ZGEC ZG ENVIRONMENT CONSULTANCY

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

FOR THE PROPOSED BURE IAIP AND MOTTA RTC

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
SOUTH WEST AMHARA REGION, ETHIOPIA

March 2018

Report produced by:
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In collaboration with WSP/UNOPS

On behalf of:
UNIDO and Amhara Industrial Parks Development Corporation, Federal Democratic Republic of Ethiopia

wsp UNIDO UNOPS

ESIA REPORT

FOR THE PROPOSED BURE IAIP AND MOTTA RTC

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

AMHARA REGION, ETHIOPIA

Amhara Region IPDC

TYPE OF DOCUMENT (PUBLIC)

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GLOSSARY

ACPZ	Agro Commodity Procurement Zones
AfDB	African Development Bank
AGP	Agricultural Growth Program
AQIA	Air Quality Impact Assessment
ASTM	American Society for Testing Materials
AVC	Aluto Volcano Centre
BDL	below the detection limit
CAPEX	Capital Expenditure
CITES	United Nations Convention on International Trade in Endangered Species
CO	Carbon Monoxide
CO_2	Carbon dioxide
CSA	Central Statistical Agency of Ethiopia
EEP	Ethiopian Electric Power
EHS	Environmental, Health and Safety
EIA	Ethiopian Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ELSR	Elevated Level Storage Reservoirs
ERA	Ethiopian Roads Authority
ESMP	Environmental And Social Management Plans
ESDPRP	Ethiopian Sustainable Development & Poverty Reduction Programme
EU	European Union
EWCA	Ethiopian Wildlife Conservation Authority
FAO	Food and Agriculture Organization

FDRE	Federal Democratic Republic of Ethiopia
GDP	Gross Domestic Product
GHG	Green House Gases
GLSR	Ground Level Storage Reservoirs
GPS	Global Positioning System
GTP	Growth and Transformation Plans
GTP II	National Growth and Transformation Plan II
ha	Hectares
IAIP	Integrated Agro Industrial Parks
IDS	Industrial Development Strategy
IFC	International Finance Corporation
ILO	International Labour Organisation
IPCC	Intergovernmental Panel on Climate Change
IPDC	Industrial Parks Development Corporations
ISRIC	International Soil Reference and Information Centre
ISS	Integrated Safeguards System
ITCZ	Inter Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
IUSS	International Union of Soil Sciences
MACE	Mahindra Consulting Engineers
MAP	Mean Annual Precipitation
MEFCC	Ministry of Environment, Forest and Climate Change
MoA	Ministry Of Agriculture and Natural Resources
MoI	Ministry Of Industry
MSW	Municipal Solid Waste

Na–HCO_3	Sodium Bicarbonate
NCSA	National Capacity Self-Assessment
NMP	Noise Management Plan
NMT	Non-Motorised Transport
NO_2	Nitrogen Dioxide
NOx	Oxides Of Nitrogen
PA	Protected Areas
PAP	Project Affected People
PM_{10} & $PM_{2.5}$	Particulate Matter
OPEX	Operational Expenditure
OS	Operating Safeguards
RAP	Resettlement Action Plan
RTC	Rural Transformation Centres
TDS	Total Dissolved Solids
ToR	Terms of Reference
SME	Small and Micro Enterprises
SO_2	Sulphur Dioxide
STP	Sewage Treatment Plant
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
UNIDO	The United Nations Industrial Development Organisation
UNOPS	United Nations Office for Project Services
US	United States
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency

UTM	Universal Transverse Mercator
WASH	National Water Supply, Sanitation and Hygiene
WBG	World Bank Group
WMS	Welfare Monitoring Survey
WRB	World Reference Base Classification System
WSP	WSP Environment and Energy, Africa.
ZGEC	Zereu Girmay Environmental Consultancy

1 INTRODUCTION

1.1 BACKGROUND TO THE PROJECT

Ethiopia is located in the Horn of Africa and it is bordered by Eritrea to the north and northeast, Djibouti and Somalia to the east and southeast, Sudan and South Sudan to the west, and Kenya to the south. It is the second most populous country in Africa (after Nigeria which has a population of approximately 186 million people, 2016 estimates) with a population of over 100 million people across a total area of 1.1 million square kilometres. The country is divided into nine National Regional States and two city administrations. Each state is drawn along ethno-linguistic lines and is endowed with a degree of self–rule. Each state is headed by a state president which is elected by the state council. These states are further divided into 103 Zones (sub-regions), 800 Woredas (districts), and 15,000 Kebeles (the lowest administrative units). Each Regional State (including the Amhara Region) has its own regional government.

Ethiopia has a federal system of government which was established in the early 1990s, in accordance with the Constitution of the Federal Democratic Republic of Ethiopia (FDRE). The national constitution pluralist political system and is headed by Dr Mulatu Teshome, President of the FDRE.

Agriculture is a key driver of Ethiopia's long-term growth and food security, contributing 46% of the country's Gross Domestic Product (GDP) and accounts for 90% of export value with approximately 83% of the population being dependent on agriculture for their livelihoods. Due to investments by the FDRE and its development partners, the agriculture sector has seen consistent growth of over 8 to 10% per annum over the past decade. The FDRE is committed to supporting the development of the sector through designing, introducing and implementing relevant policies, strategies, and programs such as the Growth and Transformation Plans (GTP) and Agricultural Growth Program (AGP). In spite of consistent growth in the agricultural sector in recent years it has been identified that the sector is not yet performing to its optimum in terms of productivity, wealth creation, foreign exchange generation and food security.

The average land holdings in Ethiopia are noted to be between 0.2 and 0.5 hectares (ha), with the majority of these not being integrated into the commercial value chain for agricultural produce. Although food-processing industries are present in Ethiopia, they are currently restricted in their production by the availability of raw materials. The restriction on raw material input is related mainly to access, but also to the quality of the produce which results in inefficient handling chains, post-harvest losses and higher prices. Investment and development of the agro-industrial sector will in turn improve the economy by converting the agro-export from primary, unprocessed products to processed products, which will underpin economic growth for this sector and Ethiopia as a whole. The primary limitation to this proposed agro-industrial growth is the severe lack of infrastructure. The development of agro-industries presents Ethiopia with an opportunity to accelerate economic development and achieve its industrial development goals.

The FDRE committed to a five-year undertaking, as part of the first Growth and Transformation Plan (GTP I) to build the foundation to launch the Country from a predominantly agrarian economy into industrialisation. Among the sectors to which the second Growth and Transformation Plan (GTP II) gives emphasis is manufacturing and industrialisation to provide the basis for economic structural change; and a central element in this strategy for transforming the industry sector is development and expansion of industrial parks and villages around the country.

The development of Integrated Agro Industrial Parks (IAIPs) and accompanying Rural Transformation Centres (RTCs) forms part of the government-run Industrial Parks Development Corporations (IPDC) strategy to make Ethiopia's agricultural sector globally competitive. The concept is driven by a holistic approach to develop integrated Agro Commodity Procurement Zones (ACPZs) and IAIPs with state-of-the-art infrastructure with backward and forward linkages based on the Inclusive and Sustainable Industrial Development model. A total of 17 ACPZs have been identified (**Figure 1-1**).

The United Nations Industrial Development Organisation (UNIDO) in coordination with the FDRE, as represented by Ministry of Industry (MoI) and the Ministry of Agriculture and Natural Resources (MoA) are working in partnership to establish an appropriate platform for agro-industrial development, in the form of IAIPs, with the aim of transforming the agriculture sector. The concept of IAIPs is to integrate various value chain components via the cluster approach. Associated RTCs are to act as collection points for fresh farm feed and agricultural produce to be transported to the IAIPs where the processing, management, and distributing (including export) activities are to take place.

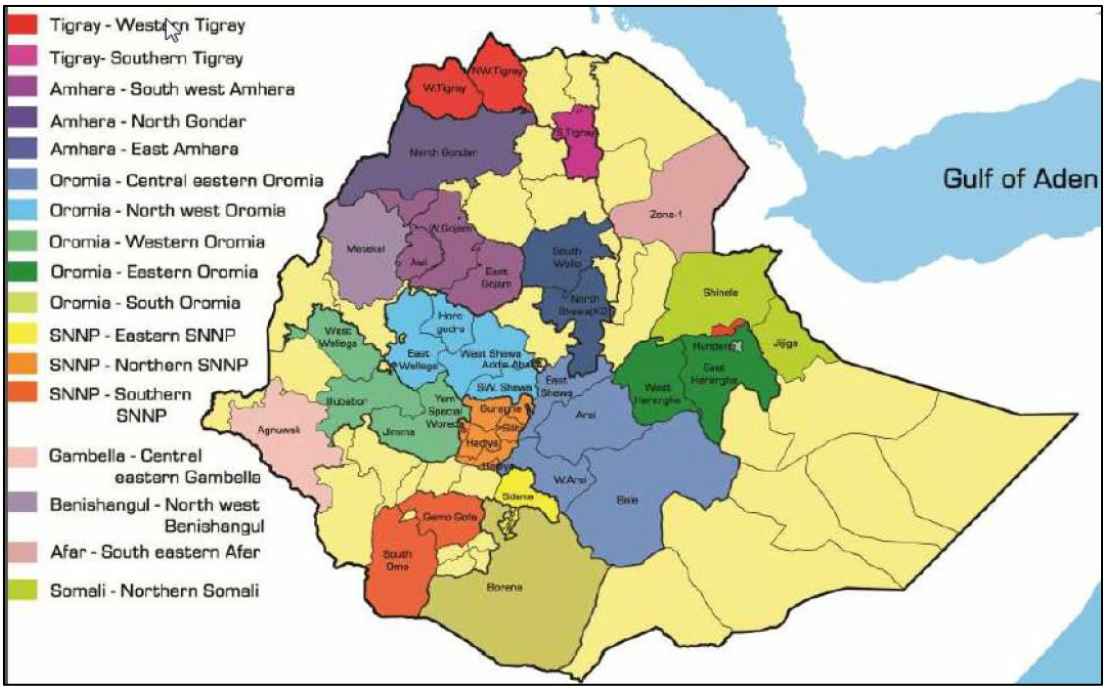

Figure 1-1: Potential Agro Commodities Processing Zones

Of the 17 ACPZs four have been selected for the establishment of pilot IAIP and RTC facilities (**Figure 1-2**). The four IAIPs and accompanying RTCs are to be established strategically across the country as a pilot phase. Based on the success of the four initial developments UNIDO and the FDRE will establish additional IAIPs and RTCs around the country. The United Nations Office for Project Services (UNOPS), on behalf of UNIDO and the FDRE, is facilitating the process to obtain the required environmental permissions for the proposed developments.

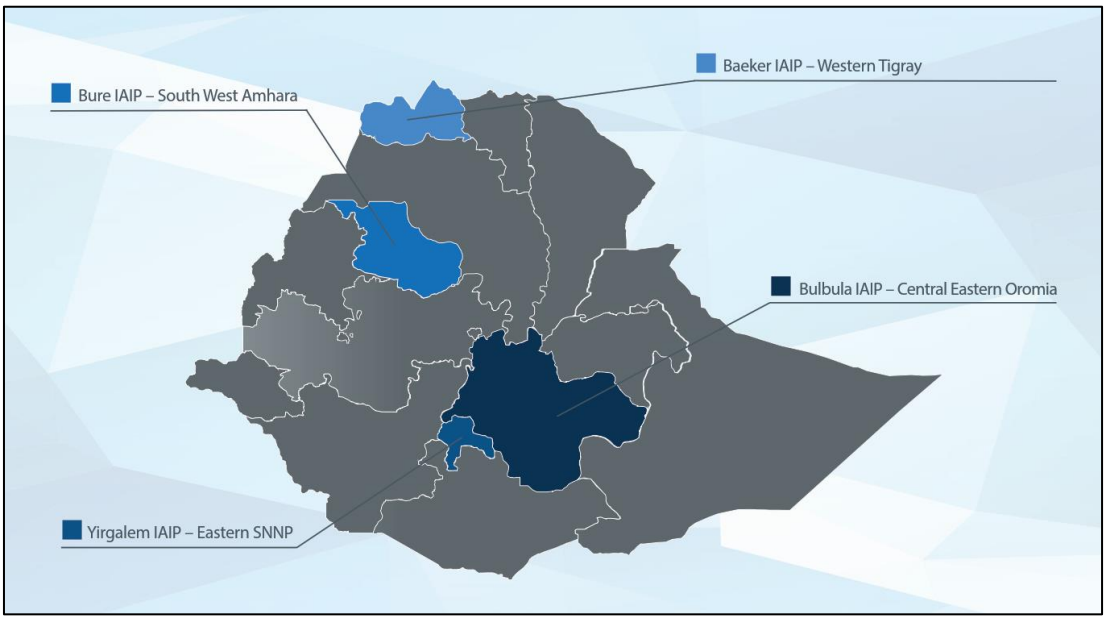

Figure 1-2: The four ACPZs selected for pilot facilities (Source: MACE)

This report relates to South West Amhara ACPZ facilities as identified in **Table 1-1**.

Table 1-1: Identified location of the Amhara pilot facilities.

Region	IAIP	RTC
South West Amhara	Bure	Motta

The proposed Bure IAIP site is located within the Amhara Region, which is one of the nine regional state members of the FDRE established by the 1995 constitution provisions. Administratively, Amhara is divided into 10 main administrative zones, three metropolitans, and further down in to 181 Woredas (districts) which; under Ethiopia's decentralised system of government, have their own governing councils.

The proposed Bure IAIP falls under the jurisdiction of Bure Town in the Amhara Region. While the RTC site falls under the jurisdiction of Motta town, in the Hulet Ej Enese Woreda which is located in the East Gojjam Zone of the Amhara Region.

The location of the Bure IAIP and Motta RTC sites are indicated in **Figure 1-3**.

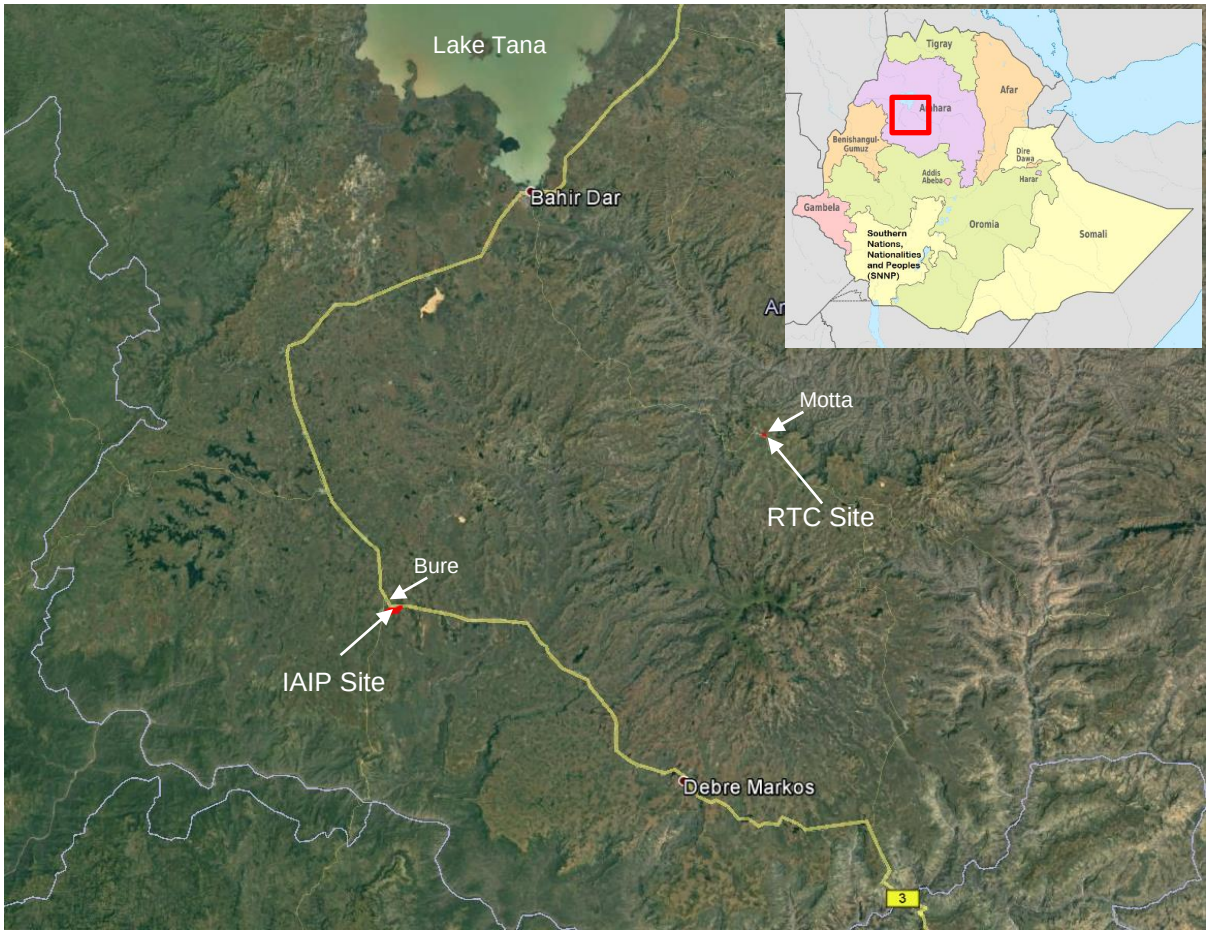

Figure 1-3: Layout showing the administrative map of the Regions and location of the Bure IAIP and Motta RTC sites in Amhara

Under the Ethiopian Environmental Impact Assessment (EIA) Proclamation (No. 299/2002), the proposed Project requires an EIA and authorisation by the Ministry of Environment, Forest and Climate Change (MEFCC) before any construction activities may commence. Due to the potential for international project financing the Environmental and Social Impact Assessment (ESIA) will be undertaken in line with the Ethiopian Environmental Legislation as well as the African Development Bank (AfDB) Integrated Safeguards System (ISS).

The Ethiopian based environmental consultancy, Zereu Girmay Environment Consultancy (ZGEC), in collaboration with WSP, Environment & Energy, Africa, have been appointed to undertake the required Environmental and Social Impact Assessment (ESIA) for the proposed Bure IAIP and associated Motta RTC within the South West Amhara Region (the Project) in order to obtain environmental certification.

An ESIA is conducted in order to identify and assess the likely environmental and social impacts of a proposed project, to determine their magnitude and significance, and to define management or mitigation measures designed to avoid and minimise where possible, or if not, to offset or compensate for adverse impacts and risks.

The development of the Amhara IAIP and RTC facilities will require ancillary infrastructure such as access roads, power lines, water pipelines and communication infrastructure in order to successfully implement the project. Ideally ancillary infrastructures would be captured as part of the development project and assessed within this ESIA. However, at this stage of the proposed Project, the routing of all linear infrastructure, including access roads, power lines, water pipelines and communication infrastructure to the sites have not yet been finalised. Therefore, this ancillary infrastructure will need to be considered under separate environmental and social studies by the third parties establishing this infrastructure.

1.2 LAND TENURE AND LAND USE

In Ethiopia all land belongs to the State and people; whilst land can be leased to private individuals, they cannot own it. The Constitution provides for equal access, use, transfer and administration over land. It grants access to agricultural land for rural residents, and allows all inhabitants to utilise the land for farming. Farmers are typically granted lifetime 'holding rights' giving them rights to farm the land except for its sale and mortgage.

All land in Ethiopia is considered public property. Ownership of land is now vested in the State and Ethiopian citizens have only a usufruct right over the land. The 1995 Constitution, Article 40(1), 40(2), 40(4), 40(5) and 40(7), includes legal frameworks that protect citizen's rights to private property and sets conditions for expropriation of such property for state or public interests. The Constitution states that every citizen shall retain full right to immovable property built on the land and to improvements s/he brings about on the land by her or his labour or capital.

Hence, the State owns all land, but citizens have a usage right and full ownership of developments and improvements built on state land. This includes the right to alienate developments, to remove them or claim compensation for expropriation of property. Article 44 of the Constitution reiterates the right of displaced persons to financial or alternative means of compensation including relocation with adequate state assistance. Based on the framework provided by the Constitution, three Proclamations were issued: 1) Expropriation of Land Holdings for Public Purposes and Payment of Compensation Proclamation 2) Rural Land Use and Land Administration and 3) Land Lease Proclamation.

Land is state property in Ethiopia and citizens have user rights. Inheritance of user rights is allowed, but land use rights may not be mortgaged, however; structures developed on the land can be mortgaged. Similarly to the Federal Land Law, the Amhara Land Law affirms the principle of public ownership of land, prohibiting its sale and mortgage. The certificate holder has the right to use the land but can also bequeath it and give it to dependants. Parcels may also be exchanged. Further land can be rented for up to 25 years and the contracts can be renewed. This provision is in practice used more or less as a transfer of the user right. Finally the right to land is dependent on residency in a rural area and engagement in agricultural pursuits.

Agriculture activities in the Region are dependent on the single *kremt* rainy season from June to September. Fertile clay and clay loam soils contribute to good harvests of barley, millet, maize, teff, chickpea and vetch. Maize, barley and millet are the main food crops, while vetch and chickpea are the main cash crops. There are pocket areas in the region with irrigated vegetable market-gardens (growing for example garlic, spices, pepper). Oxen are used to provide traction power for land preparation. Most farmers do their own labour intensive weeding and harvesting, and labour is hired by wealthier households (CSA, 2007). At the zone level, overall area of the West Gojjam zone (13,312 km^2) is divided into four main land uses, as indicated in **Table 1-2.**

Table 1-2: Land Use and Land Cover type

Land Use/Cover Type	Area Coverage (%)
Cultivated	27
Under settlements/Residential	15
Grazing	23
Forest (wood and plants)	35
Total	**100**

1.3 PURPOSE OF THIS REPORT (ESIA REPORT)

The fundamental objective of an ESIA is to ensure that the proposed development is environmentally sound and socially acceptable, and hence contributes to the development of environmental and social functions of local communities. It is also expected to provide a means whereby the overall environmental performance and social benefits of the project can be enhanced. This ESIA has been prepared to fulfil the requirements of the African Development Bank and the Ethiopian Environmental Impact Assessment Proclamation (299/2002) (the 'EIA Regulations').

The objective of the ESIA phase is to undertake an assessment of those potential impacts likely to result in significant effects, identified through the scoping phase. The Scoping Phase was conducted in November 2017 and determined the Terms of Reference for the ESIA. The ESIA will:

- Meet the requirements of the Ethiopian EIA regulations;
- Meet the requirements of the AfDB Operating safeguards;
- Provide input into the Project Engineering Team to ensure that the design minimises environmental and socioeconomic impacts and maximises sustainability opportunities wherever possible;
- Identify cross-cutting issues and coordinate mitigation measures across topics to be incorporated in an Environmental and Social Management Plan (ESMP); and
- Incorporate stakeholders through the ESIA process in accordance with the AfDB stakeholder engagement requirements.

In line with the AFDB requirements a Relocation Action Plan (RAP) has been developed and issued as a separate document associated with the ESIA report.

1.4 STRUCTURE OF THIS REPORT

The structure of this report is presented in **Table 1-3**.

Table 1-3: Structure of the ESIA Report

Chapter	Contents	AfDB Requirements
Chapter 1 – Introduction	Presents a brief background to the proposed Project, the ESIA process and the purpose and structure of the report.	Identify the project and the key role players.
Chapter 2 – Project Description	Provides a basic describes of the Project area and the proposed Project components.	Define the project and identify potential sources of impacts. Describe features, locations and activities of project.

Chapter	Contents	AfDB Requirements
		Identify interactions between project and resources. Convey what is being proposed. (2015)
Chapter 3 – Need and Desirability	Describes the need and desirability and motivates the rationale for the proposed Project.	
Chapter 4 – Project Alternatives	Details the level of information provided regarding Project alternatives that have been considered thus far.	Identify and compare alternatives. Balance economic, technical, environmental and social factors. Look at merits and disadvantages of each alternative. (2015)
Chapter 5 – Policy, Legal and Administrative Framework	Provides an outline of the legislative, policy and administrative requirements, as well as international best practise applicable to the proposed Project.	The assessment complies with the relevant legislation and standards applicable in the local jurisdiction and the Bank. Takes into account national and regional standards. The Bank assesses the institution's requirements, which needs to be equivalent to the AfDB's requirements. (OS1; 2013)
Chapter 6 – The ESIA Methodology	Provides a brief overview of the ESIA process to be followed for the proposed Project.	Conducted to the principles of proportionality and adaptive management. The level of assessment and management must be proportional to the level of risk associated with the project. This assessment leads to the development of an ESMP. (OS1; 2013) Apply an 'interactions matrix' to identify possible interactions between project components and resources/receptors. (2015)
Chapter 7 – Stakeholder Engagement	Provides a brief overview of the stakeholder engagement process required.	Capture perspective of vulnerable individuals or groups. Stakeholder engagement activities carried out throughout the ESIA process. Demonstrate links between stakeholder feedback and ESIA element.

Chapter	Contents	AfDB Requirements
		Confirm and verify stakeholder engagement activities. (2015)
Chapter 8 – Baseline of the Receiving Environment	Provides a summary of the site investigations undertaken and findings thereof. This has addressed the following technical topics: - Climate; - Topography and Geomorphology; - Geology; - Soils; - Surface Water; - Ground Water; - Wetlands; - Air Quality; - Noise; - Transport / Access; - Waste Management; - Visual; - Biodiversity; and - Socio-economic.	Detailed evaluation of climate change risks and adaptation measures (Category 1) or review climate change risks and adaptation measures (Category 2); assess climate change vulnerability. (2013) Assess potential impacts on: geology, soils, surface and groundwater resources, air resources and climate, noise and vibration, ecosystems, socioeconomic and cultural. (OS1, 2013) Ensure flows, water ecological functions and the integrity of river systems and wetlands are maintained. Assess potential risks and impacts on biological diversity and ecosystem services. Categorise habitats into Natural Habitats, Modified Habitats and Critical Habitats. Identify invasive alien species and take precautions to avoid the introduction or spreading of the species. Comply with national regulations in legally protected areas and internationally recognised areas. (OS3, 2013)
Chapter 9 - Identification of Potential Impacts	Description and assessment of physical, natural and socio-economic environment environmental and social impacts that have been identified to be focused upon in the ESIA process.	Identify potential interactions between the project and the physical, biological, cultural or human environment. Identify risks associated with cumulative impacts. Determine characteristics and magnitude of impacts. (2015)
Chapter 10 – Cumulative Impacts		Determine the size of the area around the project that should be assessed and how to practically assess complex interactions. Consider the degree to which the project will contribute to

Chapter	Contents	AfDB Requirements
		possible cumulative impacts. (2015).
Chapter 11 – Environmental and Social Management Plan	Presents the action plan for the management of impacts throughout the construction and operation of the proposed project.	Identify measures to avoid, minimise and mitigate. Follow a mitigation hierarchy which is in line with any relevant Bank Requirements. The hierarchy is as follows: - Avoid at Source or Reduce at Source - Abate on Site - Abate at Receptor - Repair on Remedy - Compensate - Offset (2015) Compensation and offsetting is a last resort (OS1; 2013). Define basic management and monitoring measures to ensure impacts remain in conformance with predictions and mitigation measures effectively address impacts. Define roles and responsibilities, measures for information disclosure, grievance redress mechanism and process for confined consultation. (GN1.4)
Chapter 12 – Conclusions	Concludes the ESIA Report.	

1.5 DETAILS OF THE ESIA PROJECT TEAM

The MEFCC requires that an ESIA study of this type utilises a multidisciplinary team composed of a team of experts to undertake ESIA study. A list of the members of the Project team for the ESIA is provided in **Table 1-4** As far as possible specialist studies were undertaken by Zereu Girmay Environmental Consultant (ZGEC) which is a local Ethiopian Consultancy firm licensed with the MEFCC. Full certificates of competency for each specialist as well and the MEFCC certificate for ZGEC are provided, see (see **Appendix A**). International ESIA experience and supplementary specialist expertise was provided by WSP Environment and Energy, Africa.

Table 1-4: ESIA Project Team

Technical Area	Expert	Level of Licences with MEFCC	Reference number of Certificate
Policy Analyst	Mr Bereket Zeleke Ekule	Consultant	11/1-1/1414
Sociologist	Mr Gebreslassie Gebreamlak Mersha	Senior Consultant	11/1-1/4011
Environmental Health	Mr Aklilu Tilahun Zeleke	Senior Consultant	11/1-1/1015

Technical Area	Expert	Level of Licences with MEFCC	Reference number of Certificate
Land Use	Getachew Simegn Eshetu	Senior Consultant	11/1-1/6876
Biodiversity	Mr. Shewaye Deribe W/Yohannis	Senior Consultant	11/1-1/6587
Water Resource Management	Solomon Kebede Gizaw	Senior Consultant	11/1-1/4026
Environmental Engineer	Mr Agaje Mekonen Agaje	Senior Consultant	11/1-1/7079
Waste Management	Mr Zereu Ghirmay Ghebreslassie	Senior Consultant	11/1-1/1959/10

Each of the above experts are licensed with the MEFCC. A copy of each of the above experts Certificate of Competency issued by the MEFCC is attached in **Appendix A**.

1.6 DETAILS OF THE APPLICANT AND ENVIRONMENTAL ASSESSMENT PRACTITIONER

Any comments on the ESIA Report should be provided to the applicant and environmental assessment practitioner as per the details provided in **Table 1-5** and **Table 1-6** respectively.

Table 1-5: Detail of the Applicant

Item	Detail
Name of Applicant	Amhara region IPDC
Responsible Person	Yehunew Abebe
Telephone	0918782320
E-mail	yehuabebe@gmail.com

Table 1-6: Detail of the Environmental Assessment Practitioner

Item	Detail
Name of Firm	Zeriou Girmay Gebreselassie Environmental Consultant
Certificate of Competence	Environmental Impact Assessment Studies as a Consulting Firm in Level 1 Reference Number: 11/1.1/6952 Date: 29/09/2016
Responsible Person	Mr. Zereu Girmay
Postal Address	100187 Addis Ababa, Ethiopia
Telephone	091 134 7013 or +251 11 557 6395
E-mail	Zereu21@yahoo.com

1.7 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations have been made/identified during the assessment process and in the compilation of this ESIA Report:

- The information provided by all parties is assumed to be accurate;
- The competent authority would not require additional specialist input, as per the proposals made in this report, in order to make a decision regarding the application.

2 PROJECT DESCRIPTION

This Chapter provides a brief description of the proposed Project, which entails the Bure IAIP and Motta RTC facilities and associated phases.

2.1 BURE IAIP

2.1.1 LOCATION

The proposed Bure IAIP falls under the jurisdiction of Bure Town as it is located approximately 2 km southwest of the town in the South West Amhara Region (**Figure 2-1**). The site abuts the federal highway No. 3 which is approximately 400 km north of Addis Ababa and 150 km north of Bahir Dar. The site is part of the industrial master plan of Bure designated for industrial development, which renders the advantage of utilising the industrial infrastructure such as power, water, stormwater systems and road networks. The site is geographically located between 1182481.036 N to 1184267.076 N, and 288737.915 E to 292314.594 E (UTM Coordinates) in the West Gojjam Zone of South West Amhara.

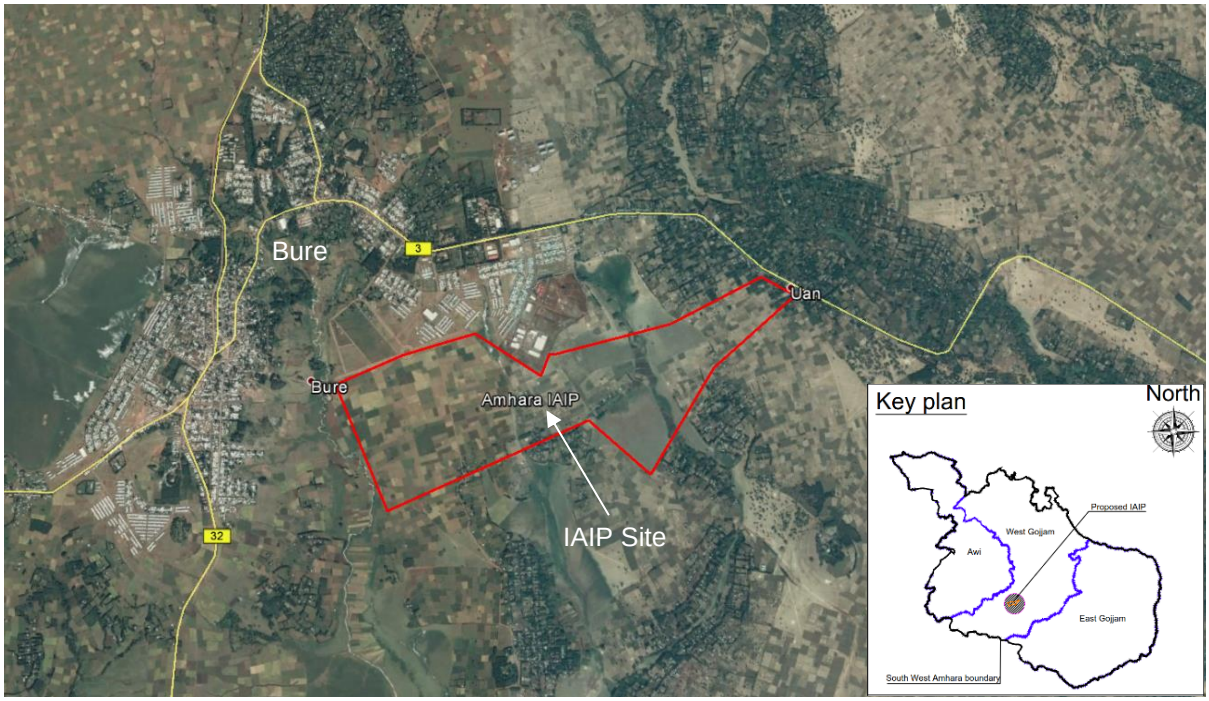

Figure 2-1: Bure IAIP, South West Amhara Region

The proposed Bure IAIP is a pilot facility with a site area of 260.56 hectares (ha) out of a total 1,000 ha of land that has been identified for potential use. Based on the success of the project the IAIP will be expanded within the remainder of the earmarked land. Note, this report only pertains to the assessment of the 260.56 ha pilot development. Future expansion of the IAIP will require separate environmental and social assessments to be undertaken. The growing area to be serviced by the IAIP is approximately 398,059 ha with the main farming activities in the area consisting of maize, sesame, potato, live animal (cattle, goat, sheep) dairy and meat, poultry and honey.

The predominant land use on the site is mixed farming. As per the land tenure of Ethiopia the land is owned by the government with land leased to farmers for agricultural and residential purposes (**Figure 2-2**).

Figure 2-2: Layout showing the boundary of the IAIP site

The coordinates of the Bure IAIP area are provided in **Table 2-1**.

Table 2-1: Coordinates of the Bure IAIP site

Point	Easting (m)	Northing (m)
1	292054.36	1184267.08
2	292314.59	1184120.77
3	291174.63	1182743.48
4	290699.18	1183158.58
5	289151.17	1182481.04
6	288737.92	1183447.64
7	289819.74	1183834.84
8	290331.58	1183506.62
9	290400.53	1183676.73

Note: Coordinates are given in geographic format, zone 37, hemisphere N of the Adindan, Ethiopia datum (Ellipsoid: Clarke 1880)

2.1.2 SURROUNDING AREA

The area surrounding the IAIP site consists of households, settlements and associated support infrastructure such as roads and electrical power lines as well as agricultural land including open grassland for grazing and production. The area includes mixed vegetation as well as the Yiser River, which runs parallel to the western boundary of the site. **Table 2-2** provides a rough breakdown of the various land use patterns identified within a 5 km radius of the IAIP site, as indicated in **Figure 2-3**.

Table 2-2: Land use pattern in the surrounding area – 5 km radius

Land use classification	Area in hectares	%
Water body	41.53	0.53%
Wetland	458.12	5.84%
Agriculture	4030.12	51.34%
Mixed vegetation	1184.30	15.09%
Settlements	2026.30	25.81%
Barren land	70.93	0.90%
Roads	38.70	0.49%
Total	**7850.00**	**100.00%**

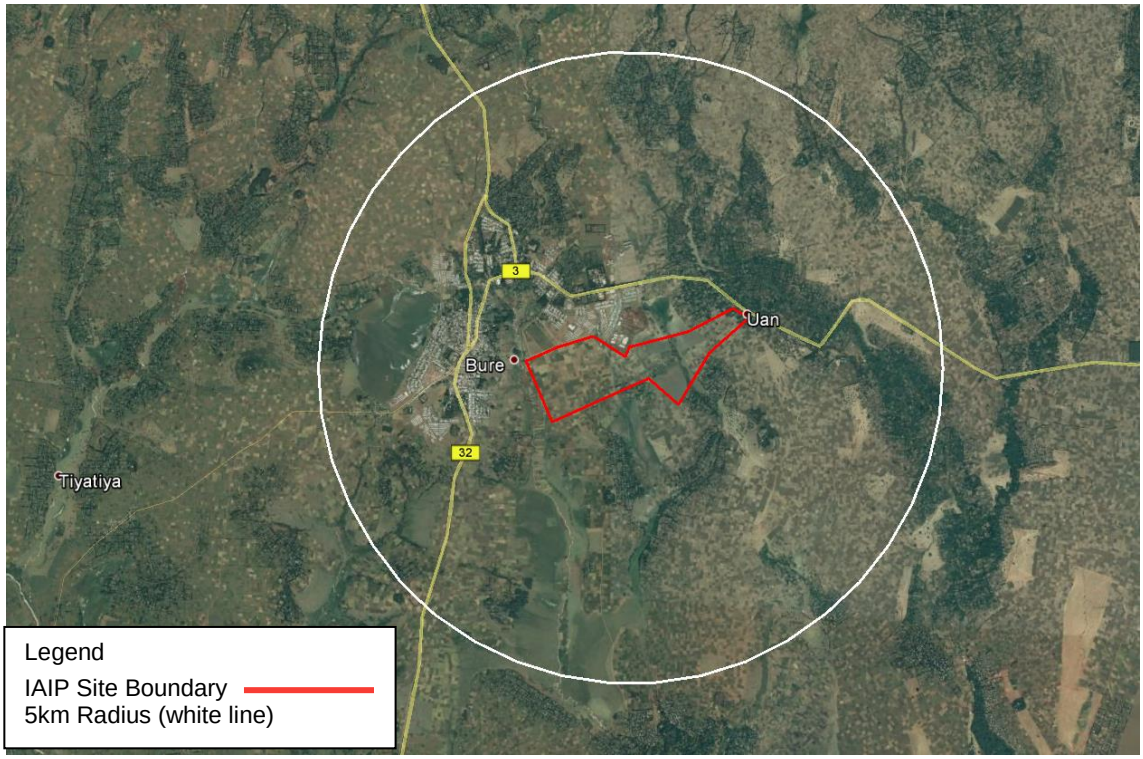

Figure 2-3: Image showing a 5km radius from the IAIP site.

2.1.3 DESCRIPTION OF THE PROPOSED BURE IAIP

The 260.56 ha IAIP is comprised of a processing area of 245.23 ha and a non-processing area of 15.33 ha. Most residents in the region are subsistence farmers with practices including the rearing of live animals as well as growing several crop types. The IAIP is designed to focus on processing cereals, sesame, vegetables, livestock as well as the brewery / malt processing industry.

The IAIP includes the associated infrastructure required to effectively process all the materials. These include water and electrical supply infrastructure, sewage treatment works, roads and storage areas and the like. Quality control and assurance facilities are also included within the park along with support and training facilities. The non-processing area of the site includes a residential area as well as supporting facilities such as a school, places of worship and commercial areas. The park also includes greenery and open spaces making up approximately 12% of the total area. **Figure 2-4** provides a layout of the proposed master plan of the Bure IAIP.

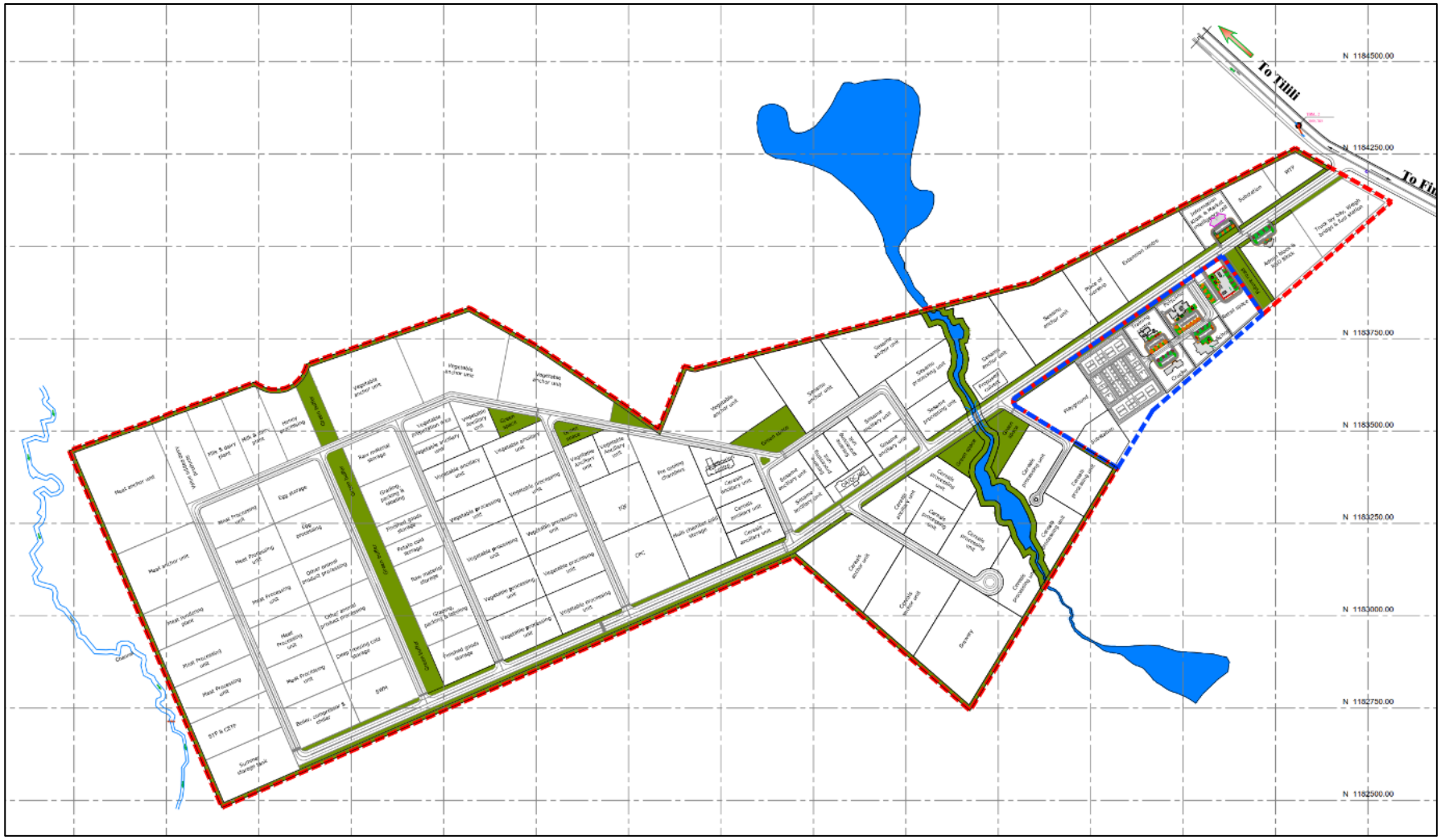

Figure 2-4: Site layout plan of the Bure IAIP

Table 2-3 provides an indication of the raw material and growing area required for the effective operation of the IAIP according to the design process.

