



## **FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA**

**Environmental and Social Impact Assessments for the Proposed Mini-Grid Solar Power Plant Project in Huluku, Liben Chukala Woreda, Oromia National Regional State**

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## Executive summary

### 1. Introduction

Renewvia Solar Ethiopia Limited (RSEL) is a solar company newly incorporating in Ethiopia. RSEL intends to deploy Solar mini-grid solutions in Huluku, Oromia in line with the DREAM projects described herein.

Renewvia Solar Ethiopia Limited is a subsidiary of Renewvia Energy Corporation, a global solar developer with its headquarter in Atlanta, Georgia, USA. African subsidiaries of REC currently operate 22 solar mini-grids in Kenya and Nigeria, with over 7 years' experience developing solar projects in East and West Africa. Expansion of the company to Ethiopia through RSEL will begin with 4 pilot projects under the DREAM project and in close partnership with the relevant Ethiopian Ministries.

### 2. Overview of the Project

Ethiopia depends on electric power generated from large hydropower stations to propel its economic growth and provide energy for domestic uses. To meet the rising demands for energy in rural areas where access is limited, the National Electrification Program 2.0 (NEP 2.0) suggests off-grid electrification. This is particularly important for Ethiopia's rural settlements which are often dispersed and inaccessible.

Huluku was chosen as one of the pilot sites for mini-grid and irrigation system development in Oromia national regional state. The stand-alone AC coupled solar photovoltaic (PV) mini grid will provide reliable electric power to both the community and farmers to supply electric pumps for irrigation. The system will help minimize the use of diesel pumps by farmers for irrigation. Once completed, the project is expected to go into commercial operation in September 2023 and supply electricity to smallholder farmers for irrigation purposes. Minigrid system project components and project impacts were assessed, identified, and addressed in this Environmental and Social Impact Assessment (ESIA) report for Huluku site in the Oromia region.

### Goals and Specific Objectives

The broad goal of the Environmental and Social Impact Assessment (ESIA) is to provide decision-makers and project proponents with information on potentially significant environmental and social impacts and risks associated with the proposed mini-grid solar power plant and irrigation project at Huluku site. The specific objectives are to identify potential positive and negative impacts of the proposed project; to suggest mitigation and enhancement measures for the identified significant adverse and beneficial impacts, respectively; to provide management and monitoring plans; and to ensure that the proposed project complies with the national environmental regulations and African Development Bank's integrated safeguards system

### Project components & main activities

The mini-grid solar systems include the following components: a mounting system that will be used to mount PV modules on structures made of aluminium or hot-dip galvanized steel. While the mounted PV panel modules absorb the sun's rays as a source of energy to generate electricity, inverters will be used to convert the Direct Currents (DC) produced by PV modules to grid-exploitable Alternative Currents (AC). Then, transformers will change voltage levels from low voltage (230V) to medium voltage (15kV or 33kV) and vice versa. Finally, overhead distribution lines mounted on wooden poles will be used to transfer power from the solar power plant to households and irrigation pumps.

## Project Alternatives

Several project options were examined to select the feasible alternative considering biophysical, social, economic, and technical factors. The alternatives considered were no project alternatives, project location alternatives, other sources of power (Hydro, Fuel, and Wind), and project implementation options. After comparing the above-mentioned alternatives based on technical feasibility, economic viability, and environmental acceptability, solar energy was selected because of the numerous project advantages it can present to the local community, and the low negative impacts of the project on the social and biophysical environment.

## 3. Description of the project areas

### Location

The proposed mini-grid solar project (Huluku Site) will be located at 8.512345°N and 38.9987703E° East Shewa zone of the Oromia National Regional State, 80 km south of Addis Ababa along the Addis-Mojo-Hawassa expressway.



## 4. Baseline Conditions of Project site

Huluku experiences semi-arid climatic conditions due to its location in the Ethiopian Main Rift system with an annual average temperature of 22°C and annual rainfall of 800mm. Even though there has not been any site-specific information on the hydrology of the site, inferences from the general hydrology of the Awash River suggest that underground water resources seem to be abundant. Geologically, the Huluku site is of quaternary volcanic deposits with alluvial lacustrine sediments. Thus, the soils in Huluku site are the product of weathered rift-related pyroclastic flow and alluvial lacustrine deposits. The soil samples collected from the site were analyzed and the results indicate that the soils are moderately acidic (a pH of 6.35). Similarly, most of the macronutrients (phosphorous, potassium, etc) are slightly deficient as recommended by the FAO. In the same connections, water samples were also collected from the boreholes where the community is currently using them for drinking purposes. The lab test indicates that parameters such as total alkalinity (400 mg/l CaCO<sub>3</sub>), sodium (200 mg/l), and fluoride (1.8 mg/l) are beyond the recommended WHO standards for drinking purposes. Therefore, the water in this site particularly, borehole water,

needs appropriate water treatment for alkalinity and fluoride treatment to make it suitable for household consumption.

There are no known endangered species and wild animals that will be affected by the implementation of the solar Power project. The most common trees are *Juniperus procera*, *Eucalyptus globulus*, shrubs such as *Rosa abyssinica*, and *Euphorbia* spp. (e.g. *Euphorbia ampliphyla*). In the proposed project site, cattle, sheep, goats, mules, donkeys, and chickens are common domestic animals whereas wild animals in the project area include Hyena, Vervet Monkey, Pig, Ape, and Tortoise.

The total population of **Liben /Chukala** Woreda is 76,351 out of which only 2,930 live in Adulala town. Most social services such as health infrastructure and education services are concentrated in small urban centers such as Adulala town. Similarly, clean drinking water and electric supply are limited to the nearby Adulala town and rural communities depend on ground wells and the Awash River for drinking water. Electricity is not available for the local communities. In Liben Chukala Woreda, various physical and cultural resources were observed. These include "Gedda", "Irrecha" and "Muda" and hence project planning should take into consideration of such indigenous cultural practices. Apart from these there were no evidence of any archaeological/historical heritages that would potentially be affected by the project implementations. Nevertheless, as always, there is a risk that cultural heritage objects are unexpectedly uncovered during construction activities. Hence, excavation works should be done carefully as per World Bank Guidelines - OP 4.11 and chance find procedures would be prepared.

## 5. Institutional and legal frameworks

As part of the ESIA study, a review of the policies, laws and institutional arrangements that govern environmental protection and the ESIA system in Ethiopia has been carried out. The ESIA study also considered the African Development Bank Integrated Safeguard System and applicable Safeguard Policies.

Concerning institutional arrangements for the implementation of ESIA, the Ethiopian Environmental Authority (EPA) is mandated to formulate or initiate and coordinate the formulation of strategies, policies, laws, and standards as well as procedures and upon approval monitor and enforce their implementation. It is also responsible for the synergistic implementation and follow-up of international and regional environmental agreements. EPA is mandated to review, approve ESIA reports and issue the environmental authorization. The EPA also undertakes the role of certification of ESIA practitioners. The EPA has its tentacle office at regional levels as well. Moreover, regional bureaus of Agriculture, irrigation and pastoral development, Women's office, and mines and energy were reviewed.

With regard to the policies, proclamations, regulations, and guidelines issued by the government of Ethiopia and the AfDB, the ones outlined below, *inter alia*, are relevant to the proposed projects:

- Constitution of The FDRE ; National Energy Policy of Ethiopia ; Water Resources Management Policy ; National Conservation Strategy of Ethiopia (CSE, 1997) ; Environmental Policy of Ethiopia (1997) ; Ethiopian Women's Policy ; Health Policy of Ethiopia ; Environmental Impact Assessment (Proclamation No. 299/2002): Environmental Pollution Control (Proclamation No. 300/2002) and the Public Health Policy (Proclamation No. 200/2000): in addition, the ESIA team has also reviewed the African Development Bank Operational Safeguards Policy.

Regarding the AfDB safeguard policies, five Operational Safeguards (OS) were established and are summarized here as extracted from the AfDB ISS Policy Statement 2013:

- **OS1: Environmental and Social Assessment:** This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements. The proposed projects are Category 3 projects as they are less likely to have site-specific environmental and/or social impacts. Likely negative impacts are site-specific, largely reversible,

and readily minimized by applying appropriate management and mitigation measures or incorporating internationally recognized design criteria and standards.

- **OS2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation:** This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and it incorporates refinements designed to improve the operational effectiveness of those requirements. As the risk category of the project falls under category 3 the project does not trigger OS 2 and hence resettlement action plan and livelihood restorations are not needed.
- **OS3: Biodiversity and Ecosystem Services:** The overarching objective of this safeguard is to conserve biological diversity and promote the sustainable use of natural resources. This safeguard could be triggered due to trade-offs of ecosystem services where availability of solar energy may result in increased withdrawal of water for irrigation (to increase agricultural production) at the cost of regulatory services such as draining wetlands which are carbon sinks and biodiversity hotspots.
- **OS4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials, and Resource Efficiency:** This safeguard covers the range of impacts of pollution, waste, and hazardous materials for which there are agreed on international conventions and comprehensive industry-specific standards that other multilateral development banks follow. The solar mini-grids power plants are meant to curb pollution which is already underway through diesel pumps for irrigation.
- **OS5 Labour Conditions, Health, and Safety:** This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights, and protection from abuse or exploitation. It covers working conditions, workers' organizations, occupational health and safety, and avoidance of child or forced labour. These operational safeguards are triggered because construction and decommissioning of the mini-grid power plant and irrigation facilities may temporarily attract many labour force where likely occurrence of sub-standard work conditions (occupational health and safety) and/or workers may not be properly informed about their rights and work conditions.

## 6. Project Impacts

Solar mini-grid power plants 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 phases and insignificant emissions to air, water, and soil during operations. The major **positive impacts** of the mini-grid and project include:

- Employment opportunities for skilled and unskilled labour
- Provision of reliable electric power supply to farmers
- Reducing greenhouse emissions to the atmosphere by replacing diesel pumps
- Enhancing agricultural production and productivity
- Improving local livelihoods by supplying electricity to communities
- Enhance women's empowerment and gender equality.

The projects' main **negative impacts on the biophysical environment** on the selected site

- Clearing of vegetation for the solar panel installations.
- There are risks of contamination of water and soil from the disposal of hazardous wastes (including PV panels)
- Increased water consumption for cleaning the solar panels.

The projects' **main adverse impacts on the socio-economic environment** may include.

- Increased prevalence of HIV/AIDS and other infections/diseases and Covid 19 due to the influx of workers. Similarly,
- Temporary labour influx, especially during the construction phase, may result in gender-based violence (GBV) and sexual exploitation risks for women and girls. In addition, the employment of children below 15 years of age could be an issue requiring monitoring protocols and administrative mechanisms. However, GBV and associated impacts will likely be minor during the operation phase since the minigrid will only be providing electricity to clients and does not involve an external labour force.
- Finally, fire hazards, workplace accidents, injuries, and traffic accidents to workers and local communities were among the identified negative impacts of the proposed mini-grid solar power during the construction and decommissioning phases of the project. The summary of the main adverse impacts and their significance are provided below:

## 7. Public Consultations

**Date:** 15/10/21

**Place of meeting:** Huluku village

**Number of participants:** Male (36) & female (12)

Public consultations at Huluku site

Name of participant	Issues raised	Response
Ato Abdu Shikur (M) and Ato Roba Chala (M)	These two people shared the view that irrigation is the lifeline of the community, but the challenges are mounting. In addition, the community does not have any access to electric light, and we are so anxious to see some solutions to our predicaments. They further noted that women are suffering from a heavy burden of domestic chores including a lack of grinding mill/flour mill. The situation for irrigation is precarious because most farmers do not afford to purchase diesel pumps which cost about 28,000 to 50,000 birr depending on the capacity. This is simply unattainable, and farmers are under much stress while conducting irrigated agriculture. Thus, the community will be waiting with high hope that this project would bring about affordable and sustainable electric power supplies.	The ESIA team responded that the main purpose of this project is to install solar panel power for the purpose of irrigation to substitute the non-renewable fuel by solar sourced power. But it is under the scope of the project in addition to irrigation, schools, churches, health posts, flour mills and small businesses will benefit from electricity production.
Ato Ayano Tesema (M)	He expressed that solar power is of great value since we have seen its positive contributions since an NGO installed solar panels which serve for few members of the community. Apart from irrigation, which is too obvious to mention, solar power can light up our life (take away burdens from women, children can learn and study, health services will be improved, etc.). However, he mentioned that projects do not transit to implementations and honestly it is frustrating because of such extended delays.	The ESIA experts said that the information is important and will be included in our report. We expect that the project will not be interrupted once it is started unless otherwise it is not feasible at the beginning, and it will start soon since irrigation is one of the priorities of our government. However, the final decision will be made by higher officials after the final evaluation of ESIA and other technical and financial reports.
Ato Regassa Buche (M)	He said that "we are so happy, and we will provide a space for installation of solar power plants". He added that our community wants to see the commencement of these projects (solar power plant and irrigation) as soon as possible.	The ESIA team said that your willingness to provide space for installation of a solar power plant is a good indication of your interest to support the project and it is valued. We expect the project will be realized soon in your village.
Ato Abe Tufa (M)	He mentioned that the potential for irrigation is quite huge but individual farmers do not afford to purchase diesel pumps, and running costs are also so expensive.	ESIA team responded that this is one of the main reasons why this project is intended to launch in your village. The site is selected based on information like its potential for irrigation and your problems to fuel and its cost etc.

## 8. Environmental and social management plan (ESMP):

The minigrid power plant, generation and distribution, and customer connections will be managed by the Minigrid Developer, with construction done by the Minigrid Contractor. The local government and municipality bodies will be involved as well as and where appropriate.

This ESIA seeks to address all potential impacts and risk mitigation activities that any of the above entities may be involved in. The following table seeks to delineate which entity will be responsible for impacts and mitigation.

The cost estimates provided in the below reflect expected costs over the 20-year estimated lifetime of the minigrid project.

Phases	Category of Impacts	Identified Impacts	Mitigation measures	Responsible Body	Estimated cost
Construction	Biophysical Environment	Generation of solid Waste	<p>Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practices</p> <p>Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean</p> <p>Solid waste from packaging materials like fertilizer &amp; seed bag should be disposed of in an appropriate place. Bottles and containers of pesticides and herbicides should be stored and removed following best industrial practices</p>	<p>Minigrid Contractor</p> <p>Woreda agriculture office</p>	Estimated cost for disposal of solid waste 40,000 birr
		Generation of liquid Waste	<p>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</p> <p>The wastewater from sanitary and construction works should be collected through a channel in a plastered pond or reservoir and can be recycled for construction, green area, and other purposes after proper filtering and treatment</p>	<p>Minigrid Contractor</p> <p>Very minimal amount of wastewater for Minigrid, very limited amount of fuel or hazardous material</p>	For construction of plastered pond and other storage structure is 60,000



		<b>Soil erosion</b>	Avoid excavation during the rainy season Heap the excavated soil in the selected area and reuse it to fill undulating areas	Minigrid Contractor	Labour cost to pile up soil is 30,000
		<b>Noise pollution</b>	Noisy activities shall be scheduled to daytime hours Noise disturbance and impact can be reduced by also administration and management deciding to work on a shift basis, work rotation and work time reduction for workers to reduce workers exposure to noise, etc.  Personal protective equipment such as ear muffers/plugs should be used	Minigrid Contractor	For purchasing PPE is 30,000 birr
		<b>Air pollution</b>	Workers assigned in the construction should wear a dust mask. The supervisor should strictly follow and make sure this procedure is in place before starting their job, and Water shall be sprayed on all internal roads to minimize dust dispersion when necessary	Minigrid Contractor	PPE included above, and water spray is 20,000 birr
	<b>Human Environment</b>	<b>Public health</b>	Conduct public health awareness campaigns addressing issues of behavioral change, HIV/AIDS, etc.	community /woreda labour and women affairs office	Awareness-raising and training 25,000 birr
			Prepare training manual and conduct regular training about STDs Provision of materials useful for the prevention of HIV/AIDS	Minigrid Contractor	For internal half day training 15,000 birr
		<b>Covid 19</b>	Workers shall follow strictly Covid19 prevention mechanisms such as temperature measurement at the gate of the compound, washing of hands, wearing of masks, avoid handshake, and keep social distance as much as possible.	Minigrid Contractor /EHS unit of the project proponent	PPE cost included above
		<b>Gender-based violence/child labour</b>	Provision of training for workers and families, Community sensitization, regular	Woreda labour and women's affairs office	100,000 for training, and regular monitoring

			monitoring for EHS compliance		
		<b>Traffic accidents</b>	Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages) Mandatory speed limits not exceeding 30km per hour Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)	Minigrad Contractor in collaboration with Woreda traffic police	Training cost for awareness creation for community and workers  20,000
		<b>Impacts on cultural, historical and archaeological site</b>	If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual	Minigrad Contractor supervised by Oromia regional state culture and tourism office	Supervision cost 20,000 birr
Operation	Biophysical Environment	<b>Liquid waste</b>	Construct a toilet inside the premise and collect sanitary waste and finally dispose it off at permitted area	Minigrad Developer	Septic tank is expected to be constructed during construction phase
		<b>Loss of farm and grazing land</b>	Landowners shall be compensated as per the new proclamation No. 1161/2019 before the construction activities started Provide job opportunity priority for those projects affected people (PAP) during construction and implementation phases	Minigrad Developer, Woreda Agriculture offices, Woreda administration	The cost will be estimated later by Woreda experts
	Human Environment	<b>Occupational health and safety</b>	Use of appropriate PPE during installation and maintenance  The solar PV plant shall be equipped with fire-fighting tools  Ensuring all electrical equipment and machinery are properly grounded Maintenance should be conducted by trained professionals only	Minigrad Developer	Estimated cost to purchase lifetime PPE is 60,000 birr
		<b>Fire hazards</b>	The solar PV plant should be equipped with proper fire extinguishers	Minigrad Developer	fire protection systems 40,000

			The technician should regularly inspect Solar PV components		
		<b>Impacts on cultural, historical and archaeological site</b>	If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual	Contractor, supervised by Oromia regional state culture and tourism office	No cost is implied
Decommission	Biophysical Environment	Generation of solid Waste	Hazardous waste, including broken PV panels, used batteries, shall be disposed of in accordance with best industrial practices	Minigrid Contractor and Irrigation Contractor	Waste disposal cost 150,000
		Air pollution	Workers assigned to the demolition should wear dust masks. Spray water on demolishing areas	Minigrid Contractor and Irrigation Contractor	PPE purchase and water spray cost 40,000
	Human Environment	Loss of employment	Transfer permanent workers to other active projects Pay compensation (severance) for permanent workers	Minigrid Contractor /regional government	Compensation payment for workers should be paid by the project proponent TBD
		Gender-based violence/child labour	Provision of training for workers and families, Community sensitization, regular monitoring for EHS compliance	Community / Woreda labour and women's affairs office	20,000 for training, and regular monitoring
	<b>Total</b>				

## 9. Environmental and Social Monitoring Plan

ESMP has been prepared to address all adverse impacts pertaining to the implementation of the mini grid project. The ESMMP presents in detail parameters to be monitored, mitigation measures, institutional responsibility, and indicative budget. The proposed monitoring measures can easily be implemented with available resources and expertise. The proponent is largely responsible for financing and coordination of the ESMP for the solar and irrigation project. The contractor and all project employees should be among the main actors, especially during the construction phase, required to act in compliance with the contract document and this ESIA study. The Federal Environmental Protection Authority is the regulatory body responsible for reviewing ESIA, monitoring, environmental auditing, enforcing, and guiding its implementation.

