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ETHIOPIAN ELECTRIC POWER

METEHARA SOLAR POWER PV PLANT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

VOLUME 1: MAIN REPORT

FINAL REPORT

April | 23 | 2019

Multiconsult

IN ASSOCIATION WITH:

SHEBELLE CONSULT PLC

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LOCATION: Fentale Woreda, East Shoa Zone, Oromia Regional State, Ethiopia

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EXECUTIVE SUMMARY

Introduction

Ethiopian Electric Power (EEP) intends to enter into a Power Purchase Agreement with Enel Green Power (EGP) to construct and operate a photovoltaic (PV) power plant with a total area of 250 ha and installed capacity of 100 MW AC outside Metehara town in Fentale woreda, Oromia Regional State, Ethiopia. The project will become the first utility-scale solar PV plant in Ethiopia connected to the national grid.

This ESIA study has been prepared in compliance with the Environmental Impact Assessment Proclamation 299/2002 and the applicable international safeguard policies, in particular the IFC Performance Standards. In addition, a Framework Resettlement Plan has been prepared to estimate the scale of resettlement and to guide the compensation and resettlement process.

The ESIA process has involved field studies and stakeholder consultations, which have been documented in detail in the ESIA report. The views and opinions of project affected people and institutional stakeholders have helped to identify the potential impacts and mitigation measures. There has also been close coordination with EEP and EGP to ensure that environmental and social issues are addressed at an early stage. The different project alternatives have been compared as part of the ESIA study.

Project Description

The Metehara solar power PV plant will occupy 250 ha of land that has been chosen by Fentale woreda as the most suitable location for solar energy development in the area. The site is immediately east of Metehara town and south of the main road between Addis Ababa and Djibouti. It belongs to Gelcha kebele, a rural area with few settlements and limited land use other than livestock grazing and seasonal farming in years with sufficient rainfall.

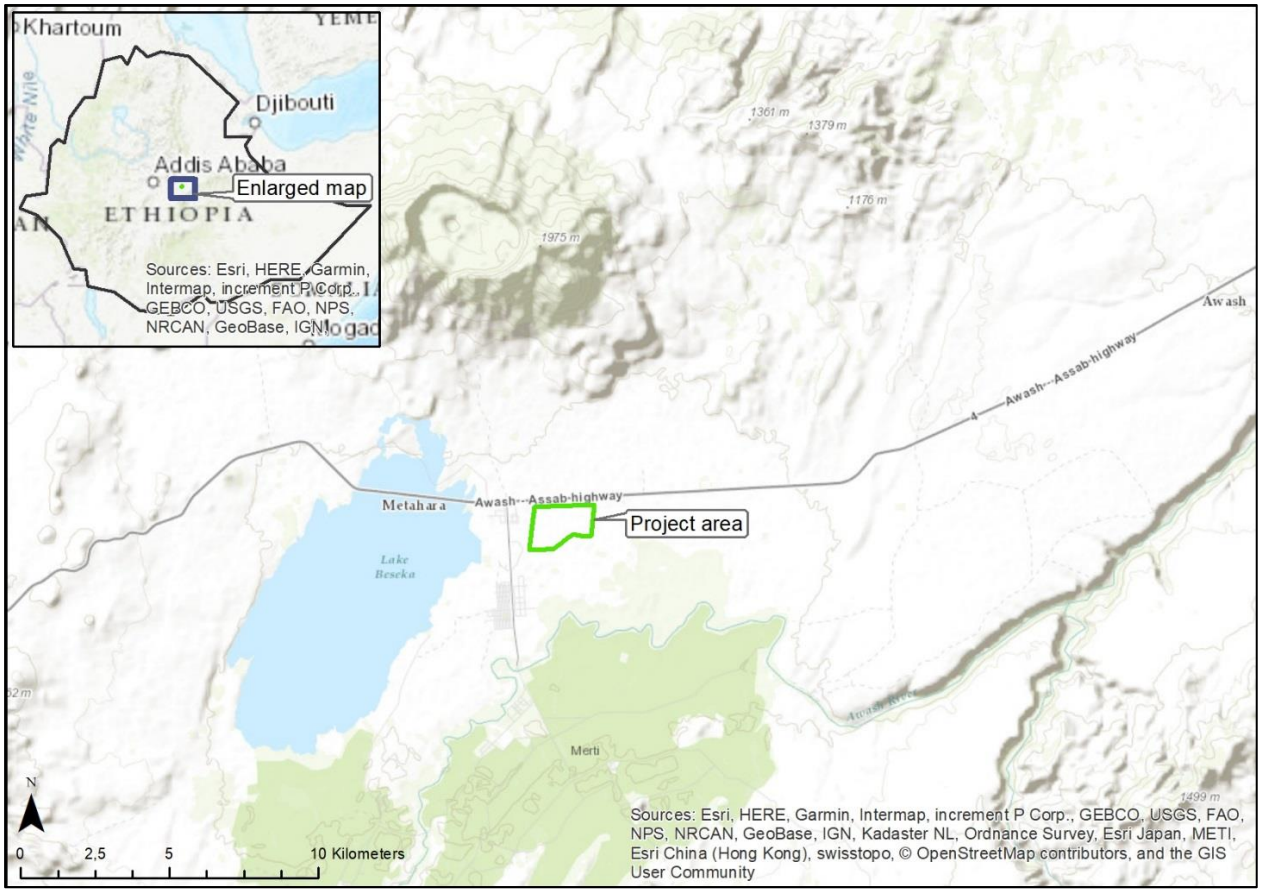
The solar PV facility will consist of a large number of PV modules (solar panels) which absorb the sun's rays as a source of energy to generate electricity. Inverters will convert the DC current produced by the PV modules to grid-exploitable AC current, while transformers will convert the low voltage (400 V) from the inverters to medium voltage (33 kV) for connection to the site substation.

The new substation will be constructed by Enel Green Power (EGP) inside the project site and thereafter be handed over to Ethiopian Electric Power (EEP) which will be responsible for the grid connection. EEP will construct a new double-circuit 230 kV transmission line from the substation to the interconnection point on an existing 230 kV single-circuit line located approximately 2 km north of the project site. The interconnection to the existing line will be made by a loop-in/loop-out arrangement. Routing of the new transmission line (by EEP) has not yet been done and has therefore not been subject to detailed ESIA study.

Baseline Conditions

Physical Environment

The Metehara solar PV plant will be situated on the flat plains between Mount Fentale, a semi-dormant volcano rising to 2,007 meters above sea level, Lake Beseka and the Metehara Sugar Estate. The vegetation originally consisted of grassland with scattered trees but has in recent years been invaded by the exotic *Prosopis juliflora* forming almost impenetrable thickets in parts of the project site.



The project site is underlain by Quaternary age volcanic rocks with a soil cover consisting of hillwash, lacustrine deposits and residual ignimbrite classified as Leptosols. The soils are generally unattractive for agriculture because of their inability to hold water. The site is characterised by flat topography with no unstable slopes or significant erosion channels. The seismic risk is classified as high.

Metehara has a semi-arid climate with an average rainfall of about 540 mm and average temperature of 25 °C. The rainfall regime is weakly bi-modal with the main rainy season in July to September and the short rains in March and April.

There are no permanent water bodies within the project boundaries, but Lake Beseka is located less than 1 km to the west. Beseka is a saline lake that has grown significantly in the past half century. The lake expansion has already caused submergence of the old highway and is posing a risk to the nearby sugar estate and to properties at the outskirts of Metehara town. A drainage canal has been excavated from Lake Beseka to the Awash River in order to limit the rise in lake-water level. This canal borders the project site to the south.

Biological Environment

The project site is not protected for conservation but is situated only 3.5 km from the border of Awash National Park. The park is home to a total of 76 mammal species (including bats) and over 450 species of birds. It is positioned within the Rift Valley / Red Sea flyway. Park management is challenged by non-conservation related activities ranging from permanent settlements to livestock grazing and there have been land use conflicts with pastoralists ever since the park was established in the 1960s.

The vegetation cover in the project area is poor and scanty with much of the land being barren in the dry season and cultivated in the rainy season (although not in recent years due to drought). The dominant woody species is the invasive shrub *Prosopis juliflora*, a well-known weed in the drylands of Ethiopia. The native vegetation consisted of*Acacia-Commiphora* bushland and woodland, but few plant species remain and none of them are of conservation value.

With the poor vegetation cover and the proximity to Metehara town, wildlife biodiversity is also low, decreasing and stressed. While the Awash National Park is relatively close to the project site, there is no evidence that the space is used as a migration corridor for terrestrial animals. No threatened mammals (including bats), reptiles or amphibians were observed in the project area.

Despite the poor ecological status of the project site and its surrounding areas near Metehara town, the site appears to be situated within an 'Important Bird Area' (IBA) associated with the Awash National Park. The IBA extends beyond the park boundary and includes part of Lake Beseka. The reason for adjusting the IBA boundaries away from the Awash National Park has not been documented, but may have been done to produce a contiguous IBA that covers the park as well as the water bird habitats of Lake Beseka.

The project site itself is not rich in bird species due to habitat degradation, but some threatened birds of prey and vultures have been observed soaring over the area. These include the endangered Egyptian Vulture and the critically endangered White-backed Vulture, Hooded Vulture and Rüppell's Vulture. These birds feed on waste dumps around Metehara town; however, they do not breed or roost at the project site.

Human Environment

Metahara town is situated about 196 km from Addis Ababa along the highway to Djibouti. It has a total population of 20,522, but also hosts a substantial transient population due to its strategic location along the highway and the migrant seasonal workers employed by Metehara sugar factory. The population in the sugar estate, known as Metehara Merti, is actually higher than in Metehara town, with an estimated population of 45,000 people consisting of employees and their families.

There is no systematic land use planning or zoning in Fentale woreda. However, the project site is situated outside the urban town area, with its western perimeter running along the boundary between the rural Gelcha kebele and Metehara town. The rural population are mainly Karrayu Oromos, who are predominantly agro-pastoralists. The pastoralist livelihoods have declined in recent decades due to the expansion of irrigation farming and urban settlements combined with restrictions on livestock herding imposed by the Awash National Park.

Land in Ethiopia (and in the project area) is the common property of the people and cannot be subject to sale. However, according to the Rural Land Administration and Use Office in Fentale woreda, an estimated 561 persons have land use rights within the proposed project site. The land is used for rainfed farming (mainly teff) and livestock grazing (cattle, shoats and camel) in the rainy season, but no evidence of such was observed during the ESIA study, apparently because of the persistent drought conditions in the last few years. This has contributed to the invasion of *Prosopis juliflora*, which will require extensive vegetation clearing before any farming activities can resume.

The number of homesteads at the project site has been estimated to consist of 38housestructures, mainly traditional tukuls built form local materials but also some more permanent structures. There is, however, some lack of clarity on this number as several houses are located along the project boundary to the north. Fentale woreda is currently undertaking an inventory of all affected property in accordance with government procedures.

The only other property that has been recorded is a short section of a power distribution line, which intersects the project site in the north-west corner near Metehara town. The wooden poles and conductors belong to EEP as part of their transmission and distribution grid. Other infrastructure outside of the project site include the abolished Ethio-Djibouti railway line (immediately north of the site) and the new Ethio-Djibouti standard gauge railway about 1.2 km further north. The distance to the main road (highway 4) is about 250 m.

The project affected households are generally poor and food insecure due to the weather-dependent livelihoods and high levels of unemployment combined with low access to safe drinking water and sanitation facilities. They are hopeful that a long planned irrigation scheme will be extended to Gelcha kebele and possibly that the proposed solar power project will contribute to community development. The irrigation project will be located east of the project site and was the main reason why the solar PV plant was shifted from where it was originally proposed (in the planned irrigation scheme) to the current plot of land.

Impacts and Mitigation

Solar PV projects are generally considered to have low environmental and social risks and impacts compared to many other energy or industrial developments due to their short construction phase and insignificant emissions to air, water and soil during operation. However, grid-scale PV facilities require large areas of land for the installation of solar modules and associated infrastructure. Project siting is therefore the most important aspect related to impact avoidance and mitigation.

The Metehara solar power PV plant will be implemented in an already degraded environment with low biodiversity value. The site was selected by the local government together with the affected community, and is as such considered as the most feasible location in terms of socio-economic impacts. Nonetheless, the scale of physical and economic displacement is significant and will require careful resettlement and livelihood restoration planning. This process is spearheaded by Fentale woreda which is responsible for property valuation and computation of compensation payment to the affected households. Once this exercise is completed, the project developer should consider the need for additional support towards livelihood restoration.

The project's main impacts on the bio-physical environment include clearing of vegetation for thePV installations, risks of contamination from accidental spills or improper storage/disposal of hazardous waste (including PV panels), potential collision of birds and bats with project infrastructure, and water consumption for cleaning the PV panels. However, none of these potential impacts are considered significant provided that the proposed mitigation and monitoring measures are put in place.

The installation of the solar PV plant will be labour-intensive though only for a short construction period (11-15 months). Around 500-700 workers including both skilled and unskilled personnel are expected to be employed during the peak period. This will provide opportunities for local employment and business development but is also likely to trigger in-migration of job seekers and camp followers. This population influx will add pressure on public services including health, water supply and sanitation, and may also cause increased prevalence of HIV/AIDS and other infections/diseases. Such impacts should be mitigated by giving priority to local residents for employment, providing free medical services to project workers, conducting public health campaigns and contributing to local water supply and sanitation facilities.

The local community will also be exposed to the risk of traffic accidents involving project vehicles and trucks on public roads. Construction traffic will be connected to the main Addis Ababa – Djibouti highway, which is already a busy road with high traffic volumes including trucks and public transport. Careful planning and management of construction traffic and transportation schedules will be required to minimise the risk of traffic accidents and disruption of road traffic. It should be noted that the PV facility is not expected to have any impact on air traffic control or airplane navigation.

The table below summarises the impact ratings with respect to the physical, biological and human environment from the construction and operation of the Metehara solar power PV project, with and without implementation of proposed mitigation measures.

Impact Source	Impact Rating	
	Without Mitigation	**With Mitigation**
CONSTRUCTION PHASE		
Physical Environment		
Topography and landscape • Visual impacts	**Medium Negative**	**Low Negative**
Geology and soils • Soil erosion • Land contamination	**Medium Negative**	**Low Negative**
Climate and air quality • Air pollution	**Medium Negative**	**Low Negative**
Noise • Construction noise	**Medium Negative**	**Low Negative**
Water resources • Water pollution • Water consumption	**Medium Negative**	**Low Negative**
Biological Environment		
Protection status	**None**	**None**
Flora and fauna biodiversity • Habitat loss and disturbance	**Medium Negative**	**Medium Low Negative**
Human Environment		
Land use • Physical and economic displacement	**Large Negative**	**Medium Negative**
Economic activities and livelihoods • Employment and business opportunities	**Medium Positive**	**Large Positive**
Infrastructure and services • Disruption of road traffic • Pressure on public services • Relocation of power distribution line	**Medium Negative**	**Low Negative**
Health and safety • Community health and safety risks • Security risks • Occupational health and safety risks	**LargeNegative**	**Medium Low Negative**
Cultural heritage • Loss of physical cultural resources	**Low Negative**	**None**
Tourism	**None**	**None**
OPERATION PHASE		
Physical Environment		
Topography and landscape • Visual impacts	**Medium Negative**	**Low Negative**
Geology and soils • Soil erosion • Land contamination	**Medium Negative**	**Low Negative**
Climate and air quality • Greenhouse gas emissions	**Large Positive**	**Very Large Positive**
Noise	**None**	**None**
Water resources • Water consumption	**Medium Negative**	**Low Negative**
Biological Environment		

Impact Source	Impact Rating	
	Without Mitigation	**With Mitigation**
Protection status	**None**	**None**
Flora and fauna biodiversity • Risk of bird and bat fatalities • Establishment of invasive species	**Medium Negative**	**Low Negative**
Human Environment		
Land use • Long-term loss of productive land	**Low Negative**	**Low Positive**
Economic activities and livelihoods • Employment opportunities	**Low Positive**	**Medium Positive**
Infrastructure and services • Pressure on water resources	**Low Negative**	**None**
Health and safety • Health and safety risks	**Low Negative**	**Low Negative**
Cultural heritage	**None**	**None**
Tourism	**None**	**None**

Mitigation and enhancement measures have been specified for each of the key risks and impacts. They are derived from good practice guidelines on environment, health and safety (EHS) as well as project-specific measures related to the most significant impacts. The implementation and monitoring of the mitigation measures are further described in an Environmental and Social Management Plan (ESMP) consisting of the following sub-plans:

- ESMP for construction works
- Community health and safety plan
- Framework resettlement plan
- Biodiversity monitoring plan
- Stakeholder engagement plan
- Monitoring and reporting system

The proposed mitigation and enhancement measures include the following:

- Include best practice health and safety provisions in the construction contracts and ensure strict compliance with national legislation and EHS guidelines. All workers should be provided with free medical services as well as water supply and sanitation facilities at all work sites and camp facilities.
- Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice and in compliance with the applicable regulations in Ethiopia at the time of disposal. Enel Green Power (EGP) is advised to inquire whether any of the potential suppliers or manufacturers provide recycling services such that PV panels can be returned if they are damaged or broken.
- Where gas insulated switchgear containing SF6 (sulfur hexafluoride) is planned as part of the technical setup, solutions with alternative insulation mediums should be requested from the provider/manufacturer.
- Drainage measures shall be provided, prior to construction works, to promote the dissipation of storm water run-off. Oil-water separators shall be installed for treatment of storm water run-off from open workshop servicing and repairs areas and bunded storage areas.
- The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services. The yield loss due to dust build-up on the PV modules should be monitored to ensure that no surplus cleaning cycles are undertaken and to prevent excessive water consumption.

- A pre-construction avifauna survey shall be carried out to verify the ESIA findings and to serve as a benchmark for continued monitoring. Bird and bat fatality searches shall be conducted for a minimum of two years into the operation phase. An avian biologist should be assigned to be on-call for bird rescue in case of bird collision with project infrastructure.
- All affected land users shall be compensated in accordance with national regulations and procedures. In addition, displaced households should be supported in their efforts to restore their livelihoods with particular attention to vulnerable households and women.
- Opportunities for dual use of the solar farm should be explored, i.e. energy production combined with agricultural production, for the benefit of the directly affected households.
- Give priority to local residents and women for less specialised labour, especially the directly impacted households as support towards livelihood restoration. On-the-job training should be provided in order to upgrade the skills of the local workforce.
- The take-off from the highway should be designed in such a way that there is minimal disruption for the other road users and minimal risk of traffic accidents. Traffic management plans and other safety information should be disseminated to the public through campaigns in schools and communities.
- Conduct public health campaigns addressing issues of water and sanitation, HIV/AIDS, etc. and support the woreda to provide additional communal sanitation facilities in Gelcha kebele and Metahara town.

The most urgent task to be pursued immediately after this ESIA study will be the preparation of a full Resettlement Action Plan (RAP). This can happen as soon as all the project affected persons (PAPs) and affected properties/assets have been identified by Fentale woreda. The RAP should pay special attention to the following key issues:

- Establish a socio-economic census of PAPs in order to, inter alia, identify vulnerable households and assess the need for additional livelihood restoration support (on top of the compensation payments) as well as to serve as a basis for livelihood monitoring.
- Confirm the availability of replacement land for the displaced households (e.g. in the planned irrigation scheme of Fentale Irrigation-Based Integrated Development Project).
- Document the free, prior and informed consent (FPIC) of the affected Karrayu community (Indigenous Peoples).

Conclusion

The ESIA consultant recommends that detailed planning and implementation of the Metehara solar power PV project continues under the condition that the design and layout of the project remains as described in this ESIA study and that the prescribed mitigation and enhancement measures are adopted.

EXECUTIVE SUMMARY (AMHARIC)

Inserted as PDF

1 INTRODUCTION

1.1 Background

Multiconsult Norge ASin association with Shebelle Consult PLC have been assigned by Tetra Tech ES, Inc. to conduct an Environmental and Social Impact Assessment (ESIA) for the proposed 100 MW Metehara solar power PV plant in Fentale woreda, Oromia Regional State, Ethiopia. Tetra Tech is the implementing partner to the USAID's Power Africa Transactions and Reforms Program (PATRP) under the Power Africa initiative.

PATRP has been supporting the Government and the Ethiopian Electric Power Company (EEP) in their efforts to select an Independent Power Producer (IPP) that will develop, finance, design, procure, construct, commission, and operate and maintain the Metehara solar power PV plant. The project is scheduled to become the first utility-scale solar PV plant in Ethiopia.

EEP invited proposals in May 2016 and bids from the shortlisted firms were received in February 2017. The contract was awarded in October 2017 to Enel Green Power (EGP), a subsidiary of the Italian company Enel, in consortium with the Ethiopian infrastructure company Orchid Business Group.

Following the contract award, the responsibility for project planning and implementation has been transferred to Enel Green Power (EGP). However, Ethiopian Electric Power (EEP) remains responsible for obtaining the environmental clearance and is thus serving as the project proponent for this ESIA. EEP will also be responsible for the transmission line connecting the power plant to the electricity grid.

Financial close is pending the approval of this ESIA report, after which EGP will enter into a Power Purchase Agreement (PPA) of 20 years with EEP.

1.2 Project Proponent

1.2.1 Ethiopian Electric Power (EEP)

The Federal Democratic Republic of Ethiopia through the Ethiopian Electric Power (EEP) is promoting private sector development of power generation to increase the total energy generation and to enhance the capacity to deliver additional power to the national grid and to regional customers. In line with this, EEP is preparing for construction of the100 MW Metehara solar power PV plant. This preparation stage includes the ESIA study and environmental permitting before the project is fully handed over to the private developer (Enel Green Power, see Section 1.3).

Ethiopian Electric Power (EEP) is the state-ownedelectricity producer in the Federal Democratic Republic of Ethiopia. It is engaged in development, investment, construction, operation, and management of power plants, power generation and power transmission. EEP owns and operates the Ethiopian national power grid with all high voltage power transmission lines above 66 kV including all attached electrical substations and almost all power plants within the national power grid. Since 2017, Ethiopia also allows independent power producers(IPPs) to construct and to operate power plants for delivering power to the national grid.EEP supplies power in bulk mainly to the Ethiopian Electric Utility (EEU), which is responsible for distribution of electricity to customers throughout the country.

EEP has established an Environment and Social (E&S) Office which sits within EEP and is responsible for the integration of environment and social matters in electric power development. The E&S Office conducts early screening of project alternatives and undertakes monitoring and evaluation against the ESIA/ESMP and environmental licensing conditions.

1.2.2 Independent Power Producer: Enel Green Power (EGP)

Enel Green Power (EGP) is an Enel Group company dedicated to the development and management of power generation from renewable sources worldwide. The company's installed capacity exceeds 10 GW, with a range of sources that includes wind, solar, hydroelectric, geothermal and biomass. EGP operates more than 700 plants in 16 countries, in Europe, the American continent, Africa and Asia.

EGP is committed to environmental sustainability and corporate social responsibility in all their operations. They have adopted an integrated safety and environmental management system in accordance with the international standards ISO 14001 and OHSAS 18001. Their approach to renewable energy development includes the concepts of "sustainable construction site" and working with the local communities through "creating shared value". Other specific company policies and procedures of relevance to the Metehara solar power PV project include:

- Enel Group Code of Ethics
- Enel Group Operation Instruction No. 9 – Health & Safety Standard
- EGP Quality, Safety and Environmental Policy
- EGP Policy No. 35 – Pre-Job Check & Post-Job Review
- EGP Operational Instruction No. 137 –Reporting and analysis of accidents, first aid cases, near misses, environmental incidents and/or damages, litigations
- EGP Organizational Procedure No. 128 – Design to Safety and Environment
- EGP Operational Instruction No. 39 – Design Criteria for Solar Plants
- COID Compensation for Occupational Injuries and Diseases

However, EGP should develop and implement an ESMS suitable to the scale of the project and which meets the requirements of applicable Ethiopian laws and WB Performance Standards. The ESMS will include policies, plans, manuals and procedures aligned with ISO 14001. The ESMS will incorporate the Environmental Management Plan (EMP) developed for the project as well as aspects related to construction covered in the WBG General Environmental Health and Safety (EHS) Guidelines. The EMS will be updated to reflect the Equator Bank Performance Standards and the new WBG EHSGs for the energy sector. The EMS, as noted above, identified responsibilities for managing identified risks for each of the specified tasks and activities. This has allowed the project enterprise to identify training needs for all staff, either at the "awareness" or "competency" level, and develop training schedules.

1.3 ESIA Process

The ESIA for the Metehara solar power PV project has been prepared in compliance with national requirements stipulated in the Environmental Impact Assessment Proclamation 299/2002 and with internationally best practices including the Equator Principles and IFC Performance Standards.

The contract between Tetra Tech and Multiconsult for the ESIA study was signed on 2nd December 2016 and the commencement date was 23rd January 2017. A field reconnaissance trip and initial stakeholder consultations were held in the last week of January 2017. The key finding from this inception phase was that the proposed project site of 250 hectares (ha)in Gelcha and Benti kebeles had not been endorsed by the Fentale woreda and that further consultations would be required between the responsible government agencies. The main concern was that the proposed site was located within the planned command area for a large-scale irrigation project known as the Fentale Irrigation-Based Integrated Development Project.

As a result, the ESIA consultant was prevented from conducting detailed studies and consultations with the affected land users and other local stakeholders until the land issue had been resolved. An attempt to resume the ESIA study was done in June 2017 with the deployment of a field team to Metehara consisting of experts from Multiconsult, Shebelle Consult and Ethiopian Electric Power (EEP); however, the field mission had to be aborted because there was still no approval from Fentale woreda that the land could be used for solar power development. This was followed by a long halt in the ESIA process that lasted until October/November 2018. In the meantime, Multiconsult proceeded with the desk studies and submitted a Scoping Report to Tetra Tech in June 2018 (Multiconsult 2018).

On 23rd October 2018, EEP notified Tetra Tech and Multiconsult that Fentale woreda had concluded the land issue by allocating another site close to the originally proposed 250 ha plot. This new site had been proposed and accepted by the local government in consultation with the affected communities. Following some further adjustments to the site layout by the Rural Land Administration and Use Office in Fentale woreda, Multiconsult then resumed work and carried out the field studies and stakeholder engagement in November and December 2018. The present ESIA report is the outcome of this prolonged ESIA process.

1.4 Objectives of the ESIA

The main objective of the Environmental and Social Impact Assessment (ESIA) is to provide decision-makers with an indication of the likely consequences of the proposed Metehara solar PV project. Specifically, the ESIA shall:

- document, in as much detail as possible, the baseline conditions prevailing before the project construction starts;
- assess and report on the likely magnitude and significance of impacts, both positive and negative;
- propose mitigation activities to reduce negative impacts and monitoring of important impacts during and after construction;
- document the consultation process undertaken to inform the Project Affected People (PAP) as well as the attitude of the PAP towards the project;
- reflect, to the extent practical, the views and wishes of the PAPsin the design of mitigation and compensation schemes; and
- look into different alternatives to the project to meet the intended objectives and discuss alternative methods for developing the project to ensure that the project is justified from a broader environmental perspective.

1.5 ESIA Report Structure

The ESIA report has been organised into eleven chapters. Following the executive summary and the introduction (Chapter 1), the ESIA report provides a description of the project design and layout (Chapter 2) and the study approach and methodology (Chapter 3). Chapter 4 outlines the policy, legal and administrative framework within which the project and the ESIA study will be carried out, while Chapter 5 contains the baseline description of the current environmental and social conditions, followed by an overview of the stakeholder engagement and public consultation process (Chapter 6). Chapter 7 gives the detailed assessment of risks and impacts together with their proposed mitigation measures, and the analysis of project alternatives is presented in Chapter 8. The Environmental and Social Management Plan (ESMP), including a preliminary monitoring and reporting system, is outlined in Chapter 9, while the preliminary plan for decommissioning is presentedin Chapter 10. Finally, the main conclusions and recommendations are summarised in Chapter 11. The ESIA report also contains two additional volumes: Appendices (Volume 2) and a Framework Resettlement Plan (Volume 3).

2 PROJECT DESCRIPTION

2.1 Background and Justification

Ethiopian Electric Power (EEP) intends to enter into a Power Purchase Agreement (PPA) with Enel Green Power (EGP) to construct and operate a photovoltaic (PV) power plant with a total area of 250 ha and installed capacity of 100 MW AC outside Metehara town in Fentale woreda, Oromia Regional State, Ethiopia. The project will become the first utility-scale solar PV plant in Ethiopia connected to the national grid.

The overall justification for solar power development in Ethiopia is given in the Power System Master Plan of 2013, where solar projects are confirmed to perform relatively well compared to other sources of energy and other power generation projects. The importance of renewable energy, including solar power technology, is also highlighted in the national Growth and Transformation Plan (GTP) II and is compliant with Ethiopia's Climate Resilient Green Economy (CRGE) Strategy.

The GTP IItargets includeincreasing the power generating capacity of the country from 4,180MW in 2014/15 to 17,208MW by 2019/20; of which, 13,817MW is planned to be generated from hydropower, 1,224MW from wind power, 300MW from solar power, 577MW from geothermal power, 509MW from reserve fuel (gas turbine), 50MW from wastes, 474MW from sugar and 257MW from biomass. Of this, more than 13,000 MW are planned to be developed through public private partnership modality.

The Metehara solar power PV project was identified in the Master Plan for wind and solar energy (HydroChina 2012) and later elaborated by Ethiopian Electric Power (EEP) through the Power Africa Transactions and Reform Program (PATRP). The project site was found to be favourable due to (i) excellent radiation source conditions, (ii) convenient location along the main road between Addis Ababa and Djibouti (Highway 4), and (iii) proximity to existing transmission grid and the load centre in Metehara.

The purpose of the Metehara solar power PV plant is to harness the solar radiation resource in order to complement the hydropower generation that dominates the Ethiopian power system. Indeed, the peak season for solar generation occurs during the dry season which is also when reservoir levels, and hence hydropower generation, are at its lowest. Solar generation can also be complementary to wind power as wind speeds are generally higher on cloudy and stormy days.

2.2 Geographical Location

The power plant will cover an area of 250 ha immediately east of Metehara town in the rural areas of Gelcha kebele, Fentale woreda. Administratively, Fentale woreda belongs to East Shewa Zone of Oromia Regional State.

The project site is bordered to the north by the old and abolished Ethio-Djibouti railway line, which runs parallel to the main road (Highway 4). The distance between the site boundary and the road highway is about 250 m. The southern portion of the site is restricted by the Beseka canal which is used to control the water level in the nearby Lake Beseka by draining water into the Awash River, while Metehara town defines the project boundary to the west such that the site does not infringe into the urban areas. Similarly, the eastern perimeter has been demarcated to keep safe distance from some rural settlements and a primary school (located about 1 km east of the site).

The project site is delineated by the following coordinates:

Table 1 Geographical coordinates of the project site

ID No.	Latitude	Longitude
105	8° 54.117'N	39° 55.853'E
107	8° 54.110'N	39° 55.570'E
108	8° 53.788'N	39° 55.529'E
110	8° 53.313'N	39° 55.473'E
112	8° 53.326'N	39° 55.767'E
114	8° 53.338'N	39° 55.896'E
116	8° 53.427'N	39° 56.038'E
119	8° 53.553'N	39° 56.189'E
121	8° 53.600'N	39° 56.285'E
123	8° 53.593'N	39° 56.328'E
125	8° 53.568'N	39° 56.505'E
127	8° 53.580'N	39° 56.609'E
155	8° 54.137'N	39° 56.655'E

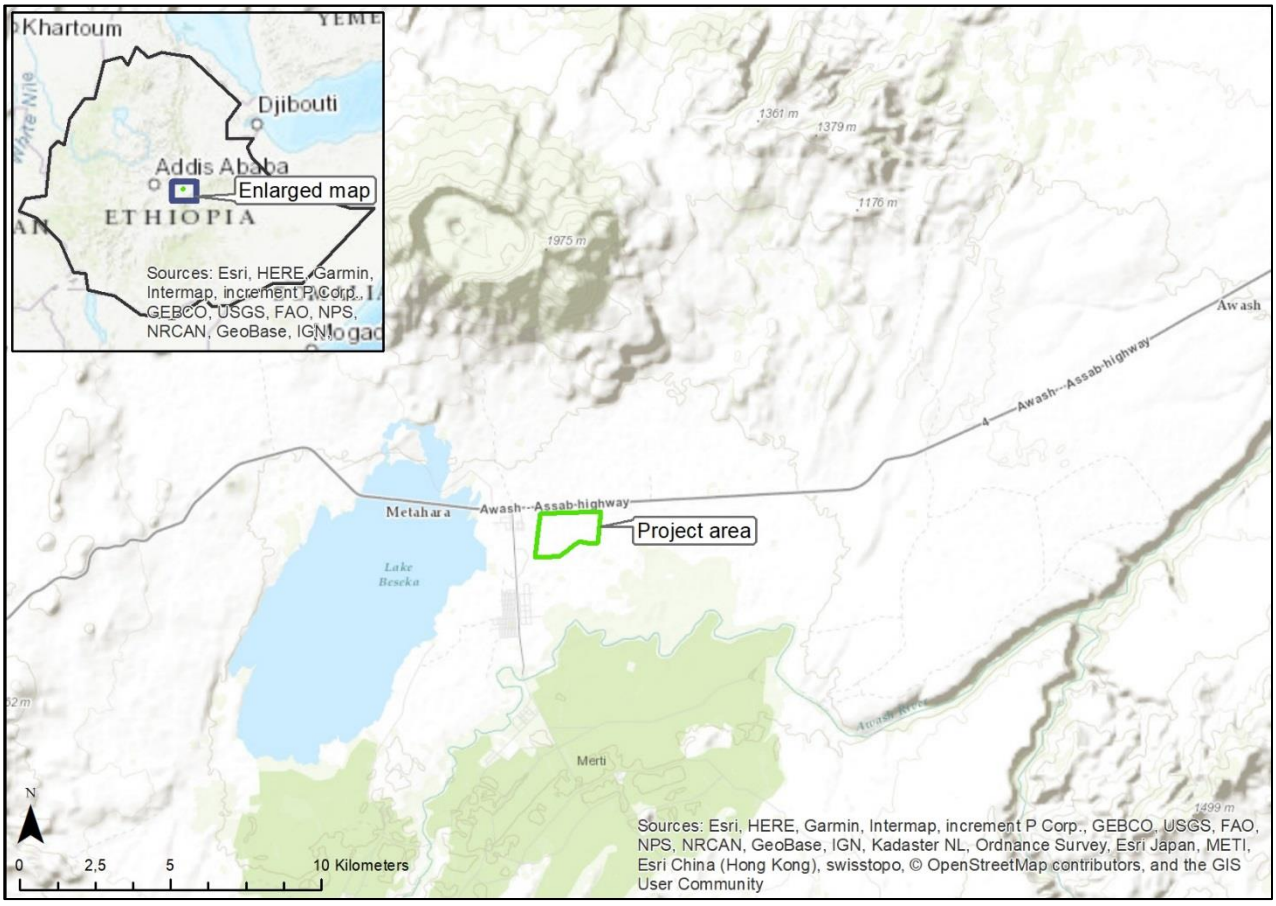


Figure 1: Map showing the location of the project site, with adjacent features including Lake Beseka, Metehara town, Metehara Merti (sugar estate) and Awash (upper right).

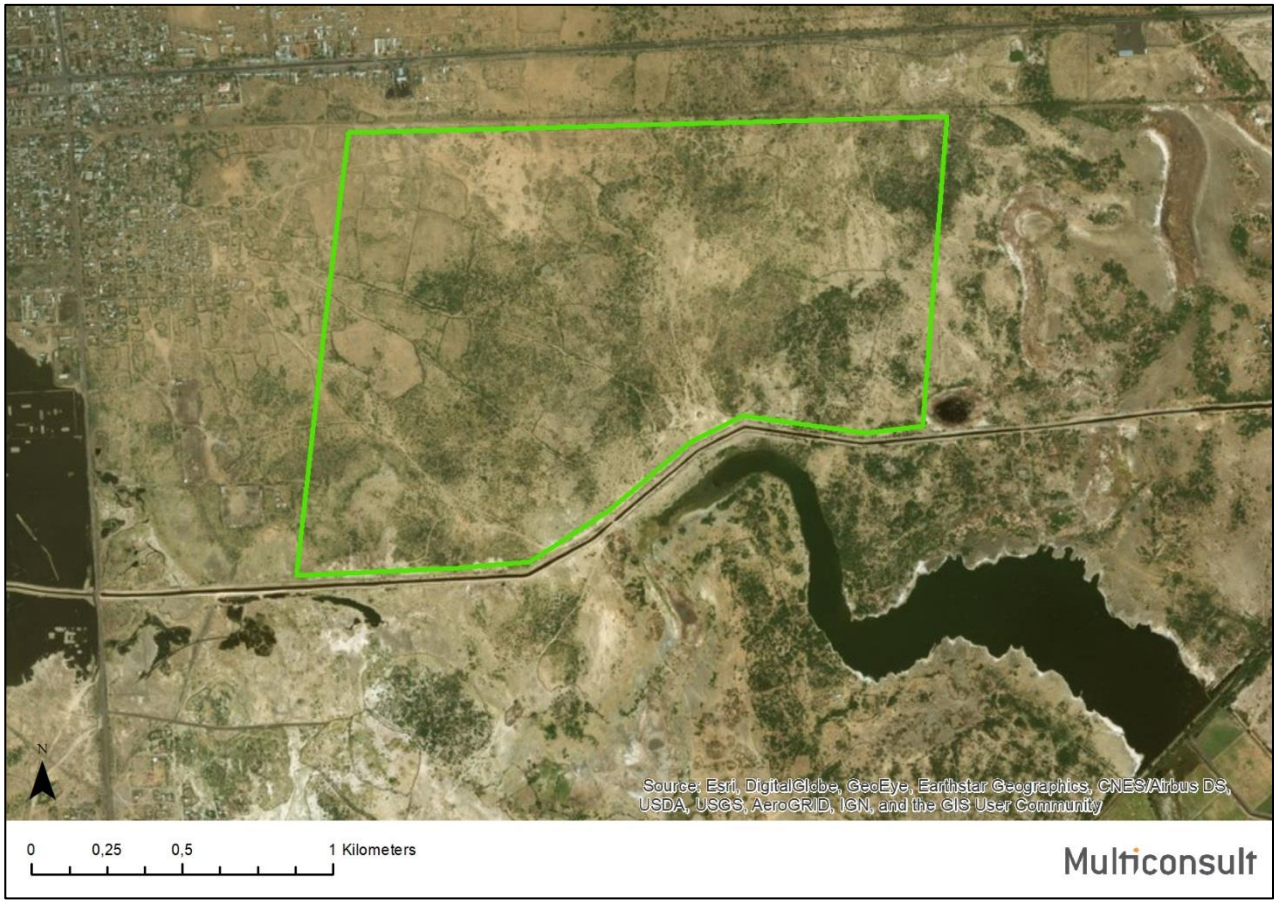


Figure 2: Aerial photo of the project site.

2.3 Status of Project Design

The present ESIA study has been prepared in parallel with the technical planning of the solar PV facility. However, due to the recent change of project site after the original tendering had been completed, the project design and implementation schedule is currently being revised. The previous design drawings are no longer valid and further feasibility studies have therefore been commissioned, including geotechnical investigations.

While these detailed technical planning and design issues may not have significant implications in terms of the project's environmental and social risks, the ESIA study has been tailored to accommodate slightly different design and technology alternatives as well as some flexibility in the how the project will be implemented. This is reflected in the project description below, which is largely based on the Request for Proposals (RfP) issued by EEP.

The RfP did not set strict technical requirements for the design of the Metehara solar power PV plant. That was done to give more flexibility to the bidders in their competition for the most relevant technology in order to achieve the lowest tariff (USD/MWh). Indeed, within the scope of a capacity of 100 MW and a

land use of 250 ha, the bidders were allowed to offer crystalline (mono or poly) or thin film PV modules (amorphous silicon, CdTe or CIS/CIGS), centralized or decentralized inverter solutions and fixed tilt or tracking systems (single-axis or dual-axis). However, it should be noted that the power production technology is defined as conventional photovoltaics and will then not involve any sort of solar concentration technology such as CSP (Concentrated Solar Power) or CPV (Concentrator Photovoltaics).

2.4 Project Components

2.4.1 Mounting System

PV modules will be mounted on structures made of aluminium or hot-dip galvanized steel. All PV mounting structures will be of the same type. Conceptual fastening to the ground will be one of the three following propositions:

- Founding on a small footings (depth approximately 1.0 m) with a cable anchor system.
- Founding on the larger footings.
- Founding by pre-drilled grouted piles (depth approximately 2.0 m) with cement grout.

2.4.2 PV Modules

PV modules absorb the sun's rays as a source of energy to generate electricity. Each PV module is rated by its DC output under STC (Standard Test Conditions). The test conditions are defined as follows: irradiation 1000 W/m²; temperature 25°C; AM 1.5 (AM stands for Air Mass, the thickness of the atmosphere). The DC output under STC (rated in Watt Peak - Wp) typically ranges from approximately 100 Wp (thin film technology) to 350 Wp (monocrystalline technology) for utility-scale PV power plants.

PV modules are connected in series (called "strings" of modules) in order to obtain the right input voltage of the inverter. Input and output DC cables (+/-) of the modules are pre-mounted with connectors so that the installation is made on a "plug-and-play" principle. Strings voltage can reach up to 1,500 V_{DC}.

The preliminary design by Enel Green Power (EGP) provides for a total of 308,970 PV modules of bi-facial type with +/- 60° east/west tracking system.

2.4.3 Inverters

Inverters convert the DC current produced by PV modules to grid-exploitable AC current (three-phase 400 V at utility frequency). They typically range from approximately 20 kVA (decentralized) up to 2,500 kVA (centralized inverters). Inverters are central components in the communication with the SCADA system, since they monitor the strings operation.PV inverters also have special functions like maximum power point tracking or anti-islanding protection.

The preliminary design includes a total of 80 inverters.

2.4.4 Transformers

Transformers will convert LV (400 V) from the inverters to MV (33 kV) for connection to the substation. The transformer specifications are not yet available.

2.4.5 Grid Connection

Substation

A new substation will be designed, constructed, tested and commissioned by EGP inside the allocated land for the project. The substation will thereafter be owned and operated by EEP. The delivery point

(ownership and operational boundary) will be the EEP isolator located between the facility's MV/HV power transformer and the HV busbar. The substation will be most probably located in the north-east corner of the site, as close as possible to the interconnection point.

Transmission Line

EEP will be responsible to construct a new double-circuit 230 kV transmission line to connect the PV power plant to the interconnection point, which shall be on the existing 230 kV single-circuit line located approximately 2 km north of the project site. Interconnection to the existing line will be made by a loop-in/loop-out (LILO) arrangement. Routing of the new transmission line (by EEP) has not yet been done and is dependent on the exact location of the substation.

2.4.6 Supervisory Control And Data Acquisition (SCADA) System

The SCADA system (or monitoring system) acquires data from the PV power plant and store it in a database. The system includes data logger acquiring parameters from several components of the plant like inverters, meters and meteorological sensors measuring temperature (ambient and on the back side of the PV modules), irradiation and wind speed. The SCADA system is a key tool for the Operation and Maintenance of the plant. It intends to maximize production of energy, improve the plant's availability and consequently allows for early detection of equipment malfunction and failure.

The following data will be monitored:

- Voltage and current values at the input of the inverters
- Phase voltage, current, frequency and power factor at the output of the inverters
- Phase voltage, current, frequency and power factor at the different meters
- Energy produced
- Inverter status
- PV module and ambient temperature
- Irradiance
- Wind speed
- Other parameters

Given the size of the project and the land covered, and in order to obtain accurate data, several meteorological stations will be installed in different areas of the PV power plant.

2.4.7 Infrastructure

The project will include internal access roads to the different parts of the PV facility, fencing of the site as well as a CCTV system. Different light buildings will also be built like an operation and administration centre, security posts, storage place for spare parts and different commodities for the O&M teams (toilets, break room, etc.). The exact locations and detailed design of these facilities have not yet been completed.

2.5 Civil Works

Civil works during construction phase will include land clearingand levelling (bushes, trees, rocks and termite mounds), installation of drainage systems in designated areas, foundations for the installation of the mounting system for the PV modules, building of access roads, fencing, as well as construction of the substation and light buildings (operation and administration building, security posts, storage, etc.). The source of construction materials is not yet known. Similarly, there is currently no information regarding water supply for construction works (and cleaning of PV panels) or waste and wastewater management.

2.6 Workforce and Worker Housing

The total workforce during the peak construction period is estimated at 500-700 workers. There is not yet any information regarding workers' accommodation.

2.7 Implementation Schedule

Following the submission of this ESIA report, the next major milestones of relevance to the ESIA are as follows (with tentative schedule):

- Commercial close (signing of PPA and Implementation Agreement): August 2019
- Procurement of equipment: January 2020
- Start of construction: April 2020
- End of construction: March 2021 (interconnection / transmission line: February 2021)
- Scheduled commercial operation date: April 2021

The construction period is 11-12 months but it might take up to 15 months depending on the rainy season.

Therefore, all the project components in which the exact location will be identified during the actual survey and design including infrastructure development and civil work activities (Building of operation and administration centre, security posts, storage houses, drainage systems access road, fences including the source of the construction material and water supply for the construction activities) shall be addressed in the ESMP which will be prepared and implemented by the EGP. In addition, EGP will be responsible for the implementation of site specific management plan e.g., Traffic Management Plan, Quarry site management plan, water resource management plan, safety management plan and any other environmental and social management plans in relation to the project activities. However, if there is any change on the site location during the actual design and survey EGP is required to update the ESIA according to change made from the existing location, prepare a land acquisition plan as per the EEP RPF.

3 APPROACH AND METHODOLOGY

3.1 Area of Influence

The study area for this ESIA has been defined based on a preliminary analysis of the direct (primary) and indirect (secondary) impacts of the Metehara solar power PV project. It has been divided into a direct impact zone and an indirect impact zone accordingly. These zones constitute the project's area of influence where risks and impacts will be analysed in greater detail.

The direct impact zone covers all areas that will be physically affected by the construction and operation of the Metehara solar PV plant. This zone is restricted to the 250 ha of land within which all the solar modules and other project infrastructure will be placed.

The indirect impact zone consists of an area beyond the direct impact zone where the construction and operation of the Metehara solar PV plant may indirectly affect the physical, biological and/or human environment. The exact size of this zone depends on the themes being studied but is generally assumed to include Metehara town and the whole of Fentale woreda as well as the Awash National Park and its Important Bird Area (IBA).

It should be noted that the ESIA will not consider the ex-situ risks or impacts associated with the manufacturing and international shipment of the PV solar panels outside of Ethiopian borders. Life-cycle assessment of solar PV technology is thus generally outside the scope of the ESIA but has been well documented in the scientific literature (e.g. Hondo 2005, Fernández-Infantes et al. 2006, Mason et al. 2006, Müller et al. 2006, Fthenakis et al. 2008, Kim et al. 2012, Kreiger et al. 2013).

Furthermore, the planned transmission line connecting the solar PV facility to the grid is not part of the scope of the ESIA study. This is because the routing has not yet been done and there is no technical information available at this stage. However, the transmission line is considered as an "associated facility" (*sensu* IFC Performance Standard 1) and has been subject to preliminary screening of potential environmental/social risks and impacts (see Chapter 8).

3.2 General Approach

This ESIA employs a standardised three-step approach to impact assessment in order tomake the findings, conclusions and recommendations more objective and transparent. The key principle of the procedure is to combine the 'value' of the affected environment and the 'magnitude' of impacts to arrive at an overall assessment of impact.

- Step 1 attempts to attach a 'value', as judged from the baseline situation, for that specific issue or theme within the area of influence, giving a ranking on a scale from "low" to "high". The setting of value is based on the absolute value, if applicable, and its value in the local, regional, national and international perspective. It also takes into account uniqueness and vulnerability/sensitivity.

***Step 2** consists of a description and an identification of the 'magnitude' of the potential impacts on that specific issue or theme. The magnitude is considered in terms of the extent (local, regional, national, international), duration, severity/intensity, reversibility, and probability/risk of the different impact sources. The magnitude is measured on a scale from "large positive" to "large negative" (seeTable 2: Definitions of different levels of impact magnitude*

-).
- Step 3 combines the results from the two first steps based on the criteria illustrated in**Error! Reference source not found.**. The outcome of this step is the final 'impact assessment' and

provides a ranking of the impacts on a scale from “very large positive” to “very large negative”. In the summary tables, this ranking is illustrated by ”plusses” and ”minuses”. Uncertainty is indicated with the symbol **?,** and no impact or irrelevant is marked with a **0**.