Table 2-3: IAIP operational requirements

Item	Quantity
Raw Materials Required	824,476 MTPA
Growing Area Required	398,059 ha

The preliminary details of the proposed Bure IAIP are summarised in the **Table 2-4** below.

Table 2-4: Summary of preliminary details of the Bure IAIP

Amhara – Bure IAIP		
Location of IAIP		Bure town in West Gojjam administrative zone
Size of IAIP		260.35 hectares considered for initial development
RTC locations		**Motta**, Merawi, Finote Selam, Dangila, Enjibara, Chagni, and Amanuel.
Agricultural potential and agri-facilities		Maize, sesame, potato, live animal (cattle, sheep, goat) dairy, meat, poultry and honey
External infrastructure	*Energy*	The total estimated power demand of 46.82 MVA is to be met from Bure substation connected to the national grid situated at a distance of 4 km from the proposed IAIP site.
	Water	6 bore wells, with a 300 mm diameter and depth of up to 100 m
	Road network	The site abuts the federal highway connecting Addis Ababa and Bahir Dar
	Railways, dry port, airport terminals	Airport – Bole International airport, Addis Ababa – 407 km & Bahir Dar airport – 156 km
	Telecommunication	Communication facilities available in Bure town can be extended.
IAIP internal infrastructure details	*Raw materials required*	824,476 MTPA
	Growing area required	398,059 hectares
	Total processing area	245.11 hectares
	Total non-processing area	15.24 hectares
	Total area	260.35 hectares
	Length of road	9.31 km
	Total water demand	7,381 m^3/day
	Wastewater generation	4,928.73 m^3/day
	Municipal Solid Waste generation	63.47 TPD
	Power demand	46.82 MVA

2.1.4 PROCESS UTILITIES

WATER REQUIREMENTS

During the design process it was established that there is no existing water supply network available in the vicinity of the site. However, it was noted that the Yiser River flows in close proximity (approximately 100 m) to the western boundary of the site. Discussions with the authorities were undertaken by MACE whereby it was identified that there is no possibility for withdrawing water from the River to supply the IAIP due to the dependency of farmers in the lower areas on the river feeding the downstream agricultural areas. Water supply to the area is currently provided through a network of bore wells sunk in and around the town of Bure. Discussions with authorities, undertaken by MACE, identified that there is no surplus water available from this existing scheme to supply the IAIP.

A minimum of 6 bore wells, with a 300 mm diameter and depth of up to 100 m, are proposed be installed in the IAIP (or nearby depending on the yield of the bore wells). The IPDC is currently undertaking a Geohydrological Assessment to determine the resource capacities in the area. The estimated total daily water demand for the IAIP was calculated by MACE, including potable[1] and non-potable[2] water requirements. The estimated average daily water demand for the IAIP is shown in **Table 2-5**.

Table 2-5: Estimated average daily water demand for the Bure IAIP

Land Use within the IAIP	Potable (m^3/day)	Non-potable (m^3/day)	Total (m^3/day)
Processing areas	4,548	161	4,709
Non-processing area	634	89	723
Total daily water demand	5,181	250	5,431

The proposed bore wells are to be installed in a phased manner so as to meet the required water demand at the various phases of the development. **Table 2-6** provides the anticipated water demand on a yearly basis, for the eight years from commencement of the IAIP, showing the annual increase in water demand.

Table 2-6: Water demand - year wise patter – m^3/day

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026
Volume (m^3/day)	549	1097	2056	2651	3474	4022	4434	4680	4709

To facilitate the adequate supply of water to the IAIP suitable water storage structures, in the form of ground level storage reservoirs (GLSR) and elevated level storage reservoirs (ELSR) with associated pump house and water treatment plant, are to be established within the IAIP. The proposed infrastructure is to facilitate receiving raw water, treating the water, collecting and storing the treated water (in the GLSR and ELSR respectively) for further distribution within the IAIP. An area of 1.03 ha is earmarked for the construction of the water treatment plant, GLSR and ELSR and pump house within the eastern portion of the IAIP. The design also includes a ‘summer storage tank’ for the capturing and storage of summer rainfall for use in the IAIP.

A suitable water treatment plant is to be established to treat the water supply in order to meet the acceptable limits of water quality as per Ethiopian drinking water standards.

WASTE WATER

A sewage treatment plant (STP) and common effluent treatment plant (CETP) are to be established within the western portion of the IAIP with a second STP located in the eastern portion of the site. It is

[1] Potable water is to be used for drinking and sanitary needs and washing vessels. A potable water system will be put in place that will meet regulatory requirements in terms of quality

[2] Non-potable water considered to be used for gardening, cleaning, cooling and toilet flushing

anticipated that wastewater will be treated and recycled in the operational process. Furthermore, sanitary wastewater from toilets and urinals shall be collected in an underground sewer system that is to be constructed as part of the processing plant's sanitary facilities. A self-contained treatment system is to be put in place to treat sanitary water.

Treated wastewater is to be re-used in the production process as non-potable water[3]. The estimated volume of sewage[4] to be generated by the IAIP during operations is shown in **Table 2-7**.

Table 2-7: Estimated average daily wastewater generation for the Bure IAIP

Processing and Non-processing areas	Quantity
Total	4,928.73 m^3/day

SOLID WASTE

The estimated volume of municipal solid waste (MSW) to be generated by the IAIP during operations was calculated by Mahindra and is shown in **Table 2-8**. Waste minimisation, recycling and treatment processes shall be included in the IAIP facility operational requirements.

Table 2-8: Estimated average daily solid waste generation for the Bure IAIP

Processing and Non-processing areas	Quantity
Total	63.47 tons per day (tpd)

ELECTRICITY

The anticipated total power demand for the IAIP during operation, as calculated by MACE, is anticipated to be 46.82 MVA (**Table 2-9**). The total power demand is to be sourced from Ethiopian Electric Power (EEP) via the Bure substation, located approximately 4 km from the proposed site. To meet the required power demand it is proposed that a new 132 kV dedicated overhead power transmission line is established from Bure substation to the proposed substation within the IAIP eastern portion of the site.

Table 2-9: Estimated power demand for the IAIP

Processing and Non-processing areas	Quantity
Total	46.82 MVA

2.1.5 ANCILLARY INFRASTRUCTURE

This Section does however provide a brief summary of what ancillary infrastructure is proposed.

FUEL (DIESEL/PETROL) STORAGE

The IAIP includes a truck lay bay, weighbridge and fuel station. The storage of fuel will therefore take place on site.

TRANSPORT ROUTES AND ACCESS TO SITE

The proposed site abuts the federal highway no. 3 connecting Addis Ababa and Bahir Dar. No specific infrastructure intervention is proposed regarding transportation routes and access roads. The site has no connectivity by railway and the nearest airports are Addis Ababa and Bahir Dar which are approximately 407 km and 156 km from the site respectively. The Motta RTC is located approximately 100 km east of the Bure IAIP, aerial distance, however approximately 266 km by road via Bahir Dar.

[3] Confirmation of such processes has not been provided.
[4] Total sewage quantity includes effluent, sewage and sullage

All internal roads will be constructed and maintained by the IPDC while the FDRE is responsible for establishment and maintenance of the roads outside of the IAIP.

ELECTRICAL OVERHEAD POWER TRANSMISSION LINES

As identified in Section 2.1.4 above, it is proposed to bring in a 132 kV overhead power transmission line from the Bure substation, which is connected to the national grid, to a substation to be established on site for the provision of electrical supply to the IAIP.

COMMUNICATION FACILITIES

Communication facilities available in the town of Bure are to be extended to the site.

2.2 MOTTA RTC

2.2.1 LOCATION

The proposed Motta RTC site is located approximately 2 km west of the town of Motta (**Figure 2-5**), 120 km southwest of Bahir Dar, and 266 km east of the Bure IAIP (by road via Bahir Dar). The proposed site falls under the jurisdiction of Motta town, in the Hulet Ej Enese Woreda, which is located in the East Gojjam Zone of the Amhara Region. The proposed RTC is located in close proximity to the federal highway no. 31 that links Dejen with Bahir Dar. The site is geographically located between 1224437.024 N to 1224883.549 N and 378948.322 E to 379342.918 E (UTM coordinates), with an elevation of approximately 2,487 m above sea level.

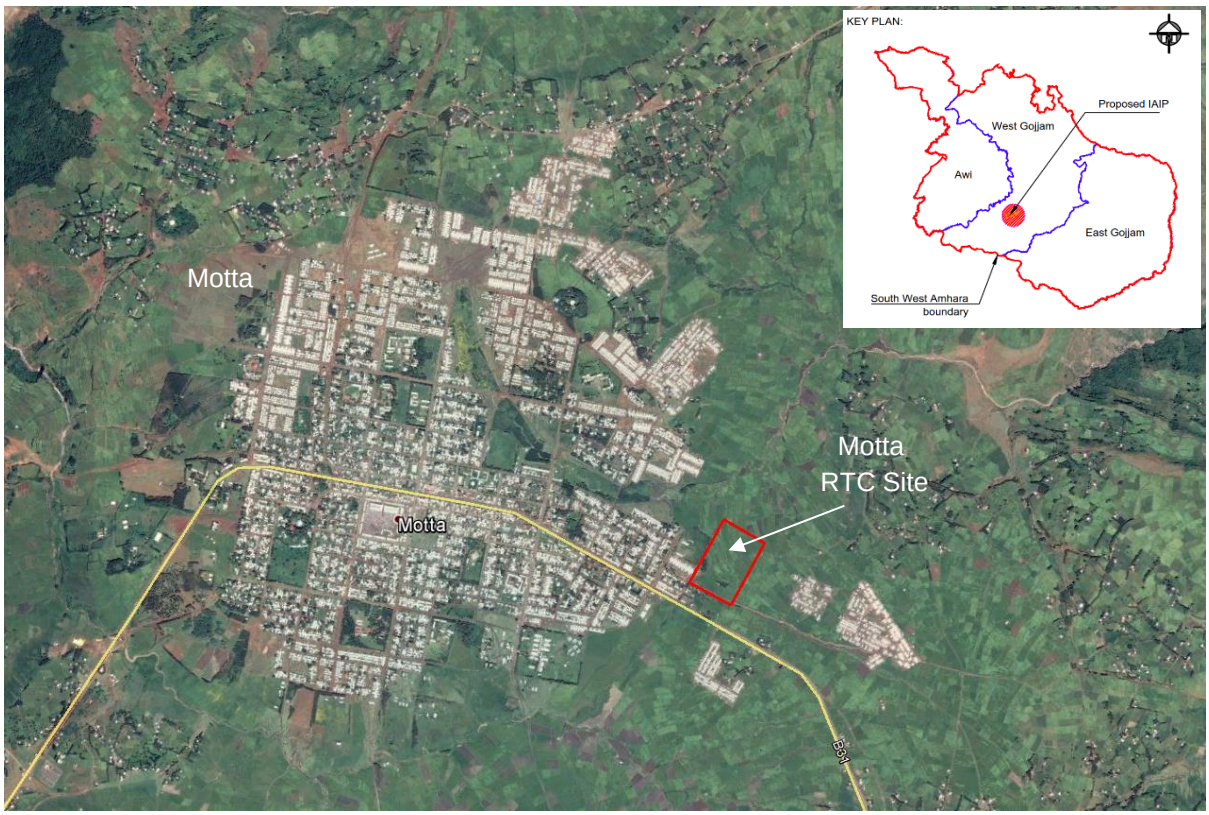

Figure 2-5: Location of the Motta RTC, South West Amhara Region

The coordinates of the Motta RTC area are provided in **Table 2-10**. **Figure 2-6** shows the layout of the IAIP boundary.

Table 2-10: Coordinates of the Motta RTC area

Point	Coordinates	
	Easting (m)	Northing (m)
1	378948.32	1224556.38
2	379130.14	1224883.55
3	379342.92	1224757.70
4	379163.98	1224437.02

Note: Coordinates are given in geographic format, zone 37, hemisphere N of the Adindan, Ethiopia datum (Ellipsoid: Clarke 1880)

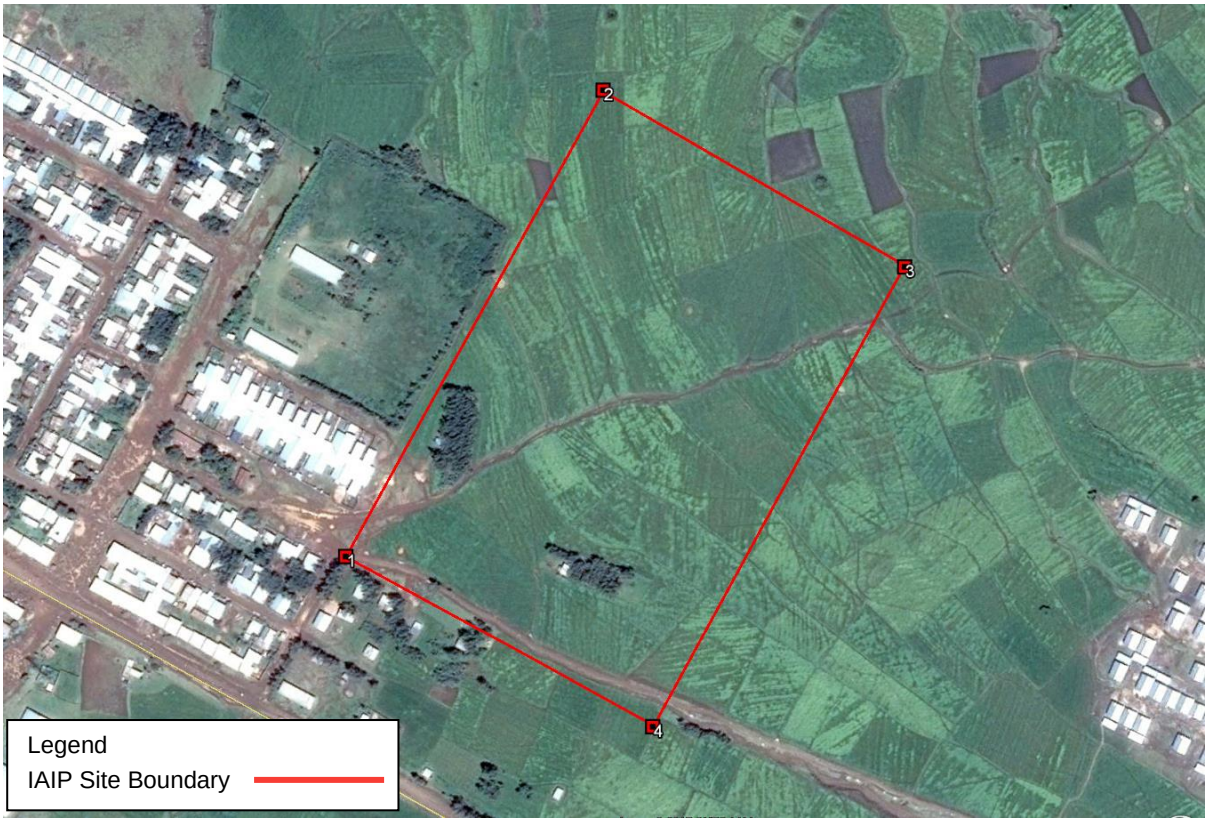

Figure 2-6: Layout showing the boundary of the RTC site

SURROUNDING AREA

The site is located approximately 100 m north of the Federal Highway No. 31 on the eastern edge of Motta. The site is surrounded by agricultural land (predominantly crops) to the north, east and south, with the area adjacent to the south west border of the site consisting of households, businesses and associated support infrastructure such as roads. A primary school is located adjacent to the western boundary of the proposed site. Additional settlements are located further north-west and west of the site. **Figure 2-7** shows the location of the RTC site and a 5km radius around the site.

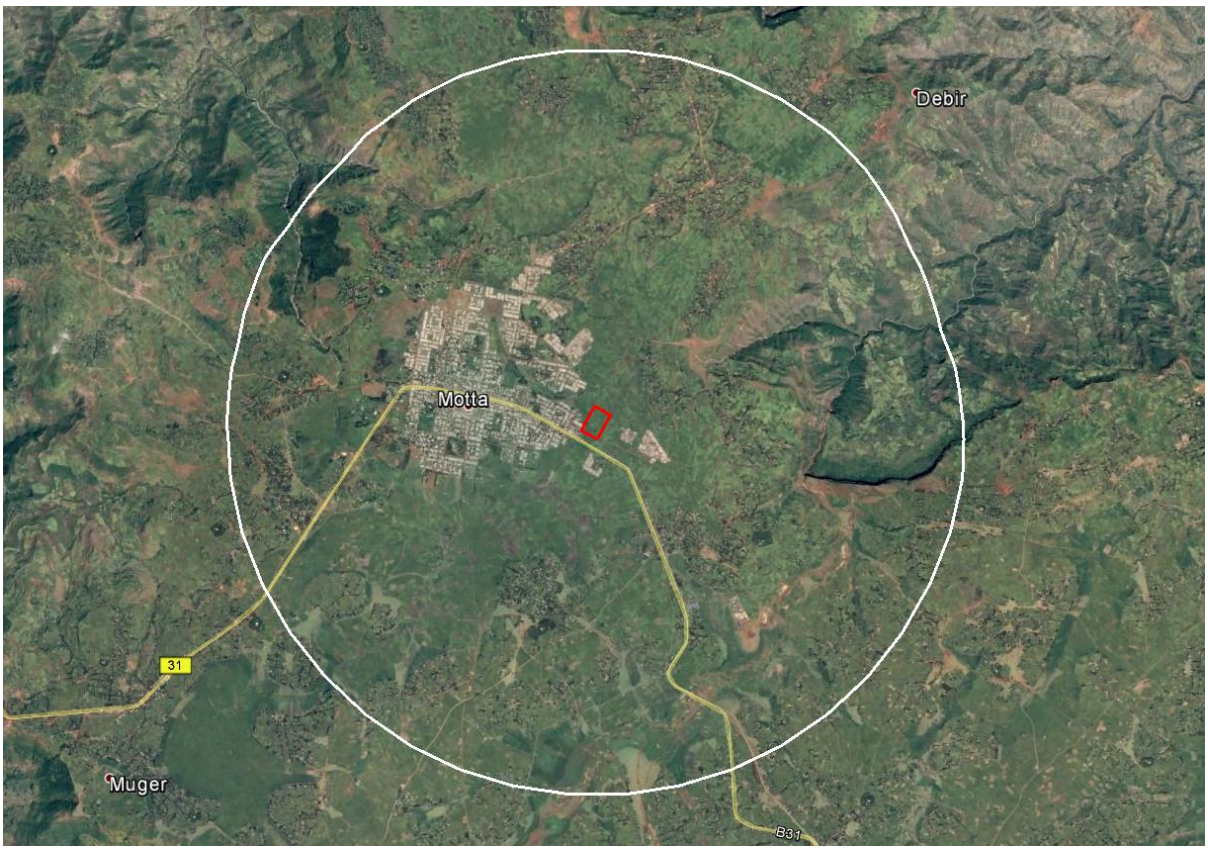

Figure 2-7: Image showing a 5km radius from the RTC site

2.2.2 DESCRIPTION

An RTC is a facility where rural communities are able to take their products (i.e. vegetables, fruits, coffee, livestock etc) for sale. The products are in turn forwarded in bulk to the IAIP for further processing.

The Motta RTC site covers an extent of 9.11 ha which mainly consists of agricultural land, predominantly teff. Two dwellings are noted to exist on the site along with a 33 kV power line that runs across the centre of the site in a southeast-northwest direction as well as a dirt track, which transects the site from the south-western corner to the north-eastern corner. A number of drainage lines cross the site, running in a north-westerly direction. A dirt track and drainage line run along the southern boundary of the site. **Figure 2-8** identifies the existing features identified on the proposed RTC site.

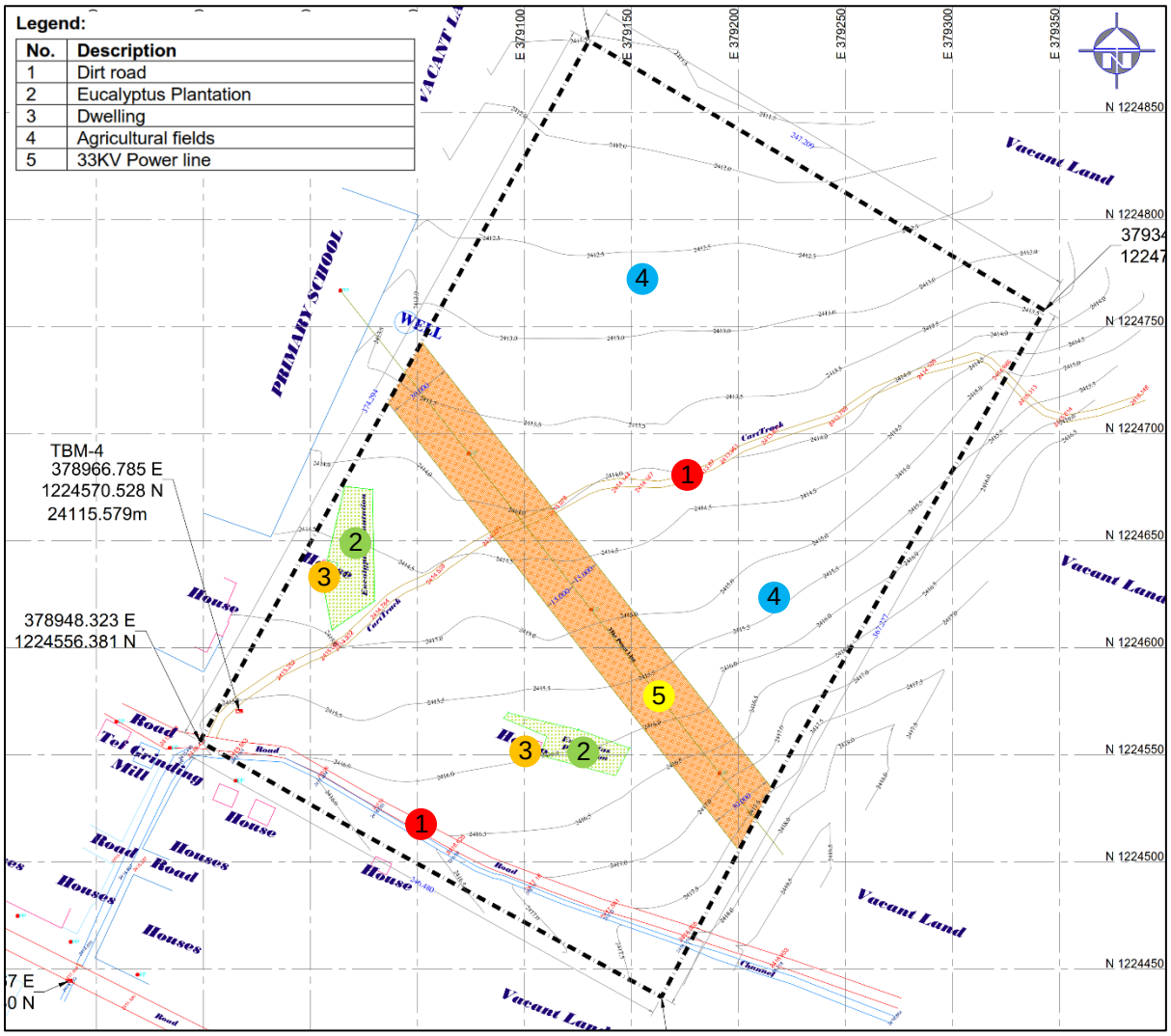

Figure 2-8: Existing features with the proposed RTC site (adapted from MA site constraints)

The RTC is to be focused on fruits, vegetables, cereals, livestock, milk and honey. Furthermore, the RTC is planned to include a quality control laboratory, agri-input centre, and social infrastructure such as a training centre and crèche. The social infrastructure provides the necessary support for the occupant industries in the RTC. **Figure 2-9** provides a layout of the proposed master plan for the Motta RTC.

Figure 2-9: Site layout plan of the Motta RTC (Source: MACE master plan drawing)

2.2.3 PROCESS UTILITIES

WATER REQUIREMENTS

Water is supplied to the town of Motta by the Motta Water Supply and Services Enterprise (MWSSE) supply network. The estimated water demand for the RTC is estimated to be 85 m^3/day, including potable[5] and non-potable[6] water requirements (**Table 2-11**).

Table 2-11: Estimated average daily water demand for the RTC

Description	Potable (m^3/day)	Non-potable (m^3/day)	Total (m^3/day)
Total water demand	65	20	85

Based on discussions held by MACE with the MWSSE, the water source for the proposed Motta RTC site is to be provided by way of providing an exclusive water supply line from the existing MWSSE water supply network.

[5] Potable water is to be used for drinking and sanitary needs and washing vessels. A potable water system will be put in place that will meet regulatory requirements in terms of quality

[6] Non-potable water considered to be used for gardening, cleaning, cooling and toilet flushing

To facilitate the continuous provision of water to the RTC it is proposed that suitable water treatment and storage structures (i.e. 90 m^3 underground sump, water treatment plant, 15 m^3 ELSR tank) and pump house be established within the site for receiving, treating and storing water for further distribution within the RTC.

WASTE WATER

A STP is to be established within the RTC which will treat the operational waste water generated within the RTC to a standard that is suitable for the treated waste water to be recycled in the operational processes. Furthermore, sanitary wastewater from toilets and urinals shall be collected in an underground sewer system that will be constructed as part of the processing plant's sanitary facilities. A self-contained treatment system will be put in place to treat sanitary water. As part of this treatment process, sludge is to be removed and disposed of by a licensed contractor when required.

Motta town does not have an existing sanitary landfill facility. There are no immediate plans for Motta to develop a sanitary landfill facility however the Motta master plan does identify land for the construction of a formalised waste management site however specific detail as to the nature of waste to be handled at the facility is not provided. Sludge handling and the disposal thereof is to be addressed in the ESIA.

Treated wastewater is to be re-used in the production process as non-potable water.

SOLID WASTE

A solid waste management area has been identified within the RTC master plan, however specific detail as to the nature of waste to be handled at the facility is not provided. Waste handling and the disposal thereof is to be addressed in the ESIA.

ELECTRICITY

The total power demand for the RTC is anticipated to be 1.2 MVA (**Table 2-12**), as calculated by MACE. It is proposed that the total power demand be sourced from the EEP via the existing 33 kV power line passing across the central section of the site. The existing 33 kV overhead power line is to be relocated to run around the site (i.e. not cross the RTC site). During this process electrical infrastructure is to be connected to the proposed substation to be established on site.

Table 2-12: Estimated power demand for the Motta RTC

Description	Quantity
Total Power Requirement	1.2 MVA

2.2.4 ANCILLARY INFRASTRUCTURE

This Section provide a brief summary of what ancillary infrastructure is proposed for the RTC.

FUEL (DIESEL/PETROL) STORAGE

The RTC includes a truck lay bay area where it is anticipated that trucks will be able to refuel.

TRANSPORT ROUTES AND ACCESS TO SITE

Entrance to the RTC is to be obtained from the south-west corner of the site via a secondary road leading off the federal highway no. 31. Traffic will then exit the RTC from the southeast corner of the site. Two additional entry and exit points are identified for future establishment, along the northern boundary of the site as indicated in the Master Plan (**Figure 2-9**) as well as represented in **Figure 2-10** below.

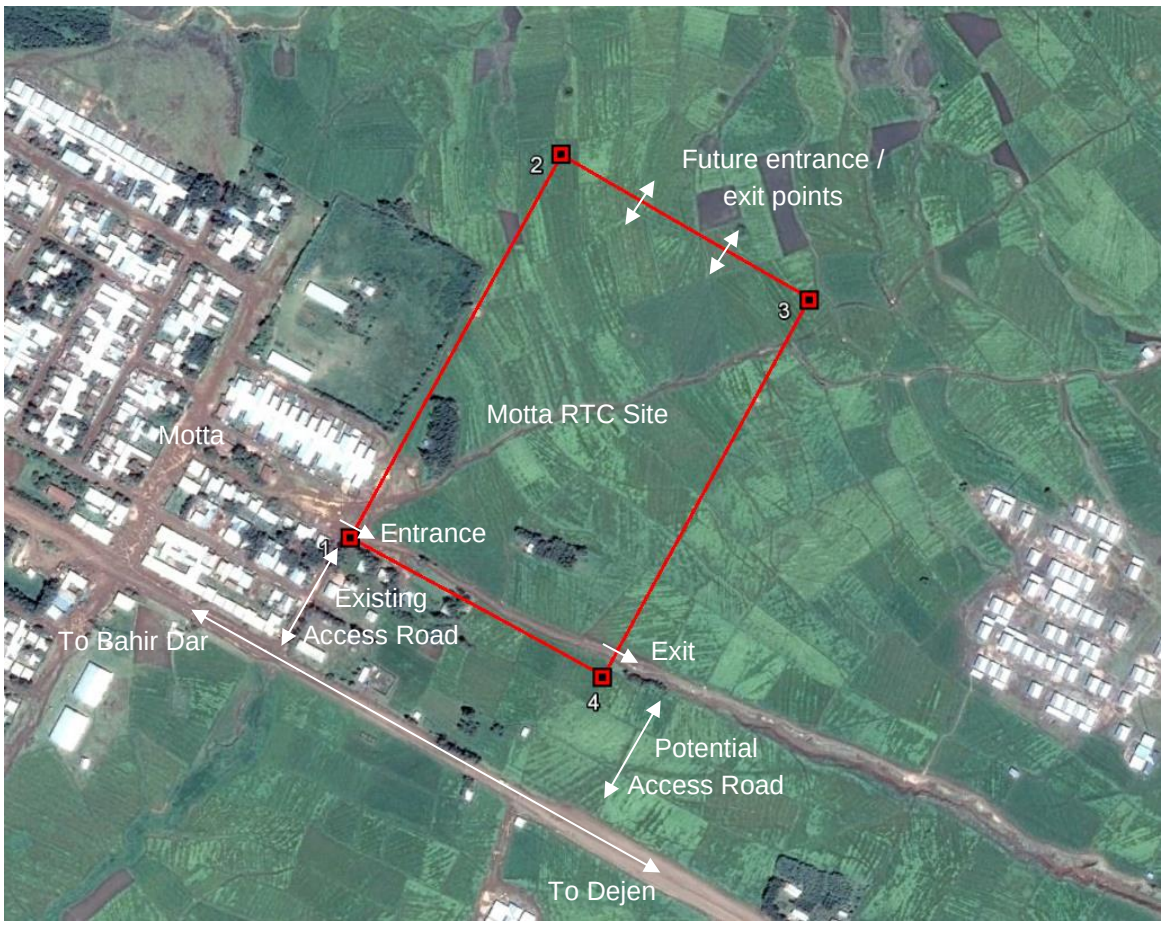

Figure 2-10: Layout indicating proposed access to the RTC.

ELECTRICAL OVERHEAD POWER LINES

As indicated above the EEP will be responsible for rerouting the existing overhead power line from crossing the site and providing electrical power to the site.

COMMUNICATION FACILITIES

Communication facilities available in the town of Motta are to be extended to the site. The installation of pipelines or infrastructure associated with the communication facilities is to be undertaken by the FDRE.

2.3 PHASES OF THE PROPOSED PROJECT

In general, development projects are undertaken in a series of set phases. Each of the phases have a different combination of activities and the commencement of each phase is dependent on the outcome and success of its predecessor. The identified Project phases are discussed below.

2.3.1 PLANNING AND DESIGN PHASE

As part of the preparation process MACE carried out the feasibility study and business plan for establishing IAIPs in Ethiopia. Following the feasibility study an engineering Scoping Study, based upon a simplified but more site-specific process, was undertaken along with the preparation of a preliminary design and associated project capital expenditure (CAPEX) and operational expenditure (OPEX) estimates corresponding to the design proposed. The engineering Scoping Study was approved by UNOPS/UNIDO resulting in the initiation of the detailed design process.

The planning and design phase of the proposed Project commenced in 2016 and will be completed once final authorisations have been issued by the relevant authorities.

2.3.2 CONSTRUCTION PHASE

Construction activities are to be undertaken in a phased manner. Construction activities commenced in 2016 with the construction of the temporary building camp for the Bure IAIP. Construction of the IAIP and RTC boundary walls commenced in January 2017 and is scheduled to continue for a period of 12 months from commencement. The construction process of horizontal infrastructure for the IAIP, including internal roads and water supply infrastructure, is scheduled to be undertaken within a period of 12 months from commencement. While the construction of horizontal infrastructure for the RTC, including internal roads and water supply infrastructure, is scheduled to be undertaken within a period of 5 months from commencement.

2.3.3 OPERATIONAL PHASE

Once the construction phase of the Project is complete, the operational phase will commence. As indicated above, the Project will consist of one IAIP and one RTC with additional RTCs to be established in surrounding areas in the future based on the success of the pilot facilities (not included in this preliminary scoping report).

An IAIP is essentially a geographic cluster of independent firms grouped together to gain economies of scale and positive externalities by sharing infrastructure (i.e. roads, power, communication, storage, packaging, by-product utilisation, effluent treatment, logistics and transport, laboratory facilities, etc.) and taking advantage of opportunities for bulk purchasing and selling, training courses and extension services. Multiple agro-processing functions take place in an IAIP, such as final processing, storage, packaging, marketing and distribution. Support businesses and social infrastructure are also present. IAIPs include open area production zones, controlled environment growing, precision farming, knowledge hubs and research facilities, rural hubs, agri-infrastructure, collection centres, primary processing hubs, social infrastructure and agri-marketing infrastructure, among others. IAIPs are proposed to consist of state-of-the-art infrastructure including general infrastructure such as roads, power, water, communications, sewerage, sewage/effluent treatment plant, storm water systems, rain water harvesting, firefighting, etc., and specialised infrastructure such as cold storages, quarantine facilities, quality control labs, quality certification centres, raw material storage, controlled and modified atmospheric storage, central processing centres, etc.

RTCs also represent geographic clusters of infrastructure and services, though on a smaller scale than IAIPs. Farmers and farmer groups deliver their produce and receive agricultural inputs. At the RTCs, agricultural produce is collected, sorted, stored and may undergo primary processing before onward transport to an IAIP. For most farmers, the RTCs are the main point of contact with commercial agricultural value chains. Apart from their primary functions, RTCs are also intended to offer small-scale financial services to farmers as well as basic social services. RTCs are to include warehouses, input supply, sorting, grading, extension services, pre-processing activities and microfinance commercial activities. Via the FDRE and partners the RTCs will support farmers to increase productivity to supply raw material of required quantity and quality to the industries in the IAIPs. The centres will provide information on agro-food, business development, prices, market trend and current market demand in terms of products and quality, among other services.

The operational phase involves the day-to-day management of all operations undertaken at the Bure IAIP and Motta RTC site and associated activities.

2.3.4 DECOMMISSIONING PHASE

The proposed IAIPs and associated RTCs are intended to be long term operational facilities (i.e. are not intended to be decommissioned in the near future). The developments are anticipated to be a permanent part of the industrialised agricultural sector going forward and are to be expanded upon.

Decommissioning requirements and activities should be considered in the planning process, however as the facilities are not anticipated to be decommissioned in the near future is more appropriate that

detailed decommissioning requirements should be addressed in the future when / if decommission of the facilities is required. As such decommissioning is not considered further in this report.

2.4 PROJECT STATUS

It is noted that construction of certain aspects of the proposed Project development have commenced. The following points summarise the status of the construction undertaken to date for the Bure IAIP and RTC sites and the respective infrastructure, based on the latest information provided by the IPDC:

- Bure IAIP
  - Amhara Building Construction Enterprise has been contracted to undertake the construction of horizontal infrastructure which includes the construction of the temporary camp buildings and compound wall. Construction of the temporary camp commenced in 2016 and was completed with the anticipated 12 month period. Construction of the compound wall commenced in January 2017 and is still currently underway.
  - Amhara Road Works Enterprise has been contracted to undertake the construction of horizontal infrastructure which includes the construction of the roads, sewerage line, drainage, street lighting and internal power system. The works are scheduled to extend for a period of 335 days from commencement.
  - Amhara Water Works Enterprise has been contracted to undertake the construction of horizontal infrastructure which includes the construction of the internal water supply system (potable and non-potable). The works are scheduled to extend for a period of 12 months from commencement.
  - Amhara Borehole Enterprise has been contracted to establish 6 deep wells to supply water for the site. Drilling activities have commenced and one borehole of the six has been completed. The proposed boreholes are to be completed within a 270 day period from commencement.
  - Amhara Metal Industry and Machine Technology Enterprise has been contracted to construct warehouses and sheds at the IAIP and RTC sites. The warehouses and sheds are scheduled to be established with a period of 12 months form commencement.
- RTC
  - The Amhara Road and Building Design Contract Administration and Supervision Enterprise have been contracted to supervise the construction of the compound walls, horizontal infrastructure and building processes.
  - Amhara Urban Development and Building Company have been appointed to undertake the construction of the RTC compound wall and horizontal infrastructure. Construction of the compound wall commenced in early 2017 and is schedule to be completed within a period of 5 months from commencement. However delays were encountered during the rainy season, as such construction of the boundary is still underway.

It is noted that as per the legislative framework, construction activities are required to only commence following receipt of environmental certification. These activities are therefore in non-compliance with the identified regulations.

3 NEED AND DESIRABILTY

The agricultural industry in Ethiopia faces the following challenges:

- Disorganized and fragmented land holdings;
- Absence of an integrated channel to link 'farm gate to food plate';
- Weak infrastructure, limited support services to farmers;
- > 50% of Food Industries concentrated in & around Addis Ababa;
- Inability to tap the growing domestic & international markets;
- Lack of coordination of value chain and actors.

The above challenges is that approximately 65 million farmers are not currently linked to industry. Ethiopia has a competitive advantage in several crops such as oil seeds and cotton, and horticultural crops such as fruits and vegetables that is often lost due to poor linkages with agro-industry and limited knowledge of efficient farming practices. The fragmented nature of the agricultural sector further compounds the inefficiencies inherent in the current market.

As identified in Chapter 1, although food-processing industries are present in Ethiopia, they are currently restricted in production by the availability of raw materials. The restriction on raw material input is related mainly to access, but also to the quality of the produce, which results in inefficient handling chains, post-harvest losses and higher prices. Investment and development of the agro-industrial sector will in turn improve the economy by converting the agro-export from primary, unprocessed products to processed products, which will underpin economic growth for this sector and the country as a whole. The primary limitation to this proposed agro-industrial growth is the lack of adequate infrastructure. The development of agro-industries presents Ethiopia with an opportunity to accelerate economic development and achieve its industrial development goals.

In addition, Ethiopia benefits from the United States' (US) African Growth and Opportunity Act, a law that gives many African countries duty-free export privileges to the US market. Opportunities also exist to obtain duty-free entry into the European Union (EU) countries, Canada and Japan. If addressed correctly, agro-industries can help fulfil the potential of agriculture and advance industrialization in the country. The production of higher value products has been identified to be critical to achieving this transformation.

The IAIPs will have comparative advantages in terms of cost and efficiency allowing industries to '*pool resources and curb shortages'* in the course of production. The intention is for the IAIPs to be a 'one-stop-shop' for agricultural industries and to facilitate and boost the export earnings for Ethiopia, which is currently restricted to coffee and vegetable product exports. Investors, both local and foreign, will also be attracted to incentives ranging from 70% loans from state banks without collateral, duty free import of machineries and spare parts, to export tax exemption. The FDRE will be seeking to attract Ethiopian diaspora business investment into the IAIPs through incentives such as offering up to 85% loans without collateral allowing the Diaspora to place only 15% of financing at risk.

The overall objectives of the IAIPs are to:

- Drive the structural transformation of the Ethiopian economy;
- Reduce rural poverty through the integration of smallholder farmers, small-scale processing enterprises and allied industries in commercial value chains; and
- Create a better environment for increased investment in agro-food and allied sectors.

