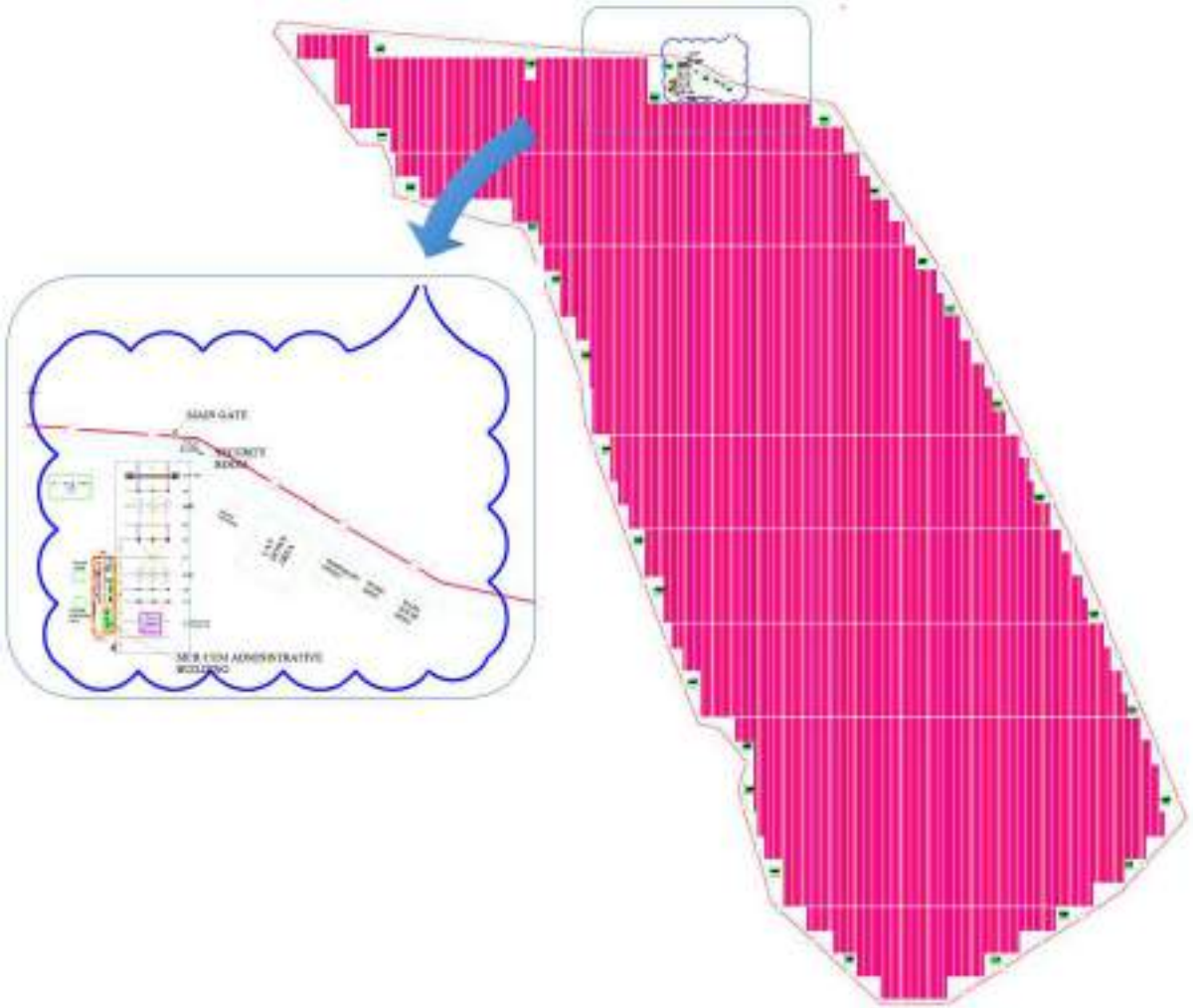
The modules will be mounted on a single axis tracker system with a bearing housing assembly attached to the piers that provides and adjustment range up to ±5˚ (8.7% grade).

Figure 4-2 Bearing Housing Assembly at 3.5 ˚ (6.1% grade)



A detailed layout is provided below.

Figure 4-3 Project Layout



4.2 Construction Equipment/Facilities

During construction, temporary facilities and equipment will be installed within the proposed PV site boundary and will be removed once the construction is complete. These facilities and equipment will include:

- Laydown area;
- Hazardous materials storage area;
- Hazardous waste storage area;
- Non-hazardous solid and liquid waste (septic tank and chemical toilets) area;
- Workshop/warehouse;
- Site offices;
- Canteen;
- Potable water storage;
- Security office;
- Diesel generators.

The above list covers key temporary facilities, but is not exhaustive

4.3 Operational Equipment/Facilities

The following permanent facilities will be built within the site boundary:

- Security building at the main gate;
- Administrative building;
- Wash Room and septic tank;
- Raw water tank;
- Reverse Osmosis polishing plant;
- Workshop/warehouse; and
- Parking area.

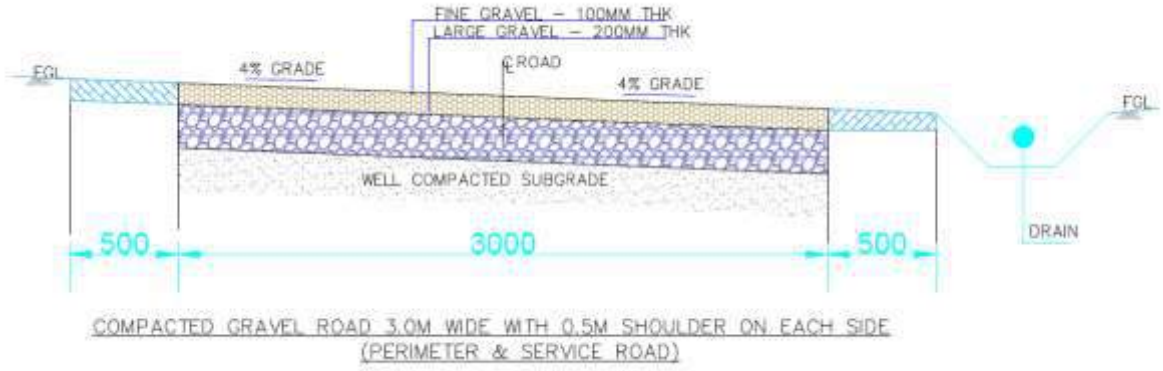
It is anticipated that at least one maintenance vehicle and one cleaning truck will be required during the operational phase.

4.4 Internal road

An internal road will be built to allow access to the site during normal and emergency operating conditions.

The internal road will comprise a one-lane 3 m wide (0.5 | 3 | 0.5) gravel road and compacted aggregate unpaved 0.5 m shoulders. Design details and alignment are provided in the figure below.

Figure 4-4 Internal Access Road

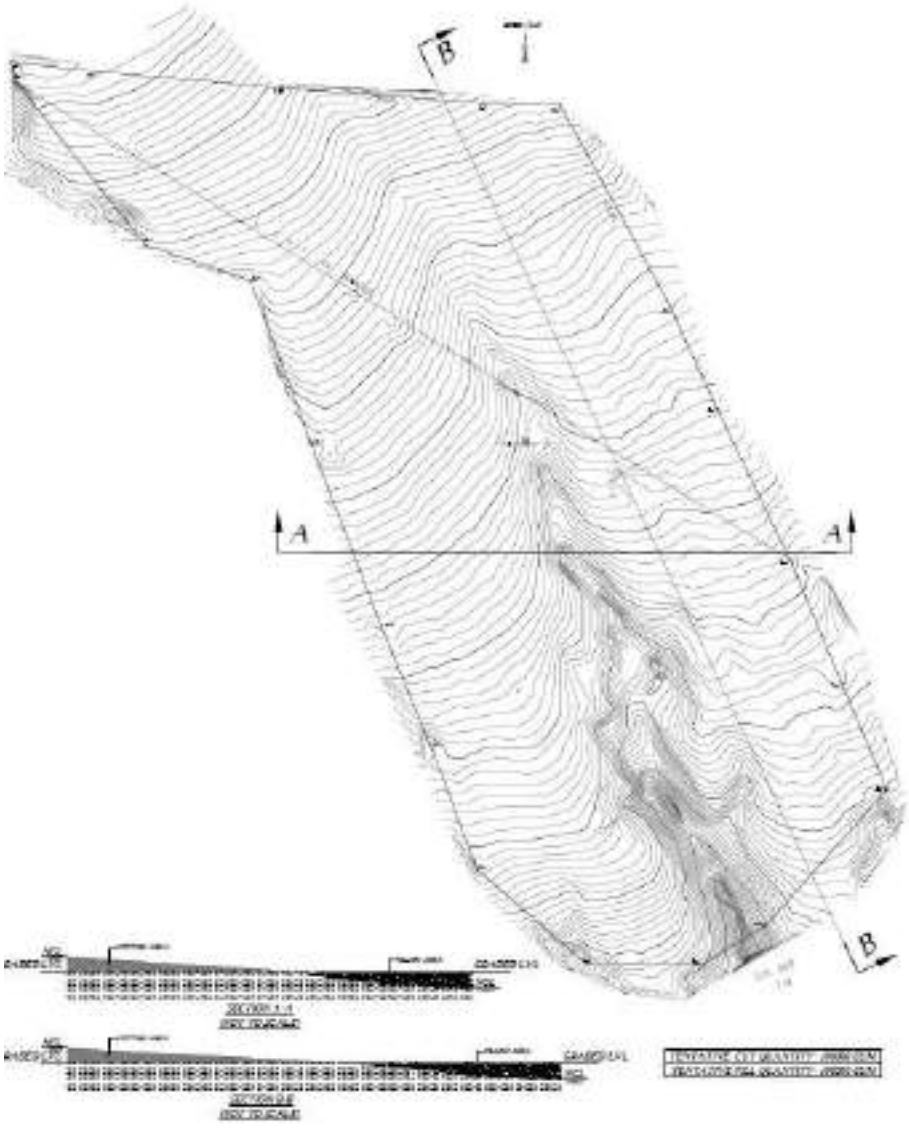


4.5 Earthworks and site levelling

Minor earthworks (levelling -cutting and filling- and compacting) will be required at the initial stage of the construction phase. Soil exportation from the site is not anticipated.

The figure below shows the tentative cutting and filling requirements to adjust the topography of the site to the required level.

Figure 4-5 Planned site levelling

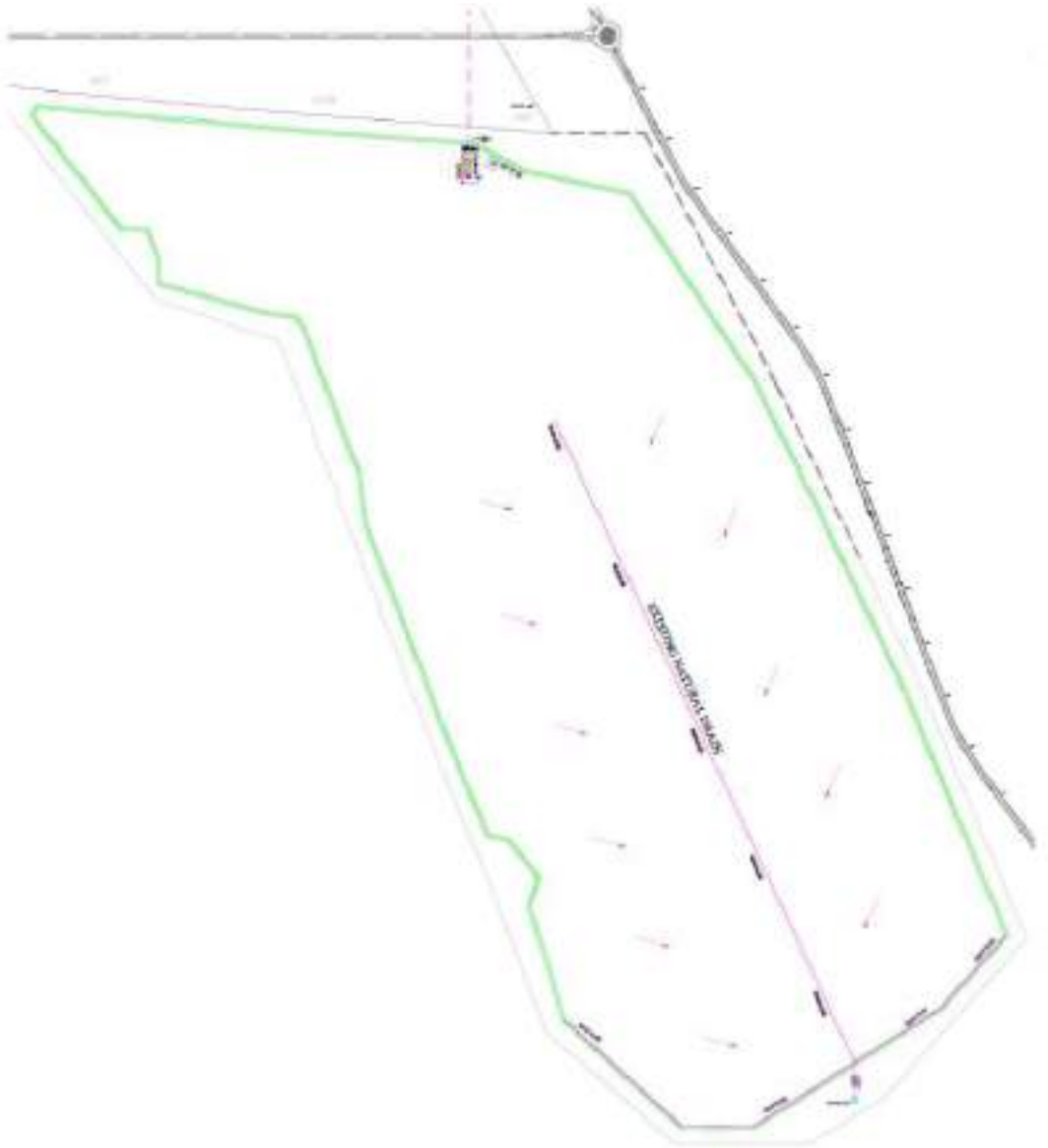


4.6 Run-off Drainage System

As a result of site levelling, the existing stormwater runoff within the site will be altered. The project design includes a site drainage system to minimise erosion and avoid flash floods. The design of the stormwater drainage system has considered the geotechnical and hydrological (i.e. natural drainage system) characteristics of the proposed site and surroundings.

As shown in the figure below, the stormwater collection system will consist of a concrete channel that crosses the project site from north to south. The drainage system will collect and direct rainwater to an interface point located at the south boundary, following the exiting ephemeral chaaba crossing the site.

Figure 4-6. Stormwater Drainage System - Ouarzazate



4.7 Power Line

The Project design includes the construction of a 2.2 km 225kV Power Line (figure below) from the project site to the existing substation owned by the Office National d'Electricité et de d'Eau Potable (ONEE) located in the east side of the Complex.

Figure 4-7 Power Line and Interconnection Point

The power line will be transferred to ONEE once its construction is complete.

4.8 Water Pipe

The project design also includes the construction of an underground pipe to connect the proposed Project to the existing common water tank for the Complex.

Figure 4-8 Water Pipe and Interconnection Point

4.9 Resource use and waste streams

4.9.1 Power Demand

Power for temporary facilities, lighting and electric equipment/machinery will be drawn from the nearest substation during the construction phase. The maximum load estimated for the NOORo IV PV is 200 KVA/month.

During the operational phase, the PV plant will be equipped with an emergency generator, for use in the administrative buildings, but not for power generation to the grid.

4.9.2 Water Demand

Water will be supplied from the Complex's water tank (figure above) and stored in an onsite water tank with a minimum capacity of 50 m^3.

The Complex's water tank is supplied by water abstraction from the Mansour Ed Dahbi Reservoir, which has been assessed in previous environmental and social studies of the

Complex. Water reuse within the project and the Complex will be maximised, as long as treated wastewater quality is adequate for proposed uses, in order to minimise water abstraction from the reservoir, which is a RAMSAR site.

The following table provides the water requirements expected for each project phase:

Figure 4-9 Phase-specific Water Requirements

Phase	Approximate Quantity	Comments
Construction	9,620 m^3 for dust suppression*, and for domestic uses.	Mainly soil conditioning and curing activities. The quality of water used for construction activities (e.g. preparation of concrete) will be monitored to ensure compliance with the parameters required in the MFS.
Commissioning	2,400 m^3/testing month (1 month)	Testing (firefighting system, spray system and containers) and equipment cleaning
Operation	The water consumption for modules cleaning is expected to be no more than 7,500 m^3/year, significantly lower than the maximum quantity (12,000 m^3/year) established in the MFS. Water for panel cleaning will not include other chemicals others than the ones suggested in the MFS. 300 m^3/year are estimated for domestic needs.	Panel cleaning (one cycle every ~28 days**) and domestic needs
Decommissioning	Quantity will be determined by the entity responsible for decommissioning, which is not expected to occur until at least 25 years from operation.	
The plant has been designed to minimise water consumption during all project phases. The maximum annual quantity of water estimated during the operation stage for all needs is significantly lower than the quantities specified in the MFS. At a later stage, the O&M Contractor might consider manual cleaning with soft sponges and squeegees as an option to reduce the water consumption over the operational phase. The O&M Contractor estimates that this alternative may reduce the water consumption by over 40 to 50%. The O&M will focus on implementing the most environmentally and cost effective cleaning solution in line with the requirements recommended by the manufacturer of the PV panels and the MFS. The reuse of wastewater on site is allowed if the following conditions are met: - Wastewater is treated in the ONEE STEP; - Analysis are provided to Masen showing that national and international water quality		

Phase	Approximate Quantity	Comments
		standards are met before its discharge into the environment; - Authorizations are obtained from local authorities allowing the reuse of the water. *This amount might vary as a result of local soil conditions, climate variables and weather conditions. **Manual dry cleaning might be considered after sand storms.

Construction water quality will be monitored on a regular basis to ensure that the following values are met, as suggested in the MFS:

Table 4-1 Permissible limits applicable for construction water

Organic content	200 mg/l
Inorganic content	3000 mg/l
Sulphates (SO4)	500 mg/l
Chlorides (Cl)	a) 1000 mg/l for RCC work b) 2000 mg/l for PCC work
Suspended solids	2000 mg/l
Alkalinity	Neutralize 200 ml of sample should not require more than 10 ml of 0.1 normal HCl using methyl orange as an indicator
pH	Neutralize 200 ml sample of water should not require more than 2 m of 0.1 normal NaOH (Caustic soda). The pH value of water shall generally be not less than 6

PV Panel Cleaning

Automated wet cleaning technology will be used to remove dust and other particles accumulated on the panels. Automated cleaning is a high quality cleaning solution that provides cost optimization and lower occupational health and safety risks while requiring less quantity of water than other technologies available in the market.

The following solution for wet cleaning has been approved by the PV panels supplier:

- Cleaning truck/tractor with water temperature, flow and pressure regulation system and water trailer with a minimum capacity of 5,000 l, and
- Mobile cleaning arm attached to the tractor.

This system will be operated by one employee. It is estimated that one automated cleaning cycle (for all cells) will require 24 days and the tractor will consume ~800 l of fuel.

Cleaning procedures will be initiated when the energy generation efficiency is low. Cleaning frequency will attempt to keep loses resulting from soiling below 2%, using a specific tool to measure soiling losses -similar to a Dust Detection System (DDS). Weather conditions and

forecast will be considered before initiating cleaning. The cleaning will be done at night to avoid thermal shock and potential cell failures.

Allocation of additional workers for manual dry cleaning might be considered under specific conditions that result in 10% loses from soiling accumulation (e.g. after dust storm events or other conditions).

The PV plant will include a Reverse Osmosis (RO) Water Treatment Plant to ensure that water for panel cleaning contains no deposits that might remain on the PV cells once dried. The RO plant will have a capacity to produce 1,000 LPH (l per hour.)

Table 4-2 Permissible limits applicable to water for panel cleaning

Parameter	Value
P.H	6,5- 8.5
Conductivity	<250 us/cm
TDS	25-150 mg/l
Total Alkalinity	25-65mg/l as CaCo3
Total Hardness	25-70 mg/l as CaCo3
Calcium Hardness	25-65 mg/l as CaCo3
Magnesium Hardness	‹15 mg/l as CaCo3
Chloride	‹50 mg/l as Cl
Sulphate	‹3 mg/l as So4

4.9.3 Wastewater

During construction and operation, all wastewater generated (mostly domestic) will be stored in appropriate waterproof septic tanks and collected by licensed operators. The expected amount of domestic wastewater generated is 15 l per worker per day.

Contamination of stormwater will be avoided by preventing rain and runoff from entering material storage rooms, maintenance sheds, and other areas that contain hazardous materials.

During operation, the RO Plant will be receiving and polishing the water stored in the NOORo Complex water tank, in order to meet the water quality limits listed in table 4-3. Since the water from the NOORo Complex tanks is potable grade water, and the requirements for the PV cleaning water only require a further reduction in the concentration of dissolved minerals and solids, the proportion of reject water resulting from the polishing process will be negligible. This reject water will be stored in appropriate impermeable tanks and collected by licensed operators.

4.9.4 Non Hazardous Solid Waste

The main types of waste generated during the construction phase will be inert (sand, gravel, glass, plastic, cables, metals, packaging materials, etc.) and domestic waste from workers.

During operation, the main types of expected waste are: domestic waste, plastic, paper, and cardboard. Waste handling during construction and operation phase will include storage in separate containers in a dedicated area within the site and regularly collected by licensed operators.

4.9.5 Hazardous Materials and Wastes

Materials

The construction and operation of a PV power plant does not require the storage of significant amounts of hazardous materials.

Fuel for vehicles and equipment will be stored onsite during construction, and small amounts of fuel for the emergency generator during the operational phase.

During operations, hazardous fluids will be integrated in the equipment (oil in the transformers or H_2SO_4 in batteries).

Waste

Other than sanitary wastewater, small amounts of hazardous waste (e.g. empty fuel drums or damaged PV panels) will be generated by the construction and operational maintenance activities.

Hazardous waste will be stored in adequate containers/facilities and collected by an authorized hazardous waste management company.

4.10 Security Provisions

The project site is already fenced and will include a closed-circuit television (CCTV) surveillance system operated from the main control room. An Access Control System will also be installed at the Security Gate to ensure registered and authorized entry only.

A security provider will be employed and trained security personnel will be onsite site 24/7 to protect access and the workforce. The number of security guards required and the equipment needed is based on existing regional security/safety conditions, previous experiences from the EPC/O&M contractors in similar projects and previous experiences of the security provider. It is expected that no more than 6 guards working in pairs on a shift rotation will be required.

It should be noted that the Complex is already secured by security guards employed by MASEN and by the Royal Gendarmerie.

5 CONSTRUCTION SCHEDULE AND WORKFORCE

The construction phase of the PV facility is expected to last approximately twelve months from the Notice to Proceed (NTP), which is planned for the first quarter of 2017. A detailed construction schedule is included in Appendix 1. No night time works are anticipated during construction.

The following main works will be undertaken during the construction of the Project:

- Civil works ("cut and fill") at the site.
- Infrastructure works (PV site): construction of the fence, internal road, drainage system, etc.
- Infrastructure works (power line): foundations, erection of poles and installation of wire conductors (i.e. stringing, tensioning, clipping, etc.), connection to interconnection point.
- Infrastructure works (water pipe): excavation of trenches, pipe positioning and assembly, installation of valves and metering equipment, covering of trenches, etc.
- Construction of PV site facilities, pipework, etc.
- Installation of PV panels, mounted on a single axis tracker system foundation, and other equipment (e.g. Reverse Osmosis Plant).
- PV connection to power line.

The figure below shows the estimated total workforce and man-hours per month during the construction phase of the photovoltaic power facility.

Figure 5-1 Expected Construction Workforce

The project will result in the creation of employment locally during both construction and operations and, subsequently, the dissemination of best practice construction skills into the local labour force. The local economy is likely to benefit from the use of local businesses and services.

Foreign workers will likely be accommodated in the city of Ouarzazate or other nearby villages. If any worker accommodation is developed for the project, it will be designed and

operated in accordance with the IFC requirements, as outlined in the. Workers' accommodation: processes and standards guidance note by IFC and EBRD.

6 SESIA METHODOLOGY

6.1 Introduction

The SESIA methodology is specific to each of the technical subjects but includes, as a minimum, a desk study review of available information and standards, on-line information sources and existing site data and laboratory analyses where available. Detailed site surveys, monitoring and predictive modelling have been undertaken to determine the baseline situation and to predict impacts that are likely to occur during the construction, operational and decommissioning phases of the proposed project.

6.2 Baseline Conditions

Document Review

The following documents have been reviewed and provided key information for the SESIA:

- Framework Environmental Impact Assessment (FESIA) of the NOORo IV Complex, prepared by MASEN for the Complex in 2011 and updated in 2014. Original document in French.
- Revised (3rd amendment) Request for Proposals. April 2016, prepared by MASEN.

Baseline Surveys

Forming an integral part of the SESIA, the baseline surveys provide a benchmark of the existing conditions by which the potential impacts of the proposed NOORo IV project can be assessed for construction and operational phases.

The environmental baseline surveys carried out as part of the SESIA have consisted of the following:

- Site walkover survey – February 2016;
- Biodiversity baseline survey – November 2016;
- Air quality baseline survey – November 2016;
- Background noise monitoring – November 2016;
- Soil sampling survey – November 2016, and
- Social survey – November 2016.

These surveys are described further within the relevant chapters.

The analysis of the physical, natural and social environment has considered the immediate site as well as an appropriate buffer surrounding the project site. The buffer width will vary in accordance with the environmental and social issues).

The identification of the buffer area of the Project follows international best practice procedures (Institute of Ecology and Environmental Management IEEM 2006) and has taken into consideration the type of project, the construction methods, the operation activities, and the environmental and social setting of the project site. Therefore, for each environmental and social issue the buffer width is based on the extent to which impacts from the construction and operation of the proposed Project would extend if no mitigation measures were implemented.

6.3 Impact Assessment Significance Criteria

In order to obtain a credible assessment of environmental impacts, the assignment of 'impact significance' for each identified impact needs to be a robust, consistent and transparent process. The methodology to assess 'impact significance' is outlined below and follows International Best Practice based on the assumption that the significance of an impact on resources or receptors is considered to result from an interaction between three factors:

- The nature and magnitude of the impact or change;
- The number of resources or receptors affected; and
- The environmental value (sensitivity) of those resources or receptors to the change.

A three-step approach has been used to determine the significance of environmental effects, as follows:

- Step 1 – evaluation of value / sensitivity of resource;
- Step 2 – assessing the magnitude of the impact on the resource; and
- Step 3 – determining the significance of effects.

The environmental value (or sensitivity) of the resource or receptor has been defined by using the criteria below in the table below.

Table 6-1 Environmental Value of Receptor or Resource

Value (sensitivity)	Description of Value
Very High	High importance and rarity on an international scale and limited or no potential for substitution. The receptor has already reached its carrying capacity, so any further impact is likely to lead to an excessive damage to the system that it supports. Locations or communities that are highly vulnerable to the environmental impact under consideration or critical for society (e.g. indigenous peoples, hospitals, schools).
High	High importance and rarity on an national scale, and limited potential for substitution. The receptor is closed to reaching its carrying capacity, so a further impact may lead to a significant damage to the system that it supports. Locations or communities that are particularly vulnerable to the environmental impact under consideration (e.g. residential areas, vulnerable/marginalized groups).
Medium	High or medium importance and rarity on a regional scale, limited potential for substitution. The receptor is already significantly impacted, but it is not close to reaching its carrying capacity. Further impacts will get increase the stress of the underlying system, but evidence does not suggest that it is about to reach a critical point. Locations or groups that are relatively vulnerable to the environmental impact under consideration (e.g. commercial areas).
Low (or Lower)	Low or medium importance and rarity on a local scale. The receptor is not significantly impacted and shows a large spare carrying capacity. Impacts are not likely to generate any noticeable stress in the underlying system. Locations or groups that show a low vulnerability to the environmental impact under consideration (e.g. industrial areas).
Very Low (sensitivity)	Very low importance and rarity on a local scale. The receptor is not impacted and shows a very large spare carrying capacity. Impacts are very unlikely to generate any noticeable stress in the underlying system. Locations or groups that show a very low vulnerability to the environmental impact under consideration (e.g. industrial areas).

The existence of receptors that are legally protected (e.g. designated areas, protected habitats or species) will be taken into consideration for the assessment of the sensitivity of the receptors.

The magnitude of the impact is defined where possible in quantitative terms. The magnitude of an impact has a number of different components, for example: the extent of physical

change, the level of change in an environmental condition, its spatial footprint, its duration, its frequency and its likelihood of occurrence where the impact is not certain to occur.

The criterion that has been used for assessing the magnitude of impacts includes the geographical scale of the impact, the permanence of the impact and the reversibility of the impacted condition. A brief description of the magnitude of the impacts is provided in the table below.

Table 6-2 Criteria for Magnitude of Impact

Magnitude of Impact	Description of Magnitude
Major	Adverse: Loss of resource and/or quality and integrity; severe damage to key characteristics, features or elements. A major impact is usually large scale, permanent and irreversible. Beneficial: Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Moderate	Adverse: Significant impact on the resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements. Moderate impacts usually extend above the site boundary, and are usually permanent, irreversible or cumulative. Beneficial: Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse: Some measurable change in attributes quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Minor impacts usually are only noticeable within the site and are temporary and reversible. Beneficial: Minor benefit to, or addition of, one (maybe more) key characteristic(s), features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse: Very minor loss or detrimental alteration to one or more characteristics, features or elements. Beneficial: Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

In addition to the factors outlined in the table above, the possibility of any standards being breached will be taken into consideration in the determination of the magnitude of the impact.

The significance of effects is a combination of the environmental value (or sensitivity) of a receptor or resource and the magnitude of the project impact value (change). The table

below shows the criterion used for determining the significance of effects. Definitions of each significance category are provided for in the table further below.

Table 6-3 Criteria for Determining Significance of Effects

		Magnitude of impact (degree of change)				
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
Environmental value (sensitivity)	**Very High**	Neutral	Minor	Moderate to Major	Major	Major
	High	Neutral	Minor	Minor to Moderate	Moderate to Major	Major
	Medium	Neutral	Negligible to Minor	Minor	Moderate	Moderate to Major
	Low	Neutral	Negligible to Minor	Negligible to Minor	Minor	Minor to Moderate
	Very Low	Neutral	Negligible	Negligible to Minor	Minor	Minor

Table 6-4 Definition of Significance of Effects

Significance Category	Criteria
Very Large	Only adverse effects are assigned this level of importance as they represents key factors in the decision-making process. Effects are associated with sites and features of national or regional importance. Effects exceed statutory limits. Mitigation measures are unlikely to remove such effects.
Large	Important considerations at a local scale but, if adverse, are potential concerns to the project and may become key factors in the decision making process. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.
Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource. They represent issues where effects will be experienced but mitigation measures and detailed design work may ameliorate or enhance some of the consequences upon affected communities or interests. Some residual effects will still arise.
Minor	Local issue unlikely to be of importance in the decision-making process. Effects do not exceed statutory limits. Nevertheless, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures.
Neutral or Negligible	No effect or effect which is beneath the level of perception, within normal bounds of variation or within the margin of forecasting error. No mitigation is required.

It should be noted that the decommissioning phase of the project has only been discussed in general terms since the proprietorship will change once the 25-year Power Purchase Agreement (PPA) ends. The Project will be handed over to MASEN at the end of the 25-year period and consequently the responsibilities for the decommissioning of the plant will fall under the responsibility of the future owner.

7 CONSULTATION PROCESS

The scale and nature of the proposed project and the emphasis that the IFC Performance Standards place upon community involvement or affected parties emphasise this important aspect of the environmental and social impact assessment process.

The SESIA has included a process by which the project stakeholders' input on matters affecting them is sought. The main goals of this procedure have been improving the efficiency, transparency and public involvement in the projects.

The project may have an impact on communities and consultation is key to understanding the existing social constraints, identifying any community grievances and identifying mitigation measures. Mitigation for the social or environmental concerns of these stakeholders has been considered at an early stage of the project development.

In Morocco, the public consultation process (*enquête publique*) is well defined under decree no. 2-04-564 and is a pre-requisite to carrying out the SESIA. The procedures and objectives are similar to those defined under the IFC Performance Standards 1, 4, 5, 7 and 8, which ensure that the development of the Project considers any impacts or practices which may affect local communities or other stakeholders.

For this project, the public consultation process has already been undertaken in accordance with the procedures outlined for the FESIA preparation. Additional meetings included:

- First Public Consultation to introduce the concept for the NOORo Solar Power Complex. November 3rd,2010.
- Second Public Consultation to provide an update of the FESIA. March 6th 2012.
- Specific Public Consultations for the SESIA of NOORo I. November 2nd, 2012.
- Presentation and public consultation of the Updated FESIA, June 9th 2014,,
- Specific Public Consultations for the SESIA of NOORo II & III. February 3rd,2015.

However, in order to meet the IFI's requirements, additional and project specific public consultation was carried out on November 28th, 2016. The detailed report of the community consultation meeting, along with the stakeholder engagement plan are provided in the annexes (SESIA-Volume 4).

7.1 Consultation Meeting

The public consultation meeting was advertised through the publication of an advert in French and Arabic in national newspapers and the invitation of identified stakeholders in Ghassate Commune. The meeting was led by representatives of 5 Capitals, Phenixa, ACWA Power and MASEN. Local Arabic was spoken during the meeting (punctually French) and 38 people attended.

A copy of the non-technical summary in French and Arabic was provided to all attendees and an initial presentation was undertaken to outline the main elements of the NOORo IV project, to summarise the baseline conditions in the study area (physical, biological and socioeconomic), to outline the positive and negative impacts identified, explain the preliminary assessment undertaken and specify the mitigation measures that were being considered.