Table 2: Definitions of different levels of impact magnitude

Impact		Definition
None or Minimal		No detectable change to the environment.
Positive and Negative	Low	A small but detectable and permanent change to the environment; or A larger short-term / temporary change to the environment.
	Medium	A larger, but non-fundamental permanent change to the environment; or A short-term / temporary large change to the environment.
	Large	A fundamental change to the environment.

Note: Fundamental changes are those which are permanent, detrimental and would result in widespread change to the baseline environment.
Source: Multiconsult

The three steps are reported in Chapter 5 and Chapter 7:

- Baseline situation: The value is derived from an assessment of the existing environment (physical, biological and human) at the inception of the construction works. Given the nature of the proposed works and the likely short lead time, the baseline can be considered as the current environmental and social conditions. The specific methodology for collecting and analysing baseline data is presented below. For themes that cannot easily be valued (such as certain aspects of the physical and human environment), the value is by default assumed to be high.
- Assessment of impacts: Based on available knowledge of solar power PV plants in general and the proposed Metehara project, potential impacts can be predicted for each theme under the physical, biological and human environment. Following the identification and description of each of these impacts, the magnitude of the impacts on each theme is determined. The final impact assessment is then summarised by combining the baseline value and the impact magnitude, as described above.

The assessment of impacts in Chapter 7also includes the relevant mitigation measures, i.e. all actions that can eliminate, offset, or reduce potentially adverse environmental and social impacts to acceptable levels.The net impact remaining with mitigation measures in place is referred to as “residual impact”.

3.3 Specific Methodology

3.3.1 Physical Environment

The physical features and composition of the landscape was observed duringthe field visits in January 2017, June 2017 and December 2018. The data included topography, vegetation cover, land use and human settlements. Photos were taken at different locations to document the existing land cover/use and landscape characteristics. Other data were compiled from the geotechnical report (Aurecon 2019) and various public databases and published literature.

Noise measurements were carried out on 21st December 2018 at five sites around the perimeter of the project site and in Metehara town (**Error! Reference source not found.**). Measurements were done using a sound level meter (model CEM DT-8852 data logger) and TQC LUO 115 Sound level, with reference to the international standards namely IEC 61672:1999, IEC 61260:1995 and IEC 60651, as well as ISO 19961:2003 and ISO 3095:2001. During testing, the digital sound level meter was set to A-weighting scale

to enable the meter to respond in the same manner as the human ear. The "A" scale is applicable for workplace compliance testing, environmental measurement, and workplace design. At each site, at least three measurements for 5 min each were performed and used to calculate the maximum, minimum and average noise levels. The recorded average values were compared with prescribed available limits to check their compliance with both the Ethiopian noise standard limits and WHO/IFC guidelines. The device was held at approximately 1.5 m above the ground/floor and at least 3 m away from hard reflecting surfaces such as walls.

Water samples were collected from three water sources near the project site (**Error! Reference source not found.**) on 10th January 2019. The samples were tested in the laboratory of the Ethiopian Construction Design & Supervision Works Corporation for the following parameters: pH, alkalinity, carbonate, bicarbonate, total dissolved solids, turbidity, total hardness, fluoride, and dissolved oxygen (see Appendix 11).

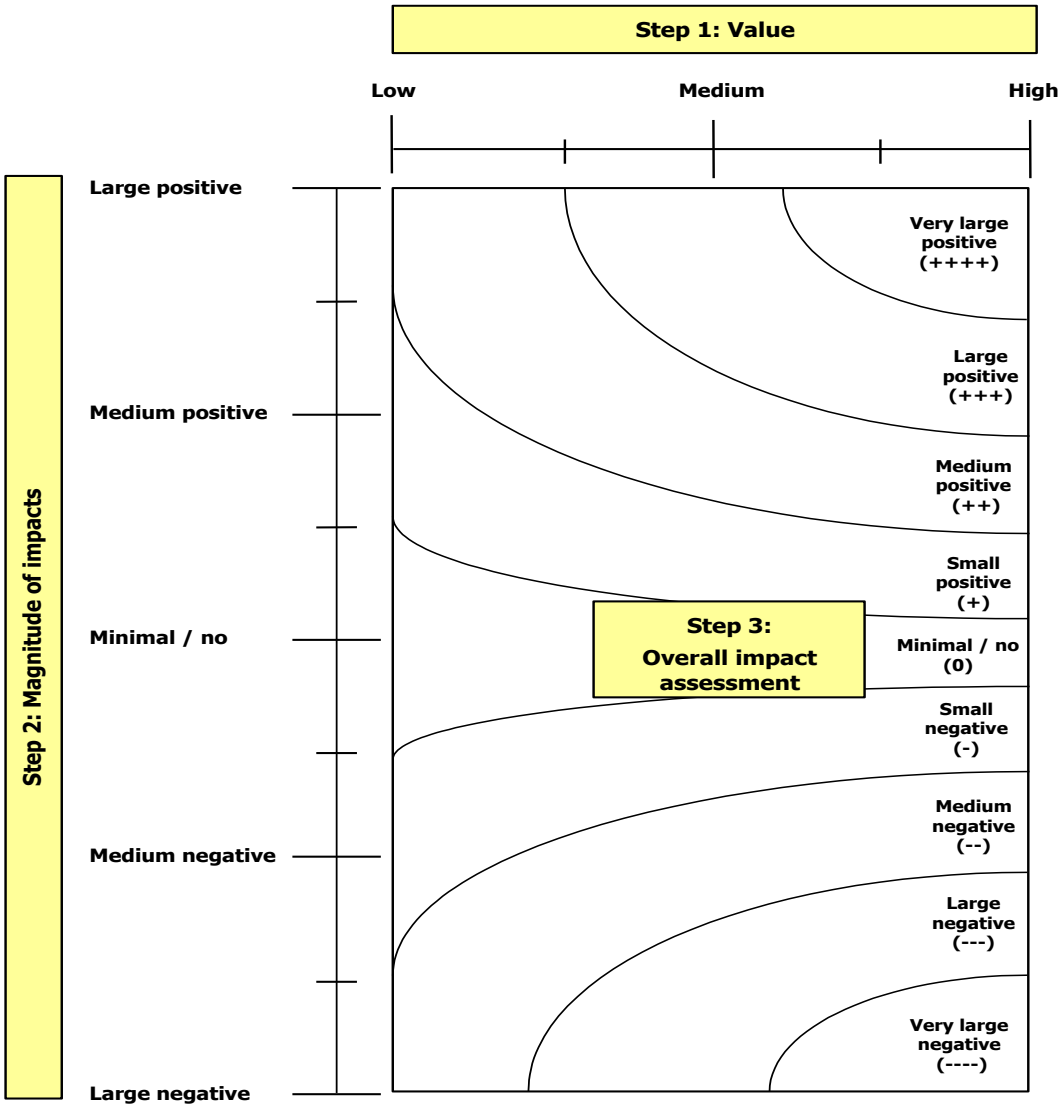


Figure 3: Impact assessment methodology.

Source: Multiconsult

3.3.2 Biological Environment

Information in biodiversity and conservation in the project area and Awash National Park was collected from existing literature, stakeholder consultations and several field visits including a two-day sampling survey in December 2018. Bird counts were carried out at the project site and its immediate vicinity, while other taxa were recorded from random transect walks combined with an ecological interpretation of the site's potential for hosting other non-observed plants and animals.

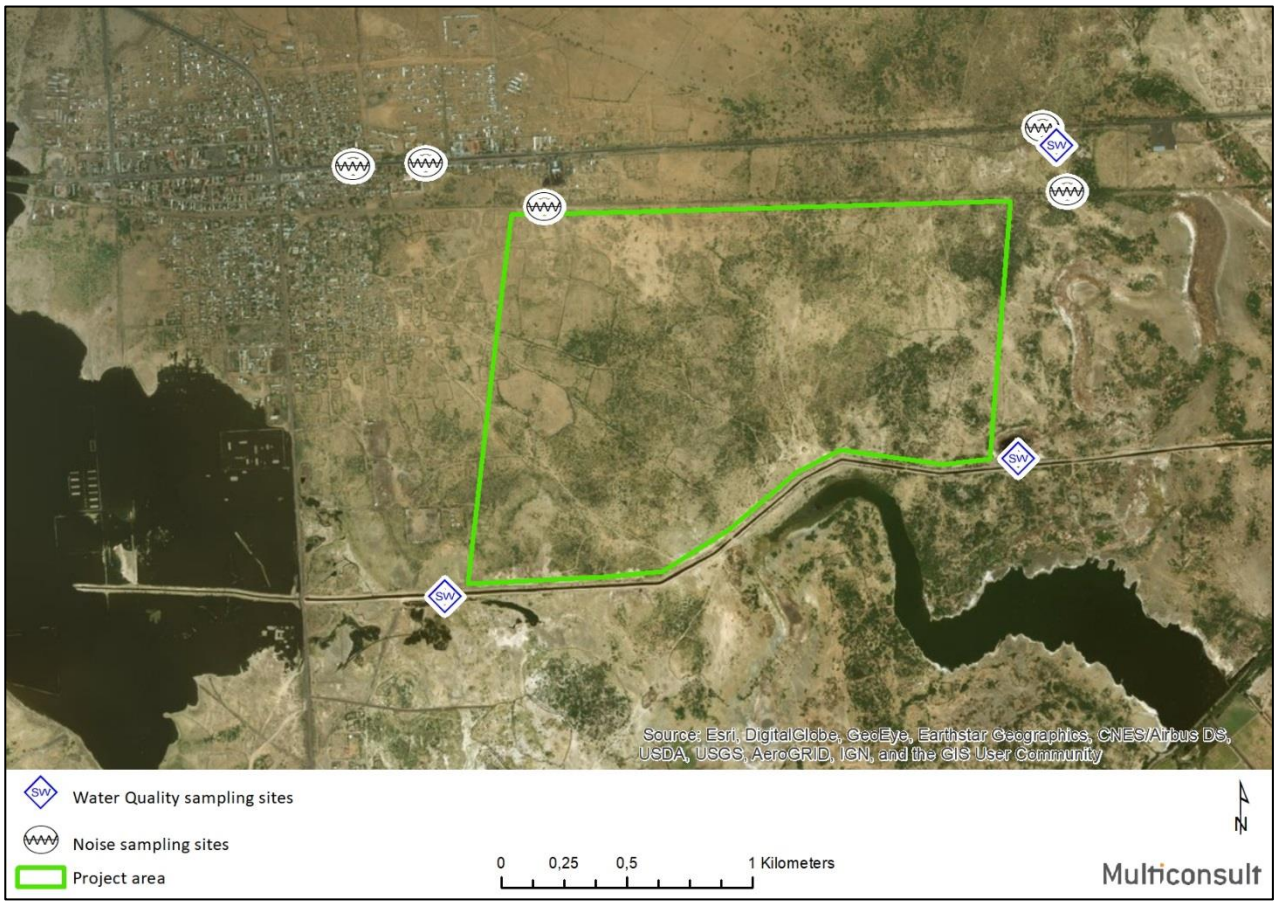


Figure 4: Sampling sites for noise measurements and water quality sampling.

3.3.3 Human Environment

Socio-economic Assessment

A combination of both qualitative and quantitative techniques were used during the collection of socio-economic data. A socio-economic survey was undertaken with the directly impacted land users (see Appendix 6), while group discussions and key informant interviews were adopted for the indirect impact zones. The sampled households were randomly selected from the Gelcha kebele while the key informants were purposively selected based on their knowledge and positions. The sample size for the socio-economic survey was 184 households.

Estimation of Affected Property

The affected property has been estimated by means of field inventories (conducted by the Rural Land Administration and Use Office in Fentale Woreda) combined with interpretation of satellite images to arrive at a preliminary estimate of the magnitude of resettlement. A Resettlement Action Plan has been subsequently prepared as a stand-alone document to accompany the present ESIA report.

Consultations

Stakeholder identification, analysis and consultation began right from the early conceptual stage of the project when EEP engaged the Fentale woreda during the initial site selection and shared the proposed project plans with the directly impacted communities of Gelcha (and Benti) kebeles. The results of these early discussions were integrated into the overall project design going forward. The stakeholder participation methodologies at this stage were mainly through meetings and key informant interviews.

During the scoping phase, the consultations were further rolled out to the key institutional stakeholders at the federal, regional and woreda level. The priority stakeholders at this point included the kebele leadership, woreda administration and other stakeholders that were considered to have a direct influence on the project or whose activities could be impacted by the project, e.g. Metahara Sugar Estate and Awash National Park. Main methodologies adopted at this stage were group discussions, brainstorming sessions and key informant interviews. The results were again shared with the core team responsible for the planning and implementation of the project.

The community level stakeholder engagement activities targeted entire communities within the project's area of influence including the indirect impact zone. Two approaches were adopted at this level, the first was to have general community meetings targeting residents of Gelcha community and thereafter have interviews with only the directly impacted households (see socio-economic survey above).

A project information brochure was distributed to the consulted stakeholders (see Appendix 5).

3.4 Limitation and Data Quality

The major parts of the ESIA study have been carried out over a compressed time frame of only a few months due to the long delays in selecting the project site followed by a tight deadline for report submission.

Conventionally, twelve months of baseline monitoring is usually required to capture seasonal fluctuations in the biological environment, while inter-annual data would ideally be needed for the certain aspects of the physical and human environment. The data set presented herein is nevertheless considered sufficient for establishing a baseline and predicting the major project risks and impacts, mainly because:

- Secondary data are available for critical aspects such as local socio-economic conditions in Metehara town and wildlife (including avifauna) in the nearby Awash National Park.
- The solar PV project is relatively straightforward with a short construction period and few indirect and long-term risks compared with many other energy/industry developments (e.g. hydropower facilities).

Thus, the scope and depth of the ESIA studies is considered appropriate to the nature and scale of the proposed project and commensurate with the level of its environmental and social risks and impacts.However, it is important that the resettlement planning continues with the preparation of a full Resettlement Action Plan (RAP). Fentale woreda is currently identifying all the project affected persons (PAPs) and their affected properties/assets to calculate the applicable compensation values. Once this process has been completed, the RAP consultant can be authorised by the local government to consult

with the PAPs to gather the necessary data for the RAP (as well as to seek their free, prior and informed consent).

4 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1 Ethiopian Policy Framework

4.1.1 Constitution of the Federal Democratic Republic of Ethiopia

The Constitution of the Federal Democratic Republic of Ethiopia (FDRE), issued in August 1995, is the foundation of all legislative and policy frameworks of the country. The Constitution has several provisions, which have direct policy, legal and institutional relevance for environmental protection and sustainable development in Ethiopia.

The Constitution specifies the concepts of sustainable development and environment rights that are entrenched in the rights of the people of Ethiopia through Articles 43 and 44, which state among others the right to development and the right to live in a clean and healthy environment. Other important provisions of the Constitution include the following Articles:

- Article 40(3) (the right to ownership of rural, urban land and natural resources);
- Article 40(4) (the rights of farmers to obtain the land without payment and the protection against eviction from their possession);
- Article 40(5) (the rights of pastoralists to free land for grazing and cultivation);
- Article 40(7) emphasises on the right to acquire property for the purpose of overriding national interest; it empowers the government to expropriate private property for public purposes subject to payment in advance of compensation commensurate to the value of the property;
- Article 41(9) deals with economic, social and cultural rights and sets out the State responsibilities to protect and preserve historical and cultural legacies;
- Article 43 (2) (the rights of the people to be consulted with respect to policies and projects affecting their community);
- Article 92 affirms the commitment of the government to ensure that all Ethiopians live in a clean and healthy environment, puts the principles that designs and implementation of development programs and projects not to damage the environment and the need to conduct consultation and the expression of views in the planning and implementation of environmental policies on projects that affect them directly.

The Constitution of Oromia Regional State is based on the federal constitution and is in conformity with the Articles listed above.

Regarding land tenure, the Constitution affirms that the right to ownership of rural and urban land, as well as of all natural resources, isexclusively vested in the state and the peoples of Ethiopia. Land is a common property ofthe Nations, Nationalities and Peoples of Ethiopia and shall not be subject to sale orother means of exchange. Ethiopian peasants have right to obtain land without payment and the protection againsteviction from their possession, and pastoralists have the right to free land for grazing and cultivation as well as theright not to be displaced from their lands. Every Ethiopian has the full right to the immovable property he builds, and to thepermanent improvements he brings about on the land by his labour or capital.

4.1.2 Ethiopian Constitution on underserved and vulnerable groups

The Ethiopian Constitution recognizes the presence of different socio-cultural groups, including historically disadvantaged and underserved communities, pastoralists, agro-pastoralists and minorities as well as their rights to socioeconomic equity and justice.

Article 39 of the Ethiopian Constitution recognizes the rights of groups identified as "Nations, Nationalities and Peoples". They are defined as "a group of people who have or share a large measure of common culture or similar customs, mutual intelligibility of language, belief in a common or related identity, a common psychological make-up, and who inhabit an identifiable, predominantly contiguous territory." This represents some 75 out of the 80 groups who are members of the House of Federation, which is the second chamber of the Ethiopian legislature. The Constitution recognizes the rights of these Nations, Nationalities and Peoples to: self-determination, including the right to secession; speak, write and develop their own languages; express, develop and promote their cultures; preserve their history; and, self-government, which includes the right to establish institutions of government in the territory that they inhabit and equitable representation in state and Federal governments.

The Constitution also recognizes another group called "national minorities". Article 54(1) states that: "Members of the House [of Peoples Representatives], on the basis of population and special representation of minority Nationalities and Peoples, shall not exceed 550; of these, minority Nationalities and Peoples shall have at least 20 seats." These groups have less than 100,000 members and most live in the 'Developing Regional States'.

Owing to their limited access to socioeconomic development and underserved status over the decades, the Ethiopian government has designated four of the country's regions, namely: Afar, Benishangul-Gumz, Gambella and Somali as Developing Regional States (DRS). In this respect, Article 89(2) of the Ethiopian Constitution stipulates: 'The Government has the obligation to ensure that all Ethiopians get equal opportunity to improve their economic situations and to promote equitable distribution of wealth among them'. Article 89(4) in particular states: 'Nations, Nationalities and Peoples least advantaged in economic and social development shall receive special assistance.

In connection with institutional framework designed to ensure equity between regions, the government has set up the Ministry of Federal Affairs (MoFAPD). The responsibilities of this Ministry include promoting equitable development, with emphasis on delivering special support to the developing regions. The main purpose of the special support is to address the inequalities that have existed between the regions over the decades, thereby hastening equitable growth and development. Federal Special Support Board, which consists of relevant sector ministries including the MoANR, was reorganized in March 2011. The MoFA acts as Vice Chair and secretariat of the Board. A Technical Committee (TC) composed of sector Ministries constituting the Board were also set up under the MoFA to monitor and report the implementation of special support plans. As its main aim, the Board coordinates the affirmative support provided to the developing regions by the different organs of the federal government and ensures the effectiveness of the implementation process.

In addition, Equitable Development Directorate General has been set up within the MoFA, with Directorates put in place to operate under it for the respective developing regions. Among many other activities, the Directorate General coordinates and directs case teams to collect, organize and analyse data in relation to the gaps in capacity building, social and economic development, good governance, gender and environmental development in the regions in need of special support.

4.1.3 Environmental Policy of Ethiopia

The Environmental Policy of Ethiopia (EPE), which was approved by the Council of Ministers in April 1997, is a major policy framework document with respect to environmental management in Ethiopia. The overall goal of the EPE is to improve and enhance the health and quality of life of all Ethiopians, and to promote sustainable social and economic development through the sound management and use of natural, man-made and cultural resources and the environment.

The policy seeks to ensure the empowerment and participation of the people and their organisations at all levels in environmental management activities, and to raise public awareness and promote understanding of the essential linkage between the environment and development. The EPE supports not only constitutional rights of citizens through its guiding principles but also directing all development proposals in the country. Among the many important principles to be considered during project development are the following:

- Regular and accurate assessment and monitoring of environmental conditions shall be undertaken and the information widely disseminated within the stakeholders or population;
- Natural resource and environmental management activities shall be integrated laterally across all sectors and vertically among all levels of organisation.

The EPE also addresses issues related to Environmental Impact Assessment (EIA). These EIA principles emphasise, among others, the early recognition and incorporation of environmental issues and mitigation plans in project design and implementation, public participation in EIA process, development of EIA tools, and capacity building at all levels of administration.

4.1.4 Energy Policy of Ethiopia

The policy aims to increase availability of reliable and affordable energy supplies and ensure their use in a rational and sustainable manner in order to support national development goals, mostly by increasing energy supply to meet needs by developing and utilising hydro-electric power, natural gas and oil exploration, and providing alternative energy sources for the household, industry, agriculture, transportation and other sectors – naming coal as the main alternative to the popular biomass.

It aims to introduce energy conservation and energy saving measures in all sectors. The plan also discusses community participation, with a focus on women, and promotes legal and institutional frameworks to deal with energy issues. Transportation is mentioned briefly, with the objective of introducing conservation measures to reduce fuel consumption.

4.1.5 Cultural Policy of Ethiopia

The Council of Ministers endorsed the Cultural Policy of Ethiopia in October 1997. One of the policy's main objectives is to enable the languages, heritage, history, handicraft, fine arts, oral literature, traditional lore, beliefs and other cultural features of the various nations, nationalities and peoples of Ethiopia to receive equal recognition. In addition, the objective is to respect, preserve and conserve these and pass them over to future generations. The policy gives attention to the inventory and standardization (Article 1); Study, Research and Development (Article 2); Protection, Conservation and Inspection (Article 4); and Repatriation and Restitution (Article 5) of cultural heritage. For instance, regarding the conservation, preservation and inspection of heritage, Article 4.3 emphasises that an appropriate precondition shall be arranged to protect sites of heritage from damages caused by construction works and other development activities.

4.1.6 Policy on Public Health

Ethiopia's Health Policy was first issued in 1993 and revised in April 1998, with the aim of giving special attention to women and children, neglected segments of the population, and to victims of man-made calamities and disasters as well as environmental pollution emanated from project activities.

The priority areas of the policy are in the field of Information, Education and Communication (IEC) of health to create awareness and behavioural change of the society towards health issues with the direct emphasis on the:

- Control of communicable disease and epidemics;

- Combating diseases that are related to malnutrition and poor living condition;
- Promotion of occupational health and safety as well as the development of environmental health;
- Rehabilitation of health infrastructures, provision of essential medicines, and expansion of frontline and middle level health professionals;
- Appropriate health service management system, attention to traditional medicines and applied health research.

The policy aims to protect and promote the health of citizens by ensuring friendly and healthy environment through controlling the environmental factors which are direct or indirect responsible for spread of environmental health related diseases. Some of the important policy frameworks relevant to the proposed solar PV project includes among other:

- Ensure that chemicals are properly stored, handled, transported, applied and disposed of in a manner that does not cause health risks;
- Establish effective monitoring mechanisms for the control of environmental pollution (water, soil, air, noise, etc.);
- Conduct and actively participate in Environmental Impact Assessment (EIA) of development projects like the one at hand.

4.1.7 Ethiopian Wildlife Policy

The Wildlife Policy was developed in 2006 by the Ministry of Agriculture and Rural Development. The prime objective of the policy is to create conducive environment for the preservation, development and sustainable use of Ethiopia's wildlife resources for social and economic development and for the integrity of the ecosystems and biodiversity. It covers a wide range of policies and strategies relating, amongst others, to wildlife conservation and protected areas with four categories from the highest protection ranking as 'National Park', followed by 'Game Reserve' and 'Sanctuary' to 'Controlled Hunting Area'. The proposed Metehara solar PV project is located nearby the Awash National Park which is endowed with a variety of plant and wildlife resources.

4.1.8 National Policy on Women

This policy was issued in March 1993 emphasizing that all economic and social programs and activities should ensure equal access of men and women to the country's resources and in the decision making process so that they can benefit equally from all activities carried out by the federal and regional institutions as well as implementation and operation of private establishments.

In general, the problem with the protection of the rights of women in Ethiopia, is not the absence of policies and laws but lack of awareness, traditional practices curtailing rights of women, and absence of strict observance of the laws by government institutions.

4.1.9 Ethiopia Social Protection Policy on Vulnerable Groups

National social protection policy of Ethiopia given special attention to segments of the society vulnerable to different social and economic problems, especially, children, women, persons with disabilities, elderly, labour constrained unable to make earnings, and the unemployed who are living under difficult circumstances. The policy serves as a framework for collaboration and coordination system of social protection in order to provide different services.

The policy consists of five focus areas. These are,

i. Promoting productive safety net,
ii. promoting and improving employment and livelihood,
iii. promoting social insurance,

iv. increasing equitable access to basic social services, and
v. Providing legal protection and support to those vulnerable to abuse and violence.

The main objectives of the National Social Protection Policy of Ethiopia are the following:

- Protect the poor and vulnerable individuals, households, and communities from different natural and manmade adverse effects of shocks,
- Establish social insurance system and increase its scope,
- Increase access to equitable and quality health, education and social welfare
- services to build human capital;
- Expand and guarantee employment for the vulnerable to unemployment;
- Enhance employment guarantee for the segments of society under social problems through promoting employment opportunities,
- Ensure that the society at all levels play roles for the implementation of the policy,

The following target groups are given due emphasis in the policy:

- Children under difficult circumstances,
- Vulnerable pregnant and lactating women,
- Vulnerable people with disabilities and people with mental health problems,
- Elderly with no care and support,
- Labor constrained citizens unable to get basic social and economic services,
- victims of social problems such as beggars, commercial sex workers, drug and medicine addicted,
- Citizens affected by HIV and AIDS and other chronic diseases that constrain their ability to work,
- Segments of the society vulnerable to violence and abuse,
- Segments of the society vulnerable to natural and manmade risks,
- Unemployed citizens,
- Citizens engaged in the informal sector and who have not social insurance coverage,
- Victims of human trafficking and repatriated emigrants.

4.1.10 Tourism Development Policy

The Tourism Development Policy (2009) has been developed so as to consolidate the fragmented activities associated with the development of the tourism sector in Ethiopia, and ensure coordination of efforts by government, the private sector, communities (at the tourism destinations) and civil organisations, and to create a conducive environment for these entities to be able to discharge their respective responsibilities appropriately.

The focus of this policy is in:

- Guiding the tourism sector in a broad based development framework;
- Developing the existing and new tourism attractions and products;
- Expanding the infrastructure and tourist service that are vital for the growth of the sector;
- Ensuring that the country benefits from the sector by being sufficiently competitive in the international tourism market;
- Solving the serious limitations in capacities which are apparent in the industry.

4.2 Ethiopian Legal Framework

4.2.1 Proclamation on Establishment of Environmental Protection Organs

Establishment of Environmental Protection Organs is stipulated by Proclamation No. 295/2002. The major objective of this proclamation is to formally lay down the institutional arrangements necessary to ensure

environmentally sustainable management and development at federal, sectoral and regional levels. The proclamation therefore re-establishes the Environmental Protection Authority (EPA, which is now replaced by Environment, Forest and Climate Change Commission), Sectoral Environmental Units and Regional Environmental Agencies with a series of respective mandates, powers and duties at federal, sectoral and regional levels in the same order. The ESIA study of the Metehara solar PV project shall be reviewed and approved by Ministry of Water, Irrigation and Energy. The environmental organs of the Oromia Region will play important role in land acquisition and environmental monitoring of the project during construction and operation.

4.2.2 Proclamation on Environmental Impact Assessment

The aim of this proclamation (Proc. No. 299/2002) is to make EIA mandatory for specified categories of activities undertaken either by the public or private sectors and is the legal tool for environmental planning, management and monitoring. The proclamation elaborates considerations with respect to the assessment of positive and negative impacts and states that the impact of a project shall be assessed on the basis of the size, location, nature, cumulative effect with other concurrent impacts or phenomena, trans-regional context, duration, reversibility or irreversibility or other related effects of a project. Categories of projects have been defined that will require full EIA, partial EIA or for which study of EIA is not called for. The proposed Metehara solar PV project is classified as a category I project and hence requires full Environmental Impact Assessment.

4.2.3 Proclamation on Environmental Pollution Control

This proclamation (Proc. No. 300/2002) is based on the right of each citizen to have a clean and healthy environment, as well as on the obligation to protect the environment of the country from being polluted. Its primary objective is to provide the basis from which the relevant ambient environmental standards applicable to Ethiopia can be developed, used and to make the violation of these standards a punishable act. The proclamation also states that the “polluter pays” principle will be applied to all persons and institutions concerned. Under this proclamation, the EPA (now replaced by Environment, Forest and Climate Change Commission) is given the mandate for the creation of the function of Environmental Inspectors. These inspectors (to be assigned by EPA or regional environmental agencies) are given the authority to ensure implementation and enforcement of environmental standards and related requirements. Discharge to the air, water and soil associated with the activities of the Metehara solar PV project shall be governed by this basic principle stipulated in this proclamation and subsequent guidelines.

4.2.4 Prevention of Industrial Pollution Regulation

This regulation (No. 159/2008) is issued by the Council of Ministers pursuant to Article 20 of the Proclamation on Environmental Pollution Control (Proc. No. 300/2002) and is directed to industry and in particular “factories”. Theregulation does not provide a clear definition of “factories”; however, certainsection of the regulation can be deemed applicable to the proposed Metehara solar PV project, e.g. the need for emergency response systems and the need for monitoring of environmental safety.

4.2.5 Proclamation on Wildlife Development, Conservation and Utilisation

This proclamation (Proc. No. 541/2007) repeals the Forestry and Wildlife Conservation and Development Proclamation No. 192/1980 and the Wildlife Regulations No. 416/1972. It provides for the legal administration of national parks, wildlife sanctuaries, and transboundary wildlife conservation areas. This Proclamation has the following three objectives: 1) to conserve, manage, develop and properly utilise the wildlife resources of Ethiopia; 2) to create conditions necessary for discharging government obligations assumed under treaties regarding the conservation, development, and utilisation of wildlife; and 3) to promote wildlife-based tourism and to encourage private investment.

4.2.6 Wildlife Development, Conservation and Utilisation Regulation

These regulations (No. 163/2008) were issued by the Council of Ministers pursuant to Article 17(1) of the Wildlife Development, Conservation and Utilisation Proclamation and, among other things, implement provisions of that proclamation with respect to management of wildlife conservation areas, hunting and various other licences, possession of wildlife products and harmful animals. The regulations provide rules around the management of wildlife conservation areas (National Parks, Wildlife Sanctuaries and Wildlife Reserves) and the administration of these areas. It also details the rules around the lawful and unlawful possession and trade of wildlife products.

4.2.7 Proclamation on Rural Land Administration and Land Use

This proclamation (Proc. No. 456/2005) was enacted for ensuring tenure security; strengthening property rights of farmers; sustainably conserving and developing natural resources; establishing land data base; and establishing an efficient land administration in the country.

Regional governments are the principal administrators and regulators of land, including the assignment and granting of use rights and regional land use planning and administrative authorities are responsible for recording, documenting, and administering use rights.

Rural land users have the right to rent or contract their land either for farmers or investors and the contract duration depends on to whom it is rented out. Hence, no formal land transaction exists by law except giving out in a form contract or lease for certain period. The maximum period to rent out is up to 25 years for investors. To ensure land use rights the government has started issuing out of land entitlement certificates for each rural land owner.

In relation to compensation payment to be made for a holder in relation to public works either by the federal or regional governments, Section 2, Article 7(3) states that:

"Holder of rural land who is evicted for purpose of public use shall be given compensation proportional to the development he has made on the land and the property acquired or shall be given substitute land thereon. Where the rural land holder is evicted by the federal government, the rate of compensation would be determined based on the federal land administration law. Where the rural land holder is evicted by their regional governments, the rate of compensation would be determined based on the rural land administration laws of regions".

4.2.8 Proclamation on Expropriation of Land Holdings and Payment of Compensation

This proclamation (Proc. No. 455/2005) sets the time limits within which land could be acquired after a request is received from a proponent and the principles for assessment of compensation for properties on the land as well as for displacement compensation. In the case of public-owned infrastructures to be removed from the project site (e.g. old railway line crossing the Metehara project site), the owners of the project would assess the value of the properties to be removed. Furthermore, the legislation provides for appeals on valuation decision but such action should not delay transfer of possession of land to the proponent or contractor appointed by the proponent.

The proclamation clarifies and defines who has the power to expropriate landholdings either in urban or rural areas of the country. As per the proclamation, the power of expropriation of landholdings mainly rests on Woreda or urban administration authorities. Article 3(1) of the proclamation states that: "*A Woreda or an urban administration shall, upon payment in advance of compensation in accordance with this proclamation, have the power to expropriate rural or urban landholdings for public purpose where it believes that it should be used for a better development project to be carried out by public entities, private*

investors, cooperative societies or other organs, or where such expropriation has been decided by the appropriate higher regional or federal government organ for the same purpose."

A land holder whose land has been expropriated for public use by the concerned government authorities is entitled for compensation for his property situated on the land and for the permanent improvements he made on the land.The amount compensation to be paid for the property situated on the expropriated land will be determined or calculated on the basis of full replacement cost.

Woreda or urban administration has to notify in writing to the entity (which is either an individual or an organization) to be expropriated indicating the time not less than 90 days when the land has to be vacated and the amount of compensation to be paid. A rural land holder, where his land does not have any crop or other property on the expropriated land, should hand over within 30 days.

Any expropriated property; in addition to the amount of compensation payment it will also receive a provision for cost of removal, transportation and erection.

Concerning displacement compensation for rural land holdings, a rural landholder whose land holding has been permanently expropriated shall also be paid displacement compensation equivalent to ten times the average annual income he secured during the five years preceding the expropriation of the land (Part 3, Article 8).

The proclamation also states that the valuation of property shall be determined based on valuation formula to be adopted at national level by the Ministry of Federal Affairs. However, until such time, valuation of properties will be carried out by property valuation committees to be established by woreda administration both in rural and urban areas as stated in Article 10 of the proclamation.

4.2.9 Payment of Compensation for Property Situated on Landholding Expropriated for Public Purposes Regulation

This regulation (No. 135/2007) provides detailed directives regarding the payment of compensation for property situated on land holdings expropriated for public purposes specific to Proclamation No. 455/2005. The methodology followed by the regulation for the assessment of compensation establishes the basis and formula for compensation that will be made for the different types of assets and categorizes into ten parts:

- Compensation for buildings
- Compensation for fences
- Compensation for crops
- Compensation for perennial crops
- Compensation for trees
- Compensation for protected grass
- Compensation for permanent improvement on rural land
- Compensation for relocated property
- Compensation to mining license
- Compensation to burial ground

The regulation recognizes that land replacement should be made for urban and rural lands. In rural areas, if land replacement is not possible for permanently affected land, project affected persons (PAPs) will be compensated for the affected perennial crops ten times of the annual production. For temporary impact, the amount of compensation will be calculated by the number of years the land is occupied by the project.

It should be noted that the regulation does not asses and provide compensation for income restoration. It also does not recognize squatters or those persons who cannot provide evidence of possession for the land they have been cultivating or have built houses.

4.2.10 Proclamations on Cultural Heritage

In the last two decades, legislations of cultural heritage management have been issued to call attention to the identification and protection of cultural sites which are under private and public ownership.

Proclamation No. 374/2003 (Proclamation to Ratify the Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property) requires developers to conduct a cultural resources survey to identify and assess cultural sites that may be affected by the development activities. It is mandatory to undertake a cultural resources survey to identify and assess any cultural sites that may be affected by the development activities.

The Proclamation defines cultural heritage broadly as "anything tangible or intangible which is the product of creativity and labour of man in the pre-history and history times, that describes and witnesses to the evolution of nature and which has a major value in its scientific, historical, cultural, artistic and handcraft content." Prior approval of the Authority for Research and Conservation of Cultural Heritage (ARCCH) is required to remove immovable (Article 21/1) and movable cultural heritage (Article 21/2) from its original site, during the execution of the project.

Proclamation No. 209/2000 (Research and Conservation of Cultural Heritage Proclamation) allows the use of cultural heritage sites for economic and other purposes if and only if such use is not detrimental to its preservation and does not impair its historical, scientific and artistic values (Article 22). It specifies that the protection and conservation of cultural heritage is the duty and responsibility of the Authority for Research and Conservation of Cultural Heritage (ARCCH).

Proclamation No. 484/2006 (Proclamation to Ratify the Convention for Safeguarding of the Intangible Cultural Heritage) formalises the adoption of the Convention for the Safeguarding of the Intangible Cultural Heritage in Ethiopia at the General Conference of the United Nations Educational, Scientific and Cultural Organisation in Paris on 17 October 2003. The Ethiopian Government ratified the said Convention on 24 January 2006.

4.2.11 Public Health Proclamation

The Public Health Proclamation (Proc. No. 200/2000) disallows the discharge of untreated effluent waste generated from septic tanks, seepage pits and industries into water resource. It also prohibits the disposal of solid or liquid wastes or any other waste in a manner which contaminates the environment or affect the health of the society. Furthermore, the proclamation details occupational health control and use of machinery by employees of any given company.

4.2.12 Labour Proclamation

This proclamation (Proc. No. 377/2003) requires that the employer takes the necessary measures to adequately safeguard the health and safety of their workers. In this proclamation the worker-employer relations are governed by the basic principles of rights and obligations with the goal to enable workers and employers to maintain industrial peace and work in the spirit of harmony and cooperation towards the all-round development of the country. The proclamation also provides requirements around normal working hours and overtime work.

The proclamation, in addition to the above, guarantees the right of workers and employers to form their respective associations and to engage, through their lawful elected representatives, in collective bargaining, as well as to lay down the procedure for the expeditious settlement of labour disputes, which arise between workers and employers.

Regarding social and environmental issues, the proclamation stipulates the basic conditions of occupational safety environment and proper utilization of work machineries and instrument. These could be summarized as below from the worker and employer perspectives.

An employer shall in addition to other provisions in the contract of employment have the following obligations regarding environmental and related issues:

- to provide work to the worker in accordance with the contract of employment and to provide him with implements and materials necessary for the performance of the work;
- to pay the worker wages and other emoluments in accordance with this proclamation or the collective agreement;
- to respect the worker's human dignity;
- to take all the necessary occupational safety and health measures and to abide by the standards and directives to be given by the appropriate authorities in respect of these measures;
- to defray the cost of medical examination of the worker whenever such medical examination is required by law or the appropriate authority.

Similarly, the worker shall have the obligations relating to the environment and related issues, including:

- handle with due care all instruments and tools entrusted to him for work;
- report for work always in fit mental and physical conditions;
- give all proper aid when an accident occurs or an imminent danger threatens life or property in his place of work without endangering his safety and health;
- inform immediately the employer any act which endangers himself or his fellow workers or which prejudice the interests of the undertakings;
- it shall be unlawful for an employer to require any worker to execute any work which is hazardous to his life.

Articles related to women and young employment need be considered while employing these categories of people into the Project. Part six, chapter 1 and 2 need to be headed strongly while engaging women and young force. The provisions listed in these two chapters of the Proclamation emphasis women's specific needs, minimum age for employment, etc.. Specifically, the law defined that "young worker" means a person who has the age of 14 but is not over age of 18 years. The law prohibited to employmentof persons under 14 years. It also prohibited employing young workers which on account of its nature or due to the condition in which it is carried out damages the life or health of the young worker performing the work.

The law defined that normal hours of work for young workers shall not exceed eight hours a day and it prohibited to employ young workers on night work between 10 pm and 6am and overtime work, weekly rest day or on public holidays.Hence, the issue of child labor abuse should be avoided in line with these national legal provisions.

It should be noted that the proclamation was amended in 2005 and 2006 by the Labour (Amendment) Proclamation 466/2005 and Labour (Amendment) Proclamation 494/2004. Amendments included amendment to government roles and responsibilities, labour entitlements and common offences and penalties.

4.2.13 Proclamation on the Rights to Employment of Persons with Disability

This proclamation (Proc. No. 568/2008) is enactment of a new law that complies with the country's policy of equal employment opportunity. The proclamation highlights the rights of disabled persons to employment and necessitates the provision of reasonable accommodation for people with disabilities and lays out simple procedural rules that enable persons with disabilities to prove to any judicial organ on any form of discrimination encountered during employment.

4.2.14 Proclamation on Accession to African Human and People's Rights Charter Proclamation

This proclamation (Proc. No. 114/1998) has been enacted so as to formalise the Ethiopian Government's support for regional and international efforts to achieve normative standards for basic human rights. The Ethiopian Government has accepted accession to the African Charter on Human and People's Rights on 2nd June 1998.

4.3 EIA Guidelines in Ethiopia

With a view to implement the environmental laws, environmental guidelines have been issued by the former Environmental Protection Authority (EPA). These guidelines are intended to guide developers, competent agencies, reviewers and other stakeholders in carrying out and managing the EIA process.

4.3.1 The Procedural EIA Guideline

The procedural guideline for Environmental Impact Assessment was issued in the year 2003 and provides details about the required procedures for conducting an EIA, the permit requirements, the stages and procedures involved in EIA processes, and the roles and responsibilities of parties involved in the EIA process. It also includes the categories of projects (schedule of activities) concerning the requirement of EIA (projects that may need full, partial or no EIA at all), and list of project types under each category. According the criteria set in the guideline, the proposed solar project is categorized as a project that needs full EIA study.

4.3.2 The Technical EIA Guideline

The technical EIA guideline was issued in the year 2000 and specifies tools, particularly the standards and guidelines that may be considered when undertaking the EIA process. Moreover, it provides details and key issues for environmental assessment in specific development sectors such as energy, water resource, manufacturing, etc.

4.3.3 Guideline for Reviewing EIA Reports

The guideline for reviewing EIA reports was issued by EPA in the year 2003 to guide and make easier the review process of the EIA reports. It is a generic guideline prepared to facilitate the EIA report reviewing and decision-making processes, and it includes review approaches, and outlines a minimum report structure and information requirements. It is intended to help the reviewers to assess the content, comprehensiveness, adequacy and accuracy of information in the report, as well as its organizational and presentation qualities. The review guideline is principally meant to be used by EPA and regional environmental agencies but also by Sectoral Environmental Units, and the proponents.

4.4 Environmental Standards for Industrial Pollution Control in Ethiopia

The Government of Ethiopia has mandated the previous Environmental Protection Authority (EPA) to set environmental standards for the purposes of preventing significant industrial pollution. Solar PV facilities

and other energy sector projects are not subject to industry-specific standards for discharges to water and emissions to air, but are instead covered by general standards for industrial pollution control. These include pollution limits for (i) effluent discharges to inland waters, (ii) controlled application of effluents to land, (iii) gaseous emissions to air, and (iv) noise emissions. The relevant standards are enclosed in Appendix 10.

4.5 International Conventions and Agreements

The following international conventions and protocols, to which Ethiopia is a signatory, have relevance (directly or indirectly) to the proposed Metehara project and its execution:

- The United Nations Convention on Biological Diversity
- The United Nations Framework Convention on Climate Change
- The United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa
- The United Nations Convention for the Safeguarding of the Intangible Cultural Heritage
- The United Nations Convention on the Protection and Promotion of the Diversity of Cultural Expressions
- The United Nations Convention Concerning the Protection of World Cultural and National Heritage
- The Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol on Substances that Deplete the Ozone Layer
- The Stockholm Convention on Persistent Organic Pollutants
- The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
- The Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste
- Bamako Convention on the Ban on the Import into Africa and the Control of Trans-boundary Movement and Management of Hazardous Wastes within Africa
- Libreville Declaration on Health and Environment in Africa
- The United Nations Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora 1973
- The International Labor Organization (ILO) Conventions- (Convention No. 111/1958 - deals with the prevention of discrimination in respect of employment and occupation; Convention No. 100/1951 - calls for all eligible workers are to be paid equal amount for equal type of work; Convention 87/1948 - gives the freedom of association and protection of the right to organize by workers and employers; Convention 98/1949 - gives the right to the workers to organize and collective bargaining; Convention 29/1930 - strives to prevent forced or compulsory labour and Convention 105/1957 - calls for the abolition of forced labour are few of them which Ethiopia is party to them).

4.6 International Guidelines and Standards

The Metehara solar PV project will be developed by an independent power producer (Enel Green Power) with international financing. One of the objectives of the ESIA study is therefore to ensure that the project is “bankable”, i.e. compliant with international safeguard policies, in order to attract international financing. The relevant international guidelines and standards for private sector financing are the Equator Principles and the WB Performance Standards.

In addition, if the World Bank provides guarantee support to the project through a public private partnership (PPP) arrangement, the World Bank Operation Policy (OP) 4.03 will be triggered. According to OP 4.03, when the World Bank provides financing to a PPP entity, the eight WB Performance Standards

are adopted by the Bank as the "World Bank Performance Standards for Projects Supported by the Private Sector".

4.6.1 Equator Principles

The Equator Principles are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. To date the Equator Principles are adopted by approximately 79 financial institutions and were updated to version three in 2013.

The Equator Principle Financial Institutions (EPFIs) commit to implementing the Equator Principles in their internal environmental and social policies, procedures and standards for financing projects and will not provide project finance or project-related corporate loans to projects where the client will not, or is unable to, comply with the Equator Principles.

In order to facilitate potential access to funding for project development potential borrowing organisations need to consider the Equator Principles and environmental and social risk management as part of the ESIA process. These Equator Principles require that projects conduct an ESIA process in compliance with the WBPerformance Standards (see below).

4.6.2 World Bank Performance Standards

The International Finance Corporation (IFC), a division of the World Bank Group that lends to private sector, has developed the Performance Standards as part of IFC's Sustainability Framework (2012 Edition).WB Performance Standards are typically applied as a benchmark of international good practice.

The World Bank Group (WBG) support for Metehara solar PV project is designed for an efficient use of IDA guarantees and, where WBG partners are involved, IDA guarantees would complement IFC investments and/or MIGA guarantees, to ultimately support increased renewable energy generation and private sector participation; with a framework of WB OP 4.03 Performance Standards for Private Sector Activities.

The Performance Standards are directed towards providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. The Performance Standards require that projects are executed in accordance with Good International Industry Practice (GIIP) as outlined in the WB Environmental, Health and Safety (EHS) Guidelines. The EHS Guidelines contain the performance levels and measures that are normally acceptable to the WB, and that are generally considered to be achievable in new facilities at reasonable costs by existing technologies. When host country (Ethiopian) regulations differ from the levels and measures presented in the EHS Guidelines, projects will be expected to achieve whichever is more stringent.

Based on the OP/BP 4.03 World Bank Performance Standards (PS) for Private Sector activities all of the performance standards are applied for this specific project. These are:

PS 1: Assessment and Management of Environmental and Social Risks and Impacts;
PS 2: Labour and Working Conditions;
PS 3: Resource Efficiency and Pollution Prevention;
PS 4: Community Health, Safety, and Security;

PS 5: Land Acquisition and Involuntary Resettlement;
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
PS 7: Indigenous Peoples; and
PS 8: Cultural Heritage.

Table 3Performance Standards and their applicability to this project

Performance Standard	Purpose / Objectives	Applicability to the Project
PS1: Assessment and Management of Environmental and Social Risks and Impacts	Performance Standard 1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project.	The Metehara solar PV project requires a full ESIA study to identify environmental and social risks and impacts and to provide a basis for the management of environmental and social performance during project planning, construction and operation.
PS2: Labour and Working Conditions	The objective of the Performance Standard 2 is to: • Promote fair treatment, non-discrimination, and equal opportunity of workers • 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. • To avoid the use of forced labour.	The ESIA will refer to the applicable laws and regulations on labour and working conditions, and specify the relevant requirements in the ESMP.
PS3: Resource Efficiency and Pollution Prevention	Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Itsaims are: • To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project-related GHG emissions. To provide guidance on how to achieve the objectives of Performance Standard 3, reference is made to the Environmental Health and Safety (EHS) Guidelines. The EHS Guidelines are technical reference documents with general and industry-specific examples of good international industry practice. When host country regulations differ from the EHS Guidelines, projects are expected to adhere to, and aim for, the most stringent requirements.	The ESIA will assess the risk of environmental pollution and impose prevention and control techniques consistent with national standards and the IFC Environmental, Health and Safety (EHS) Guidelines.
PS4: Community Health, Safety and Security	Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.	The existing and project-induced risks to community health, safety and security will be assessed, and necessary mitigation measures will be specified in the ESMP.