The IAIPs will:

- Create supply-chain infrastructure;
- Increase total flows of investment in agro-industry - both in terms of skills and capital;
- Foster linkages between agriculture and agro-industry;
- Provide a close interface between research, extension mechanisms, industry and farmers in the agricultural sector;
- Increase value addition and reduce wastages, thereby increasing the income of farmers;

- Produce better quality products to increase Ethiopia's share in manufacturing value addition in the GDP;
- Create rural employment, off-farm broad based income opportunities and improve quality of life in rural areas;
- Assist small-scale agro-industrial enterprises to remain competitive in global markets; and
- Facilitate commercialisation of agriculture and increase exports of processed and value added agro-products.

The overall goal of the Government's Industrial Development Strategy (IDS) is to bring about the accelerated structural transformation of the economy through enhancing industrialization, raising the share of the industrial sector of GDP from the current 13% to 27% by 2025, and the GDP share of the manufacturing sub-sector from the current 4% to 18% by 2025.

The development of IAIPs is prioritised in Ethiopia's national development strategy and is a core component of the current Growth and Transformation Plan (GTP II, 2015-2020). This plan emphasises that economic structural transformation is central for sustainable growth and development in Ethiopia.

The proposed Project will be an important source of foreign currency inflows and taxes, as well as creating significant direct and indirect employment in the region. As a large regional project the IAIP and RTC has the potential to act as a catalyst for development of the region.

4 PROJECT ALTERNATIVES

4.1 INTRODUCTION

An ESIA process is to include an analysis of reasonable alternatives to the proposed project such as alternative sites, routes, engineering options, layouts and technologies in terms of their potential Environmental and Social impacts, the feasibility of avoiding these impacts, and where this is not possible, the approach to mitigating the identified impacts.

There are two types of project alternatives, these are:

- Concept Level Alternatives which relate to site, technology and process alternatives; and
- Detailed Level Alternatives which related to working methods and mitigation measures.

The higher level concept alternatives are addressed in this section as detailed level alternatives are addressed through the identification and implementation of mitigation measures. The objective of the comparison of alternatives is to outline how the Project represents an optimised design that is technically and financially feasible whilst minimising overall environmental and social impacts.

4.2 CONSIDERATION OF ALTERNATIVES

Based on the project summary published by UNIDO in 2016 (UNIDO, 2016), the IAIPs were selected on the basis of six broad criteria as described below. It is noted that the issue of environment was not considered during the site selection process; this can be sited as a limitation of the feasibility and screening phases of the proposed Project.

4.2.1 AGRICULTURAL PRODUCTION POTENTIAL FOR STRATEGIC COMMODITIES

The key consideration for identifying alternatives is understanding what the primary agricultural products are in the Amhara Region, such as maize, sesame, potato, live animals (cattle, sheep, goats) dairy, meat, poultry and honey. Once this criteria was understood, the production potential for the region was calculated to assist in developing an understanding of the land requirements for the industrial park.

4.2.2 INTER-INDUSTRY LINKAGES AND TRIGGERING EFFECT

This consideration focused on the potential linkages with existing thriving industries that could trigger further industrial development. Specifically exportable cash crop commodities were identified to help in the site selection process.

4.2.3 INFRASTRUCTURE FACILITIES

Available infrastructure is an important consideration in the location and scaling of industrial parks. Therefore the presence of power, road network, water, railways, airport terminals and telecommunication infrastructure were taken into account.

- Power – Availability of power in the growth corridors was assessed based on the presence of power stations, sub-stations and transmission lines within or near the parks.
- Road network – Road network densities for the corridors were assessed by examining national road network data from official national zonal administration boundaries.
- Water – The availability of water was analysed for both agriculture and industrial processing by considering the mean annual rainfall, availability of river systems, availability of natural and artificial reservoirs, and groundwater potential.

- Railways, dry port, airport terminals and telecommunication – Railways and dry ports were evaluated considering the current and oncoming national networks/projects.

4.2.4 MARKET POTENTIAL

A viable market for the products and services available in the park is essential for the successful establishment and the long-term commercial viability of the park. The urban sector is assumed to be the prime market for industrial agro-processed products. Thus, the urban population size of each corridor and proximity of parks to urban centres was considered.

4.2.5 ACCESS TO COMMERCIAL AND SUPPORT SERVICES

Commercial and support services such as universities, research centres, technical vocational education and training centres; farmers' cooperatives and unions; and financial institutions are very important in providing services demanded by the park. Their proximity to the parks was considered.

4.2.6 CONCENTRATION OF ENTERPRISES AND ATTRACTIVENESS FOR INVESTORS

The existence of an industrial base and facilities such as import/export logistics, housing, recreation centres, schools and other social facilities are very important for attracting investors/manpower and retaining those that may establish firms or work within the Park. The density and proximity of these facilities was taken into account.

4.3 COMPARISON OF ALTERNATIVES

The original number and location of potential sites identified for the location of the Bure IAIP is unknown while it has been indicated that 26 initial sites were identified for the location of RTCs. This was limited to 7 sites following assessment. This process was undertaken at a high level and little documentation exists on the process and methods used to determine the most preferred site, as such the ESIA looks at the feasible alternatives for which information is available.

4.3.1 STRATEGIC ALTERNATIVES

As part of the feasibility studies, 17 agro-industrial growth corridors (AIGC) were identified. One IAIP is planned to be developed in each of the AIGCs. Based on the results of the feasibility studies, the development of IAIPs and RTCs will take place in two phases. The first implementation phase began in February 2016 and will see a total of four pilot IAIPs and 28 RTCs developed. The selected sites are in Southwest Amhara, Central Eastern Oromia, Eastern SNNP and Western Tigray.

4.3.2 SITE ALTERNATIVES

The site selection process was undertaken by the MoI in collaboration with the local authorities and MACE. The original number and location of potential sites identified for the location of the Bure IAIP is unknown while it has been indicated that 26 initial sites were identified for the location of RTCs. This was limited to 7 sites following assessment. This process was undertaken at a high level and little documentation exists on the process and methods used to determine the most preferred sites.

4.3.3 SITE LAYOUT ALTERNATIVES

Site layout alternatives have been considered for the Bure IAIP site. Following site selection, a site survey was undertaken to determine the sites opportunities and constraints. Based on the findings of the initial site screening assessment an initial site plan layout was prepared by MACE for the Bure IAIP (**Figure 4-1**). The initial site layout resulted in the full extent of the proposed footprint being developed.

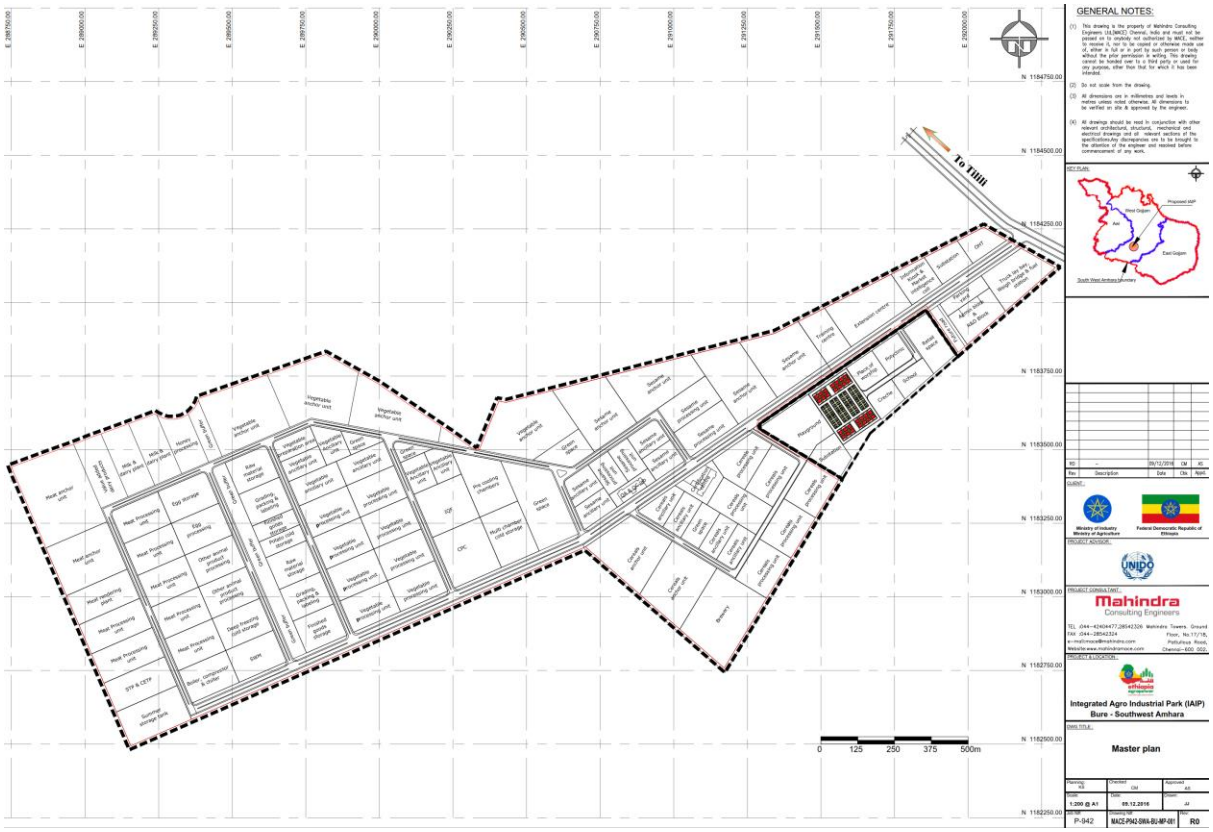

Figure 4-1: Initial site plan layout for the Bure IAIP

During the environmental site investigations undertaken in August 2017, by the ESIA team, it was identified that an extensive wetland system was located within the proposed IAIP footprint, extending form the north of the site to the south (**Figure 4-2**).

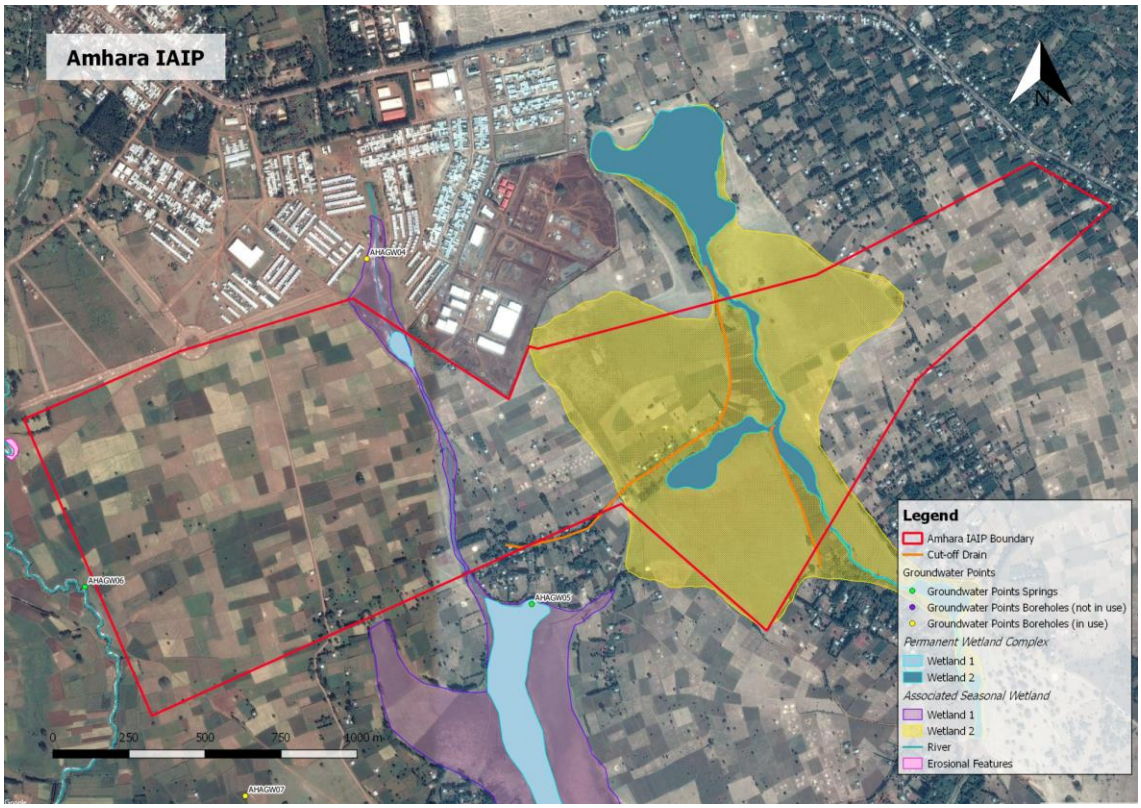

Figure 4-2: Wetland system within the proposed Bure IAIP footprint

Following the investigations it was recommended that this wetland system remain in-situ and the site plan design seek to incorporate this natural feature in order to limit the impact on the surrounding natural features and function of the system in providing water to farmers on the southern side of the site. A design review process was then undertaken by MACE which resulted in the amendment of the site layout plan to incorporate the identified wetland system into the site layout, with the inclusion of a green buffer area around the system. The amended site layout is the current design proposed for the Project.

4.3.4 TECHNOLOGY ALTERNATIVES

Various sewage treatment options were considered for the IAIP site. The sewerage treatment systems considered for selection are identified in **Table 4-1**.

Table 4-1: Sewage treatment systems considered.

No	Process	Units Required	Accessories
1	Activated sludge – extended aeration	Aeration tank and secondary clarifier	Surface aerators or membrane diffuser system for oxygen supply
2	Aerated lagoon	Earthen bund basins	Fixed or floating aerators for oxygen supply
3	Up-flow Anaerobic Sludge Blanket (UASB)	Reactor with liquid, solid and gas separation facilities	Gas collector, burner and influent distribution system
4	Trickling Filters	Circular tanks with media, under drain and secondary clarifier	Rotary distributor for influent and re-circulation pumps
5	Rotating Biological Contractors (RBC)	Trough with PVC/plastic discs, secondary clarifier	Drive mechanism for rotating the discs
6	Fluidized aerobic bio reactor	Reactor tank with poly propylene media & diffusers followed by secondary clarifier	Blowers for supply of oxygen through membrane diffusers
7	Sequencing Batch Reactor (SBR)	It uses deep RCC basins, and very efficient oxygen transfer equipment's (diffused aeration mechanism)	Diffusers, blowers and aeration grid, which provides highest aeration and oxygen transfer efficiency. Decanter assembly in Stainless steel equipped with variable frequency drive to automatically control rate of decanting based on input feed condition.
8	Membrane Bio Reactor (MBR)	Aeration tanks followed by balancing tank and membrane bio reactor	Diffusers, blowers to supply oxygen, air compressors for backwashing, chemical dosing for pre-treatment.

Factors that were considered in the selection of an appropriate treatment system included:

- Reliability;
- Vector nuisance;
- Area availability;
- Power requirement;
- Capital cost; and

- Operation and maintenance cost.

Overall the SBR system (Option 7) was identified as the preferred option as it has the lowest construction costs although the mechanical instrumentation cost is higher. In addition, the operating costs are low but this will depend on the inflow capacity of the system. The SBR system has very minimal fouling with a constant output quality. Furthermore, the system is partially automatic with low power requirements.

4.3.5 ACCESS ALTERNATIVES

BURE IAIP

During consultation it was identified that the development of the IAIP and associated boundary wall will result in a main access road and several foot paths being obstructed. These access routes are utilised by the local communities residing to the south of the IAIP site, on a daily basis, to gain access to services in Bure such as schools, medical facilities, markets etc. **Figure 4-3** indicates the access routes across the IAIP site that will be obstructed by the development.

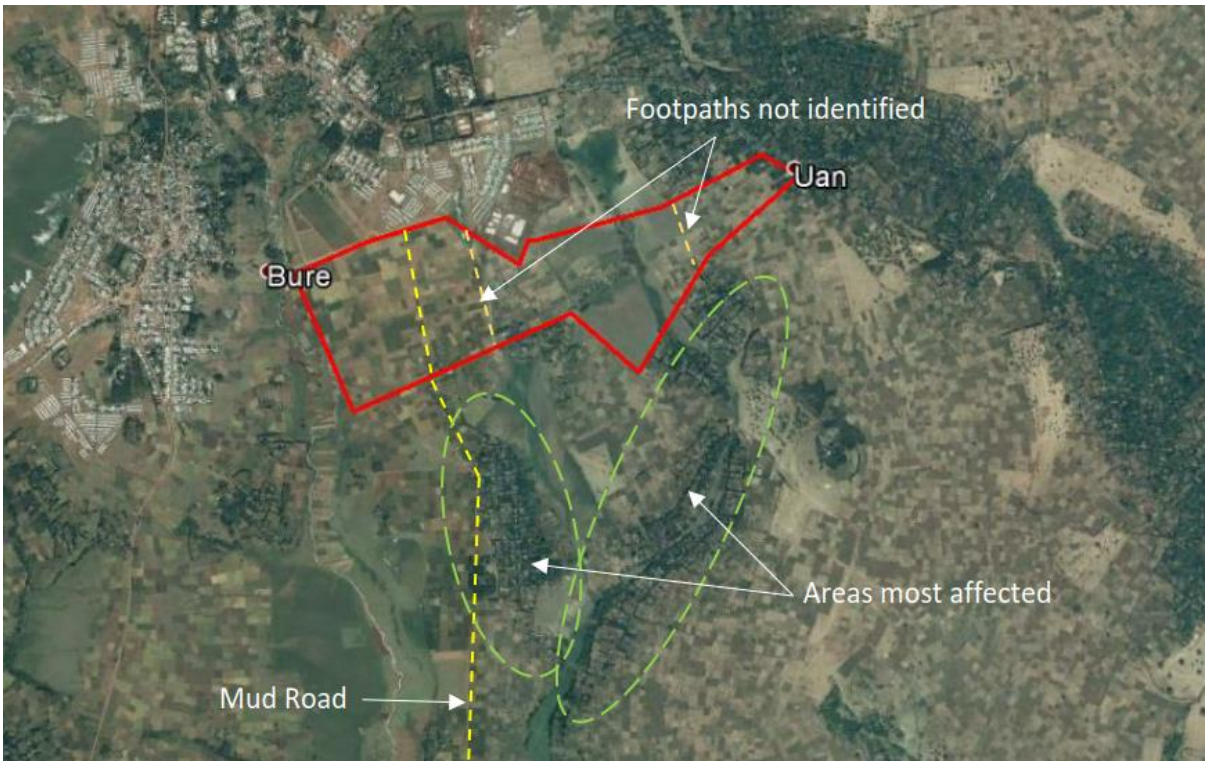

Figure 4-3: Image showing access routes across the IAIP site that will be obstructed

An alternative access road is being proposed to wrap around the western edge of the IAIP site connecting the communities in the south with those in the north. **Figure 4-4** indicates the proposed access road (yellow dashed line) from the existing gravel road from the south of the site, around the western boundary of the IAIP to connect to the existing gravel road at the North West corner of the site. This road will be a permanent engineered road resulting in an improved access road.

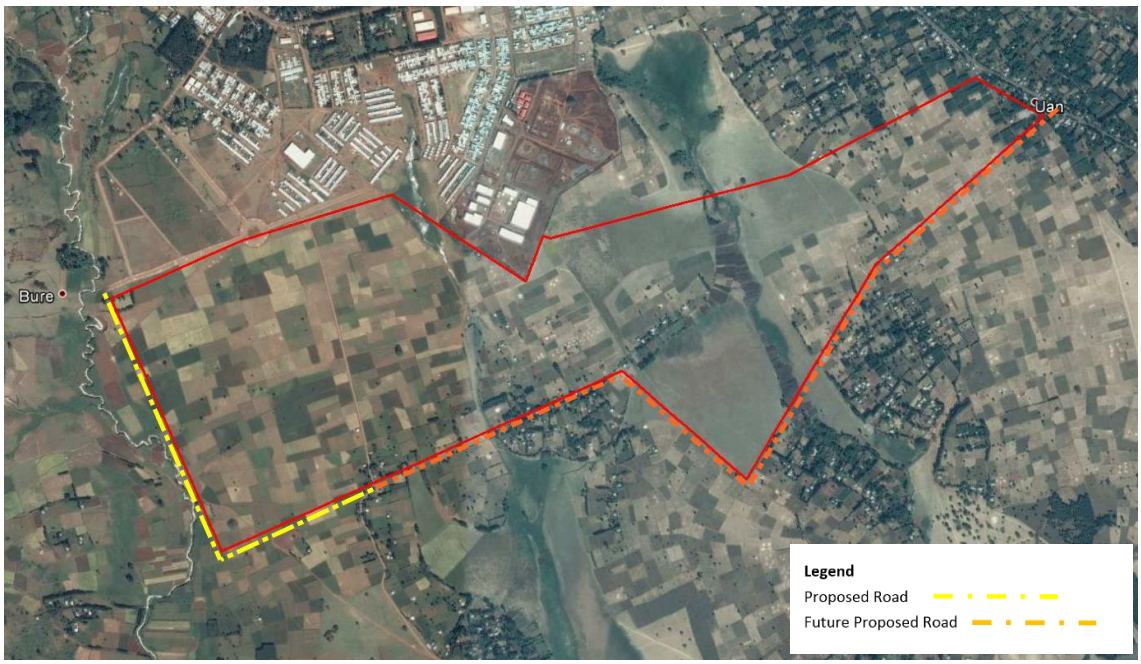

Figure 4-4: Image showing proposed access routes around the IAIP site.

It is further noted that an additional stretch of road is being proposed along the south eastern boundary of the site. It is understood that this section of road is intended to be a temporary gravel road to provide access for the communities to the highway at the eastern boundary of the IAIP. This section of road was only recently proposed, therefore full details of this proposed road are not yet finalised. As such this section of road has not been included in the ESIA assessment.

MOTTA RTC

During consultation it was identified that the development of the RTC and associated boundary wall has resulted in an access road, utilised by communities residing to the north east of the site, being obstructed. This access route was utilised by the local communities, on a daily basis, to gain access to services in Motta such as schools, medical facilities, markets etc. **Figure 4-5** indicates the access routes across the IAIP site that will be obstructed by the development.

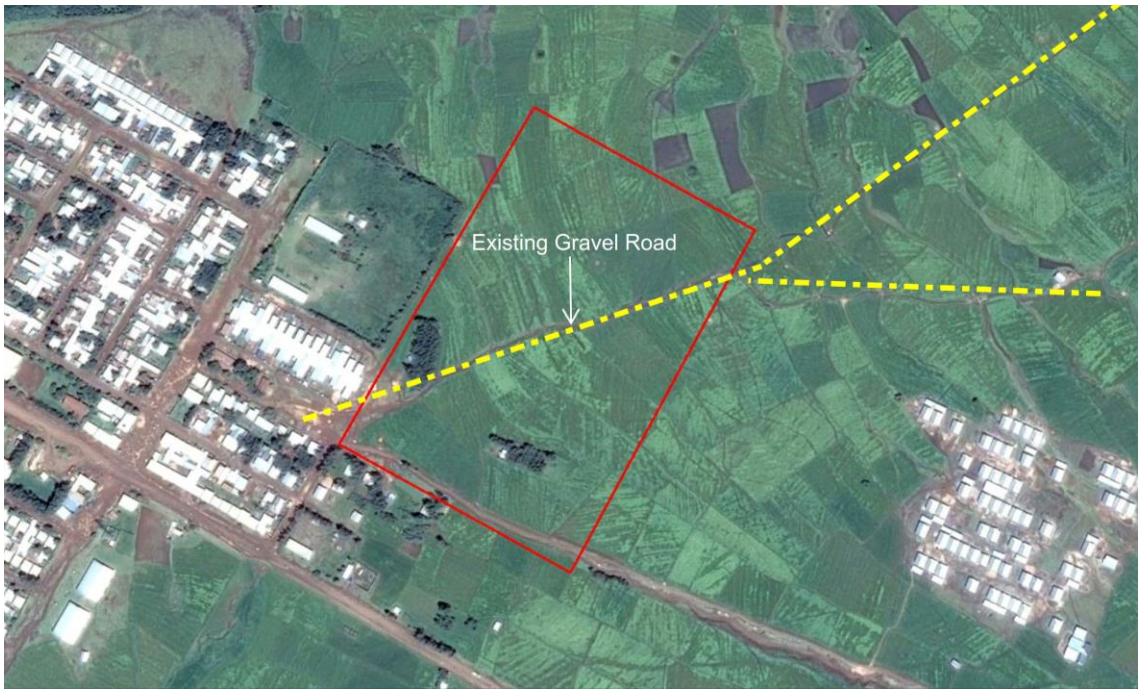

Figure 4-5: Image showing access routes across the RTC site that will be obstructed

An alternative access road is being proposed to connect the existing roads / gravel tracks to the highway on the south eastern side of the site. The proposed road forms part of the local administrations plans in terms of future development in the area as new residential areas are proposed to be established towards the north east of the RTC site (**Figure 4-6**).

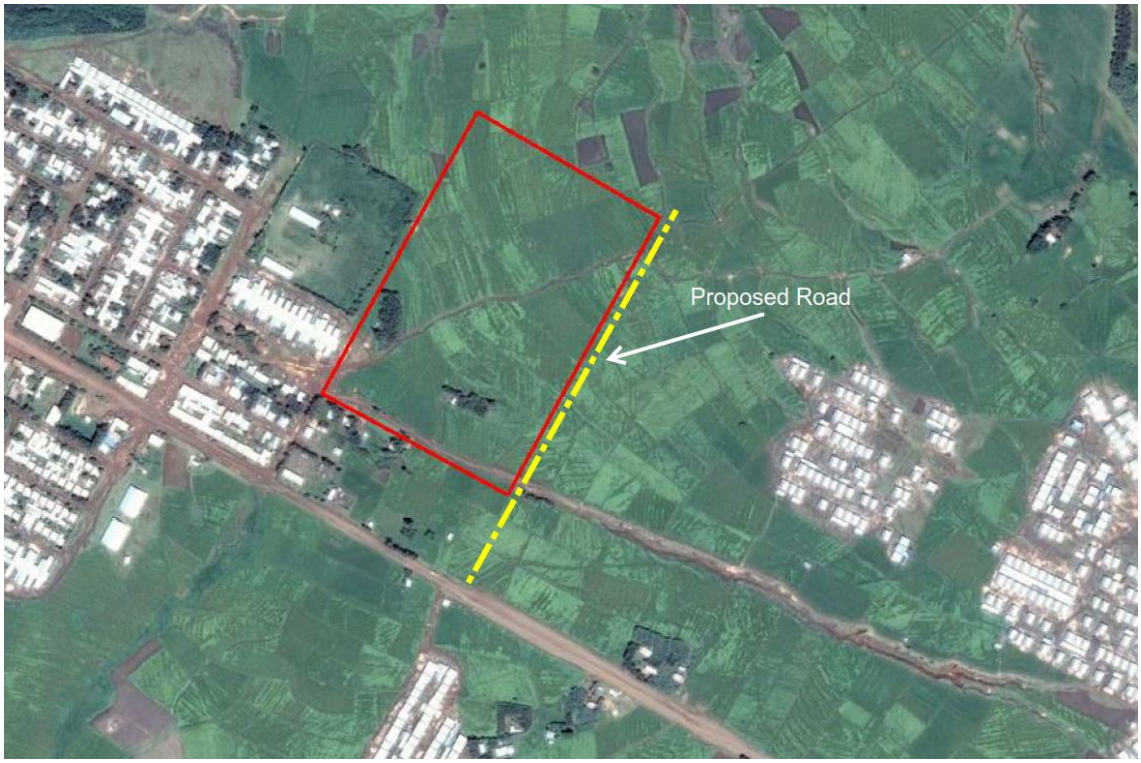

Figure 4-6: Image showing proposed access road

4.3.6 NO-GO ALTERNATIVE (I.E. THE PROJECT IS NOT ESTABLISHED)

In the event of abandonment of the Project, especially because it requires investment from international financial institutions, it could send a negative message to other international investors as to the capacity of the FDRE to accommodate this type of industrial park project. In turn this could reduce the take up and success of other mega projects being planned / implemented in Ethiopia.

Without the Amhara IAIP and RTC project, economic development of the Amhara Region will be compromised in the short term. The Ethiopian Agricultural sector's potential to support the next generation will remain constrained as a result of restrictions in available land and limited diversity of income sources. The lack of industrialisation of the agricultural sector will limit the revenue base which would leave the GDP of the country still heavily dependent on the agricultural sector.

Finally, without the Project, there would be no additional impacts, either positive or negative, on the physical, biological and social environments, although existing pressures on resources and infrastructure will continue, in some cases leading to the deterioration of the quality of life for future generations. Since the ESIA demonstrates that the overall balance of impacts is positive, primarily as a result of the employment opportunities for the current and future generations and the anticipated contribution these projects will make to the Ethiopian GDP. Therefore the abandonment of the Project would deprive the country and local communities of these benefits. Job creation expected during the construction and operational phases, as well as the positive outfalls on the health and education sectors would also not materialise.

5 LEGAL FRAMEWORK

This Chapter provides a high-level overview of the institutional and legislative framework for the ESIA associated with the proposed Project.

5.1 INSTITUTIONAL FRAMEWORK

As per Chapter 2 the proposed Project is located in in the South Western Amhara Region with the IAIP located in the West Gojjam Zone and the RTC located in the East Gojjam Zone.

The current system of government in Ethiopia is organised into a federal structure, comprised of the federal government, nine regional states and two city administrations. EIA administration in Ethiopia is shared between the federal government and regional states. The Environmental Protection Organs Establishment Proclamation (295/2002) established the institutions responsible for the enforcement and regulation of EIAs; these include the Federal Ministry of Environment, Forestry and Climate Change (MEFCC,) Regional Environmental Agencies and the Sector Environmental Units. In addition the delegated sector Ministries which, through Federal MEFCC delegation, have been assigned the dual role of ensuring timely and effective enforcement for preparation of sector specific EIAs authorised/licensed at Federal level as well as of reviewing EIA reports.

FEDERAL MINISTRY OF ENVIRONMENT, FORESTRY AND CLIMATE CHANGE

Ministry of Environment, Forest and Climate Change is the lead agency responsible for formulating policies, strategies, laws and standards to ensure social and economic development activities sustainably enhance human welfare and safety of the environment (Article 6, Proclamation 295/2002). The enforcement and administration of EIAs is one of the key responsibilities entrusted to the MEFCC. In this respect, the MEFCC is responsible for establishing and updating the system for undertaking EIAs in public and private sector projects. The Federal MEFCC is responsible for developing directives that identify categories of projects likely to generate adverse impacts and require a full EIA, and for issuing guidelines that direct preparation and evaluation of EIA reports (Proclamation 299/2002, Articles 5 and 8). As per proclamation 916/2015, the MEFCC have bestowed among others with the following powers and duties:

- Coordinate activities to ensure that the environmental objectives provided under the Constitution and the basic principles set out in the Environmental Policy of the Country are realised;
- Establish a system for evaluating and decision making, in accordance with the Environmental Impact Assessment Proclamation, the impacts of implementation of investment programs and projects on environment prior to approvals of their implementation by the concerned sectoral licensing organ or the concerned regional organ;
- Coordinate actions on soliciting the resources required for building a climate resilient green economy in all sectors and at all Regional levels; as well as provide capacity building support and advisory services;
- Establish an environmental information system that promotes efficiency in environmental data collection, management and use;
- Enforcing and ensuring compliance to the EIA proclamation which currently is being implemented through delegated authority provided to sector ministries;
- Reviewing EIAs and monitoring the implementation of EIA recommendations which is also in part being implemented through delegated authority provided to sector ministries;
- Regulating environmental compliance and developing legal instruments that ensure the protection of the environment;
- Ensuring that environmental concerns are mainstreamed into sector activities; and
- Coordinating, advising, assessing, monitoring and reporting on environment-related aspects and activities.

In addition, the Federal MEFCC is responsible for evaluating EIA reports of projects that need to be licensed and executed by the federal government and projects that are likely to generate inter-regional impacts. The Federal MEFCC is also responsible for monitoring and auditing the

implementation and performance of such projects. The Federal MEFCC holds primary responsibility for providing technical support on environmental protection and management to regional states and sector institutions

REGIONAL ENVIRONMENT, FOREST AND CLIMATE CHANGE BODIES

Proclamation 295/2002 requires regional states to establish or designate their own regional environmental agencies. The regional environmental agencies are responsible for coordination, formulation, implementation, review and revision of regional conservation strategies as well as environmental monitoring, protection and regulation (Article 15).

Relating to EIA specifically, Proclamation 299/2002 gives regional environmental agencies the responsibility to evaluate EIA reports of projects that are licensed, executed or supervised by regional states. Regional environmental agencies are also responsible for monitoring, auditing and regulating implementation of such projects.

SECTOR ENVIRONMENT UNITS:

The other environmental organs stipulated in the Environmental Protection Organs Establishment Proclamation (295/2002) are 'Sector Environmental Units' which have been established in some of the line Ministries. These Sector Environment Units have the responsibility of coordinating and implementing activities in line with environmental protection laws and requirements (Article 14, Proclamation 295/2002). To this end, Sector Environmental Units play an important role in ensuring that EIA is carried out on projects initiated by their respective sector institution.

DELEGATED AUTHORITY:

The MEFCC has delegated authority to sector institutions to ensure implementation of EIAs in their sector and to undertake EIA reviews. For instance, the Federal Ministry of Industry, Agriculture, Mining as well as Water, Energy and Irrigation are responsible for ensuring that an EIA is undertaken on their sectoral projects and to review the EIA.

5.2 POLICY AND LEGAL FRAMEWORK IN ETHIOPIA

The following policies and legal frameworks are identified to be relevant to the proposed Project and associated ESIA.

- Constitution of the Federal Democratic Republic of Ethiopia (1995), specifically Articles 43, 44 and 92 as well as Article 40.
- Environmental Policy of Ethiopia (1997).
- Environmental Impact Assessment Proclamation (299/2002), which makes EIAs a mandatory requirement for the implementation of major development projects, programs and plans in Ethiopia.
- Ethiopian Water Sector Policy (2001), whereby the Ministry of Water, Irrigation and Electricity will need to be consulted with regards to what water permitting/licensing requirements will be necessary for the successful implementation of the proposed Project.
- Water Resources Management Proclamation (197/2000). For the protection of water resources (both surface- and groundwater) of Ethiopia.
- Water Resources Management Regulation (115/2005), which provides detailed provisions for the effective implementation of its parent legislation, the Water Resources Management Proclamation.
- Water Resources Utilisation Proclamation (92/1994), regulating the use of water resources, by requiring a government permit in respect of most water uses.
- River Basin Councils and Authorities Proclamation (534/2007), for the promotion and monitoring of integrated water resources management for Ethiopia's river basins.
- Environmental Pollution Control Proclamation (300/2002), which restricts release of gaseous, liquid or solid wastes to the environment exceeding the environmental standards and advocates a "polluter pays" policy.

- Prevention of Industrial Pollution Council of Ministers Regulation (159/2008), which is directed to detail the implementation of pollution control proclamation with focus on industry.
- Solid Waste Management Proclamation 513/2007, which aims to promote community participation to prevent adverse impacts and enhance benefits resulting from solid waste management.
- Policy for Rural Development (2003), given the dominance of agriculture in the Ethiopian economy, the rural development effort is presently associated with agricultural development. In order to facilitate agricultural development, there is a need to undertake rural infrastructure and social development programmes.
- Labour Proclamation (377/2003) as amended, requiring that the employer takes the necessary measures to adequately safeguard the health and safety of their workers.
- Public Health Proclamation (200/2000), which disallows the discharge of untreated effluent waste generated from septic tanks, seepage pits and industries into water resource. It also prohibits the disposal of solid or liquid wastes or any other waste in a manner which contaminates the biophysical, physical or social environments.
- The Federal Democratic Republic of Ethiopia Rural Land Administration and Land Use Proclamation (456/2005), which applies to all rural land in Ethiopia. The proclamation aims to conserve and develop natural resources through the development of and implementation of sustainable land use planning.
- Payment of Compensation for Property Situated on Landholding Expropriated for Public Purposes Regulation (135/2007), which provides a formal approach for the payment of compensation and to assist livelihood restoration for displaced persons.
- Accession to African Human and People's Rights Charter Proclamation (114/1998), formalising the Ethiopian Governments support for regional and international efforts to achieve normative standards for basic human rights.
- Convention for the Safeguarding of the Intangible Cultural Heritage Ratification Proclamation (484/2006), which formalises the adoption of the Convention for the Safeguarding of the Intangible Cultural Heritage in Ethiopia at the General Conference of the United Nations Educational, Scientific and Cultural Organisation in Paris on 17 October 2003. The Ethiopian Government ratified the said Convention on 24 January 2006.

5.3 SPECIFIC LEGAL FRAMEWORK FOR INDUSTRIAL PARKS IN ETHIOPIA

The legal instruments identified below have been specifically developed for the purposes of providing National controls and regulations to all industrial parks developed in Ethiopia. The IAIP developments will therefore be governed by this legal framework.

5.3.1 INDUSTRIAL PARK PROCLAMATION NO. 886/2015.

The Industrial Park Proclamation No. 886/2015 defines an industrial park as being an area with a distinct boundary designated by the appropriate organ to develop comprehensive, integrated, multiple or selected functions of industries, based on a planned fulfilment of infrastructure and various services such as road, electric power and water. These parks are intended to be a 'one stop shop'. The proclamation then identifies the key role players as the 'Industrial Park Developer', 'Industrial Park Operator' and the 'Industrial Park Enterprise'. Before any of these entities can commence with any construction or operation of a business or enterprise within the park they will require an 'Investment Permit' issued by the commissioner. This permit will allow the Industrial Park Developer, Operator or Enterprise to carry out industrial park development related activities.

In terms of Article 6(4) of the proclamation the Industrial Park Developer is required to adhere to the performance requirements for the phased development of the industrial park as well as any financial obligations and time schedules for financial and debt financing, specified in the permit. The Developer will also be required to comply with other obligations specified in the Proclamation, the Regulation (see below), environmental protection legislation and other applicable laws. The Industrial Park

Operator is obliged to meet the permit terms. Article 8(6) states that the Industrial Park Operator is also obligated to comply with social and environmental as well as any other obligations as provided for in this Proclamation, the Regulation, applicable laws and its permit or agreement.

Article 10(4) obligates the Industrial Park Enterprise to comply with this Proclamation and the Regulation in general and the environmental, social and employer obligations in particular contained therein and in other applicable laws. Article 28(1) states that the Labour Proclamation No 377/2003 (as amended) shall be applicable in any industrial park.

Article 24(2) requires the MEFCC to establish offices within the industrial parks for the application, supervision, protection and enforcement of environmental norms and standards, safeguards, management and mitigation plans within the industrial parks.

Article 28(5) requires the Ministry of Industry to facilitate technology transfer and skills development in general and domestic manufacturing sector capacity building in particular mainly through clustering and other best practice approaches.

This Proclamation does provide an avenue for enforcement of compliance with the contents of the Proclamation in that Article 30(a) allows for the issuance of a reprimand, suspension and revocation of the permit.

5.3.2 INDUSTRIAL PARKS COUNCIL OF MINISTERS REGULATIONS NO. 417/2017.

The Industrial Parks Council of Ministers Regulation provides more detailed requirements in relation to Industrial Parks. Article 5(5) states that 25% of the land set aside for the industrial park may not be developed. All land to be used for the purposes of factories, buildings, facilities for common use, infrastructure, residence and related buildings within the industrial parks area shall neither be less than 50% nor exceed 75% of the land under possession. Article 5(8) requires that an ESIA be undertaken and the necessary certificate received from the competent authority. Article 9(2) states that an environmental impact assessment report is required before an investment permit can be issued.

The Regulation also places controls over construction activities by requiring in Article 11(7) for the Commission to oversee and ensure construction of an enterprise confirms with the relevant laws.

Article 18(1) requires the Ministry of Industry and other relevant organs to make sure that industrial parks recruit workers, foster skills development and transfer, and transfer and upgrading of technology; they shall also ensure supply and render support in regard to the realisation of these. Article 18(2) requires that the Ministry of Industry shall design training programs that enable transfer of skills and knowledge to Ethiopian workers.

5.4 NATIONAL STRATEGIES AND PLANS

The following national strategies and plans have been identified to be relevant to the proposed Project and associated ESIA.

- Conservation Strategy of Ethiopia;
- Ethiopia’s Climate-Resilient Green Economy Strategy
- National Growth and Transformation Plan II; and
- Ethiopian Agro-Industry Sector Strategy.

5.5 NATIONAL STANDARDS, DIRECTIVES AND GUIDELINES

The following national standards, directives and guidelines have been identified to be relevant to the proposed Project and associated ESIA.

- Environmental Standards for Industrial Pollution Control in Ethiopia - These standards present pollution limits for emissions to (i) atmosphere, (ii) water resources and (iii) noise emissions for 12 identified industrial sectors.
- EIA Directive No. 1/ 2008, A Directive to Determine Projects Subject to Environmental Impact Assessment - The directive lists the various activities that require the undertaking of an EIA prior to the commencement of that specific activity. This includes the construction of tanneries, abattoirs, industrial waste disposal facilities and industrial zones.
- Draft Guideline for Environmental Management Plan for the Identified Sectorial Developments in the Ethiopian Sustainable Development & Poverty Reduction Programme (ESDPRP), May 2004 - The guideline outlines the necessary measures for the preparation of an EMP for proposed developments in Ethiopia and the institutional arrangements for implementation of EMPs.
- EIA Guideline, July 2000, - This guideline provides a background to environmental impact assessments and environmental management in Ethiopia.
- The Federal Environmental Protection Authority, Environmental Assessment Reporting Guide, 2004, Addis Ababa - The guideline provides a standardised reporting framework for environmental assessments. It is however the responsibility of proponents and associated assessors to ensure that sufficient information is included in environmental assessments and that this information is forwarded onto all concerned and interested environmental agencies for review and consideration.

5.6 REGIONAL PLANS

Regional plans are to be reviewed and taken into consideration when developing mitigation / management measures during the ESIA process. Regional plans should align with national development plans to ensure project sustainability.