The stakeholders present at the meeting consisted of the following:

- Population;
- Provincial technical departments (Ouarzazate province Environment Department);
- Elected Communal councillors;
- Naibs of collective lands;
- Non- Governmental Organisations (<Al Fadaa Al Jamawi > Espace Associatif de Ghessate, l'Association Environnementale Tasselmante, Association Annakhil); and
- Government bodies such as the Délégation de Energies et Mines, Délégation de l'ABHSM (Agence du Bassin Hydraulique de Souss Massa), Centre Régional d'Investissement(CRI), DPE Transport, Transport et Logistique, Agence urbaine de Ouarzazate, Délégation du Ministère de la Santé..etc).

The meeting was considered to fulfill its aims, for the following reasons:

- It allowed for precise information to be provided about the main issues raised by the local population;
- It confirmed that the concerns raised by the population were in line with the mitigation measures being proposed.

The following is a summary of the perspectives and concerns of the stakeholders:

- Employment and training of the local population;
- Activities in support of initiatives for the development of health services, education, culture and economics;
- Communication and grievance mechanisms;
- Environmental impacts in relation to water consumption, waste management, wastewater management, fauna/flora; and
- Communications and grievance mechanisms

The following table summarises the most commonly raised questions and concerns raised, and the mechanism proposed/addressed in the design of the project:

Table 7-1 Summary of comments and question

Question/Comments	Provided Clarifications
Will fuels/hydrocarbons be stored on site? What measures have been implemented to ensure compliance with local directives	No fuels will be stored on site
Has the impact of Hail damage been considered in the design of the PV panels?	The PV panels, unlike parabolic mirrors, are not damaged by hail.
The village of Tasselmant is the closest village to the NOOR Ouarzazate complex.. Yet, to date, the proposed social mitigation measures that have been implemented, including employment opportunities, have not clearly benefited to the residents of Tasselmant.	Employment for the project is carried out via the ANAPEC. Priority is given to the residents of Ghassate commune, then Ouarzazate province and then nationally, according to the available qualifications. Currently, 80% of the Solar Complex employees are Moroccan nationals, and of these 50% are from Ghassate and Ouarzazate. Encouragement of local employment will also be targeted for NOORo IV project. Economic uplift to the regional population (Ghassate commune) has also been provided by way of the Date Palm rehabilitation program, which has resulted with an increase in employment and date production yield. Equally, goats (male and female) have been provided to 10 families for herding and propagation.
Some Douar residents are complaining about local employment or economic benefit from the development of the NOORo solar complex. They recommended that ANAPEC should open a local office to facilitate communication and employment potential.	
Other villages are closer to NOORo IV project site, and as a recommendation the residents of these villages should also be prioritised for employment opportunities.	
In order to facilitate the employment of women at the industrial level, some form of training and skills development is required, which is not limited to artisanal activities.	The integration and employment of women is an on-going and regular process and is commensurate with demand. Artisanal activities have been proposed because it has been requested by women. As an example, NOORo II&III currently employs 100 women.
Have long term impacts to air, soil and water been considered?	Monitoring has been implemented at the construction and operation phases of all NOORo projects. Also, the design and operation of solar power complex, has the least impact on these environmental issues.

Question/Comments	Provided Clarifications
ACWA Power should ensure that the social and environmental coordinator is a local resident, and be present at the project site.	Mr. Mustapha MECHMOUM from ACWA Power is the local point of contact for all social and environmental grievances raised by the public.
A new waste management facility has been completed in Ouarzazate and an O&M will shortly be selected. As such ACWA Power should liaise with the new waste management facility for the handling and disposal of all wastes.	Currently, solid wastes generated by the Complex are being handled by specialist waste management companies, based on the type of waste category. Similar process will be implemented for NOORo IV for construction and operation phases. Domestic waste is being handled by the local waste disposal facility. Once the O&M is selected, ACWA Power will consider entering into a contract agreement for disposal of the general waste.
ACWA Power should consider developing a technical training and skills development program which would enable candidates to open new businesses or seek employment outside of the local region.	ACWA Power and MASEN are heavily involved in social and cultural development programs , including technical trainings and skills development programs.. Additionally MASEN is focused on the development and support of employment services, infrastructure projects and sustainable developments in the province. Efforts will be maintained and strengthened
The water consumption/demands for the NOORo IV project are lower than the total projected demands in the FESIA	The design and operation of the PV system selected for this project, has the lowest water consumption requirements. It is also noted that overall consumption of water for the Solar Complex has significantly decreased with respect to the projected demand in the FESIA, thanks to the selection of technologies that require little to no water (i.e. dry cooling system for CSP plants).
Has the ABHSM been consulted for the development of the stormwater system for the NOORo IV Project.	The requirements of the ABHSM have been closely followed in the detailed hydrology study and project design. Strict collaboration and communication has been maintained with the ABHSM, to ensure compliance and approval of the proposed design.
Since the start of the development of the NOORo Solar Complex, the number of operational quarries has increased from 1 to 5. Impacts on air and noise have been increasing and nothing is being done.	All quarries are operated under approval by the competent authorities. The management of these quarries is the responsibility of these competent authorities.
Transportation connections from the east of the NOORo IV project could be	The proposal will be studied/considered.

Question/Comments	Provided Clarifications
improved. Currently, a 20km detour is required for employees coming from the east. However a short bypass of just 2Km could provide a solution that would save time and minimise pollution.	
Ancients caves are located within the proposed NOORo IV project site.	The Ministry of Culture has confirmed that no archaeological artefacts or ruins are within the project. The old caves have traditionally been used by herders for refuge, and are located outside the project boundary. However, ACWA Power is open to suggestions, and was approached for converting the caves to a museum, but no further measures from the initiator have been given yet.

7.2 Stakeholder Engagement Plan

A Stakeholder Engagement Plan was prepared in order to guide the stakeholder identification, assessment, and plan stakeholder engagement actions for the SESIA and for the construction and operational phases. This SEP is a standalone Plan that will guide MASEN, the Project Company and the EPC. A Grievance Mechanism is in place and managed by MASEN.

8 AIR QUALITY

8.1 Introduction

This chapter describes the existing air quality conditions in the project site and the potential impacts that may occur as a result of the construction and operation of the proposed NOORo IV Project. This chapter also identifies the measures that will be implemented in order to mitigate these impacts. The assessment of impacts has been measured against national Moroccan standards and applicable IFC standards and guidelines.

Impacts of poor air quality can be profound and can adversely affect human health, ecosystems and vegetation. Such impacts can include long-term health impacts and premature mortality related to heart and lung problems, as well as discomfort to humans and other health effects (e.g. asthma). Short-term exposures can also be dangerous and can lead to increases in hospital admissions. The air quality impacts on the environment can have direct effects on vegetation, as well as indirect effects to the acid and nutrient characteristics of soils and waters, which in turn impact upon species and habitats.

Air quality impacts will arise throughout the lifetime of the proposed project and the duration, frequency and severity of these impacts and their significance will vary in accordance with the phase and activity of the proposed development.

In order to adequately evaluate and develop suitable mitigation and management measures for implementation in the various phases of the project throughout its lifecycle, an assessment of the current ambient air quality condition of the project area surrounding the proposed projects was carried out.

8.2 Methodology

This study has been undertaken based on the following:

- Initial identification of the relevant national and international standards and requirements relating to air quality during the construction and operational phases (included in the Legal and Administrative section of this SESIA);
- An assessment of the likely construction and operational impacts with the potential to generate air pollution;
- Determination of required mitigation measures in light of the results of the impact assessment and the residual impacts on receptors outside the site and workers at the site predicted.

Baseline information regarding the existing air quality at the site has been compiled through data gathered via field visits.

Additionally, Ambient Air Quality Monitoring (PM_{10} and $PM_{2.5}$) was undertaken on November 8-9th for 24 hours at the project site. Equipment to continuously monitor wind speed, wind direction, humidity, and temperature was also installed for the monitoring period.

Monitoring of these parameters was conducted at in the project site to provide representative air quality characteristics of the un-influenced free-field site. Measures of other parameter was not deemed significant given the current site conditions and the absence of pollutants as a result of the operation of a PV plant. The purpose of the monitoring campaign was to establish a benchmark for the parameters associated to the construction phase of the proposed PV Plant, and will therefore be used for evaluation purposes. The results and discussion are provided in the next section.

Table 8-1 Air Quality Sampling Coordinates

Monitoring Station	Lambert Coordinates		Description	Sampling time
	X	Y		
OS1	363 311.383	48 231.552	Centre coordinate of PV project site	24 h

Figure 8-1 Air Quality Survey Location (OS1)

8.3 Baseline

8.3.1 Existing Air Quality Conditions

The proposed Project will be built within an existing solar power complex in which one solar CSP project is in operation and two CSP projects are currently under construction. Therefore, dust and other parameters associated with exhaust fumes could possibly be found in the local airshed resulting from the current construction activities/vehicles/equipment.

Otherwise, no point sources of emissions from industries are located within the project's air shed. The closest non-point source are the vehicles travelling on the N10, located 3 km south from the proposed Project site, and the small road to Tasselmant adjacent to the proposed Project site.

Analytical Results

The construction of a photovoltaic power plant typically result in increased dust levels, mainly resulting from site preparation activities and, at a lower level from vehicle movements. During operation, activities that are likely to generate dust are minimal, since the PV panels have to be kept dust free in order to maximise power generation. As such, and considering the existing impacts to ambient air quality, the project's impacts are considered negligible, and only particulate matter has been considered for the air quality survey.

Table 8-2 Air Quality Results

Parameter	IFC EHS General GLs/WHO GLs	Moroccan	Results (OS1)
PM_{10}	150 (Interim target 1)	90.4 50%centile	22.8
	100 (Interim target 2)		
	75 (Interim target 3)		
	50 (guideline)		
$PM_{2.5}$	75 (Interim target 1)	-	10.5
	50 (Interim target 2)		
	37.5 (Interim target 3)		
	25 (guideline)		

The monitoring values observed for coarse dust particles PM_{10} (2.5 to 10 micrometres ⌀) and fine dust particles $PM_{2.5}$ (<2.5 micrometres ⌀) show that the ambient air quality conditions within and adjacent to the NOORo IV project site are well within the national and international ambient air quality guidelines, and considered good.

8.4 Sensitive Receptors

In accordance with good international practice, the assessment of sensitive receptors should consider up to 500 m from the site boundary for both human and ecological receptors (Holman et al, 2014), due to the typical distance of dust dispersion. The assessment of other pollutants (e.g. gaseous exhaust fumes) will require a smaller area of assessment (~ 200 m) as suggested by Bignal, K. et al, 2004, before emissions are indistinguishable from background concentrations.

Table 8-3 Air Quality Sensitive Receptors

Receptor	Sensitivity	Justification
Air Quality (Gaseous and Particulate)	Low	The proposed location is within a non-degraded air shed as no significant polluting sources are found in the neighbouring area.
Residents – Transport Route	Medium	Construction and operational vehicles will use the available route from the Casablanca/Agadir Port, which goes through several residential areas where there is no bypass road (e.g. city of Ouarzazate), so all traffic bringing equipment from the ports is likely to cross such residential area leading to increased air pollution. Human exposure to air pollutants can lead to health effects, principally in the respiratory system.
Site employees	High	Workers will experience emissions from heavy machinery and generators, and increased dust conditions. Human exposure to air pollutants can lead to health effects, principally in the respiratory system.

No other sensitive receptors have been considered as MASEN's office is located ~1.3 km west from the northwester corner of the Project. The closest residential area (village of Igherm Ammella) is located ~2.1 km away and the NOORo II & III workers' camp is located 7 km north from the proposed NOORo IV site.

8.5 Construction Assessment

8.5.1 Potential Impacts

During construction, the ambient air quality at the Project site (including the proposed 225 kV power line alignment) may potentially be affected by increased dust, particularly during the earthworks phase and by gaseous exhaust fumes from construction activities, equipment and additional vehicle movements to and from the site.

The principle anthropogenic sources of dust and emissions at the project site during construction will be:

- Excavation and earthwork, such as ground breaking, levelling (cutting and filling), preparation of pipe trenches, etc.;
- Vehicle movement over unpaved surfaces;
- Movement of vehicles to and from the site and 225 kV PL corridor (e.g. for deliveries);
- Dust from uncovered stockpiled powdery materials or truckloads;
- Emissions (e.g. NOx, SOx and CO) and particulates from vehicles, diesel generators, heavy plant and other mechanical equipment; and
- Stored VOCs and other volatile hazardous materials.

Dust due to site preparation

Dust resulting from construction activities typically comprises large diameter particles, which settle rapidly and close to the generation source, e.g. within 500m under low/calm conditions. Far field dust impacts from construction works are therefore not considered significant. Studies by the US EPA (1995) show that particles larger than 100 μm will likely settle out within 6 to 9 m from the point of emission at wind speeds of 16km/h. Factors such as the meteorology and particle mass will influence the dispersion of dust.

Additional impacts relate to the movement of soil where trucks are not effectively covered, or where vehicles are moving on unpaved surfaces.

The significance of dust impacts from construction works is largely based on the direction of the wind and the proximity of sensitive receptors. The prevailing wind direction the project area may vary between seasons and could therefore disperse dust in almost any direction.

Dust due to movement of trucks and material transportation

Except for vehicle movements on unpaved surfaces, dust due to the movement of trucks and material transportation should only occur where mitigation measures are not effectively implemented at the site or in the access road being used by the construction vehicles.

Uncontained and/or un-sheeted trucks may be subject to losses of material where the containment is not effective (i.e. spills), or where wind or other air turbulence may disturb the contents and result in dispersion of material. Such impacts have the potential to degrade local air quality in the immediate area of such movements, if particles become suspended.

Vehicular and Equipment Gaseous and Particulate Emissions

Vehicles and equipment that operate on liquid fuel (i.e. oil) will result in the emission of gases and particulates to air due to the combustion of fossil fuels. Such vehicle and equipment include, but are not be limited to the following:

- Excavators;
- Graders;
- Trucks;
- Generators, and
- Hand held equipment operating on liquid fuel.

Air quality impacts relating to the use of the above are generally small. Equally, the equipment used on site is relatively new and well maintained; as such these impacts are unlikely to occur.

Where there are multiple vehicles or equipment in operation, the potential for cumulative impacts from the combination of these emissions increases.

Volatile Organic Compound (VOC) emissions

A small volume of fuels, paints, solvents and other volatile substances are required during the construction phase. If not properly contained, such substances have the potential to result in the dispersion of volatile emissions to the local air shed. However, only small volumes of these substances will be needed, and these will be stored at the laydown area. As such, the potential impacts are limited to the immediate area.

The following table summarises the predicted impact levels from the various sources on the nearest sensitive receptors.

Table 8-4 Air Quality – Magnitude of construction impacts

Impact	Magnitude	Justification
Dust from Earthworks and site activities	Minor	Temporary but reversible effects and cumulative loss of air quality in the site and immediate surroundings due to dust dispersion outside project boundary. All dust impacts will be generated outdoors, reducing the impact magnitude due to dust dispersal in addition to dust settling.
Dust from Vehicles (including the PV and PL).	Minor	Temporary and reversible impacts are anticipated and the number of vehicles is expected to be low. Dust suppression will be employed when and where necessary. All dust impacts will be generated outdoors, reducing the impact magnitude due to dust dispersal in addition to dust settling.
Gaseous and Particulate emissions from Vehicles (including the PV and PL).	Minor	Minor temporary impacts are likely to occur at the project site throughout the construction phase.
VOCs and other hazardous volatiles	Minor	Noticeable temporary impacts are anticipated, but these will be limited to the site.

Table 8-5 Air Quality - Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Dust from Earthworks and site activities	Minor	Air Quality (Gaseous and Particulate)	Low	Negligible to Minor
		Construction employees	High	Minor to Moderate
Dust from Vehicles (including the PV and PL).	Minor	Air Quality (Gaseous and Particulate)	Low	Negligible to Minor
		Construction employees	High	Minor to Moderate
Gaseous and Particulate emissions from Vehicles (including the PV and PL).	Minor	Air Quality (Gaseous and Particulate)	Low	Negligible to Minor
		Residents – Transport Route	Medium	Minor
		Construction employees	High	Minor to Moderate
VOCs and other hazardous volatiles	Minor	Construction employees	High	Minor to Moderate

8.5.2 Mitigation Measures

An Air Quality Monitoring Program will be implemented an this is described on Chapter 20 Monitoring Plan, of this ESIA.

Impact / Source	Mitigation Measure	Responsibility	Schedule
Dust from Earthworks and site activities & Dust from Vehicles (including the PV and PL).	Site preparation and levelling will be undertaken during periods of low winds (<15 km/h).	EPC and Subcontractors	CESMP –Site preparation
	Material stockpiles of dusty materials higher than 5 metres will be avoided where possible, with dust suppression sprays being utilised on any piles during periods where the wind speed exceeds 15km/h. Treated wastewater from exiting projects will be used when possible to minimise water withdrawal from the RAMSAR reservoir. Alternatively, stockpiles of dusty materials can be covered.	EPC and Subcontractors	CESMP – Construction Management and Monitoring
	Adding to stockpiles of dusty materials will be stopped when high winds are present (15 km/h).	EPC and Subcontractors	CESMP – Construction Management and Monitoring
	Dusty material stockpiles will be located only onsite and away from the site boundaries.	EPC and Subcontractors	CESMP – Construction Management and Monitoring
	Where sand and other dusty materials are transported to site, trucks will not be overloaded and will be appropriately covered / sheeted to avoid loses en-route.	EPC and Subcontractors	CESMP – Management and Monitoring

Impact / Source	Mitigation Measure	Responsibility	Schedule
	Powdery materials (e.g. cements) will be stored and transported in sealed containers	EPC and Subcontractors	CESMP – Management and Monitoring
	No burning of wastes or other materials will be allowed on site through the construction phase.	EPC and Subcontractors	CESMP – Management and Monitoring
	Undertake daily visual assessment of dust levels and take actions (dust suppression) to reduce emissions, when these are identified as excessive.	EPC and Subcontractors	CESMP – Monitoring
	Transport of uncovered dusty loads (materials and waste) is strictly forbidden.	EPC and Subcontractors	CESMP – Management and Monitoring
Gaseous and Particulate emissions from Vehicles (including the PV and PL).	Onsite/offsite speed limits are included in the Traffic and Road Safety Section of this SESIA. Besides road safety, these limits will contribute to reduce exhaust gases resulting from traffic movements.	-	-
	Efficiently manage deliveries of equipment/plant to the site, to reduce the number of trips.	EPC and Subcontractors	CESMP – Management
	Minimise exhaust fumes and particulates emitted from trucks and vehicles by ensuring the use of vehicles in good condition. Vehicles entering the site for the first time will be inspected for their worthiness and where necessary will not be permitted to enter the site.	EPC and Subcontractors	CESMP – Management & Monitoring
VOCs and other Fugitive Emissions	Hazardous materials stored and used on site with potential gas emissions (e.g. Volatile Organic Compounds) will be located in built well-ventilated, secure low-risk areas.	EPC and Subcontractors	CESMP – Training and Monitoring
	Fires and material burning is prohibited on the Project site.	EPC and	CESMP –

Impact / Source	Mitigation Measure	Responsibility	Schedule
		Subcontractors	Management and Monitoring
General	Personal Protection Equipment will be provided to all employees when necessary. Special attention will be given during site preparation and other activities likely to cause significant levels of dust.	EPC and Subcontractors	CESMP – Management & Monitoring

8.5.3 Residual Impacts

Following the implementation of an appropriate CESMP (which will at least include the mitigation measures outlined above, and others as noted within the Environmental and Social Management and Monitoring section) the overall residual effects are expected to be of a temporary/short-term duration and of minor to negligible negative significance.

Table 8-6 Air Quality – Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Dust from Earthworks and site activities	Air Quality (Gaseous and Particulate)	Negligible to Minor	Yes	Negligible
	Construction employees	Minor to Moderate	Yes	Minor
Dust from Vehicles (including the PV and PL).	Air Quality (Gaseous and Particulate)	Negligible to Minor	Yes	Negligible
	Construction employees	Minor to Moderate	Yes	Minor
Gaseous and Particulate emissions from Vehicles (including the PV and PL).	Air Quality (Gaseous and Particulate)	Negligible to Minor	Yes	Negligible
	Residents – Transport Route	Minor	Yes	Negligible to Minor
	Construction employees	Minor to Moderate	Yes	Negligible to Minor
VOCs and other hazardous volatiles	Construction employees	Minor to Moderate	Yes	Negligible to Minor

8.6 Operation Assessment

8.6.1 Potential Impacts

No impacts are deemed significant for the operation of the PL.

Generally, photovoltaic power plants by their very nature are zero emission facilities since it uses renewable and clean sources to generate power. The power plant will have a positive impact on the regional air quality, as it will prevent CO_2 from being emitted if a conventional fossil fuel power plant had been used.

Vehicle emissions due to movements to/from and around the site will result in limited pollutants. The typical air emissions resulting from these activities include: Particulate Matter (PM_{10} & $PM_{2.5}$), Nitrogen Oxides, Sulphur Dioxide and BTEX. Adequate protection measures must be outlined in the O&M's OESMP prior to the start of operational activities.

The onsite generator is not considered a potential source of exhaust gases as it will only be used during emergency situations (less than 500 hours per year).

Greenhouse Gas Assessment

This GHG assessment has been prepared to estimate the greenhouse emissions displacement associated with the generation of electricity from the 70 MW Ouarzazate photovoltaic power plant.

The project emissions are calculated based on the following equation:

Project Emissions = Upstream Emissions + Operational Emissions + Downstream Emissions + Leakage

Based on the IFC Greenhouse Gas Reduction Accounting Guidance for Climate-Related Projects (2013), upstream, downstream and leakage emissions are considered negligible for renewable projects since total contribution is not significant once annualized over the project life.

Electricity generated by photovoltaic power projects does not result in GHG emission and are assumed to reduce generation from more GHG-emission intense sources – i.e. displace grid generation. The following calculation has been applied:

According to the information obtained from the EPC, the expected annual energy production will be at least 163,958 MWh per year. Therefore, the environmental benefit of the project will be to reduce greenhouse gases emission in a volume of approximately 103,293.54tonnes of CO_2 tons per year - calculated based on the emission factor representative for projects supplying additional electricity to the grid in Morocco, as of 0.630 tCO2/MWh.

Annual production(MWh)*EFgrid,reduced (tCO2/MWh)=Emission Savings (t CO2-e/yr.)
163,958 MWh * 0.63 tCO2/MWh = 103,293.54 t CO2

Table 8-7 Air Quality – Magnitude of Operation impacts

Impact	Magnitude	Justification
Vehicle Emissions	Negligible	Maintenance, services or workers/visitors' vehicles will result in minimal traffic movements that are unlikely to result in identifiable impacts to local air quality.
Avoided GHG emissions	Minor Positive	The avoided GHG emissions will have a positive impact on achieving Moroccan GHG emission reduction targets.

Table 8-8 Air Quality - Significance of Operation Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Air Emissions from Vehicles	Negligible	Air Quality (Gaseous and Particulate)	Low	Negligible to Minor
		Residents – Transport Route	Medium	Negligible to Minor
		O&M plant employees	High	Minor
Avoided GHG emissions	Minor Positive	Moroccan GHG emissions	Moderate	Minor Positive

8.6.2 Mitigation Measures

Table 8-9 Air Quality – Mitigation Measures – Operational phase

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Air emission from vehicles	Regular vehicle maintenance in dedicated maintenance areas.	O&M	OESMP – operation
	Third parties employed to provide services during the operation of the project which involves regular transport to site (e.g. waste or septic tanks collectors) will be required to use vehicles regularly maintained and in good condition and will be inspected before entering the site.	O&M	OESMP – operation

8.6.3 Residual Impacts

Table 8-10 Air Quality – Residual Impacts – Operation Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Air Emissions from Vehicles	Air Quality (Gaseous and Particulate)	Negligible or Minor	Yes	Negligible
	Residents – Transport Route	Negligible to Minor	Yes	Negligible
	O&M plant employees	Minor	Yes	Negligible
Avoided GHG Emissions	Moroccan GHG Emissions	Minor Positive	No	Minor Positive

8.7 Decommissioning Assessment

A detailed Decommissioning Environmental and Social Management Plan (DESMP) will be prepared to ensure that all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not sensible to outline mitigation measures for the decommissioning phase at this stage, since decommissioning techniques are likely to be updated. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

9 NOISE AND VIBRATION

9.1 Introduction

Noise and vibration are environmental impacts that will be generated, mainly through the construction phase of the proposed NOORo IV Project. Noise and vibration may also be generated during the operational period but this is unlikely to be noticeable.

This section considers the potential effects associated with the generation of noise and vibration during the construction and operational phases of the proposed project. It includes the results of a noise modelling for the operational phase, which was undertaken to determine operational noise emissions from the plant.

The potential impacts are assessed, mitigation measures considered and the residual impacts reported.

9.2 Methodology

9.2.1 Noise

This study has been undertaken based on the following:

- Initial identification of the relevant standards and requirements relating to noise during the construction and operational phases (included in the Legal and Administrative section of this SESIA);
- An assessment of the likely construction activities and basic modelling of the potential operation phase noise generation. The assessment has been made against the permitted national and IFC standards;
- Determination of required mitigation measures, including noise abatement technologies that might be needed to comply with national and international noise limits. Mitigation measures have been recommended in light of the results of the assessment and the residual impacts on receptors outside the site and workers at the site predicted, and
- Noise modelling to assess the expected noise levels during the operational phase.

In order to establish a benchmark of the noise conditions at the site, an environmental noise survey was undertaken in the day and night time in November 2016.

During this survey, noise-monitoring measurements were conducted at two (2) locations to consider the ambient noise levels within the site and the influence of existing and surrounding noise sources. The table and figure below provide the location details.

The monitoring was undertaken using a pre-calibrated sound level meter, which was connected to a laptop for direct download of the data. A computer software specifically developed for the instrument, then interpolated the data and provided tables and graphs of the noise levels. Measurements were taken for a 15-minute period, in the day time and night

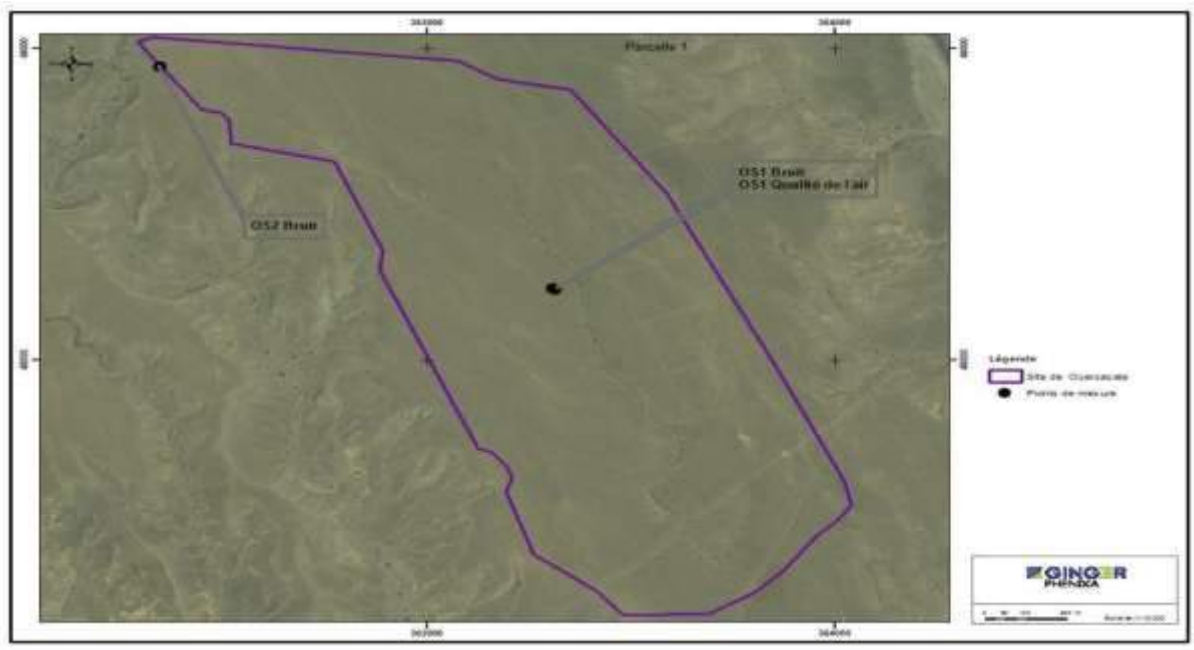
time, at each of the two locations using a broadband noise setting, within a measurement range of 20-100 dB.

The results of the noise monitoring survey will be used as a benchmark for the programmed noise monitoring activities, which will be implemented for the construction and operation phase within the ESMP.

Table 9-1 Noise Sampling Coordinates

Monitoring Station	Lambert Coordinates		Description	Sampling time
	X	Y		
OS1	363 311.383	48 231.552	Centre coordinate of PV project site	15 minutes day and night time
OS2	362 345.157	48 945.365	Along the North-East boundary of the PV project site, bordering the northwest corner of the proposed project site	

Figure 9-1 Noise Survey Locations



9.2.2 Vibration

The impacts due to vibration have been determined by considering the likely construction and operational processes involved at the proposed NOORo IV PV project. As such, a discussion of the impacts and any necessary mitigations measures has been provided in the following sections.

9.3 Baseline

The Complex is located in an isolated area, absent of residential development. The closest residential area is the village of Igherm Ammellal (~2.1 km). The closest sources of noise to the proposed NOORo IV project site are the adjacent roads, and the construction sites of NOORo II and III, which are 1.6 and 3 km away, respectively.. The closest identified source of noise is sporadic in nature and temporary as a result of the construction activities for the NOORo II and III CSP Projects. It is expected that once the construction activities have completed, the noise levels will decrease to typical historical levels, with only some road noise resulting from the movement of light commercial vehicles and private vehicles along the road that connects the N10 to the village of Tasselmant. The only other source of noise observed is the wind.

Noise Survey Analytical Results

The following tables provide the noise levels measures within the proposed project site.

Table 9-2 Noise Monitoring Results, Day Time

Monitoring Station	Measured Noise Levels Day Time			IFC EHS Noise Limits (Daytime 07:00 – 22:00) for Industrial, Commercial Areas	Description
	Leq, dB (A)	Lmax dB (A)	Lmin, dB (A)		
OS1	43.1	68.6	33.3	70	Average noise levels generally reflect a quiet environment, and are below the maximum allowable limit.
OS2	35.3	70.0	27.8		

Table 9-3 Noise Monitoring Results, Night Time

Monitoring Station	Measured Noise Levels Day Time			IFC EHS Noise Limits (Night-time 22:00 - 07:00) for Industrial, Commercial Areas	Description
	Leq, dB (A)	Lmax dB (A)	Lmin, dB (A)		
OS1	39.7	66.2	33.5	70	Average noise levels reflect a quiet environment, and are below the maximum allowable limit.
OS2	37.7	60.7	33.3		

The wind speed, during the monitoring period, was week with a minimum of 0.5 m/s and a maximum of 3.1 m/s. The predominant direction was NW-SE.

Generally, both the day time and night time noise levels at the proposed project site, reflect a quiet, undeveloped area. The levels do not change significantly between night and day and they are below the maximum allowable noise limits for residential areas.

9.4 Sensitive Receptors

The table below outlines the identified receptors in relation to noise and vibration as well as the determined sensitivity of those receptors.

In accordance with Good International Industry Practice (GIIP), the identification of sensitive noise receptors has considered a 1km buffer, which ensures that all sensitive receptors are identified considering the standard noise attenuation factors due to geometric divergence (i.e. 20 dB reduction for each tenfold increase of distance according to Murphy, E. et all, 2014). Therefore, workers at MASEN's office (located ~1.3 km west from the northwester corner of the Project boundary) and the closest residential area, the village of Igherm Ammellal (located ~2.1 km away from the northeaster corner of the Project boundary), are not considered sensitive receptors to noise or vibration generated as a result of the power plant.

Giving that the anticipated construction activities will not generate significant levels of vibration, only those sensitive receptors in close proximity to the source are considered.

Table 9-4 Noise/Vibration - Receptors sensitivity

Receptor	Sensitivity	Justification
Workers	High	Constructions workers are sensitive receptors for noise/vibration as they are directly exposed. Human exposure to consistent elevated sound levels could cause hearing impairment, stress, hypertension, etc. Repeated exposure to high levels of vibration is known to cause direct injury to the fingers and hand, affecting feeling, dexterity, and grip, besides being a known contributing factor to carpal tunnel syndrome and other ergonomic-related injuries.
Residents – Transport Route	Medium	Effects from regular human exposure to traffic noise are annoyance, sleep disturbance, stress, etc.

9.5 Construction Assessment

Construction activities normally result in temporary and short duration increases in the noise and vibration levels of a site.

9.5.1 Noise

Noise will be created and emitted to the surrounding environment via a range of processes. Pertinent construction activities in relation to noise and vibration are likely to include earthworks, piling, site levelling, installation of structures and services, use of diesel generators, etc.

Increases in traffic during construction may also lead to increases in the noise level and, particularly, in the city of Ouarzazate and other residential centres with no bypass road.

During construction it is envisaged that the work activities in the project site are likely to include the following:

- Site preparation - back-filling, levelling and grading, trenches and the removal of made ground in areas where foundations are to be installed. The initial clearing and grading of the area will require use of a common excavator. Noise from dumper trucks, compressors, excavators and generators, and well as occasional dump rumblings;
- Installation of structures, panels and other services;
- Installation of power line poles and the installation of wire conductors (i.e. stringing, tensioning, clipping, etc.).
- Drainage and road paving - This stage of the works will comprise of several operations that will likely include excavation for and laying of drainage pipes and road surfacing.