Performance Standard	Purpose / Objectives	Applicability to the Project
PS5: Land Acquisition and Involuntary Resettlement	Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood (1) as a result of project-related land acquisition (2) and/or restrictions on land use. The objectives of the Performance Standard are: • To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs. • To avoid forced eviction. • To 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. • To improve, or restore, the livelihoods and standards of living of displaced persons. • To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.	The ESIA will assess the extent of involuntary resettlement. The compensations and livelihood restoration measures will be specified in a Framework Resettlement Plan.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. Habitats are classified into modified, natural and critical habitats. The client will not significantly convert or degrade natural habitats, unless all of the following are demonstrated: • No other viable alternatives within the region exist for development of the project on modified habitat • Consultation has established the views of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation • Any conversion or degradation is mitigated according to the mitigation hierarchy In areas of natural habitat, mitigation measures will be designed to achieve no net loss of biodiversity where feasible. In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated: • No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical • The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values	The ESIA will involve baseline studies of biodiversity and living natural resources in the project's area of influence, including a description of affected habitats their conservation value. The predicted impacts will be rated according to significance/magnitude and the mitigation hierarchy will be applied as appropriate.

Performance Standard	Purpose / Objectives	Applicability to the Project
	• The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time • A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program	
PS7: Indigenous Peoples	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. The objectives of this policy include: • To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. • To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. • To promote sustainable development benefits and opportunities for Indigenous peoples in a culturally appropriate manner. • To establish and maintain an on-going relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. • To ensure the free, prior, and informed consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. • To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.	As per the agreement of the Ethiopian Government with the WB joint screening in 2013, Karrayu ethnic group is recognized under the category of underserved people, meeting the criteria of WB PSs-7, thus requires the application of this performance standard to the proposed Metehara Solar Power Plant project. While the land users (PAPs have confirmed their willingness to vacate their 250 ha of land (instead of the previously proposed tract of land), a process of free prior informed consent (FPIC) needs to be documented. Furthermore, the livelihood restoration planning (as part of the full RAP) must pay special attention to the right of indigenous people defined in PS 7.
PS8: Cultural Heritage	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. The client is responsible for siting and designing a project to avoid significant adverse impacts to cultural heritage. The environmental and social risks and impacts identification process should determine whether the proposed location of a project is in areas where cultural heritage is expected to be found, either during construction or operations. In such cases, the client will develop provisions for managing chance finds through a chance find procedure which will be applied in the event that cultural heritage is subsequently discovered. Where the client has encountered tangible cultural heritage that is replicable and not critical, the	Cultural heritage resources will be assessed by a qualified specialist as part of the ESIA process, and affected communities will be consulted.

Performance Standard	Purpose / Objectives	Applicability to the Project
	client will apply mitigation measures that favour avoidance. Where avoidance is not feasible, the client will apply the mitigation hierarchy. The client should not remove, significantly alter, or damage critical cultural heritage. In exceptional circumstances when impacts on critical cultural heritage are unavoidable, the client will use a process of Informed Consultation and Participation of the Affected Communities which uses a good faith negotiation process that results in a documented outcome.	

Table 4 Summary of Comparison of the Key Elements in the Ethiopian Legislation and WB PS 5, and Recommendations to Address Gaps

Theme	WBG PS 5	National Legislation	Comment/ Comparison	Measures to Address Gap
Policy Objectives	WB PS 5 requires that involuntary resettlement should be avoided wherever possible or minimized by exploring alternatives. Resettlement program should be sustainable, include meaningful consultation with affected parties and provide benefits to affected parties Displaced persons should be assisted in improving livelihoods etc. or at least restoring them to previous levels	The Constitution of Ethiopia and Proclamation No 455/2005 give power to Woreda or urban administrations to expropriate rural or urban landholdings for public purpose where it believes that it should be used for a better development Article 7(5) states that the cost of removal, transportation and erection shall be paid as compensation for a property targeted for the project.	Avoidance or minimization of involuntary resettlement is not specified in the Ethiopian legislation. Proclamation No 455/2005 allows for a complaints and grievance process. Proclamation No 455/2005 allows for some form of support to the displaced persons, but does not explicitly specify consultation with affected persons through the process.	WB PS 5 overall objectives shall be applied to avoid or minimize involuntary resettlement and to ensure consultation throughout the process.
Impacts	WB Guidance Note 5, GN1 identifies the main social risks as: Landlessness, joblessness, homelessness, marginalization, food insecurity, loss of access to common property and social services, social	The Constitution of the Federal Republic of Ethiopia 2005, Proclamation No. 455/2005, Proclamation No. 456/2005, and Council of Ministers Regulations No. 135/2007 consider compensation for only immovable/improvements on	The social risks recognized by the national law are limited to landlessness, loss of assets and loss of means of livelihood. The law is silent on the measures to control other risks associated with displacement.	The project aims to avoid, minimize and mitigate all the impacts identified in PS5, including those not covered in national legislation. Potential social risks recognized by WB PS

Theme	WBG PS 5	National Legislation	Comment/ Comparison	Measures to Address Gap
	disarticulation, loss of income sources or other means of livelihood and loss of assets	land. The legislation also recognizes the loss of land use rights and advocates for allocation of replacement land wherever possible. In addition, the Constitution (Article 44(2)) requires that all persons displaced or whose livelihoods are displaced are provided with monetary or alternative compensation including relocation with state assistance.	In the context of REGREP, the social risks are related to disruption of livelihoods in a rather vulnerable setting. Impacts on livelihoods can easily trigger other risks like food insecurity, disrupted access to common property (grazing land and watering points), and joblessness for poorer households who sell labor. Such risks are not covered by the law and need to be mitigated.	5 shall be considered in this case.
Displaced persons	Displaced persons may be classified as persons (i) who have formal legal rights to the land or assets they occupy or use;) who do not have formal legal rights to land or assets, but have a claim to land that is recognized or recognizable under national law;) who have no recognizable legal right or claim to the land or assets they occupy or use.	According to Article 22 of the "Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes Council of Ministers Regulations No. 135/2007", all persons claiming compensation must produce proof of legitimate possession of the expropriated landholding and ownership of the property entitling compensation.	The National legislation is silent on land users without recognizable legal right to the land they occupy. Whereas, WB PS-5 states that, for people who do not have use rights over the land they occupy, WB PS-5 requires that non-land assets be retained, replaced, or compensated for; relocation take place with security of tenure; and lost livelihoods be restored.	REGREP RPF document acknowledges in an event where there is a conflict between the national law and WB PS 5 guidelines, the WB PS prevails as resettlement framework and compensation for assets will be provided to all PAPs (including those without legal title).
Eligibility for Compensation	WB PS 5 gives eligibility to all PAPs whether they have formal legal rights or do not have formal legal rights to land, but have a claim to such land and those who do not have recognizable legal right or claim to the	Proclamation No 455/2005, Article 7(1) allows' landholders' to be eligible for compensation if they have lawful possession over the land to be expropriated and owns property	While Ethiopian law only grants compensation to those with lawful possession of the land. The national legislation does not provide clear guidance on how	WB PS 5 entitles compensation for assets to all affected individuals regardless of landholding rights to land titles (including squatter settlements).

Theme	WBG PS 5	National Legislation	Comment/ Comparison	Measures to Address Gap
	land.	situated thereon" According to Article 22 of the "Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes Council of Ministers Regulations No. 135/2007", all persons claiming compensation must produce proof of legitimate possession of the expropriated landholding and ownership of the property entitling compensation.	claimants without possession of proof of ownership will claim for compensation.	WB PS-5 states that, for people who do not have use rights over the land they occupy, WB PS-5 requires that non-land assets be retained, replaced, or compensated for; relocation take place with security of tenure; and lost livelihoods be restored.
Cut-off date	WBG Guidance Note 5, GN 32 defines the cut-off date as the date of completion of the census and assets inventory.	The Civil Code Proclamation No. 165/1960 indicates that buildings or improvements on land made after the issuance of the expropriation order will be not be considered for compensation. This implies that the issuance of the expropriation order marks the cut-off date.	According to the national legislation, the expropriation order/notification is expected to be issued at least 1 year prior to the expropriation. Notification of the communities in the project area started as early as 2016 during the assessment of the alternative project sites. Notification of the directly impacted was undertaken in mid-2018, and the asset inventory is done in March 2019.	In line with PS5 guidance, REGREP projects will use the date of the completion of the census and assets inventory. This will be publicized and communicated to the community and PAPs.
Compensation	WB PS 5Guidance Note, GN 22: The rate of compensation for lost assets shall be calculated at full replacement cost, (i.e., the market value of the assets plus transaction costs).	Proclamation No. 455/2005, Article 7(4&5) requires that the amount of compensation shall be based on replacement cost of the property. It further specifies that the value shall be equal to the value of capital and labour expended on the land. The	Despite all the provisions, there are noticeable inconsistences between Proclamation No. 455/2005 and the valuation formula set out in the Council of Ministers Regulations No. 135/2007. Transaction costs like the rural land use	The WB requirements for compensation must be followed as per WB PS 5, thus REGREP projects will follow the compensation of lost assets at full replacement cost in line with the objectives of the stated PS,

Theme	WBG PS 5	National Legislation	Comment/ Comparison	Measures to Address Gap
		articles further require that for relocatable property, the cost of removal transport and reinstallation shall be factored into the compensation. In addition, the rural land holders shall also be paid displacement allowance on top of compensation estimated as ten times the average annual income for the past 5 years prior to expropriation. Valuation formula are provided in Regulation No. 135/2007	payment and income tax imposed on users of rural land (cultivated or not) are not put into consideration. The valuation formula proposed for this REGREP projects has been updated to include such sums. The project proponent shall ensure that the compensation awards include such sums.	and in so doing meet replacement cost standard or exceed the market value (which would be lower if the asset has been subject to depreciation).
Timing of compensation payments	GN23: Compensation for lost land and assets shall be paid prior to the client taking possession of this land or assets and where possible people shall have been resettled at their new sites and moving allowances paid to them.	The Constitution (Article 40(8) requires that expropriation of private property for public purposes shall be subject to advance compensation payment commensurate to the value of the property Proclamation No. 455/2005, Article 3(1) requires that compensation shall be paid in advance of taking into possession of the expropriated immovable and permanent improvements on land. However, in certain conditions (objection to compensation payments and other related grievances), the	There is a gap in Proclamation No 455/2005 to allow land to be expropriated before necessary measures for resettlement take place, particularly before the displaced person has been paid. This can have serious consequences for those affected, as they may be displaced without shelter or livelihood.	Payment of compensation and support for displaced person should always be effected before the land is handed over, as per the requirements of WB PS 5. To ensure that all compensations are paid prior to possession of the expropriated property, REGREP projects shall institute accessible, objective, systematic and empowered grievance management mechanisms that will allow for swift handling and conclusion of all grievances.

Theme	WBG PS 5	National Legislation	Comment/ Comparison	Measures to Address Gap
		authorized authority is empowered to take over property prior to conclusions on the appeal by the PAP (Civil Code Proclamation No. 165/1960, Article 1478).		In addition, to avoid objections to compensation payments, involvement of the affected entities early in the process with clear transparency about the compensation rates will be essential. This could be done by adopting at least 2 people to represent the affected community on the compensation committee.
Resettlement instruments	Requires a resettlement instrument in form of a resettlement action plan, resettlement policy framework or livelihood restoration plan (in case of economic displacement).	The Proclamation No. 455/2005 only requires a database on properties and persons affected.	This document together with the database detailing the persons and property affected and any additional plans for livelihood restoration prepared by the developer shall together form the equivalent of a resettlement plan/livelihood restoration plan for REGREP projects.	Based on WB 5 GN43, a Resettlement Action Plan should be prepared for any project that results in physical displacement. IPPs undertaking projects that entail land acquisition but require no physical displacement of people will prepare a Livelihood Restoration Plan. The scope and level of detail of the RAP will vary with the magnitude of displacement and the complexity of the measures required to mitigate adverse impacts. In all cases, the RAP and LRP will describe the manner in which the objectives of Performance Standard 5 will be achieved.

N.B.***In case of differences between the Ethiopian Legislation and WB PS 5, the World Bank Performance Standards will prevail.***

5 BASELINE CONDITIONS

5.1 Physical Environment

5.1.1 Topography and Landscape

The Metehara solar PV facility will be situated on the flat plains between Mount Fentale, a semi-dormant volcano rising to 2,007 meters above sea level, Lake Beseka, Metehara Sugar Estate and the Awash River. There are almost no undulations or notable topography throughout the site and altitude varies minimally, between 950 m and 960 m above mean sea level. The vegetation originally consisted of grassland with scattered trees but has in recent years been invaded by the exotic *Prosopis juliflora* forming almost impenetrable thicketsin parts of the project site.

Figure 5: Panorama view of the project site from the south-west corner with Metehara town and Mount Fentale in the background.

Figure 6: Project site viewed from the north-west corner (left) and the centre of the plot (right).

The 250 ha land has a few residential structures along the northern perimeter, near the abolished Ethio-Djibouti railway line, and in the south-east corner, but is otherwise devoid of human settlements. However, the land has previously been used for rain-fed farming in the rainy seasons and there are also herds of cattle and other livestock that graze and move across the site to access watering points on the Awash River. There are numerous cattle tracks and footpaths.

Figure 7: Project site viewed from the south-east corner with cattle (left) and thicket of* Prosopis juliflora *(right).

Figure 8: Residential structures on the northern perimeter of the project sites.

There issome major infrastructure in close vicinity of the site, with Highway 4 and the new Addis Ababa – Djibouti rail both running parallel to the site at about 250 m and 1.2 km to the north. In addition, thereare several EEP transmission and distribution lines in the area, including a 230 kV line located about 2.3 km north of the siteto which the project will connect. A short section of a 15 kV distribution line from Metehara substation (2.2 km north of the site) to Metehara Sugar (1.5 km south of the site) intersects the project site in the north-west corner near Metehara town.

Apart from this infrastructure, there are no dominant landscape features within the project boundaries. The only viewpoints from where the whole site can be observed are on the slopes of Mount Fentale with its summit located about 8 km to the north. Currently, the view from Mount Fentale is dominated by the vast expanses of sugar plantations around the Metehara sugar factory and by Lake Beseka with its 40 km^2 water surface immediately west of Metehara town.

Figure 9: The new Addis Ababa – Djibouti railway (left) and the old Ethio-Djibouti railway (right).

Figure 10: View from main road towards the project site (left) and power distribution line (15 kV) in the north-west corner near Metehara town.

In conclusion, the landscape in the project's area of influence is highly modified by the invasion of the exotic weed *Prosopis juliflora* and by the expansion of urban areas in Metehara town.The site is part of the viewshed from Mount Fentale, but the overall aesthetic value of the landscape is rated as low.

Value		
Low	Medium	High
|----------	|----------	|
▲		

5.1.2 Geology and Soils

The 1: 2 000 000 Geological Map of Ethiopia indicates that the project site is underlain by Quaternary age volcanic rocks of the Dino Formation. The bedrock comprises ignimbrite, tuff, coarse pumice, waterlain pyroclastic rocks with rare intercalations of lacustrine sediments (**Error! Reference source not found.**). Various fault (NE-SW) zones sympathetic to East African rift system and Ethiopian rift system also occurs in the region.

Soil cover has a maximum depth of 1.3m and the bedrock is highly to moderately weathered with a soft rock consistency (Aurecon 2019). Rock outcrop occur sporadically across the site. The soil cover comprises hillwash, lacustrine deposits and residual ignimbrite which are typically silty/clayey soils, or silty sands with gravel with occasional cobbles. These soils are dominantly soft/loose and firm/medium dense.

No significant erosion channels occur on the site and the soils are therefore not expected to be prone to erosion. The site is characterised by flat topography with no unstable slopes.

The soils are classified as Leptosol according to the FAO classification system (**Error! Reference source not found.**). Leptosols are very shallow soils over hard rock or highly calcareous material or a deeper soil that is extremely gravelly and/or stony. Leptosols are generally unattractive soils for rainfed agriculture because of their inability to hold water.

Regarding seismic risk, the Metehara site occurs in Zone 4 according to Ethiopian Building Codes Standard (EBCS 8-1995), which is classified as a high hazard, with a design peak ground acceleration of 0.1 g selected at a return period of 100 years (Aurecon 2019).

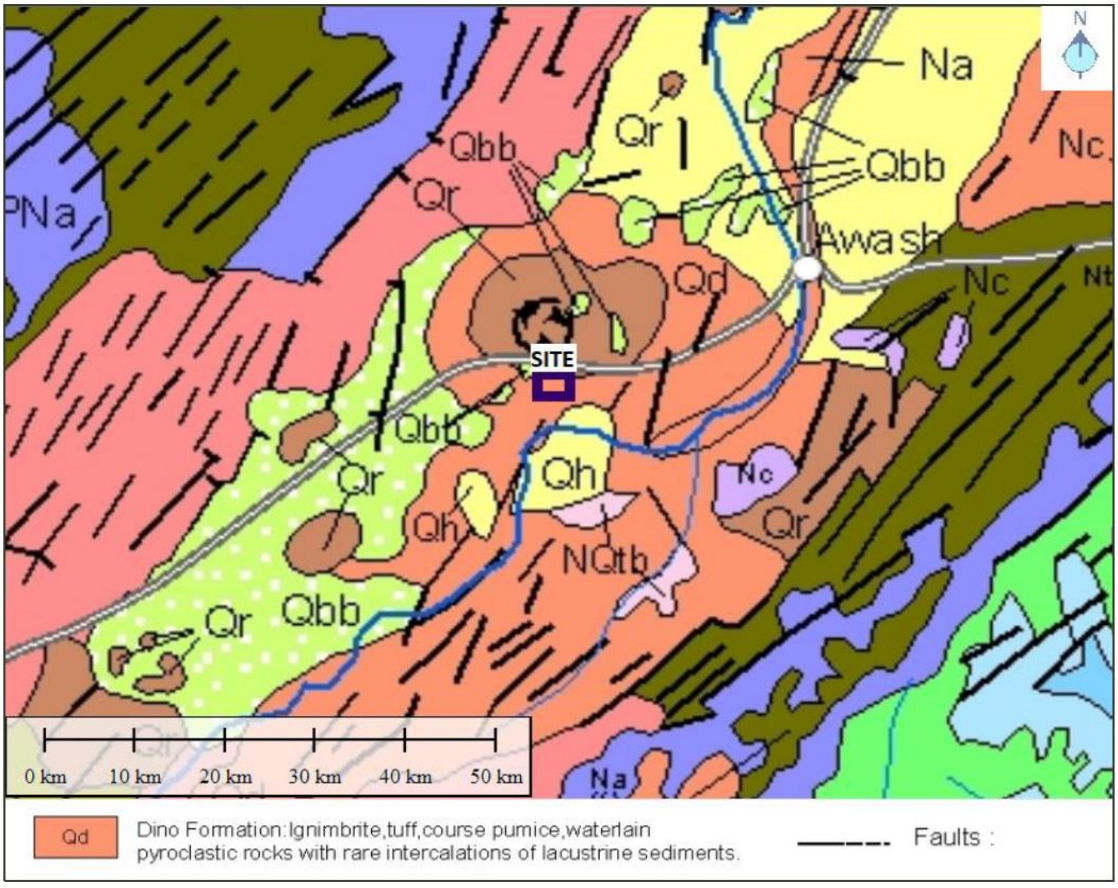


Figure 11: Geology map with the project sites indicated. Source: Aurecon (2019).

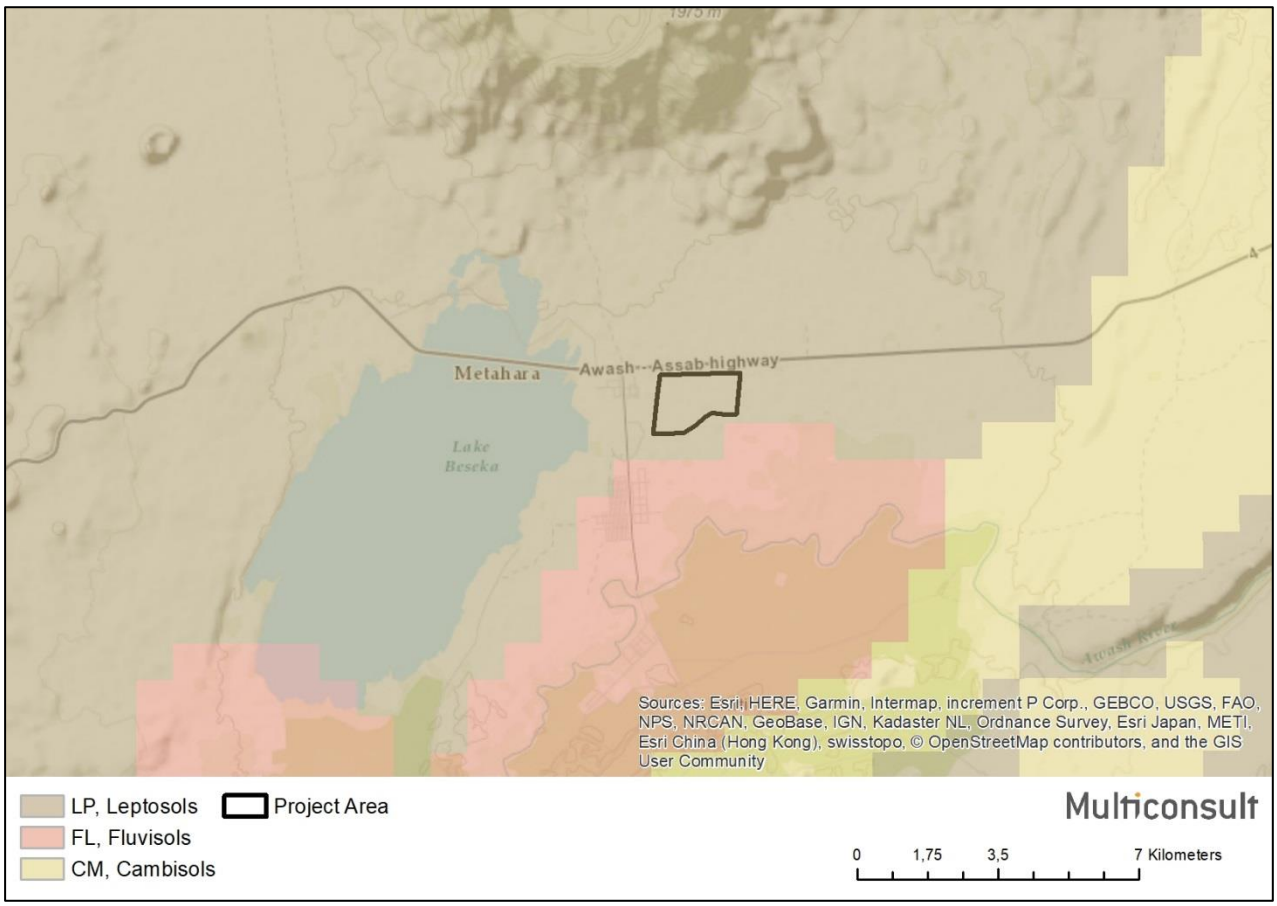


Figure 12: Major soil groups in and around the project site. Source: FAO/ISRIC/ISS-CAS/JRC (2012).

5.1.3 Climate and Air Quality

Metehara has a semi-arid climate with an average rainfall of about 540 mm. The rainfall regime is weakly bi-modal, characterised by high degree of erratic nature and variability both in amount and distribution. The main rainy season (locally known as Gannaa) is from July to September which is relatively reliable, and the short rainy season (locally known as Afrasa) occurs from March to April which is usually unreliable (**Error! Reference source not found.**). The average temperature is 25 °C with June being the warmest month (28.4 °C) and December the coldest month (21.4 °C).The mean maximum and minimum temperature are 33.4 °C and 17.8 °C, respectively.

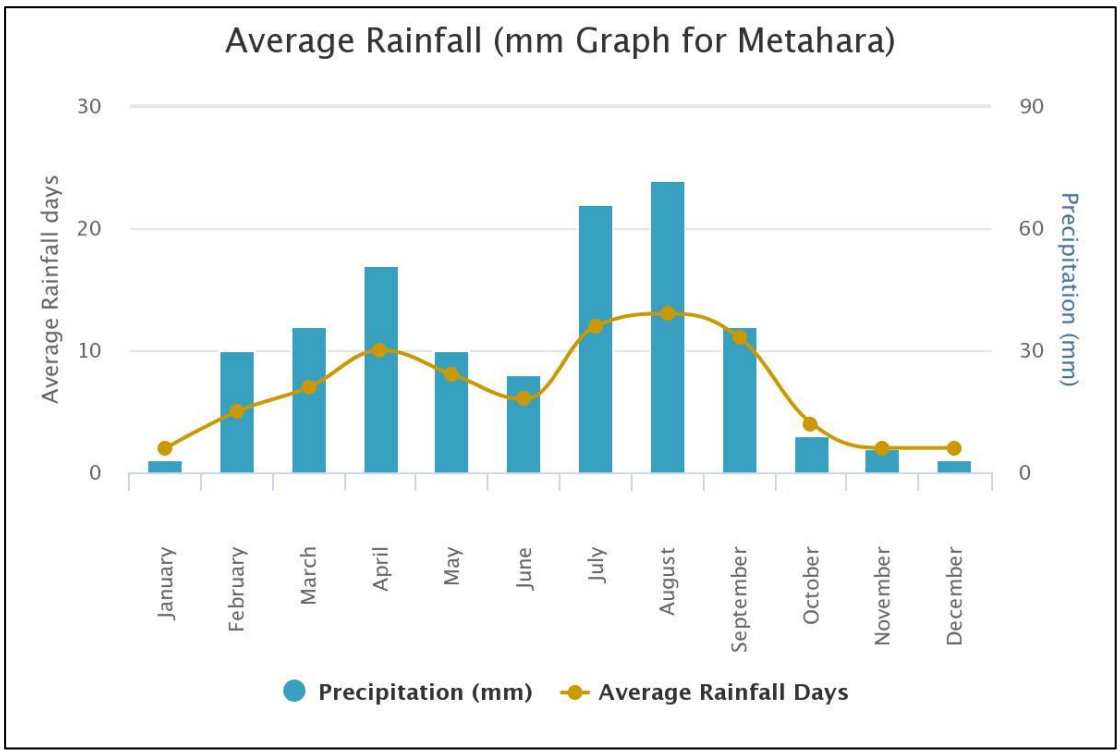


Figure 13: Average rainfall for Metehara, Ethiopia. The data are taken from year 2000 to 2012.

With respect to solar resources, Ethiopia generally benefits from the highest values of Global Horizontal Irradiation (GHI – in kWh/m²) on the African continent. Metehara is one of the sunniest and most favourable locations in Ethiopia with a GHI of 2,260 kWh/m² per year (**Error! Reference source not found.**).

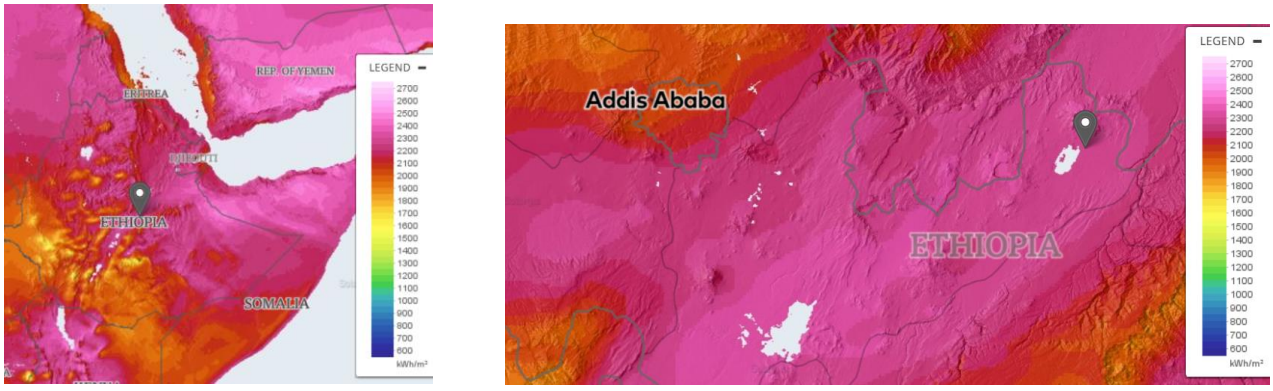


Figure 14: Global Horizontal Irradiation (GHI) in Metahara. Source: Global Solar Atlas (The World Bank Group 2016).

With respect to air quality, the nearest industrial pollution sources include a steel recycling plant located about 1.7 km north-east of the site and the Metehara sugar factory about 6 km to the south. Highway 4 with its relatively high traffic load also contributes to some air pollution in terms of vehicle emissions and dust. Whirlwinds are a common phenomenon across the Metehara plains causing short-term dust dispersal. However, despite these pre-existing impacts, the airshed is unlikely to be degraded under present conditions.

The value or sensitivity of the local air shed is rated as high.

Value		
Low	Medium	High
|----------	|----------	|
	▲	

5.1.4 Noise

The major source of noise emissions is from road traffic on Highway 4 which serves as a continuous disturbance during day time as well as night time. The north-west corner of the site is also near Metehara town which is characterised by typical urban noise. The nearest receptors are the residential houses and tukuls situated along the main road to the north (150-300 m from the site) and a few houses near the south-west corner (<100 m from the site) as well as those houses currently found inside the project boundary (to be relocated). There is also a nearby primary school in Gelcha kebele butthis is located more than 1 km to the east.

There are no noise emissions from within the project boundaries, and the noise levels are insignificant or within the normal range of natural sounds at the southern edge of the project site (> 1 km from the main road and town). The recorded noise levels in Metehara town and along the northern boundary of the project site, including the road highway, are shown in **Error! Reference source not found.**. The baseline noise levels consistently exceed the applicable noise limits for residential areas and in some cases also the limits for commercial areas. The highest noise levels are from road traffic on the main highway. The national and international noise level standards and guidelines are enclosed in Appendix 9 and Appendix 10.

Table 5Ambient noise levels recorded near the project site

Location	Coordinates (UTM 37 P)	Noise Levels (dBA)					
		Day Time Morning (10-11 AM)			Day Time Afternoon (5-8 PM)		
		Max	Average	Min	Max	Average	Min
North-west corner	601961 984162	75.0	57.7	38.9	68.3	57.5	50.2
Metehara town centre	601198 984323	67.3	58,6	49.8	65.6	55.0	49.3
Metehara town near Mikael Bet Church	601488 984336	83.1	64.1	44.1	54.4	50.1	45.1
North-east corner near old railway	604043 984222	81.2	65.5	45.5	56.2	53.8	50.7
North-east corner on main road	603946 984474	92.2	79.7	63.5	73.5	61.7	49.3
Ethiopian Limits*		55 (65)	55 (65)	55 (65)	55 (65)	55 (65)	55 (65)
WB/IFC Guideline**		55 (70)	55 (70)	55 (70)	55 (70)	55 (70)	55 (70)

* Residential area 55 dBA; Commercial area 65 dBA

** Residential 55 dBA; Commercial 70 dBA

In conclusion, the project site is already affected by noise pollution due to its proximity to Metehara town and to the main highway from Addis Ababa to Djibouti. This applies mainly to the western and northern boundary of the project site, while the other portions have insignificant noise levels within the normal range of natural sounds. The baseline value is rated medium with respect to the acoustic environment.

Value		
Low	Medium	High
|----------	|----------	|
	▲	

5.1.5 Water Resources

The main source of water for irrigation and drinking in Metehara is the Awash River located 2.5 km south of the project site. It originates west of Addis Ababa and flows for about 1,200 km before emptying into a chain of interconnected lakes on the border with Djibouti. The Awash basin is thus an endorheic drainage basin which has no outflow but converges into lakes that equilibrate through evaporation. The river is affected by water abstraction for irrigation and by pollution, mainly from industries in the upper catchment and from Metehara Sugar. The water supply for Metehara town is sourced from the Awash River, and local herders from around the project site also take their livestock to the river for drinking.

Lake Beseka, located less than 1 km west of the project site, is a saline lake which has grown significantly in the past half century, from 3 km^2 in the 1950s to more than 40 km^2 at present. The reason behind this growth has been attributed to tectonic processes and inflow from irrigation canals and rainwater runoff. The lake expansion has already caused submergence of the old highway (which now has a permanent detour) and is posing a risk to the productivity of the sugar estate and to properties at the outskirts of Metehara town. The salinity of the lake is 10.7 dS/m.

A drainage canal has been excavated from Lake Beseka to the Awash River to limit the rise in lake-water level. This has contributed to increased salinity levels in the downstream reaches of Awash River, especially during the dry season, adding to the already deteriorating water quality caused by upstream pollution and water abstractions. The Beseka canal borders the project site to the south.

Figure 15: Awash River at Awash Falls downstream of Metehara (left) and Lake Beseka with Mount Fentale in the background and the project site located further to the right in the picture (right).

Figure 16: Lake Beseka drainage canal upstream of the project site (left) and downstream (right).

Figure 17: The two water ponds immediately outside the project site from where water samples were collected for testing. The left picture shows the pond in the north-east corner, while the right picture shows the pond in the south-east corner of the project site.

Within the boundaries of the project site, there are no permanent water bodies. According to Aurecon (2019), there was also no groundwater or seepage in test pits excavated during the geotechnical investigations. However, pond water and dried out ponds, including two small, shallow and seasonal water ponds just outside the site in the north-east and south-east corner, respectively. The largest of these ponds (south-east corner) can extend to about 2 ha in the rainy season but dries out completely in the dry season. Despite the poor water quality, the ponds are used occasionally for livestock watering but they are not considered as important water resources by the community. Lake Beseka and its drainage canal are not used for other purposes than washing and bathing (due to the high salinity level), although livestock sometimes drink from the canal on their way to the Awash River. The water quality of the nearest water bodies, i.e. the two ponds and the Beseka canal, is reported in Table 4. As expected, the water sources do not meet drinking water quality standards and show high pH values, very low dissolved oxygen levels, and elevated values of turbidity, fluoride, and dissolved solids.

Table 6: Water quality analysis results.

No.	Parameter	Water pond NE Corner	Water Pond SE Corner	Lake Beseka Canal	Ethiopian Environmental Standard	WHO Guidelines
1	pH	9.21	8.91	8.79	6.0-9.0	6.5-8.5
2	Alkalinity (mg/L $CaCO_3$)	3,280	12,300	1,148	-	-
3	Carbonate (mg/L CO_3^{2-})	1,476	2,706	246	-	-
4	Bicarbonate (mg/L HCO_3^-)	1,000	9,503	900	-	-
5	T. Dissolved Solid 105^0C(mg/L)	5,260	15,350	1,998	3,000	1,000
6	Turbidity (NTU)	86.00	1,675	42.00	-	25
7	Total Hardness (mg/L Ca CO_3)	22.22	40.40	20.20	-	500
8	Fluoride (mg/L F^-)	46.00	120.00	14.00	20	1.50
9	Dissolved Oxygen (mg/L)	0.36	0.28	2.97	250	-

The value of the nearby water bodies is rated as low-medium. There is no consumption of water from these sources for irrigation or drinking due to the poor water quality. However, the Beseka canal is used for washing/bathing and livestock can be watered from the small ponds. It should be noted that the Awash River is outside the project's area of influence.

Value		
Low	Medium	High
|----------	----------|----------|	
▲		

5.2 Biological Environment

5.2.1 Protection Status

The 250 ha project site is not situated within a protected area. However, the border of the Awash National Park is located about 6 km to the east and 3.5 km to the north (**Error! Reference source not found.**). The Awash National Park was established in 1966 and officially enacted by law three years later, with the main objective to protect threatened mammals. It consists of acacia woodland and grassland and is home to a total of 76 mammal species (including bats), e.g. East African Oryx, Salt's Did-Dik, Lesser and Greater Kudu, and Warthogs. The Awash NP is classified into IUCN Management Category II (National Park).

Boasting well over 450 species of birds, Awash National Park and its environs are known to be a birder's paradise (Jacobs and Schloeder 1993). The park as an IBA has over half of the Somali-Masai Biome species assemblage for the country (EWNHS 1996). Positioned in a strategic point within the Great Rift Valley that cuts diagonally through the country, it hosts more than 50% of northern migrant species that occur during the Autumn-Winter migration period. Many passerines including warblers use the flyway through the park crossing within the Rift Valley (Schubert 2015).

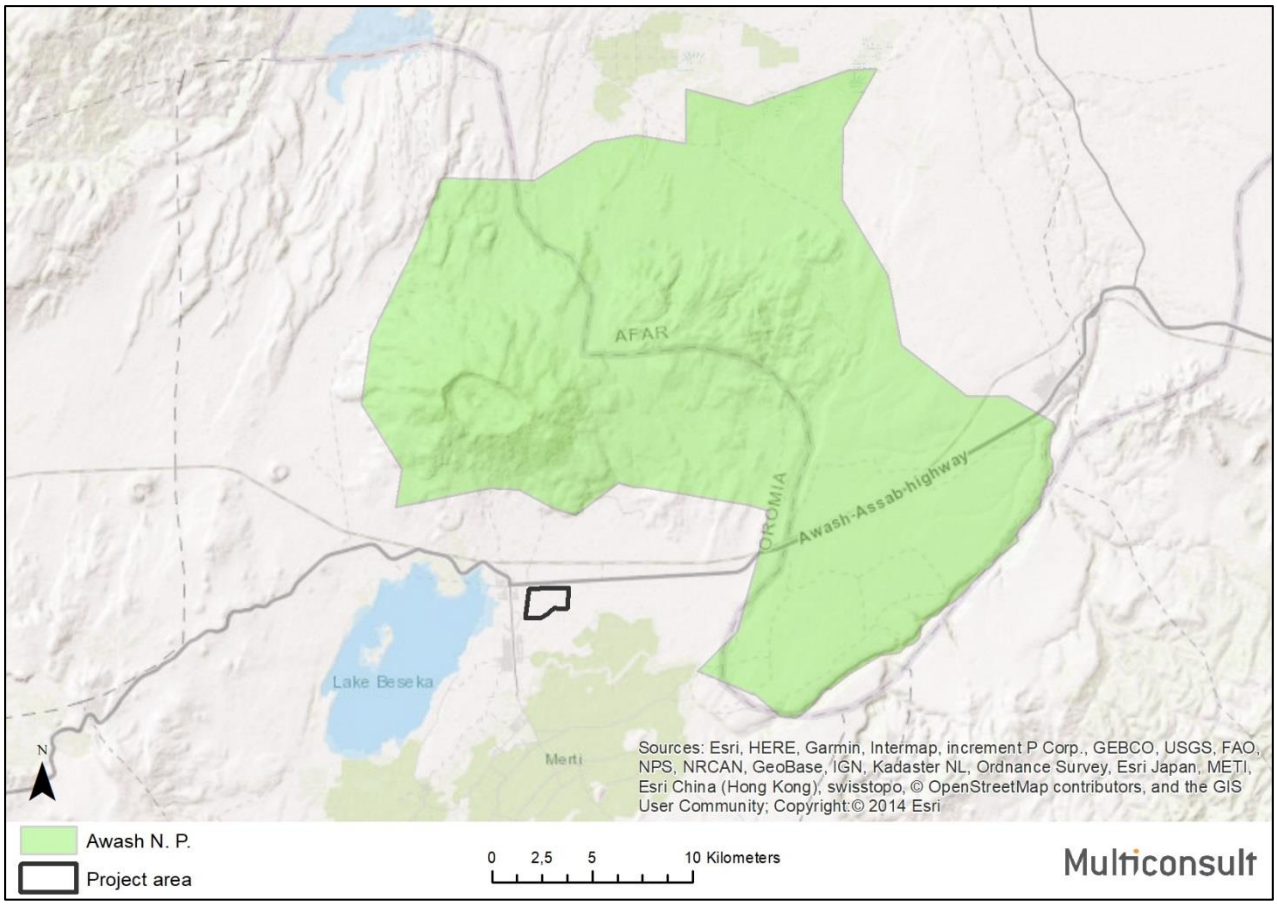


Figure 18: Awash National Park and the project site. Source: UNEP-WCMC (2019).

According to Zerga (2015), more than twothirds of the Awash National Park is either permanently or temporarily used for non-conservation related activities ranging from permanent settlements to extensive grazing. Indeed, there have been land use conflicts with pastoralists, especially the Karrayu, Ittu and Afar people, ever since the park was established in the 1960s. As a result, due to land claims by the

pastoralists, the boundaries of the Awash National Park were adjusted in 2011/2012. The total area of the park was then reduced from 756 $km^2$to 591 km^2.

From consultations with the park management and wildlife conservation agencies, the following points should also be noted:

- The total number of staff in the national park is 64, out of which 42 are park rangers. The rangers patrol the park and are also used as guides and guards for tourists.
- There is currently no management plan in place for the park.
- All national parks in Ethiopia are supposed to have a buffer zone, but Awash National Park does not have a defined buffer zone.
- There is no hunting in the park or outside. In general, people do not kill the wild animals even when they move into the farms.
- Wildlife is occasionally killed by traffic when crossing the main road and recently also the new Addis Ababa – Djibouti railway, especially those animals moving between Mount Fentale and Awash River. The animals cross the road and rail at many different locations, but there is no evidence of such wildlife accidents close to Metehara town. Bird collisions with the high voltage power lines crossing through the park have not been reported.

The project site itself has insignificant value for biodiversity conservation in terms of its potential as a future protected area. The land has been invaded by *Prosopis juliflora* supressing nearly all other plant growth and destroying any important habitats for wildlife. The short distance to Metehara town also contributes to a low value for wildlife/biodiversity conservation. The site has no legal protection status.

Value		
Low	Medium	High
|----------	|----------	|
▲		

5.2.2 Flora and Fauna Biodiversity

Vegetation

The vegetation cover at the project site is poor and scanty with much of the land being barren in the dry season and cultivated in the rainy season (although not in recent years due to drought). There is also frequent movement of livestock through the area. The dominant woody species is the invasive shrub *Prosopis juliflora*, a well-known weed in the drylands of Ethiopia with aggressive growth denying native plants water and sunlight.

According to the Atlas of the Potential Vegetation of Ethiopia (Friis et al. 2010), the climax vegetation around Metehara is *Acacia-Commiphora* bushland and woodland. This vegetation type was confirmed during the field study, but in a very degraded and depauperate form. It is generally characterised by drought resistant trees and shrubs, either deciduous or with small, evergreen leaves. The trees and shrubs often form an almost complete stratum and include species of *Acacia, Balanites, Commiphora, Capparis, Combretum* and *Terminalia.*

The *Acacia-Commiphora* deciduous woodland is currently under strong environmental stress. Extraction of fuel wood and charcoal for major towns in the country has increased the rate of deforestation and natural resource depletion. The ever increasing of woodland clearance for rain-fed agriculture and irrigation under takings further enhanced the vulnerability of the ecosystem.

The few plant species recorded at the project site are listed in Table 7List of plant species recorded at the project site

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Table 7List of plant species recorded at the project site

Species Name	Family Name	IUCN Threatened
Acacia Senegal	Fabaceae	No
Acacia tortilis	Fabaceae	No
Aervalanata	Amaranthaceae	No
Balanites aegyptica	Balanitaceae	No
*Carallumas*p.	Asclepiadaceae	No
Opuntiaficus-indica	Cactaceae	No
Prosopis juliflora	Fabaceae	No
Senna italic	Fabaceae	No
Sorobolusspicatus	Paocaeae	No
Suedamonoica	Chenopodiaceae	No
Ziziphusspinachristii	Rhamnaceae	No

Figure 19: **Prosopis juliflora** ***fruiting inflorescence.***

<u>Mammals, Reptiles and Amphibians</u>

With the proximity of the project site near a large urban setting, wildlife biodiversity is generally low, decreasing and stressed. On the other hand, being close to one of the oldest and biodiversity rich national parks in the country, there happens to be some incursion of wildlife into the project site.

Using the Awash National Park as a useful reference point, terrestrial fauna is generally of a sub-desert ecotype and dominantly relates to arid and semi-arid xerophyllous woodlands (Hillman 1993). Wildlife in this ecotype are hardy coping with high temperatures and most adapted to extended water scarce conditions. Animals such as the Defassa Waterbuck *Kobus ellipsyprimnus defassa*, Warthogs *Phacocoerusafricanus*and Baboons*Papioanubis/hamadryas*require daily watering and others including the Beisa Oryx *Oryxbeisa*can go for a few days without a drop. Some including the Salt's Dik-Dik *Madoquasaltiana* can live comfortably without seeing surface water for long periods of time. The presence of the Awash River flowing through the region is both an important feature and fulfils an ecological necessity without which wildlife or other life would not have existed at the present diversity.

While the Awash National Park is relatively close to the project area, there is no evidence (physical as well as anecdotal) that the space is used as a migration corridor, especially larger mammals. Wildlife migrations used to be more regular on this side of the park two or three decades ago. This has become more irregular and arrested with the growth of urban and agricultural development at Metehara town and the adjacent Metehara Sugar Factory.

According to the warden in Awash National Park, the wildlife is mostly confined within the boundaries of the park though stray animals can occur closer to Metehara town and in the sugar plantations (south of the project site). Since the park is traversed by the main road to Djibouti, wildlife road kills are sometimes reported, especially involving hyenas, warthogs, jackals and baboons. The animals cross the road at many different locations, hence there is no single point or hotspot for road kills. The new railway has become another obstacle for wildlife migrations between the north portion of the park (Mount Fentale) and Awash River. This risk is likely to increase once the rail traffic becomes more regular.

At the project site, anecdotal evidence suggests that Spotted Hyaena*Crocutacrocuta*(LC)and African Golden Wolf *Canisanthus* (LC) use the area regularly. Most of the wildlife incursion into the project site appears to come from the north mainly from the central part of Awash National Park including Mount Fentale. Field surveys at the project site have also revealed other mammals including Common Warthog *Phacocoerusafricanus*(LC) (two individuals seen), Scrub Hare *Lepus saxatilis* (LC) (two individuals seen), Mongoose*Herpestes sanguinea* (LC) and/or *Ichneumiaalbicauda*(LC) (indirect evidence from droppings, Crested Porcupine *Hystrix cristata*(LC) (indirect evidence from quills). There are also reptiles including the Leopard Tortoise *Geochelonepardalis*(LC) (one individual seen) on the project site.Crocodiles *Crocodylus niloticus* (LC) are common in Lake Beseka and the drainage canal as well as in Awash River. Amphibians were not observed during the field survey and the project site is unlikely to support any threatened and/or endemic amphibian species.

No bats were observed during the field survey. The project site has low potential for supporting bat populations although many bat species have been recorded in Awash National Park including the Lesser Horseshoe Bat *Rhinolophushipposideros*(LC) and Trident Leaf-nosed Bat *Aselliapatrizi* (LC).These two species were previously categorised as 'vulnerable' (VU). All the other bat species known to occur in Awash National Park are also 'least concern' (LC).

Birds

Important Bird Area (IBA): Despite the poor ecological status of the project site and the areas surrounding Metehara town, the site appears to be situated within an "Important Bird Area" (IBA) associated with the Awash National Park. The IBA extends beyond the border of the Awash National Park and includes part of Lake Beseka (**Error! Reference source not found.**).

The reason for adjusting the IBA boundaries away from the Awash National Park has not been documented but may have been done to produce a contiguous IBA that covers the park as well as the waterbird habitats of Lake Beseka. However, there is also a chance that the IBA boundaries are misrepresented on the BirdLife International map as suggested by other information stating that the IBA is identical to the Awash NP and of the same geographical size (BirdLife International 2018).

Based on the premise that an Important Bird Area (IBA) should be amenable to conservation, all protected areas fulfil the criterion of becoming an IBA (EWNHS 1996). As a result, Awash National Park by being a protected area is defined by its boundaries as an IBA. On the other hand, according to Fishpool and Evans (2001), an area estimated to be less than 50,000 km^2 and has two or more restricted range species qualifies to be an Endemic Bird Area (EBA). If the area has less than two species, it is termed as "Secondary Area". Ethiopia has three Endemic Bird Areas and one Secondary Area. Lake Beseka is within the "Awash National Park Secondary Area" by virtue of supporting a small population of the Sombre Rock Chat *Cercomeladubia* (DD) found on the black lava terrain around it. As mentioned above, Birdlife

International has placed both the National Park and Lake Beseka in a contiguous boundary, possibly to show that they share a similar ecosystem. However, it is unlikely that they have thoroughly thought out the consequences of managing the two sites together mainly because there is a growing urban area (Metehara) right in the middle of these two sites. Arguably, all areas outside this boundary by these definitions are outside the limits of an IBA including Metehara town and the area where the project site is proposed. Even though the project site is close to the Awash National Park, it does not fulfil the criteria of an IBA because there is no evidence (IBA criteria) to select this area as an IBA. However, with its position close to an IBA, it is believed that there would be interactions with or from the IBA.