5.7 INTERNATIONAL CONVENTIONS, PROTOCOLS AND AGREEMENTS

Ethiopia is signatory to a number of international conventions and agreements, and in certain cases these have influenced the development of policies, guidelines and regulations. The ESIA will need to consider these conventions and agreements and ensure compliance during the planning, construction and operation phases of the proposed Project.

The following international conventions and protocols, to which Ethiopia is a signatory, are to be considered:

- International Labour Organisation (ILO) Forced Labour Convention, 1930 (No. 29)
- ILO Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
- ILO Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- ILO Equal Remuneration Convention, 1951 (No. 100)
- ILO Abolition of Forced Labour Convention, 1957 (No. 105)
- ILO Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- ILO Minimum Age Convention, 1973 (No. 138)
- ILO Worst Forms of Child Labour Convention, 1999 (No. 182)
- ILO Right of Association (Agriculture) Convention, 1921 (No. 11)
- ILO Tripartite Consultation (International Labour Standards) Convention, 1976 (No. 144)
- The United Nations Convention on the Rights of the Child, 1990
- The Stockholm Convention on Persistent Organic Pollutants;
- Convention on Biological Diversity;
- The United Nations Framework Convention on Climate Change, 1992;

- The United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa;
- The United Nations Convention for the Safeguarding of the Intangible Cultural Heritage;
- The United Nations Convention on the Protection and Promotion of the Diversity of Cultural Expressions;
- The United Nations Convention Concerning the Protection of World Cultural and National Heritage;
- The Vienna Convention for the Protection of the Ozone Layer;
- Montreal Protocol on Substances that Deplete the Ozone Layer;
- The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade;
- Libreville Declaration on Health and Environment in Africa;
- The United Nations Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora, 1973;
- The United Nations Convention on Biological Diversity (Rio Convention), 1992; and
- RAMSAR Convention on Wetlands of International Importance.

5.8 INTERNATIONAL GUIDELINES AND STANDARDS

5.8.1 OVERVIEW

Environmental and social impacts as well as sustainability are key principles for many international financing organisations. Various guidelines and standards exist, each varying in the areas of focus and level of detail required, with regards to environmental and social requirements for proposed projects. These include the AfDB Integrated Safeguards System, World Bank Group (WBG) Operational Policies and Environmental, Health and Safety (EHS) Guidelines as well as the International Finance Corporation (IFC) Performance Standards.

Each of these above guidelines and standards cover essentially the same scope (environmental, labour, social, health and safety, supply chain etc.) The AfDB has their own integrated safeguards system based on the IFC standards, but exclude the extensive and detailed guidance notes for their standards. This typically provides more flexibility (and less stringency) in application of their standards.

In broad terms all multilateral development banks include key common features in their safeguards in that they all require an environmental and social assessment, they all address the issue of involuntary resettlement, pollution prevention, biodiversity, indigenous peoples, and cultural heritage. There is some variation in relation to the level of inclusion by some banks of important social issues such as community impacts and labour conditions and environment flows.

The World Bank and IFC requirements are broadly identical. The primary differentiation is that the World Bank applies to projects where funding is going to government-affiliated projects/lenders (including parastatals), whereas IFC applies to funding going to pure private sector borrowers. The Ethiopian Government in collaboration with UNIDO have elected to apply the African Development Bank Policy package as the regulatory framework for the ESIA to follow.

The following sections identify the relevant AfDB Integrated Safeguards System which is applied to projects to promote growth that is socially inclusive and environmentally sustainable. The purpose of the safeguards is to avoid adverse impacts of projects on the environment and affected people while maximising potential development benefits. Where avoidance is not possible mitigation and compensation should be implemented to manage the environmental and social risks.

5.8.2 AFRICAN DEVELOPMENT BANK INTEGRATED SAFEGUARD SYSTEM

The AfDB adopted the Integrated Safeguard System (ISS) as a tool for identifying risks, reducing development costs and improving project sustainability. The ISS promotes best practices in these areas but also encourages greater transparency and accountability and protects the most vulnerable communities. The AfDB encourages member countries to observe international human rights norms, standards, and best practices on the basis of their commitments made under the International Human Rights Covenants and the African Charter of Human and Peoples' Rights.

The AfDB ISS builds on the two previous safeguard policies, Involuntary Resettlement (2003) and Environment (2004), and on three cross-cutting policies and strategies: Gender (2001), the Climate Risk Management and Adaptation Strategy (2009) and the Civil Society Engagement Framework (2012). The bank has now adopted five Operating Safeguards (OSs) to achieve the goals and the optimal functioning of the Integrated Safeguards System (ISS). These OSs are:

- **Operation Safeguard 1**: Environmental and Social Assessment: this is an overarching safeguard of determining a projects environmental and social category and the resulting environmental and social assessment requirements.
- **Operational Safeguard 2**: Involuntary resettlement land acquisition, population displacement and compensation: this consolidates policy commitments and requirements contained in the Bank's policy on involuntary resettlement, and incorporates a number of refinements designed to improve the operational effectiveness of those requirements.
- **Operational Safeguard 3**: Biodiversity and ecosystem services: this seeks to conserve biological diversity and promote the sustainable use of natural resources with a focus on integrated water resources management in operational requirements.
- **Operational Safeguard 4**: Pollution prevention and control, hazardous materials and resource efficiency: this covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting. The Bank's new screening tool for climate change risk helps in screening and categorising a project in terms of its vulnerability to the risks of climate change.
- **Operational Safeguard 5**: Labour conditions, health and safety: this relates to workers conditions, rights and protection from abuse or exploitation.

The AfDB requires that an assessment be conducted according to the principles of proportionality and adaptive management. Therefore the level of assessment and management required should be proportionate to the level of risk that the project poses. This is determined through the project categorisation and scoping phase. Project categorisation follows the principle of using the appropriate type and level of environmental and social assessment for the type of operation. A Category 1 project is likely to cause significant environmental and social impacts and therefore must subject to a full ESIA process, whereas a Category 2 project is likely to cause less adverse environmental and social impacts and a simplified ESIA is applicable (AFDB, 2015).

The AfDB therefore categorises projects based on the anticipated significance of environmental and social impacts. One defining factor revolves around the level of resettlement a project is anticipated to result in. Where a project will involve 200 or more persons or the project is likely to have an adverse effect on vulnerable groups then the project will require a Full Resettlement Action Plan and is deemed a Category 1 Project. Where a project will displace fewer than 200 people and where land acquisition and potential displacement and disruption of livelihoods are less significant, then the project is deemed to be a Category 2 Project.

The proposed Amhara Project, including the Bure IAIP and Motta RTC, will result in 369 PAPs being affected by the proposed development and therefore the development is considered a **Category 1 Project** and is therefore undergoing a full ESIA assessment process.

The AfDB standards do not provide detailed guidelines on methodological requirements in some specialist areas and therefore in such cases the South African standards have been applied as these are more aligned with the IFC standards and are therefore considered to suitably meet international good practice.

6 THE ESIA PROCESS

The Environmental and Social Impact Assessments (ESIAs) and Resettlement Action Plans (RAPs) will be undertaken to African Development Bank (AfDB) requirements. AfDB requires that the level of assessment undertaken should be proportionate to the level of risk that the project poses. The AfDB therefore categorises projects based on the anticipated significance of environmental and social impacts. The defining factor revolves around the level of resettlement a project is anticipated to result in. Where a project will involve 200 or more persons or the project is likely to have an adverse effect on vulnerable groups then the project will require a full RAP and is deemed a Category 1 Project. Where a project will displace fewer than 200 people and where land acquisition and potential displacement and disruption of livelihoods are less significant, then the project is deemed to be a Category 2 project.

The Amhara IAIP and RTC site is considered a **Category 1** project based on the number of people affected by the Project. A Category 1 project must have a full ESIA process undertaken. The key steps to an AfDB ESIA are presented below.

6.1 SCOPING PHASE

The purpose of the scoping phase is to detail the key sensitivities and activities that have the potential to contribute to, or cause, potentially significant impacts to environmental and socio-economic receptors and resources and to evaluate siting, layout and technology alternatives for the proposed project.

The key objectives of the scoping phase were to:

- Identify and detail the potentially most significant impacts;
- Obtain stakeholder views through consultation; and
- Develop the Terms of Reference (ToR) for the ESIA through consultation so as to ensure that the process and output are focused on the key issues.

6.1.1 STAKEHOLDER ENGAGEMENT

The key principle of consultation is to ensure that the views of stakeholders are taken into account and reported throughout the ESIA process. The objective is to ensure the assessment is robust, transparent and has considered the full range of issues or perceptions, and to an appropriate level of detail.

Stakeholders include those individuals, groups or organisations who themselves could be directly affected by the proposed Project (Project Affected People) and those individuals or organisations who, although not directly affected by the proposed Project, represent those affected or have a regulatory duty, an interest, influence or secondary involvement in the proposed Project (secondary stakeholders).

Stakeholder engagement commenced with the IPDC having undertaken discussions with Project Affected People (PAPs) and carried out a census and asset inventory survey to inform the relocation and compensation process.

During the site investigation stage, stakeholder engagement meetings were undertaken by the ESIA team to provide detailed information about the Project to the community as well as to obtain feedback from the local community in terms of the Project. The findings from the stakeholder engagement process undertaken to date are presented in Chapter 7 of the Report and reflected in the minutes of the stakeholders and community consultation meetings (attached in **Appendix B**).

Stakeholder engagement is to continue throughout the ESIA process ensuring that legislative requirements and Project standards are met, that stakeholder concerns are addressed in the assessment and that sources of existing information and expertise are identified.

6.1.2 BASELINE DATA COLLECTION

One of the main objectives of the Scoping stage of the ESIA process is to collect suitable data on the physical, biophysical and social environment, so as to understand what receptors and resources have the potential to be significantly affected by the proposed Project. The data will also describe the baseline conditions of the environment that will be used during the impact assessment phase for both social and environmental impacts.

Site investigations were undertaken by the consultant from 19 August 2017 to 20 September 2017. The findings of the site investigations, and description of the baseline environment of the sites, are presented in Chapters 8 of the Report.

6.1.3 INTERACTION WITH DESIGN AND DECISION-MAKING

Interaction between the ESIA team and the design and decision-making process is one of the key areas in which an ESIA can influence how a project develops. It includes involvement in defining the Project and identifying those activities with the potential to cause environmental and socio-economic impacts (e.g. site clearing, noise, traffic, relocation, local employment).

Project planning, decision-making and refinement of the Project description are to continue throughout the assessment process as a result of the development of the proposed Project and in response to the identified impacts. This process has the potential to alter the site layout, processes or technology identified to prevent or, where prevention is not possible, mitigate identified impacts.

6.1.4 SCOPING REPORT

The steps detailed above are captured within a Scoping Report (dated November 2017). The Scoping Report included the terms of reference for the ESIA based on the baseline environment and the potential impacts identified. The Scoping Report provided recommendations in terms of the scope of the ESIA and the methods to be used to determine the significance of potential impacts. The Scoping Report was submitted to the MEFCC for approval on 6 December 2017.

6.2 IMPACTS ASSESSMENT PHASE

6.2.1 IMPACT DESCRIPTION AND DEFINITION

IMPACT DEFINITION

Environmental impacts from planned and non-planned activities during all phases of the Project are assessed on the basis of detailed knowledge and industry experience of these activities. For the purpose of this ESIA an environmental or socio-economic impact is defined as:

"*Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities or services*." (ISO 14001)

Prediction of impacts is an objective exercise to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in scoping, the impacts to the various resources/receptors are elaborated and evaluated. The diverse range of potential impacts considered in the impact assessment process typically results in a wide range of prediction methods being used, including quantitative and semi quantitative techniques, for example noise impacts on sensitive surrounding community receptors, and qualitative techniques for assessing certain socio-economic impacts on communities.

DESCRIPTION OF IMPACTS

Environmental impacts arise as a result of Project activities either interacting with environmental or social receptors directly, or causing changes to the existing environment such that an indirect effect occurs.

Environmental and social impacts from a planned event are those resulting from the routine and intended construction or operations/activities associated with the IAIP and RTC facilities (e.g. regular truck movements to and from the facilities transferring produce to market). Environmental and social impacts from unplanned events occur as a result of incidents or 'upset conditions'. Typical examples of impacts occurring from unplanned events include (but are not limited to) spills, leaks, odours and fires.

NATURE OF IMPACT

The nature of an impact is defined as the type of change from baseline conditions. The nature of an impact is described as being either **positive (+ve)** or **negative (-ve)**.

TYPE OF IMPACT

Impact type indicates the relationship of the impact to the Project activity in terms of cause and effect, as either:

- **Direct impact** resulting from the direct interaction between a project activity and the receiving environment; or
- **Indirect impact** which include secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements);or
- **Cumulative impact**; where a Project impact acts together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

SCALE OF IMPACT

Impact extent relates to the geographic reach of the impact and is described as:

- **Local impact** would affect local resources or receptors and would be restricted to a single community (i.e. impacts in the footprint of Project activities and the immediate adjacent area);
- **Regional impact** would affect regional resources or receptors and would be experienced at a regional scale;
- **Trans-boundary impact** would be those that are experienced in one country as a result of activities in another.

DURATION OF IMPACT

Impact duration refers to the time period over which a resource or receptor will be affected, and includes:

- **Temporary impacts** would be of a very short duration, are reversible and intermittent or occasional in nature. The resource or receptor would return to the previous state when the effect ceases or after a short period of recovery;
- **Short-term impacts** would last for a short duration (2 to 5 years) and are usually limited to the construction period. The impact would cease when the effect ceases following a short period of recovery;
- **Medium-term impacts** would last for over five years but less than fifteen years (5 to 15 years). The impact would cease following rehabilitation and a period of recovery;
- **Long-term impacts** would continue for an extended period of time (e.g. beyond 15 years), or cause a more permanent change in the affected receptor or resource that endures substantially beyond the Project lifetime.

PROBABILITY

The *probability* of an event occurring and creating an impact on a given receptor is designated using a qualitative scale from 1 to 4, the higher values being more probable that an impact will occur, see **Table 6-1** below.

Table 6-1: Probability rating of impact

Rating Scale	Description
1	**Unlikely** - very improbable, never heard of in the industry, or an event with a short duration (probably will not happen).
2	**Low probability** - incident has occurred in the industry and so therefore could occur, or an event lasting up to a day (some possibility, but low likelihood).
3	**Medium Probability** - incident has (or is) expected to occur during the project or is very likely to, or an event which may occur up to 1 month (distinct possibility).
4	**High probability** - incident is expected to happen frequently a year or is almost certain to happen, or an event which is expected to occur multiple times (most likely).

SEVERITY

The severity of an impact, on a given receptor is designated using a rating scale from 1 to 4 and defined in **Table 6-2** (Environmental Severity) and **Table 6-3** (Socio-economic Severity) below, the high values denoting a more severe impact.

Table 6-2: Definitions of Severity used in the ESIA for Environmental Receptors

Category	Environmental Receptors – Physical And Biological	
	Negative	**Positive**
4 - High	Major, long term national, international or transboundary effects. Deterioration/improvements of the existing habitat or ecosystem baseline conditions is significant. Rehabilitation is required or the baseline will not recover. Results in changes / reduction in the abundance and biodiversity of populations which may or may not recover. Such impacts are a major non-compliance with national and international regulatory standards and may result in immediate intervention by governmental bodies and stakeholders.	Baseline will be significantly improved by the project. Results in changes / increase in the abundance and biodiversity of populations. Exceed national and international regulatory standards in protection and creation of natural habitats.
3 - Medium	Moderate, medium term deterioration / impact on the ecosystem on a local / national level, leading to observable and measurable changes. Moderate deterioration / improvements and changes / reduction in the abundance and biodiversity of the area with moderate recovery periods to baseline conditions. Non-conformance with national and international regulatory standards which	Moderate, medium term rehabilitation of ecosystems or national significance, leading to observable and measurable changes. Moderate deterioration/improvements and changes / increase in the abundance and biodiversity of the area with moderate recovery periods to baseline conditions.

Category	Environmental Receptors – Physical And Biological	
	may result in the intervention by governmental bodies and stakeholders.	Conformance with national and international regulatory standards.
2 - Low	An effect will be experienced but they will be minor, short term and local, leading to observable and measurable changes recoverable within short durations. Potential non-conformance with regulatory standards. Unlikely to result in concerns being raised by governmental bodies or stakeholders. Minor deterioration of ambient environmental conditions and recovery requires little or no intervention.	An effect will be experienced but they will be minor, short term and local, leading to observable and measurable changes recoverable within short durations. Partial conformance with regulatory standards. Meets governmental and stakeholder requirements. Minor improvements to ambient environmental conditions.
1 - Very Low	Deemed 'imperceptible' or indistinguishable from natural background conditions.	Deemed 'imperceptible' or indistinguishable from natural background conditions.

Table 6-3: Definitions of Severity used in the ESIA for Socio-Economic Receptors

Category	Socio Economic Receptors	
	Negative	**Positive**
4 - High	Highly significant, loss or major damage with medium to long term effect on cultural and/or natural resources of national and regional importance which are essential for communities' livelihood. Highly significant negative impacts on the national and international community (regional, i.e. neighbouring countries). Those affected will be able to adapt to changes with some difficulty/ease, and will only be able to maintain pre-impact livelihoods with a degree of support. Immediate intervention by governmental bodies requiring rapid implementation of response measures. National and International media and community concerns and ongoing long term complaints.	Retention of all cultural and heritage resources of value on site. Highly significant positive impacts on the national and international community (regional, i.e. neighbouring countries). Those affected will be able to adapt to changes with some difficulty/ease, and will only be able to maintain pre-impact livelihoods with a degree of support. Project meeting and exceeding Government policies and plans. National and International media and community support.
3 - Medium	Moderate damage to archaeological, cultural or key natural resources of local or national importance. Moderate negative impacts on the regional or national population. Vulnerable groups significantly affected. Changes affecting livelihoods, amenity values, convenience and quality of life of study population.	Retention of cultural heritage resources (of value) where possible and appropriate recording of resources that cannot be retained. Moderate positive impacts on the regional or national population. Vulnerable groups significantly affected. Changes affecting livelihoods, amenity values, convenience and quality of life of study population; National media and community support.

Category	Socio Economic Receptors	
	National and potentially international media and community concerns and ongoing long term complaints.	
2 - Low	An effect will be experienced but they will be Minor, short term effects recoverable within short durations. Unlikely to result in concerns being raised by governmental bodies or stakeholders. Measurable negative impacts that are intermittent or effect a small minority of the local population and / or vulnerable groups. May result in concerns from local communities.	An effect will be experienced but they will be Minor, short term effects of short durations. Meets governmental and stakeholder requirements. Measurable positive impacts that are intermittent or effect a small minority of the local population and / or vulnerable groups.
1 - Very Low	Deemed 'imperceptible' or indistinguishable from natural background conditions. No public interest.	Deemed 'imperceptible' or indistinguishable to current social norms and variations. No public interest.

EVALUATION OF SIGNIFICANCE OF IMPACT

Based on the above methodology, the impacts resulting from the project are classified within this ESIA as either positive or negative with a specific severity rating.

All environmental and social impacts have been identified based on the information summarised in this ESIA and their significance is assessed and classified by combining the probability and severity scores as shown in **Table 6-4**, which relates to negative impacts, or **Table 6-5** which relates to positive impacts below.

In assessing whether an impact is significant, reference has been made, where appropriate, to criteria on which the evaluation is based. These may include legislative requirements, policy guidance or accepted practice and past experience.

Table 6-4: Significance Matrix Negative Impacts

SIGNIFICANCE			PROBABILITY RATING			
			Very low	Low	Medium	High
			1	2	3	4
Severity Rating	Very low	1	**Negligible**	**Minor**	**Minor**	**Minor**
	Low	2	**Minor**	**Minor**	**Moderate**	**Moderate**
	Medium	3	**Minor**	**Moderate**	**Moderate**	**Major**
	High	4	**Minor**	**Moderate**	**Major**	**Major**

Table 6-5: Significance Matrix Positive Impacts

SIGNIFICANCE			PROBABILITY RATING			
			Very low	Low	Medium	High
			1	2	3	4
SEVERITY RATING	Very low	1	**Negligible**	**Minor**	**Minor**	**Minor**
	Low	2	**Minor**	**Minor**	**Moderate**	**Moderate**
	Medium	3	**Minor**	**Moderate**	**Moderate**	**Major**
	High	4	**Minor**	**Moderate**	**Major**	**Major**

CATEGORIES OF IMPACT SIGNIFICANCE

The different significance categories reflected by the colour scheme used in the above matrix and within this ESIA reflect the following:

- **Negligible** - no additional action is required and the impact is already reduced to as low as reasonably practicable (ALARP);
- **Minor** - where the level of risk is broadly acceptable and generic control measures are already assumed in a design process but, where appropriate, require continuous improvement.
- **Moderate** - where the level of risk is tolerable but control measures are required to reduce the risk as far as is practicable (i.e. tolerable if as low as reasonably practicable (ALARP)).
- **Major** - changes to the project are required which requires a re-assessment of applicable mitigation and / or reconsideration of alternatives and options by the project design team.

6.2.2 CUMULATIVE IMPACTS / EFFECTS

Cumulative impacts and effects are those that arise as a result of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects. The ESIA will consider the cumulative effects that could arise from a combination of IAIP and RTC project effects with those of other existing or planned developments in the surrounding area.

Typical examples arise from impacts of nearby pre-existing or proposed new developments on local communities who may also be exposed to further impacts from the proposed Project. In addition, the cumulative impact assessment will need to include other developments which might take place as a consequence of the project, e.g. to provide access, power or water supplies, sewage treatment or waste disposal, or to house or provide jobs for people attracted to the area by the project.

6.2.3 DEALING WITH UNCERTAINTY

Even with a final design and an unchanging environment, impacts are difficult to predict with certainty, but in projects such as the proposed Project where the design process is currently in progress, uncertainty stemming from on-going development of the Project design is inevitable. Additional uncertainty may stem from issues such as variability in the natural environment between seasons and from one year to another. Where such uncertainties are material to the ESIA findings, they will be clearly stated and conservatively approached ('the precautionary approach') in order to identify the broadest range of likely residual impacts and necessary mitigation measures.

6.2.4 MANAGEMENT SYSTEMS INTEGRATION

Stakeholders and external decision-makers for the proposed Project will rely on the findings of the ESIA (e.g. as regards significance of residual impacts) in coming to their ultimate views. As an ESIA is based on predictions made in advance of an activity taking place, it effectively makes assumptions that the project will implement certain controls and mitigation measures. If the controls do not happen, then the ESIA is undermined as a tool for stakeholders and external decision-makers. It is important, therefore, that these 'assumptions' (i.e. the mitigation measures), are commitments that will be implemented through the environmental and social management plan (ESMP) and associated management and monitoring plans that have and will be developed together with the proponent as part of the ESIA.

Once potential impacts have been identified and mitigation measures developed and described in the ESIA, their integration within the proposed Project is required in order to ensure their future implementation. In order for this to be successful, management plans including the responsibility, timing and reporting requirements associated with each measure, or set of measures, are compiled and form part of the authorisation.

7 STAKEHOLDER ENGAGEMENT PLAN

This Chapter presents a summary of general stakeholder engagement activities to be undertaken as part of the ESIA process.

7.1 APPROACH TO STAKEHOLDER ENGAGEMENT

Stakeholder engagement for the ESIA is to be undertaken using a staged approach in line with the various phases of the ESIA process. The engagement process generally involves the following five key phases.

7.1.1 INITIAL ENGAGEMENT

The Ethiopian Constitution makes reference to the right of the public and communities to full consultation and participation as well as to the expression of their views in the planning and implementation of projects that would affect them. The Ethiopian EIA Guidance also identifies that all interested and affected parties have the opportunity to participate meaningfully in the ESIA processes.

Initial engagement with PAPs was undertaken by the IPDC prior to the WSP involvement on the project, including the introduction of the project and census of the PAPs. The local Authorities provided the WSP team with the record of when these meetings were held, their location and how many people attended. In addition, the more recent consultations (2017) were also captured. This information is provided in Error! Reference source not found. below:

Table 7-1 : Record of Initial Engagement carried out by the local authorities for the Amhara Bure Site

Date of Meeting	Content	Attendees
July 28, 2016	People were provided an explanation about the project and what it might involve.	PAPs ranging from 300 to 325
Sep. 22, 2016	People were provided an explanation about the project and what it might involve.	PAPs ranging from 300 to 325
Nov. 8, 2016	Project information and progress, compensation and resettlement land options	PAPs ranging from 300 to 325
Nov. 21, 2016	Project information and progress, compensation and resettlement land options	PAPs ranging from 300 to 325
Dec. 21, 2016	Once the affected people where identified, the PAPs were gathered and provided an explanation on how the resettlement process will work and how and when they will be compensated.	All the 325 PAPs were present on the meeting
Dec. 30, 2016	Once the affected people where identified, the PAPs were gathered and provided an explanation on how the resettlement process will work and how and when they will be compensated.	All the 325 PAPs were present on the meeting

Date of Meeting	Content	Attendees
Jan. 29, 2017	Once the affected people where identified, the PAPs were gathered and provided an explanation on how the resettlement process will work and how and when they will be compensated.	All the 325 PAPs were present on the meeting

Key commitments from this process include:

- Compensation to be held in kind not in cash;
- A waste management system shall be implement within the Park;
- The locally found church shall be well protected;
- In order to maintain the social ties or values, PAPs were given land in one cluster at a site not more than 300 meter from the main road;
- Training on technical skills to be provided;
- Priority to the PAPs regarding job opportunity;
- No vulnerable or destitute PAPs were identified at the Amhara site; and
- No special sensitive areas within the proposed site were raised by community.

Table 7-2 below presents the stakeholder engagement activities and meetings undertaken for the Motta site by the local authorities before compensation activities commenced.

Table 7-2 : Initial Engagement by IPDC for the Amhara Motta Site

Date of Meeting	Content	Attendees
Jan. 10, 2017	Regarding productivity of the land, type of grown crops, etc.	Agriculture Development Office of the District
Jan. 9, 2017	Regarding the market price of agricultural products and by products.	Trade and Industry Office
Jan. 13, 2017	Regarding the volume of by products and market price over the last five years.	Offices of Livestock Development and Health
Oct. 30, 2015	Regarding the estimated value of houses to be demolished or affected.	Municipality of Motta town

These meetings focused on sourcing information on primary agricultural products for the area and the product value as well as compensation calculations and the valuing of assets. More detail on the resettlement has been provided within the Amhara RAP which is a separate standalone document.

7.1.2 STAKEHOLDER IDENTIFICATION AND ANALYSIS

Stakeholder identification and analysis is an essential component of effective and meaningful stakeholder engagement activities. A comprehensive stakeholder engagement plan has been developed identifying who the key stakeholders are and how they should be engaged. The Stakeholder Plan is provided in **Appendix B1**.

The objective of the analysis was to provide a general overview of all stakeholders and their stake in the project. Specifically, the stakeholder analysis sought to:

- Identify institutions, groups, and individuals likely to impact or be impacted by the proposed project;
- Categorise identified stakeholders in relation to their operation scope and mandate; and

- Assess the identified stakeholder's interests, significant and influence in relation to the proposed project.

Key stakeholders groups will are listed, but not limited to, those listed below:

- Project affected people;
- Compensation task force;
- Agriculture Development Office of the District ;
- Offices of Livestock Development and Health;
- Office of Trade and Industry;
- Municipality of Motta town; and
- Motta District Administration.

7.1.3 MODE OF INFORMATION DISSEMINATION

Stakeholders were engaged and identified through:

- One-on-one consultations with key stakeholder representatives;
- Focus group workshops;
- Community public meetings;
- Medial briefings; and
- Distribution of project background information document (copy is included within **Appendix B2**).

Table 7-3 provides a stakeholder engagement plan matrix outlining key stakeholders, their importance and roles within the Project.

Table 7-3 : Stakeholder Engagement Plan Matrix

Stakeholder	Impact *How much does the project impact them? (Low, Medium, High)*	Influence *How much influence do they have over the project? (Low, Medium, High)*	What is important to the stakeholder?	How could the stakeholder contribute to the project?	How could the stakeholder block the project?	Strategy for engaging the stakeholder
Ministry of Industry	*High*	*High*	*Successful development and implementation of the IAIP and RTC projects*	*As project proponent and owner, it has all the leverage towards Successful development and implementation of the IAIP and RTC projects*	*As project proponent and owner, it has all the leverage towards Successful development and implementation of the IAIP and RTC projects*	*Continued reporting and consultation on preparation and implementation issues of the ESIA and RAP*
Ministry of Environment, Forest and Climate Change (MEFCC)	*low*	*High*	*Implementation of the IAIP and RTC development projects in environmentally and socially sustainable way.*	*The MEFCC will review the ESIA and RAP reports and will supervise the implementation of the ESMP.*	*As regulatory body it has all the mandate to correct unsustainable environmental and social practices of the projects*	*Continued reporting and consultation on preparation and implementation issues of the ESIA and RAP*
Amhara National Regional State IPDC	*High*	*High*	*Job creation, Agriculture Value chain enhancement, improved standard of living of farmers*	*Facilitate the smooth progress of the development project by allocating budget for resettlers, and relevant offices*	*As the ultimate benefactor and proponent of the project, it will work towards the successful completion of the project.*	*Continued reporting and consultation on implementation issues of the ESIA and RAP*
Amhara Regional Environment Forest, Wildlife Protection and	*low*	*High*	*Implementation of the IAIP and RTC development projects in*	*The EFWPDA is the regional regulatory body responsible to ensure*	*As regulatory body it has the entire mandate to correct unsustainable*	*Continued reporting and consultation on implementation*

Stakeholder	Impact *How much does the project impact them? (Low, Medium, High)*	Influence *How much influence do they have over the project? (Low, Medium, High)*	What is important to the stakeholder?	How could the stakeholder contribute to the project?	How could the stakeholder block the project?	Strategy for engaging the stakeholder
Development Authoprity			*environmentally and socially sustainable way.*	*environmental compliance of the development projects during construction and operation.*	*environmental and social practices of the projects.*	*issues of the ESIA and RAP*
Bure Town Administration	*Medium*	*Medium*	*Resettlement of PAPs and compensation to clear site for construction*	*Responsible for spearheading the resettlement and compensation process*	*Handing over the site for IAIP is already done but successful resettlement process including livelihood restoration will have an impact on the project.*	*Invite to all stakeholder engagement activities as part of the ESIA*
Project Affected Farmers and Residents in Wangedam Kebele	*High*	*Medium*	*Provision of adequate compensation, support for smooth resettlement and livelihood restoration.*	*The project affected farmers and residents will promptly evacuate from project site upon compensation and resettlement support.*	*Project affected farmers and residents can remain on project site.*	*Active and continuous consultation and engagement with the PAPs till the resettlement and livelihood restoration is complete.*
Community Representatives, including elderly, women, youth and PAPs	*medium*	*medium*	*Delivering positive impacts of the project such as job creation, enhanced commercial and*	*The community representatives can create a bridge of communication with the community to*	*Negative attitude of the community in the project area can hamper the construction and*	*Active and continuous engagement with community representatives*

Stakeholder	Impact *How much does the project impact them? (Low, Medium, High)*	Influence *How much influence do they have over the project? (Low, Medium, High)*	What is important to the stakeholder?	How could the stakeholder contribute to the project?	How could the stakeholder block the project?	Strategy for engaging the stakeholder
			economic activities, community health and wellbeing during operation and infrastructure development in the town and the neighbourhood such as roads, electricity, etc.	*positively contribute towards the project*	*operation of the development project*	*during all stages of the development project.*

7.1.4 SCOPING ENGAGEMENT

Engagement during the Scoping phase was undertaken by ESIA team with an initial introductory meeting with representatives of the local community held on 20 August 2017 at the Bure IAIP site and the 21 August 2017 at the Motta RTC site. This was followed by stakeholder and community meetings involving key informant meetings held within the period from 20 August to 26 September 2017.

The broad objective of the engagement was to:

- Formally notify stakeholders of the proposed Project and the ESIA process;
- Formally initiate the engagement process and introduce the engagement team;
- Table and elicit comment from the affected parties; and
- Provide stakeholders with an opportunity to ask questions and give input on the proposed Project.

Relevant engagement materials were generated by the ESIA team to support the engagement activities. The content thereof was written in a non-technical / accessible language in English and Amharic. The material included information on the following:

- A background and description of the proposed Project;
- The environment in which the proposed Project will be developed;
- Information on the client;
- Information on the ESIA process and timelines;
- Typical impacts associated with similar Projects; and
- Information on the ESIA consultants and their independence.

Due to the potential for high instances of illiteracy amongst the potentially impacted groups in the proposed Project area a community meeting was held to be able to present the information and obtain feedback verbally as well as in writing.

Engagement during the Scoping phase has involved consultation with stakeholders at the federal, regional, and local levels.

7.1.5 SCOPING BASELINE DATA GATHERING ENGAGEMENT

Baseline data gathering has been conducted on the IAIP and RTC sites. The primary purpose of this phase was to gather primary data for the socio-economic baseline, however; it is noted that the collection of information involved engagement with stakeholders. This afforded stakeholders further opportunity to provide feedback or ask any questions regarding the proposed Project. Stakeholder engagement during this phase included key government stakeholders at the Woreda and Kebele level, community based organisations and local community members.

It is understood that initial baseline data gathering has already been undertaken by MACE as well as the IPDC.

Scoping phase engagements were undertaken in during August and September 2017. The primary objective of the engagements was to identify social receptors in the project area and identify stakeholders and social sensitivities in areas selected for the IAIP and RTC development, as well as to disseminate the project information and to identify the key issues important for local residents and communities.

Meetings and interviews with community representatives and key stakeholder groups were engaged during the stakeholder meetings. **Table 7-4** provides a summary of consultation meetings held in the Bure and Motta areas. Minutes of the meetings and supporting photographs are provided within **Appendix B3.**

Table 7-4: Persons engaged during stakeholder meetings.

Meeting	Date	Venue	Stakeholders
1	20 – 23 August 2017	Bure, Wan Gedam Village	Key informants including: – Village Head – Administrator of Wan Gedam Kebelle – Farmers / PAPs – Civil Servant – High school Teacher – Guard
2	24 September 2017	Bure IAIP Site	Scoping Phase Community Meeting More than 31 participants representing different sections of the community including elderly, women, youth and PAPs, and Ato Nurelign (Bure IPDC).
3	26 September 2017	Motta, Hibre Selam Village	Key informants including: – Village heads – Farmers / PAPs – Civil Servants

Key informant meetings were undertaken by the ESIA team within Wan Gedam. Key issues raised at the Bure meetings include:

- Key services within the town have insufficient capacity, namely the police station and health centre.
- The spring provides the main source of water for the town however it is deemed to be insufficient for the town's needs.
- There are many unemployed youths in the area and employment opportunities for them are limited.
- Many felt that the positives from the project far outweigh the negatives.

Key issues raised at the Motta key informant meetings include:

The town is already suffering under significant amounts of in-migration from the surrounding lowlands. Movement from the lowlands is due to many cases of malaria and insufficient education and health facilities;

- Key services within the town have insufficient capacity, namely the police station and health centre.
- Household make use of hand dug water well as their main source of fresh water in the village and residents experience water borne diseases such as Jardia, bacterial infection, Amoeba, Typhoid and Typhus.
- Concerns were raised regarding insufficient consultation having taken place prior to the land being selected and demarcated.
- The RTC blocks the main access road and farmers are forced to travel through farming fields.

The community meeting consultees identified the following important issues:

- Markets for agricultural products and animal resources to be opened, benefiting farmers in that their products will get to market efficiently and their productivity will increase.
- Priority for job opportunities is to be given to the local youth in the area. It was noted that there are many unemployed university graduate youths in the village.
- Further development in terms of the urbanisation of the area. The IAIP is expected to have modern infrastructure facilities such as roads, street lights, etc. which is scarcely available in the adjacent residential areas of Bure town. Potential for the IAIP to assist the local community in developing its infrastructures so that wide gap is not created inside and outside of the IAIP.

- Waste management was identified as an issues from the IAIP and its potential impact on the community in the area.
- Access from villages on the southern side of the IAIP site like Adela, Agata, Tenga and Tebelma kebelles, to schools, market, religious places etc. located in Bure, will not be possible if the perimeter of the park blocks the existing road/foot path.
- There are some small irrigation schemes downstream of the springs in the wetland areas in the IAIP, maintaining the flow from these springs is very important to the farms on the southern side of the site.
- Possible impact of increasing living expenses due to anticipated increase in population size of the town as a result of the large labour force to come into the IAIP. A rise in living expenses will affect the low income group residents of the town whose purchasing power will be further diminished.
- Potential impacts on the local cultures and values of the community due to the anticipated incoming large labour force for the IAIP.
- Concern that during construction of the IAIP the movement of machinery and equipment will create dust problem to the local community. Furthermore, the roads connecting the IAIP with the main highway need to be developed and covered with asphalt to avoid the continuation of the dust problem during operation.
- Infrastructures such as fresh water, electricity and health centres are in short supply in the area, the anticipated influx of people into the area may worsen the situation.
- Views on the social structure or income resource effect of the project on the community are divided. Some displaced farmers believe that their income resource or social structure will be affected positively for they are given compensation and training on how to use the compensation they receive. In addition, they also think that they were farmers their whole life and their life was of subsistence however it is now going to change since they are becoming urban dwellers, they are creating job opportunity for their sons with the compensation money, building and renting houses in town and industry is coming to their area. Others however believe that the project will affect their social structure and income resource negatively for it displaced them from their land and their livelihood is affected as a result. As to their view, land is invaluable to a farmer and the area was very productive thus the compensation they received doesn't match what is taken away from them.
- Employment and livelihood support opportunities for resettled PAPs have not yet been realized. Training to support rehabilitation and livelihood restoration is not yet delivered to the PAPs. The resettled PAPs are continuing to depend on the compensation money paid to them for living. In general there is a need to provide them support and training in restoring their livelihood before they finish their compensation money.

Minutes for all these meetings are included within **Appendix B3**.

7.1.6 ESIA DISCLOSURE ENGAGEMENT

In November the Impact Assessment process had been completed and the engagement team returned to site to gather stakeholder comment and feedback on the ESIA. This engagement was targeted at allowing local stakeholders an insight into the predicted impacts and mitigation and to contribute their local knowledge to the assessment and mitigation process. This process afforded stakeholders the opportunity to confirm that their needs, fears and aspirations have been recorded and where possible appropriately considered in the specialist investigations and Project design **Table 7-5** provides a summary of ESIA consultation meetings held in the Bure and Motta areas. Minutes of the meetings and supporting photographs are provided within **Appendix B3**.

Table 7-5 : Summary of ESIA Phase consultation meetings held within the Project area.

Meeting	Date	Venue	Stakeholders
1	18 November 2017	Bure Town Administration	ESIA Phase Community Meeting More than 39 participants representing different sections of the community including elderly, women, youth and PAPs

2	17 November 2017	Motta Town Administration Hall	ESIA Phase Community Meeting More than 31 participants representing different sections of the community including elderly, women, youth and PAPs

The community meeting consultees identified the following important issues:

- Many of the participants raised that the community is very happy for the IAIP is to be built in their town and expect many opportunities from it.
- The issue of the main community access road being blocked was raised again and solution was requested (see Socio-economic assessment).
- Other participants also stated that they have concerns with air quality, shortage of soil dumping places and waste management.
- Another participant raised that the compensation paid is not enough and rehabilitation and livelihood restoration is not delivered to PAPs who received compensation.
- A query was raised regarding the site selection process and the site selected is highly fertile. In addition it was questioned why an impact assessment was not completed before the compensation was paid.
- Many of the participants stated that the community is very happy for the RTC is to be built in the town and expressed that the positive impacts outweigh the negative ones.
- Some of the participants mentioned that the community access road has been blocked by the construction of the compound wall for the RTC. In addition, the drainage line has been blocked and therefore significant erosion has occurred. This has occurred as a result of the stormwater runoff concentrating in the northwest corner of the site resulting in the erosion gulleys forming. The farms affected by this are found outside of the RTC and have not compensated.
- Another participant stated that rehabilitation and livelihood restoration has not been delivered to PAPs who received compensation.

Responses to these issues include:

- An alternative access road is being proposed to wrap around the western edge of the IAIP site connecting the communities in the south with those in the north. It is also further noted that an additional stretch of road is being proposed along the south eastern boundary of the site, however the details of this are not yet finalised;
- The impact assessment has considered the air quality impacts and although there will be impacts these are not deemed to be of moderate significance without mitigation. With the implementation of mitigation, as detailed within the ESMP, these impacts are reduced to minor significance or negligible.
- A waste management plan (WMP) has been developed for the Amhara IAIP and RTC sites to implement. The WMP seeks to achieve a zero waste discharge facility through the application of the waste hierarchy principles.
- The RAP considered the compensation paid and provides guidance on the suitability of this.
- The concerns regarding the payment of compensation prior to the impact assessment being completed is a valid one, however the ESIA team were engaged post compensation occurring.
- The IPDC are proposing a new fourteen meter wide and sixteen kilometres long road be built as a replacement for the blocked.
- The IPDC have confirmed that compensation will be paid to farmers who are found outside the RTC but whose land is affected.

It is important to note that complaints will and must be solved properly and in time through consultation among the stakeholders and the IPDC in order to ensure the success of the project. In general, the meetings were very lively and participants acknowledged their satisfaction by getting the opportunity to air their views in the consultation meeting and urged that solutions be put forward in the ESIA study for the issues they raised. Finally they endorsed the project and asked for its rapid implementation.

7.2 PROJECT STAKEHOLDERS

For the purposes of this process, a stakeholder is defined as any individual or group which is potentially affected by the proposed Project or who has an interest in the proposed Project and its potential impacts. It is likely that a diverse range of stakeholders will be identified that could be involved in the stakeholder engagement process. Furthermore, different issues are likely to concern different stakeholders.

Project stakeholders identified to date are identified in the Stakeholder Engagement Plan included in **Appendix B1** and in the stakeholder minutes provided in **Appendix B3**.