Parameters to be monitored	Mitigation measures	Responsible	Monitoring schedule	Monitoring indicators	Monitoring cost (Birr)
<b>Contract management</b>	Make sure the contractor has prepared ESMP for approval by the client	Proponent	Pre-construction and construction phases	Copy of the approved ESMP and implementation of it	Cost internal to developer to get approvals
<b>Social support to vulnerable people</b>	Job opportunities for project-affected people (loss land),  Landowners should be compensated as per proclamation No. 1161/2019	Proponent	Throughout operation phase  Note: selected land is expected to be community land, not individual	Check the amount of money paid out from finance	Supervision cost 5,000 birr
<b>Employment opportunity</b>	Hire workers from local people depending on their education preparedness and skill level	Proponent & Woreda	At the beginning and annually	Number of local workers from company human resource office	Supervision cost 2,000
<b>Solid waste</b>	Hazardous waste, including broken PV panels or panels at the end of their use-life, shall be disposed of in accordance with best industry practice  Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean	Proponent	Quarterly during construction and annually in operation	Annual site visit to determine if any hazardous waste is on site  Disposal of hazardous waste in compliance with waste management procedures	Supervision cost 5,000
<b>Liquid waste</b>	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  The wastewater from sanitary and construction works should be collected through channels in a plastered pond or reservoir and should be recycled for reuse during construction	proponent	Beginning of construction and annually each year of Operation	Annual check that the necessary are in place  Constructed plastered pond/ reservoir if required  Amount of water recycled	Supervision cost 5,000k to be done in conjunction with above annual visit

<b>Noise pollution</b>	<p>Noisy activities shall be scheduled to daytime hours</p> <p>personal protective equipment such as ear muffers/plugs will be used</p>	Proponent in collaboration with Woreda health experts	Weekly during the construction phase	Noise level should not exceed the world bank standard (55dBA and 45 dBA during the day and night times, respectively)	Cost for regular checking of noise level 5,000
<b>Air pollution</b>	<p>Workers assigned in the construction should wear dust masks. The supervisor should strictly follow and make sure this procedure is in place before starting their job; and</p> <p>Water should be sprayed on all internal roads to minimize dust dispersion when necessary</p>	proponent collaboration with Woreda health experts	Periodically during the construction and operation phase	<p>Check air quality measurement, Air emission shouldn't exceed WHO standards</p> <p>Supervise workers proper use of PPE's</p> <p>Complaints from the local governor, community</p>	Expert cost for regular check emission level 5,000 to be done together with noise checks
<b>Loss of farm and grazing lands</b>	<p>Landowners should be compensated as per the new proclamation No. 1161/2019 before the construction activities started</p> <p>Provide priority to a job opportunity for those projects affected people (PAP) during construction and implementation phases</p>	Proponent	Before commencement of construction work	<p>Check the amount of money paid for PAP</p> <p>Contractor's personnel office documentation</p>	No cost
<b>Traffic accident</b>	<p>Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages)</p> <p>Mandatory speed limits not exceeding 40km per hour</p> <p>Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)</p>	Proponent collaboration with Woreda traffic police	Every three months during construction, annually during operations	<p>Number of accidents on the site</p> <p>Speed limits put at appropriate places</p> <p>Erected traffic sign</p>	Supervision cost 2000, to be done together with above checks

<b>Sexually transmitted diseases like HIV</b>	<p>Health promotion: sensitization of both community and workforce</p> <p>Provision of materials useful for the prevention of HIV/AIDS</p> <p>Having in place an appropriate signpost to educate the workforce and community about the Project's HIV policy</p>	Woreda health office	Every month during the construction and operation phase or as determined by the local health office	<p>Number of distributed condoms</p> <p>Check the number of trainings conducted</p>	Training cost 100,000
<b>Covid 19</b>	<p>Train workers to follow strictly Covid-19 prevention mechanisms</p> <p>Temperature measurement check-up each day at the gate of the compound</p> <p>Provision of materials necessary for prevention and detection of COVID 19</p>	Proponent in collaboration with Woreda health experts	Regularly during construction and operation	Number of Covid-19 infected	<p>Expense already included in construction and operations</p> <p>No cost to report # of cases</p>
<b>Occupational Health and safety</b>	<p>Use of appropriate PPE during installation and maintenance</p> <p>The solar PV plant shall be equipped with a fire-fighting system</p> <p>Ensuring all electrical equipment and machinery are properly grounded;</p>	Proponent	Regularly during construction and operation	Total recorded incidence rates	for provision of first aid a lump sum of 5,000
<b>Fire hazards</b>	<p>The solar PV plant should be equipped with a fire-fighting system</p> <p>The technician should regularly inspect Solar PV components</p>	Proponent	Every three months during the construction and operation phase	Number of incidents and reported cases	Part of project and operation cost
<b>Impacts on historical, cultural heritage</b>	Excavation work should be done carefully as per World Bank Guidelines - OP 4.11 and prepared chance find procedures	Contractor	During construction work	Number of discovered heritage site or artifacts	Part of supervision cost
<b>Total Minigrad Developer / Contractor Only</b>					<b>34000</b>
<b>Total other parties</b>					<b>100000</b>
<b>Total Monitoring</b>					<b>134000</b>

## **Grievance redress mechanisms:**

It is expected that no major grievance issue will arise. However, to ensure that stakeholders have avenues for redressing their grievances related to any aspect that may result from the project, procedures of redress of grievances have been established. They are as follows:

- The community will be informed about the procedures in their local language. All information about grievance mechanisms will be available in public areas and with the community leaders.
- The client/contractor will accept all comments and complaints associated with the project from any stakeholder either in person, via email, post, telephone, or any other appropriate communication channel. The client/contractor will then arrange for an officer to further listen to the complaints, then summarize the grievances in a complaints/comments logbook which would contain the name of the commenter, date of receipt, brief description of issue, proposed corrective actions, and date of response sent to the complainant.
- All grievances will be registered and acknowledged within 6 working days then responded to within 15 days. All responses will be done either in writing or verbally, according to the preferred method of communication of the complainant.

## **Roles and responsibilities**

- Project proponent- manage and monitor the environmental and social impacts.
- Environmental Protection agency- is responsible for evaluating and approving ESIA study reports as well as for providing environmental approval licenses
- Environmental protection Agency of Oromia regional state is expected to be involved in monitoring the environmental performance of the solar power PV and irrigation project in the region
- Community water use associations/ cooperatives are responsible to oversee fair water sharing among farmers
- The estimated overall budget for the implementation of all environmental and social measures, which includes the cost for ESMP and ESMMP, is 804,000 birr or ~15,00 USD (assuming 1 USD = 53.65 Birr).

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## List of Abbreviations

AC	Alternative Currents
AfDB	Africa Development Bank
ADLI	Agricultural Development Led Industrialization
AIDS	Acquired Immunodeficiency Diseases
dB	decibels
CBD	Convention on Biological Diversity
CEP	Community Engagement Plan
Covid-19	Coronavirus Disease 2019
CRGE	Climate Resilient Green Economy
CSA	Central Statistical Agency
CSE	Conservation Strategy of Ethiopia
DC	Direct Currents
EFCCC	Environment, Forest and Climate Change Commission
EHS	Environment, Health and Safety
EPA	Environment Protection Authority
EIA	Environmental Impact Assessment
ESIA	Environmental & Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
FDRE	Federal Democratic Republic of Ethiopia
GTP	Growth and Transformation Plan
GHG	Greenhouse Gas
IFC	International Finance Corporation
ILO	International Labour Organization
ISS	Integrated Safeguards System
IUCN	International Union for Conservation of Nature
HIV	Human Immunodeficiency Diseases
PHCU	Primary Health Care Unit
PPE	Personal protective Equipment
PPM	Parts per million
PV	Photovoltaic
SNNPR	Southern Nations Nationalist People Region
STDs	Sexually Transmitted Diseases
STI	Sexually Transmitted Infection
TDS	Total Dissolved solids
WB	World Bank
WHO	World Health Organization

# 1. Introduction

## 1.1 Background of ESIA study

Ethiopia has shown an impressive two digits GDP growth in the last couple of decades. This economic growth brings with it an enormous demand for energy for households and industries. Nevertheless, the country depends largely on hydropower-generated energy to propel its economic growth and provide energy for domestic uses. To meet the rising demands of energy for development and meet the challenges of climate change, Ethiopia designed the Climate Resilient Green Economy strategy (CRGE). This strategy was well aligned with Ethiopia's ambitious plan to become a lower-middle-income country by 2025 (GTP II). The alignment of the two policies (GTP II and CRGE) is instrumental for Ethiopia's broad economic planning and has proven to be particularly central in the design of Ethiopia's power development strategy (Veritas, 2020). The same document stipulates that.

“Mini grids powered by renewable energy directly address two NDC [Nationally Determined Contribution] components: (i) reduction of greenhouse gas (GHG) emissions and (ii) reduction of the impact of climate change on Ethiopia's population, environment, and economy. Mini-grid development also helps to deliver on key CRGE objectives viz: (i) ensuring economic development is sustainable by limiting GHG emissions, (ii) creating green job opportunities, and (iii) protecting the economy and people from the adverse effects of climate change” (Veritas, 2020, p. 7).

In view of this, solar-powered mini-grids are favourably considered for small-scale projects in different regions of Ethiopia; namely, Amhara, Oromia, Sidama, and SNNP. According to the Environmental Impact Assessment (EIA) proclamation 299/2002, projects that may likely have adverse environmental and social impacts are required to carry out a full impact assessment. In response, this ESIA has been conducted for the proposed DREAM mini-grid solar power and irrigation projects. The purpose of ESIA study is therefore to identify, predict and analyse the nature and magnitude of environmental impacts and propose enhancement and/or mitigation measures for environmental impacts that are likely to arise from the various activities of the project implementation.

In the study process, various ESIA tools were employed for the identification, prediction, and analysis of impacts. To this end, a biophysical resources survey (vegetation, soils, air, and water quality measurements) was conducted to establish baseline conditions, and socioeconomic assessments were carried out. In addition, secondary data sources were consulted to augment field observations and measurements. The assessment followed the national and international guidelines to comply with the best ESIA practices such as the environmental impact assessment procedural guidelines of Ethiopia and that of AfDBs operational safeguards. The potential positive and negative project impacts have been identified for construction, operation, and decommissioning phases. On top of this, environmentally sound and socially acceptable impacts enhancement and management options were also suggested.

## 1.2 Objectives of ESIA Study

The main objective of carrying out the Environmental and Social Impact Assessment for the proposed mini-grid solar power plant is to improve project planning by ensuring that environmental and social considerations are taken care of in all stages of project planning and implementation- these phases include construction, operations, and decommissioning. The ESIA study is particularly aimed at ensuring the environmental and social impacts of the proposed solar mini-grid potential impacts are clearly identified and the corresponding mitigation measures are appropriately addressed before decisions are made to implement the project.

Specifically, the ESIA study is to:

- Establish the baseline conditions of the project areas.
- Assess and report on the likely magnitude and significance of impacts, both positive and negative
- Conduct stakeholders and community consultations.
- Propose mitigation actions to reduce negative impacts and enhancement mechanisms for positive impacts.
- Propose ESMP and a monitoring plan for significant impacts.

## 1.3 Approaches and Methods

### 1.3.1 General

The Environmental and Social Impact Assessment (ESIA) was conducted between September and October 2021. The data used for the ESIA were collected from both primary and secondary sources. Primary data were collected through a field survey, expert interviews, and focus group discussion with the communities, while secondary data were obtained from relevant sources including literature and archives from project area government offices. The assessment process incorporates several key steps and constitutes a systematic approach to evaluate the proposed project in the context of the natural and socio-economic environment of the mini-grid pilot sites. In addition, the ESIA team has reviewed compliance to the relevant national and international policies, laws, standards, and guidelines.

### 1.3.2 Review of relevant documents

Policies, legislation, and guidelines pertinent to environmental and social protections were reviewed to assess the relevant laws and regulations related to the expected environmental and social impact of the proposed projects. In addition, existing documents on previous studies related to mini-grid solar power plants projects were obtained and reviewed to get insights into important data for the baseline description and background information for the proposed projects (FDRE constitution, 1994; EPA, 1997; CSE, 1997; EPA/EIA, 2002; 2003).

### 1.3.3 Field Survey

Field surveys and observations are critical to understanding the likely impact of a given project on the environment. The ESIA study team conducted a field survey of the project sites in October 2021. The team made observations in and around the project sites and gathered essential field data. During site observations, information on physical, biological, and socioeconomic environments has been collected. In addition, noise level, air quality, carbon monoxide, and ambient temperature measurements were conducted. Moreover, the team has also collected soil and water samples and subjected them to physio-chemical analysis in the laboratory to establish baseline conditions.

### 1.3.4 Stakeholders and community consultations

To elicit the views of stakeholders about the potential impacts and effects of the project, stakeholders and public consultations were conducted. The ESIA team followed two stages for public and stakeholders' consultations. First, we identified and mapped potential stakeholders (details are provided in section 5.2) based on the nature of the project (e.g., off grid solar power plant) and the end users or communities. The stakeholders were identified by segmenting across the following groups: directly and indirectly affected persons, institutional stakeholders including government and organizations likely to be involved in project implementation, regulation, and monitoring.

Following stakeholders' identification, we separately engaged the relevant government offices. Official letter communications were made to all the identified government offices and then key informant interviews or focus group discussions were conducted as appropriate. For community (public) consultations we conducted public meetings including all the community members and social influences (e.g., clergy men, elders) who could potentially be affected by the proposed off-grid solar power plant in the selected project site. The above segment of the community is thought to be directly affected by the proposed mini-grid solar power plant project. Moreover, church leaders and elders can exert influence on the community and hence of vital importance for the successful execution of the project.

The local government administration at Liben Chukala and other appropriate government offices (Agriculture, Health, Education, water, mines and energy, culture and tourism, bureau, etc.) were consulted to obtain their concerns and inputs for the success of the proposed project. Community consultations were conducted with local communities in Amharic language (following AfDB's requirement to conduct consultation in a language the communities are comfortable with) at Huluku locality. The community level stakeholder engagement activities targeted entire communities within the project's area of influence including the indirect impact zones. Two approaches were adopted at this level, the first was to have general community meetings targeting residents of the

Huluku community and thereafter to conduct interviews with community representatives such as community leaders and social influencers. During the consultation, the ESIA team disclosed the project and presented project objectives, the likely benefits, and adverse impacts. Then, participants were allowed to express their concerns and expectations regarding the project and likely social and environmental impacts that would likely happen during the construction and operation phases of the mini-grid solar power plant projects.

## 1.4 ESIA Report Structure

The ESIA report is structured into 10 chapters. Chapter one introduces the project's background, scope, and objectives and chapter two deals with reviews of relevant national policies and strategies, international conventions, lenders guidelines and safeguard standards.

Project descriptions such as proposed project locations, justifications, power, and material requirements are presented in chapter 3. In chapter 4 details of baseline environmental and social conditions of the proposed project areas are provided. Chapter 5 presents stakeholders and community consultation findings. Potential environmental and social impacts of the proposed mini-grid solar power plants activities are presented in chapter 6. This is followed by discussions of project alternatives in chapter 7. Chapters 8 and 9 present the proposed ESMP and monitoring plans, respectively. In chapter 10 conclusions and recommendations, based on the findings of the ESIA study, are presented. Finally, references and annexes are provided at the end of the report.

## 1.5 Limitations

The data collected (particularly secondary data) at kebele and woreda levels may often be incomplete and fragmented. In some instances, data were not compiled in organized form (e.g., yield per year, land under farming or grazing, etc.). To rectify the constraints and limitations the study team conducted key informant interviews with concerned stakeholders and further substantiated them through community consultations.

# 2. Policy, Legal and Administrative Framework

This chapter provides an overview of the relevant legislation, policies, standards, and guidelines applicable to the proposed DREAM mini-grid solar power plant project in Huluku, Oromia. Thus, the chapter reviews applicable national legislations, policies, strategies, and proclamations particularly related to energy, environmental protections, and others. In addition, the chapter provides a brief discussion of African Development Bank Operational Safeguards which are pertinent to the proposed projects.

## 2.1 National Laws, Policies and Strategies

### 2.1.1 The Constitution of Federal Democratic Republic of Ethiopia (FDRE)

The constitution of the Federal Democratic Republic of Ethiopia, Proclamation No. 1/1995 is the supreme law of the land. Article 40 sub-article 3 states that "The right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the State and the peoples of Ethiopia. The land is a common property of the Nations, Nationalities, and Peoples of Ethiopia and shall not be subject to sale or other means of exchange."

Article 44 stipulates in sub-article 1 that "All persons have the right to a clean and healthy environment." Sub article 2 of article 44 informs on resettlement action planning. It states that; "All persons who have been displaced or whose livelihoods have been adversely affected as a result of State programs have the right to commensurate monetary or alternative means of compensation, including relocation with adequate State assistance."

Article 36 on rights of children states that every child has the right not to be subject to exploitative practices, neither to be required nor permitted to perform work that may be hazardous or harmful to his or her education, health, or well-being.

The right of the public and the community to full consultation and participation as well as to the expression of their views in the planning and implementation of Environmental Policies and development projects that affect them is enshrined in the constitution (Articles 92.3 and 43.2).



### 2.1.2 National Energy Policy of Ethiopia

The Federal government of Ethiopia formulated an energy policy in 1994, which was the first ever comprehensive energy policy in Ethiopia. The main objectives of the policy are:

- To provide reliable, timely, and affordable energy to foster the nation's agricultural and industrial development.
- To ensure and encourage the gradual shift from traditional energy sources to modern one.
- To remove institutional and other bottlenecks for energy development and utilization and streamline the development of indigenous energy sources for self-sufficiency.
- To increase energy use efficiency and reduce wastages.
- To ensure that the development and utilization of energy are not detrimental to the environment

The policy document has indicated many options for energy development (in chapter 4 of the policy document) to attain the national energy policy objectives. Among them the most relevant for this mini-grid solar project are provided below:

- To provide alternative energy sources for the household, industry, agriculture, transport, and others
- To ensure the compatibility of energy resource development which promotes ecological and environmental sustainability.
- To facilitate and encourage the participation of the private sector in energy development.
- Encourage women's participation in planning, development, and utilization of energy.

Even though the energy development plan is heavily reliant on hydropower development other sources of energy are also being considered. The main among them is geothermal, solar, wind, and other energy sources and exploration of fossil fuels (e.g., natural gas), afforestation, and increasing efficiency of agro residues as sources of energy.

### 2.1.3 National Conservation Strategy of Ethiopia (CSE, 1997)

The Federal Government of Ethiopia has undertaken several initiatives that aim to develop regional, national, and sectoral strategies to conserve and protect the environment. One of these strategies was the conservation strategy of Ethiopia (CSE, 1996). This document provides a strategic framework for integrating the environment into new and existing policies, programs, and projects. It is also an important policy document, which views environmental management as an important component of development. It recognizes the importance of incorporating environmental factors into development activities from the outset.

The major environmental and natural resources management issues facing Ethiopia are well documented in the CSE (FDRE, 1997). The CSE sets out detailed strategies and action plans as well as the institutional arrangements required for the implementation of sectoral as well as cross-sectoral interventions for the management of Ethiopia's natural, man-made and cultural resources.

The most important areas that are addressed by the CSE include the following:

- Management of forest and woodland resources
- Land resource use policy and strategies; physical land-use planning
- Integration of social, cultural, and gender issues in sustainable resources and environmental management
- Promotion of participation in the sustainable development of natural, artificial, and cultural resources, and environmental protection
- Development of environmental education, public awareness, and human resources

### 2.1.4 Environmental Policy of Ethiopia (1997)

The Environmental Policy of Ethiopia (EPE) was approved by the Council of Ministers in April 1997 (EPA/MEDAC 1997). It is based on the Conservation Strategy of Ethiopia (CSE), which was developed through a consultation process over the period 1989-1995. The policy has the broad aim of rectifying previous policy failures and

deficiencies, which in the past have led to serious environmental degradation. It is fully integrated and compatible with the overall long-term economic development strategy of the country, known as Agricultural Development Led Industrialization (ADLI), and other key national policies like the National Population Policy and the National Policy on Women.

EPE's overall policy goals may be summarized in terms of the improvement and enhancement of the health and quality of life of all Ethiopians and the promotion of sustainable social and economic development through the adoption of sound environmental management principles.

Specific policy objectives and key guiding principles are set out clearly in the EPE and expand on various aspects of the overall goal. The policy contains sectoral and cross-sectoral policies and has provisions required for the appropriate implementation of the policy itself.

### 2.1.5 Ethiopia's Climate Resilient Green Economy (CRGE) Strategy

The Climate Resilient Green Economy (CRGE) is Ethiopia's overarching framework and a national strategy toward a green economy with the main objective to protect the country from the adverse effects of climate change and to build a green economy that will help realize Ethiopia's ambition to reach middle-income status before 2025. This strategy was highly synchronized with Ethiopian Growth and Transformation Plan II (2015/2020) which was aimed to bring about structural transformation in Ethiopia's major economic sectors. The objective of the strategy is to identify green economy opportunities that could help Ethiopia reach its ambitious growth targets while keeping greenhouse gas emissions low. The CRGE strategy has identified four pillars: Agriculture and forestry, power and industry, transportation, and buildings as instrumental in supporting Ethiopia's developing green economy and for reaching middle-income status by 2025. The CRGE strategy had designed specific objectives to address issues related to water and energy sectors to climate. These objectives include:

- To identify the economic and social impacts of current climate variability and future climate change on water and energy in Ethiopia
- To identify priority ways that the water and energy sectors can build climate resilience and reduce the impact of climate variability and climate change.
- To map the necessary steps to finance and implement measures in the water and energy sectors to build climate resilience in Ethiopia and deliver an integrated climate-resilient green economy.

### 2.1.6 Ethiopian National Energy Policy 2012

Policy objectives concerning environmental impact are in place to ensure the production, delivery, and utilization of energy without affecting or threatening the environment and society. One of the Policy Instruments in this respect is the introduction of mandatory environmental and social impact assessment on new energy and non-energy investment projects to assess the level of emissions of pollution and determine whether the project will have to be realized and on the type of necessary mitigation measures to be adapted.

### 2.1.7 National Social Protection Policy of Ethiopia

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

- Protect poor and vulnerable individuals, households, and communities from the adverse effects of shocks and destitution.
- Increase the scope of social insurance.
- Increase access to equitable and quality health, education, and social welfare services to build human capital thus breaking the intergenerational transmission of poverty.
- Guarantee a minimum level of employment for the long term unemployed and under-employed.
- Enhance the social status and progressively realize the social and economic rights of the excluded and marginalized.
- Ensure the different levels of society are taking appropriate responsibility for the implementation of social protection policy.

- To make practical the above listed objectives social protection policy, the project proponent or developer should abide by the policy prescriptions.

### 2.1.8 Ethiopian Women's Policy

The then transitional government of Ethiopia 1993 adopted the first National Policy on Ethiopian Women (NPEW). This was the first such move to give an institutional approach to address gender equality and enhance women's development aspirations through policy measures. Indeed, it was a great stride in focus moving away from the welfare approach to that of realization/recognition of women's role and contribution to the national socio-economic development. The policy has a three-fold objective. The first one is to ensure women's access to basic services such as health, education, and employment opportunities and avoid barriers such as social norms, and cultural and traditional practices which may hinder women's full participation in the socio-economic development of the nation.

Secondly, the policy gives special attention to eliminating all forms of discrimination against women and creating awareness of women's legal rights. Finally, it was intended to create the appropriate structures within the government offices to establish and monitor the implementation of different gender-sensitive and equitable public policies. Following the policy recommendations of creating an appropriate institutional structure at the various tiers of government, there is now a ministry of Gender and Social Affairs /regional bureaus/district offices of women's and children's affairs. At the federal level, one of the duties and responsibilities of the ministry of Gender and Social Affairs is conducting and monitoring gender-related issues and activities at the national level and creating an environment for the implementation of the NPEW in different sectors (even though the policy needs to be updated to match with the current institutional set up). At regional, zonal, Woreda, and Kebele levels, there are respective offices (at the Kebele level, usually individuals are assigned in place of an office).