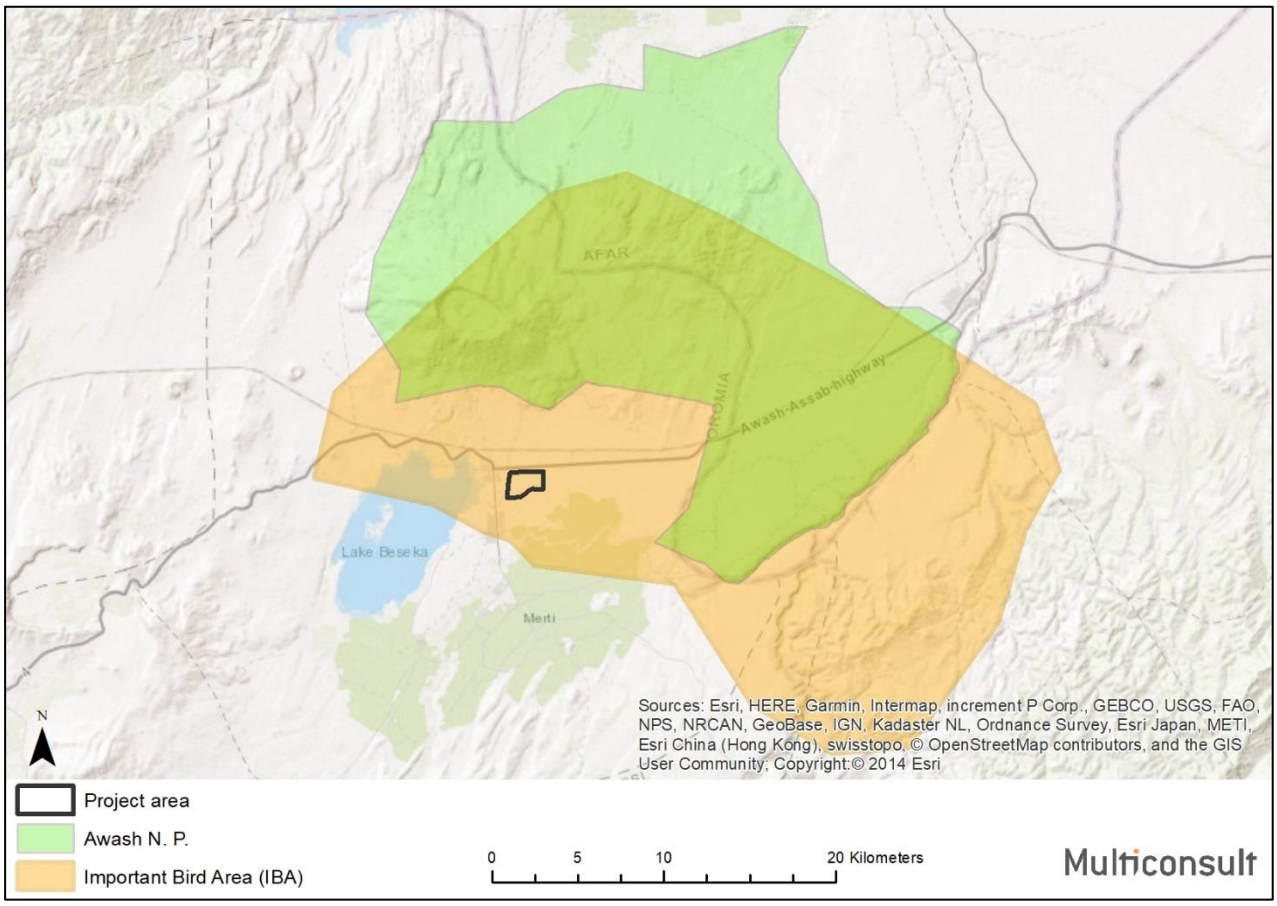

Figure 20: The Important Bird Area (IBA) and the project site.

The Awash National Park IBA is categorised as an "IBA in Danger" due to human/livestock encroachment into the park, pollution of the Awash River and Lake Beseka, and the presence of the highway road and railway which bisect the park. Based on the IBA criteria assessment done in 1996 (BirdLife International 2018), the Awash National Park IBA has 53 IBA trigger bird species, including one endangered (EN) bird species (Yellow-throated Seedeater *Crithagraflavigula*) and five near threatened (NT) species (Shining Sunbird *Cinnyrishabessinicus*, Abyssinian White-eye *Zosteropsabyssinicus*, Gillett's Lark *Mirafragilletti*, D'Arnaud's Barbet *Trachyphonusdarnaudii* andPallid Harrier *Circus macrourus*).

The park is situated on a major flyway for Palearctic migrants (Rift Valley / Red Sea flyway), with large numbers of warblers, raptors, storks and other species moving south through the area in September. Many species, and large numbers, of waterbirds have been recorded from the park—though some of these were probably recorded from Lake Beseka which, when it was much smaller and probably less chemically contaminated, was more productive than it is currently (BirdLife International 2018).

While the park is essentially an IBA by virtue of its protected area status, it also fulfils standardised criteria including the presence of biome assemblages and threatened species within its bounds. With the proximity of the park to the project site, it is presumed that threatened fauna share the similar ecosystem. Awash and its environs are categorized as Somali-Masai Biome and the birds found in this kind of biome would be the most likely to cross over and use the similar environment found at the project site.

Endemic species recorded within the park include Wattled Ibis *Bostrychiacarunculata*, (LC), Banded Barbet *Lybiusundatus* (LC), Abyssinian Woodpecker *Dendropicosabyssinicus* (LC) White-winged Cliff Chat *Myrmecocichlasemirufa* (LC), Yellow-throated Serin*Crithagraflavigula* (EN), White-billed Starling *Onychognathusalbirostris* (LC) and Thick-billed Raven *Corvuscrassirostris* (LC). However, none of these endemic birds were seen during the surveys at the site.

Birds recorded at the project site: IUCN Red List species known from the park and its surroundings, in addition to those mentioned above, are mostly Accipiters (birds of prey and vultures). Threatened species including the Egyptian Vulture (EN), Hooded Vulture (CR) and Rüppell's Vulture (CR) are among the species that have been observed soaring over the project area. This is the result of the site's proximity to Metehara town and the availability of food from waste dumps. However, these species do not breed or roost at the site.The site is not rich in bird species diversity. This can be directly related to low diversity of available habitats. The area is overtaken by the invasive *Prosopis juliflora* at shrub and tree level. There is however some diversity of vegetation at herb and grass level. It can be hypothesized that bird diversity would be higher for those species that depend on herbs and grasses, i.e. seedeaters and insectivores. A timed species count was carried out at three stations with the general assumption that the site could show higher relative abundance indices for those species that favour herbaceous and grassland undercover. Timed species counts give preliminary relative abundance indices especially for diverse communities.

The method involves walking at a constant speed through a habitat for a period of an hour. Each time a species is seen the time is noted and observations of the same species in consecutive observations on the same visit are ignored. The time taken to walk the habitat is subdivided into intervals and birds are scored higher the earlier they are seen. Precise estimation of indices for species at a site should ideally involve at least 8-10 counts. In our case, counts at three stations were conducted to present a general impression of relative abundance of various species at the project site.

Even though the sample size was small, it was evident even from the surveys conducted that vulture species including the Hooded, White-backed and Egyptian Vultures had the lowest relative abundance ranking higher in importance (higher rarity) than other species in the area. Species such as Shrikes also had lower relative indices. On the other hand, species like doves, starlings, quelea and weavers had a higher relative abundance (therefore relatively more abundant than other species). Species with higher relative abundance were mostly seed and insect eating birds. At Beseka canal south of the project site, water loving species including Egyptian Geese (LC), Marabou Stork (LC), Egrets and Herons were more abundant at or near water edges.

Conclusion

The project's area of influence is severely degraded due to the close proximity to the urban areas of Metehara town and invasion of *Prosopis juliflora* combined with rainfed cultivation and cattle grazing. On the other hand, the site is located only 3.5 km from Awash National Park and – arguably – within an Important Bird Area (IBA). It therefore represents a borderline case with respect to the 'critical habitat' classification in IFC performance standard 6. In general, internationally recognised areas of high biodiversity value, such as IBAs, will often qualify as critical habitat. However, given the uncertainty regarding the boundary of the IBA versus the Awash National Park, combined with the highly degraded environment in the project's area of influence, our professional opinion is that the affected habitat does not justify as critical habitat and should be rated as low-medium value in terms of biodiversity.

Value		
Low	Medium	High
|----------	|----------	|
▲		

Table 8 List of plant species at the project site

Common Name	Scientific Name	IUCN Status	Remarks
White-backed Vulture	*Gyps africanus*	CR	While the White-backed Vulture is one of the most common vulture species of Africa, it is slowly going into extinction due to poisoning and ill-planned development projects i.e. wind mills and power lines. It is an accomplished scavenger feeding on carcasses of wild and domestic animals all over the continent. Three birds were seen soaring over the project site during field survey.
Rüppell's Vulture	*Gyps rueppelli*	CR	The Rüppell's Vulture is another large scavenger found in Africa that depends almost totally on carrion and bones of dead animals. One bird of this species was seen passing over the site during field survey.
Hooded Vulture	*Necrosyrtesmonachus*	CR	Hooded vultures occur across sub-Saharan Africa. They are the most common scavengers at town dumps and garbage sites. They nest in large trees. Four individuals of this species were seen in proximity to Metehara town near a dump site.
Egyptian Vulture	*Neophronpercnopterus*	EN	This is another small vulture with an extensive global range. While this is a solitary bird it can form large congregations at roosts or feeding sites. It feeds at dump sites and also on carrion. One adult individual of this species was seen during field survey.

CR = Critically Endangered; EN = Endangered

5.3 Human Environment

5.3.1 Governance and Administrative Context

The Constitution introduced in 1995 created a tiered government system consisting of the federal government, regions, zones, districts (woredas), and kebeles (the lowest administrative units). Most responsibilities for the planning and implementation of development policies and programs, including the management and utilisation of natural resources are the responsibilities of the regional states. As depicted in **Error! Reference source not found.** below, the regional states are divided into zones, and further down to woredas and kebeles. The proposed project site falls within the territorial and administrative boundaries of Oromia National Regional State, East Shewa Zone, Fentale woreda, Gelcha kebele.

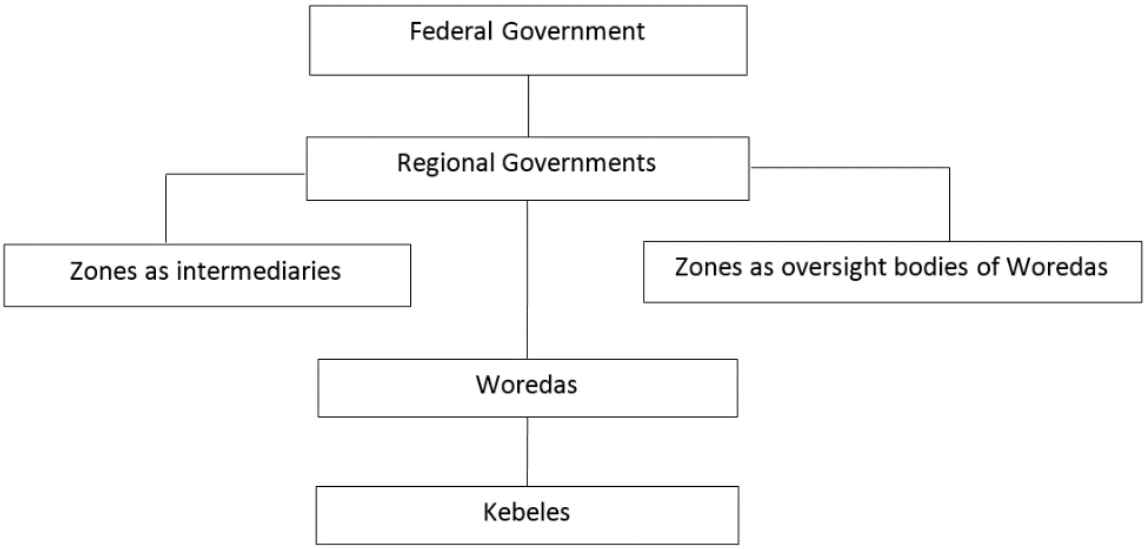

Figure 21: Ethiopia's decentralised government structure.

The project site is located close to Metehara town (administrative centre of Fentale woreda) specifically in Gelcha kebele (**Error! Reference source not found.**). Metahara town is 196 km from Addis Ababa along the highway to Djibouti and 96 km from Adama. The town is bounded in the east by Awash National Park; in the west by Lake Beseka; in the north by Mount Fentale and in the south by Metehara Sugar Factory and Awash River.

The administratively responsibilities of the Fentale woreda include:

- Implementation of the policies, laws and directives of the State
- Co-ordination of the activities of various offices in the woreda
- Maintenance of peace and security in the woreda through directing the respective police and security forces
- Planning and implementing projects
- Supervision of development programs in the woreda; and proper use and accounting of annual budget

Administratively, the responsibilities of the kebele include:

- Preparing annual kebele development plans
- Ensuring the collection of land and agricultural income tax
- Organising local labour and in kind contributions to development activities

- Resolving conflicts within the community through the social courts

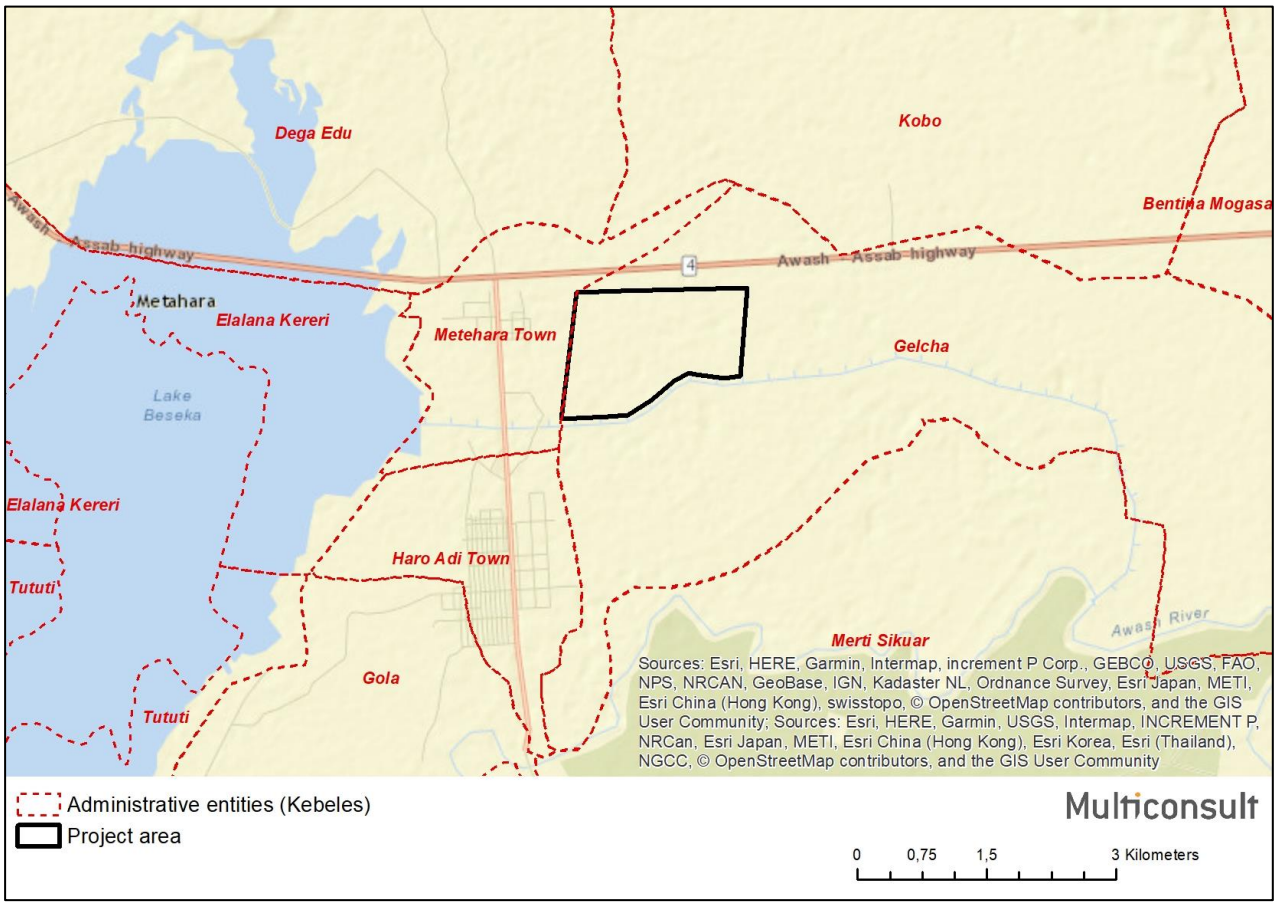

Figure 22: The project site and administrative boundaries.

5.3.2 Population Profile

Error! Reference source not found. gives the projected population in the project area as per the Ethiopian Central Statistical Agency (CSA 2007). It should be noted though that the figures for Metehara town represent only the resident population, which is most likely lower than the actual population. Due to its strategic location, Metahara town tends to host a substantial amount of transient population including travellers commuting to and from Addis Ababa to other major trading towns such as lorry drivers and traders, migrant seasonal workers employed by Metahara sugar factory (during the planting and harvesting periods), as well as the Saturday livestock market that attracts a huge number of people in form of buyers and traders.

Table 9: Projected population numbers (2016).

Level	Female	Male	Total
Oromia Region	13,398,927	13,595,006	26,993,933
East Shewa Zone	696,992	696,350	1,356,342
Fentale Woreda	38,474	43,266	81,740
Metahara Town	10,444	10,078	20,522
Gelcha Kebele	1,053	1, 131	2, 184

Source: CSA (2007)

With a total area of 1,169.85 km^2, Fentale woreda has an estimated population density of 75 people per km^2. The average household size in the project area is estimated at 6.1 persons. Most of the population is rural based. Gelcha kebele is estimated to have a total of 433 households (CSA 2007).

The majority of the inhabitants in Fentale woreda are Muslim (43%), while 28% are Ethiopian Orthodox Christians and the rest are Protestants, Catholics or practice traditional beliefs.

The primary ethnic groups in the woreda are the Karrayu and Ittu Oromos. The Middle Awash Valley was originally controlled by pastoral and agro-pastoral groups who grazed their livestock on the plains between Mount Fentale and the Awash River. These included the Karrayu people, whose territory is bordered by the Afar, Ittu Oromo, Arsi Oromo and the Issa Somali, with a complex history of conflict and competition over land use (Beyene and Gudina 2009).

The Kereyu people are identified indigenous based on the screening agreement made between the Ethiopian Government and the World Bank on 2013. They are pastoralist inhabitants of the Metehara plain and Mount Fentale. Because of consecutive drought happened in the area they have started practicing agro-pastoralism. They are governed by the Geda system, an ancient and complex form of African democracy. It is traditionally based on generation sets which alternate power every eight years. As far as ethnic composition of heads of the survey households is concerned, results of the survey reaffirmed that with respective proportions of 56.1% and 40.5% of the total survey households, Karrayu and Ittu Oromos constituted the two major ethnic groups in project affected communities. Other ethnic groups (Somali, Kembata and Berta), who are believed to have migrated to the area in search of farmland and other livelihood opportunities at different periods in time, together constituted the remaining 3.5%.

Although the Karrayu belong to the same language group—the Oromo—some aspects of their cultures differ from the Ittu. The Ittu practice agro-pastoralism and are almost exclusively Muslim while the Karrayu are primarily herders who mostly practice their indigenous religion. However, this distinction has faded in recent years as the Karrayu have been rapidly converting to Islam and have become increasingly involved in farming (Gillingham 2001), the latter due to a decline in pastoral livelihoods (Abdulahi 1998).

In addition, since the 1960s, the creation of protected areas and the establishment and expansion of large-scale commercial farms throughout the Awash Valley, especially along the floodplains of perennial rivers, has led to reduced access to traditional grazing lands, watering points and ceremonial sites. It has been estimated that these development schemes have expropriated more than 55 percent of traditionally accessed Karrayu land.

As per the agreement of the Ethiopian Government with the World Bank joint screening in 2013, Karrayu ethnic group is recognized under the category of Underserved People, meeting the criteria of WB PS-7, thus, requires the application of this Performance Standard. This issue needs to be explored further in the next phase of project development when all the PAPs have been identified (by Fentale Woreda). While the land users (PAPs) have confirmed their willingness to vacate the 250 ha of land (instead of the previously proposed tract of land), a process of free, prior and informed consent (FPIC) needs to be documented. Furthermore, the livelihood restoration planning (as part of the full RAP) must pay special attention to the rights of Indigenous Peoples.

Vulnerability Analysis

Farmers and pastoralists living in semi-arid and arid lowlands are heavily reliant on rainfed agriculture and livestock rearing. Thus, when water is scarce due to drought or erratic rainfall, crops face greater risks of failing, more livestock resources perish, and pastoralists and farmers have to travel greater distances to access water for their households and animals (Shitarek 2012). Drought is one of the most probable climate shocks, regularly affecting food production, livestock production and livelihoods of the poor. Since the 1970s, the severity, frequency and impacts of drought have increased and the areas affected by drought and desertification are expanding. Emergency situations in pastoralist areas are characterized by a lack of adequate water for both humans and animals and depleted food resources. As a result, average livestock holdings per household have declined among the Karrayu, and all pastoralists in the area have

become increasingly vulnerable to food insecurity—especially during extended dry seasons and drought years (Beyene and Gudina 2009).

5.3.3 Land Use

Land Tenure and Land Rights

According to Article 40.3 in the Constitution of the Federal Democratic Republic of Ethiopia (1995), land is the common property of the Ethiopian people and cannot be subject to sale or to other means of exchange. Rangelands, forest area, and mining places are communally owned under the administration of clans, while private user rights are issued for farmland and residential areas.

Ethiopian people have a right to obtain land without payment and the protection against eviction from their possession (Article 40(4)). Ethiopian pastoralists have the right to free land for grazing and cultivation as well as the right not to be displaced from their lands (Article 40 (5)). Every Ethiopian shall have the full right to the immovable property he builds, and to the permanent improvements he brings about on the land by his labour or capital. This right shall include the right to alienate, to bequeath, and, where the right of use expires, to remove his property, transfer his title, or claim compensation for it (Article 40 (7)).

As per the Proclamation No.456/2005 regarding Rural Land Administration and Land Use, peasant farmers, semi- pastoralist and pastoralist who are given holding certificates can lease to other farmers' or investors' land from their holding of a size sufficient for the intended development in a manner that shall not displace them (Article 8(1)).

Consultations with the woreda administration and Gelcha kebele community revealed that an estimated561households have land use rights in the proposed project site. This figure is surprisingly high for only 250 ha of land that seems to have limited potential for agriculture (and that has not been cultivated for some time), and no formal documentation has yet been provided. Preliminary data from the Rural Land Administration and Use Office in Fentale woreda suggest that approx. 200 ha have been used for rainfed farming and 31 hafor livestock grazing.

Women's rights are protected by the Ethiopian Constitution, but male dominance remains entrenched in both public and private spheres. Subjugation of women in society is commonplace. Constitutionally, women have the right to acquire, administer, control, use and transfer property. In particular, they have equal rights with men regarding use, transfer, administration and control of land. They shall also enjoy equal treatment in the inheritance of property (Article 35(7)).

The 1995 Constitution, while affirming gender equality and prohibiting discrimination on the basis of sex, reflects customary principles in that the right of married women to land is based on their husband's claim as head of household. The problem with the protection of the rights of women, is not the absence of laws but lack of awareness, traditional practices curtailing rights of women, and absence of strict observance of the laws by government institutions.

However, recent policy changes related to gender equality and women's empowerment in Ethiopia are affording women greater protection in terms of land ownership. For examples, certification of land use rights at the community level allows husbands and wives to be listed as joint holders of the rights (these rights are inheritable by the remaining spouse when the other spouse dies).

Land Use

There is no systematic land use planning or zoning in Fentale woreda or Metehara town. However, the project site is situated outside the urban town area, with its western perimeter running along the boundary between the rural Gelcha kebele and Metehara town.

Consultations with the directly impacted land users revealed that the proposed site has not been used for agriculture or livestock grazing since the severe 2016 drought. This has contributed to the invasion of the weed *Prosopis juliflora*. Prior to the 2016 drought, the land had been used for the cultivation of teff, a main food crop in Ethiopia, in combination with livestock grazing. It is believed that with improved weather conditions (more rains), the 250 ha would still be viable land for crop farming. Animal movement tracks/routes were observed across the proposed project site and it was reported that these are tracks used to access the watering points and seasonal grasslands.

According to preliminary data from the Rural Land Administration and Use Office in Fentale woreda, combined with own ground truthing, an estimated 33 housing structures are located within the boundaries of the project site, mainly along the northern perimeter (30) and in the south-east corner (3). These are clustered into homesteads as shown in **Error! Reference source not found.**. The settlements are mostly semi-pastoral types of structures such as traditional tukuls built form local materials but there are also some more permanent structures. Walls are typically of mud and wood, floors with earth, while roofs are made of grass or corrugated iron or plastic.

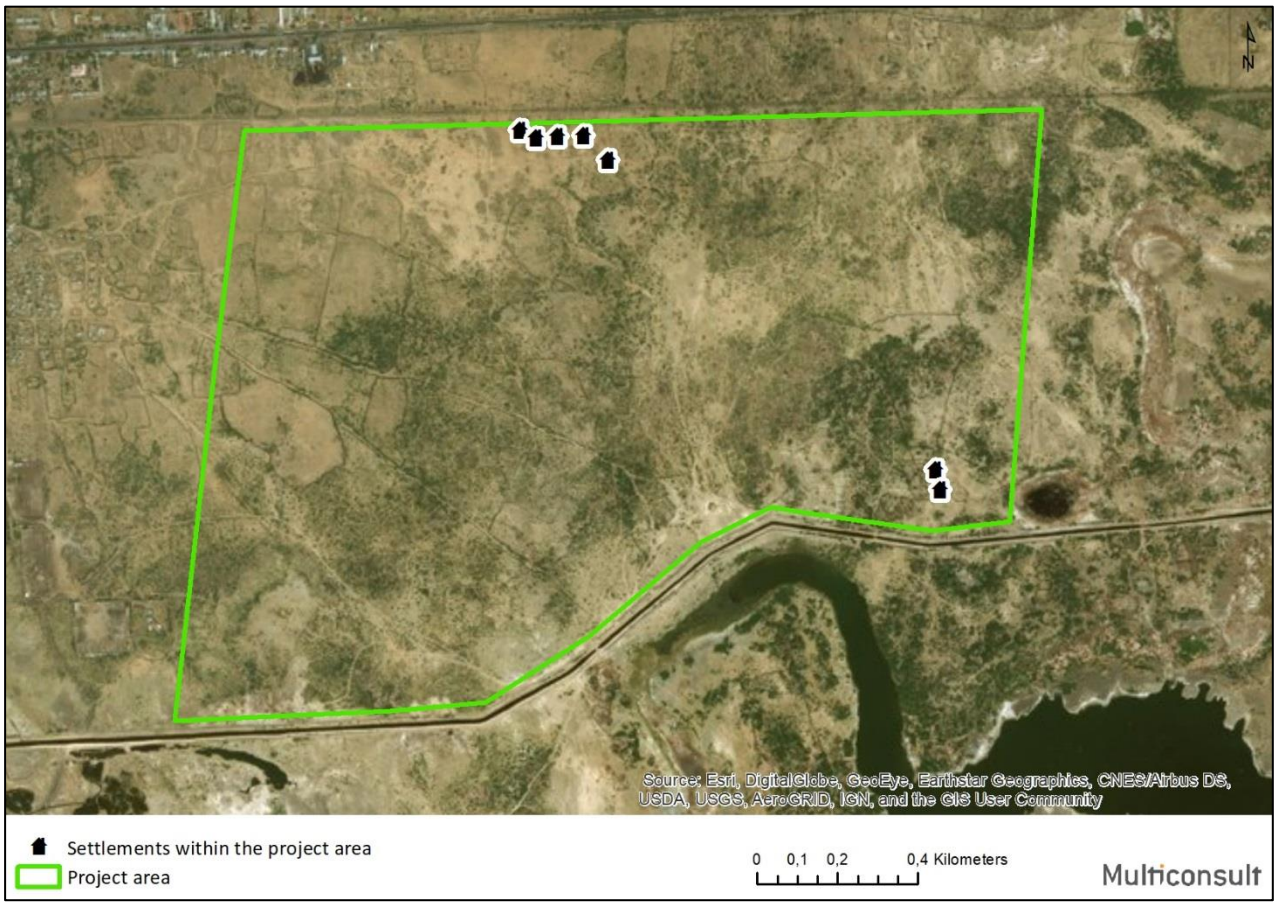

Figure 23: Location of residential homesteads on the project site.

There are several EEP transmission and distribution lines in the Metehara and Gelcha area, including a short section of a 15 kV distribution line from Metehara substation (2.2 km north of the site) to Metehara Sugar factory (1.5 km south of the site) which intersects the project site in the north-west corner near Metehara town.

Land use to the south of the project site is dominated by the Metehara Sugar Estate, the main industrial enterprise in Fentale woreda. It has a concession of 14,400 ha, of which 10,231 ha are currently planted. The total available land is about 13,300 ha due to loss of some land to local farmers (who have been permitted to cultivate on the margins of the concession area) and to the expanding Lake Beseka (which is

currently being controlled by the drainage canal from the Lake to the Awash River). The irrigation intakes are located on the Awash River with a total abstraction capacity of 3.2 m^3/s and 8.4 m^3/s, respectively.

Land Accessibility and Availability

According to the socio-economic survey among the directly impacted land users, the median size of land holding per user is 0.75 ha, with the smallest being 0.25 ha and the largest 7 ha as illustrated in **Error! Reference source not found.** below. This average landholding is slightly bigger than the regional average of 0.64 ha per household.

Sixty five percent (65%) of the directly impacted land users own plots of equal or less than 1 ha while only 34% had access to land bigger than 1 ha. Fifty one percent (51%) of the directly impacted land users do not own land elsewhere, and 77% of those without plots elsewhere indicated that they expect difficulties in acquiring replacement land due to the overall land scarcity. From the gender perspective, there was no obvious disparity between female and male-headed households in relation to land accessibility. The general observation was that the majority (56% female-headed and 65% male-headed households) all had access to small plots of land (≤1 ha).

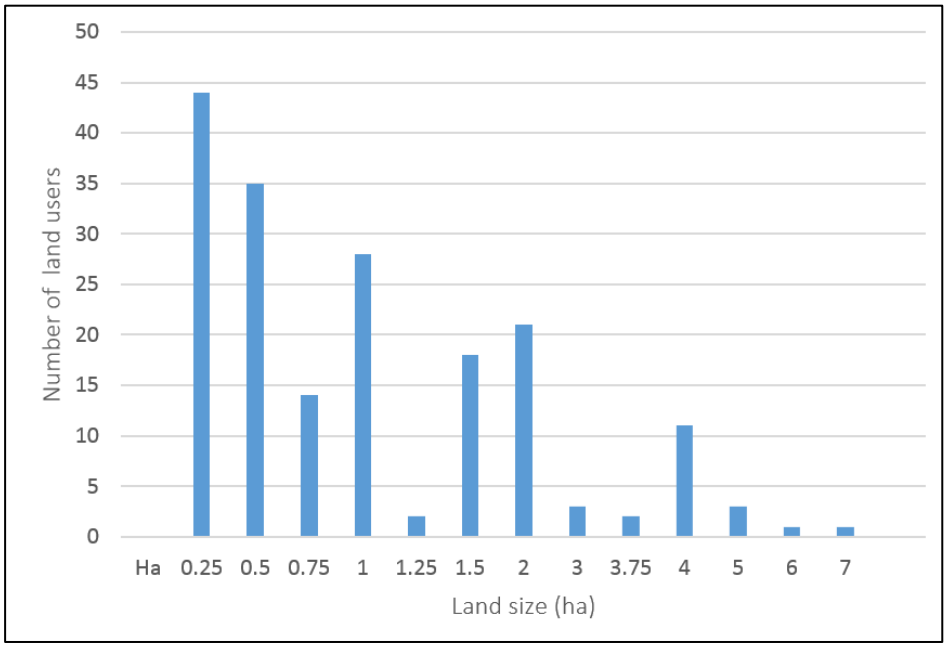

Figure 24: Landholding size per household.

5.3.4 Livelihoods and Economic Activities

Agro-pastoralism

Agro-pastoralism is the mainstay for the rural households in the project area. Historically, the rural households were pastoralists, but due to climate change, reduction in rangelands and population growth, pastoralism has proved challenging forcing communities to adopt farming as a supplement to the pastoral activities. The socio-economic survey indicated that teff is the main crop grown, with an estimated yield between 12.5 and14.8 quintal/ha. The current market price of teff is 2,500 Birr/quintal.

The key constraints to agro-pastoralism in the woreda is the shortage of land and the climatic conditions. As reported above, the majority of households have less than 1 ha of land for both crop farming and livestock keeping (although some grazing probably still occurs on communal land). With an average

household size of 6.1 persons, the size of land is hardly sufficient to meet the household's food requirements. Households are therefore forced to rely on the market for food.

Livelihoods of rural households in Ethiopia are deeply linked to the cycles of seasonal change, that is, the onset of rains, the peak of the rains and the end of the rains, with each season signalling a different set of activities and reliance on different food and income sources. Fentale woreda has a bimodal rainfall pattern with two peaks in rainfall. The first half is known as the "belg", the second half as "kremt". The belg rains have proved to be notoriously unreliable, characterised by late arrival exposing communities to the risk of hunger. In the project area, people tend to experience the hunger seasons from December to March. Failed rains result into a spiral of challenges for the household economy.

The main crops grown are sorghum, maize, millet and teff. According to the socio-economic survey, teff is the main crop grown at the project site as reported by almost all directly impacted households. Teff was reported to be grown mainly for consumption (but it is likely that some of the harvest is also sold). Other studies indicate that green maize and haricot beans are also grown in the area. Green maize is mainly used as a coping food during the hunger period.

Employment

The unemployment rate in Metehara town is 20.2% with higher unemployment among females at 30.5% than males at 12.6% (CSA 2007). The major employer in Fentale woreda is the Metehara sugar factory at Metehara Merti south of the main town. The sugar estate employs roughly 3,000 permanent staff in addition to 5,000 seasonal labourers during the planting season (usually from mid-October to end of June). The total population of the enterprise consisting of employees and their families is estimated at 45,000 people. The estate provides free housing, water, electricity and medical services to its employees. During the harvesting period, Metehara sugar factory alone has more than 6,000 day-labourers. Most of the day-labourers come from Wolaita in SNNP Region (south of Oromia) and usually stay for about eight months of the year.

Other sources of employment in Metehara town include government institutions like the local administration, schools, and hospitals. Industries and factories like the steel recycling plant east of Metehara town and the livestock market and Elfora Abattoir also offer employment opportunities.

Informally, poor households depend to a significant extent upon agricultural labour as a source of income during the hunger period. They offer labour for crop cultivation, weeding and harvesting to the economically better-off households. However, in periods of rain failure, the demand for labour drops resulting in a reduction in household income. Reduced incomes combined with increased food prices exposes many households to seasonal hunger.

Business and Trade

Over 300 people are involved in petty/informal trade in Metehara town. The businesses range from sale of household items to groceries, fabrics, agricultural and livestock products and crafts. They take form of seasonal markets to permanent establishments like kiosks and shops. Women are more involved in most informal establishments that require less capital compared to men who run larger businesses.

Fishing

There are also fishing activities on Lake Beseka. The total number of fishermen is about 50. Main fish types are catfish and one kilogram costs about 50 Birr in Metehara (ERM 2016).

Livestock Production

At the household level, livestock plays a critical economic and social role in the lives of pastoralists, agro-pastoralists, and smallholder farm households. Livestock fulfils an important function in helping people cope with shocks and accumulate wealth, and it serves as a store of value in the absence of formal financial institutions and other missing markets. In smallholder mixed farming systems, livestock provides nutritious food, additional emergency and cash income for farm inputs, educational and medical expenses and fuel for cooking food. Livestock support and sustain the livelihoods of pastoralists (Hurissa and Jemberu 2002, Gebremedhin et al. 2007).

In Fentale woreda, the most dominant livestock are goats (34%), cattle (25%), sheep (16%), camel (11%) and others (13.5%). The socio-economic survey revealed that most project affected households keep goats and sheep with an average of 15 goats per household and three (3) sheep. Female-headed households own an average of 13 goats while male-headed households had an average of 16 goats. This compares well with the national estimated average of 16 goats per household. From the gender perspective, there is no observed disparity among the female and male-headed households regarding the number of livestock owned but disparities may exist in relation to the type of livestock. It should be noted that the reported number of livestock is always prone to error, especially in pastoralist communities.

Figure 25: Livestock moving across the project site.

Households largely rely on communal grazing and crop residues to feed their cattle, and this is becoming increasingly challenging for the livestock keepers due to expanding crop areas and hence decreasing pasturelands. Population growth, the expansion of development schemes in form of commercial farms and community irrigation schemes as well as the restrictions on livestock grazing within the protected areas (Awash National Park) all account for the reduced pasturelands. The gazetting of the Awash National Park resulted in blockage of some of the seasonal livestock movement routes to watering points.

Other challenges associated with livestock keeping at the national level include the lack of access to veterinary services feed supply constraints. Communal grazing as a source of livestock feed has begun to decline in recent years, due to the increasingly intensive crop cultivation, climate change and land pressure. All these factors have forced livestock keepers to adopt a diversification strategy that allows them to mitigate both risks of crop failure and losses of livestock (Rashid et al. 2013).

From the gender perspective, Oromo women are mainly involved in milking and processing of dairy products including fluid milk, fermented or sour milk (ergo), and traditional cheese (ayib), and the dairy products are generally in the exclusive control of the women. They decide on the distribution between family consumption; conversion into other products such as ghee, gifts (to maintain social relationships), and sales. Women generally control the cash income they receive from sales of milk, although if the business increases significantly in size this may change. Men generally control the sale of livestock. Most of the cottage dairy products are consumed on-farm or in nearby towns. Fresh fluid milk is marketed within close proximity of its production areas. Marketing of dairy products over significant distances is limited due to perishability (Watson 2010).

In some of Ethiopia's pastoral areas, increasing diversification is enhancing the economic status of some pastoral women and challenging the status of men. As livestock become less important to the household economy, particularly in peri-urban areas, women engage in income generating activities (sale of firewood and handicrafts, petty trading, etc.) and are increasingly involved in agriculture but without a corresponding increase in their control of the income derived from cultivation (Watson 2010). Due to climate change, women are seen taking on additional responsibilities including herding, watering, and selling small stock; making handicrafts caring for young animals; taking animals to water; getting forage for calves, and weeding the crop farm (Eneyew and Mengistu 2013)

The key shocks and trends affecting pastoral populations in Ethiopia have different impacts on men and women, and can also change gender roles and relations. One of the common consequences of drought (and climate change) is the migration and/or splitting of the pastoral household. If men move away with the livestock, women have reduced access to livestock products and may have to depend on firewood collection and other income generation activities. They may also lose some of the social power that is mediated by their menfolk. Workloads increase for all, particularly women, as water, grazing and fuelwood become more difficult to find. If the men migrate for wage labour as a drought strategy, the women are left with the extra burden of managing the stock, which may however increase their decision making power and social status, at least temporarily. Migration and separation can also increase women's personal vulnerability: with the absence of their male family members, women are less protected and may be vulnerable to attack when they search for firewood or water, or supervise livestock. In situations of conflict, this vulnerability is greatly increased (Watson 2010).

Household Income and Expenditures

The average Gross National Income (GNI) per capita in Ethiopia is USD 971, which is below the average value for Sub-Saharan African countries of USD 1,966. The purchasing power of rural households remains weak with almost 40% of the rural population living in poverty, and about 29% of the population living in extreme poverty with an income of less than one dollar per capita per day (UNDP 2011).

According to the socio-economic survey among the project affected households, food items form the biggest portion of the household budget, followed by medical bills, water, clothing and school fees. The food expenses include food for both humans and animal feed. Households have limited expenses on housing, probably because most families own their homes. Similarly, they have limited expenses on energy which could be attributed to the reliance on fuel wood for cooking and lighting which usually is free of charge by use of forest and animal products. None of the households reported having any savings, implying that the incomes are too low and are usually fully consumed by the household.

Despite the high expenditure on food items (estimated 24,622 Birr/month), 41% of the respondents reported having received relief assistance from government and non-governmental organisation in the previous season.

Table 10Expenditure among the project affected households.

Item	Percentage of Total Household Expenditure
Food	52
Transport	38
Medical bills	6
Clothing	2
Rent	0
Fuel	0
Electricity	0
Water	2
School fees	<1
Savings	0

Assets

The key assets owned by the communities are limited to livestock, labour and land for most of the households. However, households with better propensity to pay for labour tend to be better off than the households that can afford hired labour or do not have enough of its own labour resources. Selling of labour is among the coping strategies adopted by poorer households during the hunger periods. None of the directly impacted households reported owning any communication devices like mobile phone, television or radio. They also did not own any major farm tools or transport equipment.

Welfare Support and Protection Services

Since 2004, the Government of Ethiopia introduced its National Food Security Programme (NFSP) which includes the flagship social transfer programme and the Productive Safety Net Programme (PSNP). The latter is Ethiopia's major vehicle for social protection, which has provided transfers to poor and food insecure rural households for more than a decade. The PSNP has two components: public works for adults with labour capacity, and direct transfers for adults and dependents unable to undertake the physical labour required for the public works projects due to illness, disability and age (children and older people).

Ministry of Health also implements an Indigent Health Fee Waiver programme for the poorest. For the rest of the population, financial protection in case of illness is provided through the Social Health Insurance Scheme (among formal sector employees and their family members) and Community-Based Health Insurance (CBHI) for the informal sector and rural population. Health insurance and the Indigent Health Fee waiver schemes are steadily rolling out, but issues with coverage mean that universal social health protection is still a long way off, with only 1.2% of the population insured and the Indigent Health Fee Waiver programme only covering 6% of those estimated to be living below the poverty line.

Other social protection interventions include the school feeding programme in selected regions, free waivers for the most vulnerable to access health services related to outpatient therapeutic feeding of severely malnourished children, communicable diseases, immunisation and maternal health care (CSA 2015).

The coverage of these welfare support systems among the project affected households could not be documented but is likely to be minimal.

5.3.5 Infrastructure and Services

Transport and Traffic

The main highway from Addis Ababa to Djibouti (i.e. Adama/Nazreth – Awash) and the new Ethio-Djibouti standard gauge railway connecting Ethiopia to Djibouti pass through the area about 250 m and 1.2 km north of the project site, respectively (**Error! Reference source not found.**). There are two planned train stations (Metehara and Benti) close to the project site, but they are not yet open for operations, hence cargo transport continues to be mainly by road. This is resulting in high traffic volumes along the Addis Ababa to Djibouti road as illustrated in **Error! Reference source not found.** below. Consultations with the local authorities revealed that the train operates with two scheduled trips for cargo per week. It is expected that the number of trips will increase in future, and an inland port is planned in Metehara.

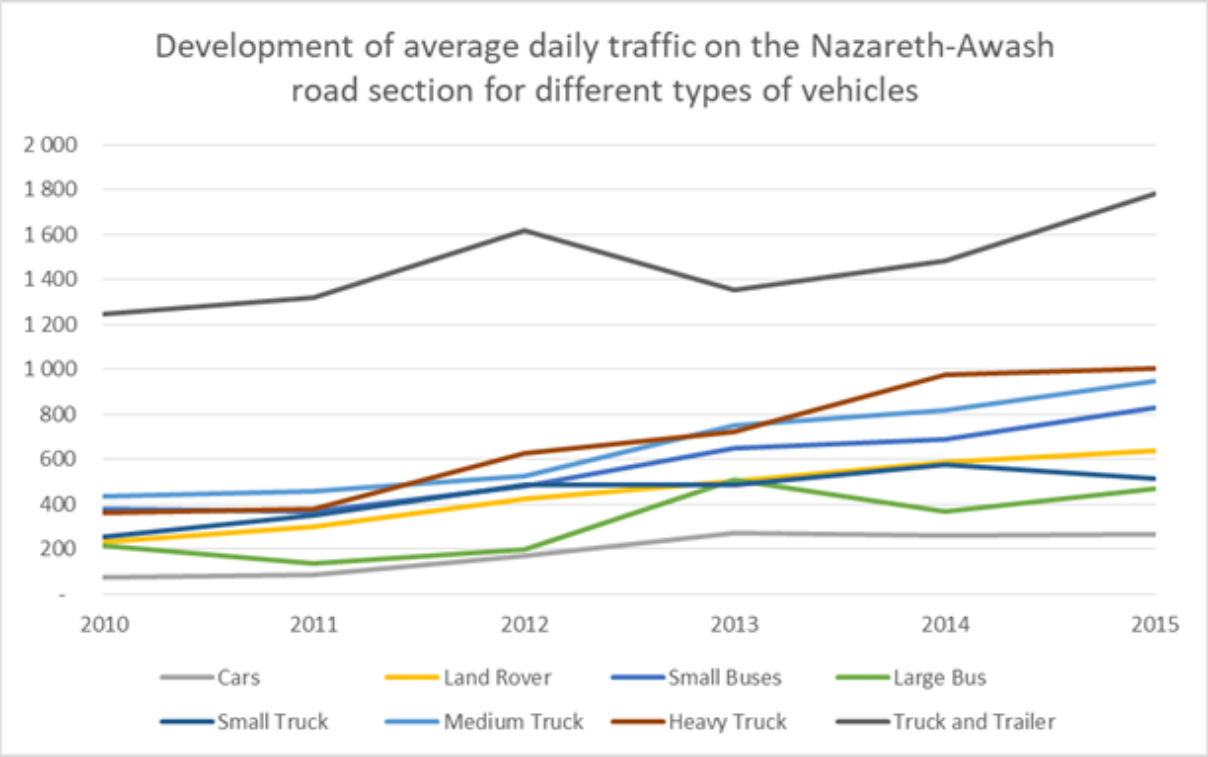

Figure 26: Traffic data for the Nazreth/Adama-Awash road.

Airport

There is no airport in Metehara town or in close vicinity of the project site. The nearest airports are Harar Meda Airport in Bishoftu (100 km to the west) and Bole International Airport and Lideta Airport in Addis Ababa (130 km to the west).

Health Facilities and Services

Ethiopia has a three-tiered health system comprising of the primary health care units at woreda level, the general hospitals and the specialised hospitals. The primary health care unit consists of a primary hospital with capacity of services for up to 100,000 people; health centres with services for about 25,000 people; and health posts with capacity of services for about 5,000 people.

According to Fentale Woreda Health Office, there is currently one government hospital (in Metehara town), four health centres, four clinics and 18 health posts in the woreda. In addition, there is a hospital at the Metehara sugar estate (see below). The staffing levels in the government health institutions are as shown in Table 11Staffing of health personnel in Fentale woreda

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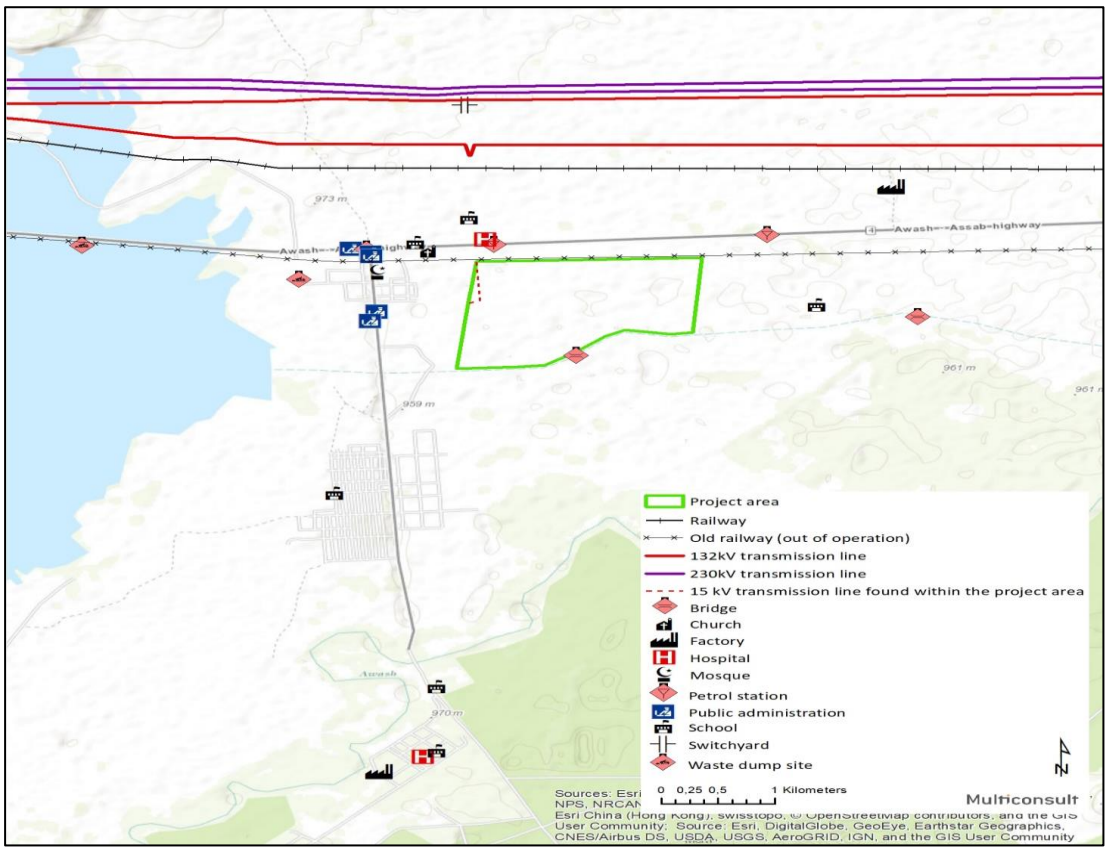

Figure 27: Map showing different infrastructure and services around the project site.