7.3 FEEDBACK MECHANISM

Each round of engagement undertaken will provide stakeholders with an opportunity to provide input and feedback on the proposed Project. However, it remains important to offer opportunities to people to both provide feedback and receive response at other time in-between formal rounds of engagement.

A feedback mechanism is therefore in place for use during the Scoping and ESIA process to ensure that potential concerns raised by stakeholders during engagement are acknowledged and addressed in a timely, structured and culturally appropriate manner.

8 THE RECEIVING ENVIRONMENT

8.1 INTRODUCTION

It is important to gain an understanding of the physical attributes of the Project area and its surroundings, as it will provide for a better understanding of the receiving environment in which the Project is being considered.

The description of the baseline environment is essential in that it represents the conditions of the environment before the construction of the proposed Project. The description of the baseline environment therefore provides a description of the current or status quo environment against which environmental impacts of the proposed Project can be assessed and future changes monitored.

The information presented in Chapter 8 has been collected from desktop studies (where data was available) and supplemented with site visits to the Project area, as well as the data provided by IPDC/developer. The methodologies used to aid data collection are discussed in the respective sections below.

The following characteristics of the receiving environment for the Bure IAIP site and the Motta RTC site are described.

Table 8-1: Characteristics of the receiving environment for the Project area considered.

Receiving Environment	Characteristics
Physical	• Climate; • Topography and Geomorphology; • Geology; • Soils; • Surface Water (Hydrology); • Ground Water (Hydrogeology); • Wetlands; • Air Quality; • Noise; • Waste Management • Transport / Access; • Visual.
Biological	• Biodiversity
Socio-Economic	• Demographics; • Ethnicity, religion and languages; • Social Infrastructure and services; • Economy and livelihood activities; • Cultural heritage.

8.2 CLIMATE

Daily meteorological data (temperature and precipitation) was obtained from the Bahir Dar Meteorological Directorate for the Bure meteorological station for the period January 2013 – September 2017. The Bure meteorological station is located approximately 33 km to the south south-east of the proposed IAIP site. This station is classified as a Third Class station which measures only three meteorological elements, namely, minimum daily temperature, maximum daily temperature and total rainfall.

8.2.1 TEMPERATURE

Mean maximum and minimum monthly temperatures for the period January 2013 – September 2017 are 27.0°C and 11.8 °C, respectively (**Table 8-2**).

Table 8-2: Mean maximum and minimum temperature (°C) from the Bure Meteorological Station

Year	Mean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
2013	Max	28.0	28.6	29.1	28.9	29.5	24.2	24.7	25.6	24.4	27.3	27.9	28.0	27.2
	Min	11.0	11.3	11.4	11.4	12.6	9.6	11.6	11.5	11.6	11.7	11.0	10.9	11.3
2014	Max	29.3	28.7	29.7	28.2	33.5	27.1	N/A	N/A	N/A	N/A	N/A	27.0	29.1
	Min	12.0	11.4	12.1	11.6	11.8	11.3	N/A	N/A	N/A	N/A	N/A	8.5	11.2
2015	Max	28.7	30.2	30.3	30.1	23.9	20.9	23.7	24.0	25.8	26.9	24.4	23.9	26.1
	Min	8.8	12.0	13.5	11.4	15.0	15.0	12.8	12.5	12.2	13.8	13.7	12.3	12.7
2016	Max	26.2	N/A	29.3	31.9	19.6	N/A	N/A	N/A	N/A	24.2	24.1	27.4	26.1
	Min	11.0	N/A	13.2	13.4	18.4	N/A	N/A	N/A	N/A	14.1	8.9	8.3	12.5
2017	Max	27.8	27.1	29.3	N/A	N/A	23.9	25.5	25.6	25.4	N/A	N/A	N/A	26.4
	Min	7.1	10.4	10.8	N/A	N/A	12.6	12.4	12.4	11.9	N/A	N/A	N/A	11.1

N/A = Not Available

8.2.2 PRECIPITATION

The total annual rainfall for the period January 2013 – September 2017 ranges from 527.9 mm to 1449.2 mm as shown in **Table 8-3**.

Table 8-3: Annual Rainfall (mm) from the period 2013- 2017 from the Bure Meteorological Station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annual
2013	0.0	0.0	0.0	2.2	305.1	159.8	420.5	291.7	153.5	116.4	N/A	N/A	1449.2
2014	0.0	0.0	7.1	158.8	144.6	209.0	N/A	N/A	N/A	N/A	N/A	8.4	527.9
2015	0.0	1.0	17.5	96.8	240.8	224.6	246.3	224.7	173.1	105.1	123.2	24.2	1477.3
2016	0.0	N/A	161.8	21.7	289.5	N/A	N/A	N/A	N/A	83.7	0.0	0.0	556.7
2017	6.8	57.6	62.8	N/A	N/A	272.3	257.8	257.6	183.5	N/A	N/A	N/A	1098.4

8.2.3 WIND

No wind data (speed and direction) was available to assess the prevailing wind patterns in the area.

8.2.4 EXISTING AIR POLLUTION SOURCES

Potential sources of emission surrounding the proposed site include:

- Commercial and industrial activities;
- Vehicle entrainment on unpaved roads;
- Vehicle tailpipe emissions;
- Domestic fuel burning; and
- Agricultural activities.

COMMERCIAL AND INDUSTRIAL ACTIVITIES

Small-scale commercial and industrial activities in Bure include edible oil manufacturing (Seid Abdy Edible Oil, Mekonen Oil, Alemitu Mekonnen Oil), animal feed manufacturing (Akaki Animal Feed) and furniture manufacturing. Belayneh Kindie Import and Export is reportedly undertaking the construction of an edible oil factory in Bure town. While Pepsi operate a soft drink manufacturing plant in the town. The town also hosts an agricultural training college.

VEHICLE ENTRAINMENT ON UNPAVED ROADS

Vehicle-entrained dust emissions from the unpaved roads potentially represent a significant source of fugitive dust. When a vehicle travels on an unpaved road, the force of the wheels on the road surface causes the pulverisation of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed (USEPA, 2006).

The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Emissions depend on source parameters that characterise the condition of a particular road and the associated vehicle traffic. Dust emissions from unpaved roads have been found to vary directly with the fraction of silt in the road surface materials. Other parameters include vehicle speeds, mean vehicle weight, average number of wheels per vehicle and road surface moisture. Although vehicle entrainment on unpaved roads has been found to result in high fugitive dust emissions, these impacts are often limited to close to the source (USEPA, 2006).

VEHICLE TAILPIPE EMISSIONS

Atmospheric pollutants emitted from vehicles include hydrocarbons, CO, CO_2, NO_x, SO_2 and particulates. These pollutants are emitted from the tailpipe, from the engine and fuel supply system, and from brake linings, clutch plates and tyres. Hydrocarbon emissions, such as benzene, result from the incomplete combustion of fuel molecules in the engine. Carbon monoxide is a product of incomplete combustion and occurs when carbon in the fuel is only partially oxidized to carbon dioxide. Nitrogen oxides are formed by the reaction of nitrogen and oxygen under high pressure and temperature conditions in the engine. Sulphur dioxide is emitted due to the high sulphur content of the fuel. Particulates such as lead originate from the combustion process as well as from brake and clutch linings wear (Samaras and Sorensen, 1999).

The federal highway No 3, which connects Addis Ababa and Bahir Dar, abuts the proposed site with the federal highway No 32 running to the west of the proposed site.

DOMESTIC FUEL BURNING

Pollutants released from these fuels include CO, NO_2, SO_2, inhalable particulates and polycyclic aromatic hydrocarbons. Particulates are the dominant pollutant emitted from the burning of wood. Smoke from wood burning contains respirable particles that are small enough in diameter to enter and deposit in the lungs. These particles comprise a mixture of inorganic and organic substances including aromatic hydrocarbon compounds, trace metals, nitrates and sulphates. Polycyclic aromatic hydrocarbons are produced as a result of incomplete combustion and are potentially carcinogenic in wood smoke (Maroni *et al*., 1995). The main pollutants emitted from the combustion of paraffin are NO_2, particulates, carbon monoxide and polycyclic aromatic hydrocarbons.

Domestic fuel burning shows a characteristic diurnal and seasonal signature. Periods of elevated domestic fuel burning, and hence emissions, occurs in the early morning and evening for space heating and cooking purposes. During the winter months, an increase in domestic fuel burning is recorded as the demand for space heating and cooking increases with the declining temperature.

A national survey conducted by the Central Statistical Agency in 2011 indicated that biomass fuel is used by nearly all Ethiopian households (95%), with the vast majority (85%) using firewood for cooking (**Table 8-4**). The household fuel use pattern is mixed, in that more than one type of fuel can be used in a household. With respect to the main source of energy, however, the pattern varies between rural and urban settings. For instance, firewood is used by nine out of ten rural households as the main fuel source for cooking, while slightly more than half (54%) of urban household dwellers use wood (WMS, 2011).

Charcoal is the second most frequently used type of fuel (18%) in urban areas, although it is used infrequently (0.2%) as fuel in rural areas, with the remainder of rural households (8.4%) using leaves/dung cakes. The use of relatively cleaner energy sources such as kerosene, LPG, and electricity for cooking is almost non-existent in rural settings, whereas in urban areas kerosene (5%) and gas/electricity (7.7%) are used in small proportions. Kerosene is used, however, for lighting in urban (88%) and rural (64.4%) households (CSA, 2011).

Table 8-4: Household energy use for cooking in Ethiopia (CSA, 2011).

Fuel Used for Cooking	Country (%)	Urban (%)	Rural (%)
Wood	85	63.3	90.8
Leaves / Crop Residue / Animal Dung	7.2	2.7	8.4
Charcoal	3.9	17.5	0.2
Solid Fuel	95	87.4	99.6
Kerosene	1.2	4.9	0.2
LPG / Electricity	1.9	7.7	0.2

AGRICULTURAL ACTIVITIES

Emissions from agricultural activities are difficult to control due to the seasonality of emissions and the large surface area producing emissions (USEPA, 1995). Expected emission resulting from agricultural activities include particulates associated with wind erosion and burning of crop residue, chemicals associated with crop spraying and odiferous emissions resulting from manure, fertilizer and crop residue.

Dust associated with agricultural practices may contain seeds, pollen and plant tissue, as well as agrochemicals, such as pesticides. The application of pesticides during temperature inversions increases the drift of the spray and the area of impact. Dust entrainment from vehicles travelling on gravel roads may also cause increased particulates in an area. Dust from traffic on gravel roads increases with higher vehicle speeds, more vehicles and lower moisture conditions.

Agricultural activities in the area include maize, sesame, potato, live animal (cattle, goat, sheep) dairy and meat, poultry and honey. As per the land tenure of Ethiopia, the land is owned by the Government. The western and eastern portions of the site utilised by Government for crops with the central portion being leased to provide individuals for residential and farming purposes (WSP, 2017).

8.3 TOPOGRAPHY AND GEOMORPHOLOGY

8.3.1 BURE IAIP

A detailed topography survey was carried out by Mahindra during October 2016. In general the topography of the site varies between +2083.932 m to +2039.0 m with undulations at some portions of the site. The eastern section of the site gently slopes from the northwest to the south while the western portion of the site gently slopes from the northeast to southwest. The proposed IAIP masterplan layout, showing the survey contour lines and predominant slope, within the site boundary is shown in **Figure 8-1**.

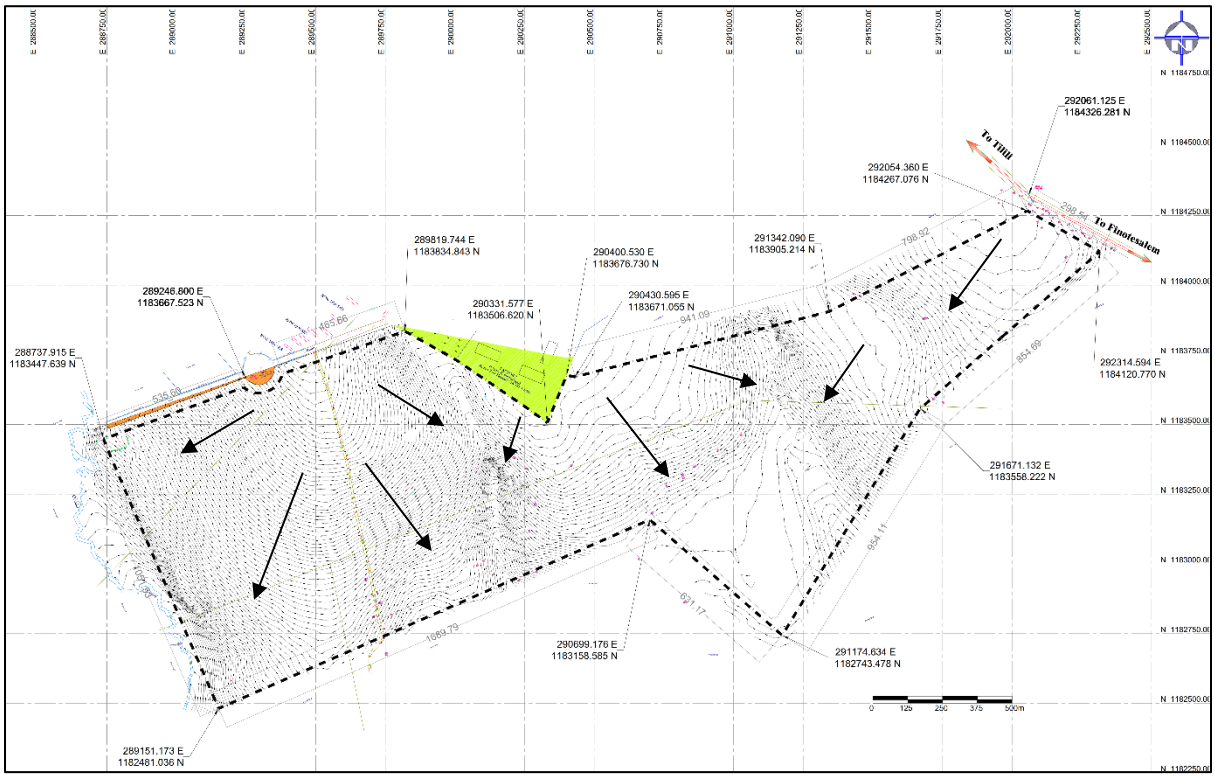

Figure 8-1: Topography survey drawing of the IAIP site indicating predominate slope (Source: MACE)

Significant areas of erosion were evident to the west of the site. These areas are associated with the Yiser River which runs parallel to the site boundary (**Figure 8-2**).

Figure 8-2: Erosion along the western boundary of the IAIP site

8.3.2 MOTTA RTC

A detailed topography survey was carried out by Mahindra in October 2016. In general the topography of the site varies between +2418.005 m to +2411.601 m with undulations at some portions of the site, gently sloping from the south to north. The proposed RTC masterplan layout, showing the survey contour lines and predominant slope, within the site boundary is shown in **Figure 8-3**.

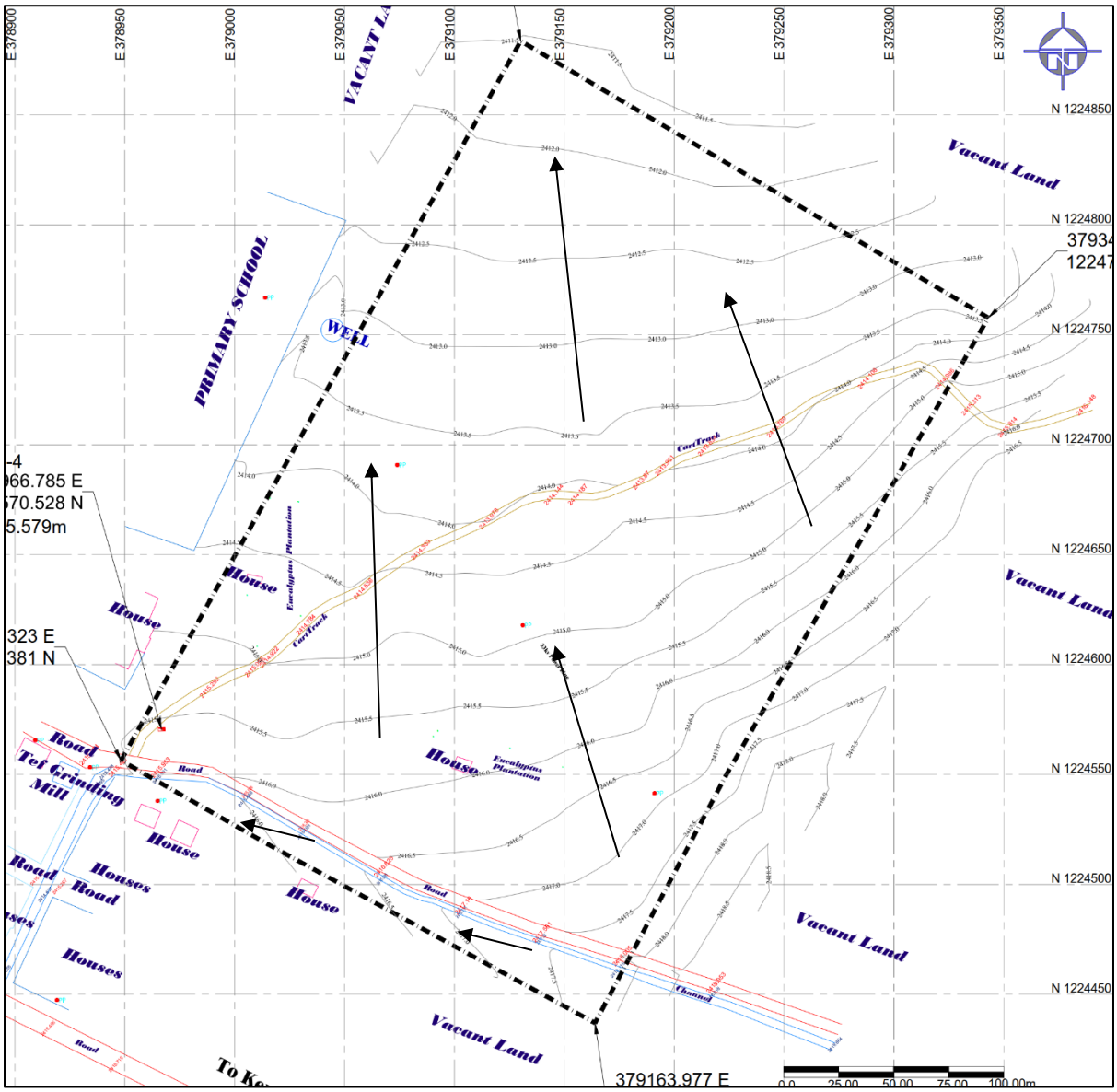

Figure 8-3: Topography survey drawing of the RTC site indicating predominate slope (Source: MACE)

8.4 GEOLOGY

8.4.1 OVERVIEW

The Project area is covered by volcanic rocks underlain by mesozoic sediment and metamorphic rocks. Formations constituting tuff and agglomerated basalt, sandstone and granite are found in the area. **Figure 8-4** provides a layout of the geological makeup of the area, including the locations of the IAIP and RTC sites.

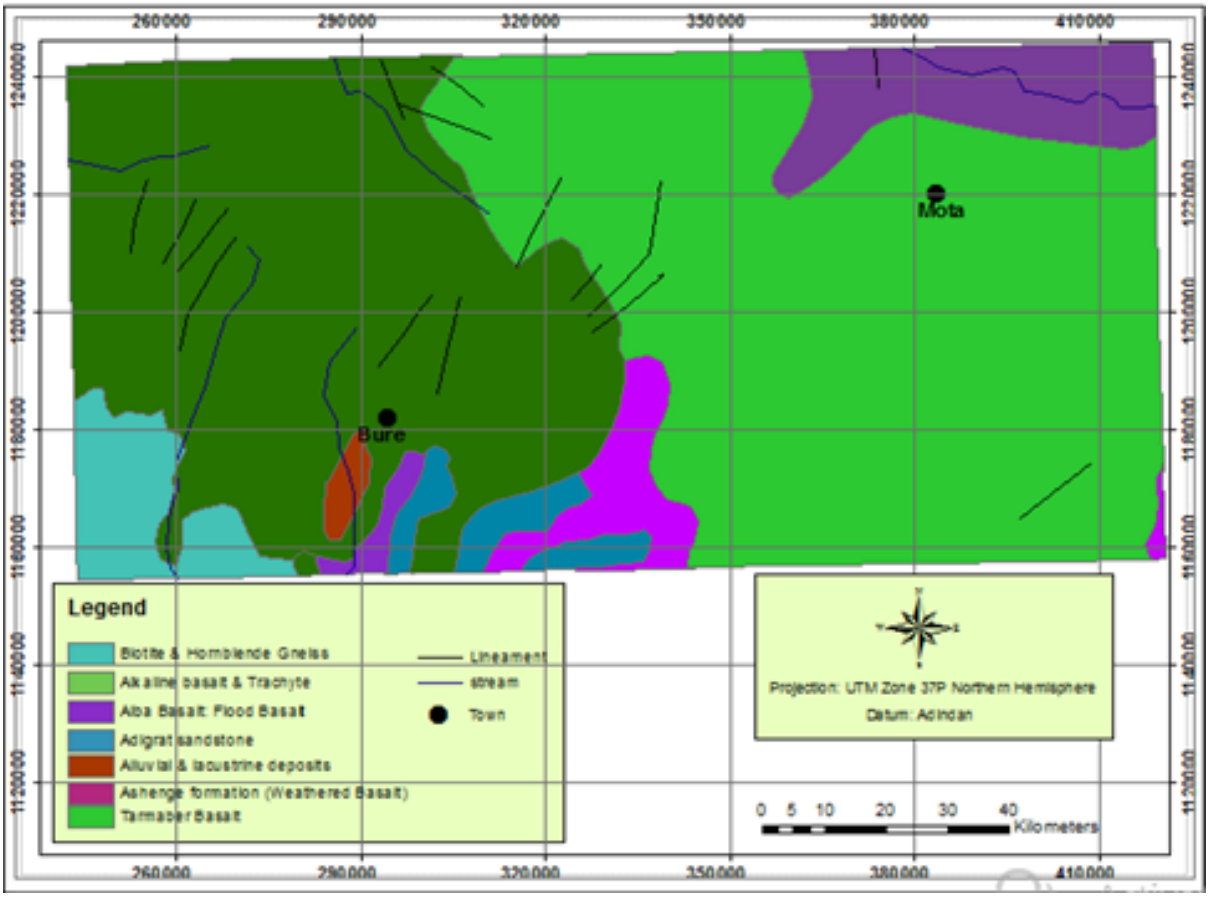

Figure 8-4: Geological Map of the Bure and Motta areas

8.4.2 BURE IAIP

The regional geology of Bure and the surrounding area is typically composed of tertiary volcanics of the Cenozoic era, (i) Ashangi Basalts and (ii) Aiba Basalts, and the sedimentary formations, as interpreted from the regional mapping of the Ethiopian Institute of Geological Surveys (Tefera, *et al*., 1996).

The local geology of the area is covered by clay, vesicular and scoracious basalts, some alluvial and unconsolidated deposit materials. The top layer is covered by a layer of clay, and highly weathered basalt, slightly and moderately fractured basalt is the dominant lithology and clay is found at places.

The hydrogeology of the project area is influenced mainly by the topography and geology of the area. The groundwater in the area is mainly located within primary porosities and the fractured volcanic rock.

8.4.3 MOTTA RTC

The area around Motta is dominantly covered by Tarmaber Formation. It represents Oligocene to Miocene basaltic shield volcanism on the northwestern and southeastern plateaus. The central type Tarmaber Formation basaltic volcanism was followed by fissural eruptions particularly along the escarpments of northwestern and southeastern plateaus. Basalts of the Tarmaber Formation in contrast to the tholeiitic and mildly alkaline nature of the earlier flood basalts typically have an alkaline affinity. On the northwestern plateau, the Tarmaber shield volcanoes become progressively younger from north to south. The classification Tarmaber Gussa Formation (PNtb) for the shield volcanoes of the northern Ethiopian plateau with an absolute age range of 26 to 16 million years (Ma) and the name Tarmaber Megezez Formation (Ntb) for the younger shield volcanoes with an absolute age range from 16 to 13 Ma in the southern part of the northwestern plateau and the southeastern plateau has been widely used and the latter is believed to mark the initiation of rifting of the Main Ethiopian

Rift (Kazmin, 1979 and references cited therein). The upper age limit of the Tarmaber-Megezez Formation (Ntb) is lowered to 7 to 8 Ma since the large basaltic centre of Arba Gugu with similar alkaline affinity is considered to be the youngest episode of Tarmaber type volcanism. Other dominantly basaltic units erupted within the ago intervals from 14 to 10 Ma (Kazmin and Berhe, 1981) mapped on the eastern escarpments of the Main Ethiopian Rift and southern Afar and Miocene basaltic volcanism in western Ethiopia with an age range of 9 to 10 Ma (Berhe *et a*l., 1987) are also considered with the Tarmaber-Megezez Formation (Ntb) on chronological grounds.

North of Motta town there are outcrops of Aiba basalt; these represent the second major pulse of fissural basalt volcanism on the northwestern plateau. They are generally aphyric, compact rocks in place showing stratification and contain rare interbedded basic tuffs. The Aiba Basalts (P3a) unconformably overlie the Ashangie Formation (P2a) and attain a thickness of 200 to 600 meters. The basalts show a distinctive tholeiitic nature with transitions to mildly alkaline varieties. The absolute age of the Aiba Basalts (P3a) ranges from 34 to 28 Ma placing them in Oligocene (Kazmin, 1979).

8.5 SOILS CHARACTERISTICS

This section describes the receiving environment in terms of soils within the Project site and surrounding area.

8.5.1 DESKTOP ASSESSMENT

A detailed desktop assessment was undertaken for the Amhara IAIP and RTC sites. This included assessing the ISRIC World Soils Database, based on the World Reference Base Classification System (WRB, 2006) in order to establish the soil types according to an international standard system. Information associated with the outcomes of the ISRIC world soils database outcomes was reviewed, as was general information associated with Ethiopian soils, and, specifically, those found in the Amhara region.

8.5.2 SITE ASSESSMENT

Site visits were conducted on during August and September 2017 at the Bure IAIP and Motta RTC sites. Soil survey, classification, field mapping and sample analysis were undertaken. Six soil samples were taken at the IAIP site and two soil samples were taken at the RTC site. The following steps were performed:

- Survey of the study area was undertaken on foot, using a hand-held bucket auger to identify soil forms present. Current activities at the site were also noted, and specific areas of land use and infrastructure were noted.
- Auger points were assessed to a depth of approximately 1.5m for classification purposes, roughly according to a pre-determined set of points (**Figure 8-5** and **Figure 8-6**) drawn along zig-zagged transects. Free survey was undertaken using the points as a guideline.
- A hand-held GPS was used to record the location of each auger point.
- Soil forms were described in the field according to local soil characteristics, the World Reference Base classification system (WRB, 2006) and the South African Soil Classification Taxonomic System (Soil Classification Working Group, 1991), published as a Memoir on the Agricultural Natural Resources of South Africa No.15;
- Representative soil samples were collected and submitted to Jones Laboratory in Wales for analysis. Samples were analysed for Total Nitrogen, Calcium, Magnesium, Potassium, Copper, Iron, Aluminium, Manganese, Molybdenum, Zinc, Phosphorus, Boron, Total Sulphur, soluble Chloride, pH, Total Organic Carbon, Available Phosphorus and pH. The particle size distribution was also determined (results are pending); and
- The typical land uses and their associated soils were investigated for the Amhara region and the land uses identified on site were noted and mapped.

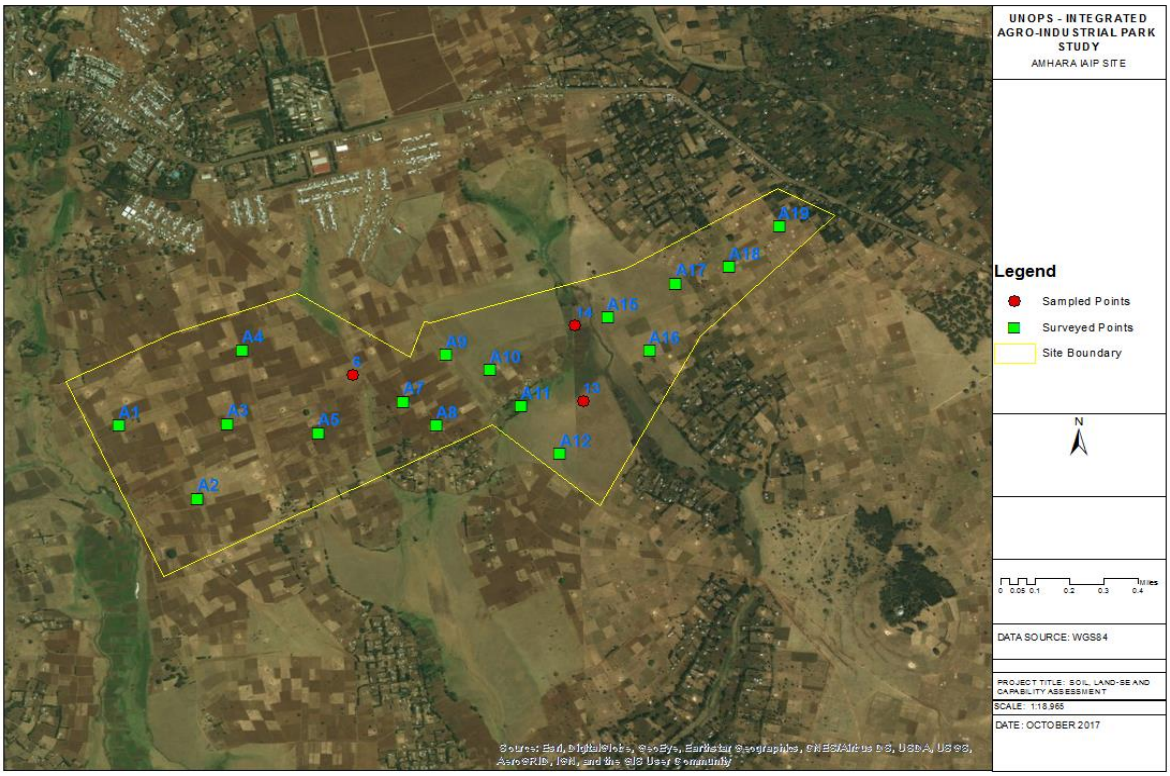

Figure 8-5: Pre-determined survey points for Bure IAIP site.

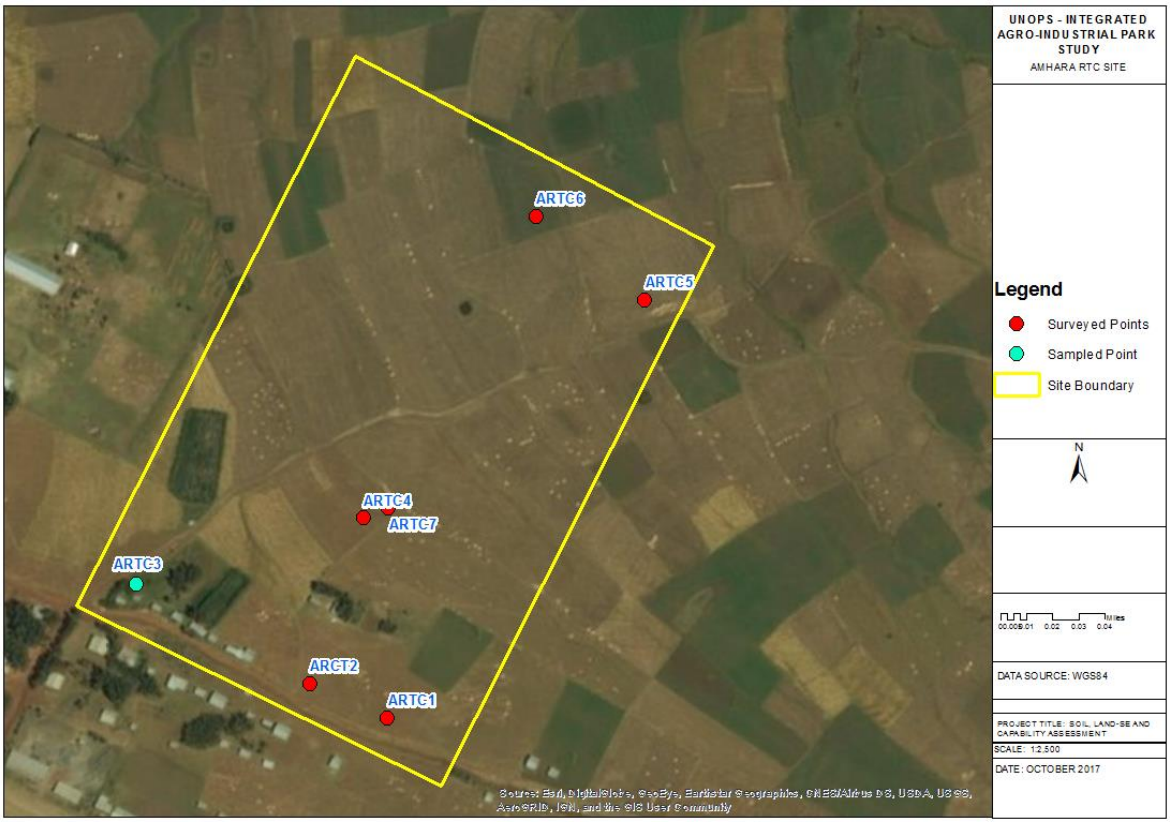

Figure 8-6: Pre-determined survey points for Motta RTC site.

8.5.3 SOIL CLASSIFICATION

WORLD REFERENCE BASE CLASSIFICATION SYSTEM

The World Reference Base for Soil Resources (WRB, 2006) is the international standard taxonomic soil classification system endorsed by the International Union of Soil Sciences (IUSS). It was developed by an international collaboration coordinated by the International Soil Reference and Information Centre (ISRIC) and sponsored by the IUSS and the FAO via its Land & Water Development division. It replaces the previous FAO soil classification. The WRB borrows heavily from modern soil classification concepts, including USDA soil taxonomy, the legend for the FAO Soil Map of the World 1988, the Référentiel Pédologique and Russian concepts. The classification is based mainly on soil morphology as an expression of pedogenesis. A major characteristic the USDA soil taxonomy system is that climate is not part of the system, except insofar as climate influences soil profile characteristics. As far as possible, diagnostic criteria match those of existing systems, so that correlation with national and previous international systems is as straightforward as possible. The WRB is meant for correlation of national and local systems.

ETHIOPIAN CLASSIFICATION SYSTEM

No Ethiopian classification system was identified through local partners, local university enquiries and literature searches. Soils papers published in Ethiopian journals utilise the FAO or WRB classification system (depending on when they were written) as these systems are widely used throughout Ethiopia (Assefa, 2002; Mishra *et al.*, 2004; Ayalew, 2015).

SOUTH AFRICAN CLASSIFICATION SYSTEM

The soils identified in the field were classified by form in accordance with the South African soil taxonomic system (Soil Classification Working Group, 1991) as a great deal of information is available about the various South African soil forms. In this way, more information could be given about the characteristics of the types of soils identified in the field. All South African soil forms fall within 12 soil types; Duplex (marked accumulation of clay in the B horizon), Humic (intensely weathered, low base status, exceptional humus accumulation), Vertic (swelling, cracking, high activity clay), Melanic (dark, structured, high base status), Silicic (Silica precipitates as a dorbank horizon), Calcic (accumulation of limestone as a horizon), Organic (peaty soils where water inhibits organic breakdown), Podzolic (humic layer forms beneath an Ae or E), Plinthic (fluctuating water table causes iron re-precipitation as ferricrete), Oxidic (iron oxides weather and colour soils), Hydromorphic (reduced lower horizons) and Inceptic (young soils - accumulation of unconsolidated material, rocky B or disturbed) soils.

8.5.4 SOIL CAPABILITY

The area's soils capability was assessed and mapped, based on the results of the classification study and the sample results. The South African land capability classification system by Scotney *et al*. (1987) was used to identify and map land capability and soil potential (**Table 8-5**). This system is useful in that it is able to quickly give one an overview of the agricultural capability and limitations of the soils in question, and is useful for soil capability comparisons. Criticisms of this system, however, include its lack of consideration of the local setting, land use planning and a lack of financial resources (Nethononda *et al.*, 2014). For this reason the site's soil capability has also been assessed taking the local setting into account.

Table 8-5: Land Capability Classification System (Scotney *et al*., 1987)

Land Capability Group	Land Capability Class	Increased intensity of use									Limitations
Arable	I	W	F	LG	MG	IG	LC	MC	IC	VIC	No or few limitations. Very high arable potential. Very low erosion hazard
	II	W	F	LG	MG	IG	LC	MC	IC	-	Slight limitations. High arable potential. Low erosion hazard
	III	W	F	LG	MG	IG	LC	MC	-	-	Moderate limitations. Some erosion hazards
	IV	W	F	LG	MG	IG	LC	-	-	-	Severe limitations. Low arable potential. High erosion hazard.
Grazing	V	W	-	LG	MG	-	-	-	-	-	Water course and land with wetness limitations
	VI	W	F	LG	MG	-	-	-	-	-	Limitations preclude cultivation. Suitable for perennial vegetation
	VII	W	F	LG	-	-	-	-	-	-	Very severe limitations. Suitable only for natural vegetation
Wildlife	VIII	W	-	-	-	-	-	-	-	-	Extremely severe limitations. Not suitable for grazing or afforestation.

W - Wildlife F - Forestry LG - Light grazing
MG – Moderate grazing IG - Intensive grazing LC - Light cultivation
MC - Moderate cultivation IC - Intensive cultivation. VIC – Very intensive cultivation

8.5.5 REGIONAL OVERVIEW

According to the World Reference Base for Soil Resources (WRB, 2006), the soils of Ethiopia can be classified into five principal types.

Soil Type	Composition and Description
1	The first type is composed of Nitosols and Andosols and is found on portions of the Western and Eastern highlands. These soils are formed from volcanic material and, with proper management, have medium to high potential for rain-fed agriculture.
2	The second group of soils; Cambisols and Luvisols, are found in the Simien plateau of the Western Highlands. They are highly weathered with a subsurface accumulation of clay and are characterized by low nutrient retention, surface crusting, and erosion hazards. With proper management, they are of medium agricultural potential.
3	The third group of soils is the dark clay found in the Western Lowlands and at the foothills of the Western Highlands. Composed of Vertisols, they have medium to high potential for both food and agriculture but pose tillage problems because they harden when dry and become sticky when wet. Some of the rich coffee-growing regions of Ethiopia are found on these soils.
4	The fourth group is composed of Yermosols, Xerosols and other saline soils that cover desert areas of the Eastern Lowlands and the Denakil Plain. Because of moisture deficiency and coarse texture, they lack potential for rain-fed agriculture. However, the wetter margins are excellent for livestock, and even the drier margins respond well to irrigation.
5	The fifth soil group is Lithosols found primarily in the Denakil Plain. Lack of moisture and shallow profile preclude cultivation of these soils.

Of the 25 World Reference Base/FAO soil orders, 17 exist in Ethiopia. Lithosols, Cambisols, Nitosols, Vertisols, Xerosols, Solonchaks, Fluvisols and Luvisols cover more than 80% of the country, and are the most important soils. Vertisols are very important soils in Ethiopian agriculture.

According to the WRB Reference Soil Group (2006), the Amhara IAIP site soils include Ferralsols, Nitisols and Plinthosols and the Amhara RTC site is covered by Vertisols.

8.5.6 BURE IAIP

DESKTOP REVIEW

The ISRIC database shows that the Amhara IAIP site to be dominated by Ferralsols, Nitisols and Plinthosols. These have an average particle size distribution of 18% sand, 21% silt and 61% clay. Using the United States Department of Agriculture Soil Texture Triangle (USDA, 1939), which is widely used world-wide, the soil of the site would, on average, be classified as a clay soil (USDA, 1939). Ferralsols are red and yellow weathered soils whose colours result from an accumulation of metal oxides, particularly iron and aluminum (from which the name of the soil group is derived). They are formed on geologically old parent materials in humid tropical climates, with rainforest vegetation growing in the natural state. Because of the residual metal oxides and the leaching of mineral nutrients, they have low fertility and require additions of lime and fertilizer if they are to be used for agriculture. Tree crops such as oil palm, rubber, or coffee are suitable, but pasture is often their main agricultural use. Nitisols are deep, strongly weathered, well-drained tropical soils with a clay-rich subsurface horizon made up of angular, blocky structural elements that easily crumble into polyhedric peds with shiny faces. The soils have a high cation exchange capacity compared to Ferralsols. Plinthosols form under a variety of climatic and topographic conditions. They are defined by a subsurface layer containing an iron-rich mixture of clay minerals (chiefly kaolinite) and silica that hardens on exposure into ironstone concretions known as plinthite. The impenetrability of the hardened plinthite layer, as well as the fluctuating water table that produces it, can restrict the use of these soils to grazing or forestry, although the hardened plinthite has value as subgrade material for roads or even as iron ore (the iron oxide content can be as high as 80 percent by mass).

LAND USE ASSESSMENT

At the Amhara IAIP site, approximately 67% of the area is used for subsistence agriculture, 31% of the site consists of permanent and seasonal wetlands, and 2% of the site is grazing land. It is noted that large portions of the seasonal wetland area is used for agriculture, especially grazing and some crop production, which varies with the seasons. This distribution of land uses can be seen in **Figure 8-7**.