On the other hand, those situated in line sectors/ministries are mandated to identify issues of gender gaps and develop strategies to address inequalities in the respective line ministries and their sub-sectors. The Gender and Social Affairs Offices are formally accountable to their respective councils, many of which have women's affairs or social affairs committees that are engaged in oversight activities. The plans included steps to enhance rural women's access to and control over productive resources like land, extension, and credit services.

### 2.1.9 Violence Against Women

A declaration on the Elimination of Violence against Women Proclaimed by General Assembly resolution 48/104 of 20 December 1993 is talking about recognizing the urgent need for the universal application to women of the rights and principles concerning equality, security, liberty, integrity, and dignity of all human beings. This under this declaration article 2 states that battering, sexual abuse of female children in the household, dowry-related violence, marital rape, female genital mutilation and other traditional practices harmful to women, non-spousal violence and violence related to exploitation; psychological violence occurring within the general community, including rape, sexual abuse, sexual harassment and intimidation at work, in educational institutions and elsewhere, trafficking in women and forced prostitution; and Physical, sexual and psychological violence perpetrated or condoned by the State, wherever it occurs. In this same declaration it is stated that women are entitled to the equal enjoyment and protection of all human rights and fundamental freedoms in the political, economic, social, cultural, civil, or any other field.

## 2.2 National Proclamations

### 2.2.1 Environmental Impact Assessment Proclamation No.299/2002

This proclamation made Environmental Assessment a mandatory legal prerequisite for the implementation of major development projects, programs, and plans. The proclamation also provides a legal base for the effective means of harmonizing and integrating environmental, economic, cultural, and social considerations into the planning and decision-making processes thereby promoting sustainable development. Moreover, it serves as a basic instrument

in bringing about administrative transparency and accountability, to involve the public and the communities, in the planning and execution of development programs that may affect them and their environment.

### 2.2.2 Environmental Pollution Control Proclamation No.300/2002 and Industrial Pollution Control Regulation No.159/2008

This proclamation is aimed at eliminating or, when not possible, mitigating pollution as an undesirable consequence of social and economic development activities. It also states that the protection of the environment and safeguarding of human health, as well as the maintaining of biota and the aesthetic value of nature, are the duty and responsibility of all citizens. It further considers other important issues such as control of pollution; management of hazardous waste, chemical and radioactive substances; the importance and need to respect environmental standards; and punitive and incentive measures. The Ethiopian regulatory body such as the former Environment, forest, and climate commission (now reconstituted as Environmental Protection Agency) may make surprise monitoring visits, without any prior notice, to ensure that the environment is protected from any serious pollution effects.

### 2.2.3 FDRE Rural Land Administration and Land Use Proclamation No. 456/2005

The Rural Land Administration and Use Proclamation (Proclamation No. 456/2005) provides entitlement to property produced on the land of the occupant, rights of intergenerational transfer, and limited leasing rights. Provisions are made for the registration and certification of tenure rights. Part Three of the Proclamation presents regulations relating to the use of rural land, particularly as it relates to soil and water conservation and watershed management. The rural land administration and land use laws are to be implemented by the regional states. Landholding right gives the right to use the land for agricultural purposes as well as to lease it and, while the right remains in effect, bequeath it to family members.

Article 7 sub-article 3 of the proclamation reinforces the rights of land users to compensation for the development they have made on the land. It also states that when the landholder is evicted by the federal government, the rate of compensation would be determined based on the federal land administration law. When the rural landholder is evicted by regional governments, the rate of compensation would be determined based on the rural land administration laws of regions. It is envisaged that the Proclamation will create a sense of ownership among most of the rural population and enable them to take initiatives and collectively engage in environmental management activities.

### 2.2.4 Expropriation of Land Holdings for Public Purposes and Payment of Compensation Proclamation No. 1161/2019

The federal proclamation on expropriation of landholding for a public purpose, payments of compensation, and resettlement (Proclamation No.1161/2019) replaced "Expropriation of Landholdings for Public Purposes and Payment of Compensation, Proclamation No. 455/2005". This new proclamation has been formulated to address, *inter alia*, the fast-growing urban population in major cities of Ethiopia and associated land acquisition for residential and infrastructure development needs. Rural areas also define the powers and responsibilities of authorities, which oversee property valuation, payment of compensation, and resettlement. This proclamation was made to correct past misgivings due to gaps seen during the implementation of the previous proclamation 455/2005. Considering these gaps, it envisions providing fair compensation and expedites decision-making for those whose land has been expropriated for development purposes. Moreover, it envisions putting in place a grievance redress mechanism to address complaints related to land appropriation and compensation. The proclamation states that the landholder whose land has been expropriated shall be paid compensation for the property on the land and the permanent improvement made on the land. The amount of compensation for the property on the land shall cover the cost of replacing the property anew. The proclamation requires compensation and resettlement for land expropriation to sustainably restore and improve the livelihood of displaced people.

### 2.2.5 Payment of Compensation for Properties Situated on Landholdings Expropriate for Public Purposes (Regulation No.472/2020)

This regulation repealed the Council of Ministers Regulation on Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes (Regulation No. 135/2007). This Regulation contains property

valuation and compensation methods and formulae that should be used in calculating compensation for various properties. It also contains lump sum compensation to be paid for severed social relationships and moral damages. The regulation also sets the provision of land expropriation procedure, proprietary right to develop the land to be expropriated, provision of substitution of land, housing and resettlement, and shareholder rights of the displaced. This regulation was issued for the purpose of not only paying compensation but also assisting displaced persons to restore their livelihoods. The Council of Ministers Regulation No. 472/2020 was issued to facilitate the proper implementation of proclamation No. 1161/2019.

### **2.2.6 Labour Proclamation No.1156/2019**

The Labour proclamation states requirements regarding employer-employee relationships including requirements for the provision of contracts of employment (Articles 6 & 7) and the need for employers to take all the necessary occupational safety and health measures and to abide by standards and directives to be given by the appropriate authorities in respect to Occupational Safety and Health (OSH) measures.

### **2.2.7 FDRE federal Civil Servants Proclamation No. 1064/2017**

Article 8 states that all positions of equal value shall have equal base salary and any Government office shall, at the end of every month, make payments of salary to civil servants or their legal representatives.

Article 14 presents that civil servant shall not be civil servant:

- a) person under the age of 18years
- b) Any person who has been convicted by a court of competent jurisdiction for offences of corruption, breach of trust, theft, fraud, or rape unless five years have lapsed from the date the penalty is served or is barred by limitation or remitted by pardon.
- c) A person having no certificate of competence.
- d) Any person who is unwilling to take oath of fidelity in accordance with Article 17 of this proclamation

### **2.2.8 Proclamation for the Establishment of Environmental Protection Organs No. 295/2002**

This proclamation established a system that fosters coordinated but differentiated responsibilities among environmental protection agencies at federal and regional levels. It clarifies the mandate and responsibilities of the Federal EPA and the Regional Environmental Authorities (REAs) within the governments of the regional states. The proclamation stipulates that each sector office shall establish an environmental unit to assess and evaluate environmental performance by the sector.

### **2.2.9 Other strategies and legislations**

Other legislation and strategies that may be of relevance to the proposed projects include but are not limited to the following.

#### **2.2.9.1 Research and Conservation of Cultural Heritage (ARCCH) Proclamation**

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. The Proclamation defines cultural heritage broadly as “anything tangible or intangible which is the product of creativity and labour of man in the prehistory 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 from 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) formalizes 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.

#### 2.2.9.2 Hazardous Waste Management and Disposal Control Proclamation No.1090/2018

This Proclamation shall have the following objectives:

- Create a system for the environmentally sound management and disposal of hazardous wastes.
- Prevent the damage to the human or animal health, the environment, biodiversity, and property due to the mismanagement of hazardous waste.

#### 2.2.9.3 National Health Policy

Ethiopia issued its first-ever health sector policy in 1993. The policy was intended to reorganize the health services delivery system to contribute positively to the overall socio-economic development effort of the country. Major aspects of this policy focus on fiscal and political decentralization, expanding the primary health care system, and encouraging partnerships and the participation of non-governmental actors. The policy and other health-related programs of the country highly promote the preventive approach to health services. Hence, the project proponent is also required to act in conformity with this strategy for the occupational health and safety of its workers and the environmental health of the community in the area.

#### 2.2.9.4 National HIV/AIDS Policy 1998

The overall objective of the policy is to provide an enabling environment for the prevention and control of HIV/AIDS in the country.

The specific objectives are:

- To establish effective HIV/AIDS preventive and control strategies to curb the spread of Covid 19
- To promote a broad multi-sectoral response to HIV/AIDS epidemic, coordination of the activities of different sectors, and mobilization of resources for the control of epidemic
- To encourage government sectors, NGOs, and communities to take measures in order to alleviate the social and economic impacts of HIV/AIDS
- To safeguard the human rights of people living with HIV/AIDS
- To empower women, youth, and other vulnerable groups to take action to protect themselves.

#### 2.2.9.5 Proclamation for Wildlife Development Conservation and Utilization proclamation 541/2007

This Proclamation has the following major objectives:

- To conserve, manage, develop, and properly utilize the wildlife resources of Ethiopia
- To create conditions necessary for discharging government obligations assumed under treaties regarding the conservation, development, and utilization of wildlife
- To promote wildlife-based tourism and encourage private investment.

This proclamation clearly stated that under article 8 no person, other than the Ministry or the concerned regional organ in the discharge of their duties, may hunt any game animal unless he owns a hunting permit.

## 2.2.10 FDRE, Pesticide Registration and Control Proclamation No.674 /2010

The main purpose of this proclamation is to enact comprehensive legislation to regulate the manufacture, formulation, import, export, transport, storage, distribution, sale, use, and disposal of pesticides and other matters by laying down a scheme of control that would minimize the adverse effects that pesticide use might cause to human beings, animals, plants, and the environment. The detailed legislation of pesticides is presented in this proclamation under 37 articles. To mention some, article 14 of this proclamation states about pesticides registration and the Ministry shall maintain a separate central database or archive containing the inventory of all pesticides to track the movement and use of pesticides according to each stage of the pesticide life cycle within the country and containing other relevant information ads, etc.

Article 17 (pesticide import and export permit), in this article under No 1 and 5, it is stated that no person shall make any import and export of any pesticide without obtaining an import or export permit issued by the Ministry and under No. 3 (a) of this article, no pesticide consignment shall be imported if it has been manufactured six months from its date of entry into the country. The disposal rule of pesticides is articulated in Article 21 and No 1 of this article states that no person shall dispose of any pesticide or pesticide waste in a manner that may harm human or animal health or the environment.

## 2.3 International Treaties Ratified by Ethiopia

### 2.3.1 The United Nations Framework Convention on Climate change (UNFCCC), 1992

Article 3(1) of the Convention states that Parties should act to protect the climate system based on "common but differentiated responsibilities", and that developed country Parties should "take the lead" in addressing climate change. Under Article 4, all Parties make general commitments to address climate change through, for example, climate change mitigation and adapting to the impacts of climate change. Ethiopia being a member state of the United Nations, therefore, ratified the convention and must abide by the principles of the convention.

### 2.3.2 Convention for the Safeguarding of the Intangible Cultural Heritage, 2003

The convention sets out the duties of States Parties in identifying potential sites and their role in protecting and preserving them. Each member country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage. The States Parties are encouraged to integrate the protection of the cultural and natural heritage into regional planning programs, undertake scientific and technical conservation research and adopt measures that give this heritage a function in the day-to-day life of the community.

### 2.3.3 International Labour Organization Core Labour Standards

Labour, working conditions, health, and safety are the subject of numerous international agreements, conventions, policies, and standards. Core labour standards formulated by the International Labour Organization (ILO) include forced labour, child labour, and workmen's compensation among others.

### 2.3.4 The Stockholm Convention

This is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms, and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel. In implementing the Convention, Governments will take measures to eliminate or reduce the release of POPs into the environment. Over 150 countries Ethiopia inclusive signed the Convention. Concerning the proposed mini-grid solar power plant and irrigation projects, POPs could arise from open-air combustion of waste, disposal of electronic waste such as used batteries, and degradation of components within the storage.

### 2.3.5 The Convention on Biological Diversity (CBD)

A major objective of this convention is in-situ and ex-situ conservation of biological diversity. Parties to this convention are required to undertake ESIA for projects likely to have significant adverse effects on biodiversity and are required to develop national plans and programs for the conservation and sustainable use of biodiversity.



### 2.3.6 African Convention on the Conservation of Nature and Natural Resources-1982

This convention was signed by the Heads of State and Governments of independent African States, assembled at Algiers, Algeria on 15<sup>th</sup> September 1968. Under this convention in Article II, the contracting States shall undertake to adopt the measures necessary to ensure the conservation, utilization, and development of soil, water, flora, and faunal resources per scientific principles and with due regard to the best interests of the people.

## 2.4 African Development Bank Operational Safeguards

The African Development Bank (AfDB) has an Integrated Safeguards System (ISS). The ISS consists of an Integrated Safeguards Policy Statement, Operational Safeguards (OSs), a set of Environmental and Social Assessment Procedures (ESAPs), and Integrated Environmental and Social Impacts Assessment (IESIA) Guidance Notes.

The Bank's Integrated Safeguards Policy Statement sets out the Bank's commitments to and responsibilities for delivering the ISS while Operational Safeguards establish operational parameters, delineates the roles and responsibilities of the Bank and its borrowers or clients in implementing projects, achieving sustainable outcomes, and promoting local participation. Operational Safeguards are also intended to prevent projects from adversely affecting the environment and local communities or, where prevention is not possible, minimize, mitigate and/or compensate for adverse effects and maximize development benefits.

Five Operational Safeguards are established and are summarized here as extracted from the AfDB ISS Policy Statement 2013:

- **OS 1: Environmental and Social Assessment** This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements

The proposed projects are Category 3 projects as they are less likely to have serious site-specific environmental and/or social impacts. Likely impacts are very few, site-specific, largely reversible, and readily minimized by applying appropriate management and mitigation measures or incorporating internationally recognized design criteria and standards.

Category 3 investment projects do not require a RAP but may have an ESMP plan to manage and mitigate minor environmental and social risks of projects in compliance with the African Development Bank's safeguards.

- **OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement, and Compensation** This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and it incorporates refinements designed to improve the operational effectiveness of those requirements. As the risk category of the project falls under category 3 the project does not trigger OS 2 and hence resettlement action plan and livelihood restorations are not needed.
- **OS 3: Biodiversity and Ecosystem Services** The overarching objective of this safeguard is to conserve biological diversity and promote the sustainable use of natural resources. This safeguard could be triggered due to trade-offs of ecosystem services where the availability of solar energy may result in increased withdrawal of water for irrigation (increase production) at the cost of regulatory services such as draining wetlands which are carbon sinks and biodiversity hotspots.
- **OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials, and Resource Efficiency** This safeguard covers the range of impacts of pollution, waste, and hazardous materials for which there are agreed on international conventions and comprehensive industry-specific standards that other multilateral development banks follow. The solar mini-grids power plants are meant to curb pollution which is already underway through diesel pumps for irrigation. These operational safeguards are triggered because irrigation activities, especially the use of pesticides, may result in water and air pollution. It is noted that pesticide-related activities are pre-existing within the baseline of farmer activities at these sites. Irrigation activities, especially the use of pesticides, will result in air pollution.



- **OS 5: Labour Conditions, Health, and Safety** This safeguard establishes the Bank’s requirements for its borrowers or clients concerning workers’ conditions, rights, and protection from abuse or exploitation. It covers working conditions, workers’ organizations, occupational health and safety, and avoidance of child or forced labour.

## 2.5 Institutional Framework

### 2.5.1 Institutional Arrangements for Environmental Protection

The definition of powers and duties of the executive organs of the Ethiopian Environmental Protection Authority (EPA) was established by proclamation 295/2002. The EPA has been subsumed under the former ‘Environment, Forest & Climate Change Commission until 2021. However, recently the commission was dissolved and renamed EPA (where the forest sector) was merged into the ministry of Agriculture). The objective of the newly re-established Environmental Protection Authority is to formulate policies, strategies, laws, and standards which foster social and economic development in a manner that enhances the welfare of humans and the safety of the environment and to spearhead ensuring the effectiveness of the process of their implementation.

Part three of Proclamation No. 295/2002 states that every competent agency shall establish or designate an environmental unit that shall be responsible for coordination and follow-up so that activities of the competent agency are in harmony with the proclamation and other environmental protection requirements. Each national regional state is also required to establish an independent regional environmental agency or designate an existing agency for coordinating the formulation, implementation review, and revision of regional conservation strategies and environmental monitoring, protection, and regulation.

### 2.5.2 Environmental Protection Authority of Ethiopia (EPA)

The former Environment, Forest, and Climate Change Commission (EFCCC) is now renamed as the Environmental Protection Authority. This federal institution is entrusted with managing the Environment of Ethiopia. The EPA is responsible to ensure the realization of the environmental rights, goals, objectives, and basic principles enshrined in the Constitution. As well as the Environment Policy of Ethiopia through coordinating appropriate measures, establishing systems, and developing programs and mechanisms for the welfare of humans and the safety of the environment.

It is mandated to formulate or initiate and coordinate the formulation of strategies, policies, laws, and standards as well as procedures and upon approval monitor and enforce their implementation. It is also responsible for the synergistic implementation and follow-up of international and regional environmental agreements. EPA is mandated to review, approve ESIA reports and issue the environmental authorization. The EPA also undertakes the role of certification of ESIA practitioners.

## 2.6 Regional Government Offices

The regional governments based on the constitution of the federal republic of Ethiopia established relevant executive organs. The following executive organs will be relevant for the proposed project:

### 2.6.1 Oromia Bureau of Agriculture and Natural Resources

The Oromia Bureau of Agriculture and natural resources has a wide range of duties in improving agriculture activities in the Region. The most relevant to the proposed project include the following:

- Provides agricultural training and extension Services. They are responsible for agronomic issues and agriculture conservation practices. Improve agronomic practices in the proposed project area such as crop rotation, intercropping, Field sanitation, Land preparation, planting method, and Planting materials.
- Provides agriculture information and extension services to the community and shall be giving similar support to the targeted farmers in the project

- Supports by training the full package and scaling up best practices to all farmers. For such cases, farmers training centre (FTC) is mandated to train farmers on different agricultural technologies
- Administers the land resource of the region and prepare land use plan
- Encourages farmers to undertake crop protection to control crop damage or yield reduction caused by insects, diseases, weeds, and other destructive animals.
- Follows the implementation of recommended fertilizer rates and time of fertilizer application for the proposed crops of this project

### 2.6.2 Oromia Bureau of Water, Irrigation, and Energy

The bureau entitled to the power wide range of duties related to irrigation activities in the region, the most relevant to the proposed activities include:

- Assign irrigation experts in the project area to advise and assist irrigation users.
- Provide training for irrigation users for the wise use of the water resource.
- Form and follow irrigation water user associations, the association will work on fair distribution of waters.

### 2.6.3 The Oromia Environmental Protection Authority

Oromia regional Authority of Environment acts as a regional environmental regulator (with its respective offices at lower levels) and is responsible for the following basic activities:

- Reviewing or evaluating the ESIA document prepared by the consultant of the proponent
- Based on the assessment results, setting the overall direction for the project's environmental performance
- Enforce and guide land compensation payment issues as per land proclamation and rules.
- Regulate and follow up that any development shall conduct ESIA before the project implementation
- Undertake environmental auditing of establishments for the safe disposal and management of liquid and toxic wastes

## 3 Description of the Project Area

### 3.1 Project Location

The proposed mini-grid solar and irrigation project is in Huluku in the East Shewa zone, Oromia National Regional State.

Huluku site is located 80 km south of Addis Ababa in Liben Chukala Woreda, east Shewa zone. It can be accessed through Addis-Bishoftu-Adulala express road and about 12 km west of the main road to reach Huluku site (Figure 1).



Figure 1: Location map for the project site

### 3.2 Project Justification and Key Information

Mini-grid solar power plants have proven to be more environmentally friendly compared to other sources of energy and other types of 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 Strategy (CRGE). The purpose of the planned solar mini-grid project is mainly to substitute diesel irrigation pumps with solar-powered irrigation, which would intensify the existing irrigation activities at the project site. Consequently, farmers will have access to reliable electricity which would help them increase agricultural production/productivity, ensure food security, and help to mitigate and adapt to climate change.

Table 1: Key project information

Particulars	Description
Project developer/owner	Will be identified later
Type of business	Renewable energy activities
Plant type and capacity	300kW, 430kW, and 250 kW Huluku
Location	Liben Chukala, Oromia Region
Manpower requirement during construction and operation phases	300
Project land area	
Area required per kW PV panel installation	10 sq. m
Total area required for PV panel installation	1.5 ha

### 3.3 Project Components

The major project components are discussed hereunder. However, this section is expected to be revised and updated once the project feasibility report is completed.

- **Mounting system:** PV modules will be mounted on structures made of aluminium or hot-dip galvanized steel. Footing design and type will be decided during design works.
- **PV Modules:** PV modules absorb the sun's rays as a source of energy to generate electricity.
- **Inverters:** Inverters convert the Direct Currents (DC) produced by PV modules to grid-exploitable Alternative Currents (AC).
- **Transformers:** Transformers will change voltage levels from low voltage (230V) to medium voltage (15kV or 33kV) and vice versa.
- **Distribution grid:** overhead distribution lines mounted on wooden poles will be used to transfer power from the solar power plant to households and irrigation pumps.
- **Irrigation pumps** will be used to pump water from the underground to the surface. The design details are shown in Figure 2.
- **HDPE (High Density Polyethylene) main line** will distribute water from well to lay flat hose.
- **Lay flat hose** will be used to distribute water from the HDPE pipeline to each farmland. The hose is made of PVC, rubber, or polyurethane materials.
- **Pesticides** used are profenofos, lambda-cyhalothrin and malathion (details are provided in Annex 6).