Table 11Staffing of health personnel in Fentale woreda

No.	Qualification	Number
1	Midwives Diploma	7
2	Midwives Degree	2
3	Nurse CN	29
4	Nurse B.Sc.	7
5	Druggist	4
6	Pharmacist	2
7	Health Officer	4
8	Health Extension Workers	66
9	Lab Technician	2
10	Administrative Staff	40
	Total	163

The most well equipped hospital in Fentale woreda is the Metehara Sugar Estate Hospital. The hospital has an inpatient department with bed capacity of up to 60 patients and is staffed with two medical doctors, 14 nurses, seven lab technicians, two pharmacists, three pharmacy technicians, four mid-wives, and two health officers. They also operate two polyclinics and four satellite clinics. These health facilities are used by the employees and their families (free services) as well as by the wider community. Maternal care is a free service to all. The nearest referral hospital is Adama General Hospital and Black Lion Hospital in Addis Ababa.

Seven private clinics were registered in Metehara town. The services of the private clinics are limited to outpatient services for non-complicated cases as well as pharmacy services for patients requiring routine drug fill-ups (ERM 2016).

Figure 28: Metehara Sugar Factory Hospital (also known as Merti Hospital).

Water Supply

Only 49% of the rural population in Ethiopia have access to safe drinking water. In comparison, 38% of the population in Fentale woreda have access to safe drinking water (ERM 2016). Furthermore, 23% of the urban population in Fentale woreda have access to piped water (CSA 2007), while 41% of the project affected population have access to safe drinking water through the MSF canal water (piped water scheme for Metehara town). The remaining 59% rely on other sources.

The main source of water for irrigation and drinking in Metehara is the Awash River. The river is affected by water abstraction for irrigation and by pollution, mainly from industries in the upper catchment and also from Metehara Sugar. The water supply for Metehara town is sourced from the Awash River, and local herders from around the project site also take their livestock to this river for drinking.Potable water is transmitted to Metehara town through a piped water system from a main abstraction point on the Awash River. The rural communities access safe water supply through ground water sources like boreholes.

Other public water supply facilities (cattle trough and a livestock watering point) were observed just outside the site in the north-east and south-east corner, respectively. These facilities are used occasionally for livestock watering despite the poor water quality.

Lake Beseka and the associated drainage canal are located about 1 km west of the project site. The Beseka canal borders the project site to the south. Lake Beseka and its drainage canal is occasionally used watering livestock watering on their way to the Awash River. 50% of the households interviewed reported that water for bathing and washing is collected from Lake Beseka.

Access to safe water supply is generally difficult in the project area due to the high concentrations of fluoride as well pollution from the upper catchments of Awash River and from the sugar plantations. According to the local authorities, the woreda struggles with acute water supply challenges.

The poor access to safe drinking water increases the burden of women who, based on the traditional division of labour, have the responsibility for water collection for both humans and livestock (the sick and calves).

Sanitation and Waste

According to the 2014 UNICEF Joint Monitoring Programme, only 24% of the rural communities in Ethiopia have access to improved sanitation services. In Metehara town, the 2007 census reported that 50% have access to either shared or private unimproved pit latrines, 11% have access to either shared or private ventilated improved pit latrines, 38% have no access to sanitary facilities and 24% have access to either shared or private flush toilets (CSA 2007). The socio-economic survey among the project affected households revealed that only 5% have access to basic sanitary facilities while 95% do not have access to any sanitary facility.

In addition to sanitary waste, other types of wastes in Metehara town include industrial waste, agricultural wastes and domestic wastes. The main source of industrial wastes is the sugar factory, mainly residues from the sugar processing. Other sources of potentially hazardous waste include the metal recycling factory and the livestock market and abattoir.

There is a landfill close to Lake Beseka, west of Metehara town, as well as several other smaller waste dump sites. Waste sorting is not a common practice and waste handling is mainly by burying and burning (47%), followed by open space disposal (19%), dumping at the municipality landfill (14%) and dumping in the river (20%) (CSA 2007).

For safe disposal of larger quantities of waste (and potentially also hazardous waste), it should be noted that a new sanitary landfill is being constructed in Sendafa outside Addis Ababa.

Energy

Firewood constitutes the greater portion of domestic energy supply for rural kebeles which results in the depletion of forests and woodland. The major sources of energy for lighting and cooking in the rural parts of the project area are firewood, crop residue and charcoal as reported in the socio-economic survey. It is usually the women's responsibility to fetch firewood or timber for household use.

Metehara town is connected to the national grid and the urban dwellers have access to electricity. Electricity use is limited to lighting (92%) and phone charging (14%) for the majority of the households. Only 1.5% use electricity for cooking due to the high electricity costs (CSA 2007). Both rural and urban households use charcoal and firewood for cooking. According to CSA (2007), 20% of the households in Metehara town use cow dung for cooking. Other sources of energy for lighting are kerosene and firewood.

Communication

Mobile network services are available within Metehara town. Metehara and Merti (sugar estate) have agent public phone and post offices department that provide communication services for all the woreda population. 14% of the population in Metehara town have access to mobile phones, 33% have access to a television, and 61% have access to radio. In contrast, none of the directly affected households have access to television, radio or mobile phones.

Ethiopia has made several attempts to increase available broadband by laying 4,000 km of fibre optic cable along the country's major highways, by making overtures to the East African Submarine Cable System and by connecting Addis Ababa to the existing fibre optic networks in Port Sudan and Djibouti.

Currently satellite internet is available to some large corporations, but individuals are not permitted to have private satellite connections. The Ethio Telecom (formerly ETC) also bans the use of VoIP (voice over IP) in internet cafés and by the general population, though its web site lists VoIP as part of the company's future broadband strategy.

Markets

Metehara livestock market is one of the two most important source markets for exportable livestock in the Central Rift Valley where all types of animals are sold and where all types of market participants operate. Metehara is a secondary market where small traders bring shoats from Afar and the surrounding primary markets. Abattoirs and live animal exporters purchase significant number of animals from Metehara. Marketing of livestock is a male dominated activity, with the women's contribution limited to sale of other livestock products like diary and dairy products in small volumes.In Metehara town, other domestic products are sold locally to the residents of the town and surrounding areas.

Housing

The general settlement pattern in the project area, outside of Metehara town, is scattered with pastoral types of dwellings. Most of the people live in traditional tukuls. Practically all dwelling units are one room structures. The tukuls are built from local materials; the roofs are thatched roofs built mostly out of grass, the walls are made of mud walls and the floors are earth floors. Few people have houses with corrugated iron sheet roofing. Houses of wealthy persons are bigger with between four and six rooms. Houses have tin roofs whereas others have thatched roofs.

Education

The education system comprises both formal and non-formal education. Non-formal education includes a broad range of educational programmes for all age categories, catering to both school leavers and new pupils. Formal education comprises pre-school education, primary and secondary education (general education), technical-professional education and higher education. Primary education has a duration of 8 years (age groups 6 to 14) and is divided into two 4-year cycles (cycle 1 from grade 1 to 4 and cycle 2 from grade 5 through to 8). This is followed by two years of general secondary education. At the end of grade 10, pupils take the Ethiopian General Secondary Education Certificate / 10th Grade National Examination. The second phase of preparatory secondary education has also consisted of a 2-year period (grades 11, 12) and is regarded as preparation for higher education.

The distribution of education facilities in Metehara town is as shown in Table 12Educational facilities in Fentale woreda.

below. There is a good distribution of the lower level education facilities (kindergarten and primary schools) but a poor distribution of post-primary educational facilities. The residents of Gelcha kebele have access to secondary and post-secondary education from other areas as indicated in the table below.

Even with a good distribution of primary schools, the socio-economic survey revealed that only 27% of the respondents attended primary school and with very low levels of completion. Only 6% reported to have attended secondary education. This could be due to the long distances to the secondary schools and the low priority attached to education in (semi-)pastoral communities. Only 1% of the respondent attained a degree and 4% attained diplomas.

The number of teachers in Fentale woreda is 396 of which 258 are male and the remaining 138 are female teachers. The overall teacher-student ratio is 1:29 though with variations at each level of education.

Table 12Educational facilities in Fentale woreda.

Schools	No.	Location
Kindergarten		All kebeles
Primary Schools (Grade 1-8)	2	Metehara Elementary School Haro Adi Elementary School
Secondary Schools (Grade 9-10)	3	Marti, Abadir and Core
Preparatory (Grade 11-12)	2	Dandi Gudina Secondary School Merti Secondary School
Technical Vocational Institutes	1	Merti Sugar Estate

Source: ERM(2016)

Planned Infrastructure

The Fentale Irrigation-Based Integrated Development Project, a government programme under the Oromia Irrigation Development Authority, intends to expand irrigation farming into parts of Gelcha kebele and other potential command areas near the proposed project site (**Error! Reference source not found.**). The irrigation intake is on the Awash River, but there is currently a lack of budget and water for further expansion (EEP 2016). According to the proposed land use plan for this irrigation scheme, Gelcha kebele will be served with 622 ha of irrigated land. As explained elsewhere in this ESIA report, this planned irrigation development was the reason why the project site for solar PV development had to be shifted to its new location to avoid loss of a potential command area.

Figure 29: The irrigation canal of the Fentale Irrigation-Based Integrated Development Project. The left picture shows the sealed upstream section close to the existing high-voltage transmission lines while the right picture shows the excavated canal adjacent to the original project site.

Figure 30: Traffic on the main road passing north of the project site (left) and in Metehara town (right).

Figure 31: One of the waste dump sites outside of Metehara town (left). There is also evidence of waste dumping in the north-west corner of the project site (right).

Figure 32: Bridges across the Beseka canal. The wooden bridge (left) is located 300 m east of the project site while the concrete bridge (right) is located 2 km east of the project site.

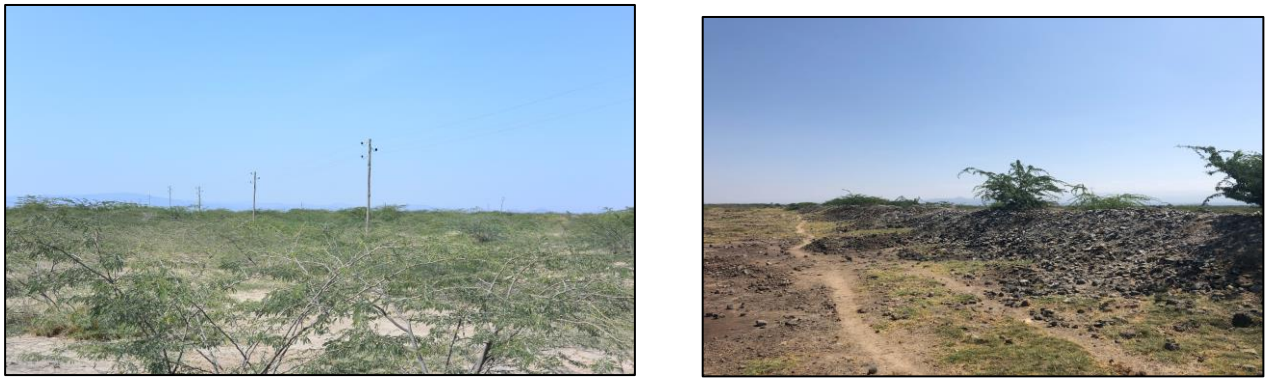

Figure 33: Power distribution line (15 kV) intersecting the project site in the north-west corner (left) and spoil tip from excavation of the Beseka canal along the southern perimeter of the project site (right).

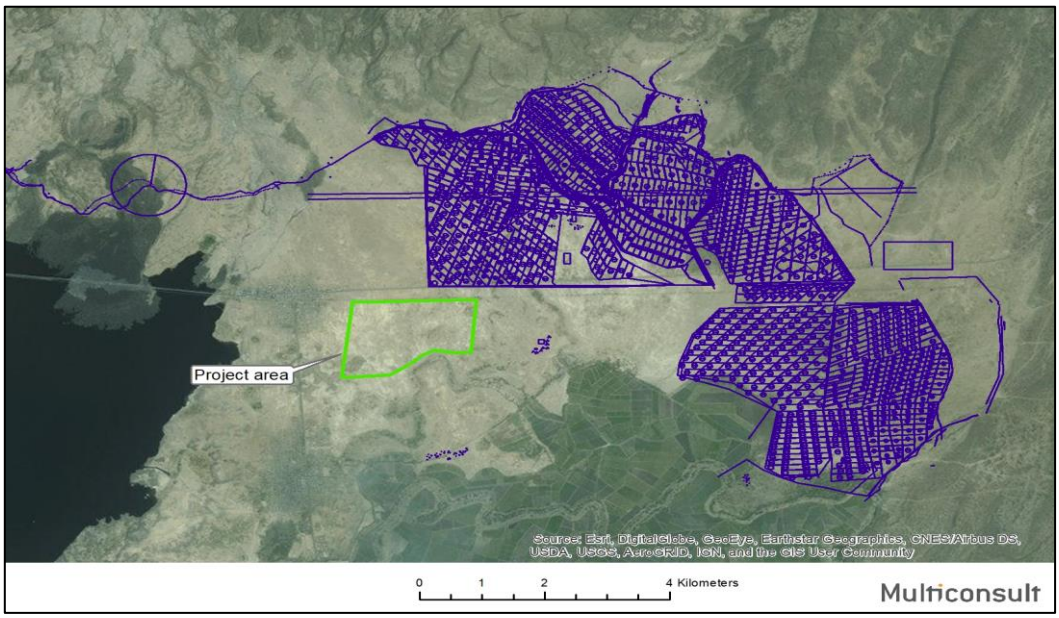

Figure 34: The location of the Fentale irrigation project with existing and planned command areas.

5.3.6 Health and Safety

Community Health

In Ethiopia, 60 to 80 percent of communicable diseases are attributed to limited access to safe water and inadequate sanitation and hygiene services. In addition, an estimated 50 percent of the consequences of undernutrition are caused by environmental factors that include poor hygiene and lack of access to water supply and sanitation. There are strong links between sanitation and stunting, and open defecation can lead to faecal-oral diseases such as diarrhoea, which can cause and worsen malnutrition. Diarrhoea is the leading cause of under-five mortality in Ethiopia, accounting for 23 per cent of all under-five deaths – more than 70,000 children a year.

Data from Metehara Sugar Hospital shows the distribution of the most prevalent diseases in the project area (Table 13Diseases recorded in the Metehara Sugar Hospital.

). The data confirms that the sanitation related health risks are the most prevalent manifesting as diarrhoea and helminthiasis. The high prevalence of acute febrile lines (AFL) points towards weaknesses in the diagnosis and treatment of opportunistic infections that if left untreated for long periods progress into AFL and eventually death.

The presence of dyspepsia in at least 6% of the patients points towards food security and nutritional challenges. Given the ongoing drought conditions, challenges with food security and balanced diet would be expected. In fact, the socio-economic survey indicated that 65% of the project affected population have only two meals a day due to shortage of food and the inability to buy food after exhausting the household harvest due to low incomes.

Table 13Diseases recorded in the Metehara Sugar Hospital.

Diseases	Patients	Percentage
Acute upper respiratory infection	17,154	21.19
Acute febrilelines (AFL)	12,195	15.06
Diarrhea (non-blood)	18,873	23.31
Trauma (injury, fracture, etc.)	8,847	10.93
Dyspepsia	5,246	6.48
Urinary Tract	528	0.65
Disease of musculoskeletal	4,750	5.87
Malaria FP	4,749	5.87
Helminthiasis	4,642	5.73
Infection of skin and subcutananeous tissue	3,985	4.92
	80,969	**100**

Other health risks in the project area include vector related diseases like malaria, respiratory infections due to the harsh dry and dusty conditions, and severe drought and poorly ventilated residential structures, traffic accidents, and exposure to hazardous materials from industrial waste, among others.

There are no reliable estimated of HIV prevalence in Fentale woreda, but the HIV positive population of women and men aged 15-49 in Ethiopia as a whole is 0.9%. HIV prevalence is higher among women than men (1.2% versus 0.6%). Among women, HIV prevalence generally increases with age, affecting 0.4% of women aged 15-19 and 3.0% of women aged 40-44, before declining to 1.9% among those aged 45-49. Among men, HIV prevalence increases from less than 0.1% among those aged 15-19 to 1.6% among men aged 40-49, and then decreases to 0.6% among men aged 55-59 (CSA 2016).

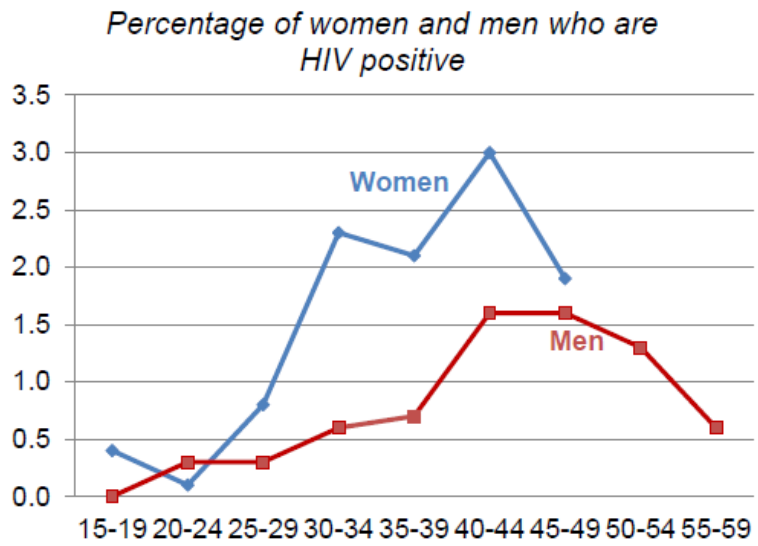

Figure 35: HIV prevalence in Ethiopia.

The major factors contributing to the rapid spread of HIV include persisting high prevalence of unprotected sex with multiple partners; seasonal migration of workers; high STI rates in the general population; the disadvantaged position of women in socio-economic and sexual decision-making; increasing sexual activity among youth with multiple partners due to delayed marriage; poverty; high unemployment rates; and the lack of adequate preventive and treatment programs.

Traffic accidents in Fentale woreda do not only involve drivers, passengers and pedestrians, but also wildlife and livestock due to the proximity to Awash National Park and the pastoral lifestyle in the area. The accidents typically happen when wildlife and livestock are crossing the highway on their way to Awash River for watering.

Security

Conflicts are quite common among pastoral communities. Grazing land is shrinking as a result of many internal and external factors, including the expansion of cultivation, and human and animal population growth. Changes in climate and environmental degradation have also caused recurrent drought. These factors intensify competition over pasture and water in the area among the pastoralists, resulting in frequent armed conflicts.

In Fentale woreda, continuous conflicts are reported between the Awash National Park and the pastoralists triggered by the search for pasture. Inter-tribal conflicts between the Karrayu and the Afar pastoralists for grazing land and access to water are also rampant.

Crime is generally opportunistic and non-violent/non-confrontational such as pickpocketing, snatch-and-run thefts (including from occupied vehicles), and other petty crimes. These are generally not planned attacks. Such crime is likely to be more common in Metehara town than in the rural areas.

Occupational Safety and Labour Conditions

With respect to occupational safety, it is known that health and safety standards on civil engineering projects in Ethiopia tend to be below best international standards, resulting in avoidable accidents and injuries to workers.In addition, the proximity of the project site to Metehara town and to the Addis Ababa – Djibouti highway suggests that much of the local workforce may consist of high risk groups, like truck

drivers, migrant workers, seasonal labourers and sex workers which are all well known for high risk behaviour.

The major employer in Fentale woreda is Metehara sugar factory, and a recent study by Tekleab (2016) found that Metehara Sugar Factory needs to strengthen its internal system for health and safety management. Assuming that the project will attract previous employees of either the Metehara sugar factory or the other small-scale industries in Metehara, the workers' level of awareness of health and safety standards and labour rights is likely to be sub-standard. Data from Metehara Sugar Hospital shows that trauma from injuries and fractures are the most reported occupational accidents among its workers.

The labour market situation in the Ethiopia does also not comply with the good international standards. There is government interference with labour unions, and men and women are working excessive hours in a week in both private and public sectors. The proportion of under-aged population involved in productive activities as well as paid employees engaged in precarious work has shown a dramatic increase from year to year (Tekleab 2016). Child labour is a common practice in agricultural and pastoral economies. The Ethiopian culture also encourages children to work to develop skills. Children are paid lower wages than adults, not unionized and are not aware of the workers' rights. According to CSA (2015), 43% of Ethiopian children aged 5 to 17 years were engaged in child labour mostly in the agricultural sector helping with weeding, harvesting and attending to domestic animals. Child labourers are mainly boys and child labour is more rampant in rural areas than urban areas. 50% of the child labourers work on average 42 hours per week.

5.3.7 Cultural Heritage

Cultural History

The Karrayu are among several traditional pastoralist groups living in the Upper Awash Valley within the Great Rift Valley in Ethiopia. Most of the Karrayuare primarily cattle herders, live within Fentale woreda. The Karrayu are believed to be early inhabitants of the area. The other traditional people in the area are the Ittu Oromo. The Ittu moved to Fentale because of drought, conflict with the Issa Somali peoples, and desire for less populated land (Beyene and Gudina 2009).

Although both belong to the same language group—the Oromo—some aspects of their cultures differ; the Ittu practice agro-pastoralism and are almost exclusively Muslim while the Karrayu are primarily herders who mostly practice their indigenous religion. However, this distinction has faded in recent years as the Karrayu have been rapidly converting to Islam and have become increasingly involved in farming (Gillingham 2001), the latter due to a decline in pastoral livelihoods (Beyene and Gudina 2009).

Before the 1960s, the Karrayu utilised the whole area within Fentale and a small portion of the neighbouring woreda, Boset. During this period, the Karrayu used three major traditional grazing zones: the primarily open grassland plain (ona ganna) for the wet season, the riverine and adjacent wooded savanna vegetation (ona birra) for the early dry season, and the thorn bush between the two zones (ona bona) for the late dry season (Beyene and Gudina 2009).

Even within these major ecological zones, different villages may be required to travel to different parts of a specific zone for livestock grazing during the appropriate season. Livestock movement between these grazing zones is regulated through traditional rules and regulations, as well as varied and complicated rituals and ceremonies (Beyene and Gudina 2009).

The history of Metehara dates to the construction of the former Ethio-Djibouti railway towards the end of the era of Emperor Menelik II when the first in-migration by Amhara and Somali settlers to the area occurred. However, it was only until the arrival of the Dutch corporation Handelsvereeningung Amsterdam, which established a factory to process sugar at Metehara in the 1950s, that the settlements

started growing into a larger town at Metehara. The town has since continued to expand and its urban boundary is currently located immediately west of the proposed project site.

Cultural Property

There are no known physical cultural resources at the project site. The ongoing inventory of affected property has confirmed one individual grave inside the project boundary,

During consultations, the Oromia Bureau of Culture and Tourism highlighted the natural features in Awash National Park as those heritage resources nearest to the project site. These include Mount Fentale, the Awash River gorge and waterfalls, and the hyena caves on the foot southern of Mount Fentale (**Error! Reference source not found.**). Lake Beseka is also considered as a unique natural feature.

Overall, the project's area of influence has insignificant value with respect to cultural heritage.

Value		
Low	Medium	High
|----------	|----------	|
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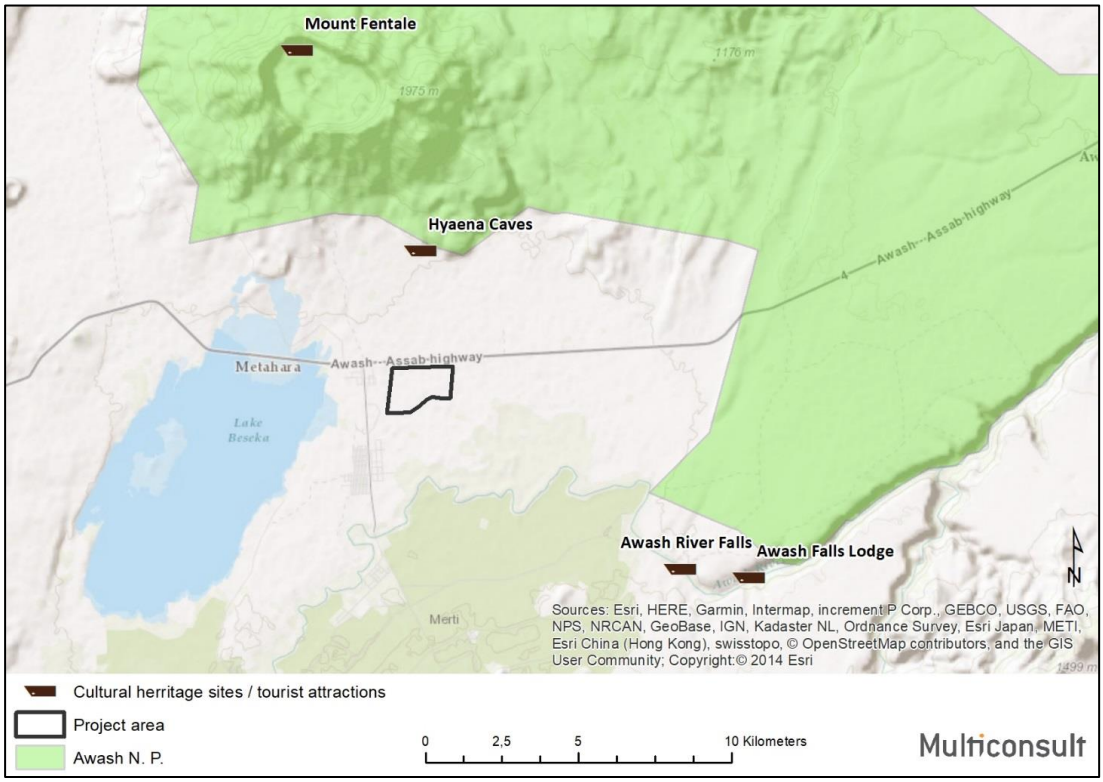


Figure 36: Tourist attractions and heritage sites.

5.3.8 Tourism

The Metehara project site, being located along Highway 4 and in relatively close vicinity of the Awash National Park, is passed by many travellers and tourists. The main tourist attraction is the park itself including a small museum at its headquarters and the adjacent Awash Falls Lodge with a viewpoint overlooking the waterfalls (where crocodiles can often be sighted) (**Error! Reference source not found.**). Some visitors also climb the Mount Fentale in the north-western part of the park.

The number of visitors to the Awash National Park has grown from around 5,000 to more than 10,000 per year over the last 15 years. In comparison, around 25,000 people visit the Semien Mountains National in a normal year. There has, however, been a slight decline in tourist numbers in the last couple of years due to the political situation and the previous state of emergency in Ethiopia.

Error! Reference source not found. ***and Table 15Visitor data (monthly) for Awash National Park in the year 2016.***

show the visitor data for the Awash National Park. Foreign tourists typically arrive during the Christmas holiday and European/US winter season (December-February) and in the summer holiday (July-August) despite this being in the rainy season. There are also many Ethiopian students visiting the park, mainly in May. The tourists normally stay for one or two nights whilst in the park.In conclusion, despite the nearby Awash National Park, the project site itself and its impact zone with respect to tourism has low value.

Value		
Low	Medium	High
|----------	|----------	|
▲		

Figure 37: Awash Falls Lodge (left) and the waterfalls (right) in Awash National Park.

Table 14Visitor data (annual) and total revenue for Awash National Park.

Year (E.C)	Ethiopian Visitors	Residential Foreign Visitors	Foreign Visitors	Total Visitors	Total Revenue (Birr)
1994	2,001	802	1,562	4,356	126,160
1995	2,024	532	1,973	4,529	151,808
1996	2,947	891	1,748	5,586	152,638
1997	3,035	915	2,501	6,451	201,256
1998	2,740	710	2,299	5,749	175,720
1999	3,380	997	3,665	8,042	26,300
2000	2,693	1,046	3,421	7,160	241,747
2001	2,369	1,005	4,538	7,912	430,442
2002	3,216	1,406	4,774	9,396	644,839
2003	3,624	1,589	6,138	11,350	821,095
2004	4,654	1,140	6,095	11,889	794,595
2005	N/A	N/A	N/A	N/A	N/A
2006	4,343	1,385	5,957	11,685	673,050
2007	3,454	1,214	6,153	10,821	671,080
2008	2,874	956	5,170	9,000	555,770

Note: The years are according to Ethiopian calendar (E.C). The period 1994-2008 corresponds to the years 2001-2016.
N/A = Not available

Table 15Visitor data (monthly) for Awash National Park in the year 2016.

Month	Ethiopian Visitors	Ethiopian Students	Residential Foreign Visitors	Foreign Visitors
January	103	103	54	680
February	79	68	124	626
March	73	185	58	294
April	56	186	67	206
May	123	552	62	146
June	N/A	N/A	N/A	N/A
July	264	33	89	315
August	161	30	71	306
September	42	0	70	166
October	43	0	23	269
November	13	35	21	188
December	119	116	33	671

N/A = Not available

6 STAKEHOLDER ENGAGEMENT AND CONSULTATIONS

6.1 Introduction

Stakeholder engagement and consultations have been an integral part of the ESIA process and will continue throughout the project development and operation. The process has been spearheading by the ESIA consultant, but Ethiopian Electric Power (EEP) and Enel Green Power (EGP) have also been actively involved at various stages (see ERM 2016, EEP 2016, EEP 2018). Information-sharing and inter-agency coordination between the different entities has been essential to avoid duplication as well as consultation fatigue among the key stakeholders. The engagement process was designed in such a way that it fulfils the requirements of both the national legislation and the international safeguard requirements.

6.2 Consultation Objectives

Stakeholder consultations to support the ESIA process were specifically aimed to achieve the following objectives:

- to provide information about the project and its potential impacts to those interested in or affected by the project, and solicit their opinion in this regard;
- to identify additional impacts/issues and possible mitigation measures;
- to verify the significance of the identified environmental, social and health impacts;
- to provide opportunities for stakeholders to discuss their opinions and concerns;
- to better understand the people's practices, perceptions and conditions in the project area;
- to manage expectations and misconceptions regarding the project;
- to inform the process of developing appropriate mitigation measures;
- to provide stakeholders an opportunity to contribute towards identification of mitigation measures and the Environmental and Social Management Plan (ESMP);
- to analyse gaps identified from the issues; and
- to timely engage the stakeholders in relation to the land acquisition process.

6.3 Free, Prior Informed Consent (FPIC)

Consultation with Karrayu Community

The primary ethnic groups in the Gelcha Kebele (where the project will be implemented) belong to Karrayu and Ittu Oromos. As per the agreement of the Ethiopian Government with the World Bank joint screening in 2013, Karrayu ethnic group is recognized under the category of Indigenous/Underserved People, meeting the criteria of WB PS-7, Indigenous Peoples. Therefore, it is required to apply this WB Performance Standard 7 to the proposed Metehara Solar Power PV Plant project.

In considering the prevailing situation, the ESIA recommends to consider FPIC in the preparation of the RAP for the proposed project. Therefore, the consultation and engagement process with the Karrayu community was designed in such a way that fulfils the requirements of both the national legislation and the WB PS-7 requirements. The following key principles were followed in conducting the various consultations for the project:

- Ensure that the development process for the Project fosters full respect for human rights, dignity, aspirations, culture and natural resource-based livelihoods of the Karrayu People;
- Anticipate and avoid adverse impacts of the project on Karrayu community, or when avoidance is not possible, to minimize and/or compensate for such impacts.
- Respect and preserve the culture, knowledge, and practices of Karrayu community
- Inform and discuss about the nature and scale of the project with the Karrayu community members and ensure that they were able to understand the project and its associated implications;

- Present adverse impacts and identified remedial measures in a more transparent and direct manner so that their views and proposals are mainstreamed to formulate mitigation and benefit enhancement measures;
- Identify perceptions and attitudes of the Karrayu community towards the project; and
- Establish and maintain an on-going relationship based on informed consultation and participation by the project throughout the project's life-cycle.
- Ensure their views and concerns are incorporated into project site selection, design and implementation.

The community members have agreed on the selected site. This agreement has been secured through subsequent consultations held with all stakeholders including the Karrayu community. The strongest argument in favour of the site finally selected is that it was selected based on a bottom-up and participatory approach whereby the local government and communities themselves were responsible for identifying the most suitable siting of the solar power PV facility.

The documentation and the consultations carried so far demonstrates free, prior and informed consent to the project by Karrayu ethnic group. First, the consultations have been carried out during alternative site investigation and before the finalization of the site selection; secondly, the consultations carried out so far meets the requirements of FPIC, because of (i) sufficient number of consultations and number of participants, (ii) there is a documented evidence for the participation of all PAPs as well as members of the Karrayu ethnic group and, last, (iii) sufficient information is available about the project and its implications. Therefore, as outlined above, the requirement of FPIC has been achieved. Below are some manifestations for the process.

Consultation Strategy and Methodology

Stakeholders Identification

Due care was taken to maintain representation of the different community groups; elders, clan leaders, religious leaders, women and youth group in such a way to incorporate and represent attitudes and views of the entire community member. Stakeholders from various woreda sector offices have also attended these meetings. Therefore, it is believed that the consultations conducted were inclusive of various social groups within the Karrayu community.

Meetings

Several meetings and discussions were held with members of the Karrayu community and their leaders, drawn from various Woreda sector offices. The project, its intended objectives, the location, its ownership as well as the need for consultations were briefly presented to the participants so that they can forward their views on these bases.

Meeting Place/Venue

In consideration of the Karrayu communities' culture and livelihood activities, every meeting was conducted on their own preferred meeting venue and time, in the villages of Gelcha Kebele where the Karrayu are residing.

Language Issue

During all the consultation meetings with members of the Karrayu community, the medium of communication was Oromiffa the local language. The engagement conducted with Karrayu community were led and facilitated by well-trained local experts. However, for the benefit of both the experts as well as the community, a local interpreter was used (i.e. to align the interpretation with the local dialect).

In addition, all household interviews (census) were also carried out by members of the local community with appropriate training provided and supervised by the Consultant Team.

Consultation Methods and Tools

Consultations were carefully planned and conducted in such a way that ensures efficiency and effectiveness in covering key issues. The methods used during the consultation process included small group discussion and community meetings.

Consultation Records

At the time of these consultations, enough information was available about the project and its implications and this was communicated to the participants in all the meetings.

Sufficientlead time was given for the community to discuss the project issues before the site was officially selected and allocated for the project use.Minutes of all meetings were recorded and kept as evidence as well as for further information processing.

6.4 Stakeholder Identification

The key objectives of the stakeholder identification were the following.

- to identify all the directly impacted stakeholders by the project and its associated facilities;
- to identify the stakeholder groups that are likely to be indirectly impacted by the project activities;
- to identify stakeholder groups whose interests might be impacted by the project and the other way round; and
- to identify any other stakeholder group that might have an influence on the project.

Table 16 presents the results of the stakeholder mapping and analysis process as well as the prioritised stakeholders for consultation.

Table 16 List of stakeholders.

Stakeholder Category	Stakeholders
Project proponents	Tetra Tech / PATRP Ethiopian Electric Power (EEP) Enel Green Power (EGP)
Regulators	Oromia Environmental and Natural Resources Development Bureau Fentale Woreda East Shewa Zone Irrigation Authority Ministry of Water, Irrigation and Energy – Environment and Climate Change Directorate Metahara Police Oromia Investment Office Ethiopia Road Authority Wildlife Conservation Authority / Awash National Park
Directly impacted	Gelcha Kebele Karrayu and Ittu clan leaders Directly impacted land users
Indirectly impacted	Metahara town
Interest parties	Metehara Sugar Factory Metehara Sugar Estate Hospital Civil Aviation Authority Ethiopian Wildlife and Natural History Society (EWNHS)
Vulnerable groups	Agro-pastoralist households Women

6.5 Consultation Approach

6.5.1 Mobilisation Strategies

The administrative system in Ethiopia is quite bureaucratic with systematic regulations regarding authorisations for public meetings and consultations. The woreda authorities had to take a lead role in the mobilisation process. Below is a summary of the strategies adopted.

- Introduction letters: EEP distributed official letters to the regional and woreda authorities informing them about the proposed project, introducing the ESIA consultant, informing about the planned consultation activities and requesting them to further mobilise the concerned stakeholders and support the consultant wherever possible.
- Mobilisation letters: Fentale woreda distributed official letters to the kebele leadership informing them about the proposed project and the upcoming consultation activities and requesting them to further mobilise the concerned stakeholders.
- Mobilisation by phone and emails: Key stakeholders not earlier foreseen but found essential to consult during and after the initial consultations were contacted either through email or by phone. This mainly applied to custodians of relevant data and literature for the ESIA study.
- Reconfirmation of appointments: Prior to the appointment dates, the ESIA consultant reconfirmed the appointments by contacting the focal persons at each venue at least one day prior to the meeting to verify whether the proposed schedule was still valid for the expected audience.
- NGOs: EGP utilised a local NGO to mobilise for the EGP-led consultation and engagement activities.

6.5.2 Consultation Schedule

The list of consultation meetings and stakeholders consulted is given in **Error! Reference source not found.** below.

Table 17Consultation schedule.

Date	Stakeholder	Purpose of the Meeting
23rd January 2017	Tetra Tech / PATRP and EEP - Mr Nebiyou Girma, PATRP - Ms Sedania Gebre, PATRP - Mr Steve Ingle, PATRP - Ms Betlhem Ermyas, EEP (Environmental Department) - Mr Mulat Azene, EEP (Generation Department)	Kick-off meeting Obtain latest status of project implementation Agree on the ESIA scope and timeline
23rd January 2017	Wildlife Conservation Authority - Mr Kasaye Wami, PA's Senior Expert - Mr Abiot Hailu, PA's Senior Expert - Mr Shimelis T/tsaddik, PA's Senior Expert	Give introduction about the Metehara PV project and the ESIA study Identify key issues and impacts related to the Awash National Park
23rd January 2017	Ethiopian Wildlife and Natural History Society (EWNHS) - Mr Yilma Dellelegn Abebe, Project Leader	Give introduction about the Metehara PV project and the ESIA study Identify key issues and impacts related to the Awash National Park and the associated Important Bird Area (IBA)
24th January 2017	Ethiopian Electric Power (EEP) - Mr Daniel Muluta, EEP (Generation Strategy and Investment Manager) - Ms Sedania Gebre, PATRP - Mr Steve Ingle, PATRP	Kick-off meeting (continued) Obtain latest status of project implementation Agree on the ESIA scope and timeline

Date	Stakeholder	Purpose of the Meeting
25th January 2017	Fentale Woreda - Mr BoruJiloBoru, Fentale Woreda Administrator - Mr Abdulahi Tole, Head of Fentale Woreda Rural land Administration and Use Office - Mr EniyewTilahun, Deputy Head of Fentale Woreda Rural Land Administration and Use Office	Give introduction about the Metehara PV project and the ESIA study Discuss issues related to land acquisition and the planned irrigation project
25th January 2017	Awash National Park - Mr Shiferaw Mengistu, Chief Warden	Give introduction about the Metehara PV project and the ESIA study Identify key issues and impacts related to the Awash National Park
26th January 2017	East Shewa Zone Irrigation Authority - Mr MotumaTolosa, Extension Team Leader - Mr Girma Nigusse, Project Engineer	Give introduction about the Metehara PV project and the ESIA study Exchange information related to the irrigation project in Fentale woreda
27th January 2017	Ministry of Water, Irrigation and Energy – Environment and Climate Change Directorate - Mr Tefera Arega, Acting Head	Give introduction about the Metehara PV project and the ESIA study Establish the criteria for obtaining environmental license
27th January 2017	Tetra Tech / PATRP and EEP - Mr Nebiyou Girma, PATRP - Ms Sedania Gebre, PATRP - Mr Steve Ingle, PATRP - Mr Daniel Muluta, EEP (Generation Strategy and Investment Manager)	Debriefing session Sharing feedback from reconnaissance trip and opinions of local stakeholders Defining the way forward
12th June 2017	Fentale Woreda - Mr BoruJiloBoru, Fentale Woreda Administrator	Give latest update about the Metehara PV project Seek permission to proceed with ESIA study and conduct public consultations
13th June 2017	Metehara Sugar Factory - Mr Eshetu, Irrigation Engineer	Give introduction about the Metehara PV project and the ESIA study Discuss issues related to land use and irrigation
13th June 2017	Metehara Sugar Estate Hospital	Give introduction about the Metehara PV project and the ESIA study Discuss issues related to public health and health services
14th June 2017	Awash National Park - Mr ZerihunKatama, Tourism and Community Partnership Warden - Mr ShelemeAbiyou, Ecologist	Give update about the Metehara PV project and the ESIA study Discuss key issues and impacts related to the Awash National Park
16th June 2017	Tetra Tech / PATRP and EEP - Mr Nebiyou Girma, PATRP - Ms Sedania Gebre, PATRP - Mr Daniel Muluta, EEP (Generation Strategy and Investment Manager)	Debriefing session Sharing feedback from scoping field visit and opinions of local stakeholders Defining the way forward
5th December 2018	Directly Impacted households	Give introduction about the Metehara PV project and its potential impacts Mobilisation for asset inventory
21st December 2018	Fentale Woreda - Cabinet Officials	Give introduction about the Metehara PV project and its potential impacts Information sharing and consultations in relation to land acquisition

Date	Stakeholder	Purpose of the Meeting
26th December 2018	Gelcha Kebele - Directly impacted households	Information sharing and consultations in relation to land acquisition
1st January 2019	Oromia Environmental and Natural Resources Development Bureau - Dr NegereLencho (Head) - Mr Bona Yadesa - Mr GewedaKibebew - Mr SintayehuBefekadu	Give introduction about the Metehara PV project and its potential impacts Confirm the ESIA approval processes
1st January 2019	Civil Aviation Authority - Mr Shimeles Kibreab - Mr HezebuKebede	Give introduction about the Metehara PV project and its potential impacts Establish if there are airports or flight routes that might be disrupted by the project

Figure 38: Public consultation meeting with project-affected persons at the project site.

Figure 39: Consultations with Fentale woreda officials and technical staff.

6.5.3 Participation and Consultation Methods

Stakeholder mini workshops: Three mini workshops were held with the Fentale woreda officials in the period April 2016 to December 2018 to discuss issues related with the site selection and land acquisition. Two of the mini workshops facilitated discussions between EEP and the Fentale woreda administration, while the third mini workshop facilitated discussions between the ESIA consultant and woreda with special focus on the procedures for land acquisition and the preparation of the asset inventory of the impacted property. The purpose of the stakeholder workshops were to:

- Systematically disseminate information about the proposed project
- To gain consensus in regard to the project site
- To initiate the process of land acquisition and asset inventory in compliance with the national regulations as well as international safeguard requirements

In-depth discussions: In-depth discussions were held with the key institutional stakeholder's for gathering detailed information about the regulatory requirements and other issues that could be relevant for project approval and implementation. Brainstorming sessions were the main strategy adopted during the follow-up sessions.

Email and phone consultations: Further consultations were also undertaken with stakeholders by phone and email. These consultations were mainly with institutional stakeholders that had relevant data/information or with stakeholders considered as experts on particular themes.

Teleconferences: Teleconferences were mainly used to facilitate discussions between the ESIA consultant, PATRP and EGP in order to share information and discuss issues arising during the ESIA process.

6.6 Summary of Issues Raised and Responses

The below tables gives a thematic summary of the issues raised by the stakeholders. Minutes of meetings are enclosed in Appendix 3.

Table 18Main issues raised during the stakeholdersconsultation meetings.

Theme	Issues Discussed
Land acquisition	Stakeholders requested for transparent land acquisition processes.
Information sharing	Stakeholders requested for honest presentation of the project benefits and expected impacts, most especially during the land acquisition and the operation phase.
Expected benefits	Stakeholders expect economic improvements in Metahara town and Gelcha kebele as a result of the project's presence in the area.
Support for the project	Almost all stakeholders pledged their support for the project acknowledging that it will be an environmentally friendly project. There was no opposition to the project (after shifting the location to the proposed site).
Site selection	The affected kebele(s) advised that the project should be sited were it does not affect farming activities. They therefore advised the woreda to identify a land that is not suitable for agriculture or pastureland.
Safety issues	The communities requested that project be designed in such a way that it protects the safety of both humans and animals. They were concerned that the solar facility will emit heat waves that could burn property, humans and animals.
Benefit sharing	Communities requested for support to improve a local road and bridge across the Beseka canal in order to facilitate livestock movement and avoid blocking of routes to the livestock watering points.
Electrocution concerns	The communities raised the fear for electrocution of both humans and livestock. They were informed that the site will be fenced to restrict unauthorised access by the public.

Theme	Issues Discussed
Compensation	The communities raised the need for fair and prompt compensation. They were assured that the compensation computations be in accordance with the national law and international requirements. The compensation amounts will be disclosed and a system for grievance redress will be provided.
Livelihood support	Communities inquired if there will be any livelihood support for those physically and economically displaced. They were told that those physically displaced will be assisted to restore their homesteads and livelihoods elsewhere, while the options for livelihood support are still being explored for the other impacted groups.
Project disclosure	Several government institutions requested for further disclosure of information after the ESIA process, since this isthe first of its kind in Ethiopia.
Encroachment and poaching	Measures should be instituted to ensure that the project does not trigger further encroachment into the Awash National Park or poaching of wild animals.
Responsibilities for land allocation	Fentale woreda informed that, they are the lead agency for land allocation including notifying the impacted persons, undertaking the asset inventory, and computing the compensation packages. The project proponent should provide the funding for the compensation payments.
Traffic accidents	Livestock and wildlife are vulnerable to traffic accidents on the highway and railroad. The project should incorporate measures to avoid such incidents.

Summary of Consultation with Project Affected People

During the preparation of the ESIA, consultation with project affected people has been held on Dec 26, 2018. The consultation was conducted in Oromifa language (the local language of the area). All the people affected are semi-pastoralist and also engaged in crop cultivation. Property affected by the PAPs include agricultural land and some residential houses. The total land taken by the solar power is 250 ha. The farm land does not seem to have been cultivated in the last few years for two reasons. (1) because of drought and(2) because of an invasive plant called Prosopis juliflora.

Table 19 Summary of Consultation

Consultation Organizer	EEP with its consultants		
Participants	Physically affected Households		
Date of Consultation	26th Dec, 2019		
Number of PAP's	**Female**	**Male**	**Total**
	6	**28**	34
Size: **Land requirement**: **Positive impacts**: **Negative impacts**:	100 MW electricity 250 ha employment, small local businesses, electricity production, and other benefits to the people and economy. Land take and impacts on houses and electric poles. Then the affected people strongly expressed their support to the proposed project and voiced their concerns about the solar power.		