With regard to the impacts upon ambient noise levels, a basic assessment of the likely construction noise levels to be experienced at the site boundary has been undertaken in regard to the expected construction plant/machinery to be used at the site. This basic assessment is provided below, but it will be noted that the predicted noise levels are indicative and are subject to variables including location, topography, weather conditions, specifications of construction plant, and works phasing.

Noise data for the likely plant/equipment to be used at the site has been obtained from 'BS:5228, British Standards: Code of practice for noise and vibration on construction and open sites'. Noise values for likely site plant/equipment have been set out in the following table. These noise levels represent the typical magnitudes observed at 10m from the construction activities.

Table 9-5 Noise Level of Anticipated site Plant/Equipment

Construction Plant	BS:5228 Noise level at 10m (db(A))	BS:5228 Reference
Excavator	79	C.2, 14
Loader	82	C.6, 33
Motor lorry	80	C.2, 34
Scraper/leveller	82	C.5, 8
Roller	80	C.5, 19
Truck mixer	80	C.4, 18
Truck crane	77	C.4, 53
Generator	84	C.4, 84
Motor-driven compressor	75	C.3, 19
Fork Lift	67	C.4, 57
Cumulative noise at 10m assuming 50% of the time	89	

For the assessment it is assumed that each item of plant/equipment is utilised at approximately half its operational capacity over a given period of time, rather than continuously at full power; as is typical with any construction process. A 50% on time factor has therefore been applied in the calculation.

As such, the accumulation of the noise levels from all the above equipment at a reception point 10 m away will be approximately 89 dB(A). It will be noted that this basic assessment assumes that the noise is being received at a distance of 10 m from the source and does not account for any other background noises.

It is known that noise levels dissipate with distance propagation and the following table sets out the anticipated noise levels at distances from the construction sources. The propagation due to distance has been calculated from the appropriate attenuation formula for distance, as set out in the BS:5228 British Standard.

Table 9-6 Construction noise levels in terms of distance from the source

Distance from Construction Works (m)	Noise Level dB (A)
10	89
20	83
50	73
100	66
200	58
300	53.6
500	48.1
1000	40.6

The above table demonstrates that the attenuating effects of distance on a noise source is profound; reducing noise levels when at greater distances from the source. Given the seclusion of the site, the construction activities are unlikely to affect ambient noise levels beyond the neighbouring area.

Prior to the implementation of mitigation measures, this impact can be assessed as being of minor significance. However, measures will be introduced to reduce noise levels when working in close proximity to the site boundary, as they could exceed the required standards without mitigation. It is likely that at certain locations of the site, noise levels will be in excess of 85 dB(A), for which ear protection would be required for the personnel on site. Such areas will include those immediately next to plant or machinery. Prior to the mitigation measures, the impact to workers can be deemed to be of a minor to moderate negative impact.

9.5.2 Vibration

Certain construction processes, particularly those involved with site preparation and civil works, e.g. breaking, piling and planning, have the potential to create vibration within the vicinity of the works. Vibration will also occur sporadically around the construction site (including the PL) due to the movement of materials and equipment. However, it should be noted that vibrations dissipate rapidly as they spread due to losses of energy radiating 360 degrees from the source.

Within the PV facility footprint, only the small size temporary structures, offices, canteens, and storage, are likely to be sensitive to vibration from the construction activities.

The response of an edifice or other erections to ground borne vibration is dependent on various features, such as foundation construct, underlying ground conditions, state of repair, etc. Response can also depend on whether vibration is continuous or constant/intermittent.

BS5228-2 recommends that a conservative threshold for minor or cosmetic damage should be taken as a peak particle velocities (ppv) of 10mms-1 for intermittent vibration and 5mms-1 for continuous vibration to determine whether there is any risk of building damage, particularly from construction works involving piling.

Surface plant such as transformers or inverters are not recognised as sources of high levels of environmental vibration and reference to 'Control of Vibration and Noise during Piling' (British Steel. 1998) confirms that even at a closest distance of 10m, ppv significantly less than 5mms-1 are generated by such plant. For example, the indication is that a bulldozer would generate a ppv of approximately 0.6mms-1 and a heavy lorry on poor road surface" a ppv of less than 0.1mms-1 at 10m.

Table 9-7 Noise and Vibration - Magnitude of Construction Impacts

Impact	Magnitude	Justification
Construction Noise (including construction of the PV and PL)	Moderate	Moderate increases in noise levels from the existing background, with possible temporary exceedances of noise standards for receptors at the construction site.
Vehicle Noise	Moderate	Required traffic levels associated with the construction phase are likely to result in discernible noise impact. Increased noise levels from frequent deliveries (goods and workers) or visitor traffic are anticipated.
Construction Vibration (including vehicle vibration)	Minor	Very minor vibration impacts may occur during construction activities, which will be limited to the site, or to immediately adjacent areas from vehicle routes.

Table 9-8 Noise and Vibration - Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Construction Noise	Moderate	Construction Workers	High	Moderate to Major
Vehicle Noise	Moderate	Construction Workers	High	Moderate to Major
		Residents – Transport Route	Medium	Moderate
Construction Vibration (including vehicle vibration)	Minor	Construction Workers / Operators	High	Minor or moderate

9.5.3 Mitigation measures

A Monitoring Program will be implemented and this is further described on Chapter 20.

The following mitigation measures will be implemented:

Table 9-9 Noise –Mitigation Measures for Construction

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Construction Noise and vibration	Diesel compression equipment or generators will be equipped with effective silencers when necessary	EPC	CESMP – monitoring
	Electrically powered equipment will be preferred, where practical, to mechanically powered alternatives. All mechanically powered equipment will also be fitted with suitable silencers when necessary.	EPC	CESMP – planning
	Items of plant on site operating intermittently will be shut down in the intervening periods between uses.	EPC	CESMP – monitoring
	Construction employees will, at all times, carry out all work in such a manner as to keep any disturbance from noise and vibration to a minimum.	EPC	CESMP – start of monitoring
	Where appropriate, noise barriers /attenuation to be employed (e.g. for generators) to ensure that the maximum noise level at 1 m distance from a single source will not exceed 85 dB(A).	EPC	CESMP – planning
	Where noise levels exceed 85dB(A) for an 8-hour time-weighted average, hearing protection devices shall be provided to personnel on-site. No unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C)	EPC	CESMP – monitoring
Vehicle Noise	Vehicles will be equipped with effective silencers when necessary and switched off when are not in motion for more than 2 minutes	EPC	CESMP – planning

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	The movement of heavy vehicles through residential areas during the night will be minimised.	EPC	CESMP – planning
	Deliveries of fuel and materials and removals of waste are to be undertaken during day hours, when possible.	EPC	CESMP – planning
	All vehicles will be adequately maintained in order to minimise sound emissions.	EPC	CESMP – planning
	Onsite/offsite speed limits are included in the Traffic and Road Safety Section of this SESIA. Besides road safety, these limits will contribute to reduce noise levels resulting from traffic movements particularly in the city of Ouarzazate. These limits will be included in the Traffic Management Plan that will be prepared by the EPC prior to the construction works.	-	-

9.5.4 Residual Impacts

Table 9-10 Noise and Vibration – Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact
Construction Noise	Construction Workers / Operators	Moderate to Major	Yes	Minor
Vehicle Noise	Construction Workers / Operators	Moderate to Major	Yes	Minor
	Residents – Transport Route	Moderate	Yes	Minor
Construction Vibration (including vehicle vibration)	Construction Workers / Operators	Minor or moderate	No	Minor

9.6 Operation Assessment

9.6.1 Noise

No impacts are deemed significant for the operation of the PL.

The operation of the PV will not include the use of heavy machinery and equipment. The main plant which are likely to emit noise levels are transformers and inverters. Adequate protection measures must be outlined in the O&M's OESMP as part of the design determination.

Operational Noise Modelling

A noise modelling study was undertaken to determine the extent of noise propagation at the proposed project, emanating from variables that may have a significant effect on the site's noise levels. Variables that are unpredictable or one-off events were not included because they are impossible to quantify. Modelling was undertaken considering two different parcels for the proposed project.

Following International Best Practice, the acoustic modelling took into consideration sound emission parameters from sound sources and environmental characteristics:

- Average temperature and humidity;
- Topography;

- Vegetation (simplifying it as a uniform distribution);
- Elements which can interfere with acoustic propagation (buildings, walls, slopes, roads, etc.);
- Roads with a high traffic or railways. Both may interfere in a significant way with local noise levels; and
- Industry or others activities with high acoustic emissions.

The result of the modelling is a mesh created over a Digital Elevation Model (DEM) with noise values for the area surrounding the project classified by noise-areas.

The software used to obtain these values was Cadna-A®-v4.0 (Computer Aided Design Noise Abatement), an acoustic prediction software. Cadna-A® takes into consideration and complies with a large number of international standards that are detailed in the SESIA Vol3 – Technical Appendices.

Using CADNA each sound source is positioned in a three-dimensional system with X, Y and Z axis and can be referred to topography by inputting a relative height over the ground. The software also considers every parameter which interferes with sound propagation: noise shielding, acoustic reflection, ground acoustic attenuation, meteorology, wind direction, wind speed, acoustic diffraction and others.

Model Assumptions

The following assumptions were made for the acoustic simulation:

- Sound Pressure emitted by electric transformers. Transformers are considered as operating at maximum rate of acoustic emission considered as most adverse scenario, for all of the cases considered in the modelling.
- Sound sources with a low level of acoustic emission were not considered during the acoustic simulation. Acoustic emissions from these sources are unpredictable and intermittent. Examples of this sound sources are single-family buildings, farms, traffic on paths and tracks, domestic animals (dogs, donkeys, cows, etc.).
- Meteorological parameters don't include events such as thermal inversion which can affect the acoustic propagation, increasing or decreasing it.
- As for reflection and attenuation from terrain and vegetation, the acoustic modelling considered the terrain and vegetation an absorbent area and with a maximum of one degree of reflection.

Model Parameters

- Solar Plant Characteristics

The proposed location of the transformer and the inverters is shown on Map 9-2.

The sound sources are a main step-up transformer located into the substation and the group of inverter transformers associated to solar panels. The main transformer shows an acoustic emission of 83 dB(A) at the worst scenario. Inverter transformers were assumed as a 55 dB(A) acoustic emission. Wind conditions are not considered because the height of these sources does not exceed 4 m and consequently, wind conditions don't have any influence on the noise propagation.

- Topography and Land Use

Topography of study area was obtained from OpenStreetMap which is a free cartography world service.

The ground acoustic attenuation was assigned a value of G=0,5. This value is determined by the characteristics of the area, which has an uninhabited environment and medium absorbing elements (sand) as per ISO 6913.

Also the industrial areas are considered as a ground acoustic attenuation G=0 (roads, solar panels...).

- Sensitive Receptors

All buildings and structures in a 1,000 m buffer around the project were identified using satellite imagery and considered potentially sensitive receptors. However, no buildings or structures were identified within this buffer, as such 10 sensitive receptor points were positioned at the boundary of the solar plant and within the 1km buffer, and listed in the following table, and shown in Figure 9-1

The impact on every sensitive receptor was modelled at a height of 1.5 m.

Table 9-11 Coordinates of Sensitive Receptors

Noise Receptor	UTM Coordinates [WGS84 - 29]			Height (m)
	X	Y	Z	
RC01	706535,58	3434628,37	1,50	1,5
RC02	707101,85	3434533,46	1,50	1,5
RC03	707503,61	3433932,40	1,50	1,5
RC04	707832,61	3433226,94	1,50	1,5
RC05	707471,97	3432841,00	1,50	1,5
RC06	707000,61	3433059,28	1,50	1,5
RC07	706715,90	3433650,85	1,50	1,5

Noise Receptor	UTM Coordinates [WGS84 - 29]			Height (m)
	X	Y	Z	
RC08	706472,31	3434248,75	1,50	1,5
RC09	706013,60	3434631,53	1,50	1,5
RC10	704848,77	3433100,92	1,50	1,5
RC11	705475,14	3432626,39	1,50	1,5
RC12	706126,82	3431753,27	1,50	1,5
RC13	705583,35	3431368,92	1,50	1,5
RC14	705311,94	3431726,62	1,50	1,5
RC15	704956,33	3432404,95	1,50	1,5
RC16	706993,62	3435112,90	1,50	1,5
RC17	707455,49	3434777,57	1,50	1,5

Other Noise Sources

The site investigation revealed that no railways or industries were identified in the study area, as such the only other noise source, which was used in the model was from the road.

The following table summarizes the data collected in relation to traffic noise.

Table 9-12 Traffic characteristics in the project area

Road	Average Daily Traffic	Average Speed km/h)
Service roads of solar plants	25	70

These daily traffic ratios were included in the model set up and converted to sound emissions by taking into consideration the period of day, type of road and the different vehicles classes which are using the road (based on transformations established by the NMPB-Routes'96 standard).

Model Scenarios

The acoustic model included 2 possible scenarios, defined in relation to the time of day:

Scenario	Wind Conditions	Time of the Day
1	Windless	Daytime
2	Windless	Night time

Considering the World Bank/IFC's Guidelines about noise limits and time of day, two periods were defined:

- Daytime period: from 07.00 to 22.00.
- Night-time period: from 22.00 to 7.00.

Taking account of this, two indexes were considered during the acoustic modelling:

- Ld – Daytime noise index
- Ln – Night-time noise index

The noise levels at each of the identified sensitive receptors were defined for these scenarios based on the noise modelling.

➢ Project Stage

Depending on the stage of the project two conditions can be defined:

- No project Stage: Preliminary simulation considering local noise sources constructed at the area (roads)
- Project Stage: Acoustic modelling for the project, considering local sound sources (roads) and project sound sources (transformer and inverters).

Noise Model Results

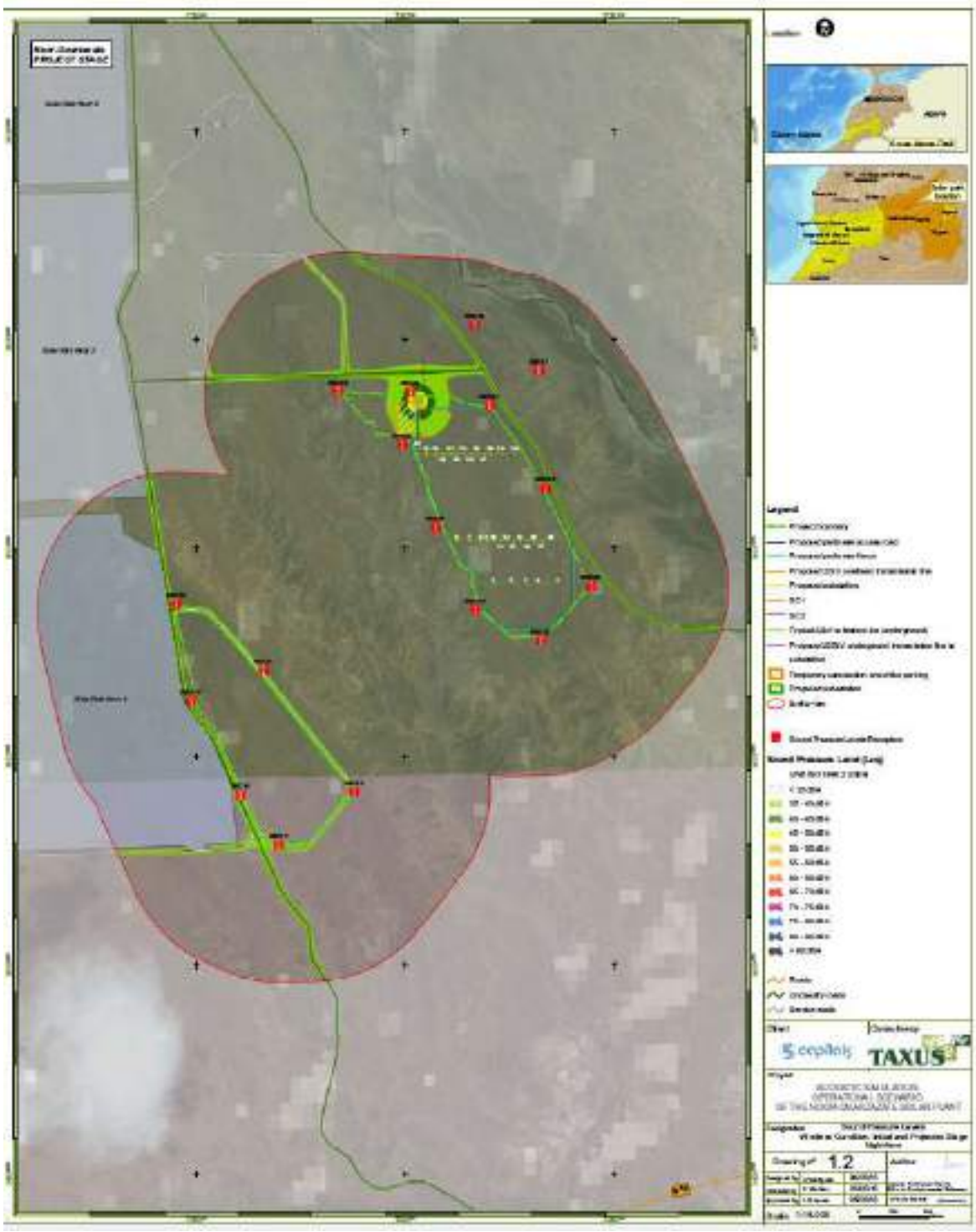
The acoustic emission that will be generated by the proposed sound sources was considered at maximum acoustic emission. The results for project stage (values obtained by acoustic modelling of sound sources) are shown in the following table and illustrated in the map.

Table 9-13 Project Stage Comparison with maximum acoustic emission

Receptor	L_{de} Daytime (dBA)				L_n Night-time (dBA)			
	Initial	Project	Limit		Initial	Project	Limit	
			IFC	MFS (*)			IFC	MFS (*)
RC01	31,7	43,4	70	50	26	43,2	70	45
RC02	32,9	34,1			25,8	29,9		
RC03	34,7	34,9			27,1	28,2		
RC04	30,4	30,7			23,2	24,4		
RC05	19	21,9			12,3	18,8		
RC06	17,9	22,7			11,5	20,4		
RC07	20,1	25,7			15	24,2		

Receptor	L_{de} Daytime (dBA)				L_n Night-time (dBA)			
	Initial	Project	Limit		Initial	Project	Limit	
			IFC	MFS (*)			IFC	MFS (*)
RC08	24,4	33,1			19,2	32,6		
RC09	33,2	34,1			27,7	30,2		
RC10	40,3	40,3			34,3	34,3		
RC11	41,1	41,1			34,3	34,3		
RC12	44,4	44,4			37,1	37,1		
RC13	41,8	41,8			35,1	35,1		
RC14	42,1	42,1			35,3	35,3		
RC15	38,6	38,6			32,9	32,9		
RC16	30,3	31,4			23,6	27,5		
RC17	25,1	27,1			18,6	24,2		
(*) At one (1) meter from the Project boundary								

Figure 9-2 Project Stage Acoustic Modelling Results



Note: Modelling was undertaken considering two different parcels for the proposed project. The NOORo IV PV Project will be constructed in the north-west parcel of the two proposed in the figure above.

The results show that none of the receptors selected will exceed the limits established during daytime or night-time. The greatest increase obtained during simulations is detected at RC1, which is located near the projected substation, which is the main source of noise for the project..

In conclusion, during the operation of the NOORo IV PV plant, none of the receptors will experience noise levels that exceed the national limits, all predicted levels are below 50/45 dB(A) limits.

Table 9-14 Noise Partial Contribution during Daytime period (Ld). Windless Projected Stage

SOUND SOURCES		RC01	RC02	RC03	RC04	RC05	RC06	RC07	RC08	RC09	RC10	RC11	RC12	RC13	RC14	RC15	RC16	RC17
OUARZAZATE SOLAR PLANT	SET1	43,1	27,7	21,1	16,5	16,1	18	22,8	32,4	26,7							25,1	22,7
	Inv01				0	0,8	8,3	0										
	Inv02				0	2,2	5,3											
	Inv03				0,8	3	3,2											
	Inv04			0	2,9	3,3	1,3											
	Inv05			0	6,8	2,8	0											
	Inv06				0	0	0	9,8										
	Inv07			0	0	0	0,2	6,6										
	Inv08			0	0	0	1,2	4,5										
	Inv09			0	0	0	0,7	2,9										
	Inv10			0,3	0	0	0,6	1,8										
	Inv11			1,2	0	0	0,7	1,1										
	Inv12			1,8	0	0	0,4	0,1										
	Inv13			2,4	0	0	0,1	0										
	Inv14			2,9	0	0	0	0										
	Inv15			3,3	0	0	0											
	Inv16			3,6	0,5	0	0											
	Inv17			3,7	1,2	0	0											
	Inv18			2,7	2	0	0											
	Inv19							0										
	Inv20							0,7										
	Inv21							0										
	Inv22							0,5										
	Inv23			0				0										

SOUND SOURCES		RC01	RC02	RC03	RC04	RC05	RC06	RC07	RC08	RC09	RC10	RC11	RC12	RC13	RC14	RC15	RC16	RC17
	Inv24			0				0										
	Inv25			0				0										
	Inv26			0,2				0										
	Inv27		4,1	1				0										0
	Inv28		4,2	1,7														0
	Inv29		0	2,9														0
	Inv30			4,6	0													0
	Inv31							0	9,2									
	SolarPlant1							9,8	7,3	9,7	24,4	18,7	13,9	17,5	23,5	25,3		
	SolarPlant2									10,7	14,3	10,3				11,4		
	Road1	21,2	32,3	34,7	30,4	19,5	18,6	19,4	19,7	15,5							29,2	23,8
	Road2	18,9	11,2	5,5			1,1	8,5	15,7	26,5							14,9	9,1
	Road3	31	23,8	13,3	7	5,4	9,5	15,3	22,7	32							23	18,8
	Road4	7						5,3	8,1	11,1	36,2	18,9		31,5	42	38,3		
	Road5					8,3	11,6	10	7,3	5,3	38	41	44,4	41,4	23,8	21,8		

In the table above, the sound sources with the highest contribution are shown for each receptor. None of the receptors experienced noise levels above the established limits and, as it has been expected, the main sound source is the transformer located in the substation, which emits a maximum of 83 dB(A).

Conclusions

This study shows that the noise emitted by the proposed Ouarzazate solar plant will not have a significant impact on sensitive receptors. Results show that modelled noise levels are bellow the limits stablished by the IFC EHS Guidelines and the MFS.

The proposed Ouarzazate solar plant will not cause exceedances of noise standards at the sensitive receptors in any scenario considered.

9.6.2 Vibration

Operational vibration is not anticipated to be significant as a result of the plant or power line activities. The majority of the equipment is static and does not involve interaction with the ground or other surfaces that could result in significant vibration.

Table 9-15 Noise and Vibration - Magnitude of Operation Impacts

Impact	Magnitude	Justification
Vehicle noise	Minor	Traffic requirements to and from the site are likely to be associated with maintenance or services requirements (e.g. waste collection). No frequent deliveries or visitor traffic is anticipated. These minimal traffic movements are unlikely to result in any discernible noise impact.
Operational noise	Negligible	Noise generated from site electrical and other equipment is within established guidelines. Operational noise modelling results showed that the noise emitted by the proposed NOORo IV solar plant and its elements, will not have a significant impact.

Table 9-16 Noise and Vibration - Significance of Operation Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Vehicle Noise	Minor	Workers / Operators	High	Minor to moderate
		Residents – Transport Route	Medium	Minor
Operational Noise	Negligible	Workers / Operators	High	Minor

9.6.3 Mitigation measures

Table 9-17 Noise –Mitigation Measures for Operation

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Vehicle Noise	Deliveries of fuel and materials and removals of waste are to be undertaken during day time.	O&M	OESMP – Management
	All vehicles will be adequately maintained in order to minimise sound emissions	O&M	OESMP – Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Operational Noise	All machinery will be adequately maintained in order to minimise sound emissions	O&M	OESMP – planning
	All equipment specifications, will limit near field noise to 85 dB(A) at 1m. Where equipment and plant exceed 85 dB(A) at 1m under typical operating conditions, noise suppression techniques will be developed, these may include: silencers, noise insulation, noise attenuation barriers and housing for equipment. This will be determined and validated during performance testing	O&M	OESMP – Management

9.6.4 Residual Impacts

Table 9-18 Noise and Vibration – Residual Impacts - Operation Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact
Vehicle	Workers / Operators	Minor to Negative	Yes	Negligible
	Residents – Transport Route	Minor	Yes	Negligible
Operational Noise	Workers / Operators	Negligible	Yes	Negligible

9.7 Decommissioning Assessment

A detailed DESMP will be prepared to ensure that all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered sensible to outline mitigation measures for the decommissioning phase at this stage. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

10 SOIL AND GROUNDWATER

10.1 Introduction

This chapter assesses the potential impacts to soil and water resulting from the construction and operation activities of the proposed NOORo IV Project.

The relatively undisturbed and undeveloped nature of the plot signifies that the potential for existing contamination is unlikely. However, the construction phase may potentially increase the risk of contamination through poor site management practices and inadequate waste disposal management. At the operational stage of the proposed project, the risk of contamination is minor.

General contamination risks are associated with the handling and processing of products. Liquid hazardous materials can escape into the soil, these are associated with the transport, handling and storage of such materials and the potential threat of releases and spills onto the ground. The only hazardous materials onsite will be diesel and oil/lubricants and specific measures are provided in the mitigation section. Other risk to soil quality are associated to soil compaction due to heavy vehicles.

10.2 Methodology

The assessment of the potential impact of the project is based on desktop research as well as soil analytical results collected during the baseline survey.

5 Capitals has reviewed the following studies:

- Review of previous environmental studies for the Complex;
- Review of relevant guidelines identified within the IFC Performance Standards;
- Review of Dutch guidelines for assessing soil, and
- Consultant's research and desktop review.

The desk study includes the assessment of the proposed design, and procedures for construction and operational issues that may impact on both the society and environment. Based on the findings of the assessment, measures have been identified to mitigate any negative effects and promote the positive effects associated with both construction and operational phases (including commissioning of the plant).

As part of the establishment of the baseline soil conditions at the proposed site, 5 Capitals undertook a limited soil sampling and analysis campaign. The sampling comprised of the collection of the top soil layer (at 0.1-0.2m depth) collected from the proposed project site (figure below), which was then analysed for heavy metals, in accordance with Dutch standards.

The purpose of the soil sampling activity was to establish a benchmark of the soil conditions at the site, which will be used for the long-term monitoring and environmental management of the site. Particularly if a spill or leak were to occur, the successful clean up procedure would include soil testing for any residual contaminants and the benchmark would be used in the assessment.

10.3 Baseline

10.3.1 Geology and topography

The proposed site is located within the Ouarzazate basin, which is bordered to the north by the foothills of the High Atlas Mountains. The area is characterised by faults and thrust faults, and the southern basin is composed of igneous rock and sedimentary deposits of the Mesozoic, Tertiary and Quaternary period.

10.3.2 Groundwater

The geologic composition of the rocky plateau consists of tertiary and quaternary formation that is highly permeable and subterraneously inclined. Equally, the Ouarzazate area is characterized by a very low and irregular rainfall (less than 200 mm/year) concentrated in short bursts between long rainless periods. The temperature variations are large and the evaporation rates (2800 mm/year on average) regularly exceed rainfall rates. The Mansour Ad-Dahbi dam regulates an annual average contribution of 420 hm3, of which Dadès river contributes by 233 hm3 at Tinouar, and oued Ouarzazate by 145 hm3 at Amane n'Tini.

Consequently, no surface groundwater tables are likely present within the project site. In fact, groundwater level was not met during geotechnical surveys (up to 50 m).

With respect to the presence of groundwater in the surrounding areas, the nearest villages use artisanal wells for the supply of irrigation water. The depth of the wells ranged from 10 m to 14 m in the village of Tasselmant. Three other wells were identified over 2.5 km from the site, however, these wells were much deeper (23 m to 26 m) and were no longer in use.

10.3.3 Soil

Within the project site, the soils consist of alluvial and lacustrine/palustrine limestone from the Quaternary period, with the surrounding areas consisting of conglomerates or lacustrine limestone from the Mio-Pliocene period.

Stratigraphic surveys identified the following sequence:

- 0.0 – 6.0 m: Sandy loam with considerable gravel comprising the surface layer.
- 5.5 -16.0 m: polygenic conglomerates with un-cemented successions.
- 8.0 – 16.0 m: a layer of Sandy clay can appear between the conglomerate layers.

- 16.0 – 30.0 m: layer of massive sandstone.
- From 30 m deep: Clayey – marl substrate

The relatively undisturbed and undeveloped nature of the plot signifies that the potential for existing contamination to the soil is unlikely. No visual indications of soil contamination were identified at the project site during the site visit.

Analytical results

The following table provides the results for the soil sample collected within the PV site boundaries.

Table 10-1 Soil Quality Results and Applicable Standards

Parameter	Results (mg/kg MS)	Dutch Target	Dutch Action
As	10.4	29	55
Cd	<0.40	0.8	12
Cr T	28.4	100	380
Co	10.8	20	240
Cu	26.4	36	190
Pb	11.1	85	530
Mo	<1.00	3	10
Hg	<0.10	0.3	200
Ni	19.4	35	210
Zn	37	140	720

In general, the results reveal that heavy metal concentrations at the sample locations are within the Dutch Target values.

Therefore, based on the analytical information, historical land use and site observations, it can be concluded that the soils on site are not contaminated by heavy metals.

10.3.4 Seismicity

The site is bordered by complex tectonic structure, around the Toundout-Boumalene zone, and is characterised by compression of the faults along a SSE-NNW alignment. These faults and fold run parallel to the massif of the High Atlas and the Anti-Atlas.

A seismicity study, which was undertaken by the consortium, identified that the maximum horizontal acceleration would be an earthquake of 5.6 magnitude, with value amax = 0.12 ·g, for a return period of 50 years with a probability rate of 95%.

Therefore, the site seismic conditions have been taken into account for plant design and the ESMP's Emergency Response Plan has included procedures to be followed in case of earthquake.

10.4 Sensitive Receptors

The table below outlines the identified receptors in relation to soil and groundwater as well as the determined sensitivity of those receptors.

Table 10-2 Soil and Groundwater - Receptor Sensitivity

Receptor	Sensitivity	Justification
Soil	Medium	The site is a greenfield, and no contamination was observed. Natural resources are not used for grazing or agriculture.
Groundwater	Medium	Groundwater recharge is low and there is no groundwater at the plateau. However, neighbouring villages in the valleys rely on groundwater for potable water and agriculture.

10.5 Construction Assessment

10.5.1 Potential Impacts

There is a range of construction related activities (including the construction of the plant and the associated power line) that could pose a threat and lead to changes in the chemical properties of the soil, resulting in potential contamination. Impacts can occur from the spillage of liquid materials used during construction, improper management of generated construction waste, and cross contamination of soil at the site.

Spillage: During the construction phase, the risk of accidental spillage and leakage of chemical products (e.g. fuels), sanitary wastewater and cleaning agents is present. Impacts of this can take place at the storage areas of the construction site as well as during the transportation of such materials on site. Improper methods of storing, transferring, and handling of these products can result in spillage to the ground and result in soil contamination. Depending on the volume of the spill and the characteristics of the pollutants, the contamination may reach the groundwater. Once contamination has reached the groundwater, the volume of contaminated soil and groundwater can increase quite rapidly. This is a function of the physical and chemical properties of the contaminants and the velocity of the groundwater.

Waste Management: Construction activities typically generate solid and hazardous waste on-site, which are a threat to the soil and groundwater. Of special concern is the management of hazardous waste generated during the construction phase. Although the hazardous fraction of construction waste such as used oil, machinery lubricants, paints and sludge, represents a relatively small proportion of the total amount of construction waste, it requires special attention. If the temporary storage and handling of such waste on the construction site is inadequate prior to being removed for disposal, the risk of soil and groundwater contamination increases

Cross Contamination of Soil: During construction work, cross contamination is the transfer of contaminated earth from one location to another, thereby exacerbating any existing environmental problem through poor management. Currently the general soil conditions on site are good. Isolated points of contamination, perhaps through localised spills during construction activities may occur on site. If this contaminated soil was relocated during levelling activities, a chance of spreading the contaminants can occur, which could lead to a negative environmental impact. In addition, if contaminated soil is dispersed through dust generation as a result of construction activities like earthworks, then further spreading of contaminants will also occur.

Table 10-3 Soil, Geology and Hydrology – Magnitude of Construction Impacts

Impact	Magnitude	Justification
Spillage	Moderate (Soil) Minor (groundwater)	The volumes and quantities of hazardous materials being transported and handled during the construction phase are low, however poor handling practices will increase the likelihood of spills. Impacts could be temporary to permanent.
Inadequate waste management	Moderate (Soil) Minor (groundwater)	Minor volumes of hazardous wastes will be generated during the construction phase. If these wastes are not properly handled, separated, stored and then disposed, contamination is very likely to occur.
Cross contamination of soils	Minor (Soil)	During ground preparation works or levelling of the site there is a minor risk of cross contamination if management and monitoring mechanisms are not implemented.