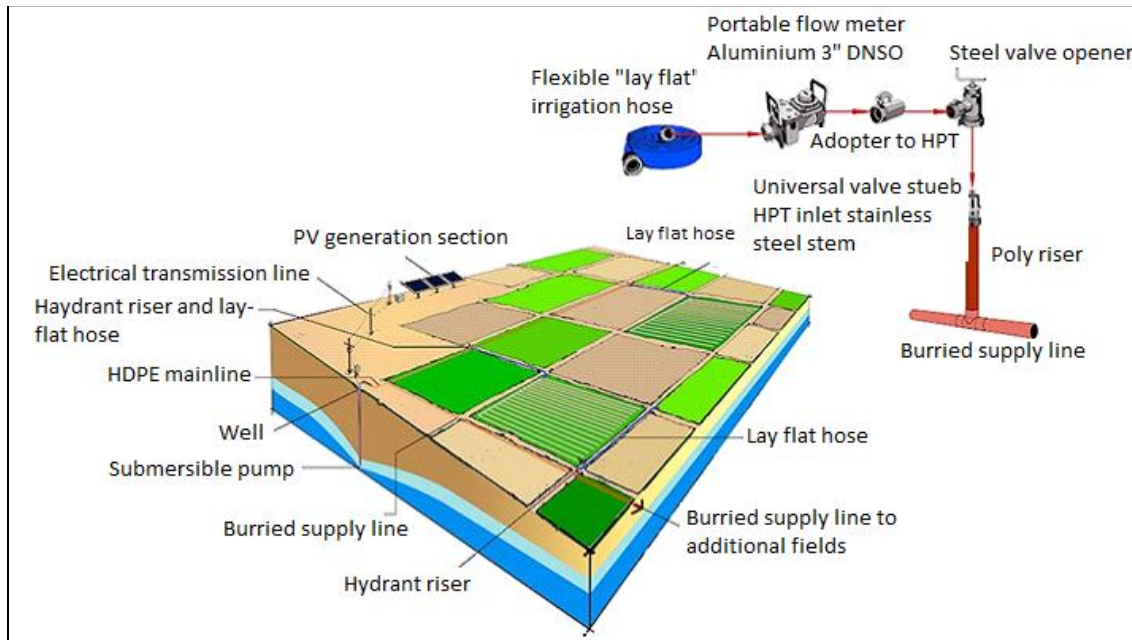


Figure 2: Irrigation scheme design

### 3.4 Civil works

Civil works related to the solar PV construction phase include land excavation and levelling, foundations for the installation of the mounting system for the PV modules, the building of access roads, fencing, as well as the construction of the light buildings (operation and administration building, security posts, storage, etc.).

### 3.5 Manpower Requirement

Installation of solar PVs, and installation of distribution grids are labour intensive during the short construction phase and are expected to hire 40-50 skilled and unskilled workers. However, during the implementation phase, manpower requirement is minimal, it is expected to create jobs 2-4 per site. Similarly, during the decommissioning phase, about 2-3 skilled manpower and about 15 laborers per site are required to dismantle solar panels and other equipment.

The non-skilled workers will be hired from the nearby community and some skilled manpower may come from other parts of the country and will rent a house in the nearby towns. Therefore, there is no need to construct a camp during construction or house for temporary workers. During the construction phase, construction machinery such as an excavator, dump trucks, a mixer, and rollers will be used.

### 3.6 Land Requirements

The land required for Solar PV modules installations is 0.39ha. The total area required, including internal roads, and light buildings is estimated to be 0.468 ha.

The area stated was calculated based on an assumption of 12 sqm per kW.

### 3.7 Implementation Schedule

The major activities are tentatively scheduled as follows:

- Construction expected to start in April 2023
- Construction is expected to last in 6 months for Minigrid.
- Operation is expected to start in November 2023

## 4. Baseline Information for the Proposed Project Areas

### 4.1 Physical and Biological Baseline Information

#### 4.1.1 Climate, temperature and rainfall

The Huluku site experiences semi-arid climatic conditions due to its location in the Ethiopian Main Rift system. The project site is found in a double maxima rainfall regions in Ethiopia' main rift system. The main rainy season begins in June and ends in October whereas the light rainy season (Belg) starts in March and ends in May, and these were interrupted by a dry season (November to February). The rainiest month is August whereas the lowest rainfall is in December. The average annual rainfall ranges in the area from 500mm to 800mm. The annual average temperature ranges from 10-30°C due to variations in altitude. Field temperature measurement at Huluka on date 14/10/2021 at noon time was 33°C.

#### 4.1.2 Geology

In the wider scenario, quaternary volcanic deposits cover the geology of the area with alluvial lacustrine sediments found within the main Ethiopian rift valley and tertiary volcanic rocks covering the escarpments and ridges that bound the rift. Specifically, the project area of Huluku is underlain by volcanic ash and pumice. It is light in colour, very porous, volcanic materials, and they are soft, loose, and friable (see Figure 3).



Figure 3: Geological formation of the project areas (Huluku site)



### 4.1.3 Topography and Drainage

The project area of Huluku lies within the central parts of the Ethiopian rift valley, which runs NNE to SSW direction (Figure 4). Topographically the project area (Huluku) is found in low laying and flat parts of the rift valley and surrounded from its west and east direction by the volcanic-formed chain of ridges. Randomly distributed sub-circular-shaped hills are also found around the project areas within the rift valley. The highest and lowest elevation points above mean sea level are 2800m and 1200m at west and northeast of Huluku site, respectively. In the project area, locally along the rift, elevation is decreasing from southwest to northeast direction and the flow of water follows the same direction. There is no perennial river around the project area, but the Awash River is found at a near distance from the Huluku site, which is the main water, and recharge area for the project site (Figure 4).

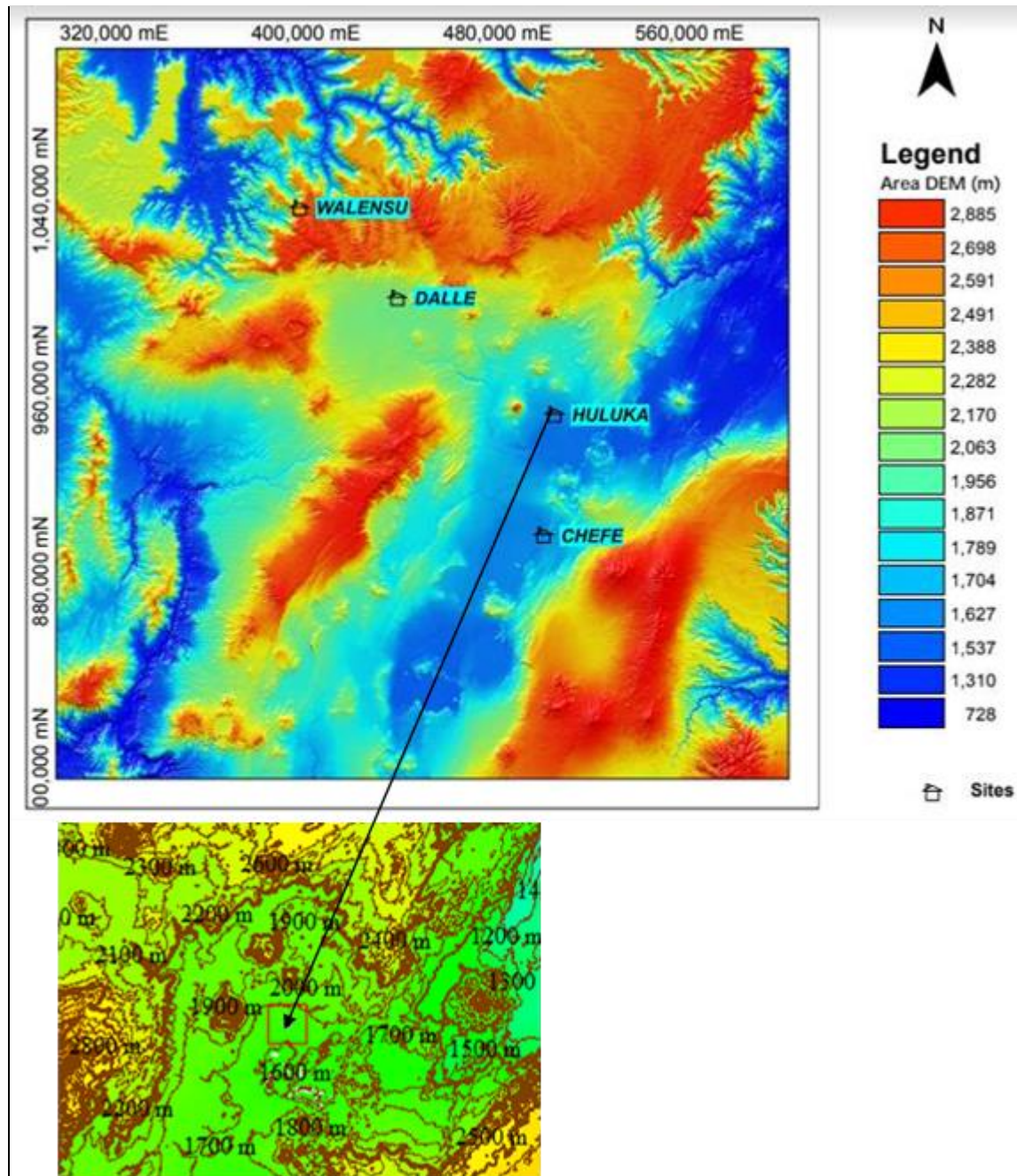


Figure 4: Topographic features of the proposed project area

#### 4.1.4 Soil

The soil in the Huluku site is the weathering products of rift related pyroclastic flow and alluvial lacustrine deposits. The clay soil in the area contains light grey to dark-brown soil gradients in colour. The soil in the area is affected by salinity since it is associated with volcanically active zone that contains plumes of hot springs. The natural soil fertility of the area is low due to salinity, but it is highly productive through various kinds of fertilizer treatments.

The ESIA team collected soil samples from cultivated fields from 20-30cm depth to characterize important macronutrients and micronutrients in the soil. Representative soil sample that had been taken from the Huluku site was analysed for this purpose.

The sample is analysed in the laboratory of Ethiopian Construction and Design Supervision Works Corporation, in Addis Ababa and the results are presented in annex 5. The annex 5 presents values for soil pH, macronutrients (Phosphorus, Sulphur, Potassium, Sodium, Calcium and Magnesium) and micronutrients (Iron, Manganese, Zinc and Copper). The pH value of the soil in Huluku site is 6.35 suggesting the soil has slight to moderate acidity. The analytical results for exchangeable Na, K, Ca and Mg are 1.22meq/100g, 5.38meq/100g, 44.69meq/100g and 13.22meq/100g, respectively. The content of these nutrients in the soil are classified following Food and Agriculture Organization (FAO) bulletin 2006 for the purpose of interpretation of exchangeable cations. Based on the information in Table 2 below, the concentration of exchangeable Na, K, Ca and Mg in the target area are very low to very high. As indicated in annex 5 the concentration of available phosphorus and sulphur in the results of the laboratory is 117.41mg/kg and 22mg/kg respectively. In the same way FAO standard concentration for phosphorus and sulphur is 1000mg/kg-5000mg/kg and 500mg/kg-5000mg/kg correspondingly. Therefore, the concentration of both phosphorus and sulphur in the area are lower than the standard ranges of FAO (Table 2).

Similarly, the laboratory result indicates that the concentrations of Fe, Mn, Cu and Zn in the area are 4.62mg/kg, 12.85mg/kg, 3.97 mg/kg and 3.75 mg/kg, respectively. Based on FAO classification, healthy and productive soil should contain Fe values from 50-1000mg/kg, Mn from 20-200mg/kg, Cu from 2-20mg/kg and Zn from 10-100mg/kg. Therefore, except for copper the concentration of Fe, Mn and Zn in the target area is lower than the reference value of FAO essential nutrients concentration in soil.

Table 2: FAO cation reference data for soils (2006)

Rating	Exch. Ca	Exch. Mg	Exch. K	Exch. Na
Very high	>20	>8	>1.2	>2
High	10-20	3-8	0.6-1.2	0.7-2
Medium	5-10	1-3	0.3-0.6	0.-0.7
Low	2-5	0.3-1	0.2-0.3	0.-0.3
very low	<2	<0.3	<0.1	<0.1

Fig. Soil exposed in the Huluka area



## 4.1.5 Flora

### 4.1.5.1 Huluku site

Based on the information from the agriculture office of Liben Woreda and local people as well as expert field observation, there are no known reserved forest areas around this project. But bushes and trees are grown within the cultivated and pastoral lands as well as in the elevated topography (mountains) like Zikuala (Ziqualla) Mountain. The most common and dominant indigenous tree in the Huluku project area is *Vachellia* (acacia) species (Figure 5). But some other trees and shrubs were often seen in the project area and include *Juniperus procera*, *Eucalyptus globulous*, *Azadirachta indica*, *Rosa Abyssinica*, and *Euphorbia* spp. (e.g., *Euphorbia ampliphyla*).



Figure 5: The common *Vachellia tortilis* (acacia tree) at Huluku project site

## 4.1.6 Fauna

### 4.1.6.1 Domestic animal

Cattle are an integral part of the farming communities in rural Ethiopia. Likewise in the proposed project site cattle, sheep, goats, mules, horses, donkeys, dogs and chickens are raised for source of food for their families, working (transportation, ploughing) and income generation. Table 3 provides figures of various domestic animals in Liben Woreda.

Table 3: Variety and number of animals in Liben Chukala Woreda

Woreda	Cattle	Sheep	Goat	Donkey	Horse	Mule	Hen	Hive
Liben	198250	39320	84600	34250	3400	4225	89500	4368

### 4.1.6.2 Wild animals

The presence of wild animals was determined using several techniques, most notably visual observation, and interviews with residents and agriculture experts. Wild animals in the project area include hyenas, vervet monkeys, pigs, apes, tortoises, rabbits, bushbucks, foxes, colobus monkeys, and antelopes.

## 4.1.7 Water Resource

The distribution and availability of water resources vary with the hydrogeological characteristics of the proposed project site. Underground water resources appear to be abundant in Huluku because of its proximate location to the Awash River. Thus, most people depend on these water sources for domestic and irrigation purposes. Interviews with local people indicated that underground water can be obtained from as shallow as 10-20 meters deep. Even



though water is available quantitatively, quality drinking water is still a challenge. The same holds for irrigation where many farmers do not afford to buy water pumps and diesel fuels which are very expensive for them.

The ESIA team has also collected a water sample from the respective site for chemical analysis of water quality (Annex 1 and Table 4). The site has a total alkalinity value above the WHO limit and has high sodium and fluoride concentrations. All other details are provided in Table 4.

As the laboratory result indicates, the water in the hand dug well at Huluka site contains alkalinity (400 mg/l CaCo<sub>3</sub>) and fluoride concentrations (1.8mg/l) beyond the World Health Organization (WHO) maximum allowable concentration for drinking purpose (Table 4). Therefore, the water in this site particularly, borehole water, needs appropriate water treatment for alkalinity and fluoride treatment in order to make it suitable for household consumption.



Figure 6: Hand-dug well pumped with fuel pump to use for irrigation and domestic uses at Huluka site

Table 4: Selected parameters of water quality test result (red highlighted doesn't meet WHO standard)

No	Parameters	Unit	Huluku	WHO maximum limit
1	Turbidity	NTU	1.08	5
2	EC	uS/cm	1196	2000
3	PH	log10	7.12	6.5- 8.5
4	TDS	ppm	598	1000
5	Nitrate, NO <sub>3</sub>	mg/l	2.2	10
6	Total alkalinity	mg/l CaCo <sub>3</sub>	400	200
7	Sodium	mg/l	260	200
8	Fluoride	Mg/l	1.68	1.5

#### 4.1.9 Air Quality Conditions

Ambient air quality measurements are essential to describe the existing conditions, provide a baseline against which changes can be measured, and assist in the determination of potential impacts of the proposed project on air quality conditions. Accordingly, at Huluka site, two locations were selected: the settlement area (considered as sensitive receptors) and the actual project area (irrigation/farm area). There is an international standard for environmental air quality since air quality is the most vital concern for a healthy life. Table 5 presents air quality measurements in

Huluku. In this regard, the air of the project areas is almost natural, pure, and clear and was not influenced by technologies and modernization. Noise level measurements indicate that at Huluku site near diesel pumps is beyond WHO maximum limits of 55dB for residential areas (Table 5).

Table 5: Air and noise quality measurements for Huluku

Table: Particulate measurements PM2.5 and PM10 Huluku										
Site	UTM	Measurement points	Unit	PM2.5			Pm10			Date & time
				Min	Max	Avg	Min	Max	Avg	
Huluku	499838E 940464N	GH001	ppm	0.001	0.006	0.003	0.001	0.034	0.018	14-10; 12:50

Table: Noises, temperature, and Co measurement results of Huluku								
Site	Location UTM	Station	CO in ppm	Temp C <sup>0</sup>	Noise in dB			Date & time
					Max	Min	Avg.	
Huluku	499838E 940464N	GH001	0	33	73.3	51.1	61.3	14-10; 12:58
Huluku near motor pump	499625E 940531N	GH002	65	33	90.2	79.2	84.7	14-10; 13:20

## 4.2 Socio-Economic Baseline Information

### 4.2.1 Population

The total population of Liben Woreda is 76,351 out of which only 2,930 live in Adulala town. Huluku (Huluku site) is densely populated and living in closely spaced communal housing. The people at the Huluku site are mostly Orthodox Christian. Almost all the houses were built from natural wood and mud with a ceiling of corrugated iron sheets. The means of subsistence in the site is farming, mainly growing a range of crops, fruits, and vegetables (maize, teff, wheat, barley, sorghum, beans, potato, pepper, tomato, avocado, mango, and onion). Animal husbandry is another mainstay with some people living on fishing and honeybee production. Cattle, horses, and small ruminants were noted as common animals. Irrigation is widely used to grow fruits and vegetables.

### 4.2.2 Health Facilities

Health infrastructure and services are limited in all studied locations as compared to the catchment area population and widespread disease. Table 6 presents health infrastructure and service information for the woreda where the proposed project site is located. As per the information obtained from the respective Woredas Pneumonia and Diarrhea are the two causes of morbidity and deaths for many people in rural communities. Typhoid and upper respiratory infection are also the most prevalent diseases affecting the communities.

Table 6: Number of health organizations in Liben Woreda

SN	Type of Health Facility	No. of health facilities in Woreda
1	Hospital	0
2	Health centre	4
3	Health post	15
4	Clinics	0
<b>Total</b>		<b>19</b>

Source: Liben Chukala Woreda health office

### 4.2.3 Education

Education services are distributed unevenly in most parts of rural Ethiopia. This has also been observed in all the sites we visited in the Oromia region where towns and urban centres have better access to education services than rural areas. Access to education appears to be better in Liben Woreda. The Liben Woreda has 4 high schools and over 50 primary schools serving around 20,000 pupils (Table 7).

Table 7: Number of schools and students in LibenChukalaWoreda in June 2020 to June 2021

SN	Level of school	No. of school in Liben	No. student in Liben		
			Male	Female	Total
1	Prim (1-8)	51	9714	8844	18558
2	Sec (9-12)	4	862	752	1614
Sub-Total		55	10576	9596	20172
3	Teachers Certificate to master		364	240	604

**N.B:** School coverage at Liben Chukala is almost 100% with each kebele having two or more schools.

The gender parity in education is closer to 0.9 with slightly more than one in urban centres in the woreda. Despite such a positive aspect, the number of girls attending school is recently declining due to various socio-economic and security challenges. In this regard, the school dropout and attrition rates are higher among girls than boys. The main causes include:

- Safety and security in rural villages
- Economic migration to major urban centres
- Early marriage
- Poverty and climate-related shocks (crop failure, food insecurity, etc.)
- Lack of transportation

Education quality and retention capacity have been compromised due to various factors such as:

- High students to teacher's ratio
- Shortages of funds for the school facilities
- Very old curriculum: that is not adapted to current situations and standards.
- Teachers' competence and training (e.g., BSc graduates are not competent enough to handle courses for secondary grades).
- Shortage of learners' materials with textbooks ratio 1:4 and delays in new textbooks supply.

However, ensuring the quality of education has been a challenge. Thus far, community cost-sharing and school grants from the World Bank have sustained public education services.

### 4.2.4 Water Supply

The main sources of water in Liben Chukala Woreda for drinking and other purposes are mainly groundwater (Table 8). According to the information obtained from Liben Chukala water and energy development office representatives, the existing water coverage (including non-functional water sources) is 67% in Liben Chukala Woreda. There are different categories of water sources in Liben Chukala that include deep well, shallow well, manually drilled well, spring, and river (Table 8).

Table 8: Deep and shallow well at LibenChukalaWoreda

SNO	Water source	Liben Woreda
1	Deep well (90-100m)	20 (2 town)
2	Shallow & Hand dug wells	250
3	Spring	-
	<b>Total</b>	<b>252</b>

#### 4.2.5 Electric Supply

In the project areas, towns and some rural places have access to electricity from the main grid lines. The majority of rural areas including all irrigation sites use traditional sources of power for lighting and cooking purposes mainly firewood, animal dung, and crop residues. There are also some solar power energy supply systems used for lighting and charging appliances. In Liben Chukala Woreda, 158 solar energy stations with a capacity of 100 watts are available. However, close to half (80) are functional and the remaining half are not working due to lack of maintenance.

There are five solar energy stations for water pumping purposes in the Liben Chukala woreda, only two of them are functioning and the remaining are out of service due to energy conversion deficiencies such as Ac to DC systems.