The Discussion The Consultant described about the proposed Solar Power Project, the size, hectare, the connection to the grid. In addition the Consultant explained the benefit of the Solar Power and the negative impacts and its mitigation options. Below is a summary table for the issues raised by the PAPs and the responses provided by the project:	
Issues Raised during the consultation form the PAP'S	**Response given to the questions and concerns of the project affected people as summarized below:**
1. They support the project because it is part of the development effort of the government. However, they are afraid that it might be like the plastic and steel industry established in neighbourhood which releases harmful substances that often affects their crops and cattle as well as the people. 2. They said they were told that the rail road and the train will never affect the society and the economy and promised sufficient care shall be taken by the concerned organ to avoid any negative impacts but when the train started operation many cattle were electrocuted by the electric installation and many camels were dead when the train derailed. So asked that what guarantee do they have that something wrong will not happen when the solar project is implements. 3. Compensation paid must be reasonably good. 4. The rail road is not properly designed there is no bridge. Humans and animals haveproblem of crossing the railroad. It is found dangerous. They do not want to happen similar things in the Solar Project 5. The solar power project is very good; in fact, the second best project after the Renaissancedam. But we want to know how much compensation is going to be paid per square meter of land. 6. We do want to be told the truth. Other project in the area never told us the truth about the compensation and the project impacts. We need you to tell us that exactly what will happen during project implementation. In the past land	1. This project does not release any harmful substances, so there is no concern to the people, animals and crops and other vegetation around and hence no effect by the project. Moreover, the site will be fenced to protect unauthorized movement of humans and livestock in to the compound. 2. Electrocution might be occurred in other electric projects but this solar power is safe for the public. 3. Compensation will be paid according to the laws of the country and WB PS 5 and that will be calculated by the woreda committee that is established for the purpose. 4. The Metehara solar power will be designed and managed by well-known international company and there will not be problem associated with design construction, and operation. 5. Compensation, according to the Ethiopian law and as per the requirements of WB PS 5, will be calculated by the woreda administration and will be fair and transparent. If PAPs may not be satisfied, there will be a project related grievance redress mechanism to appeal for. The official court system can also be used if dissatisfied by the project GRM decision. 6. The Consultant assures what is being said is the truth and can be held accountable if something happens in contrary. A Resettlement Action Plan will be developed through proper consultation of community and conducting inventory of all the affected assets by the Woreda then will be disclosed to all

were taken from the surrounding farmerssuch as for rail way construction, for Awash Park, sugar factory and for other project so what was promised andsaid was not what happened during implementation. 7. In addition to the compensation we want the project to construct a road and brides aroundthe project taken land. 8. For them land has value whether they live or die. They said that they need a passage way through the project land for their cattle and people to travel from one place to another. 9. One issue they heard is that the solar panel releases very strong heat to the surrounding so people are afraid that the strong heat will burn property, human and animals. This they said is not acceptable and wanted explanation proposed mitigation options.	PAPs. The Ethiopian legislation and WB PS 5 will be strictly applied. In cases of any differences in the two sets of laws, WB PS 5 will prevail. 7. In this project, there will be other livelihood support schemes and community development programs to be developed along with the RAP keeping the active participation of PAPs and the community members in Gelcha Kebele and Fentale Woreda. The ESIA study team will discuss this with the concerned parties and incorporate the findings in the study. 8. Once land is transferred to the project to the implementing agency, obtained after payment of compensation, the allocated land will be transformed in to the company's property and will not allow any unauthorised person in to the premises. This is because it will interfere with the power operation and for security reasons. 9. The solar panel does not release excessive heat no more than the surrounding area, so it is safe. Finally, the head of Rural Land Administration Office explained that the compensation payment will be administered by the woreda and calculation of compensation will be done according to national laws and WB PS 5. They need not worry about the payment. Regarding the project, the government of the region and woreda strongly support such project in view of employment generation and the benefits associated to the project.

7 IMPACT ASSESSMENT AND MITIGATION MEASURES

Introduction

This chapter describes the potential environmental and social impacts of the planned Metehara solar power PV project, together with the proposed mitigation and enhancement measures. The significance or magnitude of the impacts on each baseline theme is evaluated without and with mitigation/enhancement measures. Potential impacts have been described for the construction phase and operation phase, respectively,while cumulative impacts as well as future impacts from decommissioning are presented separately (see Sections 7.6 and 7.7).The implementation and monitoring of the mitigation/enhancement measures are described in greater detail in the Environmental and Social Management Plan (Chapter 9).

Impact on Physical Environment

Topography and Landscape

Construction and operation phase

Visual impact: Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. For solar PV projects, visual impacts typically concern the appearance of the solar modules and their interference with the character of the surrounding landscape, particularly to nearby residential communities. Additionally, sometimes reflection from the module surfaces exacerbates visual impacts from PV facilities. It is therefore important to evaluate the visual impacts from relevant viewing angles, including critical viewsheds.

There is a risk that the proximity of a large solar PV facility to the Awash National Park could lead to changes in the sense of place of the area, but it should also be recognised that aesthetic impacts are largely a subjective matter determined by individual preferences. The solar PV modules and associated infrastructure might beconsidered as symbols of development, or as an intrusion in the naturallandscape. The attitudes and perceptions will change with cultural background and over time.

During the construction phase, the installation works will cause visual disturbance, mainly in the immediate vicinity of the solar PV site including to those travelling on the main road and to the nearby residents. Land clearing combined with transportation and storage of equipment and machinery will turn the project's direct impact zone into a construction site for the duration of the installation works. There will, however, be no significant impact on the physical terrain since the project site is already a flat land with no notable topography.

Upon commissioning, the solar PV plant will be visible from further distances and especially from Mount Fentale (8 km north of the project site) which is occasionally visited by tourists. However, from this distance, the weather conditions will affect the visibility of the surrounding landscape. A layer of haze floating

over the landscape is quite common in these areas because of the heat, especially when viewing from long distances. In these conditions, the solar PV plant will be barely visible, while in clear weather conditions the solar PV plant will be perceived as a large monotone field without details. The design of the individual solar modules will not be visible and the facility will be perceived almost as an extension of the Metehara town.

The solar plant will also be visible from the main road, Highway 4, running parallel to the project site at a distance of about 250 m. Due to the flat topography and the low level extensive size of the plant, it will appear as a pronounced line in the landscape from the road but will not dominate the view. Solar modules will be visible along the horizon and the design of the individual solar modules can also be seen if viewed closely. However, the 250 m 'buffer zone' with rural landscape in front of the site will moderate the view slightly. Retaining the little vegetation along the main road will thus contribute to reducing the visual impact.

At close range, the view of the solar PV plant will be quite dominant. The design of the individual solar modules and other structural features like fences and internal roads will be clearly visible. The rural landscape character will be lost.

The visibility of the PV facility from the new Addis Ababa – Djibouti railway, running parallel to the solar PV site at a distance of about 1.2 km, will be minimal due to topography. Similarly, the Awash National Park is situated far from the site, hence the solar PV will have no visual impact on the park other than from Mount Fentale (see above) and when driving on the main to/from the main entrance gate.

It should be noted that the landscape impacts from solar PV plants are characterised not only by their physical infrastructure but potentially also exacerbated by the reflection ("glare") from the solar modules. However, the glare and reflection from modern solar panels are decisively lower than that generated by standard glass and other common reflective surfaces in the environment. Indeed, the light reflection from PV panels has been greatly reduced in recent years due to improved anti-reflective materials that maximize light absorption.

Mitigation measures:

- Keep the all the vegetation that surrounds the solar PV site, especially along the main road

Conclusion

The magnitude of the impact on topography and landscape without mitigation (▲) is rated as **low-medium negative** during both the construction phase and the operation phase. Applying the mitigation measures will slightly reduce the magnitude of the impact to **low negative** (▲).

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*

Construction	▲ ▲
Operation	▲ ▲

Figure 40: The Metehara project site viewed from the hillslopes of Mount Fentale.

Figure 41: The project site viewed from Highway 4 before construction.

Figure 42: Visualisation of the Metehara solar PV plant viewed from Highway 4.

Figure 43: The project site viewed from the south-west corner with Metehara town and Mount Fentale in the background.

Figure 44: Visualisation of the Metehara solar PV plant viewed from the south-west corner.

Figure 45: 3D visualisation of the Metehara solar PV site viewed from the north-west.

Geology and Soils

Construction phase

Soil erosion: During the construction phase, soils will be impacted due to clearing of vegetation, mounting of the PV modules (depending on the type of foundations), construction of internal roads, etc. Exposure of the ground and removal of vegetation cover will make the soil liable to erosion by wind and running water. However, due to the site's flat topography and the relatively limited earthworks associated with solar PV installations, these impacts are manageable throughensuringgood international industry practice in construction works.

Mitigation measures:

- Except where clearing is required for permanent works or excavation operations, all ground-level vegetation shall be preserved and protected
- Topsoil shall be set aside and reserved where possible
- All exposed surfaces and spoil areas shall be covered with topsoil and replanted or re-seeded
- The amount of earthworks shall be limited as much as possible
- Drainage measures shall be provided, prior to construction works, to promote the dissipation of storm water run-off

Land contamination: With respect to land contamination on-site (and off-site), the construction of the Metehara solar PV plant involves a risk of localised and accidental hydrocarbon spills or release of other hazardous materials from equipment used in the installation process. If such spills are not contained and handled properly, there is a risk that they can cause soil (and water) contamination. However, this risk is no different than for most other civil engineering project and it can be mitigated by good international industry practice in construction works.

The major risk related to soil and water pollution is from disposal of damaged and/or used solar PV modules (classified as electronic waste). While solar PV modules can last up to thirty years, a significant quantity of material needs to be disposed of at the end of the life of the modules. Because modules can contain potentially hazardous materials and many countries, including Ethiopia, lack adequate disposal facilities, consideration should be given at the start of a solar PV project as to how units will be disposed of at the end of their useful life or if they are broken during transportation or installation.

Many components of solar PV modules are recyclable and some solar module manufacturers provide recycling of the panels with purchase. Recycling will greatly reduce potential adverse impacts associated with panel disposal. Enel Green Power (EGP) is therefore advised to inquire whether any of the potential suppliers or manufacturers provide recycling services such that PV panels can be returned if they are damaged and/or at the end of the project life.

Mitigation measures:

- Storage areas for fuel and hazardous materials shall be roofed and have a concrete floor with a bund for secondary containment and collection of spills
- All storage areas and major construction sites shall have spill kits, sand, dust, and other appropriate absorbent materials
- Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice and in compliance with the applicable regulations in Ethiopia at the time of disposal

Operation phase

Soil erosion: There is minimal risk of project-induced soil erosion during the operation phase. However, there will be a need to provide drainage around the solar PV plant to prevent localised flooding and erosion. This will be considered in the detailed engineering phase as a measure to safeguard the solar PV installations as well as for environmental protection.

Mitigation measures:

- Provide permanent drainage at the project site to prevent flooding and soil erosion
- Maintain ground-level vegetation cover throughout the project site

Land contamination: Solar PV facilities do not involve significant risks of pollution spills or release of other hazardous materials during the operation phase. However, as mentioned above, solar PV modules contain potentially hazardous materials and need to be disposed of safely at the end of their useful life and if they are damaged during the operation phase. While this may not involve risk of land contamination at the project site itself, it represents a potential source of pollution at the disposal facility (or dump site).

Mitigation measures:

- PV panels at the end of their useful life, and other potentially hazardous waste generated during the operation phase, shall be disposed of in accordance with best industry practice and in compliance with the applicable regulations in Ethiopia at the time of disposal

Conclusion

The magnitude of the impact on soil and geology (i.e. soil erosion and land contamination) during the construction phase is **low-medium negative** without mitigation (▲) and **low negative** with mitigation (▲) during both construction and operation phases.

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
Construction	▲	▲			
Operation	▲		▲		

Climate and Air Quality

Construction phase

Air pollution: The main impact to air quality during construction will be from increased dust levels arising from movement of vehicles and construction machinery, land clearing and levelling, cement mixing, internal road construction, etc. Emissions of small particles from diesel trucks as well as dust pollution have not been estimated, but the impacts from these emissions will be intermittent and short term. In addition to emissions of particles, there will be minor emissions of NOx from construction machinery, vehicles and from diesel power generators. However, due to the relatively long distance between the main PV installation areas and the

nearest receptors(>100 m from the site boundary), the dust and air pollution is not expected to cause a significant nuisance to the public, at least not with standard mitigation measures in place.

Mitigation measures:

- Water shall be sprayed on all internal roads to minimise dust dispersion when necessary
- Trucks transporting loose/friable materials shall be tarped to reduce wind entrainment of dust
- Vehicles shall be equipped with catalytic mufflers, particulate filters for diesel engines and be kept under regular maintenance

Operation phase

GHG emissions: Upon commissioning, the Metehara solar PV plant will supply renewable energy using a technology that doesnot involve the release of greenhouse gases (GHG) during operation. Compared to diesel generators or other thermal power plants, solar PV facilities can thus contribute to reducing the total GHG emissions by avoiding reliance on fossilfuel-based electricity generation.

According to Turney and Fthenakis (2011), the most up-to-date LCA (life cycle analysis) results for GHG emissions from solar PV plants are 16-40 g CO_2 / kWh (excluding emissions from vegetation removal during installation, but including emissions from manufacturing, shipment, etc.). These numbers are similar to other renewable and much lower than thermal power plants operated on, for example, diesel (760 g CO_2 / kWh), natural gas (410 g CO_2 / kWh for combined cycle technology) and bituminous coal (940 g CO_2 / kWh) (EIA 2015). The main sources of GHG emissions from solar PV technology are extraction of raw materials and manufacturing of the PV modules.

It is beyond the scope of the ESIA study to quantify in detail the avoided emissions from the Metehara solar PV facility, but using the USAID Clean Energy Emission Reduction (CLEER) Tool the reduced GHG emissions are in the order of 1,162 tonnes CO_2 equivalents (PATRP 2016).

Notwithstanding the fact that there are no emissions from the PV modules during operation, there is one potential source of GHG emissions associated with the switchgear, namely the circuit breakers which include gas for insulation. Switchgear where several components are integrated in one unit aretypically insulated by relatively larger amounts of gas, referred to as Gas Insulated Switchgear (GIS). Such GIS components offer compact solutions, but the gas utilised for insulation is most commonly sulfur hexafluoride (SF6). While SF6 has an array of advantageous properties for preventing uncontrolled energy and reactions to happen, it is also the most powerful known GHG, with a global warming potential (GWP) at 23,600 times the one of CO_2. This means, release of 1 kg of SF6 has a climate change effect equal the release of 23.6 tons of CO_2.

GHG emissions from GIS units are known to occur during the operation phase, as leakages occur making refill necessary. The amount of leakage varies, and especially new components have evidently decreased the leakages. Other than the effects on direct GHG emissions, the value chain from production to delivery of 1 kg SF6 is estimated by EcoInvent (world leading life cycle inventory data provider) to release around 118 kg CO_2 equivalents.New developments by the leading

manufacturers of GIS components have introduced environmentally friendly alternatives, some with insulation gas with practically no leakages. These alternatives are available to a wide range of voltages in switchgear, at present to include a solid share of the HV range up to 170 kV.

Mitigation measures:

- Where gas insulated switchgear (GIS) containing SF6 is planned as part of the technical setup, solutions with alternative insulation mediums should be requested from the provider/manufacturer

Conclusion

The magnitude of the impact on climate and air quality during the construction phase is **low-medium negative** without mitigation (▲) and **low negative** with mitigation (▲).During the operation phase, it is **medium-largepositive** without mitigation (▲) and **large positive** with mitigation (▲).

Phase	Magnitude
	Large Negative *Medium Negative* *Low/Insignificant* *Medium Positive* *Large Positive*
	|----------|----------|----------|----------|
Construction	▲ ▲
Operation	▲ ▲

Noise

Construction phase

Construction noise: During the construction phase, noise will be generated from vehicular movements, construction machinery, etc. and there were no major sensitive receptors within 500m of the project site. In addition, the presence of personnel will serve as a continuous source of low-level noise emissions during the entire construction period. However, because of the relatively long distance between the main installation areas and the nearest noise receptors – and because those receptors are already exposed to traffic noise from the highway and town – the construction noise is not expected to cause a significant nuisance to the public, at least not with standard mitigation measures in place. Compliance with Ethiopian and international standards for day time and night time noise shall be verified by regular measurements of noise level (Leq, dBA) at the nearest sensitive receptors.

Mitigation measures:

- Noisy activities shall be scheduled to daytime hours
- Noise levels at sensitive receptors shall be measured regularly and whenever complaints arise

- In case of non-compliance with Ethiopian standards and international guidelines, noise control measures shall be implemented as appropriate (e.g. additional restrictions on working hours, or noise control devices in construction equipment and vehicles)

Operation phase

Operation noise: Solar PV facilities emit insignificant sound pollution.

Mitigation measures:

- N/A

Conclusion

The magnitude of the impact on noise levels during the construction phase is **low-medium negative** without mitigation (▲) and **low negative** with mitigation (▲), while it is **insignificant** during the operation phase.

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
Construction	▲	▲			
Operation			▲		

Water Resources

Construction phase

*Water pollution:*As described in Section7.2.2 above, the construction works involve a risk of localised and accidental hydrocarbon spills or release of other hazardous materials from construction machinery and equipment. There is also a risk of water pollution from the batching plant (if applicable) and particularly by the effluent from concrete truck cleaning which consist of wastewater with high pH and contaminants from the concrete additives. If such wastewater and potential spills are not contained and handled properly, there is a risk that they can cause pollution of surface and ground water. It should be noted, however, that there are no permanent water bodies within the project site area.

Another potential source of water pollution is from the workers' camp, yet the details of such camp facilities are not yet known. It will generate sanitary effluents which are potential sources for microbiological andorganic pollution of surface and ground water. The workers' camp will also produce domestic waste, typically amounting to an estimated 0.5 kg/capita/day. Unless the waste and wastewater from domestic or construction origin (e.g. scrap metal, wood, plastic, cement bags, used tires, etc.) is adequately managed, it may result in pollution of water as well as soils.

Mitigation measures:

- On-site housing, workshops, stores, offices and other buildings shall be equipped with wastewater treatment solutions for processing and disposal of sewage
- Septic tanks and/or temporary holding tanks shall be kept pumped out at such intervals that the tanks will not overflow and contaminate the ground or surface drainage
- Storm water runoff from open workshop servicing and repairs areas and bunded storage areas shall be collected and treated in hydrocarbon separation pits/tanks before discharge into drains or waterways
- Storage areas for fuel and hazardous materials shall be kept at safe distance from the nearest water body and be roofed and have a concrete floor with a bund for secondary containment and collection of spills

Water consumption: The potable water requirement for the workers during construction phase is typically 50 litres (0.05 m^3) per day per capita. With an average of 500 workers, the total consumption will amount to around 25 m^3/day. In addition, water for non-potable usage will mainly be to minimise fugitive dust emissions and this will greatly depend on weather conditions throughout the construction period. The total water consumption during the construction phase is not considered to be unsustainable but it should preferably be sourced from own supplies instead of exerting pressure on the public water supply system in Metehara town.

Mitigation measures:

- The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services

Water consumption: Solar PV technology does not cause significant risks of emissions or water pollution. However, the PV modules need to be cleaned on a regular basis to prevent dust build-up which could affected their performance. Cleaning will be undertaken through the use of water, thus contributing to increased local consumption of surface and/or ground water. The water requirements for cleaning have not yet been estimated but are typically restricted to a few cleaning cycles per year. Anecdotal information from other solar PV facilities in similar dry environments suggests a consumption of around 100,000 l/day (100 m^3/day) per 10 MW installed capacity for each cleaning cycle. As for the water consumption during the construction phase, this volume is not considered to be locally unsustainable but should be sourced from own borehole(s) instead of putting constraints on existing users – most importantly the local community. Generally, solar PV facilities are regarded as low water consumption project, despite the need for regular cleaning of the panels, and the water supply is likely to be combined with the required firefighting network as part of the project's infrastructure.

Mitigation measures:

- The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services
- The project may look for additional alternative water sources like Awash River or desalinization mechanism to use the Beseka Lake water to have a sustainable water source. In addition it is also important not to put any other disturbance to the downstream water users.
- yield loss due to dust build-up on the PV modules should be monitored to ensure that no surplus cleaning cycles are undertaken

Conclusion

The magnitude of the impact on water resources is **low-medium negative** without mitigation (▲) and **low negative** with mitigation (▲) in both the construction and operation phases.

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
Construction		▲	▲		
Operation		▲	▲		

Biological Environment

Protection Status

Construction and operation phase

Compliance with protected area management: Theproject site borders the urban areas in Metehara town and is situated outside the boundaries of the nearby Awash National Park. There is no sensitive biodiversity at the project site that would justify future protection status for conservation purposes. To the contrary, the land would probably be converted to other residential and/or industrial uses (urban expansion) in the long term if it is not developed for solar energy production. The concerned government institutions, including the Wildlife Conservation Authority, have not raised any objections to the project. Thus, the proposed project is in compliance with protected area management and not in conflict with any legally protected areas.

Mitigation measures:

- N/A

Conclusion

The magnitude of the impact on protected area management is **insignificant**.

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
Construction	▲				
Operation	▲				

Flora and Fauna Biodiversity

Construction phase

Habitat loss and disturbance: The Metehara solar power PV plant is a large-scale development which will convert a total of 250 ha of land into a highly modified habitat covered by solar PV panels and protected by a fence. This large footprint will obviously have significant impacts on the local ecosystem. Most importantly, it will involve clearing of all trees and shrubs to make way for the construction and to avoid shadow cast on the solar panels.

However, although the Metehara solar PV project is a greenfield development that will result in the loss of habitat and disturbance to wildlife during construction (and operation), it will be situated in an already highly degraded environment which is typically considered as ideal for development of such renewable energy projects. The project site has been degraded by the invasion of *Prosopis juliflora* and is used for rainfed farming and livestock grazing in the rainy season. There are no plant species of conservation concern; no regular occurrence of threatenedmammals, reptiles or amphibians; no migration corridor for terrestrial wildlife; and no breeding or roosting of threatened bird species at the project site.

Mitigation measures:

- Except where clearing is required for permanent works or excavation operations, all ground-level vegetation shall be preserved and protected
- Workers shall be strictly prohibited from cutting trees outside of the project site and from all hunting or killing of wildlife

Operation phase

Habitat degradation: The habitat loss from the construction phase will be translated into a long-term degradation of wildlife habitat within the 250 ha project site throughout the operation phase (until decommissioning). The site will be fenced and thus prevent movement of medium and large sized animals through the area. However, since the project site is close to Metehara town and does not act as a wildlife migration corridor, the fencing is unlikely to have any long-term impacts on terrestrial fauna. There are also no important plant species that will be affected, as the site is already degraded by the invasion of *Prosopis juliflora* (see above).

Mitigation measures:

- N/A

*Risk of bird fatalities:*Recent studies have demonstrated that utility-scale solar developments represent a source of fatality for wildlife such as birds (e.g. Kagan et al. 2014). However, the risk is highly dependent on the type of technology with several impacts confined only to concentrating solar power (CSP) and power tower technologies (Walston et al. 2015). The impacts may also not be greater than for any other facility with above-ground structures (solar or otherwise) including window strikes on buildings and bird collisions with power lines.

There are currently two known types of direct solar-related bird fatalities (McCrary et al. 1986, Hernandez et al. 2014, Kagan et al. 2014, Walston et al. 2015):

- *Collision-related fatality* resulting from the direct contact of the bird with a project structure(s). This type of fatality has been documented at solar projects of all technology types.
- *Solar-flux-related fatality* resulting from the burning/singeing effects of exposure to concentrated sunlight. Passing through the area of solar flux may result in: (a) direct fatality; (b) singeing of flight feathers that cause loss of flight ability, leading to impact with other objects; or (c) impairment of flight capability to reduce the ability to forage or avoid predators, resulting in starvation or predation of the individual (Kagan et al. 2014). Solar-flux-related fatality has been observed only at facilities employing power tower technologies, and hence, is not applicable to the Metehara PV project.

For utility-scale PV facilities, it has been hypothesised that migratory waterfowl and shorebirds can be attracted by the reflective surfaces of solar panels which can resemble bodies of water (referred to as the “lake effect”) (Kagan et al. 2014). Birds may then collide with project structures as they attempt to land on the panels. Increased collision risk may also occur at solar facilities that include evaporative cooling ponds (providing artificial habitat to birds and their prey/insects), which is not the case for the Metehara project. Another hypothesis is that glare and polarized light from PV facilities may attract insects, which, in turn, could attract foraging birds (Horváth et al. 2009, Horváth et al. 2010). However, to date, no empirical research has been conducted to evaluate the attraction of PV facilities to birds and the associated collision risks (Walston et al. 2015).

It should also be recognized that the light reflection from PV panels has been greatly reduced in recent years due to improved anti-reflective materials that maximize light absorption. Furthermore, the grey literature (non-peer reviewed studies) contain preliminary evidence that solar farms do not cause bird mortality and are instead capable of supporting a healthy assemblage of birds with observations of birds perching on solar arrays (Feltwell 2013).

Mitigation measures:

- Select PV panels with minimal light reflection
- Conduct another baseline avifauna survey during the main rainy season (July-August) and bird migration period (September) to verify the ESIA findings and to serve as a benchmark for continued monitoring
- Conduct bird fatality searches for a minimum of two years into the operation phase
- Assign an avian biologist to be on-call during the early operation phase (at least two years)

- If monitoring provides evidence of high bird fatality rates, consider the possibility of installing white grid lines on the PV panels that break up the reflection (there is preliminary evidence that it reduces the attraction of insects, and possibly or indirectly attraction of birds)

Risk of bat fatalities: According to a recent literature review by Harrison et al. (2017), there is currently no experimental, observational or theoretical evidence on the effect of solar panels on bats. The only indication of possible collision risk can be taken from Grief and Siemers (2010) who reported that juvenile bats display drinking behaviour over smooth plates, which suggests that bats can potentially mistake solar panels for waterbodies. However, the fact that bats use echolocation to recognise smooth surfaces strongly suggests that bats may be adept at avoiding collision with flat surfaces (Harrison et al. 2017). There is also a theoretical possibility that bats may be attracted to feed on insects on solar panels (see bird collision risk above) and to light on site in facilities that are equipped with security lighting (DOE 2015). However, without further evidence and with no indication that the project site provides important habitat for bats, mitigation measures (other than monitoring) are not warranted.

Mitigation measures:

- Conduct bat fatality searches for a minimum of two years into the operation phase

Establishment of invasive plant species: One of the effects of disturbance of vegetation and soils (during construction) is the subsequent upsurge of invasive plants (during operation). The project site has already been invaded by the weed *Prosopis juliflora* and these trees and shrubs need to be cleared during the construction phase. *P. juliflora* has a large soil seed bank, so there is need for continuous removal of seedlings as they emerge. On the other hand, the site fencing will prevent livestock from entering, which in the long term will reduce the recruitment of this species since seed germination requires scarification (typically occurring when seeds pass through the digestive system of goats and other livestock).

Mitigation measures:

- Remove the invasive *Prosopis juliflora* from the project site by clearing all trees/shrubs and preventing further seed germination and seedling establishment
- Explore opportunities for productive uses of the wood and seedpods of *P. juliflora*

Conclusion

The Metehara solar power PV project will have a large footprint of 250 ha causing local impacts on an already degraded environment. There is no evidence that solar PV facilities are causing significant impacts beyond the direct effects of habitat loss, such as increased collision risk for birds or bats. In particular, the only observed threatened species, being vultures, are among those birds that are less likely to be attracted by solar panels and be killed or injured by collision. There is, however, a strong need to monitor bird and bat fatalities in order to document no net loss in biodiversity.

Overall, the magnitude of the impact on biodiversity is **low-medium negative** without mitigation (▲) and **low negative** with mitigation (▲) in both the construction and operation phases.

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
Construction		▲	▲		
Operation		▲	▲		

Human Environment

Land Use

Construction phase

Physical and economic displacement: The Metehara solar PV project will require 250 ha of land for installation of the solar modules and auxiliary infrastructure. An estimated 561 households are reported to hold land use rights over the 250 ha and they have previously used the land for seasonal teff cultivation (approx. 200 ha) and livestock grazing (approx. 31 ha). The project land acquisition will therefore result in the loss of land use rights and access to agricultural land for these affected households. In addition, there are an estimated 38 residential structures within the boundaries of the project site, which will trigger physical displacement of those affected households that are currently using the land for residential purposes.

The scale of economic displacement is relatively high, considering that the project has made every effort to identify land that is not currently in use and that does not interfere with the urban areas in Metehara town or with other planned developments (such as the nearby Fentale Irrigation-Based Integrated Development Project). The size of the plot is also in alignment with the typical land requirements for such solar PV facilities, i.e. 2-4 ha/MW of alternating current (Ong et al. 2013).

There is no reason to expect that less displacement can be achieved in other areas of Fentale woreda, as there is generally high competition over land. Indeed, the project site has been identified by the community and the local government, suggesting that this is the preferred location(although free, prior and informed consent has not yet been documented). The affected households will be compensated for their loss of property, but it should be noted that replacement land is unlikely to be available.It should also be noted that additional land might be required on a temporary basis for the construction of the project campsite, disposal of spoil material, or other auxiliary facilities. Detailed land requirements for these facilities are not yet available. This also applies to the transmission line to the interconnection point on the grid.

The displacement of vulnerable households will increase their vulnerability to the risk of food insecurity. As noted in the baseline section, households in the project area struggle with securing sufficient food for their nutritional needs during the dry season (hunger period). In addition, the loss of agricultural land will not only

affect the legitimate land users but also the poorer households that have been earning income through the provision of labour to the affected households. It might be expected that women will be disproportionally affected as crop farming is mainly the responsibility of women. The loss of access to land for seasonal cultivation may increase the workload for women in relation to the search for food and alternative agricultural land for the household.

Mitigation measures:

- Document the free, prior and informed consent (FPIC) of the affected Karrayu community (Indigenous Peoples)
- Compensate for the loss of the land use rights to all households that hold land use rights on the project site
- Support all displaced households in their efforts to restore their livelihoods including acquisition of replacement land and housing through a participatory process and with particular attention to vulnerable households and women
- Obtain consent from the land users of the land to be temporarily acquired and restore all temporary land prior to hand over to ensure that its suitable for its original use

Operation phase

Long-term loss of productive land: It is assumed that the resettlement and compensation process has been completed prior to the operation phase.However, there will be an extended transition period until thelivelihoods of all the project affected persons have been fully restored.Indeed, restoration oflivelihoods is often difficult to achieve, especially because agricultural land of equivalent quality andquantity may not be available and because alternative livelihood activities are difficult to implement.

Once the land has been acquired and the construction completed, the affected community and land users will no longer have access to the 250 ha of land. Although they are compensated for their loss of property, there will be a long-term loss of potentially productive land that cannot be replaced, resulting in a general reduction of available agricultural land in the area. Therefore, opportunities for dual use of the land should be explored.

Whereas livestock grazing in the solar farm is probably not an option due to safety reasons and potential damage to the solar panels (e.g. climbing shoats), other dual uses could include controlled farming of crops (e.g. teff) or animal feed under or in between the solar panels. Research shows that solar panels elevated roughly 7.5 to 9 feet or more above ground allow for easier planting and harvesting mainly by hand, while 3- to 4-foot gaps between panel clusters can lead to crop yields almost the same as what they would have been in full sun sites (see Jossi 2018).

Mitigation measures:

- Continue the livelihood restoration activities until it has been verified that the livelihoods of all displaced persons have been restored to pre-project levels
- Explore options for dual use of the solar farm, i.e. energy production combined with agricultural production, for the benefit of the directly affected households

Conclusion

The magnitude of the impact on land useduring the construction phase is **medium-large negative**without mitigation (▲) and Medium **negative** with mitigation (▲). In the operation phase, the magnitude of impact is **low negative** without mitigation (▲) and **low positive** with mitigation (▲).

Phase	Magnitude
	Large Negative *Medium Negative* *Low/Insignificant* *Medium Positive* *Large Positive*
	|----------|----------|----------|----------|
Construction	▲ ▲
Operation	▲ ▲

Livelihoods and Economic Activities

Construction phase

Employment and business opportunities: Solar PV facilities of this scale are labour-intensive though only for a short construction period (11-15 months). Around 500-700 workers including both skilled and unskilled personnel are expected to be employed during the peak period. An estimated 60% of the workforce will compose of unskilled and semi-skilled labour, thus improving employment opportunities for the local population.

In addition to the direct employment, the project will also triggerindirect and induced employment through various suppliers, service providers and other economic opportunities created by this large investment. According to IFC (2013), there is a substantial multiplier effect for investment in the power sector. Business opportunities for the local communities include selling of food and other basic items, renting out accommodation and providing transport to the workers and other in-migrants. The project will also represent an opportunity for local people and unskilled workers to improve their skills and get experience in different trades, which will be of value to them at a later stage.

The project developer can enhance the opportunities for skills development during the construction phase by incorporating on-the-job training for the semi-skilled and unskilled employees. The project developer should also explore capacity-building possibilities particularly for the youth (boys and girls) and those that possess some level of vocational training. The option of organising women into formal groups/associations for the award of sub-contracts during the construction phase is highly recommended, particularly females from the directly impacted households.

Mitigation measures:

- Give priority to local residents for less specialised labour, especially the directly impacted land users as support towards livelihood restoration
- Create opportunities for employment of women in both management and casual placements attempting to employ at least 25% females of the semi-skilled and unskilled workforce

- Provide on-the-job training in order to upgrade the skills of the local workforce and incorporate measures for capacity building/skills development as part of the livelihood restoration measures

Operation phase

Employment opportunities: The operation of the solar PV plant will create direct employment of about an estimated 30 permanent employees (including security guards, etc.) and others on temporary basis under maintenance contracts. The number of workers is low compared to available job seekers but it will result into job security and improved cash flow for those permanent employees.

Mitigation measures:

- Give employment priority to local workers who have had their skills upgraded, including the directly affected land users
- Consider organising women into formal groups/associations for the award of sub-contracts for vegetation maintenance during the operation phase

Conclusion

The magnitude of the impact on economic activities during the construction phase is **medium positive** without mitigation (▲) and **medium-large positive** with mitigation (▲). In the operation phase, the magnitude of impact is **low positive** without mitigation (▲) and **low-medium positive** with mitigation (▲).

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
	|---|	|---|	|---|	|---|	
Construction				▲ ▲	
Operation			▲	▲	

Infrastructure and Services

Construction phase

Disruption of road traffic: There will be frequent movement of construction vehicles and trucks on public roads during the construction period. The take-off from the Addis Ababa –Djibouti highway to the project site will require proper planning and management to control both incoming and outgoing traffic as well as alerting

other road users. The highway is characterised by heavy traffic throughout the day and night. Poor driving skills and mechanical condition of trucks, combined withbad practices regarding load weight and speeding, are some of the factors that usually lead to fatal accidents along such public roads in Ethiopia. The project traffic should be planned such that it causes minimum disruption for other road users and minimal risk of traffic accidents.

Mitigation measures:

- Design the take-off from the highway to the project site in such a way that there is minimal disruption for the other road users and minimal risk of traffic accidents
- Ensure that traffic-holding/waiting areas for deliveries, loading and offloading are located at safe distance from the main highway
- Schedule deliveries and other project traffic to utilise the less busy hours of the day on the highway
- Collaborate with the local traffic police to ensure minimum disruption of road traffic on the public highway

Pressure on public services: The in-migration of workers and job seekers is a common phenomenon in most construction projects in Ethiopia. Population influx, even though temporary, usually puts considerable pressure on the host population, including their local infrastructure and services. In general terms, regions with a significant rural population practising and reliant upon agricultural subsistence-based livelihoods, high unemployment and under-employment, highly concentrated development, and a low per capita income are likely to experience high levels of internal migration toward economic opportunities (IFC 2009). However, while Fentale woreda may fit into the high risk category, the construction of the Metehara solar PV plant will have a relatively short duration (11-15 months) and there is also an opportunity to employ a high number of local people for less specialised labour which will reduce the need for workers from outside.

While it is assumed that EGP and the contractors will provide medical services for all project workers, hence not imposing additional pressure on the already constrained local healthfacilities, there is a high risk that in-migration of workers, job-seekers and camp followers will cause an increased demand for water, sanitation and waste management services. The construction contractors must be required to supply their workers with clean water and handle the wasteand wastewater from their operations in accordance with the applicable standards, but the project also needs to mitigate the sanitation and waste management risks caused by thegeneral population influx.

Mitigation measures:

- Establish transparent and consistent recruitment procedures and avoid recruitment at the gate in order to reduce the number of camp followers in form of job-seekers
- Ensure that contractors provide medical services, water supply and sanitation facilities to workers and their families so as to avoid adding additional pressure onpublic services
- Conduct public health campaigns addressing issues of behavioural change, water and sanitation, HIV/AIDS, etc.
- Support the woreda authorities and town administration to rehabilitate non-functional water supply facilities and/or extend the existing water pipelines to unserved areas

Relocation ofpower distribution line: The only public infrastructure on the project site consistsof a short section (~600 m) of a15 kV distribution line running form from Metehara substation to the Metehara Sugar Estate. The wooden poles and conductors will have to be relocatedto outside the project boundary about 100 m further west.

Mitigation measures:

- EEP should make arrangements for relocating the affected section of the local power line prior to commencement of construction works

Operation phase

Pressure on water resources: The maintenance of solar power plants requires the use of water for cleaning the PV panels. The water demand for cleaning has not yet been estimated but is typically restricted to a few cleaning cycles per year (see Section 7.2.5). In semi-arid environments with adjacent communities, attention needs to be paid to existing water users and the impact (if any) of proposed groundwater extraction on local water sources.

Mitigation measures:

- The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services
- The yield loss due to dust build-up on the PV modules should be monitored to ensure that no surplus cleaning cycles are undertaken

Impacts on air traffic: There is no evidence that PV panels with modern anti-reflective materials have any impact on air traffic control or navigation. To date, there have been no serious complaints from pilots or air traffic control due to glare impacts from solar PV installations (Solar Trade Association, undated). It should also be noted that the nearest airport is very far (~100 km) from the project site and that the Civil Aviation Authority has been notified and consulted as part of this ESIA study.

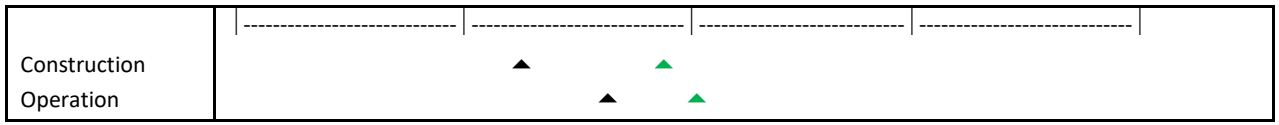
Mitigation measures:

N/A

Conclusion

The magnitude of the impact on infrastructure and servicesduring the construction phase is **medium negative**without mitigation (▲) and **low negative** with mitigation (▲). In the operation phase, the magnitude of impact is **low negative** without mitigation (▲) and **insignificant** with mitigation (▲).

Phase	**Magnitude**				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*



Health and Safety

Construction phase

Community health and safety risks: The in-migration of workers and job seekers may contribute to a breakdown in social fabrics, norms and practices, including sexual behaviour. Metahara town is already a hub for high-risk groups like truck drivers, sex workers, migrant labour and seasonal traders. Large construction projects of this nature, even if lasting no more than a year, often cause an increase in the prevalence of STI/STD including HIV/AIDS. Improved cash flow in the local economy tends to result in new marriages, extra marital affairs, family breakdowns, attraction of sex workers, and in the end more infections in the population.

The population influx may also worsened sanitation and hygiene conditions and contribute to increased prevalence of water and sanitation related diseases. Without improved sanitary facilities in the community, the likelihood of cholera outbreaks will increase. This will disproportionately affect infants and children and may increases the women's workload in relation to search for safe water as well as caring for the sick.

Another public health risk is respiratory infections. In dryland environments with dusty conditions, the construction activities (earth movement, vegetation clearance and construction traffic) will expose the neighbouring communities (and workers) to the risk of respiratory infections due to the increased fugitive dust emissions and air emissions from construction equipment and machinery.

The community will also be exposed to the risk of traffic accidents involving project vehicles and trucks on public roads. Construction traffic will be connected to the main Addis Ababa – Djibouti highway, which is already a busy road with high traffic volumes including trucks and public transport. Careful planning and management of construction traffic and transportation schedules will be required to minimise the risk of traffic accidents.

Mitigation measures:

- Conduct public health campaigns addressing issues of behavioural change, water and sanitation, HIV/AIDS, etc.
- Support the woreda to provide additional communal sanitation facilities in Gelcha kebele and Metahara town
- Provide home pack water treatment solution (water guard tablets) to households in collaboration with the kebele and the health clinics
- Disseminate traffic management plans and other public safety information through campaigns in schools and communities
- Traffic on community roads should be restricted to low speeds to avoid exposing other road users to accidents and unnecessary air pollution triggered by dust from moving vehicles

Security risks: The current security situation in Metehara town seems to be calm without any major security risks in the community except for petty thieves. However, construction projects tend to attract opportunisticcharacters who might be involved in criminal activities, including stealing of project property and equipment.

The major security risk in the rural areas include inter-tribal conflicts over grazing land and access to water sources. While it is not expected that the project will be directly exposed to such conflicts, it is essential that the land acquisition and compensation process be carefully managed in order to minimise the risk of community resistance. Failure to provide adequate compensation and support for livelihood restoration might result in conflicts with the local farmers and pastoralists, which could also expose the project to reputational risks.

Mitigation measures:

- Support local security systems to strengthen community policing and crime-handling measures
- Ensure that the conduct of security personnel complies with good international practice

Occupational health and safety risks: Most of the occupational health and safety risks are common to other large construction projects, but particular risks are related to transportation of equipment and personnel on the main road (i.e. risk of road accidents) and hiring of local workers with little experience from similar work. It is likely that their limited exposure in the past will cause increased risk of occupational accidents, including electrocution and incidents involving heavy lifting machinery, should activities not follow operation guidelines and safety measures.

Workers will also be exposed to extreme weather conditions due to high day time temperatures and shortages of water in such dryland environment. Continuous exposure (8 to 10 hours per day) to such extreme weather conditions will increase the risk of dehydration and fainting. In addition, there is a risk of sanitation related diseases among the workers due to poor local sanitation facilities (see above).

Regarding labour conditions, the industry sector in Ethiopia is characterised by prolonged workdays, poor human resource policies, and high rates of child labour. Workers are generally unaware of their rights, and the regulations towards employment are not well disseminated and enforced. Adoption of such unethical practices would expose the project to the threat or worker demonstrations and reputational risks.

Mitigation measures:

- Include best practice health and safety provisions in the construction contracts and ensure strict compliance with national legislation and EHS guidelines
- Ensure that work schedules are organised in shifts that protect workers from long-term exposure to extreme temperatures
- Provide workers with safe drinking water and dedicated sanitary facilities at all work sites and camp facilities
- Adopt sound human resource policies compliant with international standards
- Prevent gender based violence (GBV), sexual abuse and exploitation and child labour in the workplace
- Establish a grievance mechanism for workers

Operation phase

*Health and safety risks:*The health and safety risks during operation phase will be limited to the workers. They will be exposed to electrocution risks, burns and cuts as they undertake routine operation and maintenance tasks.

Mitigation measures:

- Ensure compliance to strict occupational health and safety standards
- The solar PV plant shall be equipped with a fire-fighting system

Conclusion

The magnitude of the impact on health and safety during the construction phase is **medium negative** without mitigation (▲) and medium **low negative** with mitigation (▲).During the operation phase, it is medium **negative** without mitigation (▲) and **low negative**with mitigation (▲).

Phase	Magnitude
	Large Negative *Medium Negative* *Low/Insignificant* *Medium Positive* *Large Positive*
	|----------|----------|----------|----------|
Construction	▲ ▲
Operation	▲ ▲

7.4.5 Cultural Heritage

Construction phase

*Loss of physical cultural resources:*There are no known cultural heritage resources at the project site. However, as always, there is a risk that cultural heritage objects are unexpectedly uncovered during construction activities.

Mitigation measures:

- Establish a chance finds procedure

Conclusion

The magnitude of the impact on cultural heritage during the construction phase is **low negative** without mitigation (▲) and **insignificant** with mitigation (▲). The impact is **insignificant** during the operation phase.

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
Construction	▲		▲		
Operation	▲				

7.4.6 Tourism

Construction and operation phase

Impacts on tourism potential: Despite being situated near a tourist destination, the Awash National Park, it is unlikely that the project will infringe on the tourism potential. To the contrary, local and foreign tourists, including government representatives, engineers, students, etc., might be attracted to visit the solar PV facility for educational purposes and to witness an example of the Ethiopian transformation into a modern energy system.

Conclusion

The magnitude of the impact on tourism is **insignificant** both in the construction and operation phase.

Phase	Magnitude				
	Large Negative	*Medium Negative*	*Low/Insignificant*	*Medium Positive*	*Large Positive*
Construction			▲		
Operation			▲		

7.5 Overall Impact Assessment

Table 20Summary of impact assessment without and with mitigation/enhancement measures

summarises the potential impacts of the proposed Metehara solar power PV project without and with the proposed mitigation/enhancement measures. The overall impact scores are given for the construction phase and the operation phase, respectively.

Table 20Summary of impact assessment without and with mitigation/enhancement measures

Theme	Baseline Value	Impact Magnitude		Overall Impact	
		Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
CONSTRUCTION PHASE					
Physical Environment					
Topography and landscape	**Low**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Geology and soils	**N/A**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Climate and air quality	**High**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Noise	**Medium**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Water resources	**Low-Medium**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Biological Environment					
Protection status	**Low**	**Insignificant**	**Insignificant**	**0**	**0**
Flora and fauna biodiversity	**Low-Medium**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Human Environment					
Land use	**N/A**	**Medium-Large negative**	**Medium negative**	**– – –**	**–**
Economic activities and livelihoods	**N/A**	**Medium positive**	**Medium-Large positive**	**+ +**	**+ + +**
Infrastructure and services	**N/A**	**Medium negative**	**Low negative**	**– –**	**–**
Health and safety	**N/A**	**Large- Medium negative**	**Midium- low negative**	**– – –**	**– –**
Cultural heritage	**Low**	**Low negative**	**Insignificant**	**–**	**0**
Tourism	**Low**	**Insignificant**	**Insignificant**	**0**	**0**

Theme	Baseline Value	Impact Magnitude		Overall Impact	
		Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
OPERATION PHASE					
Physical Environment					
Topography and landscape	**Low**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Geology and soils	**N/A**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Climate and air quality	**High**	**Medium-High positive**	**High positive**	**+ + +**	**+ + + +**
Noise	**High**	**Insignificant**	**Insignificant**	**0**	**0**
Water resources	**Low-Medium**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Biological Environment					
Protection status	**Low**	**Insignificant**	**Insignificant**	**0**	**0**
Flora and fauna biodiversity	**Low-Medium**	**Low-Medium negative**	**Low negative**	**– –**	**–**
Human Environment					
Land use	**N/A**	**Medium negative**	**Medium positive**	**–**	**+**
Economic activities and livelihoods	**N/A**	**Low positive**	**Low-Medium positive**	**+**	**+ +**
Infrastructure and services	**N/A**	**Low negative**	**Insignificant**	**–**	**0**
Health and safety	**N/A**	**Medium negative**	**Low negative**	**–**	**–**
Cultural heritage	**Low**	**Insignificant**	**Insignificant**	**0**	**0**
Tourism	**Low**	**Insignificant**	**Insignificant**	**0**	**0**

Very large negative – – – –, Large negative – – –, Medium negative – –, Small negative –, Minimal/no 0, Small positive +, Medium positive + +, Large positive + + +, Very large positive + + + +.

7.6 Cumulative Impacts

7.6.1 Introduction

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. The magnitude of the cumulative impacts can be equal to the sum of the individual effects (additive effect), or can be an increased effect (synergistic effect) or a decreased effect (antagonistic effect).

The cumulative impact includes two components:

- The anticipated future condition arising from the cumulative impacts
- The contribution of the development under evaluation to the cumulative impacts

The other existing and planned developments that have been selected for analysis (see below) include those identified by stakeholders to be of critical concern and that have a high relative importance. The cumulative impacts may translate into a wide range of changes in the physical, biological and human environment, but only the most significant issues are dealt with here.

7.6.2 Other Existing and Planned Projects

The Metehara solar power PV project will be implemented in an environment that is already modified by other existing projects and infrastructure. In addition, new developments are in the pipeline. Among those outlined in Section 5.3, the most relevant projects and activities are the following:

- Metehara Sugar Estate with a total concession area of 14,400 ha, of which 10,231 ha are currently planted.
- The Fentale Irrigation-Based Integrated Development Project, which is planned to be expanded into parts of Gelcha kebele (622 ha) and other potential command areas near the proposed project site.

7.6.3 Potential Cumulative Impacts

The land take for the Metehara solar power PV plant will add to the ongoing conversion of pastoral grazing areas into other land uses. As explained in Section 5.3.2, the creation of protected areas and the establishment and expansion of large-scale commercial farms throughout the Awash Valley has led to reduced access to traditional grazing lands and watering points, especially for the Karrayu pastoralists. In Metehara, urban expansion and the growth of Lake Beseka have also contributed to this process of decline in pastoral livelihoods.