Table 10-4 Soil, Geology and Hydrology – Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Spillage	Moderate	Soil	Medium	Moderate
	Minor	Groundwater	Medium	Minor
Inadequate waste management	Moderate	Soil	Medium	Moderate
	Minor	Groundwater	Medium	Minor
Cross contamination of soils	Minor	Soil	Medium	Minor

10.5.2 Mitigation Measures

Table 10-5 Soil Contamination– Mitigation measures - Construction Phase

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Spillage and leakage	Chemicals, fuels, lubricants and paints will be stored in dedicated locations on impermeable surfaces to prevent leakage into the ground and contained inside a secondary bund (110% of largest container). Additional mitigation measures are included in the Non-hazardous Waste and Hazardous Materials section.	EPC	CESMP – Management
	Permanent/temporary storage areas will be designed and located considering potential ground contamination risks. Runoff will be prevented from entering areas where hazardous materials are stored, handled or transferred. If runoff can enter potentially contaminated areas, a dedicated drainage system will direct the run off to dedicated tanks to avoid impacts to soils and groundwater. The fluids in these tanks will be collected by licensed operators and managed as Hazardous wastewater.	EPC	CESMP – Management
	Hazardous materials storage areas will be positioned away from major transport corridors and construction activities, in order to avoid potential collisions from vehicles or other machinery.	EPC	CESMP – Management
	All chemicals will be handled in accordance with relevant instructions (MSDS).	EPC	CESMP – Management
	Reduce quantity of chemicals and fuels on site to minimum practicable levels.	EPC	CESMP – Management
	Regularly inspect drip collectors and containers for spills and leaks.	EPC	CESMP – Management and Monitoring

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	Provide spill kits at all areas where hazardous liquids are stored.	EPC	CESMP – Training and Monitoring
	Develop and implement an Emergency Preparedness and Response Plan, to immediately remediate the affected area in the event of a spill or leakage of chemicals, fuels, paints, and any hazardous material.	EPC	CESMP – Training and Monitoring
	Metal structures (including painting and protections) will be designed/selected to resist corrosion due to local environment conditions.	EPC	Design phase
	Develop a Vehicle Maintenance Plan.	EPC	CESMP – Management
	Washing of equipment, machinery, and vehicles will not permitted on site and will only be carried out in adequate premises.	EPC	CESMP – Management
	Vehicle maintenance will not be undertaken in the project site and will be carried out only in offsite permitted premises	EPC	CESMP – Management
	If vehicles and machinery are too large to be moved off site, or if it is not practicable to move the machinery for maintenance during the construction phase, then measures to protect the soils from spills and leaks during the cleaning/maintenance activity must be implemented (impermeable hardstanding .	EPC	CESMP – Management
Cross contamination of soils	Implement good housekeeping practices during construction activities including procedure and requirements for proper handling, storage, and transport of hazardous chemicals and waste	EPC	CESMP – Management and Training
	If contaminated soil is observed during construction activity, the identified contaminated soil will be excavated separately, and stored onsite in accordance with environmentally adequate measures for waste management, to avoid cross-contamination. A licensed operator will	EPC	CESMP – Training and Monitoring

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	collect the contaminated soil for disposal.		
	Construction Workers will attend training programmes, and safety induction sessions with regards to the transportation and handling of hazardous materials. Toolbox talks will also be held.	EPC	CESMP – Management and Training
Storage and waste management	All hazardous construction waste and chemicals, such as fuel, will be stored in well-equipped, leak-tight enclosures where drums have drip trays to avoid spillage to the ground. The storage tanks of fuels or chemicals and septic tanks will be properly maintained and stored in bunded areas equivalent to 110% of the storage capacity.	EPC	CESMP – Management and Monitoring
	Wherever possible, reduce the quantity of chemicals and fuel stored on site to minimum practical level. Infrequently used chemicals will be ordered just before they are needed.	EPC	CESMP – Planning
	All servicing, refuelling, stockpiles, waste disposal and storage areas will be located as far as possible from the run-off drainage system to reduce potential of pollution via spillage or windblown debris.	EPC	CESMP – Planning
	No hazardous material will be stockpiled.	EPC	CESMP – start of Planning
	Minimise the size and height of the stockpile as far as possible.	EPC	CESMP – start of Monitoring
Soil Compaction	Areas where visiting vehicles are allowed to circulate or park will be minimized and located only inside the project boundaries or in the existing Complex's roads/parking areas.	EPC	CESMP – Management

10.5.3 Residual Impacts

Table 10-6 Soil Contamination – Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Spillage	Soil	Moderate	Yes	Minor
	Groundwater	Minor	Yes	Negligible
Inadequate waste management	Soil	Moderate	Yes	Minor
	Groundwater	Minor	Yes	Negligible
Cross contamination of soils	Soil	Minor	Yes	Negligible
	Groundwater	Negligible to Minor	Yes	Negligible

10.6 Operation Assessment

10.6.1 Potential Impacts

No impacts are deemed significant for the operation of the PL.

With regards to the Power Plant, although there will be little or no interaction with hazardous materials or chemicals, the potential for uncontrolled releases to soils during the operational phase is still possible. Such releases have the potential to occur during material transportation, handling and storage as well as during cleaning activities and accidental spillages to the ground. The potential sources for these contaminants are the following:

- The use of solvents/cleaning fluids, lubricants and oils is likely to be limited. Although these materials may be used in small quantities, attention must be paid to proper storage, handling and transportation;
- The transformers on site will contain oils. These units are generally very well self-contained, but precaution should be given to ensure adequate spill prevention measures are in place;
- Sanitary wastewater/waste on site has potential to contaminate soils and groundwater, and
- Only reduced quantities of fuels might be stored for site vehicles and emergency generators.

Table 10-7 Soils Contamination– Magnitude of Operational Impacts

Impact	Magnitude	Justification
Spills and Accidental Releases	Moderate	Inappropriate storage and handling of materials may result in uncontrolled contamination of soils and groundwater.
Inadequate solid/liquid waste management	Moderate	Small amounts of domestic liquid and solid wastes will be generated during the operation of the plant, and if waste facilities are not provided nor waste management procedures implemented, then contamination could occur.

Table 10-8 Soil Contamination– Significance of Operational Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Spills and Accidental Releases	Moderate	Soil quality	Medium	Moderate
		Groundwater	Medium	Moderate
Inadequate waste management	Moderate	Soil quality	Medium	Moderate
		Groundwater	Medium	Moderate

10.6.2 Mitigation measures

The pathways for soil and groundwater contamination during the operational phase are similar to the construction phase. Therefore, similar control techniques and mitigation measures will be in place to tackle such risks. Best housekeeping practices will be adopted to ensure proper measures are in place.

The O&M will implement the mitigation measures listed below. Day to day measures included in the OESMP will determine the storage of hazardous chemicals as key concerns with maintenance, storage requirements, refuelling procedures and spill clean-up procedures being particular issues which will be adequately covered in the OESMP. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

Table 10-9 Soil Contamination– Mitigation measures - Operation Phase

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Spillage	Develop and implement a spill emergency and contingency plan	O&M	OESMP – Management and Training
	Develop and implement training program for employees to increase their awareness of chemical management protocols including proper handling and storage of chemicals, emergency response, contingency plans and appropriate PPE, if needed.	O&M	OESMP – Management and Training
Storage and waste management	Storage areas for domestic waste will be sealed, covered, leak tight flooring, and correct shelving / cabinets in order to prevent spillage and leakage into the ground.	O&M	OESMP – Planning and Management
	The storage tanks of fuels/chemicals/sewage will be properly maintained and stored within a bunded area of 110% of their storage capacity.	O&M	OESMP – Planning and Management

10.6.3 Residual Impacts

Table 10-10 Soil Contamination– Residual Impacts - Operation Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impacts
Spills and Accidental Releases	Soil quality	Moderate	Yes	Negligible
	Groundwater	Moderate	Yes	Negligible
Inadequate waste management	Soil quality	Moderate	Yes	Negligible
	Groundwater		Yes	Negligible

10.7 Decommissioning Phase

A detailed DESMP will be prepared to ensure that all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered sensible to outline mitigation measures for the decommissioning phase at this stage.

11 STORM-WATER MANAGEMENT

1.1 Introduction

This chapter assesses the potential impacts resulting from changes in the topography and drainage of the proposed site and discusses the potentials risks for soil erosion and flooding resulting from stormwater runoff.

The development of the project will change the topography of the site. Infrequent heavy rain events will result with increased erosion and the discharge of sediment laden run-off.

One of the main environmental issues with stormwater relates to its potential contamination from wastewater or hazardous fluids spills or contaminated soils. This impact has been fully addressed in the Waste Water Management chapter. Measures included in such section ensure that stormwater only contains soil particles and not contaminants.

1.2 Methodology

The assessment has been conducted by identifying the relevant local and international standards and best practice applicable to the environmental conditions at the NOORo IV site relating to stormwater management and erosion prevention during the construction and operational phases of the proposed facility. Estimates and figures relating to stormwater volumes and proposed treatment processes have been based on the data available from hydrological study of the FESIA and the data provided in the bid proposal.

1.3 Baseline

11.1.1 Erosion Risk

According to the FESIA, the Complex has a high risk for erosion. Across the majority of the Complex, the level of erosion risk has been classified between 5 and 10 t/ha/year. This high risk of erosion is due to the following factors:

- Intensity of rainfall;
- Soil type;
- Sparse vegetation cover, and
- Topography and the slope.

11.1.2 Surface Drainage

The existing natural drainage system within the proposed site consists of one chaaba (ephemeral stream, i.e. it only flows after rain events) crossing the site from north to south. This

chaaba originates few meters further north in the Complex and is blocked by the Complex road.

As shown in the figure below, the NOOR IV PV site is also located in close proximity (700 m from the project boundary) to an ephemeral river. The drainage runoff from the site will not be connected to this ephemeral river and therefore the possibility to cause any environmental impact is negligible.

2 Figure 11-1 Surface Hydrological System

11.1.3 Flood Risk

With regards to flood risk, the site is an elevated plateau and the chaaba collects and drains all stormwater downstream, consequently, there is no flood risk at the plot.

The design of the man-made stormwater drainage has considered the natural drainage pattern and therefore flow rates and flood risk should remain similar under the construction of the drainage system.

2.1 Sensitive Receptors

The table below outlines the identified receptors in relation to geology and hydrogeology as well as the determined sensitivity of those receptors.

Table 11-1 Stormwater - Receptor Sensitivity

Receptor	Sensitivity	Justification
Chaaba (onsite)	Medium	The chaaba crossing the site will be altered and converted in a concrete channel (man-made stormwater drainage system).
Chaaba (downstream)	Medium	Changes in the drainage regime and flow from stormwater events will affect the volume, and quality of water running into the downstream Chaaba.
Soil/Geology	Low	The project will modify the current topography and soil characteristics of the site

The ephemeral river at the east and other small chaabas in adjacent plots are not considered a sensitive receptor as the stormwater will be directed to the south of the proposed site following the existing chaaba, and therefore, the these temporal streems will not be subject to any potential impact from the NOORo IV PV site.

2.2 Construction Assessment

4.8.1 Potential Impacts

No risks are envisaged at the power line.

Soil erosion risk will potentially be higher due to earthworks and loosened soil particles at the power plant. The changes in the soil characteristics and increased earthworks activity, may result with increased siltation in the stormwater, however, given the construction activities will be temporary and most soils will be compacted, the risk for increased silt will be temporary and infrequent.

The earthworks on site will not significantly disturb natural drainage patterns.

Flooding on the plateau is not an issue, and is unlikely to change as a result of construction activities. However, the conversion of the natural stormwater catchment system to a concrete channel will decrease the rugoses of the waterway and therefore, the speed of the stormwater flow, leading to localised and minor floods at the discharge point. Such events would be infrequent and short duration and will not pose any significant risk as the funnel effect (amount runoff water concentrated in the waterway) will be similar with the handmade drainage system to the current situation.

Table 11-2 Stormwater – Magnitude of Construction Impacts

Impact	Magnitude	Justification
Flooding	Minor	Infrequent and short duration rain events may result in minor flooding events in localised areas.
Erosion	Minor	Construction is temporary. The site already experiences natural erosion from precipitation.
Siltation	Minor	Construction will temporarily disturb soils, and during a storm event these will be more likely to become suspended.

Table 11-3 Stormwater – Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Flooding	Minor	Chaaba (onsite)	Medium	Minor
		Chaaba (downstream)	Medium	Minor
Erosion	Minor	Chaaba (onsite)	Medium	Minor
		Chaaba (downstream)	Medium	Minor
		Soils/Geology	Low	Negligible to Minor
Siltation	Minor	Chaaba (downstream)	Medium	Minor

4.8.2 Mitigation Measures

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Soil erosion/Siltation	The site will be fenced to ensure that no soil disturbance occurs outside of the site area. The areas requiring excavation/filling shall be clearly demarcated to ensure that the soil is no disturbed outside that area	EPC	CESMP – Management
	The discharge point of the drainage system will be protected against erosion at each discharge point.	EPC	CESMP – Planning and Management
	From the outset of work, plan, select and define areas for clearing, stripping and access routes in order to minimise unnecessary stripping of vegetation	EPC	CESMP – Management
	Minimise disturbed areas	EPC	CESMP – Management
	Reduce cut-offs and embankments as much as possible	EPC	CESMP – Management
	Disturbed areas will be stabilized to minimise further erosion. Construct gabions and concrete barriers for containment, use metal mesh and nets, drains and gutters in slopes for terrain stability	EPC	CESMP – Management
	Road gradient will be avoided or minimized (contour and slopes) in order reduce run-off induced erosion. Internal roads/routes gradients should not exceed 15%	EPC	Design
	Excavated materials will be kept in the stockpile for as short a time as possible and, once an area is back-filled with soil material, compacted in a short time	EPC	CESMP – Management
	Reduce height of any built up embankments and slopes, if possible	EPC	CESMP – Management
	Recover vegetation on slopes and embankments where possible and in areas away from electrical equipment to avoid fires	EPC	CESMP – Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Stormwater Drainage	The stormwater drainage system will minimize and control surface run off and erosion.	EPC	Design
	The stormwater drainage system will include the necessary sediment retaining systems to ensure that runoff is free of excessive sediment and other constituents at the discharge point.	EPC	Design
	The longitudinal slope of the road must be at least 3% in order to facilitate surface run-off of water and to avoid the build-up of sediment in gutters	EPC	Design
	Hazardous materials storage areas will be roofed to prevent rainfall entering such areas and avoid to avoid emissions of wastewater to the soils, chaabas, or stormwater drainage system.	EPC	CESMP – Management, Planning
	Permanent/temporary storage areas will be designed and located considering potential ground contamination risks. Runoff will be prevented from entering areas where hazardous materials are stored, handled or transferred. If runoff can enter potentially contaminated areas, a dedicated drainage system will direct the run off to dedicated tanks to avoid impacts to soils and groundwater. The fluids in these tanks will be collected by licensed operators and managed as Hazardous wastewater.	EPC	CESMP – Management, Planning
	The stormwater drainage system will include a system to retain garbage carried by the runoff water. The system will be atthe project boundary and allow easy access to collect retained materials.	EPC	Design / CESMP – Management, Planning
Flooding	The stormwater drainage system will be able to accommodate and evacuate runoff so that it protects equipment during the worst case scenario as per local rain conditions and site area (funnelled to the channel) and soil and vegetation coverage conditions.	EPC	Design

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	The stormwater drainage system will need to consider the increase on speed of the water flow with a concrete channel and consider the flood conditions that can potentially be caused downstream (particularly at the discharge point) to avoid erosion.	EPC	Design

4.8.3 Residual Impacts

Table 11-4 Stormwater – Residual Impacts – Construction Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Flooding	Minor	Chaaba (onsite)	Medium	Minor	Yes	Negligible
		Chaaba (downstream)	Medium	Minor	Yes	Negligible
Erosion	Minor	Chaaba (onsite)	Medium	Minor	Yes	Negligible
		Chaaba (downstream)	Medium	Minor	Yes	Negligible
		Soil/Geology	Low	Negligible to Minor	Yes	Negligible
Siltation	Minor	Chaaba (downstream)	Medium	Minor	Yes	Negligible

2.3 Operation Assessment

4.8.1 Potential Impacts

No risks are envisaged at the PL.

The water flowing from the north of the site through the existing chaaba will be collected by a concrete channel and discharged to the south of the PV.

The water flowing from the east and west of the site will be collected by a concrete channel crossing north to south through the middle of the site (see figure in the Runoff Drainage section), and discharged to the south boundary, as the currently natural drainage of the site does.

The levelling of the site, the impermeable concrete areas and the channelling of stormwater will lead to increase runoff velocities.

Table 11-5 Stormwater – Magnitude of Operation Impacts

Impact	Magnitude	Justification
Erosion	Negligible	The site will be compacted and embankments stabilised
Flooding	Minor	Flooding in the chaaba may be localised, infrequent and short duration.
Siltation	Minor	During storm events, any run-off on unconsolidated soils will result with some siltation. Events will be infrequent and of short duration.

Table 11-6 Stormwater – Significance of Operation Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Flooding	Minor	Chaaba (onsite)	Medium	Minor
		Chaaba (downstream)	Medium	Minor
Erosion	Negligible	Chaaba (onsite)	Medium	Negligible to Minor
		Chaaba (downstream)	Medium	Negligible to Minor
Siltation	Minor	Chaaba (downstream)	Medium	Minor

4.8.2 Mitigation Measures

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Erosion/Siltation /Flooding	The discharge point of the drainage system will be protected against erosion at each discharge point.	O&M	OESMP – Planning and Management
	Runoff collection system will be inspected monthly and at the start of a rain event to ensure that no blockages could result with overflowing.	O&M	OESMP – Monitoring
	The effectiveness of erosion prevention mitigation measures at rainwater discharge points will be verified after storm events to ensure that the adequacy of the design measures. Otherwise, these should be upgraded to meet stormwater flows.	O&M	OESMP – Monitoring
Stormwater Drainage	The site will be inspected regularly to ensure that no spills have occurred in areas that may be susceptible to stormwater run-off. All spills must be immediately contained and cleaned, in order to prevent direct and indirect contamination to soils and water sources.	O&M	OESMP – Monitoring
	Waste and hazardous material storage areas have to be designed in such a way that rainwater is not in contact at any point with the waste.	O&M	OESMP – Design and Management
	The stormwater drainage system will include a system to retain garbage carried by the runoff. The system will be located before the project boundary and allow easy access to collect retained materials.	O&M	OESMP – Planning and Management

4.8.3 Residual Impacts

Table 11-7 Stormwater – Residual Impacts – Operation Phase

Impact	Magnitude	Receptor	Sensitivity	Impact Significance	Mitigation	Residual Impact Significance
Flooding	Minor	Chaaba (onsite)	Medium	Minor	Yes	Negligible
		Chaaba (downstream)	Medium	Minor	Yes	Negligible
Erosion	Negligible	Chaaba (onsite)	Medium	Negligible to Minor	Yes	Negligible
		Chaaba (downstream)	Medium	Negligible to Minor	Yes	Negligible
Siltation	Minor	Chaaba (downstream)	Medium	Minor	Yes	Negligible

11.2 Decommissioning Phase

A detailed DESMP will be prepared to ensure that all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered sensible to outline mitigation measures for the decommissioning phase at this stage.

12 BIODIVERSITY

12.1 Introduction

Protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. Impacts on biodiversity can often adversely affect the delivery of ecosystem services, impacting over human beings and biodiversity.

This Chapter includes the Ecological Impact Assessment process of identifying, quantifying and evaluating potential impacts on biodiversity resulting from the project. The assessment has considered the direct, indirect, temporary and permanent changes to the ecological environment.

12.2 Methodology

In order to gain an understanding of the biodiversity of the project area and the proposed project site, a combination of desk studies and field survey was conducted. A detailed description of the methodology is provided below:

12.2.1 Desk Study

Desk studies for the area included reviewing ecological survey data from the FESIA, previous environmental assessment for the NOORo I, II and III CSP Plants, publications, and database within the region such as: (i) the CBTHA reports (UNDP project), Catalogue of the rare vascular plants, threatened or endemic Morocco (Fennane & Ibn Tattou 1998) (ii) Amphibians and Reptiles of Morocco (Western Sahara included), (iii) biogeographic atlas (Bons & Geniez 1996) (iv) Herpetologische Beobachtungen Ouarzazate (Marokko) (Schweiger 1992), (v) birds of Ouarzazate early 1980 (Danet 1980) the birds of Morocco, (vi) Catalogue of wild Mammals of Morocco (Aulagnier & Thevenot 1984) (vii) database on Morocco's Mammals (Aulagnier, Cuzin & Thevenot 2016).

12.2.2 Field Survey

The ecological section of the FESIA report provided the results of a detailed survey, which was carried out by Phenixa in 2011 and 2014. The results of this survey were representative of the typical and likely fauna, flora and habitats, which are encountered at the project area.

In order to gather new and updated information of the site, 5 Capitals and Phenixa conducted a biodiversity survey in November 2016. The biodiversity baseline study was undertaken by an experienced ecologist over a two-days survey (day and night) and covered the proposed project site and a 500 m buffer area.

The objective of the second walkover survey undertaken the 3rd and 4th of November 2016 (48 hours) was to review and confirm the ecological conditions of the NOORo IV project site.

The site was covered by vehicle, and the majority of identified habitats were then more closely investigated on foot. In addition, the transects walkovers were undertaken within the study area and this included the direct observation of fauna and flora in the field. The following methods were utilised to describe and assess the habitats, flora and fauna of the site:

- The vegetation of the site was recorded by identifying the main habitat types and their plant communities in areas retaining natural vegetation.
- Terrestrial mammals were recorded when observed, as were their tracks, for two consecutive days (night and day). Bat surveys were also undertaken using a bat detector and recorder (BatloggerM).
- Reptiles were surveyed by walking over areas representative of the main habitats. An effort was made to search for reptiles under natural shelters such as shrubs and crevices.
- Bird sightings and incidental observations of invertebrates were recoded.

No trapping or specimen collection was undertaken.

The ecological conditions of the site were assessed using an adaptation of the standardized Joint Nature Conservation Committee (JNCC) Phase 1 classification and mapping methodology (JNCC, 2010), and using 1:50000 maps of the site (Tiflit and Warzazat). The habitats at the site were surveyed using DAFOR scale and % of coverage.

12.3 Baseline

12.3.1 Project Site

The 2016 survey described five (5) distinct habitat types within the surveyed area (project site and 500 m buffer):

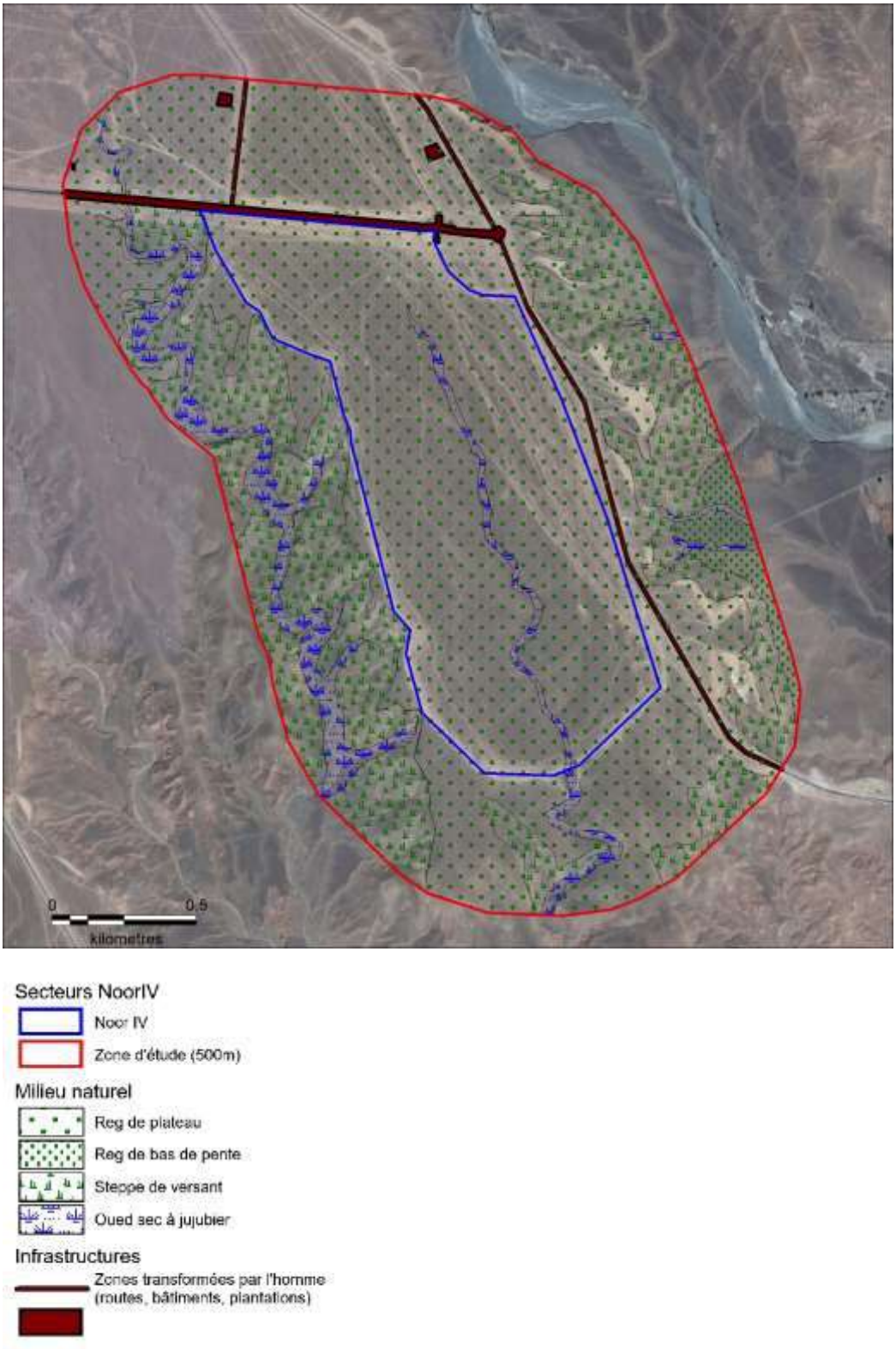
- Plateau Regs/Rocky Plateaus also designated as desert pavement, is a desert surface covered by closely packed interlocking angular or rounded rock fragments, which typically support a low biomass and limited biodiversity.
- Steppe Plateau: located to the west of the proposed site boundary, within Izarki valley, comprising an important annual flora.
- Chaabas within the site provided the greatest biomass and sustained the greatest diversity of flora, eventhough this is still a low biodiversity compared to other habitats in the region, as can be shown in the pictures below. This is not surprising as the soil conditions and water regime favours a more successful and long-term establishment of a diversity of vegetation than on the rocky plateau.
- Oued on the periphery comprising wadis with a variable width of between 3 and 20 m. Biodiversity is richer on these habitats with relatively well-developed vegetation. Chaabas offered varying degrees of biomass and biodiversity depending on the size of the Chaabas bed and the frequency and volume of water running through the system. The larger Chaabas, which would have received flash flows of water from

the High Atlas, would typically have a lower biomass than the smaller Chaabas which experienced a more tempered water flow regime.

- Escarpments formed between the plateaus and the bases of the Chaabas. Within the escarpments, the level of biomass and biodiversity was higher than on the rocky plateau, particularly in areas were water could temporarily pool or along the edges of the drainage patterns.

As illustrated in the figure below, only two (2) habitats (Plateau Regs and small Chaabas/depressions) were found within the project site.

Figure 12-1 Habitat types at the proposed PV



The following table illustrates the ecological conditions of the project site.

Plate 12-1 Site Ecological Conditions - Plateau Regs

Plate 12-2 Site Ecological Conditions – Chaaba

Flora

Thirty five (35) flora species were identified across the survey area (site and 500 m buffer). Specifically, the following four (4) flora species were identified in the plateau of the proposed site:

- *Farsetia ramosissima*
- *Asphodelus temuifolius*
- *Morretia canescens*
- *Sclerocephalus arabicus*

The rest of the species were identified in the oueds and escarpments that will not be directly affected by the project. A table summarising the species observed across the different habitat types in the survey area is provided in Appendix 2.

None of the observed species identified across the survey area are listed of internationally conservation concern (IUCN Red list of threatened species, 2016).

Fauna

Herpetofauna (Amphibians and Reptiles)

The 2016 survey did not identify any species of reptile or amphibian during the two-day field survey.

Based on the desk study, eighteen (18) reptile/amphibian species could potentially be present in the region:

- Three species Böhme's Gecko *Tarentola boehmei, Saurodactylus brosseti and the* False Smooth *Snake Macroprotodon brevis* are endemic in Morocco.
- The Algerian Whip Snake *Hemorrhois algirus* is endemic of North Africa.
- Three species *Tropiocolotes algericus,* the Mograbin Diadem Snake *Spalerosophis dolichospilus* and the Moorish Viper *Daboia mauritanica* are endemic species in the Maghreb Area.
- Two species *Uromastix acanthinura and* the Oudri's Fan-footed Gecko *Ptyodactylus oudrii* are endemic from the Western Sahara region.

None of these species is internationally protected

None of these species were identified during the field survey and their presence is unlikely within the site as the plot has been fenced for years with a walled base fence, and they were not identified either for the FESIA survey or for the surveys for NOORo II and III.

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Birds

In line with previous surveys conducted in the Complex, over twenty-five (25) species of birds (resident and migratory) potentially nest in the types of habitats present on the study area. The presence of nine (9) migratory species was identified onsite in previous surveys (passage, not nesting). It should be noted that this sector is not considered a major migratory pathway, which is mostly limited to the Southern parts of the High Atlas.

None of the bird species identified onsite are nationally or internationally threatened species.

Avifauna typically nest in favourable environments and, as such, the species identified in the area will likely nest on the oued and the steppe plateau located to the east and south of the site rather than in low biodiversity/biomass areas (e.g. rocky plateau as the NOORo IV project site).

A summary of the bird species recorded and likely resident is given in Appendix 2.

Mammals

The presence and diversity of mammals is unlikely, as the site has been fenced by the NOOR Complex fence for several years.

Evidence of the Red Fox was identified at Chaaba Izerki (outside the NOOR Complex).

A summary of the mammals recorded and historically resident is also given in Appendix 2. No major threats are known for these species.

Bat surveys were undertaken for two (2) consecutive nights using a bat detector and recorder (BatloggerM). Eight (8) bat species were identified. The overall activity level was low (about 50 passages throughout the night), which is normal in this season.

12.3.2 Ecosystem Services

Ecosystem services within the Project footprint are limited due to the extreme ecological conditions, including low rainfall and extreme temperatures.

12.3.3 Project Areas

Protected and Designated Areas

Six (6) Protected and Designated Areas were identified within 15 km of the proposed project site:

- One Biodiverse Reserve,
- Two Hunting Reserves,
- One Ramsar site,
- One Site of Biological and Ecological Importance and
- One Important Bird Area (IBA).

The Table below describes the location and key characteristics of each of these areas, which are further discussed below.

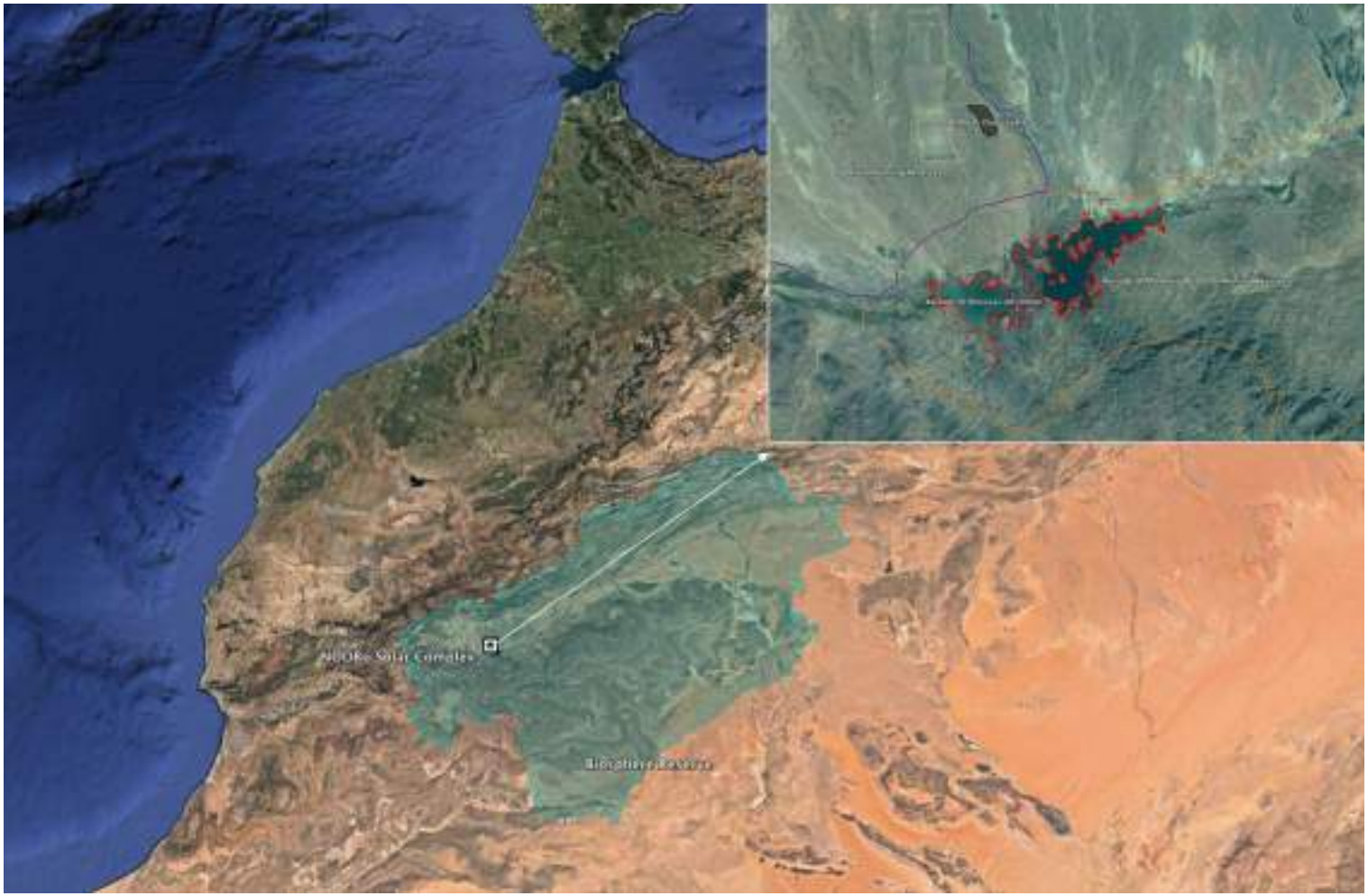
Table 12-1 Designated Areas in Proximity to the Project Site

Type		Name	Area	Coordinates	Distance to project site	Other comments
Protected AreasNational and Regional Designation	Projet de Conservation de la Biodiversite par la Transhumance	Sbaa Chaab	Unknown	Unknown	11Km (E) to Edge	Key biodiversity site.
		Iguenane	Unknown	30° 59.417'N 6° 53.709'W	15km (NW) to Edge	Key biodiversity site.
	Permanent Hunting Reserve	Ighernan	1,206,01km2	30° 59.417'N 6° 53.709'W	Project site within the PA	This reserve comprises a high biodiversity on flora and fauna species, including numerous flora endemism and an internationally threatened mammal species, *Gazella cuvieri*.
		Barrage Al mansour Ad-Dahbi	1,196.92km2	30° 55.741'N 6° 41.477'W	4,3km (S) to Edge	This hunting reserve comprises a high biodiversity on flora and fauna species, including key wetland flora and breeding and wintering birds.
	UNESCO-MAB Biosphere Reserve	Oasis du Sud Marocain (RBOSM)	80,431.46km2	31° 5.220'N 6° 45.661'W	Project site within the PA	The main conservational objective of Zone B on which the proposed Project will be developed, includes the protection of Skoura Palm grove.
	RAMSAR	Barrage Al Mansour Ad-Dahbi	32,83km2	30° 54.989'N 6° 49.888'W	6,7km (S) to Edge	The site is chiefly notable for its populations of summer visitors, such as *Marmaronetta angustirostris* and *Tadorna ferruginea*, both of which exceed IBA thresholds
	IBAs					

Source: Protected Planet, Ibat Database and BirdLife Data Zone.