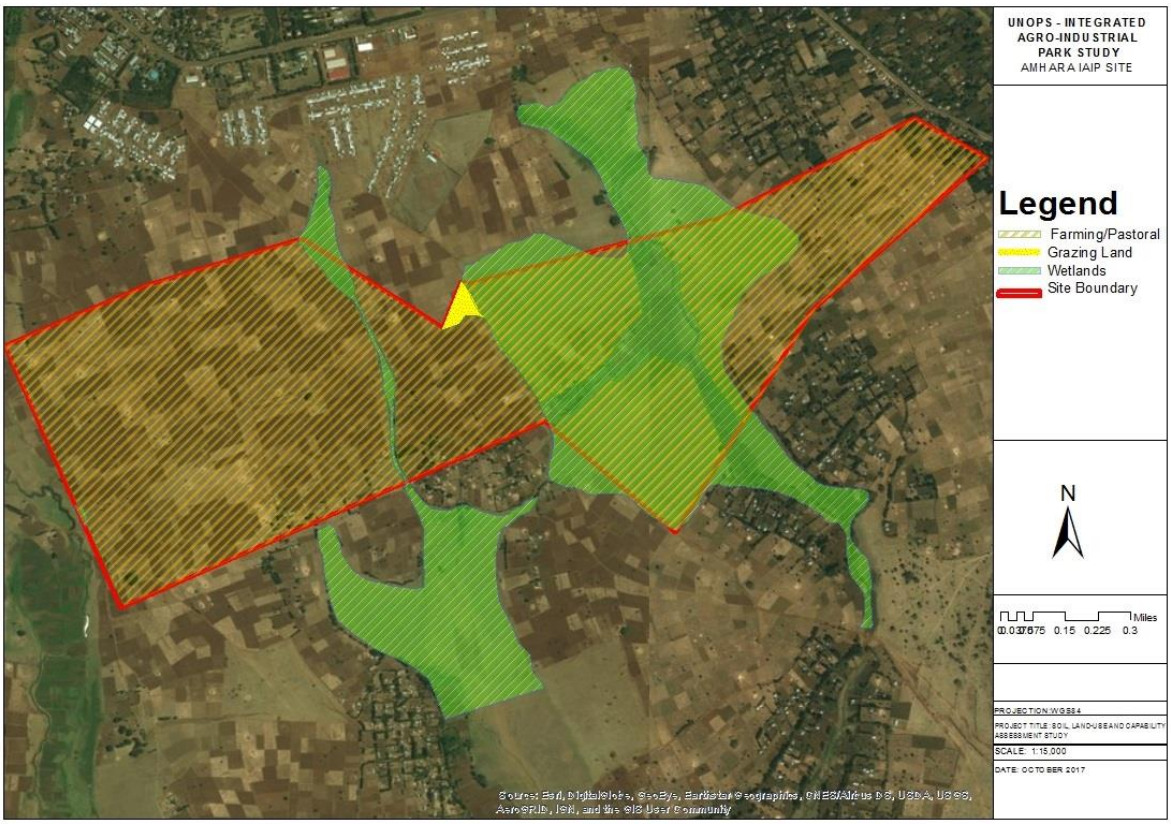

Figure 8-7: Amhara IAIP distribution of land uses

SOIL CLASSIFICATION

Figure 8-8 shows the distribution of the identified soil forms within the Bure IAIP site boundary as described below.

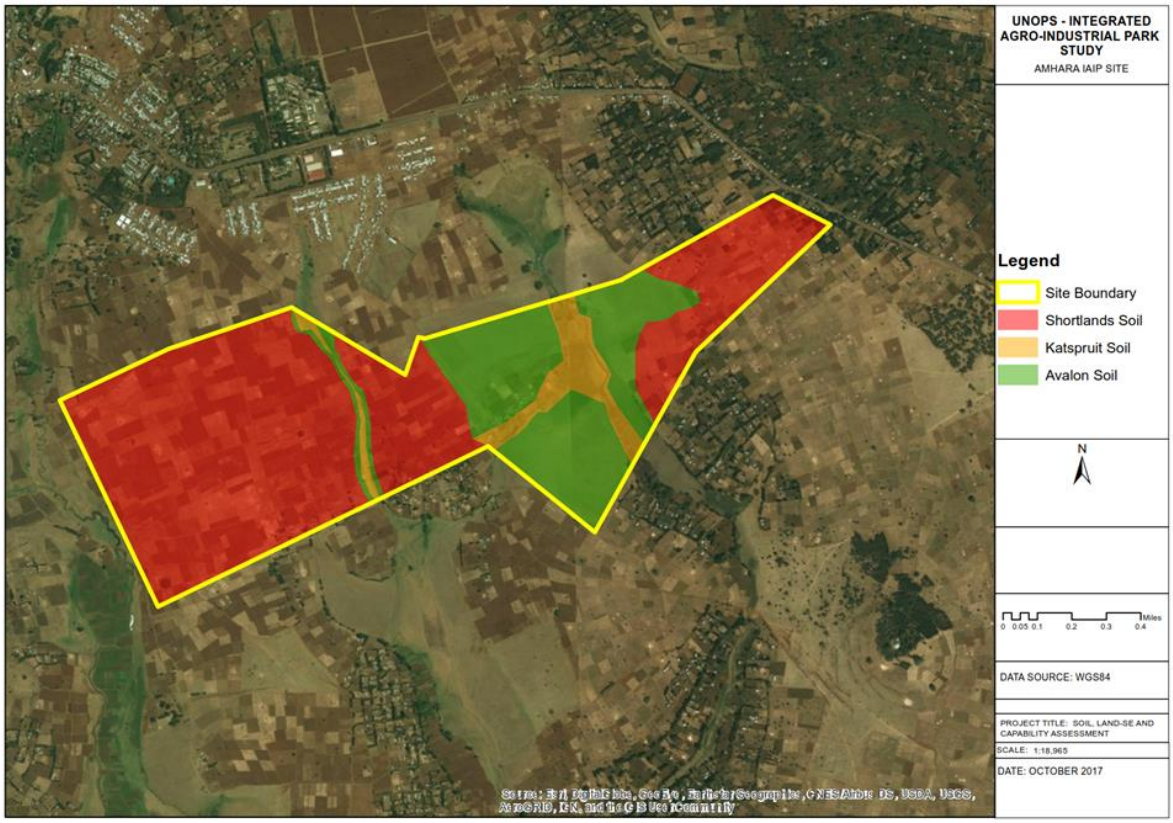

Figure 8-8: Distribution of the identified soil forms at the IAIP site.

SHORTLANDS/NITISOL SOILS

Soils that could be described as Shortlands (Oxidic) soils in the South African classification system were identified over 177ha or 69% of the IAIP site (**Figure 8-8**). This soil is characterised by an Orthic A horizon over a red structured B horizon. **Figure 8-9** shows a photograph taken during the soil survey, and indicates the horizons from the top of the picture (the upper layer is the Orthic A, followed by the red structured B horizon).

Figure 8-9: Photograph showing Shortlands/ Nitisol soil profile at the Amhara IAIP site

The Shortlands soil form falls into the South African Oxidic soil group. These soils develop as oxides of iron accumulate through weathering and colour the soils - uniformly if the conditions are well drained and aerated. Oxidic soils are characterised by iron enrichment, are not necessarily highly weathered and may be found over a wide spectrum of climatic conditions. More clay-rich Shortlands

soils can be difficult to distinguish from members of the Vertic soil group (Fey, 2012). According to the World WRB Classification system (WRB, 2006), the IAIP site is dominated by Ferralsols, Nitisols and Plinthosols. Nitisols are technically defined by an accumulation of clay and by a blocky aggregate structure. Iron oxides and high water content are believed to play important roles in creating the soil structure. Nitisols are also strongly influenced by biological activity, resulting in a homogenization of the upper portion of the soil profile. Shortlands soils can be considered similar to Nitisols.

AVALON/ PLINTHOSOL SOILS

The Avalon soil form was identified over 62ha or 24% of the Amhara IAIP site (**Figure 8-8**). This soil is characterised by an Orthic A horizon over a yellow-brown apedal B horizon over a soft plinthic B horizon. **Figure 8-10** shows a photograph taken during the soil survey, and indicates the horizons from the top of the image (the dark upper layer is the Orthic A, followed by the yellow-brown apedal B, followed by the soft plinthic B). Water was encountered throughout these mottled wetland soils.

The Avalon soil form falls into the South African Plinthic soil group. These soils develop as a result of enrichment with iron oxides where intermittent wetness from a fluctuating water table gives rise to the reduction and mobilization of iron and its migration and reprecipitation as mottles, nodules, concretions and ferricrete. A warm, sub-humid to humid climate with a distinct dry season is commonly associated with plinthite formation. Theses soils typically form in the middle to lower slope positions in the landscape.

As highlighted in the desktop assessment section, Plinthosols form under a variety of climatic and topographic conditions and are defined by a subsurface layer containing an iron-rich mixture of clay minerals (chiefly kaolinite) and silica that hardens on exposure into ironstone concretions known as plinthite. Clearly the Avalon soil form (within the Plinthic soil group) and the Plinthosol soil group describe the same types of soils.

Figure 8-10: Photograph showing an Avalon/ Plinthosol soil profile at the Amhara IAIP site

KATSPRUIT / GLEYSOL SOILS

The Katspruit soil form was identified over 18ha or 7% of the Amhara IAIP site (refer to **Figure 8-8**). This soil form falls within the Gleyic soil group within the South African soils classification system. This soil is characterised by an Orthic A horizon over gleyed horizon. **Figure 8-11** shows a photograph taken during the soil survey, and indicates the horizons from the top of the image (the dark upper layer is the Orthic A, followed by a grey gleyed horizon). These soils were saturated.

Gleysols are wetland soils, which, in the natural state are continuously water-saturated within 50 cm of the surface, for long periods of time. Reduction of Iron (Fe) and Manganese (Mn) leads predominantly to grayish hues in the profile below the water table. Clearly Gleyic and Gleysol soils describe similar soil types.

Figure 8-11: Photograph showing a Katspruit/ Gleysol soil profile at the Amhara IAIP site

SOIL FERTILITY ASSESSMENT

The productive capacity of soils depends on often complex and sometimes little understood interactions between the biological, chemical and physical properties of soil (Johnston, 2011). Soil fertility is found mostly in topsoil, however the contribution the subsoil makes should not be ignored. The fertility of the total volume of soil in which the plant roots develop should be taken into account (FSSA, 2011). According to Johnston (2011), soil analysis is an aid to managing soil nutrients efficiently to maintain soil fertility for those nutrients like Phosphorus (P), Potassium (K) and Magnesium (Mg) that are retained in soil in plant-available forms. If the amount of any of these nutrients in such forms in soil is too small then yield is jeopardised, but increasing reserves in agricultural soils to very high levels is an unnecessary expense.

The laboratory results of the levels of various nutrients analysed-for in the Amhara IAIP soils are shown in **Table 8-6**. The guidelines for some nutrients are provided as values, and in some cases they are presented as narratives simply because some nutrients have limited or no contribution to soil fertility, thus their deficiencies or excess may not influence soil fertility as such.

Table 8-6: Laboratory Analysed Soil Nutrients at the Amhara IAIP Site

Parameter	Units	AMHARA-A6-HORIZON A	AMHARA-A6-HORIZON B	AMHARA-A14-HORIZON A	AMHARA-A14-HORIZON B	AMHARA-A12/A13-HORIZON A	AMHARA-A12/A13-HORIZON B	Soil Fertility Guideline
Antimony	mg/kg	6	6	3	2	2	3	*
Calcium	mg/kg	2258	1931	6635	7676	5206	6164	>150
Copper	mg/kg	63	56	35	26	32	23	>0.6
Iron	mg/kg	103400	110700	51240	52870	31970	65480	*
Magnesium	mg/kg	2433	2341	3849	3568	2616	3456	60 – 300
Manganese	mg/kg	2775	3077	555	256	335	584	1.0 - 5.0
Molybdenum	mg/kg	2.1	2.1	0.8	0.6	0.4	0.3	*
Phosphorus	mg/kg	1039	934	669	293	511	291	20-100
Potassium	mg/kg	2791	2450	1825	1384	1215	1192	150 -800
Sulphur as S	%	0.03	0.03	0.05	0.01	0.06	0.02	>7.5
Boron	mg/kg	0.58	<0.25	1.24	<0.25	1.57	<0.25	0.2-2
Zinc	mg/kg	98	99	78	70	64	74	>1.5
Chloride	mg/kg	7	6	20	<2	20	2	5-50
Total Organic Carbon	%	1.9	0.66	4.84	1.4	6.24	1.18	*
Sand	%	37.9	85.6	77.1	69.1	45.6	75.2	-

Parameter	Units	AMHARA-A6-HORIZON A	AMHARA-A6-HORIZON B	AMHARA-A14-HORIZON A	AMHARA-A14-HORIZON B	AMHARA-A12/A13-HORIZON A	AMHARA-A12/A13-HORIZON B	Soil Fertility Guideline
Silt	%	60.3	14.3	21.3	28.4	50.4	23.9	-
Clay	%	1.7	0.1	1.6	2.5	3.9	0.9	-
pH	pH units	NDP	5.76	6.39	7.63	6.19	6.32	6-8.2
Total Nitrogen	%	0.28	0.2	0.46	0.18	0.78	0.19	0.1 - 0.12
***Refers to the general guidelines which were not discussed in terms of ranges but a narrative description is provided in the main context**								

SOIL TEXTURE

Soil texture drives crop production and field management as it influences drainage, water holding capacity, aeration, susceptibility to erosion, Organic Matter content, Cation Exchange Capacity (CEC) and pH buffering capacity. Soil texture is important in the context of a soil fertility analysis as soils with a higher clay content are more chemically reactive (they have a higher CEC), so tend to be more fertile (Fey, 2010). The laboratory results of the particle size distribution analysis as shown in **Table 8-6** are clearly incorrect. The laboratory was asked to undergo the analysis again but were unable to, so the soil textures calculated in-field using the 'Ribbon Method' were adopted. These determined that the terrestrial soils (Shortlands/Nitisols) were a Sandy Clay Loam, the temporarily saturated soils (Avalon/Plinthosols) were a Clay Loam and the permanently saturated soils (Katspruit/Gleysols) were a Sandy Clay.

PH

The pH of the Amhara IAIP soils is generally within the desired range of 6-8.2 at all the sites sampled. As pH increases, the availability of most micronutrients decreases, except for molybdenum, which becomes more available as pH increases. Micronutrient deficiencies rarely occur when the soil pH is below 6.5.

CALCIUM

The Calcium (Ca) content in all the soil samples taken from the Amhara IAIP site is considerably greater than the recommended minimum levels stated in the guidelines provided by Horneck *et al.* (2011). In soil fertility analysis one cannot separate Ca from Magnesium (Mg), thus their management is similar. According to Schulte and Kelling (2004), the Ca:Mg ratio seldom limits plant growth if the soil pH is within the normal growing range. Ca deficiencies are usually found in very acidic soils. They can be corrected by liming with calcium carbonate ($CaCO_3$). Calcium is rarely deficient when soil pH is adequate.

MAGNESIUM

As indicated, Ca and Mg contents in soil are interrelated and the Ca:Mg ratio seldom limits plant growth if the soil pH is within the normal growing range (Schulte and Kelling, 2004). As the guidelines for acceptable levels of Mg are between 60 and 300 mg/kg, the Mg content in the soil samples taken from the Amhara IAIP site are very high.

POTASSIUM

Horneck *et al*. (2011) highlights that Potassium (K) requires the most management of the three primary cations associated with soil fertility (K, Ca and Mg). Excessive K levels may be detrimental to plants. Horneck *et al*. also highlights that very low K content is likely to limit the growth of plants. Guidelines provided by Horneck *et al*. indicate that a K content ranging between 150-800 mg/kg in soils are advisable. The K content in the Amhara IAIP soils are markedly higher than this range.

COPPER

A Copper (Cu) content of above 0.6 mg/kg is sufficient to support plant growth (Horneck *et al*, 2011). Copper deficiencies are rare and Cu was markedly above the recommended lower limit in the Amhara soils analysed.

IRON

Iron (Fe) availability in the soil is related to soil's pH; more acidic soils tend to have a higher Fe content. ARC-SGI (2015) highlights that Fe concentrations can be reduced under pH conditions between 6.5 and 8.0, and the higher the pH the greater the restriction. The Amhara site pH is within the ideal range for cropping and the Fe content is high.

MANGANESE

Manganese (Mn) deficiencies are associated with interveinal yellowing which may also be light green in appearance. Manganese toxicities typically occur under acidic conditions (Arc-SGI, 2015). The diagnosis of either deficiency or toxicity may be attributed to pH during soil testing. Mn toxicity is common in acidic soils. The soils at the Amhara IAIP site are not acidic, yet the Mn content is very high.

MOLYBDENUM

According to Horneck *et al*., Molybdenum (Mo) concentrations are often too low for laboratories to evaluate. The soils at the Amhara site contain Mo below 2.1 mg/kg in both horizons. A study undertaken by ARC-SGI in 2015 indicated that Mo deficiencies in soils seldom occur and thus their effects on plant growth is trivial.

PHOSPHORUS

Phosphorus (P) soil tests are an index of P availability described either as low, medium, high or in excess. When compared to the recommended level of P of between 20 and 100 mg/kg, soils at the Amhara IAIP site are well above the recommended range. P is relatively immobile in soil. If P has been applied in a fertilizer band, concentrations of P may persist where the band was placed, making interpretation of soil test data difficult. High soil phosphorus combined with P movement from soil into surface waters can cause excessive growth of vegetation, damaging aquatic ecosystems.

SULPHUR AS S

Sulphur (S) deficiencies supress protein synthesis, and high protein crops therefore have higher sulphur requirements. S deficiencies are common in sandy soils with limited organic content (FSSA, 2011). The guidelines provided by Horneck *et al* (2011) highlight that soils with an S content greater than 7.5 mg/kg are able to support plant growth. The Amhara IAIP site S content is below the specified range at all sampling points.

BORON

Low levels of Boron (B) may limit plant growth while high concentrations may be toxic (Horneck *et al*, 2011). B content at the Amhara IAIP site soils falls within the recommended range of between 0.2 and 2 mg/kg in the A horizons sampled, and well below this range in the B horizons sampled.

TOTAL NITROGEN

Nitrogen (N) levels are dependent on the system of land use, climate, plant cover, soil microorganisms and the amount of readily decomposable carbonaceous material in the soil. Soil texture also influences the N supply rate of the soil. Soils with a high clay content supply more N than sandy soils (ARC-SGI, 2015). Soils with an N content between 0.1 to 0.12% are conducive to plant growth. The N content at the Amhara IAIP site is higher than the recommended range at all sites sampled, which is expected in these clay-rich soils.

ZINC

Horneck *et al*. (2011) highlight that a Zinc (Zn) content of greater than 1.5 mg/kg is sufficient for most plant growth. The soils at the Amhara IAIP site contain Zn levels well above this. ARC-SGI (2015) denoted that a high level of P in the soil inhibits Zn uptake while high levels of N may promote Zn uptake.

CHLORIDE

Chloride is a micronutrient essential for plant development, however it is required in small quantities (Chapagain *et al.*, 2003). Horneck *et al* (2011), indicate that soils should contain a chloride content ranging from 5 to 50 mg/kg. Samples taken from the Amhara IAIP site indicate that the Chloride

content within the site largely falls within levels that promote plant growth but are too low in two of the B-horizon samples.

ANTIMONY

Natural concentrations of Antimony (Sb) in the environment are low. In topsoil, Sb tends to be slightly enriched. Background concentrations of Sb in soils tend to range between 2 and 6 mg/kg (Tschan *et al*., 2011). The Sb concentrations measured at the Amhara sites for both the A and B horizons range between 1 and 3 mg/kg. According to Tschan *et al* (2009), Sb has no known essential biological functions. Similar to other trace elements, it can be toxic at elevated concentrations, and some Sb compounds are even considered potentially carcinogenic.

TOTAL ORGANIC CARBON

Total Organic Carbon (TOC) is a measure of the overall soil health and, if measured over a long period of time, can be an indication of whether the soil quality is improving. An increased in TOC in soils often indicates an increase in N and microbiological activity. Old soils are generally low in soil organic carbon. Soil type, climate and management influence the amount of organic carbon able to be stored in soil. Typically the organic carbon content in old, dryland agricultural soils is between 0.7–4.0%, however; it can be as low as 0.3% for desert soils or as high as 14% for intensive dairy soils. The tests undertaken for the Amhara IAIP site indicate TOC values that range between 0.66 (low) and 6.24 (relatively high).

SOIL CAPABILITY ASSESSMENT

The soil profiles at the study site indicated a uniform depth of around 1.5m at the auger points assessed. Water was encountered at the base of the majority of the profiles.

Nitisols are arable soils whose limitations can include low phosphorus availability and low base status, but, once ameliorated, these deep, stable soils have high agricultural potential, and are often planted to crops. Nitisols are strongly weathered materials of intermediate to basic parent rock, possibly rejuvenated by recent admixtures of volcanic ash. Nitisols are far more productive than most other highly weathered tropical soils because of their higher fertility and favourable physical properties (good internal drainage, deep rootability and fair water holding properties). More than half of the approximately 200 million hectares of Nitisols world-wide are found in tropical Africa, including Ethiopia.

Katspruit soils can support trees tolerant of wetness but artificial drainage is largely essential on these soils. Crusting and structural deterioration are common limitations of this soil. Precautionary tillage practices are thus necessary.

The land capability of the Shortlands soils was established as Land Capability Group ‘Arable Soils’ and Land Capability Class II, as it has ‘Slight limitations’ and ‘Low erosion hazards’ and can be used for (in order of increased intensity of use) ‘Wildlife, Forestry, Light Grazing, Moderate Grazing, Intensive Grazing, Light Cultivation, Moderate Cultivation and Intensive Cultivation‘ (Table 8.1, Scotney *et al.,* 1987). In the context of the Amhara sites, this is accurate in that these Oxidic soils do pose a low erosion hazard and are deep soils that pose no structural impediment to roots. The Shortlands soil form is potentially fertile and easily managed, and thus a high yielding soil. The Shortland soils identified had effective rooting depths in excess of a meter and good drainage characteristics. Nitisols are perhaps the most inherently fertile of the tropical soils because of their high nutrient content and deep, permeable structure. They are exploited widely for plantation agriculture.

The land capability of the Avalon soils was established as Land Capability Group ‘Grazing’ and Land Capability Class V, as it has ‘Watercourse and land with wetness limitations’ and can be used for (in order of increased intensity of use) ‘Wildlife, Light Grazing and Moderate Grazing’ (Table 8.1, Scotney *et al*., 1987). In the context of the Amhara sites, this is accurate in that these soils have land with wetness limitations. The classification system specifies that soils with wetness limitations cannot support forestry, however, while De Moraes *et al.* (2006) and Arpad (2013) found that plinthic soils can support forestry. Arpad (2013) states that the impenetrability of the hardened plinthite layer, as well as the fluctuating water table that produces it, restrict the use of these soils to grazing or forestry, although the hardened plinthite has value as subgrade material for roads or even as iron ore (the iron oxide content can be as high as 80 percent by mass). Old erosion surfaces may be preserved by a

capping of plinthite (also termed laterite). Manganese is associated with iron in some plinthic materials (DWS, 2007).

The distribution of land capability classes at the Amhara IAIP site can be seen in **Figure 8-12**.

The land capability of the Katspruit soils was established as Land Capability Group 'Grazing' and Land Capability Class V, as it has 'Water course and land with wetness limitations' and can be used for (in order of increased intensity of use) 'Wildlife, Light Grazing and Moderate Grazing' (Scotney *et al.*, 1987). In the context of the Amhara sites this is accurate as this area is used for extensive grazing.

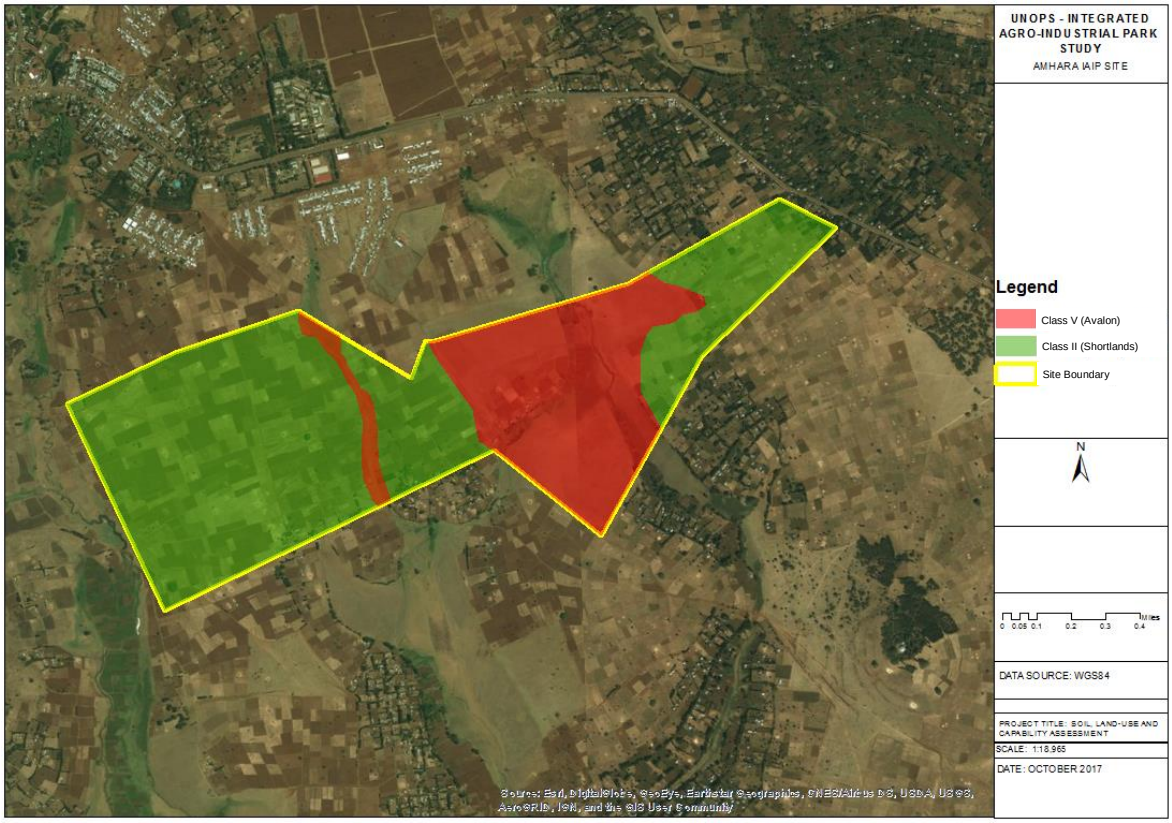

Figure 8-12: Distribution of land capability classes at the IAIP site.

8.5.7 AMHARA RTC

DESKTOP REVIEW

As mentioned, the ISRIC database shows that the Amhara RTC site is covered by Vertisols, as described in Section 8.4.2. Using the United States Department of Agriculture Soil Texture Triangle (USDA, 1939), Vertisols have an average particle size distribution of 21% sand, 24% silt and 56% clay, which works out as an average texture classification of a clay soil.

LAND USE ASSESSMENT

At the Amhara RTC site approximately 3% of the area is under plantations and 97% of the site is used for farming (crop production). This can be seen in **Figure 8-13**.

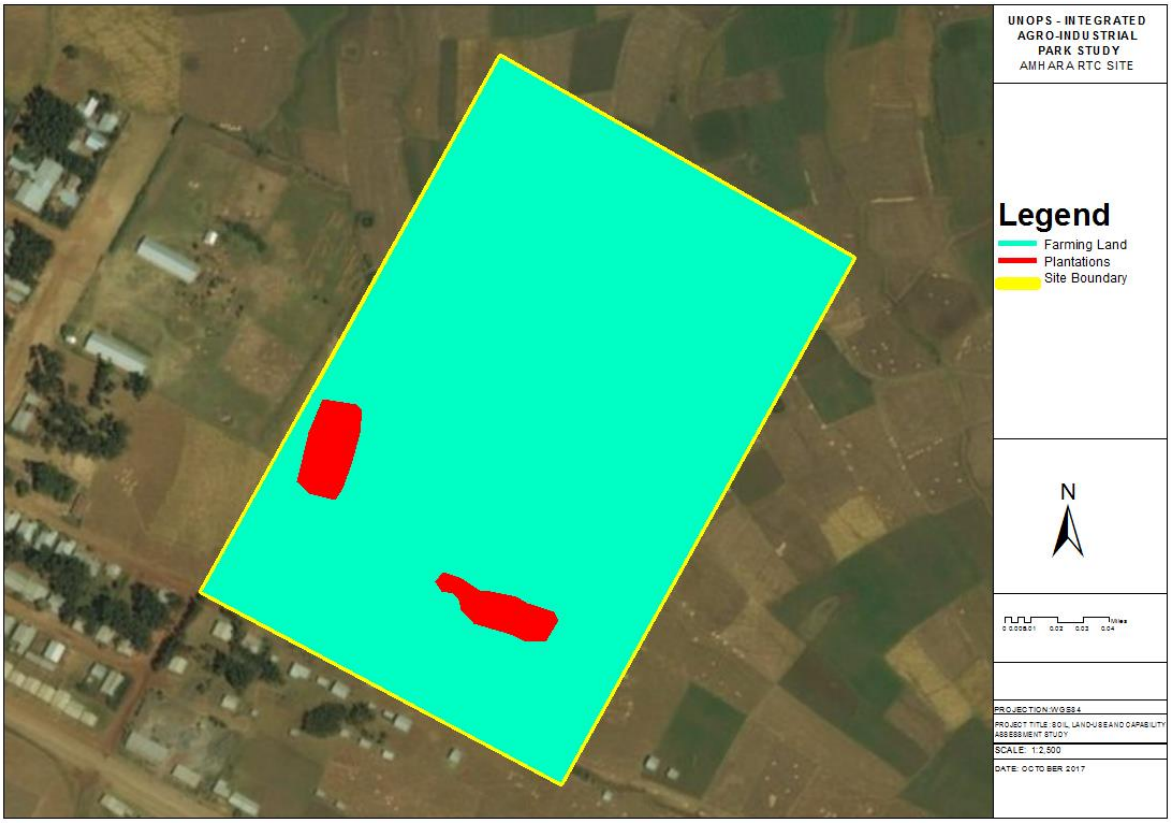

Figure 8-13: Amhara RTC distribution of land uses

SOIL CLASSIFICATION

ARCADIA / VERTISOL SOILS

Figure 8-14 shows a photograph taken during the soil survey, and indicates the unspecified lower horizons identified at the site.

Figure 8-14: Photograph showing an Arcadia / Vertisol soils profile at the Amhara RTC site

As per the soils classification process the Arcadia soil form was identified over 100% of the RTC site (**Figure 8-15**). This soil is characterised by a Vertic A horizon over unspecified lower horizons. The Arcadia soil group falls into the South African Vertic soil group owing to its shrink-swell clay properties. Using the WRB classification system, the soils could be described as Vertisols. These are soils in which there is a high content of expansive clay known as montmorillonite that forms deep cracks in drier seasons or years. Vertic and Vertisol soils clearly describe the same type of soils.

Figure 8-15: Layout showing the soil form of the RTC site.

SOIL FERTILITY ASSESSMENT

Soil analysis was also undertaken for two samples taken at the Amhara RTC site. The soil fertility results are presented in **Table 8-7** and the parameters are discussed in the subsections below. Please refer to the IAIP site section for nutrient guidelines and discussions.

Table 8-7: Laboratory Analysed Soil Nutrients at the Amhara RTC Site

Parameters	Units	AMRTSS3-HORIZON A	AMRTSS3-HORIZON B	Soil Fertility Guidelines
Antimony	mg/kg	4	4	*
Calcium	mg/kg	4680	5473	>150
Copper	mg/kg	63	57	>0.6
Iron	mg/kg	92690	75300	*
Magnesium	mg/kg	3432	3668	60 – 300
Manganese	mg/kg	2353	1715	1.0 - 5.0
Molybdenum	mg/kg	1.8	1.3	*
Phosphorus	mg/kg	753	488	20-100
Potassium	mg/kg	3580	3043	150 -800
Sulphur as S	%	0.02	0.01	>7.5
Boron	mg/kg	0.95	0.91	0.2-2
Zinc	mg/kg	78	80	>1.5
Chloride	mg/kg	18	4	5-50
Total Organic Carbon	%	0.99	1.04	*
Sand	%	57.7	70.4	-
Silt	%	40.2	28.3	-
Clay	%	2.1	1.3	-

Parameters	Units	AMRTSS3-HORIZON A	AMRTSS3-HORIZON B	Soil Fertility Guidelines
pH	pH units	6.79	7.56	6-8.2
Total Nitrogen	%	0.19	0.1	0.1 - 0.12
* **Refers to the general guidelines which were not discussed in terms of ranges but a narrative description is provided in the main context**				

SOIL TEXTURE

The laboratory results of the particle size distribution analysis as shown in **Table 8-7** are clearly incorrect. The laboratory was asked to undergo the analysis again but were unable to, so the soil texture was established based on literature review and photographic evidence as clay soils.

PH

The pH of the Amhara RTC samples taken are within the recommended range for plant growth. .

CALCIUM

The Ca content in the soil samples taken from the Amhara RTC site is higher than the recommended minimum value for optimal plant growth.

MAGNESIUM

The Mg content in the soil samples taken from the Amhara RTC site are very high.

POTASSIUM

The K content in the Amhara RTC soil samples are well above the recommended guideline range.

COPPER

The Cu content of the Amhara RTC site soil samples is well above the recommended minimum limit.

IRON

The Fe content of the Amhara RTC samples is high.

MOLYBDENUM

The Amhara RTC site Mo content is low.

PHOSPHOROUS

The sampled Amhara RTC site P levels were slightly higher than the recommended range.

SULPHUR AS S

A Sulphur deficiency was identified in the soil samples taken at the Amhara RTC site.

BORON

The B content of the Amhara RTC site soils falls within the recommended range for optimal plant growth.

TOTAL NITROGEN

The N content in the Amhara RTC site A-horizon sample analysed fell above the recommended range and the B-horizon sample was within the recommended range.

ZINC

The Zn content of the sampled point at the Amhara RTC site was found to be above the minimum recommended value for optimal plant growth.

CHLORIDE

Analysis results of the samples taken from the Amhara RTC site indicated that the Chloride content within the site falls within the recommended levels for optimal plant growth.

ANTIMONY

The Sb content in the Amhara RTC site soil samples was low and thus not a hindrance to plant growth.

TOTAL ORGANIC CARBON

The analysis undertaken for the Amhara RTC site indicates that around 1% TOC is present in the soils, which is low.

SOIL CAPABILITY ASSESSMENT

As stated in Section 8.5.6, the land capability of the Arcadia soil was established as Land Capability Group 'Arable Soils' and Land Capability Class IV. This is realistic in the context of the Amhara RTC site as the soils appear to be fertile but Vertisols/Vertic soils are highly erosive when dry and their shrink-swell clay properties make them hard to manage.

The distribution of land capability classes at the RTC site can be seen in **Figure 8-16**.

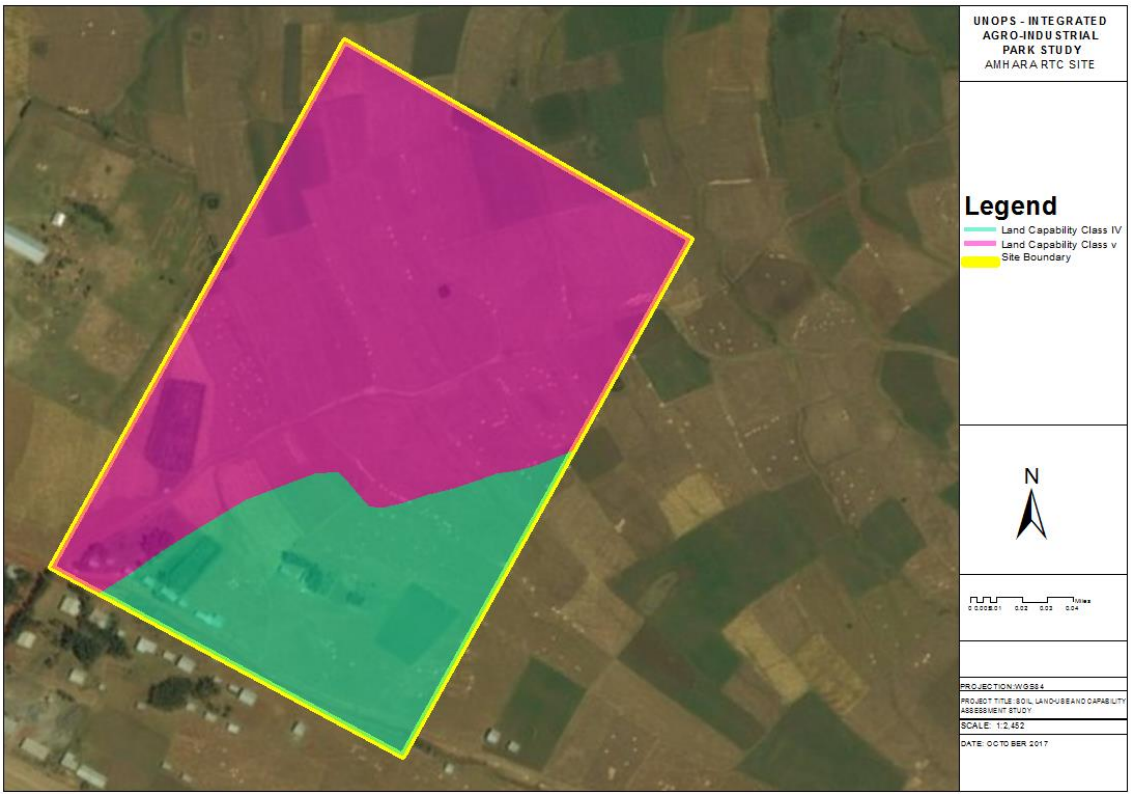

Figure 8-16: Figure showing distribution of land capability classes at the RTC site.

8.6 SURFACE WATER (HYDROLOGY)

This section describes the receiving environment in terms of surface water within the Project site and surrounding area.

8.6.1 DESKTOP ASSESSMENT

A detailed desktop assessment was undertaken for the Amhara IAIP and RTC sites. This included the sourcing and reviewing of relevant available surface water data. Data reviewed included site layout plans, relevant reporting, pertinent published data and interrogation of available databases.

DRAINAGE PATTERNS

The Amhara IAIP and RTC site is situated within the Blue Nile Basin also known as the Abay River Basin. The Blue Nile Basin is one of nine sub-basins that make up the Nile River basin which contributes 454 billion cubic meters of flow per year (**Figure 8-17**). The Blue Nile River basin originates in Lake Tana in Ethiopia, and is the second principal stream of the Nile. Before meeting the White Nile, the Blue Nile is joined by a number of rivers, the main ones being the Rahad and Dinder, both originating in the

Ethiopian Highlands. The climatic and hydrological characteristics if the Abay River Basin can be seen in **Table 8-8** (NBIS, 2012).

Table 8-8: Characteristics of the Blue River Nile Sub-basin

Sub-basin	Area (km2)	Average Annual Rainfall	Average Annual Evapo-transpiration	Specific Runoff (mm/km^2/yr)	Runoff Coefficient (%)	Specific Yield (MCM/km^2/yr)
Blue Nile River	308,157	1,099	1765	148.9	15.9%	0.175

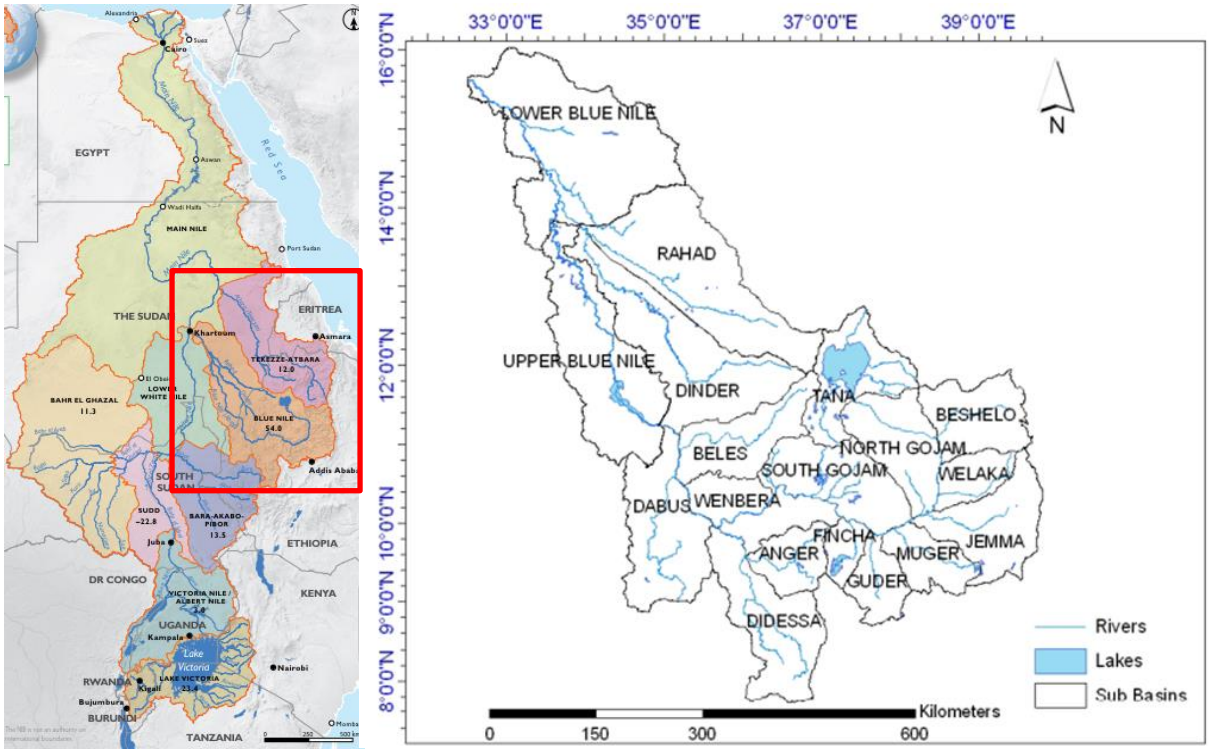

Figure 8-17: Blue Nile Basin (Yilma & Awulachew, 2009)

Rainfall over the Blue Nile basin has distinct seasonal variation with June, July, August, and September being the wet months. May is the transition month from dry to wet season and October is the transition month from wet to dry season. Dry season rainfall variation is high. Annual rainfall ranges from more than 2,000 mm in the southwest of the basin to 800 mm in the northeast. Mean annual rainfall is 1,423 mm with a standard deviation of 125 mm. It is a relatively wet basin. The estimated 100-year drought annual basin rainfall is 1,132 mm while the 100-year wet annual rainfall is 1,745 mm. A basin-wide anomaly of ± 300 mm of rainfall would result in extreme drought or high stream flows. Spatial variation of annual rainfall in the Blue Nile basin is depicted in Figure 2 (Abtew & Melesse, 2014).