#### 4.2.6 Road Infrastructure

Huluka project site is connected to its capital of town (liben) by 25km dry weather road. But, during dry season the project area is easily accessible since the locality is flat land without challenging ups and downs (depression, gorges, and mountains/ridges) and the water in the swamp area dry out. The people in the project area are using foot, horse and Mule as well as Motorcycles for transportation to town for markets and other places.



Figure 7: Local people transportation by mule and on foot at Golole sites

#### 4.2.7 Utility Service

Mobile telephone and 3G network services are available in most places of Liben Woreda which makes communication easily accessible. In particular, these services are available in the project site. Moreover, communications in the project area can easily be possible through email, Telegram, WhatsApp, etc as well as on phone call using smart mobile. Bank, Fuel, Postal office, Hotel, Super markets and other shopping services are available at Liben town.

#### 4.2.8 Physical cultural, religious, and archaeological resources

There is a strong relationship between cultural, customary practices, and religious beliefs with implications for natural environment management. In Liben Chukala Woreda, "Geda", "Irrecha" and "Muda" are common cultural and traditional practices. Thus, project planning should take into consideration such indigenous cultural practices.

According to the information from the Woreda culture and tourism office, there are different historical and natural tourist attractions in Liben Chukala (Table 9).

Table 9: Natural, cultural and traditional tourist attractions

S/No	Historical and natural heritage's
	Liben Chukala Woreda
1	Tulu Chukala (Zukwala) mountain found at Mume Horeso kebele
2	Mount Bate in Jara Goro kebele
3	Natural Cave at Holqaroge Godti locality
4	Holqa Sufte Cave

In Liben Chukala Woreda, churches are dominant. Field observation and key informant interviews showed that in addition to the churches and mosques, Lakes and wetlands are used by Gada/Irrecha practices and hence these sites should not be affected by solar power panel installations or intensive irrigations (Figure 8)



Figure 8: Oromo cultural ceremony (Gada), Zukala crater and mountain caves (Source Liben Chukala Woreda culture and tourism office and photo taken during field visit)

## 5 Public Consultation and Grievance Redress Mechanism

### 5.1 Objectives of stakeholders and community consultations

Public consultation and stakeholders' engagement are crucial components of environmental and social impact assessment. Such efforts are believed to provide opportunities for people who are potentially affected by the intended solar power plant and irrigation projects and help contribute to improving the design and implementation of the project activities. In addition, public consultations will enable the project, proponent in close cooperation, to identify or mitigate any potential adverse impact that might arise due to project implementations. Furthermore, public consultation ensures the enhancement of positive impacts of projects and contributes towards sustainable development of the target area and beyond.



A stakeholder is defined as “any individual or group who is potentially affected by the proposed initiative or can themselves affect the proposed initiative’. Stakeholder engagement is a crucial component of environmental and social impact assessment.

The main objectives of public consultations and stakeholder engagement are to:

- **Identify** all those affected by or interested in the Project to ensure that they are included in the engagement process.
- **Understand** the views of the key stakeholders and make sure that stakeholders adequately understand the positive and negative impacts of the Project.
- **Inform:** the ESIA including local benefits and partner opportunities
- **Relationships and Trust** build relationships through supporting open dialogue and engagement with stakeholders. Establish transparency in activities being undertaken and build trust with stakeholders.
- **Engage with all Stakeholders** by having an inclusive approach to consultation and participation. This may include the use of differential measures to maximize the effective participation of stakeholders that might not be easily reached through conventional methods.
- **Manage Expectations and Concerns** by providing a mechanism for stakeholders to engage with the Project about their concerns and expectations and provide a mechanism for receiving, documenting, and addressing comments received.
- **Compliance** with both national regulations and international best practice

Project details were disclosed to all stakeholders and host communities. The team also undertook to consult with administrative stakeholders to identify their views on the proposed project and perceived impacts.

## 5.2 Stakeholders Mapping and Analysis

The ESIA is considered to have engagement with Community; directly affected and indirectly affected persons, institutional stakeholders including government, and organizations likely to be involved in project implementation, regulation, and monitoring.

List of stakeholders consulted to date is included in the appendices section attached to this report. The input from stakeholders obtained during the ESIA has informed the identification of important issues and potential sensitivities that merit further stakeholder engagement (Table 10).

Table 10: Stakeholders identified, their roles and status of consultations

Stakeholder	Role and Interest/ influence	Status of consultation	Outcome
Oromia region Agriculture and natural resource bureau	Regional government	Letter sent, a meeting was conducted to introduce the project and project team.	Project disclosure was made, data and information were collected
Liben Chukala, Woreda Agriculture and natural resource offices	Local governments	Letter sent from the zone and meeting was conducted to introduce the project and project team.	Project disclosure was made, data and information were collected
Community from Huluku villages	Host communities, all have an interest in power for irrigation, electricity for domestic consumption and some have an interest in new job opportunities	meetings were conducted to disclose the project to the community	PAPs may be identified later when the exact location of the project is known, and the developer identified
Liben Chukala Woreda health, education, planning, water, and energy offices etc.	Local governments	Project disclosure and data request	Consultations were made and socio-economic baseline data were obtained
Liben Chukala, woreda Culture and tourism office	Local governments	Meetings were conducted to disclose the project and identify any cultural and archaeological sites in the proposed project area	Discussions were made, data were obtained regarding culture and tourism sites
Liben Chukala, woreda Education office	Local governments	Meetings were held for project disclosure and request basic education data for respective woredas	Consultations were made; education coverage and related data were obtained

## 5.3 Outcomes from Community and Major Institutional Stakeholders' Consultations

### 5.3.1 Huluku Communities

For community consultations, we conducted a public meeting including all the community members and social influencers (e.g., clergymen, elders) who could potentially affect or be affected by the proposed off-grid solar power plant in Huluku site. During the public consultations, many people were happy to participate, and the enthusiasm could be seen from their turnover and composition. During community consultations, women, elders, youth, and village representatives, and priests were present (Figure 9). The ESIA team has introduced itself and proceeded to disclose the proposed project, objectives and asked the community members to express their expectations and concerns. Then opened the floor for discussion, questions, and opinions. Accordingly, the following points were raised by the participants.

**Date:** 15/10/21

**Place of meeting:** Huluku village

**Number of participants:** Male (36) & female (12)

**Table 11: Local people public consultation at Huluku site**

Name of participant	Issues raised	Response
Ato Abdu Shikur (M) and Ato Roba Chala (M)	These two people shared the view that irrigation is the lifeline of the community, but the challenges are mounting. In addition, the community does not have any access to electric light, and we are so anxious to see some solutions to our predicaments. They further noted that women are suffering from a heavy burden of domestic chores including a lack of grinding mill/flour mill. The situation for irrigation is precarious because most farmers do not afford to purchase diesel pumps which cost about 28,000 to 50,000 birr depending on the capacity. This is simply unattainable, and farmers are under much stress while conducting irrigated agriculture. Thus, the community will be waiting with high hope that this project would bring about affordable and sustainable electric power supplies.	The ESIA team responded that the main purpose of this project is to install solar panel power for the purpose of irrigation to substitute the non-renewable fuel by solar sourced power. But it is under the scope of the project in addition to irrigation, schools, churches, health posts, flour mills and small businesses will benefit from electricity production.
Ato Ayano Tesema (M)	He expressed that solar power is of great value since we have seen its positive contributions since an NGO installed solar panels which serve for few members of the community. Apart from irrigation, which is too obvious to mention, solar power can light up our life (take away burdens from women, children can learn and study, health services will be improved, etc.). However, he mentioned that projects do not transit to implementations and honestly it is frustrating because of such extended delays.	The ESIA experts said that the information is important and will be included in our report. We expect that the project will not be interrupted once it is started unless otherwise it is not feasible at the beginning, and it will start soon since irrigation is one of the priorities of our government. However, the final decision will be made by higher officials after the final evaluation of ESIA and other technical and financial reports.
Ato Regassa Buche (M)	He said that "we are so happy, and we will provide a space for installation of solar power plants". He added that our community wants to see the commencement of these projects (solar power plant and irrigation) as soon as possible.	The ESIA team said that your willingness to provide space for installation of a solar power plant is a good indication of your interest to support the project and it is valued. We expect the project will be realized soon in your village.
Ato Abe Tufa (M)	He mentioned that the potential for irrigation is quite huge but individual farmers do not afford to purchase diesel pumps, and running costs are also so expensive.	ESIA team responded that this is one of the main reasons why this project is intended to launch in your village. The site is selected based on information like its potential for irrigation and your problems to fuel and its cost etc.



Figure 9: Local people participating in public consultation at Huluku site

### 5.3.5 Institutional stakeholders

The ESIA team arranged a consultation meeting with the relevant offices that may have an influence on the project in the Oromia region particularly water, mines and irrigation offices, culture and tourism office, agriculture and natural resource office, education, and health office (Figure 10). After securing a letter from the regional office the ESIA team organized meetings to disclose the projects and request them for the required socio-economic data. Accordingly, from Liben Chukala Woreda, relevant offices were identified, and stakeholder meetings were conducted. Accordingly, the ESIA team contacted experts from water, mines, and energy offices, culture and tourism offices, agriculture and natural resources offices, Health, and Education offices. With all identified office experts, the ESIA team discussed details about the project, its scope, and target area.



Figure 10: Some of the institutional stakeholders during the interview (head of Liben Chukala agriculture and natural resource office)

Invariably all the stakeholders welcomed the proposed projects and envisioned that its materialization would be of great value to the local people. Liben woreda agriculture and natural resource head mentioned that the potential for irrigation is enormous in the woreda and the selected site is one of them. Hence, they have no objections regarding the selected site.



## 5.4 Grievances Redress Mechanism

The mitigation and management plans will be carried out properly. Thus, it is expected that no major grievance issue will arise. However, to ensure that stakeholders have avenues for redressing their grievances related to any aspect that may result from the project, detailed procedures of redress of grievances have been established. The objective is to respond to the complaints of stakeholders in a timely and transparent manner without resorting to complicated formal channels to the extent possible. The procedure covers stakeholder grievances generated during construction and operation activities. Anyone will be eligible to submit a grievance to the Project if they believe a project activity is harming the community, the environment, or on their quality of life.

### 5.4.1 Grievance Handling Procedure

#### **Disclosure of the grievance and redressing Mechanism (GRM)**

The Community will be fully informed about the Grievance procedures in their local language. Information about the grievance mechanism will be tailored according to the community for ease of communication. Community leaders, social entities and the governmental units will be informed about the GRM. All information about grievance mechanisms will be made available in public areas and with the community leaders in the proposed project site.

### 5.4.2 Mode of Grievance Reporting

The client or contractor will accept all comments and complaints associated with the project from any stakeholders. Comments can be made in person or via emails, posts, telephone, or any other appropriate communication channel. The client or contractor will arrange an officer to entertain complaints about those who want to report in person within the project compound. The comments and complaints will be summarized and listed in a Complaints/Comments Logbook, containing the name/group of the commenter/complainant, the date the comment was received, a brief description of the issues, information on the proposed corrective actions to be implemented (if appropriate), and the date of response sent to the complainant.

### 5.4.3 Registration and Response to Grievances

All grievances will be registered and acknowledged within 6 working days, and we generally anticipate they will be responded to within 15 days. The project management will keep a grievance log and report on the progress of grievance management as part of the annual project progress reports which will be available on the company website. All comments and complaints will be responded to, either verbally or in writing, in accordance with the preferred method of communication specified by the complainant.

## 6 Potential Environmental and Social Impact Identification and Significance

### 6.1 General

Identification of all project-induced impacts is an essential output of environmental and social impact assessment (ESIA). ESIA is a process of addressing potential positive and negative impacts of a project to design a management action plan prior to project construction, development, and implementation phases. It is part of the project planning process and as such helps to prevent and/or mitigate the adverse impacts and enhances a project's beneficial outcomes. In addition, ESIA provides information for decision-makers for better planning and resource management and helps them avoid the negative consequences of the project.

To this end, potential impacts of the proposed projects were identified in this document and categorized as biological, physical, and socio-economic. The main impacts and their likelihood as well as their levels of impact and severity were identified based on the projects' main activities.

The ESIA team addressed some of the identified impacts based on:

- Identification of the main environmental and social resources and receptors from the baseline data collection from project site
- Literature review of impacts of solar generation projects
- Results of the stakeholders and community consultations

During the ESIA study, in addition to including some more impacts (based on additional information from the site), a brief description and analysis were made for each impact identified. Accordingly, the proposed project's potential impacts (positive and negative, large, or small, direct or indirect, reversible and irreversible, and significant and insignificant) on the existing biophysical and socio-economic environment and significance are outlined in the next section. Parameters such as Land environment, Water Environment, Air Environment, Noise Environment, and Socio-Economic Environment are of significance in the Environmental Impact Assessment and are being discussed in detail below.

## 6.2 Beneficial Impacts

### 6.2.1 Economic, Environmental and Social Benefits

The main purpose of this project is to provide electricity to the community for their irrigation pumps and for household use from mini grid solar power plants. The project will have several beneficial impacts both at the national and regional levels. Some of the major positive impacts include the replacement of diesel pumps with electric pumps, which will reduce dependence on diesel and, thus, the reduction of greenhouse gases emission into the atmosphere. In addition, the project will also increase agricultural yield/production, create an employment opportunity for skilled and semi-skilled workers, create an opportunity for knowledge transfer in utilizing best irrigation and agricultural practices, improve social infrastructures, and economic development to the nation at large. The following are some of the positive impacts of the developing project.

#### 6.2.1.1 Electric supply for the nearby community

Electrification provides a solid basis for the development of local communities. Once a community has access to electricity, it can also have access to safe potable water, better health conditions, food security, as well as lighting, and information. In addition, it reduces the need for collecting and using other traditional sources of energy, such as firewood, animal dung, and crop residues for cooking and heating (Goldenberg et al 2000), which cause harmful indoor air pollution. The planned solar mini-grid plant is a good opportunity for the community; it will free them from dependence on wood, wood charcoal, and diesel generators and provide them with a stable and affordable power supply. This will also encourage business owners to start up new businesses including shops, groceries, and flour mills. Moreover, it improves the individual quality of life, facilities community services such as health (clinics can operate at night) and education (students can study at night-time). The residents can charge their mobile and improve connectivity and communications. Likewise, pump owners for irrigation suffer from a shortage of fuel, and the flour mill business owners also face the same problem. In the project areas, it is mainly women's responsibility to prepare food by collecting wood for the fire from remote areas, so the implementation of this renewable energy has a dual purpose in overcoming the burden of females and keeping the environment from pollution.

#### 6.2.1.2 Increasing agriculture production

During the field visit, it was observed that the selected site is favourable for implementing modern irrigation activities. However, the farmers are dependent on imported fuel and its cost has been rising over time. In addition, they have to go a long distance to get fuel and its availability has been a challenge for farmers. The planned project,

generating energy from solar power, is expected to solve many of the farmers' problems. It will provide and/or increase access to water for many farmers and can have significant effects on agricultural productivity and generated income. There will be a sustainable and diverse food supply throughout the year. Furthermore, the project will increase opportunities to produce market-oriented or high-value horticulture crops for urban centres.

#### 6.2.1.3 Employment opportunity

Unemployment is a huge problem in many developing countries including Ethiopia. The development and implementation of this project will undoubtedly be very significant in creating job opportunities for trained, semi-trained local youths during the construction and implementation phases. During the public consultation, one of the community's concerns was in hiring technicians for maintenance not to interrupt at the middle of cultivation. The project developer will hire trained experts for repairing and maintenance. This proposed project is expected to generate employment opportunities for 7 people permanently during operation and 120 to 150 workers during construction work. This will have a significant impact since unemployment is currently quite high in the woreda and the country at large. Moreover, unemployed youths in the community will form associations and participate in irrigation activities.

#### 6.2.1.4 Knowledge transfer

The project will play a great role in transferring (development) knowledge and skills in utilizing the best irrigation agricultural practices and solar technology. The youths in the project area will acquire knowledge from construction to operation of solar mini-grid projects. The irrigation users will be organized in an irrigation users' association (cooperative) which can help to disseminate information effectively and efficiently. People from other parts of the country will visit the pilot project and initiate them to implement it in their localities.

#### 6.2.1.5 Alternative source of energy

Ethiopia has the potential to generate a huge amount of energy from renewable sources like Water, Geothermal, Solar, and Wind. The solar energy that is friendly to the environment, clean, and requires limited maintenance is an alternative renewable energy source, especially for countries like Ethiopia having a high amount of annual solar irradiation rate. Besides, for Ethiopia's rural areas where people live in scattered villages, mini-grid solar energy is preferable to develop. Among the various forms of renewable energy technologies Solar photovoltaic (PV) technology is perhaps the most used one to generate electricity, especially in rural areas all over the world. Currently in Ethiopia some rural areas people use solar energy for household uses. During field visits to project areas, it is observed people use solar for charging mobiles and light at home.

#### 6.2.1.6 Gender equality

Irrigation interventions can also affect women's empowerment (or disempowerment) depending on gender roles in agriculture, which vary from case to case. Improved access to the water supply may release women from water-collection chores and might allow women to invest more time in income-generating activities, such as agricultural production. If women are farming their own plots and have access to irrigation technologies, then the productivity of female-managed plots may increase, and income from the increase in productivity may also grow.

### 6.3 Potential Adverse Impacts and Mitigation measures

#### 6.3.1 Adverse impacts during pre-construction phase

Before the commencement of construction, only data collection for feasibility study and environmental and social impacts assessment study were conducted. Baseline data collection and public consultation have been conducted at the site. These activities don't have any significant impact on the environment.

### 6.3.2 Adverse impacts during construction

Environmental impacts of the construction phase are expected to be temporary and minimal as all the construction works will be carried out within the site boundary of the project land, for a short period of time and will be controlled via mitigation measures.

#### 6.3.2.1 Generation of solid waste

The major solid waste expected from this project is damaged solar PV modules during construction. These modules can contain potentially hazardous materials and result in soil and water contamination. Other wastes from the construction site will be mainly residues of the construction material. These include pieces of concrete, heaps of sand and aggregates, bits and pieces of various pipe types, pieces of electrical materials, cans and bags of paint and plastering, packing materials, pieces of timber, scrap and pieces of metal sheet and iron bar (metals) among others scattered within the project site. These waste materials create adverse impacts on the biophysical environments of the area if proper avoidance and mitigation measures have not been taken in place and on time.

##### **Mitigation measure**

- Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice
- Wastes will be kept in a dedicated storage container until the recycled materials are sold and the unwanted materials to be transported to a designated disposal site
- Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean
- 

#### 6.3.2.2 Generation of liquid waste

During the construction phase, liquid wastes like oil spills from machinery, grease, and petrol in the garage from vehicles are expected to pollute the environment in addition to water wastes from concrete rationing and water sprinkling water wastes from different sanitary uses are expected to increase. Moreover, the accidental release of other hazardous materials from equipment used in the solar panel installation process will likely create liquid wastes. If these wastes are not properly managed and mitigated, they can seep into the soil, kill plants, pollute surface and subsurface water, destroy natural habitats and cause biodiversity loss (especially the microbes and small invertebrates) in the area. Furthermore, such continued spill and seepage into the ground will result in the contamination of surface and groundwater sources. These all will further affect human health and wellbeing in the project command area and beyond.

##### **Mitigation measure**

- 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
- The wastewater from sanitary and construction works should be collected through the channel in a plastered pond or reservoir and can be recycled for construction, green area, and other purposes after proper filtering and treatment

#### 6.3.2.3 Soil erosion

During construction work, a considerable volume of soil will be excavated for the levelling site and solar mounting foundation. In the construction area, soils will be impacted due to the clearing of vegetation, mounting of the PV modules, construction of internal roads, etc. Exposure of the ground and removal of vegetation cover will make the soil vulnerable 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 by ensuring good international industry practice in construction works.

##### **Mitigation measure**

- Topsoil shall be set aside and reserved where possible
- Avoid excavation during the rainy season.

- Heap the excavated soil in the selected area and reuse it to fill undulating areas
- Drainage measures shall be provided, prior to construction works, to reduce stormwater run-off and flash floods

#### 6.3.2.4 Noise pollution

During the construction phase, some noises could be generated from construction machinery (like excavators, loaders, bulldozers, mixers, dump trucks, compactors, generators, etc.) movements. This may disturb workers of the project and the nearby villagers to some extent. Noise by nature is a nuisance and may bring about annoyance, sleep disturbance, and interference with communication and cause ear disease if the level is beyond the acceptable limit (WHO prescribes 55dB for residential areas). However, the construction noise will last for a short period and is not expected to cause a significant nuisance to the public, at least not with standard mitigation measures in place.

##### **Mitigation measure**

Noisy activities shall be scheduled to daytime hours.

- Noise disturbance and impact can be reduced by also administration and management decision to work on a shift basis, work rotation and work time reduction for workers to reduce their exposure to noise, moving away the workers from the source of noise by restricting area and shutting or turning off noisy equipment or machineries when not needed.
- Noise levels at sensitive receptors shall be measured regularly and whenever complaints arise.
- In instances where workers will be exposed to elevated sound levels, personal protective equipment (PPE) such as ear muffers/plugs should be used.

#### 6.3.2.5 Air pollution

The main impact on air quality during construction will be from increased dust levels arising from the movement of vehicles and construction machinery, land clearing and levelling, cement mixing (fugitive dust, Pm2.5 microgram per litre), and internal road construction, etc. In addition to emissions of particles, there will be minor emissions of CO from construction machinery, vehicles, and diesel power generators. However, due to the relatively long distance between the main PV installation areas and the settlements, the impacts are very minor. Principally it is essential to keep control of dust particles during construction since dust particles contribute to air pollution that might limit visibility and affect human and animal health (It adversely and seriously affects human respiratory systems, particularly bronchitis and lung).