Note: Barrage Al mansour Ad-Dahbi is also listed as a Site of Biological and Ecological Importance.

Figure 12-2 Designated areas within a 15 km buffer



Sbaa Chaab CBTHA / UNDP

Recognised in 2005 under the framework of the 'Projet de Conservation de la Biodiversite par la Transhumance' as a key biodiversity site as it represents one of the best protected sites in the region.

Iguenane CBTHA / UNDP

Recognised in 2005 under the framework of the 'Projet de Conservation de la Biodiversite par la Transhumance' as a key biodiversity site as it represents one of the best protected sites in the region.

Ighernan Hunting Reserve

Designated in 2012 as a Permanent Hunting Reserve this site was selected due to its biodiversity on flora and fauna species, including numerous endemism of flora and the presence of approximately 15 individuals of the internationally threatened mammal Cuvier's Gazelle *Gazella cuvieri*. This reserve has been recognized as a priority within the framework of the Guidelines for the Management of Ungulates in Morocco.

Barrage Al Mansour Ad-Dahbi Hunting Reserve

Designated in 2012, this site was selected due to its biodiversity on flora species.

Oasis du Sud Marocain (RBOSM)

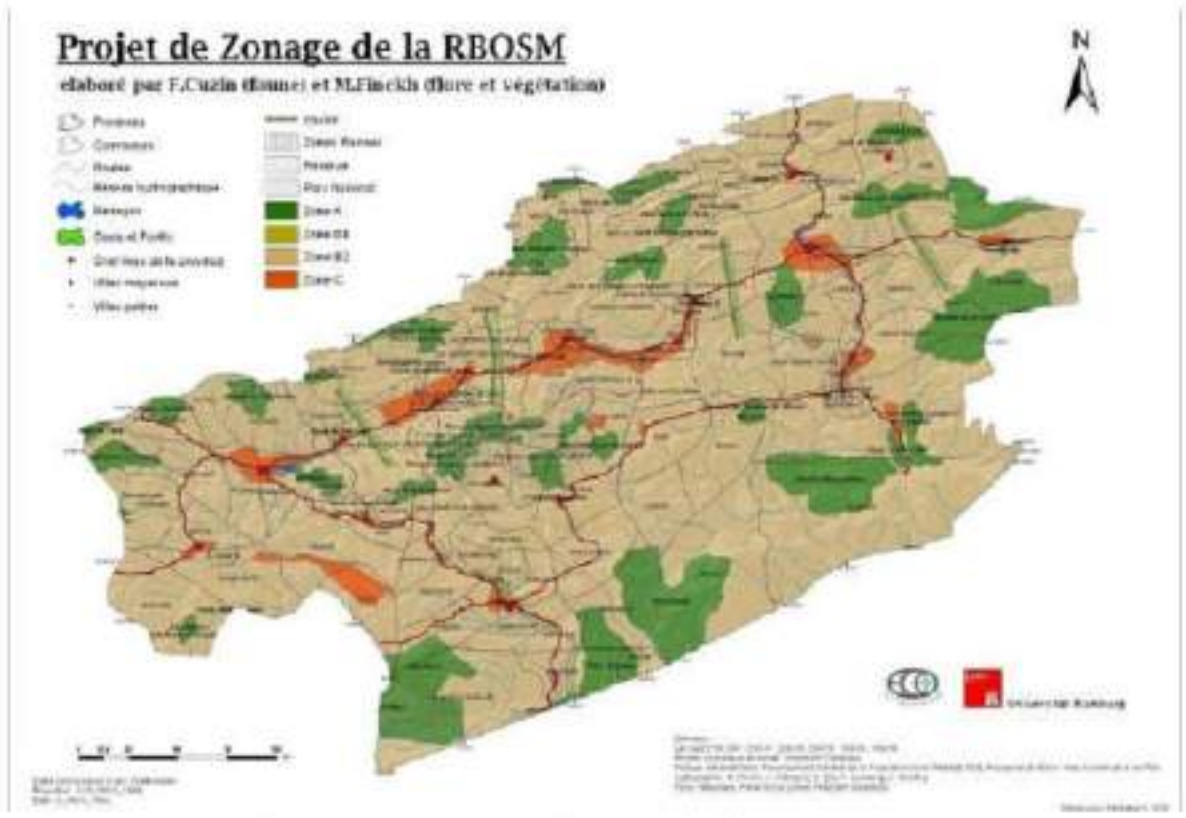
Designated in November 2000 by UNESCO as "Biosphere Reserve of the Moroccan South Oasis". With the recognition of the status of biosphere reserve, this region has become an integral part of the UNESCO World Program of Man and the Biosphere (MAB).

The habitat landscape of this biosphere reserve consists mainly of temperate grasslands, highland systems, desert areas (both semi-desert and warm-desert) and various mountain systems. The agricultural areas provide grazing but are mostly used for the cultivation of olives, cereals, dates and potatoes. Most of the habitats within this national reserve in Morocco are made up of Acacia forests, cliffs, lakes, mountain lakes, palm oases, sand dunes and desert steppes. This biosphere reserve is considered key in the fight against desertification and it is dedicated to the research and awareness of the correct use of water systems, freshwater systems and ecosystems.

A framework plan for the management of the Biosphere Reserve of the Moroccan South Oases was drawn up in 2008. It provides for a zoning of all the four provinces of Ouarzazat, Er Rachidia, Tinerhir and Zagora, which allows compatibility between actions Development and conservation actions.

The following Figure present the management areas for the Biosphere Reserve Zones.

Figure 12-3 Biosphere Reserve Zoning Map



Source: Agence Nationale pour le Développent des Zones Oasiennes et de lÁrganier. http://andzoa.ma.

Biosphere Reserve is divided in the following Zones:

- Zone A, with a major conservation objective, with the areas of Iguernan / Anrhemer, Tarhia du Draa, and Igoudlane n'Aït Zarhar; These areas often rely on existing or planned protected areas.
- Zone B, or buffer zone, with a major development objective compatible with conservation, which corresponds to all the other zones, and in particular to the Skoura palm plantation.
- Zone C, with a major economic development objective corresponding to the sector of Ouarzazate.

The project site will be located within Zone B of the South Moroccan Oasis Biosphere Reserve. The plan acknowledges the need for energy generation and favours renewable energy, so the solar plant is considered to comply with the management plan.

Barrage Al Mansour Ad-Dahbi

The reservoir is located approximately 6,7km south of the site. Water for the entire solar power complex will be drawn from the reservoir. The reservoir is part of a RAMSAR site, a Site of Biological and Ecological Importance (SIBE) and an Important Bird Area (IBA).

RAMSAR:

The RAMSAR site Moyenne Dr'a (site no. 1482) is composed of six units within two artificial habitats: the reservoir of the Al Mansour Ad-Dahbi dam and six oases with irrigated palm plantations along the course of the Dr'a River.

Designated as RAMSAR in 2005, this figure included the entire Middle Draa that includes the lake upstream as the RAMSAR site, covering a total area of 45,000 ha. The Ramsar convention is an intergovernmental treaty that provides a framework for national plans and international cooperation for wetland conservation. Al-Mansour site was selected due to the following criteria:

- Criterion 1: The site represents an original representative wetland type throughout North Africa.
- Criterion 2: regular presence of an endangered bird species Marbled Teal, *Marmaronetta Angustirostris* (global status Vulnerable) and Ruddy Shelduck, *Tadorna ferruginea,* not globally threatened.
- Criterion 3: Under this criterion, more than 20 species of birds may be considered as wintering or nesting in the dam area and about 100 other species related to palm groves.
- Criterion 4: This criterion is of particular interest to migratory birds, particularly trans-Saharan passerines, where oases serve as an essential stopover before and after crossing the desert.
- Criterion 6: important wintering and breeding populations of Ruddy Shelduck *Tadorna ferruginea,* whose size often exceeds the threshold 1% of the West Mediterranean population of the species.

Site of Biological and Ecological Importance

The reservoir is a priority 2 Site of Biological and Ecological Importance (SIBE no. H42). The SIBE network was established in the frame of "The Study of Protected Areas of Morocco"(AEFCS, BCEOM - SECA, 1995) which had as an objective the elaboration of a network that regroups all the representative sites on the bio ecological plan of zones with the index of high biodiversity, or with a high concentration of flora and fauna species, endemic, rare or endangered, and identify the zones of priority action at the heart of this network. A network of 160 SIBEs was created, grouped in 3 priority categories: priority 1 (48 SIBEs), priority 2 (50 SIBEs) and priority 3 (62 SIBEs). The priority n˚1 are the most representative and the richest in

biodiversity, and according to the "The Study of Protected Areas of Morocco" must be placed under a status of protection (natural reserve type) in a delay not above 5 years. The SIBE of priority 2 and 3 should have been placed under a status of protection in no more than 10 years.

Important Bird Area (IBA)

Birdlife International (code MA034) considers the reservoir an Important Bird Area (IBA).

According to BirdLife information, the IBA include an area where the water is relatively shallow and dense vegetation of *Cynodon dactylon*, *Cyperus spp*., *Juncus spp*., *Phragmites australis* and *Tamarix canariensis* occur. Elsewhere, the water depth drops off sharply, reaching 2–4 m deep only several metres from the rocky shore. The site is chiefly notable for its populations of summer visitors, such as *Marmaronetta angustirostris* and *Tadorna ferruginea*, both of which exceed IBA thresholds. A few pairs of *Marmaronetta angustirostris* have bred onsite and *Tadorna ferruginea* breeds regularly, but numbers of pairs are unknown. Wintering populations of waterfowl are small, although some 20 species have been recorded. The most abundant is *Tadorna ferruginea*, with up to 400 individuals noted.

The Marbled Teal, identified as vulnerable, is the species of highest concern in the reservoir according to the IUCN Red List. The reservoir is classified, as a non-breeding passage area for the species thus does not play a critical role in the conservation of this vulnerable species. However, pollution from agricultural, industrial and domestic sources is a threat at many sites and should be considered. Finally, there is limited information on the migratory pattern of Marble Teal. There is a general tendency for a more southerly distribution during the non-breeding season and a more northerly distribution during the breeding season (IUCN, 2016). Therefore, special attention must be taken when considering impacts on the species.

The reservoir is a SIBE, part of a RAMSAR site, a valuable ecosystem and provides valuable environmental services to the population. Therefore the impact of the project on the wetland ecosystem needs to be appropriately assessed and mitigated.

12.4 Sensitive Receptors

The table below outlines the identified receptors in relation to biodiversity as well as the determined sensitivity of those receptors.

Table 12-2 Ecology – Receptor Sensitivity

Receptor	Sensitivity	Justification
Local Flora & Fauna	Low	The study area has a low biodiversity value and no species of conservation concern have been identified.
Ighernan Hunting Reserve	Medium	This reserve comprises a high biodiversity on flora and fauna species
Biosphere Reserve	High	The Biosphere Reserve is a protected area that includes a variety of ecosystems that are currently under pressure due to anthropogenic impacts (i.e. overgrazing and illegal hunting).
Migratory Bird Species	High	Nine (9) migratory bird species could be affected by the proposed project when flying over the project site, in particular, due to the proximity of the Mansour Ad-Dhabi reservoir.

12.5 Construction Assessment

12.5.1 Potential Impacts

Onsite biodiversity Impacts

The baseline survey showed that the site (including the proposed PV and associated PL) exhibits limited biodiversity. This is to be expected since the site is within a fenced industrial complex, nearby operational plants and plants under construction, and the productivity of the rocky plateau was very low before the construction of the Complex as due to the lack of water onsite.

Most of the vegetation and fauna identified in the study area were on the oueds outside the complex fence site and the large chaaba that will not be directly affected by the project.

The requirements for the design and layout of the plant will necessitate site clearance and excavation, which will eliminate any remaining flora on the site and disturb any fauna on or near the site.

In addition to the existing site disturbances, the removal of soils for levelling and grading of the site may reduce the seed bank for future growth. It is possible that regrowth will occur to a certain extent where areas of ground are undeveloped.

Inadequate design and storage of wastes could result with contamination of soils and groundwater and attract pest species and spread disease.

The equipment and machinery used on site might cause direct mortality of terrestrial fauna.

Potential Impacts on protected areas and the surrounding ecosystems

Construction activities will result in the clearance of the habitat within the site. The habitat that will be directly impacted is very low value and has been fenced as part of the NOORo solar complex for several years.

The site is within Zone B of the South Moroccan Oasis Biosphere Reserve. This zone is defined as a "buffer zone" with the objective of only permitting developments that are compatible with conservation principles. The plan acknowledges the need for energy generation and favours renewable energy, so the solar plant is considered to comply with the land uses allowed in zone B by the management plan. The biosphere reserve is 72.000 km^2, and the project site will occupy 2.1 km^2.

Given that the project and its entire ancillary infrastructure (including the associated PL) are within the NOORo Complex, and there will be a buffer zone between the project fence and the complex fence, the only two impacts outside the project site on protected areas are considered to be water abstraction and potential wastewater discharges.

The abstraction of water from the Mansur Ad Dhabi reservoir for construction could potentially have an impact on the wetland ecosystem. As described in the water chapter, the calculated capacity of the reservoir was estimated at 439 hm^3 in 2010. Contributions to the Mansour Ed Dahbi dam average 420 hm^3 per year. The water use during construction of NOORo IV PV will be 9,620 m^3/year, which represents a minor amount of the average contribution to the Mansour Ed Dahbi Reservoir. It is highly unlikely that these minor quantities of water abstraction might have any noticeable impact on the ecosystem.

Discharges of polluted water outside the project fence are not envisaged and measures have been included in order to avoid uncontrolled discharges.

The analysis undertaken in this section shown that the construction impacts of NOOR IV on protected areas will be insignificant and has been scoped out from the analysis below.

Summary of construction impacts

Table 12-3 Ecology and Biodiversity – Magnitude of Construction Impacts

Impact	Magnitude	Justification
Direct Loss of habitat	Minor	The requirements for the design and layout of the plant will necessitate site clearance, which will remove any flora within the site.
Loss of seedbank	Minor	Site clearing and earth moving will alter the diversity and density of seeds in the soils. Removal of the vegetation will also limit the deposition of new seeds, and soil compaction will prevent regrowth of any seeds remaining on site. However, the site has a low biodiversity value and low biomass, therefore available seedbank is not considered of high importance.
Poaching/Hunting/Trade	Negligible	Harassment, poaching, and trade activities of some species might lead to decreases of populations at local level. This is, however, highly unlikely as hunting is not allowed within the project, and a double fence and security will prevent workers from hunting in the area.
Direct mortality of terrestrial fauna	Minor	The increment of traffic levels and machinery as well as the site clearance and excavation might cause direct mortality of reptiles and other terrestrial fauna in the project site and in the access route. However, the cumulative impact of traffic on existing routes is small and the surveys have found very limited fauna onsite.
Displacement due to Human disturbance	Negligible	Displacement due to human disturbance on fauna will be generated by human presence, noise levels, lighting and vibration. The magnitude is considered negligible as the site is within an existing industrial complex and such impacts already exist.
Pest from domestic waste	Negligible	Pests could potentially pose a minor temporary reversible loss of biodiversity through the spread of disease and nuisance to native habitats in the site and immediate surroundings. Due to the location of the project, this impact is considered negligible.

Table 12-4 Ecology - Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Direct Loss of habitat (onsite)	Minor	Local Flora & Fauna	Low	Negligible to Minor
Loss of Seed-bank	Minor	Local Flora & Fauna	Low	Negligible to Minor
Poaching/ Hunting/ Trade	Negligible	Local Flora & Fauna	Low	Negligible
Direct mortality of fauna	Minor	Local Fauna	Low	Negligible to Minor
Human disturbance	Negligible	Local Fauna	Low	Negligible to Minor
Pests	Negligible	Local Fauna	Low	Negligible to Minor

12.5.2 Mitigation Measures

Table 12-5 Ecology – Mitigation Measures - Construction

Impact	Mitigation	Responsibility	Schedule
Habitat Loss	The contractor will ensure that no encroachment to the nearby, adjacent land will occur. All temporary facilities and infrastructure for the construction phase will be located within the project site boundaries and removed maximum 2 months after the start of the operational phase.	EPC	CEMP – Design, Management
	Vehicles will keep to the designated routes in order to prevent unnecessary land encroachment, thus protecting the natural resources and reducing dust emissions	EPC	CEMP – Design, Management
	Replanting in places where colonization is difficult or in the interest of accelerating the process will be carried out in areas were vegetation will not be a safety concern during the operational phase. Particular effort will be put in the selection of the native vegetation and location of planting in order to successfully achieve 'in-kind' ecological restoration. Replanting will only be conducted in sites away from electrical equipment to avoid future fire hazards. Plating large trees or shrubs onsite is not recommended, as the existing evidence suggests that it attracts birds, reptiles and other fauna to the site, and this might result in increased mortality. Therefore planting will be limited to the herbaceous species that currently inhabit the site.	EPC	CEMP – Management
Poaching/ Hunting/ Trade	Hunting, falconry and trade will be strictly forbidden and penalized on site. Notes on informative boards will be displayed.	EPC	CESMP – Management and monitoring
Direct Mortality of Fauna	A 25 km/h speed limit will be imposed across the construction site in order to avoid direct mortality of fauna. Speed limits will be respected on offsite access routes.	EPC	CESMP – Management and monitoring

Impact	Mitigation	Responsibility	Schedule
	Workers will be trained to inform the HSE team of any reptiles or small mammals trapped on trenches, and a procedure will be in place to safely take the animals outside the complex (not only outside the project site).	EPC	CESMP – Management and monitoring
	Transportation within, to and from the site will be minimised through efficient transport management in order to minimise the risk of running animals over.	EPC	CESMP –Planning
	Include in the inception training sections to increase their awareness of ecological management protocols including activities forbidden onsite, and protocols when fauna is encountered.	EPC	CESMP – Management and monitoring
	Establish procedures to handle any species found on the construction site, including procedures for reporting, identification and potential relocation.	EPC	CESMP – Management and monitoring
Pest	An integrated pest management scheme will be developed, in preference to the use of large scale pesticides. All food waste will be stored in lidded containers.	EPC	CEMP – Management
Human disturbance	Where and when possible, night work will be avoided in order to prevent excessive human disturbance over fauna species. Measures on lightning, as described in the landscape chapter, and noise, as described in the relevant chapter, will minimise human disturbance.	EPC	CESMP – Management and monitoring

12.5.3 Residual Impacts

Following the implementation of the mitigation measures described above, and considering the relatively limited ecological value of the site, it is considered that the residual impacts upon the terrestrial ecology of the site will be of minor negative significance.

Table 12-6 Ecology – Residual Impacts

Impact	Receptor	Impact Significance	Measures	Significance of Residual Impacts
Habitat Loss	Local Flora & Fauna	Negligible to Minor	Yes	Negligible
Loss of Seed-bank	Local Flora & Fauna	Negligible to Minor	No	Negligible to Minor
Poaching/ Hunting/ Trade	Local Flora & Fauna	Negligible	Yes	Negligible
Direct mortality of fauna	Local Fauna	Negligible to Minor	Yes	Negligible to Minor
Human disturbance	Local Fauna	Negligible to Minor	Yes	Negligible
Pests	Local Fauna	Negligible to Minor	Yes	Negligible

12.6 Operational Phase Assessment

12.6.1 Potential Impacts

Power Line

The two potential impacts of operational power lines are mortality of avifauna due to electrocution and mortality of avifauna due to collision.

According to Hassen, D. *et al*, (2005) high voltage power lines during operation may generate impacts on biodiversity in the form of direct mortality of avifauna by collision due to the low visibility of the conductor cables and the neutral cable. Because of their long suspended insulators the risk of electrocution on high-voltage power lines is low. Nevertheless fatalities by electrocution are reported in humid weather by large birds roosting on the cross-arm above the insulators.

The following Table based on Hassen, D. *et al*, (2005) present information on the severity of the impact on populations from losses due to electrocution and/or collision for the families of bird species identified onsite. The following classification is used:

- 0: no causalities reported;

- I: causalities reported but no apparent threat to the bird population
- II: regional or locally high causalities; but not significant impact on the overall species population
- III: causalities are major mortality factor; threatening a species with extinction, regionally or on a large scale.

Table 12-7 Severity of impact on bird populations of mortality due to (A) electrocution and/or (B) collision with Power Lines for the identified families of birds.

Family	A	B
Petrels (*Procellariidae)**	0	I-II
Raptors (*Falconidae*)*	II-**III**	I-II
Gulls (*Laridae*)*	I	II
Waders (*Scolopacidae*)*	I	II-**III**
Rollers (*Coraciidae*)*	I	II

*Some of the species included in this family are migratory birds.

Raptors, identified during the field surveys and Waders, identified on the desktop study (see Appendix 2) are potentially the species with a major mortality factor due to collision and electrocution with power lines. As such specific measures have been included in the mitigation section in order to avoid or minimize potential negative impacts on these species.

Power Plant

Potential impacts during the operational phase of the PV include direct mortality of fauna due to traffic, collision impacts of migratory birds with panels, and the use of herbicides or pesticides onsite.

Direct Mortality

Traffic density during operation will be very small and mitigation measures to limit speeds and avoid irresponsible behaviours are included on the traffic chapter.

Bird mortality due to collisions with PV panels

According to BirdLife International (http://www.migraciondeaves.org) some species of birds may collide with panels because they are attracted to shaded areas, particularly if panels are located in previously undisturbed areas and/or within migratory paths. Additionally, due to the proximity of the Al-Mansour Reservoir, migratory birds might confuse the surface of the PV panels with a freshwater body.

While this impact has only been described on few PV plants globally and most of the risk from solar power plants is associated with tower CSPs, the following assessment on the importance of the area as a migratory route is considered relevant, following a precautionary approach:

The Mediterranean/Black Sea Flyway is one of three Palearctic-African flyways connecting Europe with Africa. The proposed site is not located on the main flyway path, which is concentrated to the West High Atlas; however, some migratory species might use this site for migration. The following figures from BirdLife International Mediterranean/black sea flyway database (http://www.migraciondeaves.org) present some examples of the species identified using the West High Atlas region, to the west of the proposed Project. As shown in the figures, migratory activity in the area is low.

Figure 12-4 Egyptian Vulture Migratory Path (2014)

Figure 12-5 Black Stork migratory path (2014)

Table 12-8 Ecology and Biodiversity – Magnitude of Operational Impacts

Impact	Magnitude	Justification
Direct mortality of avifauna due to collision with the PL	**Moderate Negative**	Wader species, including species from the Ramsar are likely to use the area occasionally as a migratory path. Collision causalities are major mortality factor for these species.
Direct mortality of avifauna due to electrocution with the PL	**Minor Negative**	Raptor species identified during the field surveys are likely to use the area occasionally. Electrocution causalities are major mortality factor for these species.
Direct mortality of avifauna due to collision with the PV or nest destruction	Minor	Migratory birds could potentially mistake the PV panels with surface freshwater. No long-term scientific data has showed direct mortality from collision, and this impact has been described in a very limited number of operational plants worldwide. Some species could establish a nesting or resting area in the project site. However, this is considered unlikely as there are more attracting areas for birds in the oueds, oasis and the reservoir.
Herbicides and pesticides	Minor	Inadequate management and selection of persistent non-biodegradable landscape chemicals may be toxic and also impact on the local vegetation.

Table 12-9 Ecology - Significance of Operational Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Direct mortality of avifauna due to collision with the PL	Minor	Migratory Birds	High	Mino to Moderate
Direct mortality of avifauna due to electrocution with the PL	Minor	Local Fauna	Low	Negligible or Minor
Direct mortality of avifauna due to collision	Minor	Migratory Birds	High	Mino to Moderate
Herbicides and pesticides	Minor	Local Flora	Low	Negligible or Minor

12.6.2 Mitigation Measures

The following mitigation measures are recommended, in order to minimise the impact and potentially improve biodiversity of the project site and surrounding area during the NOORo IV Ouarzazate Project operations.

Table 12-10 Ecology – Mitigation Measures - Operation

Direct mortality of avifauna due to electrocution	The EPC will prepare a technical assessment of the PL design, to show compliance with international good practice for bird mortality management in the design of the line, as specified in the EU "*Bern Convention Group of Experts on Conservation of Birds*" and Birdlife "*Birds and Power Lines within the Rift Valley/ Red Sea Flyway*". For each of these design recommendations, the EPC will clearly state which have been incorporated into the design, and when one has not been incorporated, the technical reason why it is not applicable will be detailed. The report will be submitted to the Project Company and reviewed by a qualified independent expert to ensure that the proposed detailed design is aligned with good international practice to minimise bird mortality.	EPC	Design
Direct mortality of avifauna due to collision	Multi-level arrangements of the power line cables and with neutral cable high above the conductor cables will be avoided if possible, as there pose higher risks for birds. A single-level arrangement is preferred.	EPC	Design
	Where possible, use of neutral cable will be avoided. If the avoidance of the neutral cable is not possible, the cable could be required to be made clearly visible by suitable marker balls. Marker balls can reduce collision accidents by 50 to 85%.	EPC (Design) O&M (monitoring) EPC (if installation of marker balls is	Design

	In order to determine if collision rates justify the installation of marker balls, bird mortality monitoring will be undertaken for the first two years of operation of the Power Line, as detailed in the monitoring chapter. If identified mortality during a single migratory season exceeds 3 carcasses of threatened species (VU, CR or EN as per IUCN) or 10 carcasses in total, ball markers will be installed. If there is a clear geographical pattern of bird mortality, the markers could be installed only in the areas with significantly higher mortality rates.	required during the first two years of operation)	
Direct mortality of avifauna due to collision	Mortality monitoring will be undertaken on a continuous basis by O&M stuff during the operational phase of the plant. Specific training will be provided to ensure that carcases or wounded birds are reported and an the appropriate identification of species. If the number of carcasses identified during three consecutive months exceeds 3 carcasses of threatened species (VU, CR or EN as per IUCN) or 10 carcasses in total, bird deterrent measures will be implemented in line with good international practice.	O&M	OEMP – Monitoring and Training
Direct Mortality of Fauna	A 30km/h speed limit will be imposed across the site in order to avoid direct mortality of fauna.	O&M	OEMP – Management
	Vehicles will keep to the designated routes in order to prevent unnecessary land encroachment, thus protecting the natural resources and reducing dust emissions	O&M	OEMP – Management and Training
Poaching/Hunting/Trade	Hunting, falconry and trade will be strictly forbidden and penalized on site. Notes on informative boards will be established.	O&M	OESMP – Management and monitoring
Herbicides and Pesticides	An integrated pest management scheme will be developed for the plant, in preference to the use of large scale pesticides	O&M	OEMP – Management

12.6.3 Residual Impacts

Following the mitigation and management techniques outlined above, which will be further developed within the OESMP, the residual impacts are generally expected to be as follows:

Table 12-11 Ecology – Residual Impacts – Operation Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Direct mortality of avifauna due to collision with the PL	Migratory Birds	Mino to Moderate	Yes	Minor
Direct mortality of avifauna due to electrocution with the PL	Local Fauna	Negligible or Minor	Yes	Negligible
Direct mortality of avifauna due to collision with the PV	Migratory Birds	Mino to Moderate	No	Mino to Moderate
Herbicides and pesticides	Local Flora	Negligible or Minor	Yes	Negligible

12.7 Decommissioning Assessment

A detailed Decommissioning E&S Management Plan will be prepared to ensure that all impacts are identified, assessed and mitigated. The DESMP will use the construction impacts of this SESIA as a basis to develop the MP. It is expected that the National and IFC standards will be updated at the time of decommissioning, and the DESMP will be compliant with the applicable requirements at the time of preparation. Given the time lapse between the preparation of this SESIA and associated ESMP, it is not consider realistic to outline mitigation and monitoring measures at this stage. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

13 HAZARDOUS AND NON-HAZARDOUS MATERIALS AND WASTE MANAGEMENT

13.1 Introduction

This chapter provides an assessment of the environmental impacts that may occur as a result of non-hazardous waste generation and inadequate handling of hazardous materials (including waste) during both the construction and operational phases of the NOORo IV PV Project.

Non-hazardous waste and hazardous materials have the potential to contribute to a number of environmental problems if not properly stored and/or managed, such us direct contamination to ground and indirect contamination to sensitive receptors, leading to severe environmental and public health issues.

With proper management, a large amount of discarded materials can be reduced, reused, or recycled; and hazardous materials can be adequately contained and managed reducing the risk of environmental and public health impacts.

The construction and operational phases of the proposed project will necessitate the proper management of non-hazardous waste and hazardous materials on site. Specific mitigation measures are recommended to address the identified potential impacts.

13.2 Methodology

The main objective of this chapter is to assess the impacts associated with the generation, handling, storage and transportation of non-hazardous and hazardous waste and hazardous materials during both construction and operational phases of the project. This assessment has been informed through a desktop study, site visit, and an overall understanding of associated issues gained from assessing the environmental impacts of other PV facilities. The following specific information has been reviewed as part of the desk study:

- Assessment of applicable national and international standards and guidelines identified within the IFC Performance Standards;
- Assessment of available site specific information relating to waste generation;
- Assessment of the proposed design, construction procedures and project features that may impact on both the society and environment in terms of waste generation and hazardous materials, and
- Walkover survey to identify sensitive receptors and determine the existing baseline conditions.

Based on the findings of the assessment, measures have been identified in order to mitigate any negative effects and promote positive effects associated with both the construction

and operational phases. General waste management and hazardous materials practices are evaluated with respect to legal requirements and where applicable, mitigation measures resulting in the improvement of waste management and minimisation, and storage, transport and handling of hazardous materials are recommended.

The main aims of the chapter are to identify the following:

- Materials required or generated onsite with the potential to pose substantial or potential threats to public health or the environment;
- Options for the reduction, re-use, recycling and recovery of all waste streams;
- Opportunities to minimise waste streams from project inception, thereby minimizing the amount of waste sent to landfill;
- Specify methods for the segregation of waste streams within the facility, and
- Detail methods for safe storage, transfer and handling of hazardous materials.

13.3 Baseline

13.3.1 Non-hazardous and Hazardous Waste

Solid waste generation is generally growing rapidly due to industrial and economic growth. Consequently, responsible waste management is essential to minimise direct and indirect impacts upon the environment as a result of waste generation and resource consumption. In order to promote sustainable economic development in Morocco, it is vital to consider the methods for handling, storage and management of waste generated.

Waste management sites and facilities in Morocco are operated and managed either by private companies or local municipalities. When new sites are proposed and constructed, the regulator plays an important role in advising the operators on the environmental protection requirements for each facility. The required authorizations and contracts for the collection, transport and disposal of waste shall be obtained by the EPC and the O&M before the start of the construction and operation phases.

Waste Characterisation

Waste can exhibit certain characteristics according to the process stream from which it is generated and any pre-treatment processes that are undertaken. Different types of waste require different management and disposal techniques according to the potential risk that the material poses to human health or the environment. In order to categorise the different risks to these receptors, it is often useful to demarcate the streams into 3 main categories that effectively equate to the level of the management and disposal which are required for each:

- Hazardous waste which pose a potential hazard to the environment or health of employees or the general public;
- Non-hazardous wastes - solid materials which are not hazardous and degrade, chemically or biologically in the environment; and
- Non-water soluble wastes - materials that do not breakdown in the environment, and are otherwise inert.

It is considered likely that the proposed project will potentially generate waste in all of the categories listed above.

Waste Management Hierarchy

The waste management hierarchy is a key element of waste management. Minimising the amount of waste to be stored and disposed of not only protects the environment but also has the potential to reduce costs that may be incurred by the main contractor or the proponent for handling and disposing of the waste.

In general, waste generation is evaluated according to the waste minimisation approach. This approach is common to various national and internal guidelines and principles and involves the following steps in decreasing order of importance. The waste hierarchy is illustrated in the following figure.

Figure 13-1 Waste Management Hierarchy

Initially, options to prevent or reduce the amount of waste generated should be considered. Where waste generation cannot be avoided or further reduced at source, opportunities for reuse of materials should be explored, either for use for the same or a different purpose.

Disposal to landfill is the least favoured option in the waste hierarchy and is the last resort after all other options have been considered.