MACE undertook an analysis of the 50-year dataset (1967-2016) for the storm water hydraulic analysis to determine the rainfall intensity. The dataset showed that the project site experienced a maximum rainfall event of 179mm during 18 August 2013. During the period of 2007-2016, the maximum rainfall event experienced was 72.4mm per hours on 1 June 2008 and 60.1mm during 26 June 2007. MACE assumed that that the 179mm event occurred over 3 hours during the day. The assumption was made in order to avoid abnormal drain size and wastage of land and to optimise the drain size and associated cost implications. The intensity assumed for the storm water design was 75mm/hr (MACE, 2017).

FLOW PATTERNS

Flow patterns for the site were obtained using stream flow data for the period from 1984 to 2003. This was the only available data set and for the purposes of the assessment it is assumed that flow has not changed significantly over the period. The Yiser River is ungauged therefore flow data from the Lah

River situated near the town of Fenoteselam was used in determining the flow patterns of the Yiser River. Fenoteselam is situated approximately 20km away from the IAIP site and it is assumed to follow a similar hydrological regime of the Yiser stream. Gauged data transferring equation, which is developed by Admasu (1989) for Ethiopian basins applied to transfer the gauged flow data of Lah River to the ungauged Yiser stream near the Bure IAIP project site. The monthly flow data for 21 year presented in **Table 8-9**. The results show that the Yiser River is perennial with your high flow months occurring during June-October.

Table 8-9: Monthly flow for the Yiser River (m^3/s)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1984		0.21	0.21	0.21	0.23	0.4	0.6	0.47	0.43	0.29	0.24	0.23	0.32
1985	0.21	0.21	0.2	0.22	0.26	0.33	0.45	0.56	0.43	0.3	0.25	0.25	0.31
1986	0.21	0.2	0.2	0.21	0.2	0.32	0.48	0.5	0.4	0.31	0.25	0.22	0.29
1987	0.21	0.2	0.2	0.22	0.26	0.35	0.37	0.38	0.38	0.38	0.28	0.25	0.29
1988	0.22	0.21	0.2	0.2	0.22	0.33	0.53	0.57	0.45	0.41	0.28	0.24	0.32
1989	0.23	0.21	0.21	0.21	0.23	0.29	0.52	0.45	0.4	0.32	0.27	0.24	0.3
1990	0.22	0.21	0.2	0.21	0.23	0.26	0.47	0.59	0.53	0.27	0.23	0.22	0.3
1991	0.21	0.2	0.19	0.19	0.19	0.27	0.45	0.63	0.46	0.32	0.29	0.24	0.3
1992	0.24	0.23	0.22	0.21	0.23	0.35	0.41	0.49	0.45	0.37	0.28	0.25	0.31
1993	0.21	0.2	0.2	0.23	0.24	0.37	0.47	0.46	0.42	0.35	0.27	0.22	0.3
1994	0.2	0.2	0.19	0.19	0.24	0.35	0.59	0.51	0.38	0.28	0.24	0.22	0.3
1995	0.2	0.19	0.2	0.2	0.2	0.31	0.9	0.72	0.38	0.28	0.24	0.21	0.34
1996	0.2	0.19	0.19	0.21	0.25	0.34	0.47	0.47	0.4	0.31	0.25	0.21	0.29
1997	0.01	0.01	0.01	0.02	0.36	0.48	1.68	1.8	1.21	0.68	0.25	0.1	0.55
1998	0.02	0.01	0	0.01	0.09	0.56	1.77	2.74	1.19	1.13	0.19	0.05	0.65
1999	0.01	0.01	0	0	0.08	0.65	1.43	1.59	0.72	1.36	0.23	0.07	0.51
2000	0.02	0	0	0.01	0.07	0.4	1.35	1.65	0.73	0.98	0.42	0.07	0.48
2001	0.02	0.01	0.01	0.01	0.03	1.16	0.84	0.79	0.54	0.07	0.06	0.04	0.3
2002	0.2	0.18	0.19	0.19									0.19
2003	0.21	0.2	0.2	0.19	0.18	0.3	0.48	0.45	0.37	0.28	0.23	0.2	0.27
Average	**0.16**	**0.15**	**0.15**	**0.16**	**0.20**	**0.41**	**0.75**	**0.83**	**0.54**	**0.46**	**0.25**	**0.19**	**0.35**

DEPENDABLE FLOW

Dependable flow analysis is an important element of hydrological analysis especially when dealing with the abstraction of water for different use without any storage facility. The reliability of the discharge available at the river during the dry seasons can be computed using the low flow duration curve. As the principle of low flow computation it is essential to use the actual observed data. Based on this basic principle, twenty years of monthly flows of the stream adjacent to the Bure IAIP site, computed using the transferring equation presented above.

The dependable flow at the site computed using the transferred monthly flow and the Gringorten plotting position formula. The Gringorten (1963) plotting position formula, which gives us P= (m-0.44) /(N + 0.12) * 100, where P is the probability of the event of the given amount of flow, m is the rank of flows with their descending order and N is the number of years is used to compute 50% - 90% dependable flow and presented in **Table 8-10**.

Table 8-10: Monthly Dependable Flow of Yiser River (m^3/s)

Exceedance (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50	0.20	0.20	0.20	0.20	0.22	0.35	0.52	0.57	0.44	0.32	0.25	0.22

Exceedance (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
60	0.20	0.19	0.19	0.19	0.20	0.33	0.48	0.51	0.42	0.31	0.24	0.21
70	0.18	0.19	0.19	0.19	0.19	0.32	0.47	0.48	0.40	0.30	0.24	0.19
80	0.02	0.01	0.01	0.02	0.13	0.30	0.46	0.46	0.39	0.28	0.23	0.09
90	0.01	0.01	0.00	0.01	0.08	0.28	0.43	0.45	0.38	0.27	0.21	0.06

The average dependable flow varies throughout the year with the highest flow rates occurring from June to November. Interpretation of the results indicate that that the average dependable flow for 60% of the time during June is 0.33m^3/s. Downstream water users and ecological health would be dependent on that amount of flow in the Yiser River during June for 60% of the time.

8.6.2 SITE ASSESSMENT

Site visits were conducted on during August and September 2017 at the Bure IAIP and Motta RTC sites to ascertain the following:

- General site characteristics such as the site drainage, soils, vegetation, land uses and surface cover;
- General characteristics of the surrounding rivers such as the width of the channel, height of the banks and Manning's roughness coefficients; and
- Baseline water quality samples from the surrounding rivers.

BURE IAIP

Adjacent to the Bure IAIP site the Yiser River, a perennial river runs parallel to the western boundary of the site. The IAIP site has two drainage lines running through the site, in a north-south direction. **Figure 8-18** indicates the location of the identified surface water features in relation to the IAIP site.

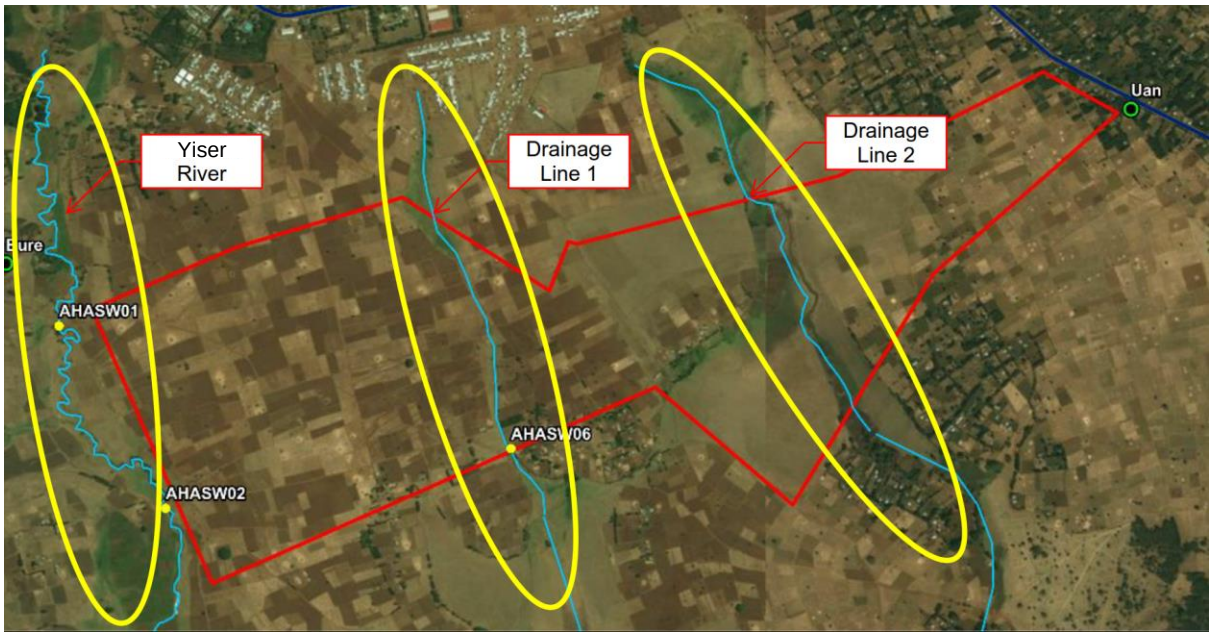

Figure 8-18: Layout showing the surface water features at the IAIP site

Figure 8-19 shows photographs of the upstream and downstream views of Yiser River running adjacent to the site.

Figure 8-19: Photos showing the Yiser River to the west of the IAIP (Source: ESIA team site investigations)

Figure 8-20 shows photographs of the upstream and mid-stream views of Drainage Line 1.

Figure 8-20: Show the upstream and midstream view of the drainage line 1 running through the site

Figure 8-21 shows photographs of the upstream and downstream views of Drainage Line 2. It is noted that this drainage line consists of significant wetland features. For further detail on the wetland features refer to section 8.8.3 of this report.

Figure 8-21: Show the upstream and downstream view of the drainage line 2 running through the site

WATER QUALITY ANALYSIS

Four surface water samples were taken around the site. The location of the sample points are indicated in **Table 8-11** and shown in **Figure 8-22**.

Table 8-11: Surface water sampling points at the Bure IAIP

Surface Water Points	Easting	Northing	pH	Temp (ºC)	TDS (mg/l)	DO (mg/l)
AHASW01	288621.21 m E	1183393.27 m N	7.07	23.9	143.65	3.94
AHASW02	288988.09 m E	1182747.10 m N	7.37	16.2	87.1	7.95
AHASW06	290192.94 m E	1182950.12 m N	7.4	16.3	95.55	7.71
AHASW08	290482.58 m E	1182018.69 m N	7.16	17.6	130.65	2.87

Figure 8-22: Image showing the surface water features and sampling points at the IAIP.

The water quality results are shown in **Table 8-12** and these were compared to the following guidelines:

- Compulsory Ethiopian Standard-Drinking Water Specifications, 2013; and
- World Health organisation (WHO) Guidelines for Drinking Water Quality, 2008.

The water quality samples showed an exceedance in Turbidity which was evident at the time of sampling. This is indicative of the amount of erosion occurring within the catchment. All other parameters fell below the limits

Table 8-12: Water Quality Results for Amhara IAIP (Bure)

Test	Units	LOD	Ethiopian Standard	WHO Guidelines	AHASW 01	AHASW 02	AHASW 06	AHASW 08
Dissolved Aluminium #	ug/l	<20	200	100	<20	<20	<20	<20
Dissolved Antimony #	ug/l	<2	-	20	<2	2	<2	<2
Dissolved Arsenic #	ug/l	<2.5	10	10	<2.5	<2.5	<2.5	<2.5
Dissolved Barium #	ug/l	<3	700	700	32	34	33	29
Dissolved Boron	ug/l	<12	300	500	<12	<12	<12	<12
Dissolved Cadmium #	ug/l	<0.5	3	3	<0.5	<0.5	<0.5	<0.5
Total Dissolved Chromium #	ug/l	<1.5	50	50	<1.5	<1.5	<1.5	<1.5
Dissolved Copper #	ug/l	<7	2000	2000	<7	<7	<7	<7
Total Dissolved Iron #	ug/l	<20	300	-	<20	<20	109	241
Dissolved Lead #	ug/l	<5	10	10	<5	<5	<5	<5
Dissolved Manganese #	ug/l	<2	500	400	191	180	244	138
Dissolved Mercury #	ug/l	<1	-	6	<1	<1	<1	<1
Dissolved Nickel #	ug/l	<2	-	70	<2	<2	2	5
Dissolved Selenium #	ug/l	<3	-	10	<3	<3	<3	<3
Dissolved Sodium #	mg/l	<0.1	200	40	4.2	4.3	5.7	4.8
Dissolved Uranium	ug/l	<5	-	15	<5	<5	<5	<5
Dissolved Zinc #	ug/l	<3	5000	3	<3	<3	<3	<3
Fluoride	mg/l	<0.3	1.5	1.5	<0.3	<0.3	<0.3	<0.3
Sulphate as SO4 #	mg/l	<0.5	-	-	2.6	3.1	1.6	<0.5
Chloride #	mg/l	<0.3	250	-	3.5	5	1.7	1.4
Nitrate as N #	mg/l	<0.05	50	50	2.29	2.33	0.25	0.07
Nitrite as N #	mg/l	<0.006	3	3	0.015	0.008	<0.006	<0.006
Total Cyanide #	mg/l	<0.01	70	70	<0.01	<0.01	<0.01	<0.01
Electrical Conductivity @25C #	uS/cm	<2	-		137	187	222	196
Free Ammonia as N	mg/l	<0.006	1.5	1.5	<0.006	<0.006	<0.006	<0.006
Free/Residual Chlorine	mg/l	<0.02	0.5	5	<0.02	<0.02	<0.02	<0.02
pH #	pH units	<0.01	6.5 - 8.5	6.5 - 8.5	7.59	7.47	7.56	7.64
Total Dissolved Solids #	mg/l	<35	1000	600	<35	172	163	128
Turbidity	NTU	<0.1	-	5	44.3	33.3	3.7	3.9

8.6.3 MOTTA RTC

The Motta RTC site has no surface water features on the site. Numerous drainage lines cross the site in a northern direction. These drainage lines lead into a main drainage line situated approximately 200 m north of the site (**Figure 8-23**). Additionally a drainage channel runs across the southern most

portion of the site, in a westerly direction. This drainage line then flows in a southerly direction under the main road via an existing culvert. Due to the identified features being temporary drainage channels, flowing only during high rainy periods, no surface water monitoring waste undertaken at the site.

Figure 8-23: Image showing the surface water features at the RTC site.

8.7 GROUNDWATER (HYDROGEOLOGY)

This section describes the receiving environment in terms of groundwater within the Project site and surrounding area.

8.7.1 DESKTOP ASSESSMENT

A detailed desktop assessment was undertaken for the Amhara IAIP and RTC sites prior to site work commencing. All available data, including topography data, climate data, hydrogeological classification maps, drilling and pump testing reports and design plans, were reviewed. This data allowed for the establishment of general hydrogeological conditions on site, and was used as the basis for the planning of the site investigation.

According to the geological and hydrogeological maps consulted, the geological and hydrogeological conditions at the IAIP site is similar to that encountered at the RTC site. Thus the general hydrogeological baseline conditions are described as a whole for both the IAIP and RTC sites in the following sections.

8.7.2 SITE ASSESSMENT AND HYDROCENSUS

Site visits were conducted during August 2017 at the Amhara IAIP and RTC sites. During the sites visit, a detailed hydrocensus was carried out across the areas in order to identify all groundwater users and/or groundwater abstraction points. A total of nine points were identified at the IAIP site and five points at the RTC site. The following steps were taken and data gathered at each identified point:

- Location of the point was recorded using a hand held GPS;
- The depth to groundwater was measured and recorded using an electronic dip meter;

- Information was gathered from the water source owner or the water users regarding water use, abstraction volumes, water reliability and availability between wet season and dry season and water quality; and
- Water samples were collected in laboratory approved containers in accordance with internationally accepted best practice guidelines and were submitted to a suitably accredited laboratory for chemical analysis.

8.7.3 GEOLOGY

The geological map of Ethiopia (Kazmin, 1972; and Mengesha Tefera et.al., 1996) showed that both the IAIP and RTC regions are underlain by basalts. The local geology was confirmed through the drilling of water supply boreholes for Bure and Motta towns, which encountered predominantly basalt and basalt-related weathering products.

8.7.4 HYDROGEOLOGY

AQUIFER TYPES AND FLOW DIRECTION

Two main aquifer types are anticipated in the IAIP and RTC project areas.

WEATHERED AQUIFER

A shallow, weathered aquifer system exists in the weathered basalt and clay formations. Groundwater levels within the weathered aquifer tend to be relatively shallow and under unconfined conditions. The weathered aquifer is typically targeted for hand dug supply wells. Five hand dug wells were encountered in close proximity to the IAIP site and four were encountered in close proximity to the RTC site. Static water levels ranged from 5.48 meters below ground level (mbgl) to 8.27 mbgl at the IAIP site and 4.0 mbgl to 7.0 mbgl at the RTC site.

FRACTURED AQUIFER

A deeper, fractured rock aquifer occurs in the basalts underlying the weathered zone. Groundwater flow occurs in discrete fractures which form preferential flow paths within the geological unit under confined conditions. The fractured rock aquifer represents the major aquifer in the region, with deep supply wells being drilled to supply both Bure and Motta towns. Two water supply wells were encountered at the Bure IAIP site and one at the Motta RTC site. Local inhabitants and officials indicated that additional water supply boreholes exist around both towns. Water levels in the boreholes encountered were relatively shallow, with static water levels of 2.78 mbgl encountered at the IAIP site and 13.30 mbgl at the RTC site.

The general groundwater flow direction in all aquifers is expected to be from north to south, broadly flowing the topography and surface water drainage.

HYDRAULIC PARAMATERS

The hydraulic parameters of an aquifer describe the ease with groundwater (and thus potential contaminants contained within the groundwater) move through the subsurface and is used to predict the rate of groundwater movement. The higher the hydraulic conductivity and/or transmissivity, the faster groundwater will move through an aquifer. The hydraulic parameters are obtained by conducting aquifer tests on borehole drilled into the relevant aquifer units.

Aquifer testing information for both the IAIP and RTC sites was very limited, with no aquifer testing reports available for any of the water supply boreholes drilled in either area. Aquifer testing information from a drilling report for the Bure Cool Water Factory, located approximately 9 km south west of the IAIP site, contained the only detailed aquifer testing information which could be obtained for the region. Aquifer parameters were obtained by conducting step tests, constant discharge tests and recovery tests on the borehole. Aquifer parameters were obtained using the Cooper Jacob and Theis Recover methods to analyse the data. The results of this testing has been summarised in **Table 8-13**. The full borehole drilling report is provided in Appendix A of the specialist report attached as **Appendix C-3**.

Table 8-13: Summary of Calculated Aquifer Parameters

Analysis method	Constant rate test	
	Transmissivity	Conductivity
Cooper Jacob	1.54E+1m^2/d	4.32E-1 m/d
Theis Recovery	6.61E+0m^2/d	1.86E-1 m/d

HYDROCENSUS

During the August 2017 site investigation, a detailed hydrocensus was carried out across the IAIP and RTC site areas. The hydrocensus resulted in the following findings:

BURE IAIP SITE

Bure town receives its water supply from municipal water supply boreholes located in the vicinity of the IAIP site, though people living outside the town are still heavily reliant on groundwater for their water supply.

Groundwater use in Bure Town is extensive, with the majority of the town's water supply coming from boreholes in and around the town. Two of the Town's water supply boreholes (AHAGW01 and AHAGW02) are located within relatively close proximity to the IAIP Project Site (approximately 1.2km and 1.3km respectively). However, at that distance it is unlikely that activities at the IAIP Site will have any impact on these boreholes.

Private groundwater use around the IAIP site is prolific, with five shallow hand dug wells (AHAGW03, AHAGW04, AHAGW07, AHAGW08 and AHAGW09) and two springs (AHAGW05 and AHAGW06) being identified in the area.

Water levels in these wells were relatively shallow, with water levels ranging from 0mbgl to 8.27mbgl. The two springs were relatively strong flowing, with local inhabitants indicating that they flow year round.

A total of nine groundwater points were identified at the IAIP Site. A summary of the identified groundwater points is provided in **Table 8-14**, and their locations are shown in **Figure 8-24.**

Table 8-14: Groundwater point inventory around the Bure IAIP site

Groundwater Point	Easting	Northing	Type	Status	Static water level (mbgl)	Status
AHAGW01	289608	1181209	Deep borehole	Not in use	2.78	Deep borehole drilled in marshy ground to the south of the IAIP site. Planned as municipal supply borehole for Bure town. Not currently in use.
AHAGW02	289146	1181313	Deep borehole	In use	Unable to measure	Deep borehole drilled in marshy ground to the south of the IAIP site. Currently being used as a municipal water supply borehole for Bure town.
AHAGW03	289744	1181182	Hand dug well	In use	5.48	Hand dug well in private dwelling. Used for domestic water supply.

Groundwater Point	Easting	Northing	Type	Status	Static water level (mbgl)	Status
AHAGW04	289865	1183966	Hand dug well	In use	0.00	Hand dug well in headwaters of wetland. Used for domestic water supply
AHAGW05	290401	1182837	Spring	In use	N/A	Spring to the south of the site boundary. Used for domestic water supply
AHAGW06	288932	1182902	Spring	In use	N/A	Spring to the west of the site boundary. Used for domestic water supply.
AHAGW07	289455	1182217	Hand dug well	In use	6.27	Hand dug well in private dwelling. Used for domestic water supply.
AHAGW08	289803	1182448	Hand dug well	In use	8.27	Hand dug well in private dwelling. Used for domestic water supply.
AHAGW09	289759	1182671	Hand dug well	In use	6.80	Hand dug well in private dwelling. Used for domestic water supply.

Figure 8-24: Image showing the ground water sampling point at the IAIP

MOTTA RTC SITE

Groundwater use in Motta Town is also extensive, with the majority of the town's water supply coming from boreholes in and around the town. One deep groundwater borehole was identified approximately 850m north east of the RTC Site, with a groundwater level of 13.3 mbgl.

Private groundwater use around the IAIP site is prolific, with four shallow hand dug wells being identified in the area.

A total of five groundwater points were identified at the RTC Site. A summary of all of the groundwater points identified is provided in **Figure 8-16**, and their locations are shown in **Figure 8-25**.

Figure 8-25: Image showing the ground water sampling points at the RTC site.

Table 8-15: Groundwater point inventory around the RTC site.

Groundwater Point	Easting	Northing	Type	Status	Static water level (mbgl)	Comments
Motta 1 (Akobo deep well)	379676	1225558	Deep borehole	In use	Unable to measure	Deep borehole drilled to the north east of the RTC site. Used as a municipal supply well for Motto town
MOTGW01	378905	1224563	Hand dug well	In use	3.0	Hand dug well in private dwelling. Used for domestic water supply.
MOTGW02	378878	1224826	Hand dug well	In use	6.5	Hand dug well in private dwelling. Used for domestic water supply.

Groundwater Point	Easting	Northing	Type	Status	Static water level (mbgl)	Comments
MOTGW03	379516	1224503	Hand dug well	In use	6.15	Hand dug well in headwaters of wetland. Used for domestic water supply
MOTGW04	379490	1224585	Hand dug well	In use	4	Hand dug well in private dwelling. Used for domestic water supply.

GROUNDWATER QUALITY

Five water quality samples were collected from the Amhara IAIP site for chemical analysis. Samples were submitted to an internationally accredited laboratory for analysis during the August 2017 site visit. The results of the analysis are presented in **Figure 8-16**. The complete laboratory report is provided in Appendix B of the specialist report which is attached as **Appendix C-3**.

Table 8-16: Water Quality Results for Amhara IAIP site

Test	Units	Ethiopian Standard	WHO Guidelines	AHAG W03	AHAG W04	AHAG W05	AHAG W06	AHAG W07
Aluminium	µg/l	200	100	<20	<20	<20	<20	<20
Antimony	µg/l	-	20	<2	<2	<2	<2	<2
Arsenic	µg/l	10	10	<2.5	<2.5	<2.5	<2.5	<2.5
Barium	µg/l	700	700	20	39	40	38	8
Boron	µg/l	300	500	<12	<12	<12	<12	<12
Cadmium	µg/l	3	3	<0.5	<0.5	<0.5	<0.5	<0.5
Total Chromium	µg/l	50	50	<1.5	<1.5	<1.5	<1.5	<1.5
Copper	µg/l	2000	2000	<7	<7	<7	<7	<7
Total Iron	µg/l	300	-	<20	146	<20	40	<20
Lead	µg/l	10	10	<5	<5	<5	<5	<5
Manganese	µg/l	500	400	<2	<2	<2	59	8
Mercury	µg/l	-	6	<1	<1	<1	<1	<1
Nickel	µg/l	-	70	<2	<2	<2	<2	<2
Selenium	µg/l	-	10	<3	<3	<3	<3	<3
Sodium	mg/l	200	40	7.4	9.8	8.0	5.7	5.7
Uranium	µg/l		15	<5	<5	<5	<5	<5
Zinc	µg/l	5000	3000	6	<3	4	<3	<3
Fluoride	mg/l	1.5	1.5	<0.3	<0.3	<0.3	<0.3	<0.3
Sulphate as SO_4	mg/l			1.9	1.3	1.9	1.2	0.8
Chloride	mg/l	250	-	0.9	3.2	5.5	1.0	1.0
Nitrate as N	mg/l	50	50	2.52	1.15	6.22	2.20	5.31
Nitrite as N	mg/l	3	3	<0.006	0.021	<0.006	<0.006	<0.006
Total Cyanide	mg/l	70	70	<0.01	<0.01	<0.01	<0.01	<0.01
Electrical Conductivity	µS/cm	-		246	369	276	179	162
Free Ammonia as N	mg/l	1.5	1.5	<0.006	<0.006	<0.006	<0.006	<0.006
Free/Residual Chlorine	mg/l	0.5	5	<0.02	<0.02	<0.02	<0.02	<0.02

Test	Units	Ethiopian Standard	WHO Guidelines	AHAG W03	AHAG W04	AHAG W05	AHAG W06	AHAG W07
pH	pH units	6.5 - 8.5	6.5 - 8.5	7.10	7.16	7.05	6.95	6.94
Total Dissolved Solids	mg/l	1000	600	128	262	134	135	116
Turbidity	NTU	-	5	0.6	1.0	0.6	1.4	1.9

The results of the groundwater quality analysis indicate that the groundwater quality in the area is good, with all analysed constituents falling within the recommended guidelines.

8.8 WETLANDS

This section describes the receiving environment in terms of wetlands within the Project site and surrounding area.

8.8.1 DESKTOP ASSESSMENT

An in-depth desktop assessment, utilising aerial imagery (2005 - 2016) and available datasets, was conducted to determine potential wetland habitats.

Ethiopia is reported to have more than 58 different types of wetlands which provide significant socio-economic and environmental values. Despite their small area coverage, wetlands in Ethiopia are among the most productive ecosystems, and have significant economic, social, and environmental benefits. The importance of Ethiopian wetlands goes beyond their status as habitat of many endangered flora and fauna species but they are a vital element of national and global ecosystems and economies Mengesha 2017). Despite all this and other indispensable values, these wetlands are under severe pressure and degradation (Seid, 2017).

The most common threats to wetlands are the result of a combination of social, economic and climatic factors, which have increased pressure on the natural resources in Ethiopian wetlands. Wetlands in Ethiopia are being transformed and altered at a significant rate into what many people consider better alternative uses.

The main activities resulting in the transformation of wetland habitat in Ethiopia include the unregulated conversion for agricultural production (including draining and diversion of water), overgrazing, clearance and overharvesting of vegetation and appearance of alien invasive plant species. Another constraint to the sustainable use of African wetlands is lack of knowledge by planners and natural resource managers of the benefits that specific wetland habitats provide and techniques by which these habitats be utilised in a sustainable manner (Mengesha, 2017).

The impacted wetlands provide various socioeconomic and ecological benefits to society, which are or have the ability to significantly improve the livelihood of the communities surrounding the wetland systems. As the level of wetland degradation increases their benefit is also reduced (Kassa and Teshome, 2015).

Ethiopia has not yet ratified the Ramsar Convention on wetlands and, therefore, none of the identified 25 potential Ramsar wetlands in the country is designated in the list of wetlands of international importance (Mereta, 2013; Harper et al., 2016). Regardless of their vital role in food security and rural livelihood, the extent, diversity, distribution and conservation status of wetlands in Ethiopia is not well documented. Furthermore, there are no clear policies and strategies that protect wetlands in the country. Although wetland related issues are included in Ethiopian water resources, agricultural and environmental policies, the implementation of wetland management and conservation in the context of the above policies is compounded by a '*more pressing wetland task force, extension package and food security policies that may seek to convert wetlands for agricultural purposes*' (Mereta, 2013).

In Ethiopia, there is a lack of efficient and sufficient coordination and policy support, relating to wetland management. Due to the absence of workable institutional arrangement and wetland management policy, sustainable wetland management and capacity building are not encouraged. The result is a shortage of skilled manpower which is capable of disseminating the concept of wise use of wetlands (Birhan et al., 2015; Seid, 2017).

8.8.2 SITE ASSESSMENT

An infield assessment was conducted during August 2017 and the confirmed systems were delineated and assessed, along with additional systems identified during the infield assessment.

The methods used for the wetland delineation broadly followed the approach as outlined below:

- Desktop identification of watercourses within the boundary of the proposed sites;
- Infield delineation and classification of watercourses within the proposed sites;
- Functional analysis of the potentially impacted watercourses (i.e. PES, EIS).

For an in-depth description of each individual method refer to the specialist report attached as **Appendix C-4**. Available datasets were utilised, to supplement the information gathered on site.

8.8.3 BURE IAIP

WETLAND DELINEATION

The site spans across three (3) micro-catchments, with two drainage lines falling within the site boundary. These drainage lines contain both permanent and seasonal wetland habitats. There are riverine wetland systems located within the valley-bottom areas of the catchments. Additionally there are seasonal hygrophilous grasslands located on the slope of the catchments leading towards these valley-bottom systems.

WETLAND CLASSIFICATION

In order to identify the wetland types, a characterisation of hydrogeomorphic (HGM) types was conducted. These have been defined based on the geomorphic setting of the wetland in the landscape (e.g. hillslope or valley bottom, whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated), how water flows through the wetland (diffusely or channelled) and how water exits the wetland.

The HGM approach considers structural components of the wetland and surrounding landscape such as plants, animals, hydrology, and soils; biological, chemical, and physical processes; and the interaction of these components and processes. Surrounding land use is addressed because it impacts structural components and processes in the wetland.

The identified systems were classified into respective HGM units, as identified in **Table 8-17**. The extent of each of the HGM units are illustrated in **Figure 8-26**.

Table 8-17: Classification of identified wetland habitats

ID	Ramsar Classification	HGM Unit	Ethiopian Biome	Nature	Co-ordinates	
W1	Freshwater, tree-dominated wetlands (Xf); Permanent freshwater marsh (Ts)	Riverine	Afro-Tropical Highlands	Perennial	10°41'57.92"N	37° 5'29.23"E
W2	Seasonal/intermittent freshwater marshes on inorganic soils (Ss)			Seasonal	10°41'55.98"N	37° 4'51.92"E
W3	Permanent freshwater marsh (Ts)			Perennial	10°41'54.18"N	37° 5'19.32"E
W4				Perennial	10°41'26.94"N	37° 5'1.51"E
W5	Seasonal/intermittent freshwater marshes on inorganic soils (Ss)			Seasonal	10°41'27.74"N	37° 4'48.78"E
W6		Slope		Seasonal	10°41'38.73"N	37° 4'15.60"E
W1a				Seasonal	10°42'11.08"N	37° 5'32.01"E
W1b				Seasonal	10°42'1.71"N	37° 5'13.59"E

ID	Ramsar Classification	HGM Unit	Ethiopian Biome	Nature	Co-ordinates	
W1c				Seasonal	10°41'48.50"N	37° 5'23.97"E

Wetlands W1, W3 and W4 are areas of water, which is natural, and permanently flowing throughout the year (Plate 1a). Wetland W2 is an area of water, which is natural and consists of permanent and temporary zones, with variable flows (Plate 1b & c). Wetlands W1a-c, 5 & 6 are areas of water that are natural and seasonal (temporary) in nature.

All the wetlands identified onsite showed signs of permanent and/or seasonal wetness as indicated by the soil properties (Plate 2). Iron is one of the most abundant elements in soils, and is responsible for the red and brown colours of many soils (Plate 2a). As iron is dissolved out of the soil as a result of prolonged anaerobic conditions, the soil matrix is left a greyish, greenish or bluish colour, and is said to be gleyed (Plate 2b).

This is indicative of the permanently wet areas of the wetlands. A fluctuating water table associated with seasonal and temporary areas of the wetlands has resulted in the formation of mottles (Plate 2c-d). Additionally, all the wetlands have wetland-dependent and wetland-associated wetland species (e.g. *Cyperus latifolius, Pycreus spp.)* (Plate 3).

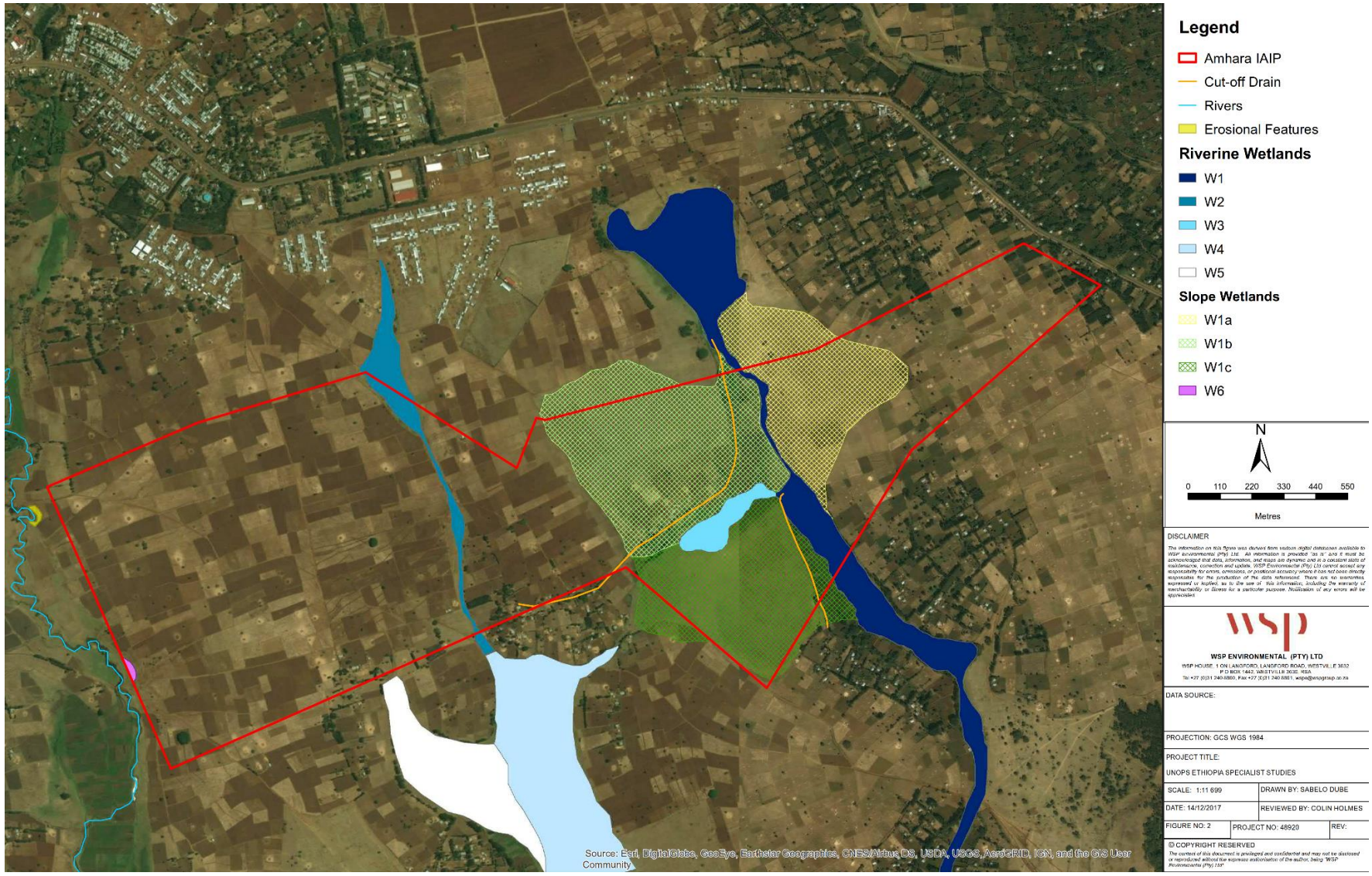

Figure 8-26: Delineation of wetland units in relation to the Bure IAIP site

Although wetlands located within a valley-bottom setting (riverine) are generally sites of sediment accumulation or temporary storage, the process of river-derived deposition is not nearly as important in these systems as it is in floodplain wetlands. As such, there tend to be few (if any) depositional features present within the wetland that can be ascribed to riverine processes, although erosional features relating to riverine processes may be present. These wetlands are not formed by the process of flooding and large-scale sediment movement. The dominant water inputs to these wetlands are from the river channel flowing through the wetland, either as surface flow resulting from flooding or as sub-surface flow, and from adjacent valley-side slopes (as overland flow or interflow). Water generally moves through the wetland as diffuse surface flow, although occasional, short-lived concentrated flows are possible during flooding events. The water exits these types of wetlands in the form of diffuse surface or subsurface flow into the adjacent channel, with infiltration into the ground and evapotranspiration of water from these wetlands also being potentially significant.

The seasonal hygrophilous grassland (slope) wetland systems are located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope. They are located on the side-slopes of a valley but they do not, typically, extend onto a valley floor. The water inputs are primarily via subsurface flows from an up-slope direction. Water movement through the seep is mainly in the form of interflow, with diffuse overland flow (known as sheetwash) often being significant during and after rainfall events. The systems occupy a significant area of the IAIP and act as a sponge and have a sustaining effect on downstream flow during low-flow periods.

PRESENT ECOLOGICAL STATE

All the wetlands are considered to be natural in origin with the systems having undergone minimal to large modifications. The wetland systems within the boundary of the site have experienced significant impacts. These systems are still however functioning and providing goods and services within the natural environment. There is wetland obligate species present within the systems. The various micro-catchments have been transformed from natural vegetation to agricultural land for crop production and grazing.

The catchment impacts include landscape transformation from the natural state due to formal/informal housing, unpaved road infrastructure, livestock/human tracks, grazing and subsistence farming practices. These impacts have resulted in modified surface runoff regimes as there is a reduction in surface roughness and modified soil permeability. Alien invasive plant species such as *Eucalyptus grandis* are also present within the catchment in disturbed areas. Soil erosion is largely restricted to outside the site boundary with active bank instability (incision of the bed of the channel) along with river profile along the western boundary of the site.

A major indirect factor resulting in the degradation of the wetlands' current state is poverty. The wetland resources are utilised in an attempt to make a livelihood, however as these are limited resources they have been over exploited (Dabassa 2010). A significant portion of the vegetation resources have been denuded and the majority of the bird and other wild fauna species have left these wetlands (and the surround catchments) due to loss or transformation of their natural habitats, (i.e. trees have been removed and grasses been overgrazed) (EPA 2004).

Grazing is a direct threat to these wetlands in addition to the above factors. Due to historic grazing followed by cultivation; wetlands and their catchments easily became degraded, and lost their natural characteristics (consequently their resources as well) as with the IAIP site. The livestock lead to soil compaction and vegetation loss as they trample the soil and compact it, resulting in the transformation of the natural vegetation (Coates et al. 2010). These effects have resulted in the degradation of the wetlands and their catchments by reducing the water table and by changing the original vegetation (Mengesha 2017).

FUNCTIONAL ASSESSMENT

The functionality of the riverine wetlands located within the valley-bottom tends to contribute less towards flood attenuation and sediment trapping, but they supply these benefits to a certain extent. The potential for removal of nutrients and toxicants would generally be expected to some degree, particularly from diffuse water inputs from the adjacent slope wetlands (Kotze et al. 2009). The erosion of a channel through the wetland (W1 and W2) indicates that sediment trapping is not always an important function of this wetland type. Under low and medium flows, transport of sediment

through, and out, of the system are more likely to be the dominant processes. Erosion is vertical and reflects the attempts of a system to reach equilibrium with the imposed hydrology. As flows become more channel-bound through vertical incision and lateral erosion of the channel, the ability of the wetlands to trap sediments decreases.

The slope wetland systems are known to contribute to a level of surface flow attenuation until soils are saturated, after saturation, their contribution to flood attenuation is limited. Services also relate to water quality enhancement, e.g. removal of excess nutrients and inorganic pollutants produced by agriculture, industry and domestic waste.