##### **Mitigation measures**

- Workers assigned in the construction machinery operation should wear a dust mask
- The supervisor should strictly follow and make sure this procedure is in place before starting their job
- Water shall be sprayed on all internal roads to minimize dust dispersion when necessary

#### 6.3.2.6 Impact on public health

In the construction phase, solar PV installation involves a high number of workers from other parts of the region. The influx of workers may contribute to a breakdown in social fabrics, norms, and practices, including sexual behaviour. Many workers both male & female are expected to be involved in the different stages of the construction activities as envisaged in the project feasibility study. Along the process, workers may have a chance for interaction within themselves or with any nearby that might lead to behavioural change which could result in the transmission of contagious diseases such as HIV/AIDS and other STIs. Such incidences may further strain rural health infrastructure

and become community health concerns. In addition, ponds and stored water may result in malaria risks and other diseases such as bilharzia.

#### **Mitigation measures**

Prevention will be the key intervention measure and therefore sensitization and awareness measures on HIV/AIDS should be carried out on a regular basis among workers and the host community during the construction phase in the following ways:

- Conduct public health campaigns addressing issues of behavioural change, HIV/AIDS, etc.
- Putting in place appropriate signage to educate the workforce and community about the Project's HIV policy
- Provision of materials useful for the prevention of HIV/AIDS
- A code of conduct shall be in place to manage workers' behaviour
- Conducting malaria awareness raising campaign, using mosquito bite prevention methods such as mosquito nets
- Avoid drinking contaminated water (raising communities' awareness to boil and drink water) to reduce bilharzia infection

#### **6.3.2.7 Impact on occupational health and safety**

The construction activities will result in potential impacts on workers' health and safety due to exposure to risks through construction activities that lead to accidents causing injuries and death. Construction works and activities bear frequent accidents and health risks for the workers.

#### **Mitigation measure**

- The contractor shall provide all appropriate resources (Personal Protective Equipment) onsite

#### **6.3.2.8 Impacts on fauna and flora**

It may cause temporary disturbance to resident birds with ground nests due to noise, dust, and particulate emissions, and possible illegal hunting by construction workers. Reptiles present within the project site may temporarily move to adjacent locations during construction activities. During the baseline study, it is observed that the project site is selected on bare and sparsely vegetated areas, so there will be minor clearances of some bushes and shrubs.

#### **Mitigation measures**

- Restrict activities to allocated construction areas only, including the movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances.
- Prohibit hunting at any time and under any condition by construction workers on site.

#### **6.3.2.9 Spread of Covid-19**

The influx of labour is associated not only with the spread of HIV/AIDS and other sexually transmitted diseases but also with other pandemics such as Covid 19. Coronavirus is a novel contagious disease that is spread through crowding and from the person-to-person transmission of the virus. During construction work, many workers will be involved and work in close contact and this will aggravate the spread of Covid-19 among workers and within the surrounding communities.

#### **Mitigation measures**

- Workers shall follow strictly Covid-19 prevention mechanisms.
- Temperature measurement check-up each day at the gate of the compound

- Workers should clean their hands with soap and water, or sanitizers or alcohol many times as much as possible each day
- Keep a safe distance (2 meters) from anyone who is coughing or sneezing
- Workers keep proper physical distance from others (2meter) and always wear a mask and avoid handshakes or other physical contact
- Workers do not touch their eyes, nose, or mouth
- Cover their nose and mouth with their bent elbow or a tissue when they cough or sneeze
- Stay home if workers feel unwell.
- If workers have a fever, cough and difficulty breathing, seek a doctor on time

#### 6.3.2.10 Traffic accident

During the construction phase, there could be traffic accidents associated with the construction of the solar minigrid facility. Specifically, some large trucks, rollers and perhaps excavators will be used. In addition, the roads leading to the project area are not accessible for all vehicles except tracks during the dry season to transport agricultural products. Furthermore, the community awareness regarding the traffic system is also limited. Therefore, unless traffic safety is promoted among workers and the community, a traffic accident is expected to increase during the construction phase.

##### **Mitigation measures**

- Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages)
- Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)
- Mandatory speed limits not exceeding 30km per hour.

#### 6.3.2.11 landscape change and visual impacts

During the construction phase, the existing relatively flat topography may change due to excavation and levelling, in addition, the excavated overburdened materials and construction materials leftover inside the site and surrounding area may create visual impacts.

##### **Mitigation measures**

- Use the excavated soil for backfill during site restoration phase
- Properly store and finally clear construction leftover materials

#### 6.3.2.12 Gender based violence (GBV)

Gender-based violence involves power imbalances where, most often, men are the perpetrators and women the victims. While women are usually the immediate victims of gender violence, the consequences of gender violence extend beyond the victim to society. Experience from other projects indicates that among the most serious and invisible risks is the increase in gender-based violence (GBV) in the populations in which a project is carried out. For this specific project during the construction phase, there will be a temporary labour influx which will likely result in gender-based violence (GBV) and sexual exploitation risks for women and girls.

##### **Mitigation measures**

The main measures to minimize these cases in the context of development projects include preventive measures such as codes of conduct, worker training, and specific complaint mechanisms to address sexual violence. The proponent should work closely with local women's support groups, organizations, and institutions that can provide the timely and immediate support that girls and women require.



### 6.3.2.13 Child labour abuse

In most parts of the country in Ethiopia including this specific project area, the culture encourages children to work to develop skills. Children are considered assets to generate income in a time of poverty. Children should, therefore, be given work at home early in life and be obliged to assist parents in the farming area. During the construction phase, children may be involved in construction activities as laborers and running errands. These activities will likely keep the children away from school in addition to the risk of being exposed to accidental and other injuries.

#### **Mitigation measures**

- Continuous monitoring of contractor's compliance to national labour laws and AfDB's OS5

## 6.3.3 Adverse Impact during Operational or Implementation Phase

### 6.3.3.1 Impacts on biophysical environment

#### 6.3.3.1.1 Soil contamination and fertility decline

Solar mini-grid power plant facilities do not involve significant risks of pollution spills or the release of other hazardous materials during the operation phase. However, as mentioned earlier, solar PV modules and batteries contain potentially hazardous materials and need to be disposed of safely at the end of their use and when they are damaged during the operation phase.

#### **Mitigation measures**

- PV panels and batteries 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 practices.

#### 6.3.3.1.2 Soil erosion

The proposed solar mini-grid plants at the site have flat laying topography and the expected soil erosion during the operation phase is very minimal. However, there will be a need to provide drainage around the solar mini-grid plant to prevent localized 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**

- Plant trees in areas exposed to flooding.
- Provide permanent drainage at the project site to prevent flooding and soil erosion.
- 

#### 6.3.3.1.3 Water contamination

The impact of water pollution from solar PV plants during the operation phase is very minimal. The expected potential source of water pollution is from the permanent workers (e.g., Guard, technician) facilities, therefore, sources from these facilities may generate sanitary effluents.

#### **Mitigation measures**

- Ensure proper facilities and disposal processes exist for waste and water at the minigrid site and toilet/guardhouse facilities.

#### 6.3.3.1.4 Impacts on biodiversity (flora and fauna)

The planned solar PV installation areas are sparsely covered with bushes and grasses. Clearing of vegetation will be conducted at the start of construction, once the solar PV installation is completed impact on flora will be minor.

### **Mitigation measures**

- Rehabilitation of trees through planting
- Stakeholders should work hand in hand with demographic pressure on diminishing natural resources rather than starving to meet their own individual interests at the expense of the park and its objectives.

### **6.3.3.2 Impacts on the socio-economic environment**

#### **6.3.3.2.1 Loss of plots of land**

Though the implementation of the irrigation project has numerous benefits for most of the local communities, the construction of the solar PV will occupy a sizable amount of land not more than 0.5 hectares per site. Hence, land take will result in permanent loss of agricultural and grazing lands. However, the area needed for solar is so small and there is a chance to construct communal land. Therefore, it doesn't result in economic displacement for farmers.

In project areas, a public consultation was conducted, and the communities agreed to hand over land for solar panel installation if compensation payment is made as per the provision of the law (proclamation no. 1161/2019).

### **Mitigation measures**

- Landowners shall be compensated as per the new proclamation No. 1161/2019 before the construction activities started.
- Provide job opportunity priority for those projects affected people (PAP) during construction and implementation phases.

#### **6.3.3.2.2 Noise pollution**

Both the irrigation activities and solar PV facilities emit insignificant sound pollution. Therefore, noise impact will likely be insignificant and may not need mitigation measures.

#### **6.3.3.2.3 Air pollution**

Air pollution is one of the serious environmental and social problems which create several adverse effects on human health due to its nature and residence time in the atmosphere. In addition to their negative effect on human health, they exert a strong effect on local and global climate change. Air pollution is often intensified in connection with development activities such as agriculture (irrigation) and industry. Hence, the source of air pollution and its mitigation measures should be understood and analysed in advance before the commencement of any project development and implementation.

Baseline data field measurement was conducted for particulate matter and carbon monoxide in the field. Though we measured CO at a different time, the result didn't exceed 0ppm except for one measurement at the Huluku site while the fuel pump was working. The measurement at this site was 56 ppm.

Upon commissioning, the solar PV plant will supply renewable energy using a technology that does not 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 air pollution.

### **Mitigation measures**

- Measure levels throughout lifetime of project and address as needed.

#### 6.3.3.2.4 Generation of liquid waste

During the operation phase, the generation of liquid waste from the solar mini-grid plant is very limited. The major source of liquid waste emanates from sanitary wastewater from restrooms.

##### **Mitigation measures**

- Construct a septic tank inside the premise and collect sanitary waste and finally dispose of it off at permitted area.

#### 6.3.3.2.5 Occupational health and safety

The health and safety risks during the operation phase will be limited to the solar PV site workers will be exposed to electric shock, burns, and body damage as they undertake routine operations and maintenance tasks.

##### **Mitigation measures**

- Use of appropriate PPE during installation and maintenance
- The solar mini-grid plant shall be equipped with a fire-fighting system

#### 6.3.3.2.6 Contagious diseases (STDs, HIV, TB) and Covid-19

The operation phase of the solar PV project involves a limited number of workers; however, the influx of labour is often associated with the spread of communicable diseases such as HIV/AIDS and other sexually transmitted diseases. Coronavirus disease is also a new and potentially dangerous contagious disease that is spread through crowding and from person-to-person contacts. In addition, it is expected that a disproportionate percentage of the labour force will be constituted of the young population in their sexually active age hence exposure to STDs (e.g. HIV) would be expected.

##### **Mitigation measures**

- Health promotion: sensitization of both community and workforce
- Provision of materials necessary for prevention and detection of COVID 19
- Provision of materials useful for the prevention of HIV/AIDS
- Having in place appropriate signpost to educate the workforce and community about the Project's HIV policy and project COVID management and prevention policies.

#### 6.3.3.2.7 Fire hazards

During the operation phase of the project, there could be different activities that may lead to a fire outbreak. Poor handling of Solar PV components like AC and DC converters, transformer & electricity systems, faulty electrical equipment, carelessness, etc., are some of the possible causes of a fire outbreak. The effects may result in total damage from fire hazards which could permanently affect the project and may result in loss of property and life.

##### **Mitigation measures**

- The solar mini-grid plant shall be equipped with a fire-fighting system.
- The technician should regularly inspect Solar PV components

#### 6.3.3.2.8 Impacts on tourism and cultural heritage

As described in section 4.2.8 all woredas are rich in different cultures and tourist attraction areas. However, the information obtained from public consultation, woredas culture and tourism office and field visits indicated the absence of known historical and cultural heritage resources at the proposed project site or their area of influence.

However, as always, there is a risk that cultural heritage objects are unexpectedly uncovered during construction activities.

#### **Mitigation measures**

- Prepare chance finds procedure base on world bank

#### **6.3.3.2.10 Child labour abuse**

In most parts of Ethiopia, including this specific project area, the culture encourages children to work to develop skills. Children are considered assets to generate income in times of poverty. Children should, therefore, be given work at home early in life and be obliged to assist parents in farming areas. During the operation phase, the minigridd developer will not have any role to hire children in to, so this is a highly unlikely risk for the operation of a solar energy power plant.

#### **Mitigation measures**

- Provide training for families not to participate children underage.

### **6.3.4 Impact During Decommission Phase**

Information from different literature reviews reveals that solar power PV plants are expected to have an economic life span of 25 to 30 years and are more likely above with proper maintenance and interim replacement of major equipment (National Renewable Energy Laboratory, 2012). Once the power generation ceased, it is mandatory to decommission the solar modules and all associated equipment and facilities to return the affected area to the natural environment

#### **6.3.4.1 Air pollution**

Like the construction phase, the dismantling of the solar PV equipment and unwanted constructed structures will create dust emissions. The dust results in respiratory problems and other health impacts on decommissioning workers.

#### **Mitigation measures**

- Workers should wear dust masks.
- Spray water on demolishing areas

#### **6.3.4.2 Generation of solid waste**

During the decommissioning phase, solid waste will be generated after the use-life of solar modules, batteries, cables, substructures, demolished civil structures, etc. Solar modules can contain potentially hazardous materials, so considerations should be given at the start of the project to determine how units will be disposed of at the end of the project lifetime.

#### **Mitigation measures**

- Hazardous wastes should be dumped in specified protected sites.
- Separate recyclable materials and sell for interested buyers.

#### **6.3.4.3 Loss of employment**

The solar PV project will create jobs for a limited number of workers during the implementation phase. When the project phases out, permanent workers will be jobless and will likely be negatively affected.

## Mitigation measures

- Transfer permanent workers to other active projects.
- Pay compensation (severance) for permanent workers.

### 6.3.4.4 Noise pollution

The decommissioning activities of dismantling the solar power plant and removing the ancillary facilities are associated with potentially increased noise levels. The receptors of the increased noise level will likely be only the workers of decommissioning activities.

## Mitigation measures

- As the only receptors will be the workers at the site and within the proposed facilities in the vicinity of the solar power plant, these increased noise levels are considered occupational noises that require occupational health and safety measures, like wearing earplugs.

### 6.3.4.5 Labour influx and GBV

The activities associated with decommissioning will involve the dismantling of the solar power plant, irrigation pipes, and removal of its facilities. These activities involve a limited number of workers. Hence it may have a temporary effect. We don't anticipate any significant impact on gender-related violence and the spreading of communicable diseases like HIV, Covid 19, etc. By the same token, the participation of child labour will be unlikely since the number of workers required for decommissioning phase is very limited.

## 6.3.5 Significance of Impacts

Identification of impacts significance and analysis is a core element in an ESIA process. It involves impact identification, prediction, and evaluation. The most possible potential impacts associated with this project were identified using professional exposure to similar projects, from collected baseline data, community consultation and professional judgments. Based on these factors, the identified impacts of the project on the biophysical and socio-economic environment of the area were evaluated and predicted. The identified impacts were evaluated to determine their significance by using typical parameters; type, duration, nature, magnitude, and significance through the project development periods as indicated in Table 12 & 13.

The parameters used in evaluating the magnitude and likelihood of the impacts are briefly addressed in the table. Spatial and temporal extent, the natural resources carrying capacity and possible potential environmental sustainability because of the impacts of the identified parameters were done. Based on these factors, the most possible impacts of the project on the biophysical and the socio-economic conditions of the project area were evaluated.

Table 12: Impact Significance Evaluation Criteria

S. No	Criteria	Impact rating	Description
1	The extent of the impact	Local	Site-specific or confined to project premise
		Regional	Extending beyond the boundaries of the project site and its buffer zone, affecting neighbours, town, local authority, district, and even province
		National	Affecting areas beyond the province.
2	Magnitude	Very low	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
		Low	Where the impact affects the environment in such a way that natural, cultural and social functions and processes continue, albeit in a slightly modified way
		Medium	Where the affected environment is altered, but natural, cultural and social functions and processes continue, albeit in a modified way.

		High	Where natural, cultural and social functions or processes are altered to the extent that they will temporarily or permanently cease.
3	Nature	Permanent	When the effect is long-lasting
		Temporary	When the effect is for a short period of time

Table 13: Potential Environmental and Social Impacts Evaluations

S. No	Main Identified Potential Impacts	Type		Reversibility		Impact Extent		Nature		Magnitude	Significance
		Beneficial	Adverse	Reversible	Irreversible	Local	Trans-Region	Temporary	Permanent		
<b>I.</b>	<b>Potential positive impacts</b>										
1	Employment opportunities	x		x		x		x	x	Medium	Medium
2	Agriculture productivity	x		x		x	x		x	Very High	Very High
3	Knowledge transfer	x		x		x	x		x	Medium	Medium
4	Gender Equity	x		x		x		x	x	Medium	Medium
5	Electric supply	x		x		x			x	High	High
<b>II</b>	<b>Potential Adverse Impacts</b>										
<b>a. Construction Phase Impacts</b>											
1	Generation of Waste		x	x		x		x		Medium	Medium
2	Generation of noise		x	x		x		x		Low	Low
3	Dust emission		x	x		x		x		Low	Low
4	Impact on public health		x	x		x		x		Medium	Medium
5	Workplace Accidents		x	x		x		x		Medium	Medium
6	Covid 19		x	x		x	x	x		High	High
7	Soil erosion		x	x		x		x		Medium	Medium
8	Traffic Accident		x	x		x		x		Medium	Medium
9	Landscape change and visual impacts		x	x		x		x		Medium	Medium
10	GBV		x		X	x			x	High	High
11	Child labour abuse		x		X	x			x	High	High
<b>b. Operation Phase Impacts</b>											
1	Air emission/pollution		x	x		x			x	Low	Low
2	Noise pollution		x	x		x			x	Very low	Very low
3	Over abstraction		x	x		x			x	Medium	Medium
4	Siltation		x	x		x			x	Low	Low
5	Water pollution		x	x		x			x	Medium	Medium
6	Soil contamination		x	x		x			x	Medium	Medium
7	Impact on fauna		x	x		x			x	Low	Low
8	Impact on flora		x	x		x			x	Medium	Medium
9	Covid 19		x		x	x	x		x	High	High
10	Sexually transmitted disease		x		x	x	x		x	Medium	Medium



11	Impact on public health		x		x	x			x	Medium	Medium
12	Fire Hazards		x		x	x			x	High	High
13	Traffic accident		x		x	x			x	Low	Low
14	Occupational health and safety		x		x	x			x	Medium	Medium
15	Impacts on culture, tourism		x		x	x			x	Low	Low
16	Loss of land		x		x	x			x	High	High
17	Child labour abuse		x		x	x			x	High	High
<b>C. Decommission phase impact</b>											
1	Pollution		x		x	x			x	Low	Low
2	Loss of employment		x		x	x			x	Low	Low

## 7 Project Alternatives

During environmental impact assessments, it is crucial that assess feasible alternatives for the project to bring sustainable development to the area. Therefore, prior to deciding on the proposed solar panel irrigation design and implementation of the project in general, several project options were examined to select the feasible alternatives considering biophysical, social, economic, and technical factors. The alternatives considered were:

**No project alternative:** This is the “No action or does nothing option” which hinders the implementation of an irrigation project in the area using solar as an energy source. This option limits or excludes the benefits of the local community that will be gained from a modern irrigation system. The community will be dependent on wood and cow dung for their energy source, and this will intensify deforestation. If the solar project cannot be implemented, the price of fuel for their pump and flour mill will be more costly to the community. In addition, the major benefits like increasing agricultural products and income of the people from the project will be lost. Moreover, it contradicts the interest of the people in the project, as well as the socio-economic development, and need of the nation by using the available water resources (see water management policy). As a result, this option was not found to be feasible.

**Other sources of power (Hydro, Fuel, Wind).** The site is far from the main electric line, and it will be more costly to get power from the main grid. The site is not favourable for generating power from wind. Currently, some farmers are using fuel for their pump flour mill, but the cost of fuel increases from time to time (30 to 40 birr per litter) and is not economical to proceed with further irrigation activities. Environmentally, it is not advisable to use fuel for the pump. The ESIA team measured carbon monoxide (CO) at the field while the pump worked with fuel and read 56 ppm at the Huluku site whereas in the absence of pump/ideal time the measurement is 0 ppm.

**Project location alternative:** The study teams have analysed other site alternatives, based on topography, hydrology, soil, and biological and socioeconomic parameters. At the Huluku site, the groundwater is at a shallow depth of 4 to 5 meters with rich groundwater recharge.

The community practicing irrigation activities in the project area suffers from the high price of fuel for their pump, to alleviate this problem and due to the presence of plenty of water and irrigable lands, made the selected site more favourable. In addition to supplying energy to irrigation pumps, it is planned to supply electricity for domestic use and also for other service-giving organizations like schools, and health posts. All the selected areas are currently not getting electricity from the main grid; therefore, it is a good opportunity for communities to implement this solar mini-grid power plant.

**Project implementation option:** the planned project in the selected areas has numerous advantages for the local community. The community can get sustainable energy sources for their irrigation activities, and it enables them to increase agriculture products. Save the community from extra fuel costs and the environment from pollution. The

community can also get electricity for their home, school, health post, and their flour mill, getting electricity for these infrastructures will improve the services which provide to the community.

Generally, all the above-mentioned alternatives were analysed based on technical feasibility, economic viability, and environmental acceptability. Then, the “No Action” alternative has not been accepted while the project implementation option using solar energy is selected because of the numerous project advantages of the project to the local community, and the low negative impacts of the project on the social and biophysical environment.

## 8 Environmental and Social Management Plan

### 8.1 General Overview

One of the objectives of undertaking an Environmental and Social Impact Assessment (ESIA) is to develop an Environmental and Social Management Plan (ESMP), which outlines the costs, timeframes, and responsibilities for the implementation of the proposed mitigation and enhancement measures. It identified all measures considered for the Mini-grid project and irrigation activities in the handling of impacts that were significantly generated by environmental impacts. These include:

- A mitigation plan with mechanisms and actions to minimize negative environmental impacts during construction, operation, and decommissioning.
- A compensation plan with measures for designing activities to restore the environment.
- A risk- and accident prevention plan linked to the construction, operation, and decommissioning of the mini-grid solar projects
- A public-participation plan that involves stakeholders.
- A training plan to adequately meet human-resource needs.