13.3.2 Hazardous materials

A hazardous material is any substance or agent (biological, chemical, radiological, and/or physical) which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Hazardous materials include chemicals which are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents which act on the hematopoietic system; agents which damage the lungs, skin, eyes, or mucous membranes; chemicals which are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive or water-reactive; and chemicals which in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapours, mists or smoke which may have any of the previously mentioned characteristics.

Mitigation measures to ensure safe transport, transfer, storage and handling of hazardous materials are provided below.

13.4 Sensitive Receptors

Table 13-1 Solid and Hazardous Waste - Receptors sensitivity

Receptor	Sensitivity	Justification
Soil & Water	Medium	The site is a greenfield and no contamination was observed or identified through soil contamination analysis. The soil has low organic matter and productivity. There is no permanent groundwater or surface water onsite. Rainwater is uncontaminated and surface runoff feeds larger water channels in the area.
Waste Infrastructure	Medium	Construction and operational/maintenance activities will result in an additional input of waste materials into the regional waste management service/infrastructures. There is one municipal landfill in Ouarzazate and no infrastructure for recycling. There is no infrastructure for the handling of hazardous waste in the province, and the only authorised companies are in the Casablanca region.

13.5 Construction Assessment

13.5.1 Potential Impacts

During construction of the PV and associated facilities (including the PL), waste will be generated during earthworks, construction of the fence, paths, buildings, etc. The main types of waste generated are outlined below. Given the size of the facility, the amount of waste

generated will not be significant but if not properly managed will look unsightly, and may lead to contamination of the soils and groundwater.

Non-Hazardous Waste

During the construction phase, a number of activities will result in waste generation. These activities include but are not limited to the following:

- Site clearance and levelling;
- Backfilling and excavation;
- Constructing a boundary wall and site offices, and
- Temporary wastewater storage and drainage network construction.

The types of waste generated by these activities include:

- Sand;
- Gravel;
- Asphalt paving;
- Scrap steel;
- Plastics;
- Packaging materials (wood, etc.), and
- Domestic waste from construction workers.

Most construction waste is often bulky and heavy and mostly unsuitable for disposal by incineration or composting. The expected construction waste is inert and does not pose a threat to human health or the environment. However, proper management is required in order to reduce associated secondary impacts such as resource use, dust emissions, landscape disturbance or habitat destruction. Increased pressure may be placed upon local facilities/services and result in a reduced capacity for handling waste from municipal sources.

Hazardous Materials

Even though no significant amounts of hazardous materials will be stored/generated onsite, a small amount requires careful consideration. Typical hazardous materials stored onsite and waste streams that may arise during construction include:

- Fuel;
- Solvents;
- Lubricants;
- Resins and paints;

- Batteries;
- Waterproofing compounds;
- Adhesives;
- Clean-up materials (such as rags, used spill-kits, etc.) contaminated with the items listed above;
- Drums, containers and tins with remains of hazardous substances, or
- Broken PV panels or other components (e.g. inverter).

The hazardous materials can potentially cause significant adverse impacts on human health and the environment if managed improperly. Inappropriate handling as a result of deficient training may lead to accidental spills and inadequate infrastructure or equipment may lead to leaks to the ground that will result in soil and groundwater contamination events. Contamination may also arise as a result of transportation by diesel suppliers or waste contractors who have not been approved by the authorities.

Other environmental and social impacts that might arise from the construction activities are waste disposal to unlicensed landfills or increased pressure upon local licensed landfills that result in a reduced capacity for handling waste from municipal sources.

Therefore, prior to the implementation of mitigation measures, it is expected that the hazardous waste generated during the construction phase of the Project will result in a temporary impact of moderate negative significance.

Table 13-2 Solid Wastes - Magnitude of Construction Impacts

Impact	Magnitude	Justification
Non Hazardous wastes	Minor	Given the size of the project and the technology to be implemented, moderate amounts of waste are expected to be generated. However, the risk of non hazardous wastes to the environment is low.
Hazardous Materials	Moderate	Small volumes of hazardous materials will be generated and/or kept onsite. However, the uncontrolled release of small amounts of hazardous materials poses a moderate risk to the environment.

Table 13-3 Solid Wastes - Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Non Hazardous wastes	Minor	Local Waste Infrastructure	Medium	Minor
		Soil & Water	Medium	Minor
Hazardous	Moderate	Waste	Medium	Moderate

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Materials		Infrastructure		
		Soil & Water	Medium	Moderate

13.5.2 Mitigation Measures

The mitigation measures provided refer to both hazardous and non-hazardous materials. Whilst some mitigation measures are specific, many measures are applicable to both and therefore this section does not consider these measures separately, unless specified.

In addition to the CESMP, the EPC will be required to prepare the following documents:

- Hazardous Materials Management Plan (this will contain procedures, rules and training for hazardous waste handling and storage, spill response protocols, contingency plans to detail the clean-up of any spillages, etc.);
- Waste Management Plan (this will comprise the necessary measures to fully apply the Waste Hierarchy described in the baseline section);
- Emergency Preparedness and Response Plan.

These documents will incorporate, as a minimum, the mitigation measures included in the table below. These plans can be standalone documents or can be incorporated into the CESMP.

Table 13-4 Solid Wastes–Mitigation Measures for Construction

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Solid waste volumes/quantities	Prepare a site-specific Waste Management Plan (WMP) including hazardous and non hazardous waste. The plan will include training of staff.	EPC	CESMP – Management
	Waste masonry should be re-used in the internal road construction and base fillings. Reasonable levels of utilization would be 60 to 80%.	EPC	CESMP – Management
	100% waste metal will be recycled.	EPC	CESMP – Management
	Ordering materials that have reusable packaging and/or in bulk to reduce waste generated.	EPC	CESMP – Management
	Request suppliers to use minimal packaging.	EPC	CESMP – Management
	Chemicals should be ordered in returnable drums.	EPC	CESMP – Management
	"Buy-back" arrangements should be made with key suppliers so that any surplus chemicals or materials can be returned.	EPC	CESMP – Management
	Refillable containers will be used, where possible, for collection of solid and liquid wastes.	EPC	CESMP – Management
Housekeeping	Separate waste streams to facilitate recycling. All storage areas must be well organised and waste appropriately managed through segregation of hazardous and non-hazardous waste. Waste within each category will be further segregated by type (paper, plastic, metal, masonry) and whether the material is recyclable or non-recyclable.	EPC	CESMP – Management Monitoring

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	A waste log will be kept onsite and will contain, at least, information about quantities, management solution (according to the waste management hierarchy described in the baseline section) types, operator, final disposal/destination, etc.)	EPC	CESMP – Management Monitoring
	Install adequate storage facilities for non-hazardous waste in designated areas to prevent waste from dispersing throughout the site	EPC	CESMP – Management
	Include in the employees' inception training information to increase their awareness of waste management protocols including proper handling and storage of waste, and emergency response and contingency plans.	EPC	CESMP –- Training
Waste Storage	Food waste must be stored within a sealed metal or plastic skip or bin with self-closing lid, in order to prevent birds/vermin/pests gaining access	EPC	CESMP – Management
	Lightweight waste e.g. paper, cardboard, plastics: Must be stored within a skip sealed with a secured tarpaulin/netting sufficient to prevent any material being dispersed.	EPC	CESMP – Management
	Heavy waste can be contained within an open skip, providing that segregation occurs effectively enough to remove all lightweight material that could be blown away.	EPC	CESMP – Management
	Litter, bins for different types of waste (food waste, domestic waste) categories will be placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. Portable separate bins will also be placed at areas where works will be undertaken (interconnection point, power line, access road, etc.)	EPC	CESMP – Management
	No underground waste containers will be deployed.	EPC	CESMP – Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	Waste containers will be clearly marked with appropriate labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, and securely attached. Wherever possible, chemicals will be kept in their original container	EPC	CESMP – Management
	Waste generated during construction will only be transported off-site for disposal by an appropriately licensed vendor. This service provider will follow the proper protocols to ensure that all waste handling and disposal from the site is carried out according to the environmental regulations. A record for all waste streams will be kept onsite.	EPC	CESMP – Management - Monitoring
	Regular training of site personnel in proper waste management and chemical handling procedures will be conducted at regular intervals.	EPC	CESMP – Training
	Incineration/burning of wastes will not be allowed onsite	EPC	CESMP – Management
Hazardous Materials	Implement best practice and regulations procedures for adequate handling, establishment of secure temporary storage areas, and disposal of waste by approved contractors.	EPC	CESMP – Management
	Hazardous wastes will be disposed in an environmentally safe manner and by licensed hazardous waste operators	EPC	CESMP – Management
	Materials will be separated into combustible and non-combustible, and all flammable substances must be kept away from sources of ignition.	EPC	CESMP – Management
	No underground hazardous materials storage containers will be deployed. Storage of hazardous materials will be undertaken in a fenced dedicated area with a dedicated drainage system and roofed to prevent rainwater from entering the area. This hazardous materials storage area will be located considering	EPC	Design and CESMP – Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	potential risks (e.g. traffic accidents/collisions, fall of items, drainage system, etc.).		
	Provide bunds for storing hazardous materials containers. The bunds will have the capacity to contain 110% of the total volume of stored materials and will be protected from vehicles or other risks. This area must be placed away from any sources of ignition. Storage areas will have impermeable bases (this need to cover a wider area if needed to avoid soil contamination, e.g. refuelling areas will include an impermeable base that protects the ground where the vehicles will be parked), will be roofed and be equipped with spill kits.	EPC	CESMP – Management
	Hazardous Materials containers will be clearly marked with appropriate warning labels to accurately describe their contents and detailed technical specifications and safety precautions. Labels will be waterproof, and securely attached. Wherever possible, hazardous materials will be kept in their original container	EPC	CESMP – Management
	Hazardous materials will only be transported to/from the site by a licensed operator. This service provider will follow the proper protocols to ensure that all hazardous materials are transported and transferred according to the environmental regulations. A record for all hazardous materials will be kept onsite.	EPC	CESMP – Management - Monitoring
	Only trained personnel will be permitted to handle hazardous materials.	EPC	OESMP –Training
Waste Facilities	Only licensed waste management facilities shall be used for the disposal of non-hazardous and hazardous wastes, respectively.	EPC	CESMP – Management

13.5.3 Residual Impacts

Following the implementation of the mitigation measures detailed above and through effective implementation of the measures and protocols set out within the Waste Management Plan, the potential residual impacts of waste generated during the construction phase are likely to be negligible in significance.

Table 13-5 Solid Waste– Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Non-hazardous wastes	Waste Infrastructure	Minor	Yes	Minor
	Soil & Water	Minor	Yes	Negligible
Hazardous Wastes	Soil & Water	Moderate	Yes	Negligible
	Waste Infrastructure	Moderate	Yes	Minor

13.6 Operation Assessment

13.6.1 Potential Impacts

No wastes are likely to be generated as part of the operational PL.

With regards to the operational phase of the PV, the following wastes are likely to be generated: domestic waste, industrial non-hazardous waste and hazardous materials.

Domestic waste

The operation of the proposed project will generate domestic waste from administration and workers. This waste can be classified as both recyclable and non-recyclable. Recyclable waste includes paper, tin cans, plastics, cartons, rubber, and glass, while non-recyclables will consist mainly of food residues and other organic waste.

Industrial Non-Hazardous Waste

Industrial non-hazardous waste refers to waste generated by operation activities that do not exhibit any characteristics that can potentially harm human health or the environment. This type of waste can be classified further as recyclable and non-recyclable.

Small amounts of industrial non-hazardous waste generated during the operation of the proposed NOORo IV PV. These may include empty containers, general clean-up materials, packaging materials and inert insoluble solid materials such as glass, rubber, and plastics.

Hazardous Materials

Hazardous Materials can potentially cause significant adverse impacts on human health and the environment if managed improperly. However, the amount of hazardous materials required and the hazardous waste generated from the operation of a PV is undeniably minor.

Examples of likely hazardous materials/waste streams that may arise during the operation of the Project include the following:

- Fuel for cleaning vehicles or small emergency generators;
- Broken PV panels;
- Used chemicals and clean-up materials;
- Soil contaminated by potential spills and leaks, and
- Miscellaneous wastes such as batteries.

Hazardous materials could potentially be released into the environment. This subsequently represents a potential impact upon soil and groundwater, in terms of contamination events. Potential sources, contamination pathways and appropriate mitigation measures are addressed in the Soil and Groundwater chapter.

Inappropriate handling through lack of personnel training on site may lead to accidental spills or leaks to the soil which leads to a contamination event, resulting in a potential health risk to workers and environmental impacts. Contamination may also arise as a result of transportation by waste contractors who have not been approved by the regulator or disposal to unlicensed landfills. Increased pressure may be placed upon local hazardous waste landfills and result in a reduced capacity for handling waste from municipal sources.

Table 13-6 Solid Wastes - Magnitude of Operational Impacts

Impact	Magnitude	Justification
Non Hazardous wastes	Minor	The low number of staff employed at the site and type of daily activities will only generate small volumes of waste which represent a low risk to the environment.
Hazardous Materials	Minor	The amount of hazardous materials stored/generated during the operation of a PV plant is very small, but could cause localised contamination if released to the environment.

Table 13-7 Solid Wastes - Significance of Operational Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Non Hazardous wastes	Minor	Land fill	Medium	Minor
		Soil & Water	Medium	Minor
Hazardous Wastes	Minor	Land fill	Medium	Minor
		Soil and Groundwater	Medium	Minor

13.6.2 Mitigation Measures

The mitigation measures provided refer to both hazardous and non-hazardous materials. Whilst some mitigation measures are specific, many measures are applicable to both and therefore this section does not consider these measures separately, unless specified.

The O&M will be required to prepare the following documents in addition to the OESMP:

- Hazardous Materials Management Plan (this will contain procedures, rules and training for hazardous waste handling and storage, spill response protocols, contingency plans to detail the clean-up of any spillages, etc.);
- Waste Management Plan (this will comprise the necessary measures to fully apply the Waste Hierarchy described in the baseline section);
- Emergency Preparedness and Response Plan.

These documents will incorporate, as a minimum, the mitigation measures included in the table below. The plans, procedures and measures can be presented as standalone documents or included in a comprehensive OESMP

Table 13-8 Solid and Hazardous waste – Operational Mitigation measures

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Solid waste volumes/quantities	Prepare a site-specific Waste Management Plan (WMP) including both hazardous and non hazardous waste. The plan will include training of staff.	O&M	OESMP – Management
	100% waste metal will be recycled	O&M	OESMP – Management
	Ordering materials that have reusable packaging and/or in bulk can to reduce waste generated	O&M	OESMP – Management
	Request that suppliers use minimal packaging.	O&M	OESMP – Management
	Chemicals should be ordered in returnable drums.	O&M	OESMP – Management
	"Buy-back" arrangements should be made with key suppliers so that any surplus chemicals or materials can be returned	O&M	OESMP – Management
	Refillable containers will be used, where possible, for collection of solid and liquid wastes	O&M	OESMP – Management
Housekeeping	Separate waste streams to facilitate recycling. All storage areas must be well organised and waste appropriately managed through segregation of hazardous and non-hazardous waste. Waste within each category will be further segregated by type (paper, plastic, metal) and whether the material is recyclable or non-recyclable. A waste log will be kept onsite and will contain, at least, information about quantities, management solution (according to the waste management	O&M	OESMP – Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	hierarchy described in the baseline section) types, operator, final disposal/destination, etc.)		
	Install adequate storage facilities for non-hazardous waste in designated areas to prevent waste from dispersing throughout the site.	O&M	OESMP – Management
	Include in the inception training for employees sections to increase their awareness of waste management protocols including proper handling and storage of waste, and emergency response and contingency plans.	O&M	OESMP –– Training
Waste Storage	Food waste must be stored within a lidded metal or plastic skip or bin, in order to prevent vermin/pests gaining access.	O&M	OESMP – Management
	Lightweight waste e.g. paper, cardboard, plastics must be stored within a skip lidded with a secured tarpaulin/netting sufficient to prevent any material being dispersed.	O&M	OESMP – Management
	Electronic waste (defect PV modules, inverters, cable, etc.) will be stored in designated areas and collected by a licensed operator that ensures appropriate recycling or disposal. If licensed operators are not available in Morocco, electronic waste will be safely stored onsite until appropriate treatment is available.	O&M	OESMP – Management
	For litter (food waste, domestic waste), bins for separate categories will be placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area.	O&M	OESMP – Management
	Waste containers will be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, and securely attached. Wherever possible, chemicals will	O&M	OESMP – Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	be kept in their original container		
	Waste generated during operation will only be transported off-site for disposal by an appropriately licensed vendor. This service provider will follow the proper protocols to ensure that all waste handling and disposal from the site is carried out according to the environmental regulations. A record for all streams of generated and collected waste will be kept onsite.	O&M	OESMP – Management
	Regular training of site personnel in proper waste management and chemical handling procedures will be conducted at regular intervals.	O&M	OESMP – Management
	Incineration/burning of wastes will not be allowed	O&M	OESMP – Management
Hazardous Materials	Implement best practice and regulations procedures for adequate handling, establishment of secure temporary storage areas, and disposal of waste by approved contractors.	O&M	OESMP – Management
	Hazardous wastes be disposed in an environmentally safe manner and by licensed hazardous waste operator	O&M	OESMP – Management
	Materials will be separated into combustible and non-combustible, and all flammable substances must be kept away from sources of ignition.	O&M	OESMP – Management
	No underground hazardous materials storage containers will be deployed. Storage of hazardous materials will be undertaken in a fenced dedicated area with a dedicated drainage system and roofed to prevent rainwater from entering the area. This hazardous materials storage area will be located considering potential risks (e.g. traffic accidents/collisions, fall of items, drainage system, etc.).	O&M	OESMP – Management
	Provide bunds for storing hazardous materials containers. The bunds will have	O&M	OESMP –

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	the capacity to contain 110% of the total volume of stored materials and will be protected from vehicles or other risks. This area must be placed away from any sources of ignition. Bunds for large fuel storage tanks will be tested regularly with reused water / wastewater (i.e. non hazardous water that was previously used for an activity that did not risk contaminating it or treated wastewater). Raw water shall not be used to avoid increasing water consumption from the reservoir, which is a RAMSAR site. The reused water / wastewater should have no oils and greases, and the bund will be cleaned from spills prior to testing it. Following the test, the water will not be further reused onsite without treatment due to the risk of contamination. Photographic records of water tests will be kept. Storage areas will have impermeable bases (this need to cover a wider area if needed to avoid soil contamination, e.g. refuelling areas will include an impermeable base that protects the ground where the vehicles will be parked), will be roofed and be equipped with spill kits.		Management
	Hazardous Materials containers will be clearly marked with appropriate warning labels to accurately describe their contents and detailed technical specifications and safety precautions. Labels will be waterproof, and securely attached. Wherever possible, hazardous materials will be kept in their original container	O&M	OESMP – Management
	Hazardous materials will only be transported to/from the site by an appropriately licensed operator. This service provider will follow the proper protocols to ensure that all hazardous materials are transported and transferred according to the environmental regulations. A record for all hazardous materials will be kept onsite.	O&M	OESMP – Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	Only trained personnel will be permitted to handle hazardous materials.	O&M	OESMP –Training
Waste Facilities	Only Waste management facilities approved by authorities shall be used for the disposal of non-hazardous and hazardous wastes, respectively.	O&M	OESMP – Management

13.6.3 Residual Impacts

Following the implementation of the mitigation measures detailed above, it is predicted that the residual impacts of the Project upon the local waste infrastructure, landfill capacities and human health and the environment are likely to be of minor to negligible negative significance.

Table 13-9 Solid Waste– Residual Impacts – Operational Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Non-hazardous wastes	Land fill	Minor	Yes	Minor
	Soil & Water	Minor	Yes	Negligible
Hazardous Wastes	Soil & Water	Minor	Yes	Negligible
	Waste Infrastructure	Minor	Yes	Minor

13.7 Decommissioning Assessment

High amounts of waste as a result of panels/structures dismantling and site restoration activities is expected during the decommissioning phase of NOORo IV. A detailed DESMP will be prepared to ensure that all impacts are identified, assessed and addressed.

It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered realistic to outline mitigation measures for the decommissioning phase at this stage. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

14 WASTEWATER MANAGEMENT

14.1 Introduction

This chapter identifies the main issues associated with wastewater production and management. Wastewater refers to any contaminated water resulting from any project activities. Wastewater can result from many processes, both man-made (i.e. sewage, oily wastewater) and naturally (i.e. contaminated stormwater runoff).

Environmental impacts from poor wastewater management can be significant and can impact various environmental components including the degradation or contamination of surface waters, soils and groundwater, with secondary impacts upon ecology, living natural resources and communities (in terms of health and economics).

Both the construction and operational phases of the proposed NOORo IV project will generate domestic wastewater and will have a relative potential to detrimentally impact upon the surrounding environment and society.

This section provides a number of measures to ensure that appropriate management is achieved during construction and operation.

14.2 Methodology

The assessment has been conducted by identifying the relevant local and international standards and best practice relating to wastewater and stormwater runoff and erosion management during the construction and operational phases of the proposed facility. Estimates and figures relating to wastewater volumes and proposed treatment processes have been based on the data available from the bid proposal.

14.3 Baseline

There is no wastewater onsite. The NOORo I, II and III plants follow the zero wastewater discharge approach for industrial wastewater, so all industrial wastewater is treated for reuse and the remaining sent to evaporation ponds.

There is a municipal wastewater treatment plan in Ouarzazate. Domestic wastewater from NOORo I, II and III plants is sent to Ouarzazate for treatment.

14.4 Sensitive Receptors

The table below outlines the identified receptors in relation to wastewater as well as the determined sensitivity of those receptors.

Table 14-1 Wastewater -Sensitive Receptors

Receptor	Sensitivity	Justification
Soil / Water	Medium	The site is a greenfield, and no contamination was observed in the ground (including main ephemeral stream in the site). There is no groundwater onsite. In the event of any spills or leaks of non-treated or poorly treated wastewater, contamination to soil may occur.

14.5 Construction Assessment

14.5.1 Potential Impacts

Wastewater

The main wastewater contamination risks arising during construction relate to sanitary waste from canteens and lavatories, and contaminated wastewater generated by stormwater events washing hazardous spills/leaks.

Although construction activities are limited to a 12-month period, the impacts from poor wastewater storage could lead to significant impacts to the soil and groundwater. This could be particularly pertinent if the contaminants include high concentrations of bacteria, nutrients or oil from domestic activities.

The quantity of sanitary wastewater that will be produced within the PV area is estimated on an average of 14 litres/worker/day and the total predicted volume of sanitary wastewater produced would equate to 2,800 litres of wastewater per day at peak construction periods. This wastewater will be stored on-site prior to removal by a licensed contractor. If the storage tanks and removal process are not properly managed and handled, contamination to soils or surface waters can take place.

The quantities of sanitary wastewater at the PL will be very limited during construction as only 10-15 workers are expected to undertake this task.

Table 14-2 Wastewater– Magnitude of Construction Impacts

Impact	Magnitude	Justification
Domestic Wastewater	Moderate	Domestic wastewater will contain bacteria, parasites, and nutrients.
Stormwater Contamination	Moderate	Rainfall or runoff stormwater entering areas where hazardous materials are stored could lead to distribute pollutants onsite/offsite the proposed site

Table 14-3 Wastewater - Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Domestic Wastewater	Moderate	Soil / Water	Medium	Moderate
Stormwater Contamination	Moderate	Soil / Water	Medium	Moderate

14.5.2 Mitigation measures

Table 14-4 Wastewater – Mitigation Measures for Construction

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Sanitary wastewater	Chemical toilets will be available at different locations in the construction site in sufficient number to attend the number of employees expected (at least one per 20 workers) and cleaned at least every two days. Overground chemical toilets will need to be checked frequently for leaks and replaced when required.	EPC	CESMP – Planning
	Underground septic tanks will be equipped with flow metres (to identify leaks) and overflow alarms.	EPC	CESMP – Planning, Monitoring
	No domestic wastewater will be discharged outside the chemical toilets / septic tanks to avoid emissions of wastewater to the soils, chaabas, or stormwater drainage system.	EPC	CESMP – Monitoring
	Wastewater from chemical toilets/ septic tanks will be collected by licensed operators. Each chemical toilets/ septic tank will generally be collected and emptied before its contents reaches 80% of its capacity. The required authorizations and contracts shall be obtained by the EPC before the construction works start.	EPC	CESMP – Management
	Septic tanks and chemical toilets must be completely emptied before demobilisation to avoid contamination to the site area. The demobilisation procedure will ensure that tanks are not destroyed or damaged during the removal process.	EPC	CESMP – Management
	Develop a Wastewater Management Plan.	EPC	CESMP – Management and Monitoring
	The reuse of wastewater on site is allowed if the following conditions are met :	EPC	CESMP –

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	- Wastewater is treated in the ONEE STEP; - Analysis are provided to Masen showing that national and international water quality standards are met before its discharge into the environment; - Authorizations are obtained from local authorities allowing the reuse of the water.		Management and Monitoring

14.5.3 Residual Impacts

Table 14-5 Wastewater – Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact
Domestic Wastewater	Soil / Water	Moderate	Yes	Negligible

14.6 Operation Assessment

14.6.1 Initial Impact

No impacts are deemed significant for the operation of the PL.

Water use during the operation of the PV is only likely to be for sanitary/domestic purposes and general panel washing activities.

Sanitary Wastewater

The facility will include washroom facilities for maintenance and administration workers. Sanitary/domestic wastewater requirements for the facility are anticipated to be no more than 14 litres/worker/day. Inappropriate containment and disposal could result in uncontrolled discharge to ground, resulting in contamination of soils and waterbodies throughout the operation of the facility. This wastewater will be stored on-site prior to removal by a licensed contractor. If the storage tanks and removal process are not properly managed and handled, contamination to soils or surface waters can take place.

Panel Washing

Treated water from the Reverse Osmosis (RO) plant will be used for cleaning the PV panels. The amount of water required for panel washing is expected to be 2,800 m^3/year. No chemicals will be used for panel washing. Therefore, run off water from the panels will only contain dust and this wastewater will be left to naturally evaporate.

The O&M will focus on implementing the most environmentally and cost effective cleaning solution in line with the requirements recommended by the manufacturer of the PV panels and the MFS. The O&M Contractor will consider manual cleaning with soft sponges and squeegees as an option to reduce the water consumption over the operational phase. The O&M Contractor estimates that this alternative may reduce the water consumption by approximately 40 to 50%.

RO Plant

The RO Plant will only be used to polish treated water received from NOORo Complex potable water reservoir, and will only contain few trace minerals and suspended solids,

resulting from the polishing of potable water. This wastewater comprises of the backwash following the cleaning of the filter cartridges and the high concentrate water resulting from the polishing process. Since these wastewaters emanate from a potable water source and no hazardous chemicals are used in the polishing process, the wastewater is inert and is temporarily stored on site, in dedicated above ground storage tank that will be collected by licensed operator for disposal according to national legislation.

Independent treatment of the wastewater is not required, and it can/will be combined with the domestic wastewater during collection and treatment at a licensed off site facility.

Table 14-6 Wastewater - Magnitude Impacts – Operation Phase

Impact	Magnitude	Justification
Wastewater	Minor	Given the small work force and that the RO Plant will only polish fresh water, potential impacts associated with wastewater generation are considered minor.

Table 14-7 Wastewater - Significance of Operation Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Wastewater	Minor	Soil / Water	Medium	Minor

14.6.2 Mitigation measures

Table 14-8 Wastewater– Mitigation Measures for Operation

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Sanitary Wastewater Generation	Sanitary and domestic wastewater will only be discharged to chemical toilets/ septic tanks that will be available on the project site.	O&M	OESMP – Design and Management
	Underground septic tanks will be equipped with flow metres (to identify leaks) and overflow alarms.	EPC	CESMP – Planning, Monitoring
	The septic tanks will be sited away from vehicle traffic, in order to prevent any damage to the tanks.	O&M	OESMP – Monitoring
	Aboveground septic tanks will be bunded. The bund will be able to accommodate 110% of the capacity of the tank.	O&M	OESMP – Design and Management
	Wastewater from the chemical toilets/ septic tanks will be collected by a licensed operator.	O&M	OESMP – Management and Planning
	Develop a Wastewater Management Plan.	O&M	OESMP – Management and Planning
	The reuse of wastewater on site is allowed if the following conditions are met : - Wastewater is treated in the ONEE STEP; - Analysis are provided to Masen showing that national and international water quality standards are met before its discharge into the environment; Authorizations are obtained from local authorities allowing the reuse of the water.	O&M	OESMP – Management and Planning

14.6.3 Residual Impacts

Table 14-9 Wastewater – Residual impacts - Operation Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact
Domestic Wastewater	Soil and Chaaba	Minor	Yes	Negligible

14.7 Decommissioning Phase

A detailed DESMP will be prepared to ensure that all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered realistic to outline mitigation measures for the decommissioning phase at this stage. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

15 TRAFFIC AND TRANSPORT

15.1 Introduction

This chapter focuses on the transportation related impacts associated with the construction and operation of the project. The baseline transportation infrastructure within the region and particularly within the immediate vicinity of the project is described. Consequently, the impacts from the increased traffic generated by the construction and operation phases of the project have been considered. Where necessary and possible, opportunities to pursue measures to minimise and / or mitigate any impacts have been developed and put forward.

15.2 Methodology

The baseline analysis of this chapter is principally desk based, drawing from the technical proposal for the project, secondary sources (transportation and local authorities) and the site visit. Once the baseline conditions are established, the impact of the development on the surrounding transport infrastructure is evaluated.

As the development will have differing impacts throughout the lifecycle of the project, we have structured our analysis to reflect the key development stages of construction and operation. The analysis in this chapter deals solely with primary transport impacts, namely demands placed on transportation infrastructure by the development. Issues relating to secondary impacts arising from the transportation needs of the development, such as noise, are dealt with separately in the relevant chapters of this report.

15.3 Baseline

The site will be accessed by road for transport of materials, equipment and machinery and by workers. Ports will be used to bring equipment into the Kingdom of Morocco. Migrant workers may use the airport of Ouarzazate to access the region.

Main Port Facilities

The Casablanca (438 km to site) and Agadir (390 km to site) ports are the two options to be utilised to transfer cargo.

Given the size of the components required to operate a PV plant, no special transportation is expected to be required.

Road Network

Figure 15-1 Regional Road Network and Road Connection to Site

The vast majority of the plant's equipment and supplies will have go via the Casablanca-Agadir-Ouarzazate route or the Agadir-Ouarzazate route. There is another route crossing through the Atlas Mountains that is not be suitable for cargo.

Since there is no bypass road around several residential centres in the tentative route, all traffic bringing equipment from the ports will have to cross the city of Ouarzazate.

The NOORo IV project sire is adequately connected to the national road by the Complex's roads. No new roads will be built for the project outside the site.

15.4 Sensitive Receptors

Table 15-1 Traffic and Transport – Receptor Sensitivity

Receptor	Sensitivity	Justification
Casablanca - Agadir - Ouarzazate Route, or Agadir - Ouarzazate Route	Very Low	As a new highway, with areas still under construction, there is a very low vehicular flow, with much capacity for future expansion.
N10 through Ouarzazate	Low	The main road though the city, which also connects to all other neighbouring towns and majored cities.
Site access	Low	Dedicated road, built specifically for the site.

15.5 Construction Assessment

15.5.1 Potential Impacts

Two aspects of transport during construction (including the proposed PV and associated facilities such as the PL) can potentially generate impacts: The transport of the workforce and the transport of equipment to the site.

The major components for the construction of the plant are equipment that will be assembled in-situ and no special platforms will be required.

The following routes will be used for bringing equipment from the ports to the site:

- Casablanca / Ouarzazate (437 Km, 4:59 h). This road crosses the Atlas and will be used for non-essential supplies.
- Casablanca Harbour / Agadir / Ouarzazate (844 km, 9:26 h). This route shall be used to transport the solar panels, HCE tubes and any other essential supplies.
- Agadir Harbour / Ouarzazate (382 km, 5 hours 9 minutes). This route shall be used by the special cargo weighing less than 80 tons.

All routes will cross Ouarzazate to reach the Complex's access road.

Workers are likely to be accommodated in Ouarzazate. Transport services will therefore need to be included as part of the daily construction activities.

In summary, there will be a noticeable increase in Heavy Goods Vehicles (HGV) and vehicle movements for the transport of workers during construction activities. The severity of the impact will vary significantly depending on the stage of construction (frequency of deliveries and volumes of workers required). However, experience during previous NOORo projects has shown that the existing roads Casablanca – Ouarzazate can handle with minimum impact additional traffic demanded by the construction of the Project.

Table 15-2 Traffic and Transport – Magnitude of Construction Impacts

Impact	Magnitude	Justification
Increased congestion highway	Minor	Minor direct but temporary impacts to volume and traffic flow.
Increased congestion and local roads	Moderate	Significant temporary impact on local roads generating direct (congestion) and indirect (noise, air quality) impacts on a local scale.
Movement of vehicles on the site	Minor	Noticeable temporary impacts (e.g. noise, air quality, etc.) caused by the movement of vehicles and machinery in the project site (or other areas where works will be done) and other impacts.

Table 15-3 Traffic and Transport – Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Increased congestion highway	Minor	Casablanca - Agadir - Ouarzazate Route, or Agadir - Ouarzazate Route	Low	Negligible o Minor
Increased congestion and local roads	Moderate	N10 through Ouarzazate	Low	Minor
Movement of vehicles on the site access road	Minor	Site access	Low	Negligible o Minor

15.5.2 Mitigation Measures

In addition to the CESMP, the EPC will prepare a Traffic and Road Safety Management Plan in accordance with national and IFC requirements and aligned with GIIP.

These documents will incorporate, as a minimum, the mitigation measures included in the table below.