The Karrayu people living in Gelcha kebele are predominantly agro-pastoralists and are increasingly involved in farming. Many of them rely on Metehara town for public services, including health and education,and some of the younger generation have changed their livelihoods away from dependency on livestock and land.

This transition is likely to continue with the growth in the Ethiopian economy. However, for the foreseeable future, the majority of Karrayu will remain dependent on agro-pastoralism and land-based livelihoods. Thus, in terms of cumulative impacts, the reduced access to land resources due to the Metehara solar power PV project willhave an additive or even synergistic effect on traditional agro-pastoral livelihoods.

On the other hand, it should be recognised that the land for solar power development was selected by the local communities themselves after having rejected the initially proposed site. The selected 250 ha of land does not appear to play a very important role in livestock production and crop cultivation, at least not compared to those areas that can be supported by irrigation.

The cumulative impact of the Fentale Irrigation-Based Integrated Development Project will depend on whether the displaced households can be given land in the irrigation scheme. If so, the effect can be considered as antagonistic, i.e. the irrigation scheme can help reduce the impact of the Metehara solar power PV project. However, if the displaced households will not benefit from the irrigation, either because they are not allocated any replacement land or the irrigation scheme does not materialise (e.g. due to lack of budget or water), then the effect will be negative and additive (i.e. causing even more loss of land for the affected agro-pastoralists).

As described in the Resettlement Policy Framework, the project proponent should collaborate with Oromia Irrigation Development Authority to ensure that displaced households are allocated agricultural fields in the Fentale Irrigation-Based Integrated Development Project.

7.6.4 The Karrayu Conflict Context

Conflicts has adversely affected pastoral areas for centuries, but they have increased in recent years, variously attributed to rising pressure on resources, reduced resource availability, a proliferation of arms, and the decline of traditional conflict management mechanisms. The Karrayu Oromo pastoralists are not exceptions to this fact. Conflict disproportionately affects women and children and places additional limits on animal mobility, including stressing resources pastoral livelihoods depend. While there are no active conflicts nor is associated with the proposed Solar PV site in Metehara, it is important to examine the historical context.

The Middle Awash Valley was originally controlled by pastoral and agro-pastoral groups who grazed their livestock on the plains between Mount Fentale and the Awash River. These include the Karrayu, whose territory is bordered by the Afar, Ittu Oromo, Arsi Oromo and the Issa Somali pastoralists and agro pastoralists, with a complex history of conflict and competition over land use (Beyene and Gudina 2009).

The primary ethnic groups in the Project Affected area are the Karrayu and Ittu Oromos. The Oromo language is the dominant language spoken by almost all PAPs. The Karrayu are herders, practicing their indigenous religion. The Ittu practice agro-pastoralism, are almost exclusively Muslim. However, this distinction has diminished as the Karrayu gradually convert to Islam and involved in farming, due to a decline in pastoral livelihoods (Abdulahi 1998 and Gillingham 2001). The proposed Metehara Solar PV site, the land take will affect, (i) 56.1% Karrayu; (ii) 40.5% Ittu Oromos and (iii) 3.5% other ethnic groups (Somali, Kembata and Berta).

The Karrayu believed that they are the most disadvantaged groups in the country in economic and political participation. The neighboring groups have better access to automatic weapons and administrative institutions rendering them more power and domination over them. The state has growing interest to expand commercial farms as well as private investments.

The Awash National Park established in early 1960s (about 3.5 km away from the site) is home to a total of 76 mammal species (including bats) and over 450 species of birds. Park management is challenged by non-conservation related activities ranging from permanent settlements to livestock grazing and there have been land use conflicts with pastoralists.

Metehara Sugar Factory is also called Wonji Shoa Sugar Factory. its construction was carried out by H.V.A. Company of the Netherlands. The factory started sugar production in 1970. Formed as Share Company between the then Ethiopian government and the constructing company. Due to the plantation land acquisition since its establishment and expansion, the factory appropriated the Karrayu grazing area.

Given the overall conflict history and complexity, the proposed Solar PV site in Metehara, undertook iterative consultation with different stakeholders including the underserved Karrayu groups since January 2017 through March 2019. The consultation and negotiation resulted in the following agreements; (i) undertake community social cohesion events through continued stakeholder engagement; (ii) ensure appropriate and timely compensation payment as per the complementary RPF, (iii) ensure that there is livelihoods restoration support proportional to the scope of impact; (iv) benefit sharing through community development projects; (v) a harmonized GRM mechanism which is conflict sensitive with the indigenous system; (vi) private sector community relationship with communities including workers code of conduct which is sensitive to the conflict history, prohibiting hunting and fishing by project workers; (vii) livelihoods restoration measure based on local context and appropriate to the PAPs livelihood choices.

7.7 Decommissioning Phase

7.7.1 Introduction

The Metehara solar power PV plant is expected to have an economic life span of minimum 25 years (equal to the normal warranty period for PV modules) and more likely 35-40 years with proper maintenance and interim replacement of major equipment. The Power Purchase Agreement (PPA) is valid for 20 years, hence another PPA may be signed to extend the operation of the solar PV facility until it is no longer economically viable.

Once the power generation has ceased and is no longer required, it will be necessary to decommission the solar modules and all associated equipment and facilities to return the affected area to a natural environment similar tothat which existed prior to construction.

A decommissioning plan will be prepared before the start of the decommission operations, taking the applicable legislation and baseline conditions prevailing at that time into account. Due to the obvious uncertainties related to the future scenario, the potential impacts and mitigation measures described below should only be considered as a preliminary analysis.

The decommissioning works shall be undertaken in liaison with the relevant regulatory authorities and adhere to applicable safety guidelines to ensure that the decommissioned facilities do not become a hazard to the public or the environment.

7.7.2 Potential Impacts

The environmental and social impacts of decommissioning include among others:

Ecological restoration: A decommissioning of the Metehara solar power PV plant and removal of all equipment and materials will restore the affected land to its pre-project state. Although the ecological value of the project site is limited, this will have a positive impact on the ecosystem and affected habitats, at least until the land is developed for another purpose (e.g. expansion of Metehara town).

Pollution: Decommissioning will cause impacts similar to those of the construction phase, including temporary increase in noise dust emissions. The deconstruction of internal roads and buildings and dismantling of solar modules and other electronic and mechanical equipmentwill also result in the creation of both hazardous and non-hazardous waste.

Loss of employment: There will be loss of jobs as the solar PV facility is envisaged to provide a number of long-term employment opportunities during the operation phase. This adverse impact will only partly be compensated by the short-term jobs created by the decommissioning works.

Occupational health and safety risks: The decommissioning works will involve occupational health and safety risks similar to those of the construction phase.

7.7.3 Mitigation Measures

Occupational Safety

All workers shall be provided with personal protective equipment and be trained in safety procedures relevant for the decommissioning works. EGR shall ensure that all sub-contractors abide by the applicable health and safety procedures.

Recycling and Disposal of Equipment and Materials

Most materials from the solar facility will be processed by recyclers. Metal parts (sub-structures, cables, racking, posts etc.) will be sold to local scrap metal dealers, while the solar modules will be recycled by appropriate recyclers.

EGP is committed to ensure safe disposal of all hazardous waste, concrete and similar non-recyclable construction materials, and recycling of scrap metal.

*Solar modules:*PV modules contain materials that can be recovered and reused in either new PV modules or other new products. Materials such as glass, aluminium, as well as a variety of semiconductor materials, are valuable when recovered.

The disassembly of the solar modules will consist of:

- removing fasteners attaching each module to the racking (reusable fasteners will be saved for re-use)
- removing the modules from the racking
- placing the solar modules in loading pallets
- loading pallets in trucks for transportation to the recycle facility

While solar PV modules can last up to thirty years, a significant quantity of material needs to be disposed of at the end of the life of the modules. Because modules can contain potentially hazardous materials and many countries, including Ethiopia, lack adequate disposal facilities, consideration should be given at the start of a solar PV project as to how units will be disposed of at the end of their useful life.

Many components of solar PV modules are recyclable and some solar module manufacturers provide recycling of the panels with purchase. Recycling will greatly reduce potential adverse impacts associated with panel disposal.

EGP is therefore advised to inquire whether any of the potential suppliers or manufacturers provide recycling services such that PV panels can be returned if they are damaged and/or at the end of the project life.

*Mounting and racking system:*Once the solar modules have been removed, the racking will be disassembled and the posts supporting the racking will be removed. These components will be sold to local scrap metal dealers.

Concrete used for foundations will be delivered to a certified dump site where the material can be re-used for road construction or similar purposes.

Cables: Copper and aluminium cables are used for cabling of the solar plant. The aim is to sell all of these cables to local scrap metal dealers. No waste product of the wiring will remain on site.

The managing of cables will consist of:

- disconnection of cables from electrical appliances
- collection on site according to their nature (copper or aluminium)
- loading from the buyer into his trucks for evacuation from site

As underground cables are only laid down in the ground, they will be easily pulled out with a tractor. In the event where difficulty is observed to pulling cables out, the trenches shall be opened with a TLB (tractor loader backhoe).

Other electrical equipment: All other electrical equipment (such as inverters, transformers, security perimeter system, weather station, etc) shall be removed and disposed as electrical waste to a certified contractor dealing with electrical and electronic waste.

Site Restoration

Once all facilities, equipment and materials have been removed from the site, the land will be returned to its pre-construction conditions through landscaping. The site will either be re-vegetated with native species, or be prepared for crop cultivation and/or settlements depending on the land use plans of Fentale woreda at the time of decommissioning.

8 ANALYSIS OF ALTERNATIVES

8.1 Introduction

This chapter describes and examines the alternatives to the proposed Metehara solar power PV project. While only one project alternative was examined in detail in Chapter 7, different siting/layout and technological alternatives have been considered in the early planning stage and during the ESIA process, as presented below.

The overall purpose of the Metehara solar PV project is to supply electricity to the Ethiopian transmission grid using a renewable source of energy. A comparison of alternatives can help to determine the best method of achieving the stated project objective while also minimising environmental and social impacts. It also serves to document how risks and impacts have been *avoided* during project planning, which is always the first and most important step in the mitigation hierarchy.

It should be noted that the present ESIA has been carried out under a constrained project scenario, i.e. the project identification has largely been completed prior to the ESIA process. This chapter will therefore mainly deal with project-specific alternatives and not try to retroactively revisit the whole range of power generation technologies (e.g. fossil fuels, wind, hydro, biomass, or concentrating solar power – CPS).

8.2 Other Solar Power PV Alternatives

The Metehara solar power PV project was identified in the Master Plan for wind and solar energy (HydroChina 2012). The Metehara site was one of five potential sites that were recommended for development (Table 21 List of recommended sites for solar PV power stations in Ethiopia.

, **Error! Reference source not found.**). However, no ranking was performed because they all followed a similar pattern of solar irradiation levels (Hydro China 2012) and are thus assumed to be equally suitable for solar PV installations. The decision to move forward with the Metehara project was taken by EEP in partnership with the Power Africa Transactions and Reform Program (PATRP).

The Metehara project was found to be favourable due to (i) excellent radiation source conditions, (ii) convenient location along the main road between Addis Ababa and Djibouti (Highway 4), and (iii) proximity to existing transmission grid and the load centre in Metehara.Without site-specific environmental and social screening of the other four potential sites, it is not possible to confirm that the Metehara site is the overall most favourable project alternative.

In general, due to the large land requirements of utility-scale solar PV facilities, such projects are preferably sited on unproductive land to minimise resettlement and loss of agricultural production. Whether such land is available in the alternative project locations is not known, but it should be noted that land is a scarce resource in Ethiopia and that almost all land is used for cultivation and/or livestock grazing. Thus, the identified impacts on land use in Metehara would probably also occur in the alternative locations shown in Table 21 List of recommended sites for solar PV power stations in Ethiopia.

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Table 21 List of recommended sites for solar PV power stations in Ethiopia.

No.	Name	Capacity (MW)	Area (km^2)	Grade in preliminary selection	Domicile
G1	DebreBirhan PV power station	10	0.39	95	Amhara
G2	Metehara PV power station	50	1.6	92	Oromia
G3	Awash solar energy PV power station	20	0.62	99	Afar
G4	Dera solar energy PV power station	60	1.59	97	Oromia
F51	Addis Ababa wind energy and solar energy demonstration base	1	-	95	Oromia

Note: Metehara solar power PV plant was originally planned to have an installed capacity of 50 MW but has since been expanded to 100 MW.
Source: HydroChina (2012)

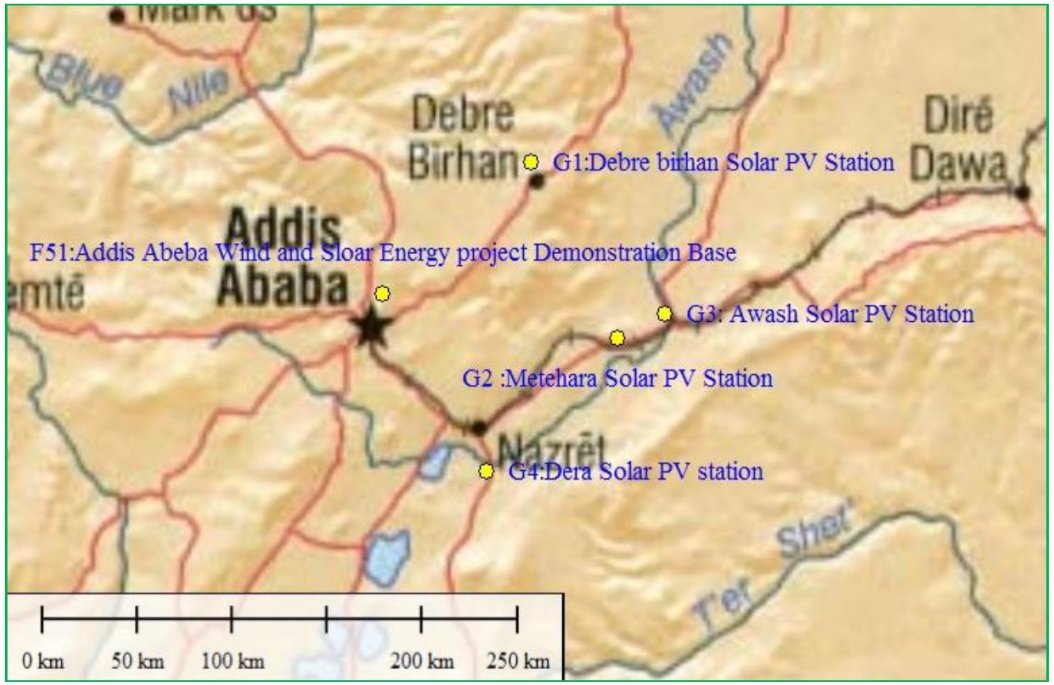

Figure 46: Location of the recommended solar PV power stations in Ethiopia.

Source: HydroChina (2012)

8.3 Project-Specific Alternatives

8.3.1 Project Siting

The detailed siting of Metehara solar power PV station was originally proposed by Ethiopian Electric Power (EEP) in a preliminary/prefeasibility ESIA report (EEP 2016). Four project-specific siting alternatives were identified and evaluated atthat early planning stage (*Error! Reference source not found.****). The pros and cons of these alternatives, referred to here as Options 1A, 1B, 1C and 2, are summarised in Table 22Comparison of the initial project-specific siting alternatives***

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Table 22Comparison of the initial project-specific siting alternatives

Parameter	Option 1A	Option 1B	Option 1C	Option 2
Presence of residential structures?	Yes	Yes	Yes	No
Planned for irrigation development?	Yes	Yes	Yes	Yes
Distance to main road (km)	1.0	0.7	0.1	0.1
Distance to transmission line	0.2	0.9	1.3	2.0
New railway acting as barrier for transport from main road?	Yes	Yes	No	No
Located within Awash National Park?	No	No	No	No
Presence of 'natural' forest?	No	No	Yes	No

Source: Multiconsult (2018)

The overall conclusion was that Option 2 represented the preferred alternative and that it was justifiable both from a technical/economic and an environmental/social perspective (EEP 2016). However, during the inception phase of this ESIA study in January 2017, it was found that the proposed site (as well as the other siting alternatives) had been planned for inclusion in a large-scale irrigation development programme known as Fentale Irrigation-Based Integrated Development Project.An irrigation canal had already been excavated immediately east of the proposed site (**Error! Reference source not found.**). The woreda administration as well as the two concerned kebeles (Benti and Gelcha) were hesitant to permit solar energy development within the planned command area of the irrigation scheme.

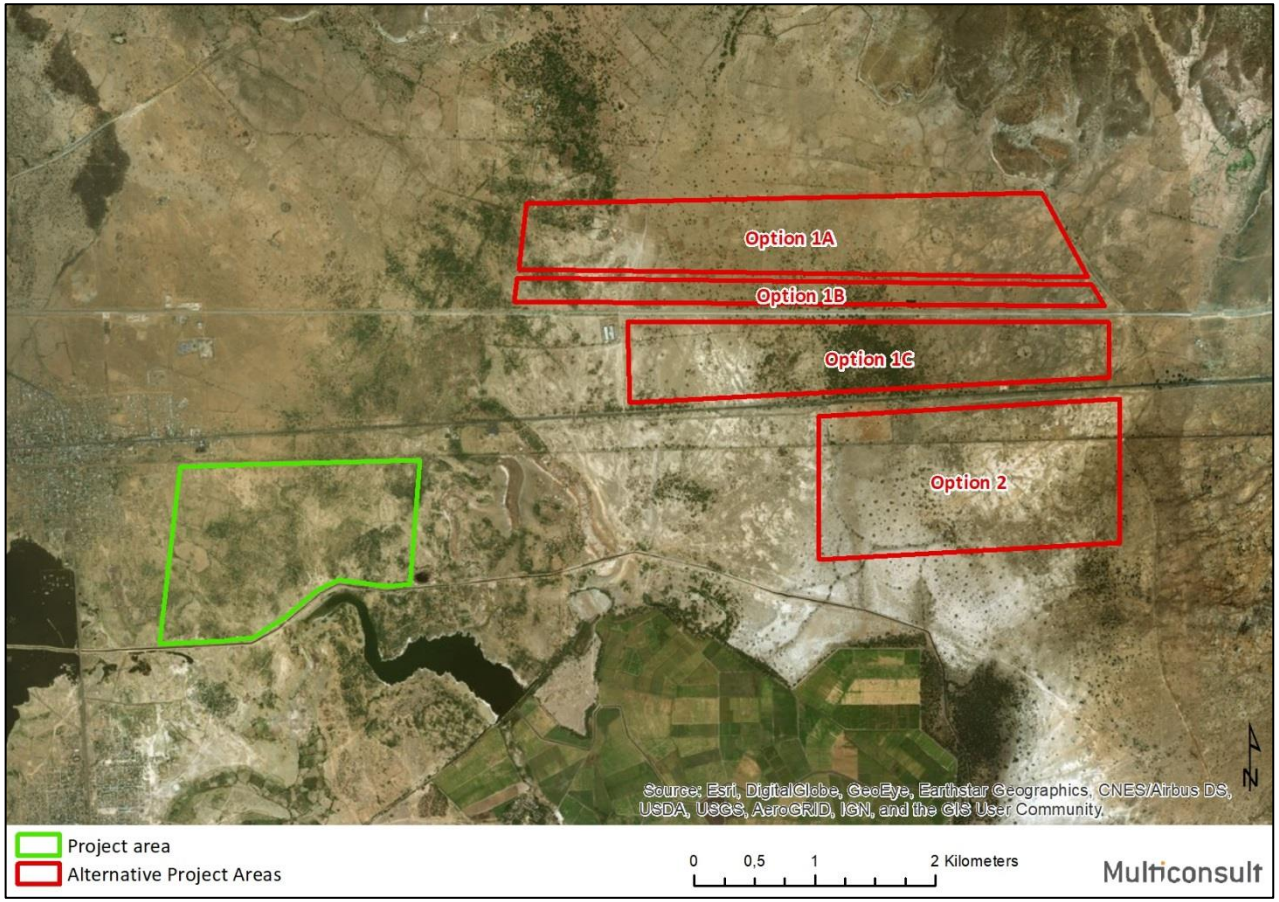

Figure 47: Aerial photo showing the initial project siting alternatives located about 3.5 km east of the current project site.

This finding triggered a re-consideration of the project siting alternatives. Initially, EEP requested the Oromia Irrigation Development Authority and Fentale woreda to allocate a portion of the planned irrigation scheme for the Metehara solar power PV plant. It was noted that renewable energy production is a priority of the federal government and that the viability of irrigation development on the land for Option 2 is questionable due to high water demand and the impacts on downstream flow in the Awash River (the source of irrigation water).

There is already evidence that the river flow has been reduced significantly due to water abstraction for irrigation, affecting all downstream users including the Metehara Sugar Estate and the entire Afar region. An extension of Fentale irrigation scheme all the way to Benti and Gelcha (the most downstream portions of the irrigation scheme) would require correspondingly more water than what is currently abstracted from the Awash River whereas reducing the planned irrigation area by 250 ha would contribute to saving water in the river especially in the critical dry season. On the other hand, the irrigation scheme–if realised–would serve more than 300 households on the 250ha land[1], thus representing a significant opportunity cost.

Fentale woreda eventually decided that the originally proposed plot of land could not be accepted because of the above-mentioned conflict with the planned irrigation scheme. In a letter from the Rural Land Administration and Use Office to EEP dated 8th September 2018, Fentale woreda explained that the community had agreed to allocate an alternative site located in Gelcha kebele near Metehara town about 3.5 km west of the original project site.Following some further adjustments to the site layout, the current boundaries were officially adopted and endorsed in a letter from the Rural Land Administration and Use Office dated 29th November 2018.

Figure 48 shows the location of the planned command areas of the Fentale Irrigation-Based Integrated Development Project. Unlike the initially proposed sites (Options 1A, 1B, 1C and 2), the new project site is located such as to avoid any land use conflicts with future irrigation developments. There also appears to be less cultivation as evidenced by the widespread occurrence of the invasive shrub *Prosopis juliflora*. On the other hand, a few residential structures will be affected (which could have been avoided in the originally proposed Option 2).

In conclusion, the new site selected by the woreda in consultation with Gelcha kebele and the local community is preferred over the originally proposed project site (Option 2).**Error! Reference source not found.** provides a simple comparison between these two main siting options. The strongest argument in favour of the new site is that it was selected based on a bottom-up and participatory approach whereby the local government and communities themselves were responsible for identifying the most suitable siting of the solar power PV facility.

Table 23Comparison between the 'old' and 'new' site.

Parameter	Old Site ('Option 2')	New Site
Presence of residential structures?	No	Yes (few)
Planned for irrigation development?	Yes	No
Distance to main road (km)	0.1	0.25
Distance to transmission line (km)	2.0	2.4
Distance to Awash National Park (km)	3.0	9.0
Presence of 'natural' forest?	No	No
Presence of invasive plants (*Prosopis juliflora*)?	Low	High

[1] *The typical size of individual farm plots in the Fentale Irrigation-Based Integrated Development Project is 0.75 ha per households.*

Parameter	Old Site ('Option 2')	New Site
Consent by local land users	No	Yes
Size of land (ha)	250	250

8.3.2 Power Line Routing

The connection to the existing 230 kV single-circuit line located approximately 2 km north of the Metehara project site will be made by a loop-in/loop-out (LILO) arrangement. EEP will be responsible to construct and operate/maintain the new transmission line from the PV power plant to the interconnection point on the existing 230 kV line. However, the routing of the new line cannot be done until the location of the Metehara solar PV substation has been defined by the independent power producer (EGP).

It has been agreed that the transmission line infrastructure is not part of the scope of the ESIA study, but that it be considered as an "associated facility" (*sensu* IFC Performance Standard 1) and be subject to initial screening of potential environmental/social risks and impacts. For this purpose, three routing alternatives have been defined: (1) eastern route, (2) middle route, and (3) western route (**Error! Reference source not found.**). Alternative 1 is compatible with the proposed location of the solar PV plant substation and switchyard in the north-east corner of the project site (as shown on preliminary design drawings by EGP).

Table 23 shows how the different routing alternatives perform with respect to some simple parameters serving as proxies for environmental and social risks and impacts. The best option seems to be the middle route (2), which avoids any resettlement impact as well as forest clearing in the right of way. However, alternative 1 (eastern route) is also likely to have acceptable risks and impacts as the affected woodlands are not expected to be rich in biodiversity and are only confined to short sections of the line route. Moreover, the possible interference with future irrigation farming (see **Error! Reference source not found.**) is not considered as a significant risk because crop cultivation can continue to be practiced underneath overhead transmission lines (and the land take for tower foundations is limited). On the other hand, alternative 3 (western route) seems to be non-feasible since it would traverse some urban areas of Metehara town.It should be noted that the right of way for 230 kV power lines in Ethiopia is 40 m wide (i.e. 20 m on each side of the centre line).

Table 24Comparison of routing alternatives for the grid interconnection.

Parameter	Eastern Route (1)	Middle Route (2)	Western Route (3)
Presence of residential structures?	No	No	Yes
Planned for irrigation development?	Yes	No	No
Crossing the main road?	Yes	Yes	Yes
Crossing the new railway?	Yes	Yes	Yes
Crossing of 132 kV transmission line?	Yes	Yes	Yes
Located within Awash National Park?	No	No	No
Presence of forest?	Yes	No	No

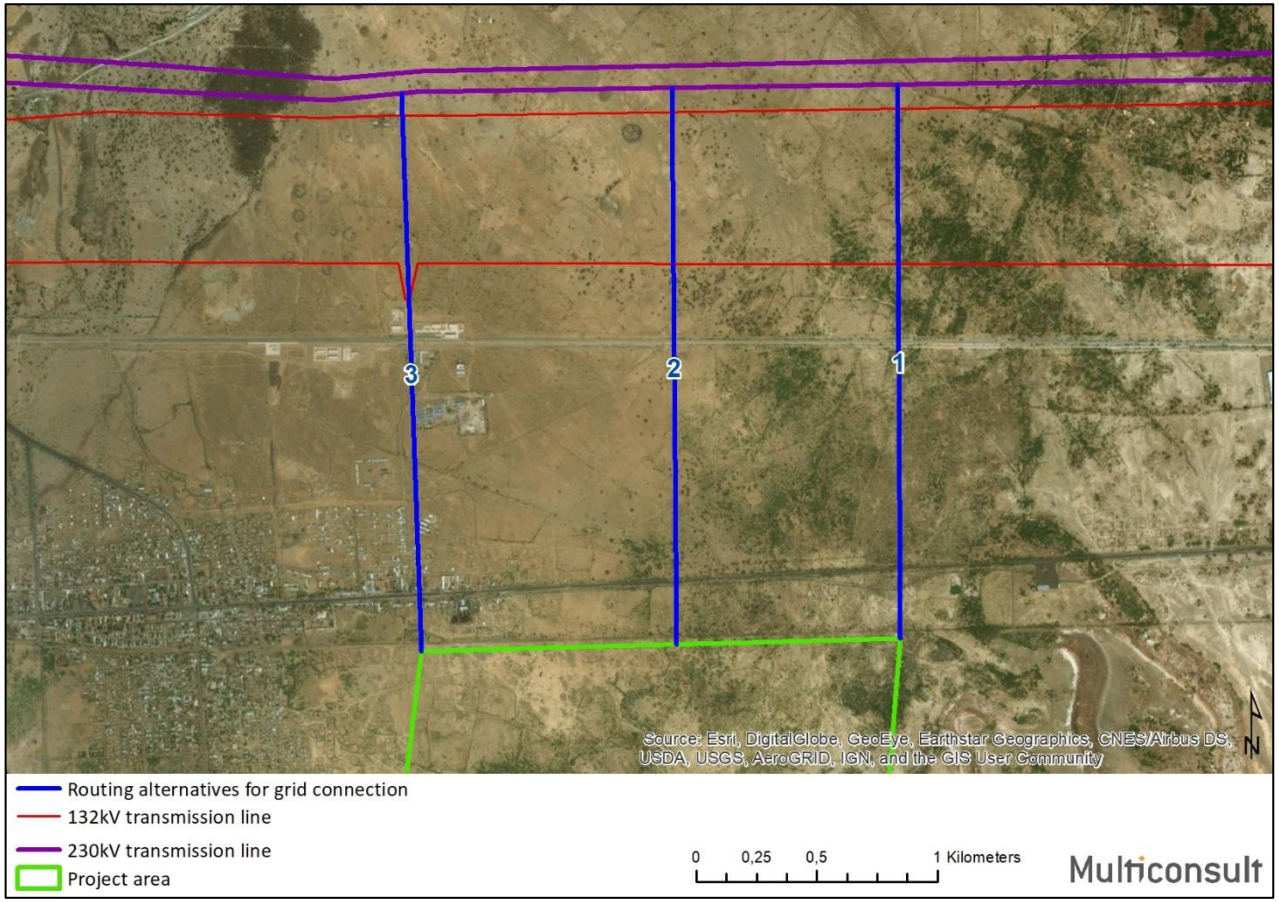

Figure 49: Aerial photo showing three possible routing alternatives for the grid interconnection.

8.4 No Project Alternative

Under the "no project" alternative, the proposed Metehara solar PV plant would not be constructed and operated, and hence, the project-induced environmental and social impacts would not occur. However, choosing the no project alternative does not necessarily correspond to maintaining baseline conditions or status quo, as changes may result from other actions.

The most relevant consideration for the no project alternative (apart from suppressing economic growth due to power shortages, or triggering other power generation schemes elsewhere in the country) is thealternative land uses that would be realised if the site is not used for solar power development. According to woreda officials, Metehara town is likely to continue expanding into the proposed project site, especially since the opposite/western boundary of the town is limited by Lake Beseka. Indeed, this is the reason why the Rural Land Administration and Use Office has kept a 200 m wide 'buffer zone' between the main road and the old railway line for future urban expansion (the project site was initially planned to extend across the old railway towards the main road). Thus, even without the Metehara solar PV plant, the project site is likely to be developed and the current environmental and social conditions will be significantly changed.

Overall, given that most of the adverse environmental and social impacts can be successfully mitigated through provision of adequate compensations to the displaced households and careful environmental planning and monitoring, the no project alternative is not considered to be a preferred option when taking all technical, economic, social and environmental aspects into account.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Introduction

One of the objectives of the ESIA process is to develop an Environmental and Social Management Plan (ESMP) which outlines the costs, timeframes and responsibilities to implement the mitigation and enhancement measures. The present ESMP also includes a monitoring programme to provide checks on the mitigation activities and their effectiveness and to allow corrective actions in a timely manner.

This chapter presents the preliminary ESMP for the Metehara solar power PVproject based on the information available at the current stage of project development. It is expected that the ESMP will be refined during the detailed design phase and once the construction contractor(s) have been identified. Thus, the ESMP will need continuous revision and updating.

The sole responsibility for the implementation and outcome of the ESMP rests with the project proponent. In the present project, Ethiopian Electric Power (EEP) will be responsible for the ESMP until the Power Purchase Agreement (PPA) Implementation Agreement have been signed with Enel Green Power (EGP) and the environmental permit has been issued and transferred to EGP. The only project component that will continue to be under the sole responsibility of EEP is the transmission line connecting the solar facility to the grid.

EGP (as the owner of the solar PV facility) and EEP (as the owner of the transmission line) shall be committed to manage all the environmental, health, safety and social risks and impacts identified in this ESIA study as elaborated below. EGP and EEP will also be responsible for ensuring that all contractors and sub-contractors are in compliance with the ESMP requirements(for the solar PV facility and transmission line, respectively).

9.2 Institutional Arrangements

The project implementation arrangements have not yet been finalised. However, it is assumed that both EGP and EEP will procure the services of contractors to perform most of the construction and installation works while the major equipment may be purchased directly from suppliers. The construction of the solar PV facility is likely to be managed by one EPC contractor with sub-contractors.

In addition to EGP and EEP as project owners and their contractors/sub-contractors, the Metehara solar power PV project will also require the involvement of the government/regulator, financing institutions, and different services providers. The roles and responsibilities of the different project parties in the context of this ESMP are outlined below.

Regulatory Authorities

For purposes of this project, the regulating body will include all those government institutions responsible for enforcing compliance with national standards in the different areas of specialisation. The regulatory authority for the energy sector in Ethiopia is the Ministry of Water, Irrigation and Energy (MoWIE).MOWIE's Environment and Climate Change Directorate (formerly Environmental Impact Assessment and Social Development Office) is responsible for evaluating and approving ESIA/ESMP study reports for electrical infrastructure projects as well as for providing environmental approval which must be obtained prior to the commencement of project implementation. Thus, the overall responsibility for monitoring environmental and social compliance for the project lies with MoWIE. They also follow up on projects to ensure that environmental and social mitigations have been implemented.

At the regional state level, environmental protection and land management is administrated by the Oromia Rural Land and Environmental Protection Bureau. It is expected that this office will also be involved in monitoring of the environmental performance of the Metehara solar power PV project. In addition, the land title will be issued by the regional government through the Oromia Investment Commission following the approval of the Rural Land Administration and Use Office of Fentale woreda. The sectoral offices in Fentale woreda will be responsible for the day-to-day monitoring of the project's compliance with government regulations, including all issues related to the land and payment of compensations. The Rural Land Administration and Use Office will also be directly involved in the payment of compensations, as described in the Framework Resettlement Plan (see Volume 3).

Ethiopian Electric Power (EEP)

EEP is currently serving as the project proponent for the Metehara solar power PV project. This role will be handed over to the independent power producer Enel Green Power (EGP) prior to the implementation of the ESMP. However, the grid connection will remain EEP's responsibility, including the acquisition of right-of-way for the transmission line and the future ownership and operation of the substation (to be constructed by EGP).

EEP's Environment and Social (E&S) Office has already conducted preliminary screening of the Metehara project and is following up on the present ESIA study. Once the environmental license for the solar facility has been transferred to EGP, the E&S Office will mainly be responsible for providing control and oversight and for the detailed planning and monitoring of the transmission line component.

Enel Green Power (EGP)

EGP will be responsible for implementing all the ESMP requirements during the detailed planning, construction and operation of the Metehara solar power PV plant. This will include responsibility for ensuring compliance with the applicable Ethiopian regulations and international lenders' guidelines for environmental and social performance.

For the purpose of ESMP implementation, EGP will be expected to establish an Environmental and Social Management Unit ('ESMU') and designate at least two appropriately experienced and qualified persons in charge of the environmental, health & safety and the second person on socialrisk management. The two staff could be assigned as Environment, Health and Safety Officer and Community Liaison Officer (Social risk management officer), respectively. They will be supported by

additional support staff as required. The interaction with the community should be through a Community Liaison Unit ('CLU') as described in the stakeholder management plan (Section 9.7).

EGP will also be responsible for the environmental, health and safety (EHS) performance of all contractors and sub-contractors. This will be achieved by incorporating relevant ESMP requirements into bidding and contract documents and by evaluating the environmental and social criteria as a basis for selecting the contractors. EGP will manage and monitor the contractors (and sub-contractors) in order to ensure that they comply with the EHS requirements and contractual obligations.

Contractors

The contractors will be responsible for avoiding or minimising environmental impacts caused by the construction activities within their scope of work. Each contractor should be required to have an EHS unit, which will be responsible for managing and monitoring the environmental and social mitigation measures in accordance with the contractual obligations. The contractors will also be responsible for ensuring that all their sub-contractors are in compliance. There will probably be one main EPC contractor responsible for the solar PV installations and all other construction activities. This contractor will then serve as the principal contractor with a responsibility to coordinate all EHS activities on site.

Financiers/Lenders

The Metehara solar power PV project is likely to be backed by grants, loans and/or guarantees from international financing institutions. However, until the financing structure has been agreed, the roles and responsibilities of financiers and lenders are unknown.

A requirement of lender policies is usually that the project be subject to third-party monitoring and auditing, or that a Panel of Experts is appointed to provide regular oversight of compliance with the relevant safeguard policies and performance standards. The financiers will normally also request for quarterly progress reports.

9.3 ESMP for Construction Works

9.3.1 Introduction

The detailed contractual and implementation arrangements for the construction of the Metehara solar power PV facility have not yet been decided. ThisESMP for the construction works therefore applies equally to EGP, EEP and all contractors (and sub-contractors). Each party will be expected to comply with the relevant requirements within their scope of work.

Based on the requirements in the present ESMP for construction works, each party shall develop a detailed Environmental, Health and Safety (EHS) Plan in accordance with their own policy framework and management systems to ensure that the organisation can fulfil all tasks required to achieve the objectives. The

overriding principle of the construction management will be to comply with the requirements of ISO 14001:2004 and OHSAS 18001:2007 as well as the environmental and social standards of the financiers and lenders (e.g. IFC's Performance Standards and EHS Guidelines).

It should be noted that the ESMP costs associated with the construction works have not been estimated, as the environmental, health & safety and social criteria will be included in the tender package upon which the tenderers will develop their base rates. Hence, the costs of the construction-related environmental and social management will be within the contract price. It is recommended that the environmental and social costs, as well as the occupational health and safety costs, are specified in the tenders and that payments are made conditional on performance.

The construction-related environmental, health and safety requirements are specified below. They are derived from the mitigation measures for each identified impact as described in Chapter 7 but also incorporate other industry-specific best-practices.

9.3.2 General Requirements

Risk management: The construction contractors shall ensure that critical operations within their respective scope of work are systematically identified, analysed, evaluated and documented at the planning stage and by use of a recognised risk assessment method and that adequate control measures are taken. At a minimum, the risk management approach should comprise of Job Safety Analysis/Job Hazard Analysis (JSA/JHA) and Toolbox Talks.

EHS induction and training: EGP and the contractors shall establish an EHS induction program for all their personnel that are going to work at the project site, including sub-contractor personnel. EGP shall establish and operate a register of all personnel and visitors that have passed this induction or briefing and issue designated identification cards that shall be required for access to the construction site.

EHS monitoring and inspection: EGP shall establish an EHS monitoring and inspection plan in accordance with the ESMP requirements and in compliance with applicable rules and regulations. EHS topics to be monitored and inspection findings shall be documented. Proper follow-up of inspection findings shall be ensured.

EHS meetings: EGP shall conduct regular EHS meetings with the contractors. The meetings shall be used to review the effectiveness of the ESMP implementation, to resolve EHS problems relating to current operations, and to provide a forum for planning future construction activities and EHS tasks. The EHS meetings can be held as part of weekly construction meetings where EHS items shall be included on the agenda.

Incident reporting: EGP and the contractors shall have a documented procedure for reporting and handling of incidents occurring during and outside work hours. All medium and major incidents, including near misses with a potential of major or medium consequences, shall be reported without delay to the management and to the regulatory authorities.

9.3.3 Waste Management

Waste management shall be based on a hierarchy that considers prevention, recycling and reuse, treatment and disposal. The waste shall be segregated at source, stored in designated areas, and removed by a licensed waste removal contractor. Metal waste shall be sold to local scrap metal dealers.

Waste shall be removed on a regular basis in order not to store more than 100 m^3 of non-hazardous waste and no more than 20 m^3 of hazardous waste, and if not exceeding this quantity, no more than 3 months for hazardous and 6 months for non-hazardous waste.

Broken PV panels must be segregated and collected as waste of electric and electronic equipment (WEEE) paying particular attention to avoid dispersion in the environment of any fragments. Some solar module manufacturers provide recycling of the panels with purchase. EGP is therefore advised to inquire whether any of the potential suppliers or manufacturers provide recycling services such that PV panels can be returned if they are damaged or broken.

Other hazardous waste, such as spent solvents and oily rags, empty paint cans, used lubricating oils, used batteries, lighting equipment, etc. shall be stored in containers, with proper bunds, which are able to prevent spillage or leakage of the hazardous wastes into the environment. The containers of the hazardous wastes shall be clearly labelled for identification and warning purposes. Only contractors that are licenses for this purpose shall be allowed to collect, transport and dispose of such hazardous waste.

9.3.4 Pollution Spill Prevention

An emergency procedure for handling accidental spills of hazardous materials shall be developed. All storage areas shall have spill kit and appropriate absorbent materials available and a spill containment plan displayed.Itshall be ensured that all employees are aware of the procedure to be followed in case of accidental spills and leaks.

9.3.5 Wastewater Management

On-site housing, workshops, stores, offices and other buildings shall be equipped with wastewater treatment solutions for processing and disposal of sewage. The facilities shall be complete with adequate closets, urinals and hand-basins, septic tanks, absorption trenches or other sewerage disposal installations.

Septic tanks and/or temporary holding tanks shall be kept pumped out at such intervals that the tanks will not overflow and contaminate the ground or surface drainage. On completion of the works, sanitary facilities shall be properly disinfected and all evidence of same including temporary buried tanks and foundations removed from the site.

Temporary toilet facilitiesshall be provided for workers on the project site. Toilets (male and female separate) shall be installed at each short-term work site employing 5 workers or more. At least one toilet shall be installed per 20 workers.

9.3.6 Erosion Control and Storm Water Management

Storm water must be managed to negate contamination by oils, fuels, litter and other waste and to prevent erosion of the site during the construction phase. A Storm Water and Erosion Control Management Plan shall be developed in advance of the site clearing activities. This plan must include appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off. Storm water from open workshop servicing and repairs areas and bunded storage areas shall be collected and

treated in hydrocarbon separation pits/tanks before discharge into drains or waterways. Erosion control should include maintenance of ground-level vegetation and re-vegetation of all disturbed surfaces.

9.3.7 Air Pollution and Dust Management

All vehicles entering or leaving the site carrying a load that may generate dust shall be covered, except during loading and unloading. Dust control measures and/or equipment shall be operated in areas where risk of dust emission is identified. This includes water sprinkling especially on unpaved roads.

To prevent gases and particulate emissions, vehicles shall be equipped with catalytic mufflers, particulate filters for diesel engines and be kept under regular maintenance.

Burning of materials resulting from clearing of trees and bush, combustible construction materials, and rubbish will be permitted only when atmospheric conditions for burning are considered favourable. Where open burning is permitted, the burn piles shall be properly constructed to minimise smoke, and in no case shall unapproved materials, such as tires, plastics, rubber products, asphalt products, or other materials that create heavy black smoke or nuisance odours, be burned. Burning of hazardous combustible material is not permitted.

To minimise the potential release of greenhouse gases (GHG) from gas insulated switchgear (GIS), solutions with other insulation mediums than SF6 should be requested from the provider/manufacturer.

9.3.8 Noise Management

Noise levels at the nearest sensitive receptors shall not exceed Ethiopian or international standards for day time and night time noise. Regular measurements of noise level (Leq, dBA), using standard sound level meter, shall be carried out to demonstrate compliance. In case of non-compliance, mufflers and other noise control devices shall be installed in construction equipment and vehicles. Noise-intensive works, such as piling, demolition, metalworking, etc., shall not be permitted during night time.

9.3.9 Traffic Safety

The main EPC contractor is required to submit a traffic safety plan prior to commencing the construction works. It shall include key responsibilities and the processes to operate on site and speed limits for employees, visitors and general public. As a minimum, the plan must comply with the following requirements:

Vehicles shall not be operated unless:

- Vehicle is fit for purpose, inspected and confirmed to be in safe working order.
- System for annual inspection and control of all vehicles is in place. Tag or similar identification of last annual inspection dated to be fitted on individual vehicle.
- Number of passengers does not exceed manufacturer’s specification for the vehicle.

- Loads are secure and do not exceed manufacturer's design specification or legal limits for the vehicle.
- Seat belts are installed and worn by all occupants.

Drivers shall not be authorised to operate the vehicle unless:

- They are trained, certified and medically fit to operate the class of vehicle.
- They are not under the influence of alcohol or drugs, and are not suffering from fatigue.
- They do not use hand-held cell phones and radios while driving.

The contractor shall develop procedures for parking and on-site traffic movement. At no time shall construction vehicles be parked in a manner which may restrict movement of traffic on public roads, including Highway 4 (main road between Addis Ababa and Djibouti).The parking on site shall be well defined with a clear separation of the construction machinery, trucks, personal vehicles, etc. Parking areas and internal roads shall include space for pedestrian areas and pedestrian crossings.

The contractor shall be responsible for adequate signing, warnings and controls. This includes speed limit signs and the use of flagmen when required. Speed limits shall not exceed 30 km/hour on internal roads and 20 km/hour around logistic areas, car parks and yards.

The contractor shall ensure that all vehicles, equipment and materials that are required to pass through Metehara town or other urban areas and villages are operated and loads transported safely without endangering these communities. Special caution has to be taken in front of schools where children suddenly cross the street. In all cases, animals and pedestrians have the right of way.

9.3.10 Occupational Health and Safety

The main EPC contractor is required to submit an Occupation Health and Safety (OHS) Plan prior to commencement of construction works. As a minimum, the plan must:

- Describe the overall OHS policy of the organisation
- Describe hazards and risks to workers' safety and health arising from the working environment
- Identify which sources of injury and harm that can be eliminated, and identify preventive and/or protective measures that can be implemented in order to avoid those hazards and risks that cannot be eliminated
- Based on this analysis, formulate the company's OHS objectives for the Metehara solar power PV project, a plan for achieving each objective, and suitable measurement criteria for confirming that each objective has been achieved

Awareness and training: In order to achieve the objectives defined in the OHS management plan, the contractor should ensure that personnel on all levels in the organisation are aware of and participate in OHS activities.

The contractor shall establish and maintain the necessary arrangements to ensure that all persons with OHS responsibilities at all levels are competent to perform their duties and responsibilities. The contractor shall provide initial and refresher OHS training for all members of the organisation. This training course shall also include education on Sexually Transmitted Diseases (STDs) and their prevention.

Incidents reporting and investigations: The contractor is required to identify, investigate, record and report all incidents including accidents, near misses, diseases, and environmental incidents. The findings and conclusions of every investigation shall be reported to the site manager without delay. The contractor shall notify the site manager immediately when any accident occurs whether on site or off site in which the contractor is directly involved which results in any injury to any person whether directly concerned with the site or whether a third party. Such initial notification may be verbal and shall be followed by a written comprehensive report within 24 hours of the accident.

Emergency preparedness and response: The contractor shall establish and maintain emergency preparedness and response measures, including first-aid stations, fire-fighting equipment, trained personnel and an evacuation plan in case of emergencies and serious accidents.

The emergency preparedness and response plan shall describe how to provide rapid and effective countermeasures to contain and control incidents and to prevent or limit undesired consequences. The emergency preparedness and response plan shall outline the following:

- Notification and warning procedures
- Evacuation procedures
- First aid facilities and equipment
- Procedures for rescue of people and treatment of the injured
- System for registration of personnel

Training drills should include rescue, evacuation, first aid, firefighting (use of different extinguishing agents and fire truck), communicating and use of communication equipment.

The contractor shall produce accessible consultation sheets for review in case of emergency situations. These should have phone numbers for police, fire-fighters, hospital, site manager, etc.

A Community Health, Safety and Security Action Plan will been drafted and includes the following specific objectives/components: designing and implementing HIV/AIDS, road safety strategy, hazardous material management strategies, and a plan for emergency response; developing and improving health services and health indicators in the project area in connection with the Community Action Plan; ensuring the project facilities are operated in accordance with relevant occupational health and safety guidelines. The project enterprise is committed to work with the Community Communications Committee or a smaller subcommittee as well as representatives of communities and vulnerable groups which are susceptible to different health impacts of the project. Communication of

risks, safety measures and impacts to the broader community and understanding stakeholder perceptions of risks and impacts is an essential part of this action plan. Comprehensive baseline information will also be constructed.

Medical screening: In order to facilitate placement decisions and early detection of occupational diseases, pre-placement and periodic medical screening of all workers is required. Qualified medical personnel, with the help of an approved checklist, should do this. The contractor shall keep health records of all the contractor's personnel.

Health services: The contractor shall provide first-line free qualified medical assistance for the benefit of the contractor's personnel and, if applicable, their families. In addition, the contractor shall ensure that there is an ambulance service available.

The contractor shall provide first aid equipment at each construction site. The contractor shall ensure that at least two people amongst the site staff and this for each of the different working areas/working groups, during site working hours are trained in first aid.

Malaria and HIV/AIDS prevention: Special precautions shall be taken by the contractor at his own expense to keep the incidence of malaria and other diseases as low as possible. The contractor shall accordingly spray with approved insecticide the interiors of buildings which he occupies within one week of their occupation under the contract and at two monthly intervals thereafter.Thecontractor shall provide mosquito nets to workers and prophylactic treatment for malaria.

The contractor should ensure that his workforce is made fully aware of the causes and dangers of HIV/AIDS and ensure that a supply of condoms is available at all times at his camp facilities.Thecontractor shall provide support and not stigmatise their HIV positive employees.