The sole responsibility for the implementation and outcome of the ESMP rests with the project proponent. In this case, the developer will be responsible for the implementation of ESMP. The proponent has to incorporate an environmental management system in its daily operations and its ESMP is implemented, maintained, and updated in a manner that is consistent with nationally and internationally recognized standards. The Environmental management issues outlined in this ESMP will be used to manage all environmental and social aspects of the operations activities. The proponent should ensure that it puts in place the essential institutional setup (Environment, Health, and Safety unit) and hire competent, experienced, and qualified person(s) to implement the ESMP.

### 8.2 Institutional framework

This section assesses institutional issues for implementing the ESMP and its monitoring plan and accordingly recommends a reporting and monitoring framework before discussing the mitigation measures for each identified impact in detail. The implementation of Mini grids in this project will directly involve the project proponent, the duty and responsibility of managing the environmental and social impacts should therefore be the sole responsibility of the project proponent. At the national level, the Environmental Protection Authority (former EFCC) is responsible for evaluating and approving ESIA study reports as well as for providing environmental approval licenses which must be obtained before the commencement of project implementation.

In addition, the environmental protection Agency of Oromia regional state is expected to be involved in monitoring the environmental performance of the solar power PV project in the region. The contractor should maintain adequate control over the project to minimize the extent of impacts during construction, ensure appropriate restoration of areas affected by construction activities and prevent long-term environmental degradation. Community associations/ cooperatives are responsible for fair water sharing among farmers, it will solve problems that arise due to water shortages during the dry season.

### 8.3 Air Quality and noise management plans

The intended project will have some pollution impacts on air and noise to workers during construction, operation and decommissioning phases. Therefore, the project proponent has to do its bests to comply with the performance standard that deals with pollution prevention and abatement.

During the design, construction, and operation of the mini-grids, the project proponent has to consider ambient conditions and apply pollution prevention and control technologies and practices (techniques) that are best suited to minimize or reduce adverse impacts on human health and the environment. Noise levels at the nearest sensitive receptors shall not exceed Ethiopian or international standards for daytime and night-time noise. Regular measurements of noise level (Leq, dBA), using a standard sound level meter, shall be carried out to demonstrate compliance.

### 8.4 Occupational Health and safety plans

The project proponent provides safety wear, safety equipment, and occupational safety training before replacing and maintaining solar modules. To attain workplace safety, for example, some construction machines and solar PV components shall have protections, warning stickers, automatic stopping, or safety switches. Fire extinguishers should be placed at proper places which are easy to access during an emergency. Depending on the site context of workplaces and the types of machinery; workers shall be provided with safety wear such as goggles, hand gloves, work clothes, dust masks, safety shoes, working manuals, etc.

**For example:**

- Providing information materials, instructions, and regular pieces of training for employees regarding workplace injuries and hazards
- Regular reporting and consultation with employee-elected health and safety representatives and/ or other employees about occupational health, safety, and welfare situations
- Providing adequate personal protective clothing and equipment to ensure safety; and
- Ensuring all work procedures are undertaken without exposing workers to hazards.

### 8.5 Waste Management Plan

The project site is selected in rural areas where there is no proper waste disposal. Therefore, it is the proponent's responsibility to manage hazardous (e.g., accidental leakage of energy storage batteries) and non-hazardous wastes following guidance included in the General Ethiopian Guidelines.

Management and disposal of hazardous and non-hazardous wastes should be undertaken following guidance included in the "General Ethiopian Guidelines".

### 8.6 Community Engagement Plan (CEP)

The proposed solar mini-grid plant has planned to supply electricity to the nearby community, but the main objective of this project is to provide a reliable supply of energy for irrigation so that smallholder farmers increase their farm productivity and mitigate climate change impacts. Farmers often use diesel pumps to irrigate their farms. Nonetheless, they face multifaceted problems such as rising diesel prices due to inflation, shortage of fuels in the market, and frequent maintenance-related costs of the pumps. During the public consultations, the ESIA team witnessed that the community members of the site were eager to see the implementation of this project. Hence such a positive outlook and attendant good relations with the community should be promoted by implementing an action plan that aims to provide a timely response to any inquiries, concerns, or complaints about construction or operation activities. The project proponent should consult and disclose any problems during operations, particularly

regarding disclosure of information related to effluents, public health, and safety issues, and reporting results of environmental monitoring. The project should continue to remain in contact with irrigation user communities, local and regional agriculture offices, energy experts at various levels, and other stakeholders during the period of operation. Ongoing stakeholder consultation will allow the project to receive and respond to community concerns on an ongoing basis.

- The Community Engagement Plan (CEP) should be designed on the following principles:
- A Community Liaison Officer for each site needs to be appointed.
- The Community Liaison Officer will initiate the CEP through consultation with key stakeholders identified during community consultation.
- A formal CEP should be produced and documented in consultation with all key stakeholders.
- Through the Community Liaison Officer, the solar PV project proponent will implement a community grievance mechanism allowing community members to raise their concerns about any environmental or social concerns that they may have concerned the project.
- The project proponent will likely take responsibility for the implementation of the ongoing CEP.

## 8.7 Community Health and Safety Plan

The proponent will be responsible for safeguarding the health and safety of the public. During the construction phase, an influx of workers is expected from other parts of the country. The spread of Covid 19, HIV/AIDS, and other Sexually Transmitted Diseases (STDs) will be expected. In addition, due to the increased movement of construction machinery and dump tracks, traffic accidents will be one of the problems for the residents.

- Create awareness between workers and the community to prevent communicable diseases (HIV, Covid19, and other STDs)
- Enforce the drivers to limit speed (not more than 40km/hr.) in the project area and surroundings.
- Aware the communities about traffic accidents through campaigns
- Put the traffic and other safety signage in the project site during construction and operation.

## 8.8. Construction phase Environmental Management Plan

Table 14: Summary of construction phase management plan

	Identified Impacts	Mitigation measures	Responsible Body	Estimated cost
<b>Biophysical Environment</b>	<b>Generation of solid Waste</b>	<p>Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practices</p> <p>Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean</p>	<p>Minigrad Contractor</p> <p>Woreda agriculture office</p>	Estimated cost for disposal of solid waste 40,000 birr

		Solid waste from packaging materials like fertilizer & seed bag should be disposed of in an appropriate place. Bottles and containers of pesticides and herbicides should be stored and removed following best industrial practices		
Human Environment	Generation of liquid Waste	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  The wastewater from sanitary and construction works should be collected through a channel in a plastered pond or reservoir and can be recycled for construction, green area, and other purposes after proper filtering and treatment	Minigrid Contractor  Very minimal amount of wastewater for Minigrid, very limited amount of fuel or hazardous material	For construction of plastered pond and other storage structure is 60,000
	Soil erosion	Avoid excavation during the rainy season  Heap the excavated soil in the selected area and reuse it to fill undulating areas	Minigrid Contractor	Labour cost to pile up soil is 30,000
	Noise pollution	Noisy activities shall be scheduled to daytime hours  Noise disturbance and impact can be reduced by also administration and management deciding to work on a shift basis, work rotation and work time reduction for workers to reduce workers exposure to noise, etc.  Personal protective equipment such as ear muffers/plugs should be used	Minigrid Contractor	For purchasing PPE is 30,000 birr
	Air pollution	Workers assigned in the construction should wear a dust mask. The supervisor should strictly follow and make sure this procedure is in place before starting their job, and Water shall be sprayed on all internal roads to minimize dust dispersion when necessary	Minigrid Contractor	PPE included above, and water spray is 20,000 birr
	Public health	Conduct public health awareness campaigns addressing issues of behavioral change, HIV/AIDS, etc.	community /woreda labour and women affairs office	Awareness-raising and training 25,000 birr

	<p>Prepare training manual and conduct regular training about STDs</p> <p>Provision of materials useful for the prevention of HIV/AIDS</p>	Minigrid Contractor	For internal half day training 15,000 birr
<b>Covid 19</b>	Workers shall follow strictly Covid19 prevention mechanisms such as temperature measurement at the gate of the compound, washing of hands, wearing of masks, avoid handshake, and keep social distance as much as possible.	Minigrid Contractor /EHS unit of the project proponent	PPE cost included above
<b>Gender-based violence/child labour</b>	Provision of training for workers and families, Community sensitization, regular monitoring for EHS compliance	Woreda labour and women's affairs office	100,000 for training, and regular monitoring
<b>Traffic accidents</b>	<p>Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages)</p> <p>Mandatory speed limits not exceeding 30km per hour</p> <p>Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)</p>	Minigrid Contractor in collaboration with Woreda traffic police	Training cost for awareness creation for community and workers  20,000
<b>Impacts on cultural, historical and archaeological site</b>	If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual	Minigrid Contractor supervised by Oromia regional state culture and tourism office	Supervision cost 20,000 birr
<b>Total Minigrid Developer / Contractor Only</b>			<b>235000</b>
<b>Total other parties</b>			<b>125000</b>
<b>Total Construction Phase</b>			<b>360000</b>

## 8.9 Operational phase Environmental and Social Management Plan

Table 15: Summary of operational phase management plan

	Identified Impacts	Mitigation measures	Responsible body	Estimated cost
Biophysical Environment	Liquid waste	Construct a toilet inside the premise and collect sanitary waste and finally dispose it off at permitted area	Minigrad Developer	Septic tank is expected to be constructed during construction phase
	Loss of farm and grazing land	Landowners shall be compensated as per the new proclamation No. 1161/2019 before the construction activities started  Provide job opportunity priority for those projects affected people (PAP) during construction and implementation phases	Minigrad Developer, Woreda Agriculture offices, Woreda administration	The cost will be estimated later by Woreda experts
Human Environment	Occupational health and safety	Use of appropriate PPE during installation and maintenance  The solar PV plant shall be equipped with fire-fighting tools  Ensuring all electrical equipment and machinery are properly grounded  Maintenance should be conducted by trained professionals only	Minigrad Developer	Estimated cost to purchase lifetime PPE is 60,000 birr
	Fire hazards	The solar PV plant should be equipped with proper fire extinguishers  The technician should regularly inspect Solar PV components	Minigrad Developer	fire protection systems 40,000
	Impacts on cultural, historical and archaeological site	If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual	Contractor, supervised by Oromia regional state culture and tourism office	No cost is implied
<b>Total Minigrad Developer / Contractor Only</b>				<b>100000</b>
<b>Total Operation Phase</b>				<b>100000</b>



## 8.10 Decommission phase Environmental Management Plan

Table 16: Summary of decommissioning phase management plan

	Identified Impacts	Mitigation measures	Responsible Body	Estimated cost
Biophysical Environment	Generation of solid Waste	Hazardous waste, including broken PV panels, used batteries, shall be disposed of in accordance with best industrial practices	Minigrad Contractor and Irrigation Contractor	Waste disposal cost 150,000
	Air pollution	Workers assigned to the demolition should wear dust masks.  Spray water on demolishing areas	Minigrad Contractor and Irrigation Contractor	PPE purchase and water spray cost 40,000
Human Environment	Loss of employment	Transfer permanent workers to other active projects  Pay compensation (severance) for permanent workers	Minigrad Contractor /regional government	Compensation payment for workers should be paid by the project proponent TBD
	Gender-based violence/child labour	Provision of training for workers and families, Community sensitization, regular monitoring for EHS compliance	Community / Woreda labour and women's affairs office	20,000 for training, and regular monitoring
Total Minigrad Developer / Contractor Only				190000
Total other parties				20000
<b>Total Decommission Phase</b>				<b>210000</b>

## 9 Environmental and Social Monitoring Plans

Monitoring usually takes two forms, i) compliance monitoring and ii) effect monitoring. The former is about whether impact mitigation and enhancement measures are implemented in time and to the agreed national and international standards. Whereas the latter refers to the monitoring of project-induced impacts on the social and biophysical receptors. Thus, the compliance aspect is monitored by government authorities at the federal level (EPA) and the Oromia regional bureau of environmental protection authority unit. The proposed organizational structure for monitoring is provided in Figure 11 below:

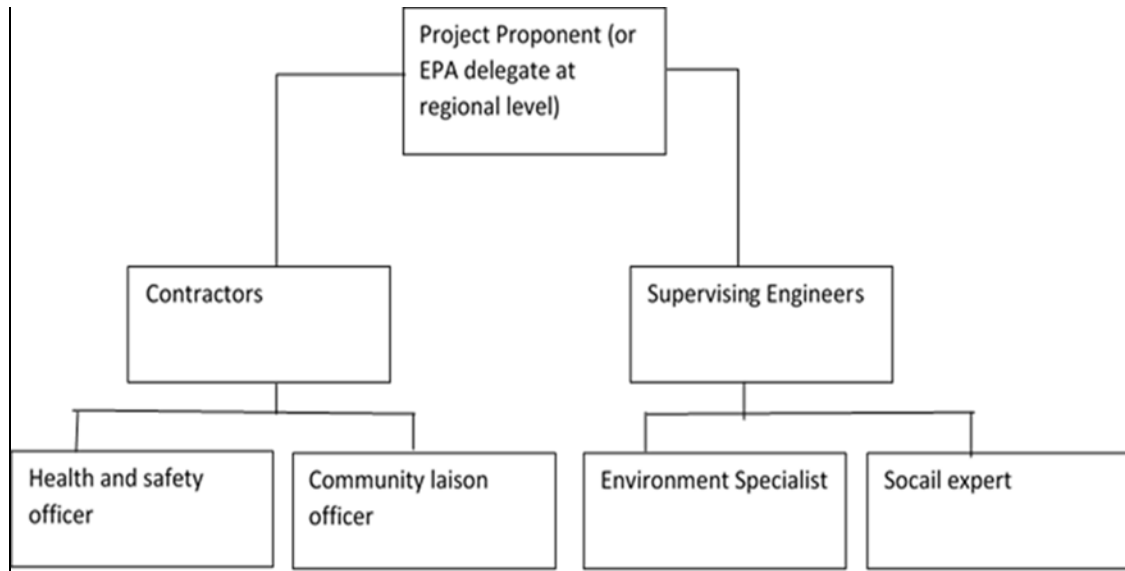


Figure 11: Organizational structure for compliance monitoring

The main objective of the environmental monitoring plan (EMP) is to ensure that the predicted outcome of the company is achieved. Primarily, its focus will be on the sustainable service of the intended solar mini-grid plant and the protection of humans and the environment from adverse detrimental effects. The overall objective of this EMP is to integrate environmental and social considerations into account to ensure the successful economic and social development of the project. The regular monitoring program will determine whenever changes or operations are required to reduce the negative impacts and enhance the beneficial ones. Therefore, conducting monitoring will be of paramount importance.

**Effect (target) Monitoring:** Periodical ambient air quality measurement should be conducted at solar PV installed areas and around irrigated farmlands and the quality of the water effluent should be monitored regularly for all critical parameters such as Biochemical Oxygen Demand (BOD), pH, Total Dissolved Solids (TDS), Total Suspended Solids, alkalinity, hardness, and turbidity. In addition, soil samples should be collected from irrigated farms and monitor changes in soil fertility. Woreda Environmental protection office should periodically conduct its independent monitoring for compliance with national standards. The project proponent should submit an annual compliance report indicating all the monitoring results to the respective woreda Environmental protection office as well. Details for monitoring are provided in Table 17.

Table 17: Environmental monitoring plan

Parameters to be monitored	Mitigation measures	Responsible	Monitoring schedule	Monitoring indicators	Monitoring cost (Birr)
Contract management	Make sure the contractor has prepared ESMP for approval by the client	Proponent	Pre-construction and construction phases	Copy of the approved ESMP and implementation of it	Cost internal to developer to get approvals
Social support to vulnerable people	Job opportunities for project-affected people (loss land),  Landowners should be compensated as per	Proponent	Throughout operation phase	Check the amount of money paid out from finance	Supervision cost 5,000 birr

	proclamation No. 1161/2019		Note: selected land is expected to be community land, not individual		
<b>Employment opportunity</b>	Hire workers from local people depending on their education preparedness and skill level	Proponent & Woreda	At the beginning and annually	Number of local workers from company human resource office	Supervision cost 2,000
<b>Solid waste</b>	Hazardous waste, including broken PV panels or panels at the end of their use-life, shall be disposed of in accordance with best industry practice  Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean	Proponent	Quarterly during construction and annually in operation	Annual site visit to determine if any hazardous waste is on site  Disposal of hazardous waste in compliance with waste management procedures	Supervision cost 5,000
<b>Liquid waste</b>	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  The wastewater from sanitary and construction works should be collected through channels in a plastered pond or reservoir and should be recycled for reuse during construction	proponent	Beginning of construction and annually each year of Operation	Annual check that the necessary are in place  Constructed plastered pond/ reservoir if required  Amount of water recycled	Supervision cost 5,000k to be done in conjunction with above annual visit
<b>Noise pollution</b>	Noisy activities shall be scheduled to daytime hours  personal protective equipment such as ear muffers/plugs will be used	Proponent in collaboration with Woreda health experts	Weekly during the construction phase	Noise level should not exceed the world bank standard (55dBA and 45 dBA during the day and night times, respectively)	Cost for regular checking of noise level 5,000
<b>Air pollution</b>	Workers assigned in the construction should wear dust masks. The supervisor should strictly follow and make sure this procedure is in place before starting their job; and  Water should be sprayed on all internal roads to minimize dust dispersion when necessary	proponent collaboration with Woreda health experts	Periodically during the construction and operation phase	Check air quality measurement, Air emission shouldn't exceed WHO standards  Supervise workers proper use of PPE's	Expert cost for regular check emission level 5,000 to be done together with noise checks

				Complaints from the local governor, community	
<b>Loss of farm and grazing lands</b>	Landowners should be compensated as per the new proclamation No. 1161/2019 before the construction activities started  Provide priority to a job opportunity for those projects affected people (PAP) during construction and implementation phases	Proponent	Before commencement of construction work	Check the amount of money paid for PAP  Contractor's personnel office documentation	No cost
<b>Traffic accident</b>	Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages)  Mandatory speed limits not exceeding 40km per hour  Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)	Proponent collaboration with Woreda traffic police	Every three months during construction, annually during operations	Number of accidents on the site  Speed limits put at appropriate places  Erected traffic sign	Supervision cost 2000, to be done together with above checks
<b>Sexually transmitted diseases like HIV</b>	Health promotion: sensitization of both community and workforce  Provision of materials useful for the prevention of HIV/AIDS  Having in place an appropriate signpost to educate the workforce and community about the Project's HIV policy	Woreda health office	Every month during the construction and operation phase or as determined by the local health office	Number of distributed condoms  Check the number of trainings conducted	Training cost 100,000
<b>Covid 19</b>	Train workers to follow strictly Covid-19 prevention mechanisms  Temperature measurement check-up each day at the gate of the compound  Provision of materials necessary for prevention and detection of COVID 19	Proponent in collaboration with Woreda health experts	Regularly during construction and operation	Number of Covid-19 infected	Expense already included in construction and operations  No cost to report # of cases
<b>Occupational Health and safety</b>	Use of appropriate PPE during installation and maintenance  The solar PV plant shall be equipped with a fire-fighting system	Proponent	Regularly during construction and operation	Total recorded incidence rates	for provision of first aid a lump sum of 5,000

	Ensuring all electrical equipment and machinery are properly grounded;				
<b>Fire hazards</b>	The solar PV plant should be equipped with a fire-fighting system  The technician should regularly inspect Solar PV components	Proponent	Every three months during the construction and operation phase	Number of incidents and reported cases	Part of project and operation cost
<b>Impacts on historical, cultural heritage</b>	Excavation work should be done carefully as per World Bank Guidelines - OP 4.11 and prepared chance find procedures	Contractor	During construction work	Number of discovered heritage site or artifacts	Part of supervision cost
<b>Total Minigrad Developer / Contractor Only</b>					<b>34000</b>
<b>Total other parties</b>					<b>100000</b>
<b>Total Monitoring</b>					<b>134000</b>

## 10 Conclusion and Recommendations

The main aims of the environmental and social impact study were to identify, predict and evaluate all the potential environmental and social impacts due to the proposed solar power plants in Huluku site in Oromia regional state. The ESIA study is done with the overall intention of integrating environmental and social concerns into the project’s planning, design, construction, operational, and decommissioning stages.

Environmental and social impacts have been identified for all components of the project (solar power plant, and electric supply to the community) in the proposed project site in the Oromia region. For all the identified negative impacts mitigation measures were provided alongside the impacts and in some cases, enhancement for positive impacts was also indicated in chapters (see chapters 7, 8, and 9).

A review of international safeguard standards reveals that the major policies triggered relate to environmental and social assessment, biodiversity and ecosystem services, labour and working conditions, community health and safety, information disclosure, and stakeholder engagement. Management measures have been proposed and most of these can be easily implemented with available local resources and national policy and legal provisions (e.g., proclamation 1161/2019, proclamation 1156/2019).

**RECOMMENDATIONS:** As soon as the project proponent is identified the project implementation schedule covers all project activities. For example, solar panel installations, designation of command areas for irrigation, and time and modalities for compensation for land take should be communicated ahead of time for the Woreda and Kebele administrations as well as for the potentially affected persons. This should be done at least three months before the commencement of solar power plant installations. Secondary salinization could potentially undermine the environmental and economic aspects of the proposed projects hence timely monitoring and management are suggested. To avoid potential conflicts which might delay the project implementation, the potential project proponent should work in close cooperation with the local administrations to establish grievance handling


committees, which will serve as avenues for community members to channel grievances to the project proponent. The potential contractor should also prepare the grievance handling mechanism for the workforce during the construction phase and this has to be monitored by the client or any other responsible body. There should be continuous monitoring for biophysical and social impacts of the projects so that the developer or any project proponent could draw a lesson for future investments.