Table 15-4 Traffic and Transportation – Mitigation Measures - Construction Phase

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Increased traffic load along National Highway and local roads	Develop a Traffic Management Plan	EPC	CESMP – Planning and Management
	Determine the designated access routes for delivery of equipment, road capacity, site entrance/exit points, etc.	EPC	CESMP – Planning and Management
	Determine requirements for regular maintenance of vehicles (currently implemented) and use of manufacturer approved parts	EPC	CESMP – Planning and Management
	Identify areas/spots sensitive to road safety issues and implement the necessary road safety measures, including residential areas where construction-related vehicles will pass through. Sensitive area will be communicated in advance to all drivers who will be provided with maps to ensure awareness. Special measures will need to be implemented if deemed necessary and appropriately communicated to drivers (e.g. lowers speed at a specific vulnerable spot in the route).	EPC	CESMP – Planning and Management
	Construction heavy and light vehicles will not exceed 20 km/h in residential areas	EPC	CESMP – Planning and Management
	Stagger key deliveries or periods of high vehicle movements to the site and reduce waiting times for drivers and over demand on receiving staff at the site.	EPC	CESMP – Planning and Management
	Engines will be turned off while waiting in or outside the project site.	EPC	CESMP – Planning and Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	Staff will not be allowed to rest in vehicles to prevent excessive fuel wastage through the need to use air conditioning. Appropriate resting facilities will be provided at the landing for the drivers.	EPC	CESMP – Planning and Management
	Drivers should be fully competent and authorised to drive HGVs and should receive specific road safety training	EPC	CESMP – Planning and Management
	All vehicles dedicated full time for the project and circulating on roads outside the project site (owned or used by the Project Company, EPC or subcontractors) will have a clearly visible unique identification number and a sign with a telephone number for any road user that identifies reckless driving behaviour to be able to report it. Reports will be documented as grievances and investigated.	EPC	CESMP – Planning and Management
Movement of vehicles on the site	The access road will be clearly signalled and compacted (as a minimum) or tarmacked. Dust suppression measures will be conducted where and when required.	EPC	CESMP – Planning and Management
	Determine the designated access routes for delivery of equipment, site entrance points, laydown areas and parking areas, etc.	EPC	CESMP – Planning and Management
	Post designated routes and signs for directions and speed limits (25 km) in the project site.	EPC	CESMP – Planning and Management
	Specific waiting areas will be designated in suitable locations. No waiting areas will be designate in proximity to residential units or settlements.	EPC	CESMP – Planning and Management

15.5.3 Residual Impacts

Table 15-5 Traffic and Transportation – Residual Impact - Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact
Increased congestion highway	Casablanca - Agadir - Ouarzazate Route, or Agadir - Ouarzazate Route	Negligible o Minor	Yes	Negligible
Increased congestion and local roads	N10 through Ouarzazate	Minor	Yes	Negligible
Movement of vehicles on the site access road	Site access	Negligible o Minor	Yes	Negligible

15.6 Operation Assessment

15.6.1 Potential Impacts

No impacts are deemed significant for the operation of the PL.

The operational workforce at the PV is not likely to exceed 12 employees (including security), and the total requirements for material supplies is very low, the traffic impacts during this phase are negligible. Nevertheless, the following mitigation is proposed to aligned the management of vehicles with best practice.

15.6.2 Mitigation Measures

Table 15-6 7 Traffic – Selected Mitigation Measures for operation

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Movement of vehicles along the site access road and onsite	Develop a Traffic Management Plan	EPC	CESMP – Planning and Management
	Determine the designated access routes for collecting and delivering, site entrance points, and parking areas, etc.	O&M	OESMP – Planning and Management
	Determine requirements for regular maintenance of vehicles in line with national requirements and GIIP. Maintenance of vehicles will be undertaken in appropriate premises outside the project site.	O&M	OESMP – Planning and Management
	Specific waiting areas will be designated in suitable locations.	O&M	OESMP – Planning and Management
	The movement of vehicles along the access road will be minimized to essential operational and maintenance related activities.	O&M	OESMP – Planning and Management
	All vehicles dedicated full time for the project and circulating on roads outside the project site (owned or used by the Project Company, EPC or subcontractors) will have a clearly visible unique identification number and a sign with a telephone number for any road user that identifies reckless driving behaviour to be able to report it. Reports will be documented as grievances and investigated.	O&M	OESMP – Planning and Management

Impact/ Source	Mitigation Measure	Responsibility	Schedule
	Speed limit to be established onsite (30 km).	O&M	OESMP – Planning and Management

15.7 Decommissioning Phase

A detailed DESMP will be prepared to ensure that all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered realistic to outline mitigation measures for the decommissioning phase at this stage. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

16 ARCHAEOLOGY AND HERITAGE

16.1 Introduction

This chapter considers the potential cultural heritage and archaeology impacts which could potentially result during the construction phase of the proposed NOORo IV Project.

The cultural heritage and archaeological assessment takes into account that archaeological and cultural resources are finite and therefore consideration for their preservation will always be addressed. In addition, cultural and historical sites are an important value for the tourist activities in the area.

For the purpose of this assessment, these resources may include, but not be limited to:

- Archaeological remains, buried and/or above ground;
- Historical structures and sites e.g. tombs or forts; and
- Any other structure of archaeological and/or cultural/historical significance.

Where appropriate, mitigation measures to minimise or prevent potential risks to cultural heritage and archaeology have been provided.

This chapter provides an overview of existing information and guidelines for handling artefacts or sites of cultural and archaeological significance, which will be used in the event that such artefacts are discovered during the construction phase.

16.2 Methodology

The assessment in this chapter has been undertaken according to the relevant local and international law, regulations and standards as described earlier in this report. The assessment has included a desk-based study that included the review of the available information on the area and a site inspection.

Desk-Based Study

The purpose for conducting the desk-based assessment is to identify any relevant historic sites or the location of any artefacts on the site or the study area (including the presence or absence, character and extent, date, integrity, state of preservation and relative quality of the potential archaeological resource). The desk-based study consisted of the collation of existing written, graphic, photographic, electronic information and information from the FESIA in order to identify the likely character, extent, quality and worth of the known or potential archaeological resource at the site in a local, regional, national and international context.

Site Walkover

In order to complement the information gathered during the desk-based study, a site visit was undertaken to identify the presence of any above ground archaeological structures, deposits and /or antiquities. The results and findings are discussed below.

16.3 Baseline

The investigations from the FESIA concluded that no sites of historical or cultural value where found on the Ghassate commune other than sepulchral or burial sites. In addition, no evidence of archaeological value was detected on the solar complex site during the fieldwork for the FESIA.

Equally, during the site visit no artefacts or structures of cultural or archaeological significance were observed onsite. Buildings of potential historical value were identified in Tasselmant (Plates below). These structures/sites are located outside the project site and study area, and will not be affected by the project.

Plate 16-1 Fort in Tasselmant

Plate 16-2 Burial site in Tasselmant

However, the possibility of finding evidence of historical occupation, unknown belowground archaeological artefacts or remains of cultural conservation value (during site clearance and earthworks cannot be ruled out.

16.4 Sensitive Receptors

The table below outlines the identified receptors in relation to cultural heritage and archaeology as well as the determined sensitivity of those receptors.

Table 16-1 Culture and Archaeology - Receptors sensitivity

Receptor	Sensitivity	Justification
Potentially unidentified archaeological artefacts	High	The sensitivity of tangible cultural artefacts is considered high as physical damaged could occur if archaeological discoveries are not handled properly.

16.5 Construction Assessment

16.5.1 Potential Impacts

For the reasons outlined in the baseline, it is considered unlikely that potential impacts of cultural or archaeological value will occur during the construction phase of the PV and associated facilities (including the PL). .

In the event that earthworks during the construction phase uncover unidentified sources of archaeological or cultural heritage, this will result in an impact of major negative significance prior to the implementation of mitigation measures, as the archaeological resource could be destroyed.

Table 16-2 Culture and Archaeology – Magnitude of Construction Impacts

Impact	Magnitude	Justification
Destruction of unknown archaeological remains onsite	Negligible	Construction activities may cause the destruction of archaeological remains onsite, resulting in permanent loses of the archaeological features. However the likelihood of finding artefact onsite is consider very low.

Table 16-3 Culture and Archaeology – Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Destruction of unknown archaeological remains onsite	Negligible	Potentially unidentified archaeological sites	High	Minor

16.5.2 Mitigation Measures

The EPC contractor will be required to prepare a Chance Find Procedure based on the Standards and Guidance for an Archaeological Watching Brief, Chattered Institute of Field Archaeologists, Version December 2014. The Archaeological Watching Brief is a formal programme of observations and investigations that are carried out for non-archaeological projects. It can be undertaken in any site where possibilities to find any archaeological deposits exist.

Training and awareness programmes will be provided to ensure that construction staff and labourers are aware of the procedures relating to the Archaeological Watching Brief will any artefacts or anthropogenic finds be uncovered. In the unlikely event of any artefacts being found/uncovered, the construction work would be ceased immediately and the Minister of Culture, via the "*Institut National des Sciences de L'Archéologie et du Patrimoine* (INSAP)" will be contacted by the EPC Site Manager. The INSAP will take charge of any archaeological investigations.

16.5.3 Residual Impacts

Given that no evidence of sites of historical or archaeological value has been observed in the area, the risk of uncovering any archaeological resources is considered very low. Equally,

the implementation of the above mitigation procedures will help minimise any impact that may occur to an acceptable level.

Table 16-4 Culture and Archaeology – Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Destruction of unknown archaeological remains onsite	Potentially unidentified archaeological sites	Minor	Yes	Negligible

16.6 Operation Assessment

It is not considered that any significant impacts upon archaeological or cultural resources could occur during the operational phase.

16.7 Decommissioning Assessment

It is not considered that any significant impacts upon archaeological or cultural resources could occur during the decommissioning phase.

17 LANDSCAPE AND VISUAL IMPACT

17.1 Introduction

Impacts upon the landscape typically occur in situations where the visual horizon is disturbed by a development. Such impacts may include:

- The anthropogenic intrusion of the landscape by buildings or structures where no intrusion previously existed; or
- The change in the landscape character of an area, which could arise from new/out of place development or from changes in the land use.

Visual impacts may occur when the visual envelope or line of sight to and/or from a receptor (e.g. residential areas, area of natural beauty) is intersected or blocked by a development.

This chapter of the SESIA focuses upon the potential landscape and visual impacts, both direct and secondary, associated with the development and subsequent operation of the plant and associated secondary facilities.

17.2 Methodology

The assessment of the project upon the landscape and visual amenity of the surrounding area has been informed by the following:

- Desk-based assessment of existing information available, including maps, satellite images, site plans and viewpoint photographs taken at various locations, and
- Site visit undertaken to identify the existing landscape and visual character of the area

17.3 Baseline

The proposed project is located within the NOOR Complex, which is positioned on a rocky plateau, crossed by chaabas and surrounded by canyons, which are characteristic of this part of the Atlas Mountains. There are several anthropogenic elements on the Complex: the NOORo I CSP now in operation, and NOORo II and III CSPs currently under construction, power lines, substations, offices, the common water storage tank and the complex road network. Therefore the complex is characterised by numerous industrial facilities. This section presents a number of photos that have been taken in and surrounding the proposed project site to provide an indication of the landscape and visual characteristics.

Plate 17-1 Complex View: NOORo I (parabolic CSP operation)

Plate 17-2 NOORo I (parabolic CSP operation) – Power House

Plate 17-3 Complex View: NOORo II (parabolic CSP construction)

Plate 17-4 Complex View: NOORo III tower (tower CSP construction)

Plate 17-5 Southeast View from the Northwest Corner of Project Site

17.4 Sensitive Receptors

The table below outlines the identified receptors in relation to landscape and visual impacts as well as the determined sensitivity of those receptors.

Table 17-1 Landscape and Visual – Receptor Sensitivity

Receptor	Sensitivity	Justification
Landscape Character	Low	The Complex is highly industrialised. There are no specific landscape designations or other outstanding features present to make the landscape character of this particular area unique.
Visual Receptors	Low	The villages are located in the Oueds, therefore they are at a lower elevation with respect to the site. Residents would not be able to see the solar panels, however while driving the road to Tasselmant, the PV field could be visible.

17.5 Construction Assessment

17.5.1 Potential Impacts

During the construction of the PV plant and associated facilities (including the PL), a variety of construction vehicles will be travelling to and from the site and several buildings will be temporarily located on site, including offices and material storage. Some construction materials and equipment will also be located on site during the entire construction program.

The construction site will not be visible from the N10 road nor from the city of Ouarzazate. Only people walking/driving through the local road areas will be likely to notice the construction site.

Currently the topography of the corridor is flat and the PL will not require any topographical changes.

Night-time works will not take place but the site will likely require floodlighting for security. Glare effect is expected to be noticed from the road located parallel to the east boundary but not to the residents of the nearest villages.

Table 17-2 Landscape and Visual – Magnitude of Construction Impacts

Impact	Magnitude	Justification
Topographical impacts to landscape	Minor	Only minor changes to the topography are anticipated to flatten the proposed project site.
New features impacting	Minor	New features will partially impact views from receptors, however they will not result in total losses of key views from receptors and

Impact	Magnitude	Justification
views		the construction will be a temporary phase. All the temporary facilities will be removed once the construction phase is completed.
Light Pollution	Moderate	Flood lights will increase glare effect in the project area

Table 17-3 Landscape and Visual – Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Topographical impacts to landscape	Minor	Landscape Character	Low	Negligible to Minor
		Visual Receptor – passing next to the construction site	Low	Negligible to Minor
New features impacting views	Minor	Visual Receptor – passing next to the construction site	Low	Negligible to Minor
Light Pollution	Moderate	Visual Receptor – passing next to the construction site	Low	Minor

17.5.2 Mitigation Measures

Table 17-4 Landscape and Visual – Mitigation Measures - Construction Phase

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Topographical impacts to landscape	The heights of fences and any other structures will aim to minimise their visibility from the road to Tasselmant.	EPC	Design CESMP – Planning and Management
Light Pollution	Any flood lights required during night time construction activities will be directed onto the site, with a maximum position angle of 30° from vertical, therefore minimising any potential light leakage and impacts at night.	EPC	CESMP – Planning and Management

17.5.3 Residual Impacts

Table 17-5 Landscape and Visual – Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Topographical impacts to landscape	Landscape Character	Negligible to Minor	No	Negligible to Minor
	Visual Receptor – passing next to the construction site	Negligible to Minor	No	Negligible to Minor
New features impacting views	Visual Receptor – passing next to the construction site	Negligible to Minor	No	Negligible to Minor
Light Pollution	Visual Receptor – passing next to the construction site	Minor	Yes	Negligible

17.6 Operation Assessment

17.6.1 Potential Impacts

The PL will be located on a flat plateau away from the main residential centres and within anthropogenic elements (unpaved roads, paved roads, CSP Complex and existing power lines) that characterises the landscape character or the area. The PI will avoid disturbance to view sheds resources in pristine spaces in the project area and will not be noticeable from the nearest residential areas.

The proposed PV design does not include the construction of towering structures, thus the impact on the landscape character will not be altered significantly. The PV plant will not be noticeable from the nearest residential areas.

Table 17-6 Landscape and Visual – Magnitude of Operation Impacts

Impact	Magnitude	Justification
New plant components in the Landscape	Minor	Only minor changes to the topography are anticipated to flatten the proposed project site.
New plant components impacting	No change	The new PV will add no additional impact to the existing views of the Complex. The design of the PV does not require towering elements.

Impact	Magnitude	Justification
views		
Light Pollution	Moderate	Flood lights will increase glare effect in the project area

Table 17-7 Landscape and Visual – Significance of Operation Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
New plant components in the Landscape	Minor	Landscape Character	Low	Negligible to Minor
		Visual Receptor – passing next to the Project site	Low	Negligible to Minor
New plant components impacting views	No Change	Visual Receptor – passing next to the Project site	Low	Neutral
Light Pollution	Moderate	Visual Receptor – passing next to the Project site	Low	Minor

17.6.2 Mitigation Measures

No mitigation measures are available to reduce the visual impact of the structures that will be required for the plant. The measures designed for vegetation restoration and compensation include re-vegetation, to provide compensation for the lost habitat and reduce soil erosion, and will therefore not screen the structures built onsite. It is not considered beneficial from an ecological or from a water management perspective to implement a landscaping programme to plant alien species of vegetation within the site or at the project boundary that could screen the visual impact from the project, as attracting birds to the site could result in more avian deaths..

Table 17-8 Landscape and Visual – Mitigation Measures - Operation Phase

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Light Pollution	Lighting provision shall not be excessive or unnecessary – Lights for the plant will be switched on only when strictly necessary	O&M	OESMP – Plant design
	Lights required during night time will be directed onto the site, with a maximum position angle of 30° from vertical, therefore minimising any potential back spill and impacts at night to avoid disturbance to fauna.	O&M	OESMP – Planning and Management
	Strictly monitor the light intensity, direction and duration. Design and install lighting such that light bulbs and reflectors are not visible from public viewing areas. Lighting should not cause reflected glare.	O&M	OESMP – Planning and Monitoring

17.6.3 Residual Impacts

Table 17-9 Landscape and Visual – Residual Impacts – Operation Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Topographical impacts to landscape	Landscape Character	Negligible to Minor	No	Negligible to Minor
	Visual Receptor – pedestrian/drivers in adjacent to the construction site	Negligible to Minor	No	Negligible to Minor
New features impacting views	Visual Receptor – pedestrian/drivers in adjacent to the construction site	Neutral	No	Neutral
Light Pollution	Visual Receptor – pedestrian/drivers in adjacent to the construction site	Minor	Yes	Negligible

17.7 Decommissioning Assessment

A detailed DESMP will be prepared to ensure that all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered sensible to outline mitigation measures for the decommissioning phase at this stage. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

18 SOCIOECONOMIC

18.1 Introduction

This chapter of the SESIA Report focuses on the social and economic issues, both direct and indirect, associated with the development and subsequent operation of the proposed NOORo IV Project. Initially this chapter considers the existing socio-economic conditions within which the development will proceed, before examining the potential impact of the development during the various stages of the project lifecycle. Where necessary and possible, opportunities to pursue measures to minimise and / or mitigate any impacts have been developed and put forward.

18.2 Methodology

This chapter looks at key indicators relating to factors such as population, the economy, the labour market and social development at a regional level. Where relevant, professional judgement was drawn upon, including knowledge from site visits and information collected during consultation with interested parties to augment the secondary baseline data.

Once this baseline was established the report considered a more detailed assessment of the impacts of the development. As the development will have different socio-economic impacts throughout the lifecycle of the project, impacts during construction and operation are discussed separately.

In reflection to the requirements of the IFC Performance Standards, core components of this analysis include:

- A review of any local communities within the proposed development site and its immediate environs;
- An assessment of local labour market impacts;
- An outline assessment of any community health, safety and security implications of the facility;
- An assessment of impact upon local services; and
- The suitability of the site in light of the social / development profile of the site environs.

18.3 Baseline

The Project is located in the Ghassate commune, in the province of Ouarzazate, Draâ-Tafilalet Region. Ghassate is a rural, sparsely populated commune. In 2014 the population was 8,848 inhabitants and the number of households 1,298. The commune has shown a minor population decrease of -0.42% between 2004 and 2014. From 1994 to 2004, the population decreased -2.4% due to migration to Ouarzazate, Agadir, Casablanca or international cities.

The commune of Ghassate is located in the ethnic regions of Igrnane and Ait Ougrrour. The project is located in an uninhabited area of the Ait Ougrour ethnic group. There are no nomad communities or individuals reported in the area.

The villages that are closer to the project site (i.e. Tasselmant, Tiflite and Igherm Amellal,) grow crops in the bottom of ephemeral river valleys. The main types of crops include date palm, fruit trees (e.g. olive trees) and annual and forage crops. The crop planting areas have been included as sensitive receptors, as they are essential for the economic well being of these villages and impacts on these areas have to be avoided.

The industrial sector occupies a secondary place in the economic activity of the province of Ouarzazate. There is a very young industrial fabric of small and medium-sized businesses with low diversification. The other most important sectors of activity is the construction and public works sector. The area has also a significant tourist industry, for which the cultural heritage and the landscape are important factors that need to be considered and maintained. The cultural heritage and the landscape are also essential for the film studios located near the city of Ouarzazate. Impact on archaeology and heritage, as well as landscape are specifically discussed in sections 15 and 16 respectively.

At the level of the commune of Ghassate, rural population is mainly active in livestock, agriculture and crafts. 95% of the households in the commune of Ghassate have access to potable water. There is no wastewater collection and treatment system in the commune. In general, 70% of the population uses latrines and lost wells. Solid domestic waste is incinerated in outdoor areas of the commune.

2.4 Sensitive Receptors

18.4 Sensitive Receptors

Table 18-1 Socio-economic – Receptor Sensitivity

Receptor	Sensitivity	Justification
Employment	Medium	Employment is shared through different sectors but highly temporal (construction of NOORo Projects, studios, agriculture, etc.). The project is expected to provide short and long term employment opportunities for the villagers and residents of the area.
Local / Regional Economy	Low	The project will contribute to economic development in the area. The sensitivity considered is low as the economic growth is relatively high in the area and relies on different sectors.
National Grid	Medium	The national grid will receive electricity generated by the PV.

Receptor	Sensitivity	Justification
		Sensitivity is considered medium as the energy system in Morocco is well developed but highly depend on fossil sources
Residents – Ouarzazate & Villagers	Medium	The population is considered to have a medium vulnerability to socioeconomic impacts as the socioeconomic conditions of the area are relatively stable. Due to the NOORo I, II and III projects, residents are familiar with a much larger number of expats that the expected for this project.

18.5 Construction Assessment

18.5.1 Potential Impacts

The primary economic positive impact during construction of the proposed project and its associated facilities is likely to result from any local employment creation and the use of local businesses/services. The workforce that will be employed during the construction phase will range from 150 to 200 workers at the peak of construction. As well as the direct monetary uplift to the families of those employed, salaries to local workers will also stimulate the local economy, whereby money earned on the project expended locally will re-circulate within the local economy.

Notwithstanding the above, it is likely that the lack of some necessary skills within the immediate local population will require a proportion of work on the site to be undertaken by immigrant population. This could result in the repatriation of wages, with benefits to the local economy potentially being reduced.

Training programmes have been implemented for NOORo I, II and III, so it is likely that the proportion of foreign workers will be lower than for those projects.

Conflicts could potentially arise between communities and the project workforce due to ethnic or religious differences, mistrust of foreigners, misbehaviour by the project workforce, etc. Additionally, the interaction between the workforce and the local population can result in the proliferation of diseases, with Sexually Transmitted Diseases (STDs) being a specific risk.

No conflicts have been reported for NOORo I, II and III. The expatriate population for these projects was mostly Spanish and Chinese.

In addition to the direct monetary impact of employment created during construction, there also exists the potential for the project to promote the dissemination of best practice construction skills into the local labour force. To the extent that the development proves an enabler for further regional development, any skills acquired are likely to prove readily marketable in the aftermath of the project construction. A further secondary impact is likely to arise from spending on local goods during the construction process.

I should be noted that negative impacts to the workers may result during the construction phase, due to community health and safety issues related to traffic, noise and air quality. These Impacts are discussed in previous chapters of this SESIA.

The proximity of a project may result in in encroachment by people looking for job opportunities. Encroachment and informal settlements can potentially result in secondary impacts (destruction of habitat, sanitation, security risks).

Finally, the presence of security on site could lead to potential conflicts between local communities and security staff.

Table 18-2 Socio-economic – Magnitude of Construction Impacts

Impact	Magnitude	Justification
Local employment creation	Moderate Positive	Temporary creation of employment relating to construction will be likely and should benefit the local/regional area.
Dissemination of skills	Moderate Positive	Dissemination of know-how among the construction force.
Purchase goods and materials from the local / regional economy	Moderate Positive	Increase in the purchase of goods and services by the workforce and of construction materials within the local/regional area.
Conflict with security staff	Minor Negative	There is a potential for conflict between local communities and security staff. The project is not within populated areas and has dedicated access roads, so conflict with the security personnel is highly unlikely.
Conflict workforce – local population	Minor Negative	Conflicts could potentially arise between communities and the project workforce due to ethnic or religious differences, mistrust of foreigners, misbehaviour by the project workforce, etc. No conflicts have been reported for NOORo I, II and III. The local population is used to a relatively large expatriate community already.
Spread of STDs	Minor Negative	The interaction between the workforce and the local population can result in the proliferation of diseases, with Sexually Transmitted Diseases being a specific risk. The on-going engagement with the authorities, NGOs and the pubic for NOORo I, II and III has not identified any concern on STDs.
Informal settlements and encroachment	Negligible Negative	The proximity of a project may result in in encroachment by people looking for job opportunities. Encroachment and informal settlements can

Impact	Magnitude	Justification
		potentially result in secondary impacts (destruction of habitat, sanitation, security risks, etc.). No informal settlements were created for NOORo I, II and III. The significant security on the perimeter on the complex, including private security and gendarmerie, makes this eventuality highly unlikely.

Table 18-3 Socio-economic – Significance of Construction Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Local employment creation	Moderate Positive	Employment	Medium	Moderate Positive
Dissemination of Skills	Moderate Positive	Local / Regional Economy	Low	Minor Positive
Purchase goods and materials from the local / regional economy	Moderate Positive	Local / Regional Economy	Low	Minor Positive
Conflict with security staff	Minor Negative	Residents – Ouarzazate & Villagers	Medium	Minor Negative
Conflict workforce – local population	Minor Negative	Residents – Ouarzazate & Villagers	Medium	Minor Negative
Spread of STDs	Minor Negative	Residents – Ouarzazate & Villagers	Medium	Minor Negative
Informal settlements and encroachment	Negligible Negative	Residents – Ouarzazate & Villagers	Medium	Negligible to Minor Negative

18.5.2 Mitigation Measures

The mitigation and local enhancement measures provided refer to socioeconomic and labour issues. The EPC will be required to prepare the following documents aligned with national and IFC requirements:

- CESMP;
- Labour and Working Conditions Management Plan, including retrenchment;
- Security Management Plan (this might be incorporated in the CESMP), and
- Emergency Preparedness and Response considering community health and safety impacts.

These documents will incorporate, as a minimum, the mitigation measures included in the table below. The documents can be prepared as standalone plans or can be merged into working documents (e.g. several aspects can be incorporated into the CESMP)

Table 18-4 Socioeconomic – Mitigation Measures - Construction Phase

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Employment and Accommodation	The project will seek to employ local workers where these are willing and available and have the skills required for the task. Non-specialist job opportunities will be offered to the local residents prior to hiring of employees from other areas when possible. The employment of women and vulnerable groups will be specifically targeted when possible.	EPC	CESMP – Planning
	Establish and Implement a recruiting policy and ensure that the necessary measures to mitigate negative impacts associated to labour and working conditions are implemented (e.g. child and forced labour, exploitation, excessive overtime, insufficient wages, harassment, unsafe/unhygienic living and working conditions, etc.). Labour and working conditions will be aligned with IFC standards.	EPC	CESMP – Planning, Management
	A Retrenchment Plan will be prepared for moving from construction to operation.	EPC & Project Company	CESMP– Planning
Purchases	The EPC will only engage with reputable suppliers that do not use force or child labour	EPC	CESMP – Planning, Management
	Purchase of goods and services by the workforce and of construction materials within the local/regional will be prioritized	EPC	CESMP – Planning, Management
E&S and Health and Safety Risks	If any activities that have not been assessed on the SESIA are proposed, potential E&S and HS risks to the communities will be assessed prior to commencement.	EPC	CESMP – Planning, Management
	The site will be fenced and access to the construction site will be controlled by the security staff	EPC	CESMP – Planning,

Impact/ Source	Mitigation Measure	Responsibility	Schedule
			Management
Dissemination of Skills	Local employees will receive E&S and OHS training to enhance the development of skills. A certificate outlining the contents of the training and signed by the management of the PV plant will be provided.	EPC	CESMP – Planning, Training
Conflict – workforce / local residents	Inception training will include information on the cultural background of the closest residents	EPC	CESMP – Training
Security Provisions	Develop and implement a Policy on Security and a Code of Conduct for Security Personnel.	EPC	CESMP – Planning, Management
	The security provider and personnel will adhere to international human right code of conduct. Only security personnel and companies with no human right violations will be employed.	EPC	CESMP – Planning, Management
	Security personnel will undergo a dedicated training program which will include, as a minimum, information on how to exercise practices following GIIP (UN Voluntary Principles on Security and Human Rights), cultural background of the area and the workforce (main groups), the way they should interact with local communities and workers.	EPC	CESMP – Planning, Management
Spread of Diseases	Prevention of diseases (including STDs) will be included in the training programme through toolbox talks or separate training sessions.	EPC	CESMP – Training
Informal Settlements /	Unplanned settlements will be monitored by onsite security personnel	EPC	CESMP – Planning,

Impact/ Source	Mitigation Measure	Responsibility	Schedule
Encroachment			Management
	The local public security forces will be required to deal with encroachers as per national requirements	EPC	CESMP – Planning, Management

18.5.3 Residual Impacts

Following the implementation of mitigation measure and promoting socio-economic activities, the positive significance of effects is expected to increase.

Table 18-5 Socio-economic – Residual Impacts – Construction Phase

Impact	Receptor	Impact Significance	Mitigation	Residual Impact Significance
Local employment creation	Employment	Moderate Positive	Yes	Moderate Positive
Dissemination of Skills	Local / Regional Economy	Minor Positive	Yes	Minor Positive
Purchase goods and materials from the local / regional economy	Local / Regional Economy	Minor Positive	Yes	Minor Positive
Conflict with security staff	Residents – Ouarzazate & Villagers	Minor Negative	Yes	Minor Negative
Conflict workforce – local population	Residents – Ouarzazate & Villagers	Minor Negative	Yes	Minor Negative
Spread of STDs	Residents – Ouarzazate & Villagers	Minor Negative	Yes	Minor Negative
Informal settlements and encroachment	Residents – Ouarzazate & Villagers	Negligible to Minor Negative	Yes	Negligible to Minor Negative

18.6 Operational Assessment

18.6.1 Potential Impacts

At a strategic level the operation of the plant offers potential to support the sustainable growth of the local and national economies, through the ability to provide a renewable source of energy to the national grid.

The most significant economic impact upon nearby communities during operation will result from the employment opportunities created by the Project. Several unskilled workers will likely be employed in the project during the operational phase for panel washing and general cleaning. Even though the direct impact on local employment is not as significant as during the construction phase, the increased time-scales involved offer an opportunity for greater

dissemination of skills into the local workforce and via this for the role of local workers to increase over time.

It is likely that the lack of some necessary skills within the immediate local population will require a proportion of work on the site to be undertaken by immigrant population.

Conflicts could potentially arise between communities and the Project workforce due to ethnic or religious differences, mistrust of foreigners, misbehaviour by the project workforce, etc. However, this is unlikely as the population in the area is used to expatriate labour working for the solar plants and the size of the operational workforce will be small.

Additionally, the interaction between the workforce and the local population can result in the proliferation of diseases, with Sexually Transmitted Diseases being a specific risk.

Access to the site will remain restricted during the plant operation, so only authorised staff will be allowed to access the site. There is a potential for conflict between local communities and security forces.

Table 18-6 Socio-economic – Magnitude of Operation Impacts

Impact	Magnitude	Justification
Provision of electricity to the National Grid	Minor Positive	The project's addition to the national grid will provide a renewable power supply.
Local Employment	Minor Positive	Several unskilled opportunities for permanent local employment during the operational phase are likely.
Conflict – workforce / local residents	Negligible Negative	Potential conflicts could result in injuries, damage to property, create or exacerbate conflicts within the community, significantly affect the development of the project, etc. Potential conflicts are less likely than during the construction phase due to the small size of the workforce.
Conflict – Security forces	Negligible Negative	There is a potential for conflict between local communities and security staff. The project is not within populated areas and has dedicated access roads, so conflict with the security personnel is highly unlikely
Spread of diseases	Negligible Negative	The spread of STDs or other diseases could result in sickness on the communities and workers and loss work time for the project. The likelihood of this risk is lower than during the construction phase due to the small size of the workforce.

Table 18-7 Socio-economic – Significance of Operational Impacts

Impact	Magnitude	Receptor	Sensitivity	Impact Significance
Provision of electricity to the National Grid	Minor Positive	National Grid	Low	Minor Positive
Local employment creation	Minor Positive	Employment	Medium	Minor Positive
Dissemination of skills	Minor Positive	Local Economy	Low	Minor Positive
Conflict with security staff	Negligible Negative	Residents – Ouarzazate & Villagers	Medium	Negligible Negative
Conflict workforce – local population	Negligible Negative	Residents – Ouarzazate & Villagers	Medium	Negligible Negative
Spread of STDs	Negligible Negative	Residents – Ouarzazate & Villagers	Medium	Negligible Negative

18.6.2 Measures

Table 18-8 Socioeconomic – Mitigation Measures - Operational Phase

Impact / aspect	Mitigation Measure	Responsibility	Schedule
Employment	The PV will seek to employ local workers where these are willing and with articular skills for the job, and where appropriate. All non-specialist job opportunities will likely be offered to the local residents prior to hiring of employees from other areas. The employment of women and vulnerable groups will be specifically targeted when possible and monitored.	O&M	OESMP – Planning, Management
Employment	Establish and Implement a recruiting policy and ensure that the necessary measures to mitigate negative impacts associated to labour and working conditions are implemented (e.g. child and forced labour, exploitation, excessive overtime, insufficient wages, harassment, unsafe/unhygienic living and working conditions, etc.). Labour and working conditions will be aligned with IFC standards.	O&M	OESMP – Planning, Management
Purchases	The O&M will only engage with reputable suppliers that do not use forced or child labour	O&M	OESMP – Planning, Management
	Purchase of goods and services by the workforce and of construction materials within the local/regional will be prioritized	O&M	OESMP – Planning, Management
Dissemination of Skills	Local employees will receive E&S and OHS training to enhance the development of skills. A certificate outlining the contents of the training and signed by the management of the PV plant will be provided.	O&M	OESMP – Planning, Training
Conflict – workforce / local residents	Inception training will include information on the cultural background of the population	O&M	OESMP – Training

Impact / aspect	Mitigation Measure	Responsibility	Schedule
Security Provisions	Develop and implement a Security Policy and a Code of Conduct for Security Personnel.	O&M	OESMP – Planning, Management
	The security provider and personnel will adhere to international human right code of conduct. Only security personnel and companies with no human right violations will be employed.	O&M	OESMP – Planning, Management
	Security personnel will undergo a dedicated training program which will include, as a minimum, information on how to exercise practices following GIIP (UN Voluntary Principles on Security and Human Rights), cultural background of the area and the workforce (main groups), the way they should interact with local communities and workers.	O&M	OESMP – Planning, Management
Spread of Diseases	Prevention of diseases (including STDs) will be included in the training programme.	O&M	OESMP – Planning, Management

18.6.3 Residual Impacts

Table 18-9 Socio-economic – Residual Impacts – Operation Phase

Impact	Receptor	Impact Significance	Mitigation	Residual impact
Provision of electricity to the National Grid	National Grid	Minor Positive	Yes	Minor Positive
Local employment creation	Employment	Minor Positive	Yes	Minor Positive
Dissemination of skills	Local Economy	Minor Positive	Yes	Minor Positive
Conflict with security staff	Residents – Ouarzazate & Villagers	Negligible Negative	Yes	Negligible Negative
Conflict workforce – local population	Residents – Ouarzazate & Villagers	Negligible Negative	Yes	Negligible Negative
Spread of STDs	Residents – Ouarzazate & Villagers	Negligible Negative	Yes	Negligible Negative

18.7 Decommissioning Assessment

A detailed DESMP will be prepared to ensure that the existing socioeconomic conditions are considered and all impacts are identified, assessed and addressed. It is expected that Moroccan and IFC standards will be updated in the future, and the DESMP will be compliant with the applicable requirements at the time of preparation.