Water supply and sanitation: The contractor shall ensure that the workers have access to potable water and sanitation facilities at all wok sites.

Safety equipment and regulations: The contractor shall provide proper safety equipment and draw up emergency regulations, including fire and electric shock prevention, stretchers and first aid boxes, together with rescue facilities, as well as properly trained personnel to administer these.

The contractor shall provide adequate training regarding justification for and use of safety equipment to all workers. The contractor shall make basic safety equipment available, and enforce use of such equipment during all working operations, which may expose workers to occupational health hazards. Minimum requirement to Personal Protective Equipment (PPE) for all personnel at site (does not apply to indoor offices and in vehicles) are:

- Protective helmet / hardhat
- Protective footwear/safety boots
- Working clothing with strong colours and wide reflecting bands (similar vests shall be used by visitors)
- Safety glasses or over specs

Additional PPE such as ear, eye and respiratory protection or fall protection shall be provided when required to avoid occupational health incidents or illnesses as stipulated in regulatory requirements, material safety data sheets or Job Hazard Analysis.

The contractor shall provide hearing protection for all workers working around equipment or at locations with a noise level of 80 dB(A) or more (e.g. heavy equipment and drills). The contractor shall provide an appropriate instrument at site to measure noise levels.

All employees working with hazardous materials shall be trained and provided with suitable personal protection equipment (footwear, masks, protective clothing and goggles in appropriate areas), emergency eyewash and shower stations, ventilation systems, sanitary facilities, pre-employment and scheduled periodic medical examinations.

All restricted plant facilities shall be labelled with caution signs, especially those with potential risk for workers. Moreover, all construction areas shall be marked and fenced to avoid accident from unauthorised people.

9.3.11 Labour Management

Labour management shall comply with the national labour and employment law. In circumstances where the national law is not explicit, international practices will take precedence. Compliance with legal requirements includes payment of no less than the relevant minimum wage, adherence to working hour/week restrictions, and ensuring proper treatment in regard to availability of water and food.

The contractor shall hire local labourers and ensure that local workforce content is as high as possible. The contractor is required to develop a local employment program to ensure that preference of employment is given to people from the area of influence of the project, provided adequate qualifications. The contractor shall also develop procedures for equitable selection of the local labour.

The contractor shall maintain accurate records in relation to each worker's employment covering issues such as payment of wages and social security, and working hours. The recruitment process shall be transparent and all employees shall be given written contracts. Employees shall be provided with information regarding their rights under national labour and employment law, including their rights related to wages and benefits in a clear and understandable language to the employees at the time of recruitment.

The employment relationship shall be based on the principle of equal opportunity and fair treatment, and not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline.

The contractor shall provide a grievance mechanism for workers to raise reasonable workplace concerns and ensure that all workers are informed about the grievance mechanism and that it is accessible. The grievance mechanism shall ensure safe, confidential, non-judgmental and ethical reporting systems on gender

based violence (GBV), sexual abuse and exploitation of child labour in the workplace as well as service referral to survivors to alert cases of prevalence and assure them to access adequate response.

9.3.12 Security Arrangements

Security arrangements shall comprise but not be limited to necessary watchmen and other security staff for access control, site guarding and traffic regulations. The site shall be restricted by fencing or otherwise secured to prevent illegal or unauthorised access. Access control to the site shall be arranged to ensure that all personnel can be accounted for. The security measures and operation shall be in accordance with the Voluntary Principles on Security and Human Rights.

9.3.13 Drug and Alcohol Policy

The possession, use, distribution or dispensation of alcohol and illegal drugs, as defined by Ethiopian Laws, is prohibited on the project site. There shall be regular drugs and alcohol monitoring and testing, including a mandatory post-accident testing requirement.

9.3.14 Community Relations

EGP and the contractors shall interact with local communities and their representatives in a manner that maintains and promotes a good relationship. Special attention should be given to land, labour and cultural issues, including local norms and values. A Code of Conduct shall be prepared covering the main rules of interaction with local communities and the rules of conduct in case of conflict situations. The Code of Conduct shall include prevention and strong sanctions on gender based violence (GBV), sexual abuse and exploitation of child labour in the workplace, especially related to project affected communities.

All contractors shall participate in the project's grievance mechanism, which will allow the affected communities to express concerns about the conduct of personnel and other issues. The grievance mechanism will include a mechanism for assessing the credibility of allegations, investigation of credible allegations of unlawful behaviour, corrective actions and documentation and (where appropriate) reporting of such incidents. The grievance mechanism shall ensure safe, confidential, non-judgmental and ethical reporting systems on GBV, sexual abuse and child labour as well as service referral to survivors to alert cases of prevalence and assure them to access adequate response.

The contractors shall be responsible for any damage to structures, crops and public infrastructure arising from the execution of the works, including unauthorised work and personnel's activities outside the approved project area.

In order to avoid conflicts with local communities and promote sustainable management of natural resources, all hunting and fishing by project workers shall be prohibited. Workers shall also be prohibited from cutting trees outside of the project site.

9.3.15 Chance Finds Procedure

If any worker or other person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following procedure shall be observed:

- Stop the construction activities in the area of the chance find.
- Delineate the discovered site or area.
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over.
- Notify the site manager who in turn will notify the Ministry of Culture and Tourism and the responsible local authorities immediately (within 24 hours or less).

9.3.16 Monitoring and Reporting

The monitoring of construction practices and mitigation measures will be based on visual inspections at the construction sites combined with recording of ambient noise conditions, dust emissions and (waste)-water quality as appropriate. A preliminary monitoring plan for the construction related activities and impacts are given in

Table 25Proposed monitoring methodology for the construction contractors.

. However, the monitoring system, including parameters and monitoring methods, should be based on the detailed design and be elaborated by the contractors in their EHS Plan. Consequently, the monitoring costs have not been estimated here, as the construction contractors' monitoring responsibilities will be included in the tender package upon which the tenderers will develop their base rates. The costs of the construction-related environmental and social monitoring will therefore be within the contract price.

As a basic requirement, the contractors shall self-monitor their compliance with the ESMP and their EHS Plan. The contractors will perform routine monitoring inspections using pre-established checklists and prepare monthly reports to the EGP's Environmental and Social Management Unity (ESMU) describing the implementation of the mitigation measures, including key performance indicators, as well as any deviations, incidents or accidents and corrective measures taken. When a non-conformance is detected and is not, or cannot be, immediately resolved, then a corrective action process will be initiated by the contractor. On completion of the corrective or preventive action, EGP's Environmental and Social Management Unit (ESMU) will confirm and record all the necessary details.

In addition to self-monitoring by the contractors, EGP will supervise compliance with EHS commitments included in the construction contracts. This will be achieved by routine inspections of construction activities and review of written documentation. For this purpose, the Environmental and Social Management Unit will prepare inspection checklists and regularly take part in the contractors' self-monitoring inspections.

EGP's Environmental and Social Management Unit will prepare monthly reports on the overall ESMP implementation including the performance and compliance with the ESMP for construction works. The report will be based on the corresponding monthly reports from the contractors and on the findings from the routine inspections. The monthly report will be submitted to the management and distributed to other relevant stakeholders as appropriate.

EGP's Environmental and Social Management Unit will also organise weekly meetings with the contractors where environmental and social performance will be discussed and, where necessary, any additional mitigation measures will be agreed upon.

EGP will also prepare annual environmental and social management reports to the management and as part of its statutory responsibilities towards the Government.

The concerned government institutions will carry out inspections and audits as they may deem fit. The technical staff from Fentale woreda are expected to take part in joint inspection and monitoring sessions with their federal and regional state counterparts.

Table 25Proposed monitoring methodology for the construction contractors.

Management Issue	Performance Indicators	Means of Verification	Monitoring Frequency
Waste and wastewater management	• Amounts and types of waste generated, sorted, recycled/reused, treated and disposed • Wastewater quality parameters • Quality of secondary containment structures • Labelling of hazardous waste • Evidence of pollution spill contingency plan	• Visual inspections • Photographic documentation • Interviews • Wastewater quality measurements at source (see applicable standards in Volume 2)	Weekly inspections Weekly wastewater quality measurements
Air pollution and dust control	• Frequency of water spraying on roads and stockpiles • Evidence that trucks cover loose materials • Ambient air quality (PM_{10}) at site and nearest receptors	• Visual inspections • Photographic documentation • Interviews • PM_{10} measurements using standard air sampling equipment (conforming to EC Directive 89/336/EEC and ISO 12103-1) (see applicable standards in Volume 2)	Weekly inspections Weekly air quality measurements
Noise management	• Evidence of hearing protection used by workers • Evidence of noise control devices • Noise levels (dB) at site and nearest receptors	• Visual and auditory inspections • Interviews • Noise level measurements (Leq, dBA) using a standard sound level meter (conforming to class 2 according to IEC 61672-1:2002) (see applicable standards in Volume 3)	Weekly inspections Weekly noise measurements, or daily in case of non-compliance with IFC Noise Level Guidelines
Chance finds procedure	• Number of chance finds • Evidence of chance finds procedures	• Visual inspections • Photographic documentation • Interviews	Weekly inspections

Management Issue	Performance Indicators	Means of Verification	Monitoring Frequency
Occupational health and safety	• Evidence of occupational health and safety plan and emergency preparedness and response plan • Number of workers trained in safety procedures • Percentage of workers using Personal Protective Equipment (PPE) • Structural integrity of workers' accommodation and sanitary facilities • Access to health services by workers • Malaria prevalence rate in workforce • HIV/AIDS prevalence rate in workforce • Incident statistics (Total Recordable Injuries, Fatalities, Lost Time Injuries, Restricted Work Case, Medical Treatment Case, First Aid Case, Near Miss, Reports on Unwanted Occurrences)	• Visual inspections • Interviews • Photographic documentation • Incident reports	Daily monitoring
Traffic and transportation safety	• Evidence of traffic and transportation safety plan • Traffic incident rate (including workers and the public) • Observed speed of construction vehicles • Number of drivers trained and equipped with license • Evidence of signing, warnings and controls	• Visual inspections • Speed checks • Photographic documentation • Interviews	Weekly inspections and checks
Security arrangements	• Compliance with Voluntary Principles on Security and Human Rights • Evidence of training of security personnel in the use of force and arms • Number of security related grievances raised by the communities and workers	• Visual inspections • Photographic documentation • Interviews	Weekly inspections
Labour management	• Proportion of local population on overall project workforce • Proportion of women and youth employees on overall project workforce • Evidence of written contracts • Number of worker grievances	• Visual inspections • Interviews • Employment contracts	Weekly inspections

Management Issue	Performance Indicators	Means of Verification	Monitoring Frequency
	• Age of workers • Quality of workers accommodation • Proportion of unskilled workforce that have had their skills upgraded		
Community relations	• Number of community grievances • Incidence of damages to crops and structures on land that has not been acquired	• Visual inspections • Photographic documentation • Interviews	Weekly inspections
Conflict management	• Number of community social cohesion events • A code of conduct defines the contractor's workers relationship with the community	• Number of events • Signed code of conduct by all workers, including understanding of the content of the Code of conduct	

9.4 Community Health and Safety Plan

EGP (and EEP) will be responsible for safeguarding the health and safety of the public. This will be achieved by imposing strict conditions on the EHS performance of the construction contractors (see above), combined with a dedicated community health and safety programme as outlined below.

Water and Sanitation

To mitigate the potential impacts from in-migration during the construction phase, the following activities should be carried out:

- Provide home pack water treatment solution (water guard tablets) to households in collaboration with the kebele and the health centres
- Support the woreda to provide additional communal sanitation facilities in Gelcha kebele and Metahara Town
- Support the woreda authorities and town administration to rehabilitate non-functional water supply facilities and/or extend the existing water pipelines to unserved areas

Public Health Campaigns

Prior to and during the construction phase, the project shall adopt a comprehensive approach to prevent HIV/AIDS and other Sexually Transmitted Diseases (STDs). The approach shall target both workers and the community since human interaction will not only be confined to the project boundaries. The contractors are expected to make arrangements for the workforce through their occupational health and safety programme (Section 9.3.10), while the community health and safety measures should include the following:

- Awareness raising and peer education: Targeted campaigns, small group counselling (particularly for all high-risk groups), IEC/BCC along with event organisation, and the use of mass media in schools, for women groups, for workers, and the general population.
- Condom promotion: Free and effective distribution, and education on appropriate use
- Support existing initiatives to promote HIV preventive campaigns

Traffic Safety Campaigns

In addition to the traffic safety requirements set out in the ESMP for construction works (see Section 9.3), the following activities shall be carried out by EGP:

- Design the take-off from the highway to the project site in such a way that there is minimal disruption for the other road users and minimal risk of traffic accidents
- Ensure that traffic-holding/waiting areas for deliveries, loading and offloading are located at safe distance from the main highway
- Collaborate with the local traffic police to ensure minimum disruption of road traffic on the public highway
- Disseminate traffic management plans and other public safety information through campaigns in schools and communities

Monitoring

Monitoring will be an integral part of the community health and safety programme. The monitoring shall be conducted by EGP's Environmental and Social Management Unit as well as by the relevant service providers. The following performance indicators should be included (together with other parameters to be defined in the detailed design phase):

- Number of health preventive campaigns
- Disease prevalence and incidence
- Number of sanitation facilities
- Number of traffic accidents involving community

9.5 Biodiversity Monitoring Plan

This ESIA has concluded that the proposed project has few significant impacts on biodiversity and there are few opportunities for mitigating the loss of local habitats within the project footprint. However, since few solar PV facilities of this size have yet been commissioned in Sub-Saharan Africa, there are some uncertainties regarding the impacts on biodiversity, especially concerning bird (and bat) collision risks. It is therefore important that such potential impacts are closely monitored.

For this purpose, the following monitoring and conservation activities shall be undertaken:

- Conduct another baseline avifauna survey during the main rainy season (July-August) and bird migration period (September) to verify the ESIA findings and to serve as a benchmark for continued monitoring
- Conduct bird and bat fatality searches for a minimum of two years into the operation phase

- Assign an avian biologist to be on-call during the early operation phase (at least two years)

The avian biologist should be called upon if birds are found stranded, but apparently uninjured, in which case the biologist will assist with efforts to secure the bird and have it transferred as expediently as possible to a suitable location for release into its natural habitat.

If monitoring provides evidence of high bird and/or bat fatality rates, the possibility of installing white grid lines on the PV panels that break up the reflection should be considered (there is preliminary evidence that it reduces the attraction of insects, and possibly or indirectly attraction of birds).

In addition to the above biodiversity monitoring activities, the following mitigation measures of relevance for biodiversity management and conservation shall be implemented (as outlined in Chapter 7):

- Select PV panels with minimal light reflection
- Except where clearing is required for permanent works or excavation operations, all ground-level vegetation shall be preserved and protected
- Workers shall be strictly prohibited from cutting trees outside of the project site and from all hunting or killing of wildlife
- Remove the invasive *Prosopis juliflora* from the project site by clearing all trees/shrubs and preventing further seed germination and seedling establishment
- Explore opportunities for productive uses of the wood and seedpods of *P. juliflora*

9.6 Stakeholder Engagement Plan

9.6.1 Introduction

The development of the proposed solar PV facility will require the involvement of a range of stakeholdersin project planning, land acquisition, grievance management, construction works, and operation and maintenance. In addition, the implementation of the proposed environmental and social mitigation measures might require a multi-sectoral approach to be able to achieve the intended objectives. For this reason, a stakeholder engagement plan has been prepared as a guiding framework for ensuring proper coordination and management of all the stakeholder interests and concerns. The stakeholder engagement strategy will apply to the planning, construction and operation phases and to all project components.

9.6.2 Objectives

The objectives of this stakeholder engagement plan are:

- To identify all potential project stakeholders including their priorities and concerns;
- To identify strategies for information sharing and communication to stakeholders in ways that are meaningful and accessible throughout the project cycle;
- To specify procedures and methodologies for stakeholder consultations, documentation of the proceedings and strategies for feedback;
- To establish accessible and responsive grievance mechanism; and
- To develop a strategy for stakeholder participation in the monitoring of project impacts and reporting or sharing of results among the different stakeholder groups.

9.6.3 Regulations and Requirements

The stakeholder engagement plan is developed because of the need to comply with the requirements of the Constitution of the Federal Republic of Ethiopia and all national legislations related to conducting environmental and social studies and land acquisition for public purposes and with the safeguard policies of international financial institutions (e.g.WB performance standards). All these instruments unanimously advocate for meaningful involvement of project stakeholders in decisions that affect them, participatory planning and transparent grievance management mechanisms.

9.6.4 Project Stakeholders and Previous Stakeholder Engagement

The stakeholders and their involvement in the ESIA process are described in Chapter 6.

9.6.5 Stakeholder Engagement Strategies

The proposed stakeholder engagement programme applies to the time period beyond the ESIA and into operation phase. It mainly targets the affected community groups that are not part of the project organisation. Envisaged activities after the ESIA phase include the following:

- Participatory and meaningful involvement in land acquisition, resettlement and livelihood restoration planning
- Participate in the implementation of the RAP
- Grievance management
- Mobilisation for construction phase (recruitment for employment, acquisition of temporary sites, etc.)
- Implementation of the Environmental and Social Management Plan (ESMP)
- Mobilisation for project commissioning and start of operation phase (safety sensitisation, communication of emergency procedures, etc.)

Incorporation of Views of Vulnerable Groups

Generally, the entire population in the project area could be categorised as vulnerable due to the prevailing high levels of poverty, weather dependent livelihoods and the very poor access to basic services like waterand sanitation. Livestock keepers struggle most in the dry season when they have to walk long distances to the watering points and grassland. Women and children bear the burden of the search for water for both humans and livestock (young and sick) as well as the search for food and fuel for the household. Children and the elderly disproportionately feel the impact of the looming food insecurity and the resultant malnourishment.

To ensure that the views of the vulnerable groups are taken into consideration in the planning of the project, efforts were made during the ESIA consultations at community level to solicit for their opinions and contributions on how the project is likely to affect them and proposals for mitigation. The results of these consultations were used as input into the ESMP. All issues raised have been summarised in the ESIA report and stakeholders should review it to ensure that the recommendations are brought forward to the next stage of project implementation.

It is further recommended that in future stages of project development, theopinions of women and agro-pastoralists be sought for purposes of gathering their input into key issues such as location of replacement land and housing, location of the proposed communal sanitation and water supply facilities, choice of crops to be grown underneath the solar panels, livelihood restoration options, etc. Mobilisation of these groups can be through informal discussions at household level or through formal discussions with community basedorganisations andlocal NGOs.

Incorporation of Proceedings into Management Decisions

The results from the consultation and information sharing meetings should be shared with project management to facilitate informed and participatory decision making. The views and opinions expressed by the target groups will be used as basis upon which management interventions will be designed and/or refined.

9.6.6 Public Disclosure

EGP together with EEP shall disclose the ESIA, RPF, ESMF and RAP and provide affected communities with access to relevant information on:

- the purpose, nature, and scale of the project;
- the duration of proposed project activities;
- any risks to and potential impacts on such communities and relevant mitigation measures;
- the envisaged stakeholder engagement process; and
- the grievance redress mechanism.

Moreover, the ESIA, ESMF, RPF and RAP shall be disclosed on EEP and EGP websites as well as the World Bank External website and announced on the Ethiopian newspapers to the public as necessary. In addition the ESIA document should be cleared by MOWIE and the World Bank. The document shall be translated in to local language prior to disclosure

Timetable

The table below attempts to give indicative deadlines within which the stakeholder engagement activities should be completed if it is to be effective. The timetable is based on the tentative construction schedule (with commencement of construction works in April 2020) and the legal requirements in relation to the land acquisition processes.

Table 26Stakeholder engagement schedule

Activity	Project Phase	Timeline	Responsibility
Submission of ESIA report	Planning	January 2019	Multiconsult
Disclosure of ESIA results and public hearing if necessary	Planning	February - April 2019	EEP/EGP
Establishment of Community Liaison Unit (CLU)	Planning	April 2019	EGP
Appointment of Community Liaison Officer(s)	Planning	April 2019	EGP
Training of Community Liaison Officers and Woreda Officials (project grievance handling procedures)	Planning	April 2019	EGP
Mobilisation of communities for disclosure of compensation entitlements	Planning	May 2019	Fentale Woreda and EEP/EGP
Media notifications for compensation payment	Planning	May 2019	Fentale Woreda and EEP/EGP
Relocation planning for the physically displaced	Planning	May 2019	EGP
Disbursement of compensation payments	Planning	June 2019	EGP and Fentale Woreda
Grievance handling (related to compensation)	Planning	May - June 2019	EGP and Fentale Woreda
Notifications for land take over	Planning	June - August 2019	EGP and Fentale Woreda
Land takeover	Planning	August 2019	EGP and Fentale Woreda
Disclosure of the detailed Environmental and Social Action Plan including the Livelihood Restoration Plan	Planning	August 2019	EGP
Community mobilisation and sensitization in preparation for construction phase (e.g. recruitment policy, public traffic management)	Pre-construction	August 2019	EGP and Fentale Woreda
Periodic stakeholder update meetings and press releases (ESAP implementation and construction progress and plans)	Construction	2019 - 2021	EEP and EGP

Activity	Project Phase	Timeline	Responsibility
Monthly grievance resolution sessions (construction related grievances)	Construction	2019 - 2021	EGP
Quarterly monitoring of the agreed livelihood restoration programme	Construction	2019 - 2021	EGP
Community mobilisation in preparation for commissioning (e.g. emergency procedures, safety considerations, maintenance responsibilities, etc.)	Commissioning	April 2021	EGP and Fentale Woreda

9.6.7 Resources

For the successful implementation of the stakeholder engagement plan, EGP will have to establish a Community Liaison Unit (CLU) with one or more Community Liaison Officers. The CLU will collaborate and coordinate with all the identified project stakeholders, including the directly affected communities and their leadership. The Community Liaison Officer should be part of the project management team for purposes of ensuring that community related issues are given due consideration when taking management decisions. In addition to managing the interaction with external stakeholders, the CLU will collaborate closely with the project's internal managementin order to create consensus on the procedures to follow and ensure consistency in the information sharing with stakeholders.

9.6.8 Responsibilities

The responsibilities of the Community Liaison Unit will include but not be limited to the following:

- Serve as the official representative of the project to the project stakeholders
- Liaison with all project stakeholders
- Be responsible for all the project public relations and communications to all the stakeholders including the communities
- Disseminate information about the grievance mechanisms to all affected communities
- Serve as mediator between the project and the community
- Coordinate all project community development initiatives
- Identify local NGOs or CBOs for potential collaboration related to public health and safety campaigns and/or livelihood restoration activities
- Monitor the effectiveness of the grievance resolution system
- Monitor the effectiveness of the community health and safety plan
- Ensure that the contractors' EHS systems are aligned with the stakeholder engagement plan
- Periodically update the project management on community affairs
- Report on all the community related activities including community health and safety initiatives, livelihood restoration programme and grievance handling

- Follow up on any pending issues in regards to resettlement

GRIEVANCE REDRESS MECHANISM (GRM)

Grievance redressing mechanism is designed in view of the fact that Metehara Solar PV plant project activities may upset the existing balance in society. The resettlement operation will touch upon property issues, means of livelihood, and organization of social and spatial aspects that influence proximity to a set of environmental, economic, social, and spiritual assets. Therefore, the grievance redressing system is designed in such a way that it functions in a flexible manner and the implementing agency/EGP has to incline to a pro-poor approach in all its decisions. The GRM will have a working place and adequate budget for implementation.

Grievances will be actively managed and tracked to ensure that appropriate resolution and actions are taken. A clear timeframe shall be defined for resolving grievances, ensuring that they are addressed in an appropriate and timely manner, with corrective actions being implemented, if appropriate, and the complainant being informed of the outcome.

The purpose of a grievance redressing mechanism is to establish a way for individuals, groups, or communities affected by the project activities to contact responsible body if having an enquiry, a concern, or a formal complaint. Grievance handling mechanism should address affected persons' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected population.

Grievances may arise from members of communities who are dissatisfied with (i) the eligibility criteria, (ii) community planning and resettlement measures, (iii) actual implementation, or (iv) issues related to environmental and social concerns.

The following section sets out the procedures to be followed to manage grievances caused as a result of Metehara Solar project implementation.

The grievance procedure does not replace existing legal processes. Based on consensus, the procedures will seek to resolve issues quickly in order to expedite the receipt of entitlements, without resorting to expensive and time-consuming legal actions. If the grievance procedure fails to provide a result, complainants can still seek legal redress procedure.

The grievance redressing procedure is developed to meet Ethiopian government legal requirements relating to grievance resolution and international requirements for grievance management and is in line with WB's Performance Standards.

A local Grievance Redress Committee (GRC) will be established, consisting of representatives from PAPs, EEP representative, representative of EGP, representative from Gelcha Kebele Administration, elders or influential personalities other than the aggrieved persons, and the Church/Mosque Administration. The Committee will be headed by Kebele Administrator. Grievances should be settled amicably whenever possible. However, if the resolution of a case requires additional payment or any form of relocation of resources, the report shall be sent to the appropriate administrative executive for consideration. If the administrator agrees to the recommendation, he/she shall instruct the resettlement Unit/ Department in the EGP office to implement the amended provision. On the other hand, if complainant is not satisfied by the recommendation of the GRC, the aggrieved party may be advised to pursue the case in a formal court system.

Under the proposed Metehara Solar Power project, a set of forms are developed to be used for recording grievances and to the actions taken are prepared, as listed below (shall need to be translated in local language). The specific forms to manage grievances are attached in Annex 15.

- Grievance Statement Form
- Grievance Receipt Acknowledgement Form
- Grievance Investigation Form
- Grievance Investigation Outcome Form

The grievance mechanism applies to all complaints related to Metehara project activities; and comprised of the following steps:
Outline of Metehara Grievance Redress Mechanism Steps
Step 1 – Receive and Record Complaint(using the Grievance Receipt Standard Form). The grievance shall also be registeredin a ledger/ log book at the project site.
Step 2 – Review Complaint and Allocate Actions(Complaints are screened, and actions then be allocated to investigate and resolve grievance or refer matter to next level)
Step 3 – Notify Complainant of Proposed Resolution (notify the complainant that the complaint has been received, how it is being dealt with, by whom and an approximate estimate of how long the process might take(this must happen within 7 days).
Step 4 – Act and Update Complainant (undertakes the proposed actions for resolution and update complainant when it is complete).
Step 5 – Close out & Lessons Learnt(occurs when both parties are happy with proposed solution).
Step 6 – Update Project Grievance Records (ongoing) (using standard forms, grievances will be maintained and stored including for information for any outstanding actions)
Step 7 – Reporting (to concerned/ defined parties).
A detailed feedback and grievance redress mechanism (GRM) will be prepared by EGP. It will ensure that the grievance mechanism will include the necessary procedures for disclosure and resolution of environmental and social related grievances of the project.

For cases related with gender-based violence, sexual exploitation and abuse, the Woreda Women and Children Affairs office will be the first level reference. The project will allocate adequate resources for awareness creation on this GBV GRM. The Woreda Women and Children Affairs Office will be provided with capacity building and orientation on the basic principles of GBV case management encompassing confidentiality, non-judgmental, service referrals for survivors, etc. The office will have a working procedure regarding the standards for services, referral, data collection, maintaining the best interest of the survivor. The details of the GBV GRM will be further elaborated in the project PIM and defined with the specific contexts of the respective Woreda Women and Children Affairs Office.
Based on the Bank’s Grievance Redress Service (GRS), project-affected communities and individuals may submit complaints regarding a Bank-financed project to the project grievance redress mechanism, appropriate local grievance mechanism, or the World Bank’s corporate Grievance Redress Service (GRS).

Table 9-27:Procedure to be followed by Metehara Solar Power Plant Project GRM

p	Description of the Step
Step 1: Receive and Record Complaint	IPP-E&SUnit/Department will be the focal point for receipt of complaints; however, EEP and/or other stakeholders (who have been provided with forms and a log book by the project) can also register grievances at the project site. All project staff at the IPP office will also be made aware of how to either receive a grievance directly or forward to the responsible body in the office. Complaints will be recorded as soon as possible, using the Grievance Statement Form (Annex 15-A) which is a carbon copy form, allowing records to be retained by the complainant also. Where grievance forms are not immediately available, efforts will be made to record the grievance as soon as practicable thereafter. For each complaint registered, a written receipt of complaint acknowledgement will be made within a maximum of seven (7) calendar days. This will be done using the Grievance Receipt Acknowledgement Form (Annex 15 B). If information is already available at this point as to how it is being dealt with, by whom and an approximate estimate of how long the process might take; this will also be included in the acknowledgement, otherwise this information will be provided within a maximum of 15 calendar days based on the proposals for resolution generated in Step 2 onward. Each grievance will be registered as an entry into the grievance log book with a unique reference number, supported by the full information on the Grievance Receipt Acknowledgement Form. If a complainant wishes to raise a grievance anonymously, this would be achieved via an appropriate mechanism (e.g. using only reference number).

Step2:ReviewandAllocate Actions	Grievances will be reviewed and appropriate actions identified. If there is an obvious and immediate action not requiring higher level decisions or approval, the IPP project office will have the authority to propose and enact the grievance resolution. The project will establish local level GRC (described above) who will meet regularly to resolve all grievances which require higher level Management approval/decisions. Following the first internal examination by the implementing agency/ IPP, a resolution and actions proposed to the complainant (or the complaint is refused or considered to be inadmissible with reasons for this provided).There are possibly four main categories of actions. Complaints which are not directly within IPP's responsibility and / or their authority to resolve, in which case they would be screened as such and referred directly to the GRC. Complaints/queries that have already been held in action, or for which no further action is needed other than to respond back to complainant. Complaints for which the action required is clear. Complaints which need further investigation by the implementingagency internally, and potentially other IPP staff and external parties, in order to ascertain cause and appropriate action. Action to resolve grievances will be allocated to the GRC, unless the action can be immediately (not more than 4 calendar days) taken by the IPP project officewithout further approval. The Grievance Investigation Form (Annex 15-C) will be the main document for recording the decision-making process within the IPP office.
Complainant of Proposed Resolution	If it has not already occurred at this point, the GRCwill then notify the complainant that the complaint has been received (this must happen within 7 days), how it is being dealt with, by whom and an approximate estimate of how long the process might take. This provision of a proposed resolution shall happen within a maximum of 15 calendar days of receipt of the grievance. Notification will generally occur through a face to face meeting.
Action and Update Complainant	Then will undertake proposed actions for resolution,and update the complainant once actions are completed.

Project Grievance& Lessons Learnt	This occurs only when both are happy with the solution (agree on a compromise), it has been implemented and both parties have signed off.Grievance Investigation Outcome Form (Annex 15-D) will be used to document this process. The IPPproject management will periodically perform an internal review to document lessons learned with respect to specific grievances, and to identify any general trends in issues being raised, to take actions as necessary to try to prevent similar grievances being raised in the future.
Records	As described in Step 1, the details of grievances will be held in the 4 forms included in Annex 8, and will be maintained / stored by the IPP E&S Safeguards Unit/ Team, on regular basis. This will include information on any outstanding actions.The forms will therefore be updated over time.
	Information on grievances will be reported on a quarterly basis to EEP- PIU as part of the Environmental and Social Safeguards Performance Report, including the total number of complaints, the major areas/causes of complaints, how many have been closed out etc. The report will be prepared by IPP- E&S Team.

9.7 Auditing and Reporting System

9.7.1 Monthly Reporting

The construction contractor(s) will prepare monthly reports on their environmental and social performance and their compliance with the relevant ESMP sections and contractual obligations. The reports will be submitted to EGP's Environmental and Social Management Unit and be based on the monitoring system developed in the contractors' EHS Plan.

EGP's Environmental and Social Management Unit will compile monthly reports that will be forwarded to the management and shared with the concerned stakeholders. These reports will be based on the monthly reports from the contractors and on monitoring data from EGP's own environmental and social management programme.

9.7.2 Annual Reporting

EGP's environmental and Social Management Unit will prepare annual reports on the project's overall environmental and social management performance. The annual report will be submitted to relevant government agencies and be disseminated to the other project stakeholders including financing institutions.

9.7.3 Auditing and Evaluation

In addition to the monitoring and reporting system described above, EGP should establish an auditing and evaluation system in order to obtain independent verification of its environmental and social performance and external checks on its compliance status.

Audits and evaluations might be commissioned by the governmental regulators and/or the lenders as they may deem fit. It is assumed that audits/evaluations will either be carried out by external consultants hired directly by EGP, or by a Panel of Experts appointed by the lenders. The costs will be covered by the project's administration budget.

9.8 Summary of ESMP

The predicted impacts, proposed mitigation measures, responsible institutions and estimated costs are summarised and outlined in Table 28 Summary of ESMP.

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Table 28 Summary of ESMP.

Impact Source	Mitigation Measures	Responsibility	Estimated Cost
CONSTRUCTION PHASE			
Physical Environment			
Visual impacts	• Keep the all the vegetation that surrounds the solar PV site, especially along the main road	EGP and Contractors	No cost
Soil erosion	• Except where clearing is required for permanent works or excavation operations, all ground-level vegetation shall be preserved and protected • Topsoil shall be set aside and reserved where possible • All exposed surfaces and spoil areas shall be covered with topsoil and replanted or re-seeded • The amount of earthworks shall be limited as much as possible • Drainage measures shall be provided, prior to construction works, to promote the dissipation of storm water run-off	Contractors	Included in construction cost
Land contamination	• Storage areas for fuel and hazardous materials shall be roofed and have a concrete floor with a bund for secondary containment and collection of spills • All storage areas and major construction sites shall have spill kits, sand, dust, and other appropriate absorbent materials • Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice and in compliance with the applicable regulations in Ethiopia at the time of disposal	Contractors	Included in construction cost
Air pollution	• Water shall be sprayed on all internal roads to minimise dust dispersion when necessary • Trucks transporting loose/friable materials shall be tarped to reduce wind entrainment of dust • Vehicles shall be equipped with catalytic mufflers, particulate filters for diesel engines and be kept under regular maintenance	Contractors	Included in construction cost
Construction noise	• Noisy activities shall be scheduled to day time hours • Noise levels at sensitive receptors shall be measured regularly and whenever complaints arise • In case of non-compliance with Ethiopian standards and international guidelines, noise control measures shall be implemented as appropriate (e.g. additional restrictions on working hours, or noise control devices in construction equipment and vehicles)	Contractors	Included in construction cost
Water pollution	• On-site housing, workshops, stores, offices and other buildings shall be equipped with wastewater treatment solutions for processing and disposal of sewage • Septic tanks and/or temporary holding tanks shall be kept pumped out at such intervals that the tanks will not overflow and contaminate the ground or surface drainage • Storm water runoff from open workshop servicing and repairs areas and bunded storage areas shall be collected and treated in hydrocarbon separation pits/tanks before discharge into drains or waterways • Storage areas for fuel and hazardous materials shall be kept at safe distance from the nearest water body and be roofed and have a concrete floor with a bund for secondary containment and collection of spills	Contractors	Included in construction cost
Water consumption	• The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services	EGP and Contractors	Included in construction cost

Impact Source	Mitigation Measures	Responsibility	Estimated Cost
Biological Environment			
Habitat loss and disturbance	• Except where clearing is required for permanent works or excavation operations, all ground-level vegetation shall be preserved and protected • Workers shall be strictly prohibited from cutting trees outside of the project site and from all hunting or killing of wildlife	Contractors	No cost
Human Environment			
Physical and economic displacement	• Document the free, prior and informed consent (FPIC) of the affected Karrayu community (Indigenous Peoples) • Compensate for the loss of the land use rights to all households that hold land use rights on the project site • Support all displaced households in their efforts to restore their livelihoods including acquisition of replacement land and housing through a participatory process and with particular attention to vulnerable households and women • Obtain consent from the land users of the land to be temporarily acquired and restore all temporary land prior to hand over to ensure that its suitable for its original use	EGP and EEP	TBD (asset inventory ongoing)
Employment and business opportunities	• Give priority to local residents for less specialised labour, especially the directly impacted land users as support towards livelihood restoration • Create opportunities for employment of women in both management and casual placements attempting to employ at least 25% females of the semi-skilled and unskilled workforce • Provide on-the-job training in order to upgrade the skills of the local workforce and incorporate measures for capacity building/skills development as part of the livelihood restoration measures	EGP and Contractors	On-the-job training estimated at USD 10,000
Disruption of road traffic	• Design the take-off from the highway to the project site in such a way that there is minimal disruption for the other road users and minimal risk of traffic accidents • Ensure that traffic-holding/waiting areas for deliveries, loading and offloading are located at safe distance from the main highway • Schedule deliveries and other project traffic to utilise the less busy hours of the day on the highway • Collaborate with the local traffic police to ensure minimum disruption of road traffic on the public highway	EGP and Contractors	Included in construction cost
Pressure on public services	• Establish transparent and consistent recruitment procedures and avoid recruitment at the gate in order to reduce the number of camp followers in form of job-seekers • Ensure that contractors provide medical services, water supply and sanitation facilities to workers and their families so as to avoid adding additional pressure on public services • Conduct public health campaigns addressing issues of behavioural change, water and sanitation, HIV/AIDS, etc. • Support the woreda authorities and town administration to rehabilitate non-functional water supply facilities and/or extend the existing water pipelines to unserved areas	EGP and Contractors	Included in construction cost Public health campaigns estimated at USD 10,000 Contribution to public water supply TBD
Relocation of power distribution line	• EEP should make arrangements for relocating the affected section of the local power line prior to commencement of construction works	EEP	TBD by EEP
Community health and safety risks	• Conduct public health campaigns addressing issues of behavioural change, water and sanitation, HIV/AIDS, etc. • Support the woreda to provide additional communal sanitation facilities in Gelcha kebele and Metahara town • Provide home pack water treatment solution (water guard tablets) to households in collaboration with the kebele and the health clinics • Disseminate traffic management plans and other public safety information through campaigns in schools and	EGP	Public health campaigns estimated at USD 10,000 Communal sanitation facilities estimated at USD 20,000

Impact Source	Mitigation Measures	Responsibility	Estimated Cost
	communities • Traffic on community roads should be restricted to low speeds to avoid exposing other road users to accidents and unnecessary air pollution triggered by dust from moving vehicles • Establish a grievance mechanism for the community and other stakeholders		Grievance management estimated at USD 30,000
Security risks	• Support local security systems to strengthen community policing and crime-handling measures • Ensure that the conduct of security personnel complies with good international practice	EGP and Contractors	No cost
Occupation health and safety risks	• Include best practice health and safety provisions in the construction contracts and ensure strict compliance with national legislation and EHS guidelines • Ensure that work schedules are organised in shifts that protect workers from long-term exposure to extreme temperatures • Provide workers with safe drinking water and dedicated sanitary facilities at all work sites and camp facilities • Adopt sound human resource policies compliant with international standards • Prevent gender based violence (GBV), sexual abuse and exploitation and child labour in the workplace • Establish a grievance mechanism for workers	EGP and Contractors	Included in construction cost
Loss of physical cultural resources	• Establish a chance finds procedure	EGP and Contractors	Included in construction cost
OPERATION PHASE			
Physical Environment			
Soil erosion	• Provide permanent drainage at the project site to prevent flooding and soil erosion • Maintain ground-level vegetation cover throughout the project site	EGP and Contractors	Included in construction cost
Land contamination	• PV panels at the end of their useful life, and other potentially hazardous waste generated during the operation phase, shall be disposed of in accordance with best industry practice and in compliance with the applicable regulations in Ethiopia at the time of disposal	EGP	TBD by EGP
GHG emissions	• Where gas insulated switchgear (GIS) containing SF6 is planned as part of the technical setup, solutions with alternative insulation mediums should be requested from the provider/manufacturer	EGP	Included in construction cost
Water consumption	• The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services • The yield loss due to dust build-up on the PV modules should be monitored to ensure that no surplus cleaning cycles are undertaken	EGP	Included in construction cost and as part of regular operation and maintenance
Biological Environment			
Risk of bird and bat fatalities	• Select PV panels with minimal light reflection • Conduct another baseline avifauna survey during the main rainy season (July-August) and bird migration period (September) to verify the ESIA findings and to serve as a benchmark for continued monitoring • Conduct bird and bat fatality searches for a minimum of two years into the operation phase • Assign an avian biologist to be on-call during the early operation phase (at least two years) • If monitoring provides evidence of high bird fatality rates, consider the possibility of installing white grid lines on the PV panels that break up the reflection (there is preliminary evidence that it reduces the attraction of insects, and possibly or indirectly attraction of birds)	EGP	Estimated at USD 70,000

Impact Source	Mitigation Measures	Responsibility	Estimated Cost
Establishment of invasive species	• Remove the invasive *Prosopis juliflora* from the project site by clearing all trees/shrubs and preventing further seed germination and seedling establishment • Explore opportunities for productive uses of the wood and seedpods of *P. juliflora*	EGP and Contractors	Included in construction cost
Human Environment			
Long-term loss of productive land	• Continue the livelihood restoration activities until it has been verified that the livelihoods of all displaced persons have been restored to pre-project levels • Explore options for dual use of the solar farm, i.e. energy production combined with agricultural production, for the benefit of the directly affected households	EGP	TBD by EGP
Employment opportunities	• Give employment priority to local workers who have had their skills upgraded, including the directly affected land users • Consider organising women into formal groups/associations for the award of sub-contracts for vegetation maintenance during the operation phase	EGP	TBD by EGP Organising women groups estimated at USD 10,000
Pressure on water resources	• The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services • The yield loss due to dust build-up on the PV modules should be monitored to ensure that no surplus cleaning cycles are undertaken	EGP	Included in construction cost and as part of regular operation and maintenance
Health and safety risks	• Ensure compliance to strict occupational health and safety standards • The solar PV plant shall be equipped with a fire-fighting system	EGP	Included in construction cost and as part of regular operation standards
Risk of community Conflict	• Undertake community social cohesion events through continued stakeholders engagement • Ensure appropriate and timely compensation payment as per the complementary RPF • Ensure that there is livelihoods restoration support proportional to the scope of impact • Benefit Sharing through Community Development projects. The consulted community consulted and negotiated development projects which mainly promotes social cohesion by the private sector, Enel Green Power (EGP), which include infrastructure (access roads bridge across Beseka Canal, rural electrification) and social services (public health and grain mills). • A harmonized GRM mechanism which is conflict sensitive with the indigenous system. • Private sector community relationship with communities including workers code of conduct which is sensitive to the conflict history, prohibiting hunting and fishing by project workers. • Livelihoods restoration measure: LRP based on scope of impact and land take, which has not been adopted by predecessor government and private sector financed projects. The LRP was developed based on local context (a) agriculture Based Strategies (crop and livestock production and improvement components), and (b) non-agriculture Based Strategies (petty trade and services, small scale handcrafts manufacture – Pottery and Weaving as well as solar project related employment opportunities) • Timely and adequate compensation payment for land take including affected properties.	EGP, EEP	LRP, CDP covered by the RAP and an estimated budget of

10 SUMMARY AND CONCLUSIONS

10.1 Introduction

As part of the planning and permitting of the Metehara solar power PV project, Multiconsult Norge ASin association with Shebelle Consult PLC was appointed to carry out an Environmental and Social Impact Assessment (ESIA) in compliance the Environmental Impact Assessment Proclamation 299/2002 and the applicable international safeguard policies, in particular the IFC Performance Standards.

The ESIA addresses the environmental and social impacts arising from the construction, operation and decommissioning of the proposed solar PV facility and all its infrastructure. An Environmental and Social Management Plan (ESMP) sets out how and when the mitigation measures shall be implemented by the various stakeholders including the project developer and the construction contractors.

10.2 Main Findings

Solar PV projects are generally considered to have low environmental and social risks and impacts compared to many other energy or industrial developments due to their short construction phase and insignificant emissions to air, water and soil during operation. However, grid-scale PV facilities require large areas of land for the installation of solar modules and associated infrastructure. Project siting is therefore the most important aspect related to impact avoidance and mitigation.

The Metehara solar power PV plant will be implemented in an already degraded environment with low biodiversity value. The site was selected by the local government together with the affected community, and is as such considered as the most feasible location in terms of socio-economic impacts. Nonetheless, the scale of physical and economic displacement is significant and will require careful resettlement and livelihood restoration planning. This process is being spearheaded by Fentale woreda which is responsible for property valuation and computation of compensation payment to the affected households. Once this exercise is completed, the project developer should consider the need for additional support towards livelihood restoration.

Mitigation and enhancement measures have been specified for each of the key risks and impacts. They are derived from good practice guidelines on environment, health and safety (EHS) as well as project-specific measures related to the most significant impacts. The implementation and monitoring of the mitigation measures are further described in an Environmental and Social Management Plan (ESMP) which includes the following main requirements:

- Include best practice health and safety provisions in the construction contracts and ensure strict compliance with national legislation and EHS guidelines. All workers should be provided with free medical services as well as water supply and sanitation facilities at all work sites and camp facilities.
- Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice and in compliance with the applicable regulations in Ethiopia at the time of disposal. Enel Green Power (EGP) is advised to inquire whether any of the potential suppliers or manufacturers provide recycling services such that PV panels can be returned if they are damaged or broken.
- Where gas insulated switchgear containing SF6 (sulfur hexafluoride) is planned as part of the technical setup, solutions with alternative insulation mediums should be requested from the provider/manufacturer.
- Drainage measures shall be provided, prior to construction works, to promote the dissipation of storm water run-off. Oil-water separators shall be installed for treatment of storm water run-off from open workshop servicing and repairs areas and bunded storage areas.

- The project should make arrangements for water supply that are independent from the public utility in order to avoid exerting additional pressure on such services. The yield loss due to dust build-up on the PV modules should be monitored to ensure that no surplus cleaning cycles are undertaken and to prevent excessive water consumption.
- A pre-construction avifauna survey shall be carried out to verify the ESIA findings and to serve as a benchmark for continued monitoring. Bird and bat fatality searches shall be conducted for a minimum of two years into the operation phase. An avian biologist should be assigned to be on-call for bird rescue in case of bird collision with project infrastructure.
- All affected land users shall be compensated in accordance with national regulations and procedures. In addition, displaced households should be supported in their efforts to restore their livelihoods with particular attention to vulnerable households and women.
- Opportunities for dual use of the solar farm should be explored, i.e. energy production combined with agricultural production, for the benefit of the directly affected households.
- Give priority to local residents and women for less specialised labour, especially the directly impacted households as support towards livelihood restoration. On-the-job training should be provided in order to upgrade the skills of the local workforce.
- The take-off from the highway should be designed in such a way that there is minimal disruption for the other road users and minimal risk of traffic accidents. Traffic management plans and other safety information should be disseminated to the public through campaigns in schools and communities.
- Conduct public health campaigns addressing issues of water and sanitation, HIV/AIDS, etc. and support the woreda to provide additional communal sanitation facilities in Gelcha kebele and Metahara town.

The most urgent task to be pursued immediately after this ESIA study includes the preparation of a full Resettlement Action Plan (RAP). This can happen as soon as all the project affected persons (PAPs) and affected properties/assets have been identified by Fentale woreda. The RAP should pay special attention to the following key issues:

- Establish a socio-economic census of PAPs in order to, inter alia, identify vulnerable households and assess the need for additional livelihood restoration support (on top of the compensation payments) as well as to serve as a basis for livelihood monitoring.
- Confirm the availability of replacement land for the displaced households (e.g. in the planned irrigation scheme of Fentale Irrigation-Based Integrated Development Project).
- Document the free, prior and informed consent (FPIC) of the affected Karrayu community (Indigenous Peoples).

10.3 Conclusions and Recommendations

The ESIA forms an important basis for making a decision on whether a project should be implemented or not. Ideally, an ESIA should conclude with a ‘yes’ or ‘no’ towards the licensing or approval of the project, and it should specify under which conditions and requirements the project should be implemented.

A range of criteria should be put forward as a basis for the conclusion in the ESIA as to whether a project should be implemented or not, including:

- Is there a need for the project?
- Have various alternatives for meeting the need been considered?
- Is the project environmentally and socially acceptable?

In the case of the Metehara solar power PV project, there is high demand for additional renewable energy in the Ethiopian electricity grid, and the project is well aligned with national policies and strategies. The project site has been selected through a participatory process involving the local government and

communities who have not raised any objections to the proposed project. The environmental impacts are considered to be small and manageable. Physical and economic displacement will be triggered by the relatively large footprint of the solar PV facility, but it is assumed that the outcomes of the compensation and resettlement process will achieve restoration of the livelihoods of the affected households.

In conclusion, the ESIA consultant recommends that detailed planning of the Metehara solar power PV plant continues under the condition that the design and layout of the project remains as described in this ESIA report and that the prescribed mitigation and enhancement measures are adopted.

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