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# Annexes

## Annex 1: Letters to Regional and local government offices



የኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፐብሊክ  
የውሃ ማስፍን አገርጂ ሚኒስቴር  
The Federal Democratic Republic of Ethiopia  
Ministry of Water, Irrigation and Energy

ቁጥር 000/2014/2  
Ref. No  
18 መጠያ 2014  
Date

**ለሚመለከተው ሁሉ**

ኸረታስ ደብዳቤ ተገኝቶ ጋ/የተገንጠብና ስራ ስርዓት ተቀባይ ቁጥር ቪ.ሲ-አሰ-429/21 መስጠት 13 ቀን በተገኘ ደብዳቤ ወደ ተለያዩ ክልሎች መስክ ለመሥሪያ የትብብር ዳብዳቤ እንዲጻፍላቸው ጠይቀዋል።

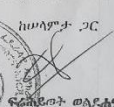
የጥናት ዕድን አገልግሎት:-

1. ደ/ር ደሳለኝ ዋና ..... ቡድን መሪ
2. አቶ ደመረው ይርጋ ..... የአካባቢ ጥናት ባለሙያ
3. አቶ ገንጠው ባለገንጠው ..... የአካባቢ ጥናት ባለሙያ
4. አቶ መሬሳ ለታ ..... የአካባቢ ጥናት ባለሙያ
5. አቶ በሰሜ ሞላ ..... የአካባቢ ጥናት ባለሙያ
6. አቶ ብርሃኑ ገብራ ..... የአካባቢ ጥናት ባለሙያ
7. አቶ ሲባሉ ጋሾራ ..... የማህበራዊ ጥናት ባለሙያ
8. አቶ ግሩም ጳባይ ..... ሹፊር ታርጋ 3 አ.አ. B- 57508
9. አቶ ተስፋዬ ደሬቦ ..... ሹፊር ታርጋ 3 አ.አ. A 0328


ሲሆኑ በጥናቱ የሚያካትታቸው ዕቃዎች፡-

1. በአርሚያ ክልል ምስራቅ ሸዋ ዞን የላቦን ወረዳ ጎለል ቀለሌ አርሲ ዞን ዝግጅ ዱግዳ ወረዳ ጎልቤ ተበሌ በምዕራብ ሸዋ ዞን ኤጀራ ወረዳ ተልቦ ተበሌና ደልፋ ወረዳ ቶሌ ጎርጌ ተበሌ
2. በደቡብ ብሔር ብሔራዊ ክልል ጋም ዞን አርባምንጭ ዙሪያ ወረዳ ጋንታ ክንቻም ተበሌ
3. በሲዳማ ክልል አረቢያ መር ተበሌ
4. በአማራ ክልል ደቡብ ጎንደር ዞን ፎገራ ወረዳ ተበሌ ደራ ወረዳ ሞገጠራ ምጽሌ እና ጣና ደንብሶ ተበሌ


በተጨማሪም በጥናት ዕድሉ የሚያካትት ሰነድ ለማስፈጸም ለሚያስፈልጉት ሰነድ ለመስጠት 19 ቀን 2014 ደምር ወደ ተጠቀሱት አካባቢዎች ሲገቡላቸው አስፈላጊው ትብብር እንዲደረግላቸው አየጠየቅን። ለዚህም በትድግሥ እና መሰጠት።



ከሠላም ታርጋ  
አ/ር ገብረመስቀል ወልደሰ  
ገብረመስቀል



አከ 011-661-11-11      ፎካ 440      011-661-08-85      ፖ.ሰ.ቁ 5744      አዲስ አበባ ኢትዮጵያ  
ቴሌ.ፊክስ 011-663-72-22      011-661-07-10      P.O. Box. 5744      Addis Ababa - Ethiopia



Bulchiinsa Mootummaa Naannoo Oromiyaatti  
Biroo Qonnaa fi Qabeenya Uummama  
በአርሚያ ብሔራዊ ክልላዊ መንግስት የአርሚያ ተፈጻሚ ቤት ቢሮ  
The Regional Government of Oromia  
Bureau of Agriculture and Natural Resource

Guyyaa/ቀን/Date 02/10/14  
Lakk./ቁጥር/Ref.No. 1-1/93/04

Waaajjira Qonnaa fi Qabeenya Uumamaa Godina Sh/Babaatiif  
**Adamaa**  
**Dhimmi-Waa'ce Deegarsa barbaachisu akka gootaa gaafachuu Ta'a.**

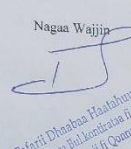
Akkuma mata durree iratti ibsuuf yaalametti ministeeri Bishaan, Jallisiif fi Inajjii Xalayyaa Lakk. 000/2/05/596 gaafa guyyaa 18/01/2014 barreesaniin dhaabanni "viratas Consulting PLC" jedhamu dhima hojif gara godina keessaniin Aanalee Ejeree fi Jalduu waan dhufaniif deegarsi barbaachisu akka taasifamuuf gara godina keessaniitti xalayyaa akka barrefamu gaafataniif jiru.

Kanuma irraa ka'uun BQQUO's qaamni armaan olitti maqaan isaa ibsame kun dhimma hojitiif gara Aanaa **Liban** waan deemaniif deegarsa barbaachisu gochuu barbaachisaa ta'uu hubatee xalayyaa deegarsaa kana gara godina keessaniitti waan barreesef isins kanuma hubatanii deegarsa barbaachisu akka gootaniif kabajaan isin gaafanna.


**G.G.**

- I/A/H fi I/G/Dam/Bu'uura Jallisiitiif
- Daayirektoreetii Ijaarsaa fi Bul/Kontiraata BQQUO'niif

**BQQUO**



Nagaa Wajjira  
Tafarii Dhanadha Hantakuu  
Daayirektara Bul/Kontiraata Ijaarsaa fi  
Bul'ankaa Jallisiif fi Qonnaa



251 11 371 7455/011 371 7506      8770      FAX 251 11 371 7488      Finfinnee/Addis Ababa  
E: oboanr@gmail.com      ፎንድ/ኤ/አ/ስ ስብ

Deebii Yeroo Kennitan lakkoofsa xalayyaa keenyaa caqasaa!  
የወጣት ሰነድ የደብዳቤን ቁጥር ይጻፉ!  
Please quote our Ref. No. While replying!

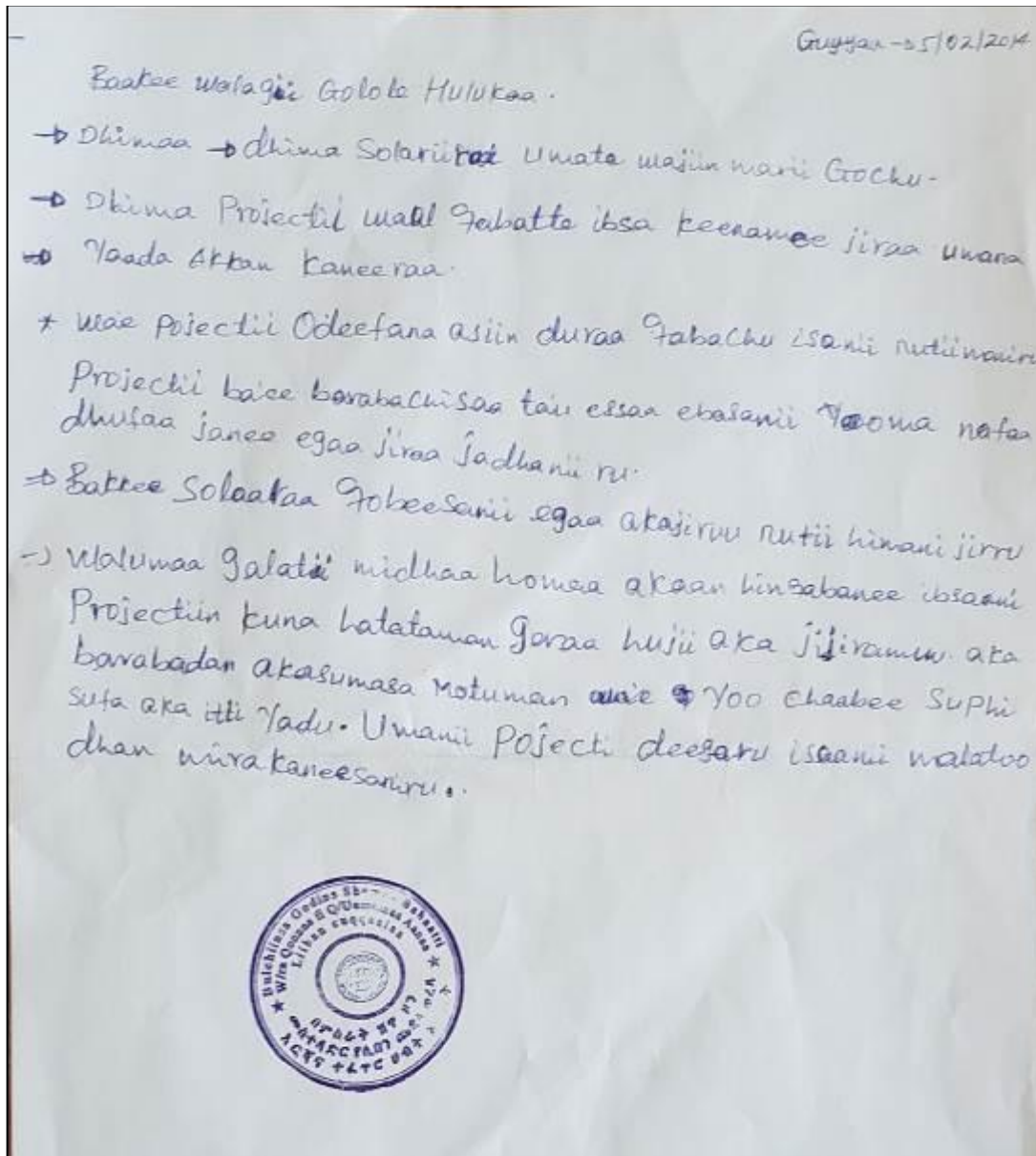


## Annex 2: Consulted Woreda officials list

Stakeholders Consultative Meeting Registry					
VERITAS Consulting/Ministry of Water, Irrigation & Energy	Client				
	Project		DREAM: Proposed Mini-Solar Grid		
	Date		14/10/21		
	Venue		Libenchukala Woreda, Huluk		
Name	Office/Woreda/Kebele	Title/position	E-mail	Telephone	Signature
Abera Bojova	Agriculture Office	Head		0923822332	
Werku Demese		Core Process		0932167054	
Tefari Kebede	Irrigation	Irrigation Officer		0920383115	
Shegena Konuicho	Construction	Expert		0912025727	
Fene Abebe	Health Office	DI w/H/office		0915381544	
Debalan Dedeto	Educational office	DI w/H/office		0972998420	
Sosena Teklu	Small scale	Core Process		0924856274	
Addis Getmanyan	Water & Energy	HR		0923682841	

Annex 3: community consultation minutes

Huluku Site




- 1 Nagardas Badheo Niggosm
- 2 Reebas Calesa BC
- 3 Mujoo Lammas BC
- 4 Dabhamachalain PNDE+6
- 5 Gades Buhulaa BC
- 6 Tabarna Eleemo TC
- 7 Raggada Abbuchee amhaz
- 8 Abdo Shubinn Abdo Shubinn
- 9 Abbuchee Omittaa PNDE+6
- 10 mangaa Tasamaa PNDE+6
- 11 Eleemo Kafanii PNDE+6
- 12 Abosun Shoojoo PNDE+6
- 13 Kalanco Malkaa PNDE+6
- 14 Sadee miidaboo PNDE+6
- 15 Badhi Hulufaa PNDE+6
- 16 Daudu Najathu PNDE+6
- 17 Doojoo miidaboo PNDE+6
- 18 Shoojoo Jalaa PNDE+6
- 19 Doojoo Hiidaboo PNDE+6
- 20 Tadam Ayyalaa PNDE+6
- 21 moomi B'om PNDE+6
- 22 Walee Boffala PNDE+6
- 23 Boshoo Kammallo Boshoo Kammallo
- 24 Rajalun Koojoo PNDE+6
- 25 Xajoo Joojoo PNDE+6
- 26 Moomi Shubinn PNDE+6
- 27 Doojoo Hiidaboo PNDE+6
- 28 Boffalaa Talamaa PNDE+6
- 29 Fudun Tabbalaay PNDE+6
- 30 B'omaa Shufaraa PNDE+6
- 31 Zallafaa Shufaraa PNDE+6
- 32 Adoojoo Koojoo PNDE+6
- 33 Fojoojoo Shubinn PNDE+6
- 34 Walee B'ommi PNDE+6
- 35 F'oomoojoo Mujoo PNDE+6
- 36 Fudunnaa Koojoo PNDE+6
- 37 Walee Buhulaa PNDE+6



- 38 Lammi Abbaboo BC
- 39 Shi maloo Koojoo BC
- 40 Naadhee Dababoo BC
- 41 Oochaa Dajaboo BC
- 42 B'omaa Koojoo BC
- 43 B'omaa B'omaa BC
- 44 Lammi Wadaaboo BC
- 45 Doojoo Koojoo BC
- 46 Mujoo Koojoo BC
- 47 Kalanco Jimaa BC
- 48 Walee Buhulaa BC
- 49 Mujoo Jimaa BC
- 50 Doojoo Shufaraa BC
- 51 B'omaa Omittaa BC
- 52 Tadam Eleemo BC
- 53 Walee Lammas BC
- 54 Doojoo Buhulaa BC



## Annex 4: Water baseline data lab reports for Huluku



**ADDIS ENVIRONMENTAL SERVICES**  
WATER & WASTE WATER QUALITY TESTING LABORATORY

**LABORATORY TEST REPORT**

<b>Client:</b>	Geoscience Consultancy plc.	<b>Lab Ref:</b>	AES/LAB/21/193	
<b>Location:</b>	<b>Region:</b> Oromia.	<b>Sample No:</b>	21/192-6	
	<b>Zone/Town:</b> East Shewa.			
<b>Project /Institution:</b>	ESIA Study for irrigation.	<b>Water use:</b>	Domestic Use	
<b>Source of Water</b>	Borehole.	<b>Sample Delivered on:</b>	Oct 21/2021	
<b>Sample point (Site):</b>	GHW.	<b>Test report issued on:</b>	Oct 27/2021	
<b>Sample Collected by:</b>	Geoscience Consultancy plc.	<b>Sample Delivered by:</b>	Geoscience Consultancy plc.	


**Test Description: Selected Physicochemical Tests**

No	Parameters	Unit	Value	WHO Maximum Allowable Concentration for Drinking
1	Odourless	-	Odourless	Unobjectionable
2	Colour	-	Colourless	Colourless
3	Turbidity	NTU	1.08	5
4	E.Conductivity	µS/cm	1196	2000
5	PH	Log 10	7.12	6.5-8.5
6	TDS	Ppm	598	1000
7	Total Alkalinity	mg/l CaCO <sub>3</sub>	400	200
8	Ammonium, NH <sub>4</sub>	mg/l	0.07	1.5
9	Bicarbonate, HCO <sub>3</sub>	mg/l HCO <sub>3</sub>	488	-
10	Calcium, Ca	mg/l	108	200
11	Chloride, Cl <sup>-</sup>	mg/l	89	250
12	Carbonate	mg/l	Nil	-
13	Fluoride, F	mg/l	1.68	1.5
14	Magnesium, Mg	mg/l	27	150
15	Manganese, Mn	mg/l	0.01	0.1
16	Nitrate, NO <sub>3</sub>	mg/l	2.2	10
17	Nitrite, NO <sub>2</sub>	mg/l	0.01	1
18	Phosphate, PO <sub>4</sub>	mg/l	0.53	-
19	Potassium, K	mg/l	10.25	-
20	Sodium, Na <sup>+</sup>	mg/l	260	200
21	Sulphate, SO <sub>4</sub>	mg/l	5	250
22	Total hardness	mg/l CaCO <sub>3</sub>	130	300
23	Total iron, Fe	mg/l	0.10	0.3

>> Alkalinity & Sodium Concentration exceeds WHO Maximum Allowable concentration for drinking water & not recommended for drinking purpose. Installed Appropriate water treatment is recommended to make water potable.

Test Performed by: Fasika Berhanu  
 Checked by: Degnet Goshu  
 Approved by: Dr Addis A. Zeleke

Signature: \_\_\_\_\_  
 Signature: \_\_\_\_\_  
 Signature: \_\_\_\_\_

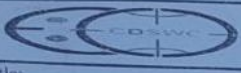


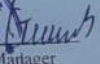


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Tel: 0116631773, 0935401532, 0911244918    Email: info@addisenvironmental.com, addisenvironmental@gmail.com  
 www.addisenvironmental.com

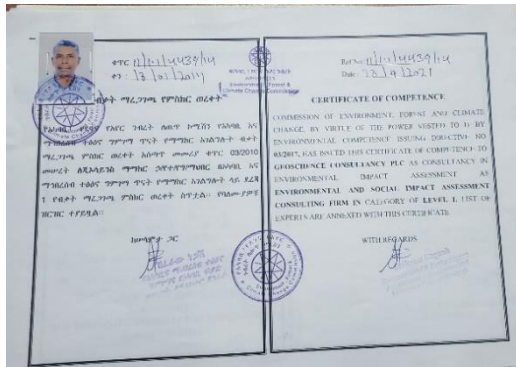


# Annex 5: Soil sample laboratory result

		Company Name: <b>Ethiopian Construction Design &amp; Supervision Works Corporation</b> በኢትዮጵያ የኮንስትራክሽን ዲዛይንና ስፐርቪዥን ሥራዎች ኮርፖሬሽን	
Title: <b>Soil Fertility Testing Report</b>		Document No: <b>OF/ECDSWC/0921</b>	Issue No.1 Page No. 1 of 1
Client:- <b>Geoscience Consultancy PLC</b>		Client Ref:- <b>SF/036/2021</b>	
Project:- Source of Sample:- <b>Amhara (Fogera ) and Oromiya</b> Location:- Date of Collection:- Date Received :- <b>27/10/2021</b>		Reported Date:- <b>10/11/2021</b>	
Test Requested:- <b>pH-H<sub>2</sub>O,Exch.Bases,Av.P,Av.S,Micronutrients(Fe,Mn,Cu,Zn)</b>			
Laboratory Number	215/14	216/14	Test Method
Profile Code	HS-1	TSS-001	
pH-H <sub>2</sub> O (1:2.5)	6.35	6.28	Potentiometric
Exch.Na(meq/100gm of soil)	1.22	0.90	Ammonium Acetate Ext. and Instrumental
Exch.K(meq/100 gm of soil)	5.38	0.28	
Exch.Ca(meq/100 gm of soil)	44.69	30.44	
Exch.Mg(meq/100 gm of soil)	13.22	11.19	
Available Phosphorus (Av.p) (mg P <sub>2</sub> O <sub>5</sub> /kg soil)	117.41	57.97	Olsen
Available Sulfur (Av.S) (mg/kg of soil)	22.00	27.00	KH <sub>2</sub> PO <sub>4</sub> Ext. Turbidimetric
<b>Micronutrients</b>			
Fe (mg/kg soil)	34.62	51.40	DTPA Ext. & Instrumental
Mn(mg/kg soil)	12.85	39.17	
Cu(mg/kg soil)	3.97	2.03	
Zn(mg/kg soil)	3.75	1.21	
REMARK: The Soil sample is collected and submitted to the laboratory by the client.			
Reported by <b>Tseganesh K.</b>  Lab Expert		Checked by <b>Tseganesh K.</b>  Senior Soil Expert	
		Approved by <b>Getu</b>  Soil Fertility Lab S/ Manager	
Among the major services rendered by the Soil Fertility Laboratory Testing S/Process of Ethiopian Construction Design & Supervision Works Corporation are: Testing Soil Fertility/ Agricultural Soil Testing and Plant Analysis, Sampling of soil, etc			
Please make sure that this document is the correct version before use			

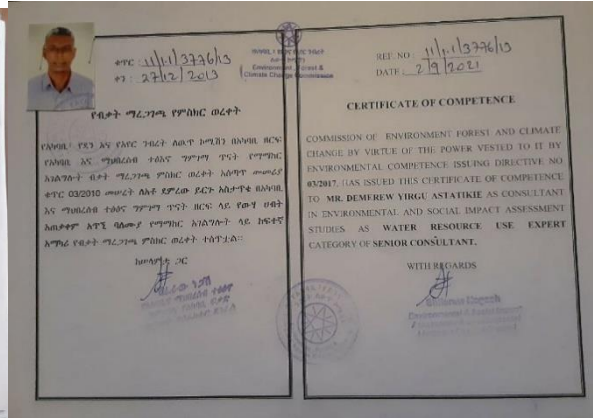
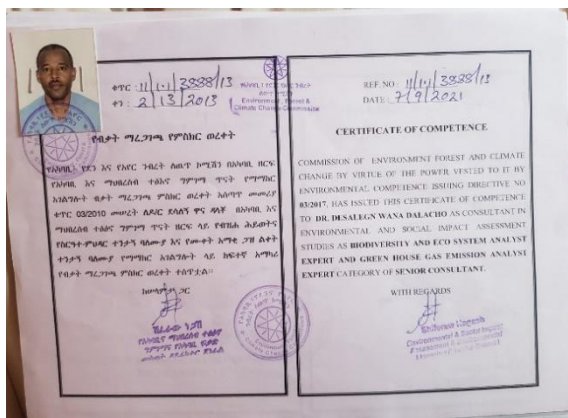
## Annex 6: Competency certificates

Geoscience consultancy firm



Experts License

Dr Desalegn Wana, Senior ESIA consultant, Biodiversity & Ecosystem Analyst    Mr Demirew Yirgu, Senior consultant (Water resources use expert)



Ms. Hana Atsbha, Pollution expert

Mr Wondyraw Girmachew, Social affairs expert