Given the time lapse between the preparation of this SESIA and associated ESMP, it is not considered realistic to outline mitigation measures for the decommissioning phase at this stage. However, the DESMP will consider the applicable mitigation measures included in the SESIA, CESMP and OESMP.

19 ELECTRIC AND MAGNETIC FIELDS

19.1 Introduction

Power lines generate electric and magnetic fields when electricity is being transmitted. The strength of the electromagnetic field (EMF) at ground level will vary in accordance with the capacity (voltage), configuration of the conductors, the terrain, shielding structures in the terrain (buildings and trees), and the distance of the transmission lines from the ground.

This chapter discusses the potential impacts from EMF on sensitive receptors at the operational phase of the project only, since EMF is not produced during the construction or decommissioning phases of the proposed PL.

The evaluation of the potential environmental and health impacts resulting from exposure to EMF is based on the guidelines and recommendations developed by the International Commission on Non- Ionization Radiation Protection (ICNIRP) Guidelines (in cooperation with the Environmental Health Division of the World Health Organization (WHO)) on the limitation of the exposure to electromagnetic field (0Hz to 300GHz) which applies to occupational and general public exposure.

19.2 EMF Guidelines

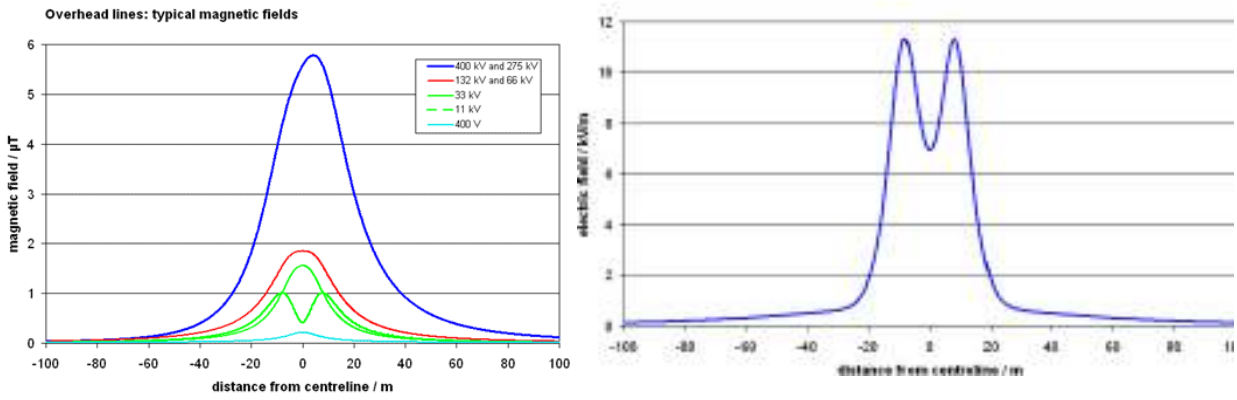
The International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued guidelines on exposure to EMFs in 1998, which have since been reviewed in 2009 for different types of radiation. The Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (2010) states that even though epidemiological studies have shown that chronic low intensity power frequency magnetic field exposure is associated with an increased risk of child leukaemia, no casual relationship has been established, nor have any other long term effects been established.

Although there is public and scientific concern over the potential health effects associated with exposure to EMF, according to the IFC Environmental, Health, and Safety Guidelines on Electric Power Transmission and Distribution, there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines. However, while the evidence of adverse health risks is limited, it is still sufficient to license limited concern.

Electric fields are shielded by materials, such as trees and buildings, while magnetic fields pass through most materials and are difficult to shield. Power frequency EMF typically has a frequency in the range of 50 – 60 Hertz (Hz), and is considered Extremely Low Frequency (ELF). In addition to the fact that the strength of both electric and magnetic fields is a

function of the capacity, distance from the wire conductors to the ground and the distance from the power line to the receptor; studies have also shown that radiation reduces with distance by a factor of $1/r^2$ to the source, as shown in the figure below.

Figure 19-1 Typical Magnetic (Lefts – blue line) Electric (Right) Fields Dissipation for a 300 kV line (source: EMFs.info)



The following table includes the reference levels for exposure to the public against the developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) – included in the table below.

Table 19-1 ICNIRP exposure limits for general public to electric and magnetic

Frequency	Magnetic Field (µT)	Electric Field (KV/m)
50 Hz	100	5
60 Hz	83	4

Table 19-2 ICNIRP occupational exposure limits to electric and magnetic

Frequency	Magnetic Field (µT)	Electric Field (KV/m)
50 Hz	10,000	0.50
60 Hz	8300	0.41
Minimum Working and Clear Hot Stick Distance ~ 0.51m for a voltage range of 15.1 to 35 kV		

19.3 Baseline and Sensitive Receptors

The closest residential area of the PL (village of Igherm Ammella) is located ~ 618 m away and the NOORo II & III workers' camp is located 2,6 km north from the proposed Power Line alignment. As such, there are no permanent sensitive residential receptors identified in the impact corridor of the proposed power line.

19.4 Construction Assessment

No impacts are deemed significant for the construction of the PL.

19.5 Operational Assessment

19.5.1 Potential Impacts

Taking into consideration the low voltage transmitted by the 225 kV PL, the low EMF field levels emitted by the 225 kV power line, the dissipation of EMF over distance, and the absence of any sensitive receptors within the potential impact corridor of EMF, the significance of negative impacts on roads users (a temporary and transient sensitive receptor) is considered negligible.

Table 19-3 EMF - Magnitude of Occupation Impacts

Impact	Magnitude	Justification
Exposure to EMF	**Negligible**	The risk of exposure decreases with distance and distance of the isolated houses from the edge of the corridor are outside the impact buffer zone.

19.5.2 Mitigation Measures

In order to help minimise the risks of exposure, the following measures are recommended:

- Ensure that the design height of the poles and cables maximizes the distance of the lines from the ground,
- Ensure that the configuring of the conductors minimises the EMF's strength,
- Prevent planting or establishment of any tall vegetation within the corridor, as these could damage the lines or cause a short circuit.
- Prevent any land use (residential, commercial, agriculture) within the PL corridor.

19.6 Decommissioning Assessment

No impacts are deemed significant for the decommissioning of the PL.

20 MONITORING PLAN

The following table outlines the parameters that, as a minimum, need to be monitored for the project.

Additional frequency, parameters or locations might be monitored if new activities that were not covered in the SESIA are implemented onsite, or following emergency situations, incidents (e.g. spills) or requests from stakeholders.

Table 20-1 Monitoring Plan

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
Construction						
Air quality - PM_{10} $PM_{2.5}$	Site boundary	Air filters or dust collectors	Weekly during site preparation activities	Dust from vehicles and earthworks	To be determined by the EPC	EPC
Air Quality - Exhausts	Equipment exhausts	Visual inspection of the smoke (follow testing equipment specifications for use)	Daily Inspections	If there is visible dark smoke, the equipment will be sent for maintenance or replaced	Not applicable	EPC/ Subcontractors
Air Quality – Exhausts	Vehicles entering to the site	Visual inspection of the smoke (follow testing equipment specifications for use)	Always	If there is visible dark smoke, the vehicles will not enter the site	Not applicable	EPC/ Subcontractors
Noise	Inside the Project Site	Standard noise monitoring	Weekly during site preparation and	Construction activities increase	To be covered by the EPC	EPC

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
		methodology, as described in the baseline monitoring survey.	construction of foundations. Monthly during the rest of construction.	noise levels (nuisance, disturb fauna, work hazard)	(indicative cost noise meter 2000-5000 MD)	
Waste management - quantities and types of solid waste reuse, recycling and disposal. Include an indication if solid waste disposal has met intended construction phase recycling, recovery or reuse targets	-	Waste log	Bi-weekly	Monitor compliance with waste management targets	Not applicable	EPC / subcontractors
Waste management - quantities and types of solid waste taken off site, the approved handler, and where the	-	Waste log	Every time waste is taken offsite. Statistics compiled monthly.	Monitor compliance with off-site disposal by approved subcontractors	Not applicable	EPC / subcontractors

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
waste was disposed. Special attention will be given to hazardous waste.						
Wastewater management - quantities and types septic tanks taken off site, the approved handler, and where the waste was disposed;	-	Waste log	Every time sewage is taken offsite. Statistics compiled monthly.	Monitor compliance with off-site disposal by approved subcontractors	Not applicable	EPC / subcontractors
Waste Management - non-hazardous solid waste storage collection, storage and transfer areas or evidence of accidental releases and to verify that wastes are properly	Solid Waste Storage Areas	Visual inspection	Daily	Monitor compliance with waste storage targets	Not applicable	EPC

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
labelled and stored						
Underground Septic Tanks, identification of leakage – quantities of sewage flowing into underground septic tank compared to sewage being tankered off;		Waste log	Calculations undertaken monthly.	Potential leakage from underground septic tanks.	Not applicable	EPC / subcontractors
Hazardous Materials -	Hazardous Materials storage collection, storage and transfer areas	Visual inspection	Daily	Monitor compliance with hazardous materials storage targets	Not applicable	EPC
Runoff system - blockages	Runoff system	Visual inspection	Weekly and in prevision of rain	Monitor compliance with	Not applicable	EPC

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
				overflowing		
Runoff system - erosion prevention	Runoff system discharge points	Visual inspection	Weekly and following intense rain events	Monitor compliance with erosion objectives	Not applicable	EPC
Soil Quality	Hazardous materials and liquid and solid waste storage areas as a minimum	Sampling methodology as described in SESIA Vol. 2	Soil samples will be analysed following the release of hazardous substances onto the soil and the required restoration	Monitor compliance with ground pollution targets	Quotations to be obtained by the EPC.	EPC
Ecological status – presence of fauna.	Onsite and ~200 m buffer area	Count and identification of fauna species	Monthly	Monitor ecology around the site	Not applicable	EPC
Ecological status - Additionally, detect	Onsite	Visit trenches and other risk areas as part	Daily	Monitor ecology onsite	Not applicable	EPC

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
caught/trapped fauna. Specialist is not required.		of the daily inspections to identify trapped animals				
Traffic and Transportation	Within the site and in the access road	Speed meter device	Weekly	Monitor compliance with speed limits	Cost of speed meter	EPC
Housekeeping	Site and access roads	Visual Inspection and collection	Onsite: Daily Access roads: Weekly	Monitor good construction housekeeping practices onsite and at access roads	Not applicable	EPC
Lighting	Boundaries of the site	Visual assessment of directional lighting	Quarterly	Prevent light pollution to the other areas	Not applicable.	EPC
Recruitment policy	Not applicable	Ratio local, regional, national and	Monthly	Provide employment for	Not applicable	EPC

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
		international employees. Rations of women employees.		local population, minimize impact immigrant labour		
Complaints register	Point of contact to be posted at the site entrance	Register complaints and how they are addressed	Every time there is a complaint	Record, address and follow up complaints	Not applicable	EPC
Emergency monitoring	Not applicable	Register emergencies and follow-up-remediation	Every time there is an emergency	Register emergencies and follow-up-remediation	To be covered by the EPC.	EPC
Operation						
Waste management - estimated of quantities and types of solid waste reuse, recycling and disposal. Include an	-	Waste log	Quarterly	Monitor compliance with waste management targets	Not applicable	O&M / subcontractors

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
indication if solid waste disposal has met intended recycling, recovery or reuse targets						
Waste management - quantities and types of solid waste taken off site, the approved handler, and where the waste was disposed. Special attention will be given to hazardous waste.	-	Waste log	Every time waste leaves the site. Statistics to be compiled quarterly.	Monitor compliance with off-site disposal by approved subcontractors	Not applicable	O&M / subcontractors
Waste management - quantities and types septic tanks taken off site, the approved handler, and where the	-	Waste log	Monthly	Monitor compliance with off-site disposal by approved subcontractors	Not applicable	O&M / subcontractors

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
waste was disposed;						
Waste Management - evidence of accidental releases and to verify that wastes are properly labelled and stored	Waste storage collection, storage and transfer areas	Visual inspection	Weekly	Monitor compliance with waste storage requirements	Not applicable	O&M
Hazardous Materials -	Hazardous Materials storage collection, storage and transfer areas	Visual inspection	Weekly	Monitor compliance with hazardous materials storage requirements	Not applicable	O&M
Runoff system - blockages	Runoff system	Visual inspection	Monthly and in prevision of rain	Monitor compliance with overflowing	Not applicable	O&M
Runoff system - erosion	Runoff	Visual inspection	Monthly	Monitor	Not applicable	O&M

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
prevention mitigation measures	system discharge points			compliance with erosion objectives		
Soil Quality	Hazardous materials and liquid and solid waste storage areas as a minimum	Sampling methodology as described in SESIA Vol. 2	If major accidental releases of pollutants take place, following remediation.	Monitor compliance with ground pollution targets	To be covered by the O&M or responsible subcontractor.	O&M / subcontractor
Ecological status – Identify bird or other fauna mortality	Onsite	Identification and count of mortality	Daily inspections All O&M workers to be trained to report carcasses onsite.	Monitor potential mortality due to collision	Not Applicable	O&M
Ecological status – Bird Mortality Monitoring	PL alignment and poles See Section	Bird mortality identification, count of carcasses, species	Monthly during bird migration periods (end of August to November	Monitor Bird Mortality within the alignment.	To be covered by the O&M.	O&M

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
	20.1	identification and carcass removal trials. All O&M workers to be trained to report carcasses onsite. See Section 20.1	and March to mid May) for the first two years of operation of the power line. See Section 20.1	See Section 20.1		
Lighting	Boundaries of the site	Visual assessment of directional lighting	Quarterly	Prevent light pollution	Not Applicable	O&M
Recruitment policy	Not applicable	Ratio local, regional, and Moroccan to expatriate labour and women to men	Quarterly	Provide employment for local population, minimize impact immigrant labour	Not Applicable	O&M
Complaints register	Point of contact to be posted at the site entrance	Register complaints and how they are addressed	Every time there is a complaint	Record, address and follow up complaints	Not Applicable	O&M

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
Emergency monitoring	Not applicable	Register emergencies and follow-up-remediation	Every time there is an emergency	Register emergencies and follow-up-remediation	To be covered by the O&M .	O&M
Supervision (during the construction and operation phases)						
Independent Environmental Audits – Documentation	-	The auditors will review the environmental and social documentation kept at the facility, check the adequate implementation of the environmental procedures established in the ESMP (CESMP/OESMP) and documentary evidence of the	Quarterly (construction) Twice a year (operation –first two years) Yearly (remaining operational phase)	Independent environmental audits provide assurance of compliance with the measures included in the SESIA and the ESMP.	Project Company to hire independent external auditors.	NOORo IV Project Company. The auditors will be required to have auditing experience in Morocco in renewable projects and auditing experience in

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
		application of the mitigation and monitoring measures stated in the SESIA, including the monitoring results				projects aligned with IFC requirements— Site inspection
Independent Environmental Audits.	-	The auditors will visit the plant, to ensure that the environmental and social procedures are being adequately applied onsite.	Quarterly (construction) Twice a year (operation –first two years) Yearly (remaining operational phase)	Independent environmental audits provide assurance of compliance with the measures included in the SESIA and the ESMP.	Project Company to hire independent external auditors.	NOORo IV Project Company The auditors will be required to have auditing experience in Morocco in renewable projects and auditing experience in projects aligned

MONITORING PLAN						
What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)	When (Define the frequency / or continuous?)	Why (Is the parameter being monitored?)	Cost (if not included in project budget)	Who (Is responsible for monitoring?)
						with IFC requirements— Site inspection

20.1 Bird Mortality Monitoring - Operation

A bird-monitoring program will be implemented to assess the effectiveness of the mitigation measures.

Bird-mortality monitoring for the Power Line will take place monthly during bird migration periods (end of August to November and March to mid May) for the first two years of operation of the power line. The recommendations of Birdlife International for bird mortality monitoring from Power Lines will be taken into consideration for the preparation of the bird-monitoring programme. Once a year during the first two years, carcass removal trials will be undertaken to monitor carcasses removed by scavengers and estimate the length of time that carcasses remain in the field for possible detection.

After each migratory season, the need to deploy measures to further reduce bird mortality will be assessed, as per the monitoring measures for biodiversity.

If less than four carcasses are identified per year, no further bird mortality monitoring will be undertaken after the 2nd year of operation of the Power Line.

21 REFERENCES

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APPENDIX 1 – CONSTRUCTION SCHEDULE

Task Name	Duration	Start (estimate)	Finish (estimate)
Ouarzazate 70 MW (total)	313 days	Sun 01-01-17	Sun 31-12-17
Receiving of NTP	0 days	Sun 01-01-17	Sun 01-01-17
Design & Engineering	90 days	Sat 07-01-17	Thu 20-04-17
Ordering & Procurement	76 days	Sun 29-01-17	Wed 26-04-17
Manufacturing & Inspection, MDCC	160 days	Wed 15-02-17	Sun 20-08-17
Transportation & Delivery from Exworks to Site	160 days	Mon 03-04-17	Thu 05-10-17
Civil & Structural Works	192 days	Wed 25-01-17	Tue 05-09-17
Equipment Installation Testing & Commissioning	140 days	Sat 20-05-17	Sun 29-10-17
Transmission Line Works	264 days	Sun 08-01-17	Sun 12-11-17
MDCC & Delivery From Ex-works to site	105 days	Tue 02-05-17	Thu 31-08-17
Testing and Commissioning	70 days	Mon 09-10-17	Thu 28-12-17

APPENDIX 2 –SPECIES LIST

The following raw data was obtained from the Integrated Biodiversity Assessment Tool (BAT) (2011-2012). https://www.ibat-alliance.org/ibat-conservation/home.

IBAT for Research and Conservation Planning is a tool designed to facilitate access to wide range of biodiversity data for research and conservation planning purposes. The tool is the result of a partnership among BirdLife International, Conservation International, International Union for Conservation of Nature and UNEP World Conservation Monitoring Centre.

The following information includes a list of the species identified within grid 47585 on which the proposed PV is located. The following species list includes the proposed area for the PV and a 30km buffer. Therefore these species are likely to occur, but it does not mean that it is distributed equally within that grid or occurs everywhere within that grid.

Table 21-1 Species list for grid cell 47585

Type	Scientific Name	Common Name	Global UICN Category (2016)
Plants	*Carex fissirostris*	Laîche	EN
	Epilobium psilotum		NT
	Limonium ornatum		VU
	Mentha gattefossei	Menthe de Perse	NT
	Myosotis atlantica	Myosotis de l'Atlas	NT
	Ranunculus batrachioides		NT
Reptiles	*Daboia mauritanica*	Moorish Viper	NT
	Macroprotodon brevis	False Smooth Snake	NT
	Spalerosophis dolichospilus	Mograbin Diadem Snake	DD

Type	Scientific Name	Common Name	Global UICN Category (2016)
Birds	*Acrocephalus paludicola*	Aquatic Warbler	VU
	Aythya nyroca	Ferruginous Duck	NT
	Chlamydotis undulata	Houbara Bustard	VU
	Coracias garrulus	European Roller	NT
	Limosa limosa	Black-tailed Godwit	NT
	Marmaronetta angustirostris	Marbled Teal	VU
	Neophron percnopterus	Egyptian Vulture	EN
	Sylvia undata	Dartford Warbler	NT
Mammals	*Ammotragus lervia*	Aoudad	VU
	Gazella cuvieri	Cuvier's Gazelle	EN
	Gazella dorcas	Dorcas Gazelle	VU
	Hyaena hyaena	Striped Hyaena	NT
	Lutra lutra	Eurasian Otter	NT
	Miniopterus schreibersii	Schreiber's Bent-winged Bat	NT
	Myotis punicus	Maghreb Mouse-eared Bat	NT
	Rhinolophus euryale	Mediterranean Horseshoe Bat	NT

1.1.1 Flora

Endemic species, rarity:

- Maroc endemic species in Morocco
- Maur, endemic species in Morocco and Mauritania
- Rare : rare species

- Rare ?: species likely to be rare onsite

Table 21-2 Flora species List

	Rocky Plateau	Oued	Scarpments	Reg de bas de pente
Coverage	**<5%**	**10 à 20%**	**5 à 20%**	**5 à 10%**
Shrub 3à1m				
Ziziphus lotus		x		x
Ligneux 0,5-1m				
Carthamus fruticosus			**x**	
Farsetia ramosissima	x	x	x	
Launaea arborescens		x		x
Ononis natrix prostrata		**x**	**x**	**x**
Zilla macroptera		x		x
Shrub <0,5m				
Antirrhinum ramosissimum		x		x
Anvillea radiata		x		x
Artemisia inculta		x	x	
Convolvulus trabutianus			**x**	
Farsetia ramosissima	x	x	x	x
Hamada scoparia		x		
Helianthemum sessiliflorum		x		
Marrubium desertii		x		
Moricandia suffruticosa		x	x	

	Rocky Plateau	Oued	Scarpments	Reg de bas de pente
Coverage	**<5%**	**10 à 20%**	**5 à 20%**	**5 à 10%**
Salvia aegyptiaca		x	x	
Grassland				
Aizoon canariense				x
Aristida caerulescens		x	x	x
Asphodelus temuifolius	x	x	x	x
Carlina involucrata		x		
Chrysopogon aucheri			x	
Citrullus colochyntis		x		x
Cymbopogon schoenanthus		x		
Diplotaxis harra		x		
Echinops strigosus		x	x	
Eryngium ilicifolium		x		x
Fagonia glutinosa		x	x	
Forskahlea tenacissima			x	
Morretia canescens	x	x		x

	Rocky Plateau	Oued	Scarpments	Reg de bas de pente
Coverage	**<5%**	**10 à 20%**	**5 à 20%**	**5 à 10%**
Notoceras bicorne		x		
Reseda villosa		x	x	
Schismus barbatus		x		
Sclerocephalus arabicus	x	x	x	x
Stipagrostis foexiana		x		
Stipa cappensis		x		x
Nombre d'espèces	**5**	**31**	**15**	**15**
Nombre d'espèces endémiques	**0**	**1**	**3**	**1**

1.1.2 Fauna

Presence of species:

- P: present onsite
- O: species observed or detected
- P: potentially present species
- E: extinct species in the region
- En: Endemic
- MAR: Morocco
- MAG: Maghreb
- AFN: North Africa (including the Sahara)
- SAH: Sahara (W Western part of the Sahara)

IUCN Status, 2016:

- CE Critically Endangered
- EN Endangered
- VU: Vulnerable
- NT Near Threatened
- LR Lower Risk / Minor Concern
- DD Data deficient / Insufficient data

IUCN status is assessed at the following levels: International (according to IUCN 2014): Globally, Mediterranean and National level.

The following legal information is provided:

- Protected species by the Hunting Act in Morocco.
- Species listed by Annexes I, II and III of CITES Convention (on trade of wildlife species) and CITES law in Morocco.
- Birds and mammals species listed on Annex I, II of CMS Convention (on migratory species).
- Species listed on Berne Convention (on European protected species)
- Bat species listed on EUROBAT Convention (on bat protection).

Table 21-3 Reptiles

Presence	Family	Scientific Name	Common name	Endemic species	UICN World	UICN Mediterranean	Hunting Act	CITES Maroc AppIV	CITES App II
O	AGAMIDES	*Agama impalearis*	Agame de Bibron		LC	LC	x		
P		*Uromastix acanthinura*	Fouette-queue à queue épineuse	SAH	LC	NT	x		x
P	GECKKONIDES	*Tarentola boehmei*	Tarente de Böhme	MAR	LC	LC	x		
P		*Ptyodactylus oudrii*	Gécko d'Oudri	SAH	LC	LC	x		
P		*Tropiocolotes algericus*	Tropiocolotès d'Algérie	MAG	LC	LC	x		
P		*Saurodactylus brosseti*	Saurodactyle de Brosset	MAR	LC	LC	x		
P		*Tarentola*	Tarente de Maurétanie		LC	LC	x		

Presence	Family	Scientific Name	Common name	Endemic species	UICN World	UICN Mediterranean	Hunting Act	CITES Maroc AppIV	CITES App II
		mauritanica							
P	LACERTIDES	*Mesalina olivieri*	Erémias d'Olivier		LC	LC	x		
P		*Acanthodactylus boskianus*	Acanthodactyle de Bosk		LC	LC	x		
P		*Mesalina guttulata*	Erémias à gouttelettes		LC	LC	x		
P	COLUBRIDES	*Hemorrhois algirus*	Couleuvre algire	AFN	LC	LC	x	x	
P		*Psammophis schokari*	Couleuvre de Schokar		LC	LC	x	x	
P		*Rhagerhis moilensis*	Couleuvre de Moïla		LC	LC	x	x	
P		*Spalerosophis dolichospilus*	Couleuvre à diadème d'Afrique du Nord	MAG	DD	DD	x	x	
P		*Macroprotodon brevis*	Couleuvre à capuchon	MAR	NT	NT	x	x	
P	ELAPIDES	*Naja haje*	Cobra		LC	LC	x	x	
P	VIPERIDES	*Daboia mauritanica*	Vipère de Maurétanie	MAG	NT	NT	x	x	
P		*Cerastes cerastes*	Vipère à cornes		LC		x	x	

Table 21-4 Birds

Présence	Nom latin	Espèce	UICN Mondial	UICN Méditerranée	Loi chasse	CITES Maroc Appl V	CITES App I	CITES App II	CMS App I	CMS App II	Berne App II	Berne App III
E	*Neophron percnopterus*	Vautour percnoptère	EN	EN	x			x	x	x	x	
O	*Buteo rufinus*	Buse féroce	LC		x			x		x	x	
P	*Falco tinnunculus*	Faucon crécerelle	LC		x			x		x	x	
P	*Falco biarmicus*	Faucon lanier	LC		x			x		x	x	
E	*Chlamydotis undulata*	Outarde houbara	VU	VU	x		x				x	
O	*Cursorius cursor*	Courvite isabelle	LC		x	x					x	
P	*Pterocles coronatus*	Ganga couronné			x	x						
P	*Pterocles senegallus*	Ganga tacheté	LC		x	x						
O	*Pterocles orientalis*	Ganga unibande	LC		x	x					x	
O	*Columba livia*	Pigeon biset	LC									x
P	*Bubo ascalaphus*	Grand-duc d'Afrique du Nord	LC		x			x				
P	*Athene noctua*	Chevêche d'Athéna	LC		x			x			x	
P	*Caprimulgus ruficollis*	Engoulevent à collier roux	LC								x	
P	*Merops persicus*	Guêpier de Perse	LC			x						
P	*Ammomanes cinctura*	Ammomane élégante	LC									
O	*Ammomanes deserti*	Ammomane isabelline	LC									
P	*Alaemon alaudipes*	Sirli du désert	LC									
P	*Rhamphocoris clotbey*	Alouette de Clot-bey	LC									
O	*Calandrella brachydactyla*	Alouette calandrelle	LC								x	

Présence	Nom latin	Espèce	UICN Mondial	UICN Méditerranée	Loi chasse	CITES Marroc Appl V	CITES App I	CITES App II	CMS App I	CMS App II	Berne App II	Berne App III
O	*Galerida theklae*	Cochevis de Thékla	LC								x	
O	*Eremophila bilopha*	Alouette bilophe	LC									
O	*Ptyonoprogne rupestris*	Hirondelle de rochers	LC								x	
O	*Oenanthe deserti*	Traquet du désert	LC									
P	*Oenanthe (lugens) halophila*	Traquet deuil	LC									
O	*Oenanthe leucopyga*	Traquet à tête blanche	LC									
P	*Oenanthe leucura*	Traquet rieur	LC								x	
O	*Lanius excubitor*	Pie-grièche grise	LC								x	
E	*Corvus corax*	Grand Corbeau	LC									x
O	*Rhodopechys githaginea*	Roselin githagine	LC			x					x	

Table 21-5 Mammals

Presence	Family	Scientific Name	Common name	UICN Mondial	UICN Méditerranée	Hunting Act	CITES Maroc AppIV	CITES App I	CITES App II	CITES App III	CMS App I	CMS App II	Berne App II	Berne App III	Eurobats
P	*Atelerix algirus*	Hérisson d'Algérie		LC	LC	x	x						x		
P	*Hemiechinus aethiopicus*	Hérisson du désert		LC	DD	x	x								
P	*Elephantulus rozeti*	Macroscélide de Rozet	MAG	LC	LC										
P	*Rhinopoma hardwickei*	Petit Rhinopome		LC	LC		x								x
P	*Eptesicus isabellinus*	Sérotine isabelle		LC			x						x		x
O	*Hypsugo savii*	Vespère de Savi		LC	LC		x						x		x
O	*Pipistrellus kuhli*	Pipistrelle de Kuhl		LC	LC		x						x		x
O	*Pipistrellus pipistrellus*	Pipistrelle commune		LC	LC		x							x	x
P	*Myotis punicus*	Murin du Maghreb	MAG	DD	NT		x					x	x		x

Presence	Family	Scientific Name	Common name	UICN Mondial	UICN Méditerranée	Hunting Act	CITES Maroc AppIV	CITES App I	CITES App II	CITES App III	CMS App I	CMS App II	Berne App II	Berne App III	Eurobats
P	*Asellia tridens*	Trident		LC	LC		x								x
O	*Rhinolophus blasii*	Rhinolophe de Blasius		LC	NT		x						x		x
P	*Rhinolophus euryale*	Rhinolophe euryale		NT	VU		x						x		x
P	*Otonycteris hemprichi*	Oreillard d'Hemprich		LC	LC		x								x
P	*Rhinolophus ferrumequinum*	Grand Rhinolophe fer à cheval		LC	NT		x						x		x
P	*Tadarida aegyptiaca*	Molosse d'Egypte		LC	LC		x								
P	*Rhinopoma microphyllum*	Grand Rhinopome		LC	LC		x								x
O	*Rhinolophus hipposideros*	Petit Rhinolophe fer à cheval		LC	NT		x						x		x
O	*Tadarid*	Molosse de		LC	LC		x						x		x

Presence	Family	Scientific Name	Common name	UICN Mondial	UICN Méditerranée	Hunting Act	CITES Maroc AppIV	CITES App I	CITES App II	CITES App III	CMS App I	CMS App II	Berne App II	Berne App III	Eurobats
	a teniotis	Cestoni													
O	*Miniopterus maghrebensis*	Minioptère du Maghreb	MAG				x								
O	*Plecotus gaisleri*	Oreillard du Maghreb	MAG	LC	LC		x						x		x
P	*Lepus capensis*	Lièvre commun		LC	LC									x	
P	*Pachyuromys duprasi*	Rat à queue en massue	SAH	LC	LC										
E	*Hystrix cristata*	Porc-épic		LC	LC	x	x						x		
P	*Jaculus jaculus*	Petite Gerboise		LC	LC										
P	*Eliomys melanurus*	Lérot de Berbérie	MAG	LC	LC		x								
P	*Meriones crassus*	Mérione du désert		LC	LC										
P	*Gerbillus tarabuli*	Gerbille de Libye		LC	LC										
P	*Gerbillus*	Gerbille naine	SAH	LC	LC										

Presence	Family	Scientific Name	Common name	UICN Mondial	UICN Méditerranée	Hunting Act	CITES Maroc AppIV	CITES App I	CITES App II	CITES App III	CMS App I	CMS App II	Berne App II	Berne App III	Eurobats
	amoenus	d'Egypte													
P	*Atlantoxerus getulus*	Ecureuil de Barbarie	MAG	LC		x	x								
P	*Acomys cahirinus*	Rat épineux		LC											
P	*Felis silvestris ssp libyca*	Chat ganté		LC	LC	x			x						
E	*Hyaena hyaena*	Hyène rayée		NT	VU	x	x								
P	*Genetta genetta*	Genette		LC	LC	x	x							x	
O	*Vulpes vulpes*	Renard roux		LC	LC										
P	*Canis aureus*	Chacal doré		LC	LC					x					
E	*Gazella cuvieri*	Gazelle de Cuvier	MAG	VU		x		x			x				
E	*Gazella dorcas*	Gazelle dorcas	AFN	VU	EN	x				x(Algérie, Tunisie)	x		x		