There is expected high removal of potential nitrogen (nitrates) within the systems. Nitrogen and specifically nitrate removal could be expected as the groundwater emerges through low redox potential zones within the wetland soils, with the wetland plants contributing to the supply of organic carbon necessary to 'feed' the denitrification process. Particularly effective removal of nitrates is associated with diffuse sub-surface flow, which is a characteristic of majority of the slope wetlands. Slow water flow through a wetland is essential for settling of particulate phosphorous (Van der Valk et al., 1978).

The systems linked to a stream channel have an accumulation of organic matter and fine sediments in the wetland soils resulting in the wetland slowing down the sub-surface movement of water down the slope. This 'plugging' effect increases the storage capacity of the slope above the wetland, and prolongs the contribution of water to the stream system during low flow periods. This contribution may continue into the dry season, but it is confined mainly to the wet season (Kotze et al., 2007).

There is currently provision in terms of cultivated foods derived directly from these systems. This is evident due to the cultivated land within the systems and the presence of cut-off drains to drain the cultivated areas. Additionally, the wetland systems provide a grazing resource for the local community. The provision of water for human use is also a significant benefit that is being provided to the local community by Wetlands W1-3. There was no evidence of endangered species however this would be confirmed by the biodiversity assessment. There is no evidence that any of the systems are providing services in the form of tourism/recreation, education/research and/or socio-cultural aspects.

Due to the low organic content within the soil and subsequent lack of peat all the systems are not deemed significant in terms of carbon storage. However, in general, wetlands are one of the most effective ecosystems for storing soil carbon (Schlensinger, 1997) (Mereta 2013). The provision of water for human use is the only benefit that is considered a significant service provided by wetland W1, W3 and W5.

It must be noted that wetland size plays a major role in the contributing to the provision of particular benefits. The size of wetland in relation to benefits such as flood attenuation, sediment trapping and phosphate assimilation is always very important; with nitrate and toxicant removal, erosion control, cultivated foods and carbon storage usually being determined by wetland size. The ability for the systems to provide goods and services such as water supply, streamflow regulation and biodiversity maintenance is less dependent on the size of the systems. Therefore as the systems are significant in extent and hydrologically connected, the ability for the wetlands to provide the abovementioned goods and services is further improved.

8.8.4 MOTTA RTC

The desktop screening and infield assessments of the Motta RTC determined that there were no wetland habitats within the site boundaries or in close proximity to the site, where there was a potential for wetland habitats to been indirectly impacted. Site investigations confirmed that the RTC site showed no signs of wetland habitat within its boundary.

8.9 AIR QUALITY

This section describes the receiving environment in terms of Air Quality within the Project site and surrounding area.

8.9.1 BURE IAIP

Potential sources of emission surrounding the proposed site include:

- Commercial and industrial activities;
- Vehicle entrainment on unpaved roads;
- Vehicle tailpipe emissions;
- Domestic fuel burning;
- Agricultural activities.

Table 8-18 presents all the proposed production units within the IAIP as well as potential significant sources of air quality within each unit. It is anticipated that most units will not generate significant emissions with trucks the main source of particulate and gaseous emissions. The boiler will also generate emissions during start-up, normal and abnormal operating conditions. The brewery will also likely be a key source of odorous emissions. Detailed information on each source (such as source type, fuel consumption and operational hours) is required to assess the potential impact of emissions from sources on the surrounding area.

Table 8-18: List of various IAIP units and associated air quality sources

Unit	Potential Air Quality Sources	Pollutants
Sewage treatment plant	Composting	Odour, TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
	Septic wastewater or sludge	
	Solids processing	
	Trucks	
Solid waste management plant	Trucks	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
	Conveyors	
Boiler, chiller & compressor	Boiler	PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
Milk & Dairy Plant	Boiler (if applicable)	PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
	Filling/empting milk tankers and storage silos	Odour
	Spray drying systems, bagging of product (milk powder residues)	TSP, PM_{10}, $PM_{2.5}$
	Trucks	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
Honey processing unit	Trucks	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
Brewery	Wort boiling	Odour
	Use and storage of grains, sugar and kieselguhr	TSP, PM_{10}, $PM_{2.5}$
	Trucks	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
Cereals ancillary unit	-	-
Cereals processing unit	Trucks	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs
Cereals anchor units	-	-
Cereals raw material storage	-	-
Vegetable anchor units	-	-
Vegetable ancillary units	-	-
Vegetable preparation area	-	-
Vegetable processing units	Solids handling, solid reduction and drying	TSP, PM_{10}, $PM_{2.5}$,
	Steam peeling, blanching and dehydrating	Odour
	Trucks	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, VOCs

Unit	Potential Air Quality Sources	Pollutants
Vegetables – finished goods storage	-	-
Raw material storage	-	-
Grading, packing and labelling	-	-
Finished goods storage	-	-
Sesame processing units	-	-
Sesame anchor units	-	-
Sesame ancillary units	-	-
Poultry - egg storage unit	-	-
Poultry - egg processing unit	Trucks	TSP, PM_{10}, $PM_{2,5}$, SO_2, NO_2, CO, VOCs
Other animal products processing unit	Trucks	SP, PM_{10}, $PM_{2,5}$, SO_2, NO_2, CO, VOCs
Meat - deep freeze cold storage	-	-
Meat anchor unit	-	-
Meat processing unit	Singeing, scalding, lairage, wastewater treatment and rendering	Odour, TSP, PM_{10}, $PM_{2,5}$
	Trucks	TSP, PM_{10}, $PM_{2,5}$, SO_2, NO_2, CO, VOCs
Meat rendering unit	Singeing, scalding, lairage, wastewater treatment and rendering	Odour, TSP, PM_{10}, $PM_{2,5}$
	Trucks	TSP, PM_{10}, $PM_{2,5}$, SO_2, NO_2, CO, VOCs
School	-	-
Crèche	-	-
Certification lab	-	-
Retail space	-	-
Polyclinic	-	-
Substation	-	-
Extension centre	-	-
Administrative building	-	-
Training centre	-	-
Housing	-	-
Truck lay bay, fuel station and weigh bridge	Trucks, Filling Station	TSP, PM_{10}, $PM_{2,5}$, SO_2, NO_2, CO, VOCs

To assess the current baseline ambient air quality situation, dust fallout monitoring was conducted at five sites from the 18 September to 17 November 2017. Passive monitoring of SO_2 and NO_2 concentrations was also undertaken at the same sites for a 14-day period from 18 September to 02 October 2017 (with the exception of Amhara – DFO 03 which was undertaken from 24 September to 08 October 2017). The coordinates of the monitoring points are provided in **Table 8-19** and are graphically illustrated in **Figure 8-27.**

As per the terms of reference, dust fallout monitoring was proposed to be undertaken for a three-month period. However, due to high rainfall experienced at the start of the project, the monitoring was delayed until September 2017, and as such, monitoring was limited to a two-month period. In addition, a number of constraints were experienced over the monitoring period, including security issues, possible contamination of samples and other external factors.

Table 8-19: Dust fallout and passive monitoring locations at Amhara.

Site	Coordinates	
	UTM N (m)	UTM E (m)
DFO 1	1183878.24	289795.58
DFO 2	1183460.85	288724.06

Site	Coordinates	
	UTM N (m)	UTM E (m)
DFO 3	1182475.03	289112.10
DFO 4	1183235.17	291559.24
DFO 5	1183855.67	291451.83

Figure 8-27: Dust fallout and passive monitoring locations at Bure IAIP.

DUST FALLOUT MONITORING

Deposition of large (>10 µm) solid particles is a function of the airborne concentration and the particle gravitational speed. The monitoring of fugitive dust is therefore conducted principally by passive dust deposition gauges, whereby an open-mouthed container is partially filled with distilled water and exposed for a designated period of time. The container is then collected and the insoluble particles are removed by filtering the water and weighing, whilst the soluble particle mass is determined after evaporation of a sample of the filtered solution. This is a standardised sampling technique in South Africa, commonly referred to as 'bucket-monitoring' that was originally derived from the American Society for Testing and Materials standard method for collection and analysis of dust fallout (ASTM D1739).

The sampling equipment consists of a non-directional fallout bucket with a circular opening of 19 cm and a depth of 33 cm (ASTM D1739-98). The specifications are as close as possible (with available materials) to those recommended by the ASTM D1739-98 Standard. The low aspect ratio (i.e. the height to width ratio) is required to keep collected particulates in the bucket before they settle in the sample water that is treated with a small quantity of biocide to prevent algal growth. The ASTM method stipulates that the stand which supports the container needs to be two metres above the ground as there is a large variability in the concentration of particles subject to settling at heights less than two metres.

PASSIVE SAMPLING

Passive samplers do not involve the pumping of any air. Instead gases diffuse onto the surface of the sampler and adsorb onto filter material contained inside a collection cartridge. The rate of adsorption of the samplers is known and, with the recorded exposure period, a gas concentration can be calculated. **Figure 8-28** shows the adsorption process. Passive samplers are deployed for specific time periods to allow for adequate adsorption of the gas onto the sorbent material for analytical measurement, but to avoid saturation point or a result below the detection limit (BDL). Air flow along the central duct is at ~2 m/s with a temperature of 13°C and relative humidity of 70%. These are within the limits appropriate to the samplers (Radiello, 2006).

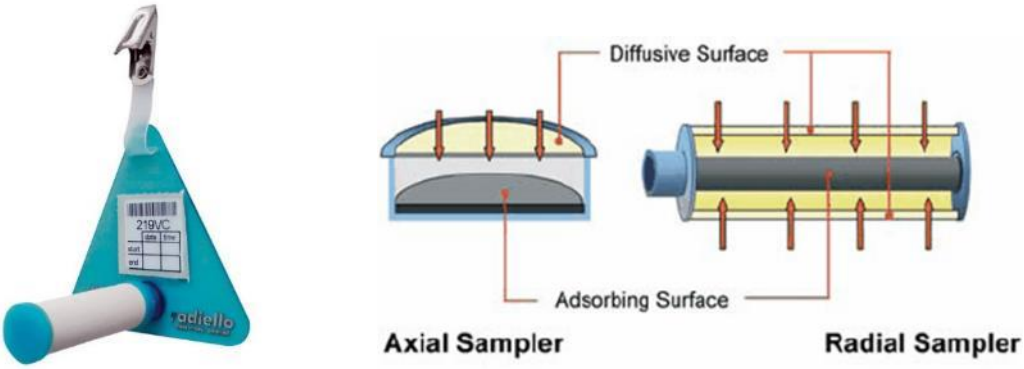

Figure 8-28: Diffusive and absorbing surfaces of a passive sampler

SITE ASSESSMENT RESULTS

No monitoring data is available to date to assess the baseline air quality situation.

SENSITIVE RECEPTORS

Bure is the nearest town, located less than 1 km to the north and west of the Amhara IAIP site. Other sensitive receptors located in close proximity to the IAIP site include residential and farming activities. **Table 8-20** identifies other major receptors in relation to the IAIP site and the direction and distance from the site.

Table 8-20: Sensitive receptors surrounding the Bure IAIP

Receptor	Distance	Direction
Bure	~ 1 km	West and North
Denjin	~ 7 km	South
Tiyatiya	~ 8 km	West
Masha Kuta	~ 8 km	Northeast
Mankusa	~ 9 km	East
Jib Gedel	~ 9 km	North

8.9.2 MOTTA RTC

Based on the activities proposed at the RTC, it is anticipated that air quality impacts will be minimal and as such, a high-level assessment of the Amhara RTC site was conducted.

SENSITIVE RECEPTORS

The town of Motta is located immediately west of the Amhara RTC site. Sensitive receptors located in close proximity to the RTC site include residential and farming activities. **Table 8-21** identifies receptors surrounding the site and the direction and distance from the site.

Table 8-21: Sensitive receptors surrounding the Motta RTC

Receptor	Distance	Direction
Motta	Immediate	West
Debir	~ 6 km	Northeast
Muger	~ 8 km	South Southwest
Hudad	~ 12 km	West
Adasha	~ 10 km	East
Assama	~ 11 km	Southwest

8.10 CLIMATE CHANGE

8.10.1 OVERVIEW

Climate change poses a huge challenge to Ethiopia's government and people. Home to 90 million people, it is one of the world's most drought-prone countries. The country faces numerous development challenges that exacerbate its vulnerability to climate change, including high levels of food insecurity and ongoing conflicts over natural resources. Chronic food insecurity affects 10% of the population, even in years with sufficient rains. Food insecurity patterns are linked to seasonal rainfall patterns, with hunger trends declining significantly after the rainy seasons.

Climate variability already negatively impacts livelihoods and is likely to continue. Drought is the single most destructive climate-related natural hazard in Ethiopia. Estimates suggest climate change may reduce Ethiopia's GDP up to 10% by 2045, primarily through impacts on agricultural productivity (Climate Risk Profile: Ethiopia). These changes also hinder economic activity and aggravate existing social and economic problems. **Figure 8-29** shows the climate classification in Ethiopia.

Historic climate trends since 1960 show that:

- Mean annual temperature has increased by 1°C, an average rate of 0.25°C per decade, most notably in July through September;
- The average number of "hot" nights (the hottest 10 percent of nights annually) increased by 37.5% between 1960 and 2003, while the average number of hot days per year increased by 20%;
- More intense precipitation during extreme weather events, although long-term rainfall trends are difficult to determine;
- Ethiopia has three rainy seasons: June–September (kiremt), October–January (bega), and February–May (belg). Kiremt rains account for approximately 50–80% of the annual rainfall totals, and most severe droughts usually result from failure of the kiremt. The lowlands in the southeast and northeast are tropical, with average temperatures of 25°–30°C, while the central highlands are cooler, with average temperatures of 15°–20°C. Lowlands are vulnerable to rising temperatures and prolonged droughts, while highlands are prone to intense and irregular rainfall;
- The incidence of drought has hence increased; and
- Belg rains are increasingly unpredictable.

Future projections of temperature and rainfall patterns in Ethiopia exhibit a high degree of uncertainty, but most projections predict that:

- Mean annual temperature is projected to increase by between 1°–2°C by 2050;
- The frequency of hot days and nights will substantially increase. About 15–29 percent of days will be considered hot by 2060;
- It is uncertain whether rainfall will increase or decrease; projections range from -25% to +30% by the 2050s; and

- Increases in the proportion of total rainfall that falls in “heavy” events with annual increases of up to 18%.

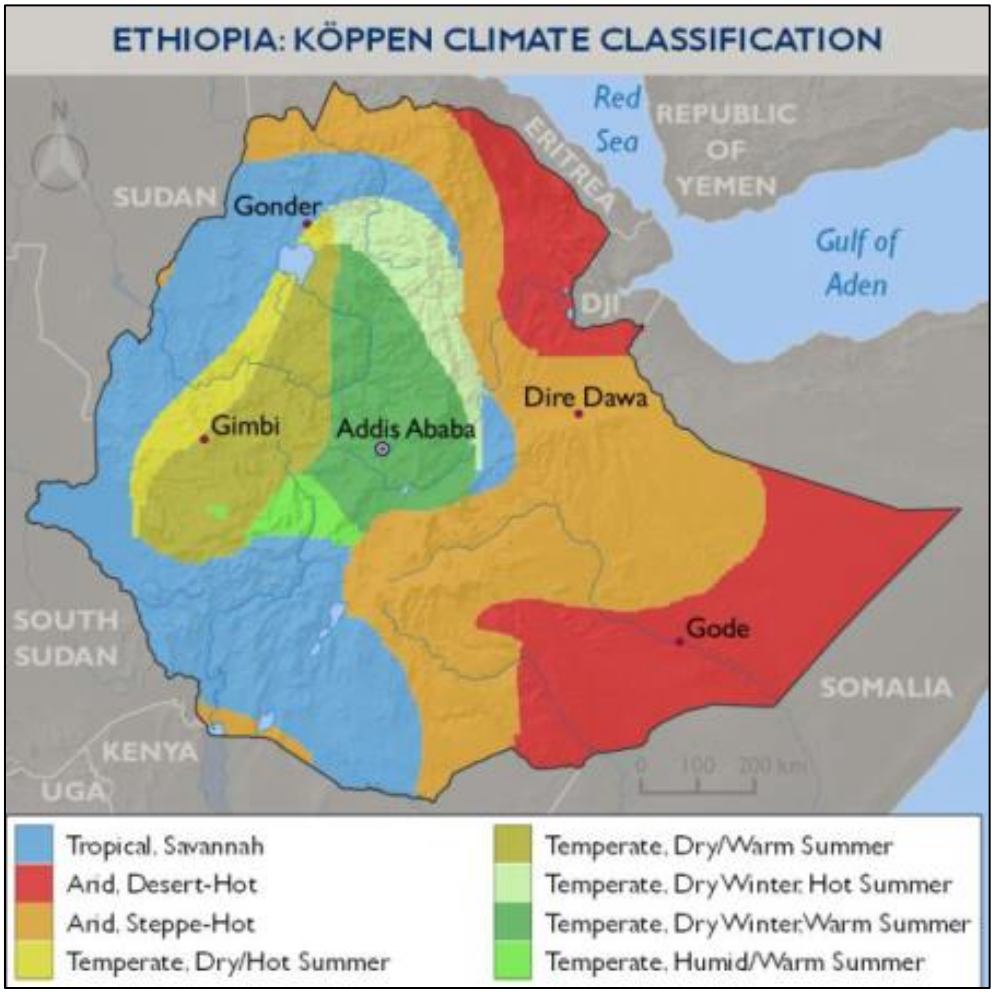

Figure 8-29: Climate classification of Ethiopia (Climate Risk Profile: Ethiopia)

Climate change will have key impacts on agriculture, livestock, water and human health in Ethiopia. In particular, this will result in:

- Reduced yields and/or crop failure, reduced soil moisture availability; and increased evapotranspiration and water stress;
- Increased incidence of pests and diseases, reduced feed and water sources, and increased livestock mortality;
- Changing ranges of vector-borne diseases and increased risk from waterborne diseases;
- Reduced water quality and quantity, drying of wetlands and freshwater sources, disruption of hydropower generation;
- Changing ranges of vector-borne diseases; and
- Increased risk from waterborne diseases.

Despite the challenges, Ethiopia hopes to capitalise on its current economic growth by becoming more resilient to the impacts of climate change while developing its economy in a carbon neutral way by transforming development planning, investments and outcomes.

The country’s Climate Resilient Green Economy Strategy (CRGE), which was published in 2011, sets out this vision (International Institute for Environment and Development). It is viewed as an opportunity to transform the country’s development model by leaping to modern energy-efficient development trajectories.

Ethiopia is one of the few countries to have formally merged its aims of developing a green economy and greater resilience to climate change under a single policy framework in support of its national

development objectives. While the government is still preparing its climate resilience objective, the Green Economy component of the CRGE has already been developed (International Institute for Environment and Development). It aims to develop Ethiopia's green economy by:

- Improving crop and livestock production practices to improve food security and increase farmer's incomes while reducing emissions;
- Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks;
- Expanding electricity generation from renewable energy sources for domestic and regional markets; and
- Advancing to modern and energy-efficient technologies in transport, industrial sectors, and buildings.

Greenhouse gas emissions in Ethiopia increased by 86% from 1993 - 2011. Through the Intended Nationally Determined Contribution, Ethiopia pledges to cap 2030 greenhouse gas emissions at 145 MtCO2e, a 64% reduction from projected business as usual emission levels in 2030. The pledge includes greenhouse gas reductions from agriculture, forestry, industry, transport and buildings sectors.

8.10.2 GREENHOUSE GAS ASSESSMENT

EMISSION FACTOR APPROACH

Default IPCC emission factors available in the 2006 IPCC Guidelines have been used to calculate emissions from activity data

EMISSION CATEGORIES

GHG emission activities are divided into three scopes within the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard, defined as:

- **Scope 1**: Direct emissions arise from activities owned or controlled by an organisation, such as emissions from combustion in boilers, furnaces, and vehicles operating onsite. In the case of Project, this refers to emissions associated with the internal combustion engines for transport vehicles;
- **Scope 2**: Indirect emissions released into the atmosphere associated with the consumption of purchased electricity, heat, steam and cooling; these emissions occur at a distance from the site (e.g. at a power plant). In the case of the Project, this refers to GHG emissions due to their electricity consumption onsite; and
- **Scope 3**: Other indirect emissions, other than those associated with energy usage, including business travel by means not owned or controlled by the entity, waste disposal by means not owned or controlled by the entity, and extraction/production and transport of purchased materials or fuels.

For the purposes of this assessment Scope 3 emissions have been excluded, with the exception of electricity consumption emissions. The assessment therefore focuses only on those activities occurring on site.

GREENHOUSE HAS EMISSION INVENTORY

A GHG, as defined by the IPCC, is a compound which has the ability to trap heat over a certain lifetime in the atmosphere. The six priority pollutant GHGs are CO2, CH4, N2O, HFCs, PFCs and SF6.

The key GHG emissions associated with activities at the facility include:

- CO_2;
- CH_4; and
- N_2O.

The impact of these GHGs are quantified using their Global Warming Potential (GWP), which is a measure of their heat trapping effect relative to the effects of the same weight of CO_2 released over the same period of time. It is important to consider the GWP of GHG's, given that minor emissions of a high GWP gas could make a significant contribution to a carbon footprint. GHG emissions are therefore usually expressed in CO_2 equivalent terms (CO_{2eq}) to reflect the contribution of the various GHG emissions. **Table 8-22** shows the heat trapping ability of the major GHGs after 20 years and 100 years as compared to CO_2.

Table 8-22: Global Warming Potential of greenhouse gases

Greenhouse Gas	GWP after 20 years	GWP after 100 years
CO2	1	1
CH4	72	25
N2O	289	298

IPCC default factors have been applied for coal consumption for the coal-fired boiler and electricity generation to estimate CO_2 emissions. The emission factors as applied in this inventory are presented in **Table 8-23**, with the coal consumption data presented in **Table 8-24**.

Table 8-23: Greenhouse gas emission factors

Scope	Source	Emission Factor Unit	CO_2	CH_4	N_2O
Scope 1	Coal consumption	Kg per GJ	94.6	0.001	0.0015
Scope 2	Electricity generation using coal	Kg per GJ	94.6	0.001	0.0015

Table 8-24: Coal consumption data

Scope	Source	Main Activity	Unit	Quantity / Annum
Scope 1	Coal consumption	Coal-fired boiler operations	MJ/s	10
Scope 2	Electricity consumption IAIP	Coal-fired operations	MVA	46.82
	Electricity consumption RTC	Coal-fired operations	MVA	1.2

GREENHOUSE GAS EMISSIONS

The total potential GHG emissions for the Amhara site was calculated to be approximately 173 955.02t CO_{2eq} based on the above approach. For the assessment a worst case scenario approach was calculated whereby all electricity required for the sites is generated via coal-fired operations. As such Scope 2 coal-fired operations was shown to contribute the highest GHG emissions to be emitted in terms of the Amhara Project (making up approximately 83% of the total GHG emissions emitted). CH_4 and N_2O emissions are marginal from all sources, being significantly over shadowed by CO_2 emissions which account for 99.5% of total CO_{2eq} emissions associated with the Amhara activities (**Table 8-25** and **Figure 8-30**).

GHG emissions from vehicles have not been accounted for as accurate vehicle counts from the IAIP to the RTC is unknown. Credibility of such data is key to ensure that the footprint is transparent, accurate and reliable for reporting and without such information, a true representation of the GHG emissions emitted from vehicles cannot be determined.

Table 8-25: Estimated greenhouse gas emissions for the Amhara IAIP and RTC

Scope	Source	Main Activity	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)	CO_2e (tons/year)
Scope 1	Coal consumption	Coal-fired boiler operations	29833.06	7.88	140.97	29981.91

Scope	Source	Main Activity	CO_2 (tons/year)	CH_4 (tons/year)	N_2O (tons/year)	CO_2e (tons/year)
Scope 2	Electricity generation at IAIP	Coal-fired operations	139678.37	36.91	660.00	140375.28
	Electricity generation RTC	Coal-fired operations	3579.97	0.95	16.92	3597.83
TOTAL GHG EMISSIONS						173955.02

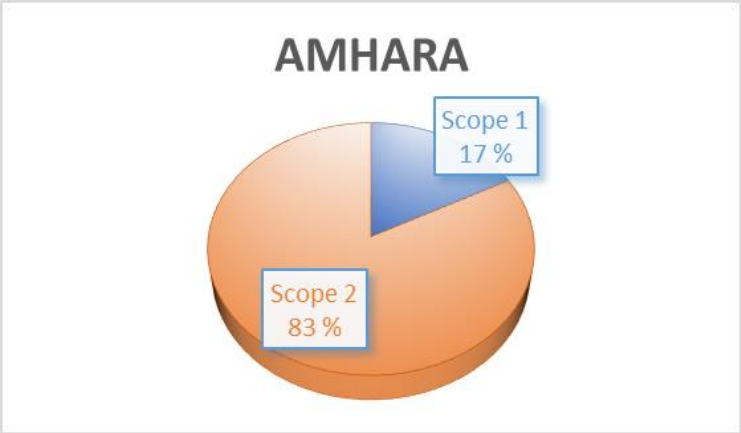

Figure 8-30: CO_{2eq} percentage contribution from Scope 1 and Scope 2 sources

It is important to note that according to the Ethiopian Electric Power Corporation (EEPCo), Ethiopia's total electricity generation in 2010 was 3,981.07 GWh. Hydropower generates approximately 88% of the total electricity generation and is thus the country's dominating electricity resource, followed by Diesel (11%) and geothermal (1%) electricity generation.

It is therefore noted that the total greenhouse gas emissions estimated for the Project are considered a worst case scenario. Should the IAIP and RTC facilities be provided electricity from the national grid the greenhouse gas emissions resulting from the generation of the required electricity is drastically reduced (in the region of 80% reduction) due to the use of renewable resources as the predominant energy source for the generation of electricity.

8.11 NOISE

This section describes the receiving environment in terms of Noise within the Project site and surrounding area.

8.11.1 BURE IAIP

The current noise climate is typically rural, with various anthropogenic influences. The site currently consists of farming activities which do not generate significant levels of noise, however, the site is considered to fall within the Bure industrial area which is currently located directly north of the site. Construction activities are currently taking place within the industrial area. Other sources of noise include vehicles travelling along regional roads as well as the federal highway adjacent to the site on the eastern boundary.

NOISE MONITORING METHODOLOGY

In order to assess the current noise climate in the vicinity of the Bure IAIP, ambient environmental acoustic monitoring was undertaken on 20 and 21 August 2017 at six locations in and around the proposed site (**Table 8-26** and **Figure 8-31**).

Table 8-26: Noise monitoring locations.

ID	Classification	Coordinates	
		UTM N (m)	UTM E (m)
AM_01	Residential	1183744.34	289387.79
AM_02	Residential	1183444.74	288657.94
AM_03	Residential	1182708.87	289711.56
AM_04	Residential	1183472.5	291678.45
AM_05	Residential	1184225.80	292156.40
AM_06	Industrial	1183764.27	290393.80

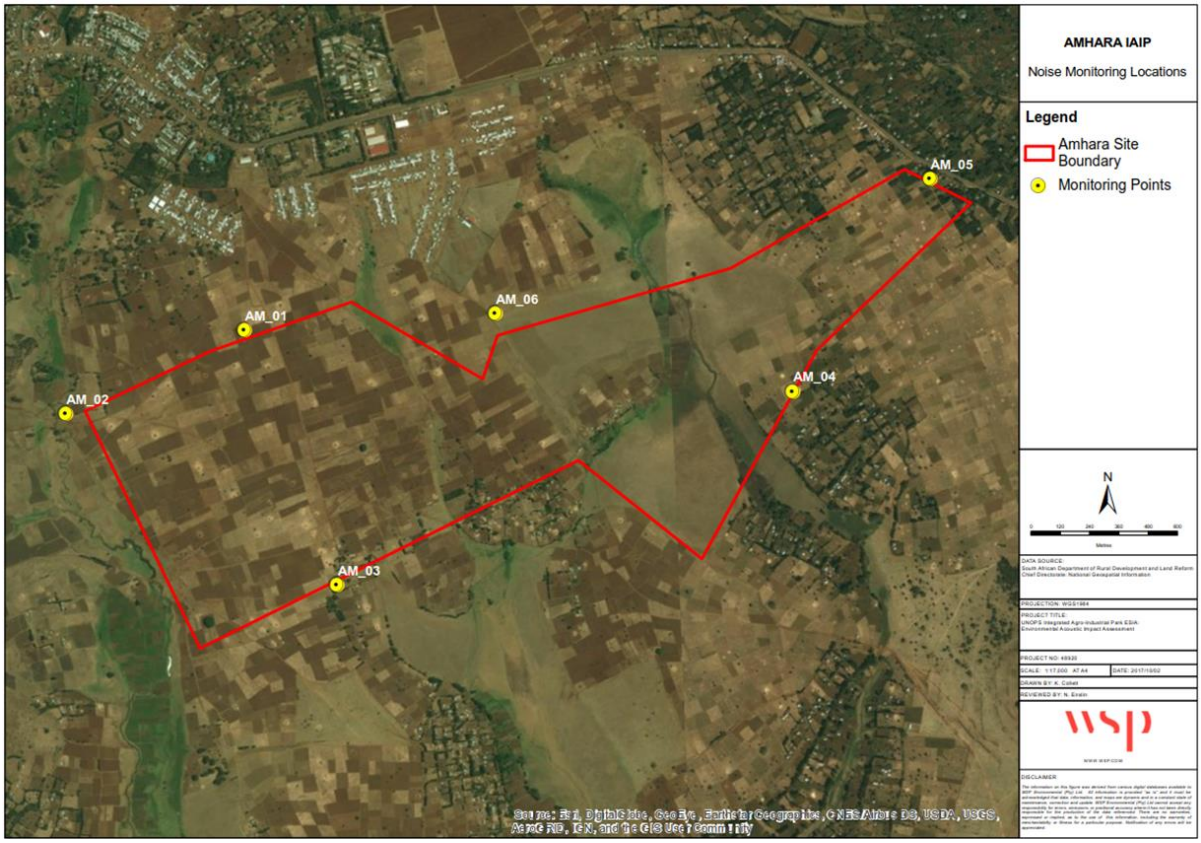

Figure 8-31: Noise monitoring locations surrounding the Bure IAIP.

All sound level measurements were free-field measurements (i.e. at least 3.5 m away from any vertical reflecting surfaces). Measurement procedures were undertaken according to the relevant South African Code of Practice SANS 10103:2008 which is in line with IFC requirements. This guided the selection of monitoring locations, microphone positioning and equipment specifications. Sound level measurements were taken with a SABS-calibrated Type 1 Integrating Sound Level Meter. The sound level meter was calibrated before and after measurements were conducted and no significant drifts (differences greater than 0.5 dB(A)) were found to occur.

Day-time and night-time measurements were conducted for 15 minutes, allowing monitoring to be adequately representative. In accordance with the IFC EHS Guidelines, monitoring was conducted during the relevant timeframes for day (07:00 to 22:00) and night (22:00 to 07:00).

The noise parameters recorded included:

- L_{Aeq} The equivalent continuous sound pressure level, normally measured (A-weighted);
- L_{Amax} The maximum sound pressure level of a noise event measured (A-weighted);
- L_{Zpeak} The peak noise level experienced during the measurement (Z-weighted); and
- L_{A90} The average noise level the receptor is exposed to for 90% of the monitoring period.

The make and model as well as serial number and calibration validity of the sound level meter and calibrator are presented in **Table 6**.

Table 8-27: Sound level meter and calibrator specifications.

Sound level meter	Calibrator
Make & model: CEL 63X	Make & model: CEL-120/1
Serial number: 3134723	Serial number: 3939145
Date calibrated: November 2016	Date calibrated: November 2016
Calibration due date: November 2017	Calibration due date: November 2017

DAY-TIME MONITORING RESULTS

The results from the day-time noise monitoring campaign conducted on 20 August 2017 are presented in **Table 8-28** and **Figure 8-32**. Noise levels at the residential locations were compared to the typical day-time guideline level for noise in residential areas (55 dB(A)), while noise levels at the industrial area north of the site (AM_06) were assessed against the industrial guideline level (70 dB(A)).

Noise levels at all locations were below their respective guideline levels. The highest noise level was recorded at AM_01, a residential area north of the site. The main source of noise at this location was the activity of people.

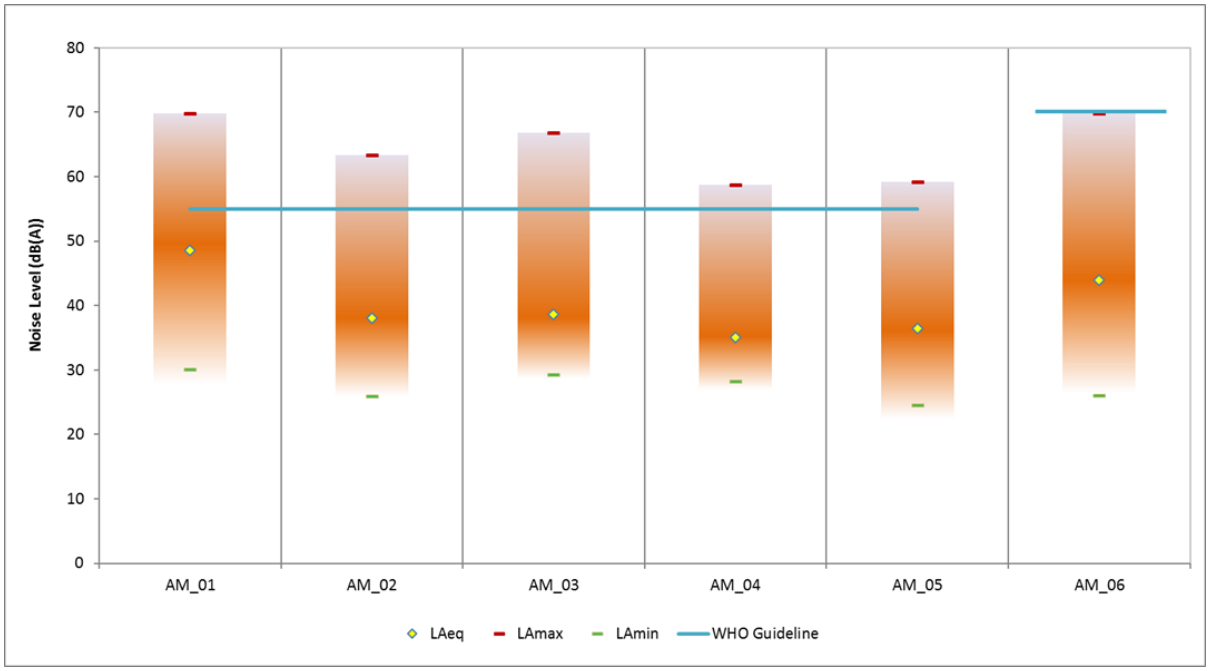

Figure 8-32: Day-time monitored noise levels. LAeq (yellow diamond) is compared with the WHO guideline.

Table 8-28: Day-time noise monitoring results.

Location	Time	L_{Aeq} (dB(A))	L_{Amax} (dB(A))	L_{Amin} (dB(A))	WHO Guideline (dB(A))	Compliant
AM_01	12:55	48.6	69.8	30.1	55	Yes
AM_02	12:29	38.1	63.3	25.9	55	Yes
AM_03	11:57	38.6	66.8	29.3	55	Yes
AM_04	11:15	35.1	58.7	28.2	55	Yes

Location	Time	L_{Aeq} (dB(A))	L_{Amax} (dB(A))	L_{Amin} (dB(A))	WHO Guideline (dB(A))	Compliant
AM_05	10:50	36.5	59.2	24.6	55	Yes
AM_06	14:53	43.9	69.8	26.1	70	Yes

NIGHT-TIME MONITORING RESULTS

The results from the night-time noise monitoring campaign conducted on 20 and 21 August 2017 are presented in **Table 8-29** and **Figure 8-33**. Noise levels at the residential locations were compared to the typical night-time guideline level for noise in residential areas (45 dB(A)), while noise levels at the industrial area north of the site (AM_06) were assessed against the industrial guideline level (70 dB(A)).

Noise levels at five of the six locations were below their respective guideline levels. Noise levels at AM_05, located along the eastern boundary of the site, marginally exceeded the WHO night-time guideline of 45 dB(A). This monitoring site is located directly alongside the federal highway. Dominant noise sources included activity of vehicles on the highway and people.

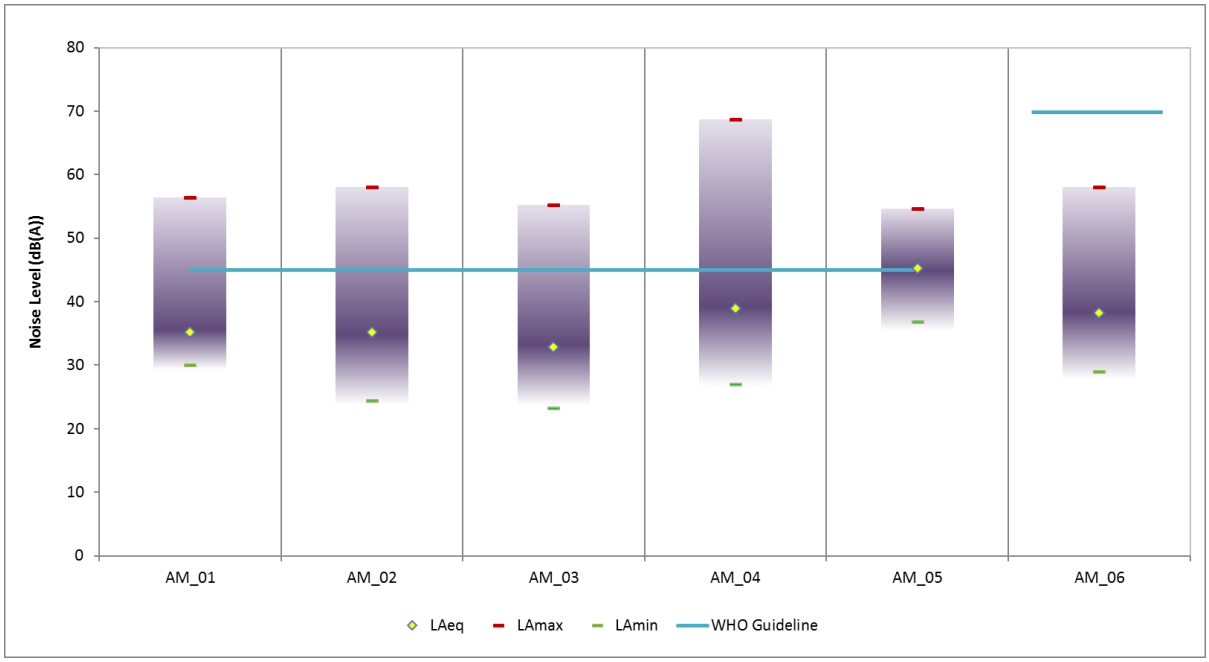

Figure 8-33: Night-time monitored noise levels. L_{Aeq} (yellow diamond) is compared with the WHO guideline.

Table 8-29: Night-time noise monitoring results.

Location	Time	L_{Aeq} (dB(A))	L_{Amax} (dB(A))	L_{Amin} (dB(A))	WHO Guideline (dB(A))	Compliant
AM_01	01:50	35.2	56.4	30.0	45	Yes
AM_02	01:00	35.2	58.1	24.4	45	Yes
AM_03	00:34	32.9	55.2	23.3	45	Yes
AM_04	02:30	39.0	68.7	27.0	45	Yes
AM_05	23:05	45.3	54.6	36.8	45	No
AM_06	23:43	38.3	58.0	29.0	70	Yes

SENSITIVE RECEPTORS

Sensitive receptors are identified as areas that may be impacted negatively due to noise associated with the construction and operation of the proposed IAIP site. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. The nearest town of Bure is located approximately 1 km to the north and west of the Amhara IAIP site. Other sensitive receptors located in close proximity to the IAIP site include residential and farming activities.

8.11.2 CONSTRUCTION PHASE ASSESSMENT

Detailed construction plans for the entire IAIP development have not yet been developed and as such a generic construction situation was assessed for the IAIP site based on previous experience with construction phase acoustics. **Table 8-30** presents a list of potential construction equipment that will be utilised during the construction of IAIP site as well as the sound power level (PWL) specifications of the equipment (BSI, 2009). Construction will be erratic in nature with no set locations for equipment at a given time. In order to represent a worst-case scenario, it is assumed that one of each piece of equipment will be operational simultaneously at any location within the IAIP site. Such a worst-case scenario is unlikely to occur in reality. The sum (logarithmic) of the PWLs from all noise sources was utilised to calculate resultant noise levels at specified distances from the IAIP site. Such resultant receptor noise levels were calculated using attenuation-over-distance acoustic calculations.

Table 8-30: Construction phase equipment and sound power level ratings

Equipment	Sound Power Level (dB(A))
Excavators	101.0
Tipper Trucks	108.0
Graders	111.0
Bulldozers	111.0
Front end loaders	104.0
Rollers	101.0
Concrete Mixers	107.0
Generators	102.0
Logarithmic Total	**116.3**

8.11.3 OPERATIONAL PHASE ASSESSMENT

A high-level, semi-quantitative assessment of the potential sources and impacts associated with the IAIP site has been undertaken, based on the proposed site layout plan. Sound power level specifications for potential operational equipment was sourced from literature and subsequently used as a basis for attenuation-over-distance calculations in order to determine worst-case operational noise levels.

Table 8-31 presents all the proposed production units within the IAIP as well as potential significant sources of noise within each unit. It is anticipated that most units will not have significant sources of noise, with the sewage treatment plant; solid waste management plant; boiler, chiller and compressor; and the meat processing unit generating the largest amount of noise. The meat processing unit, with anticipated noise sources being fans, rotary meat saws, compressors and pumps is envisaged to be the noisiest unit.

Table 8-31: List of various IAIP units and associated significant noise sources

Unit	Potential Significant Noise Sources	Sound Power Level (dB(A)
Sewage treatment plant	Pumps	104.0

Unit	Potential Significant Noise Sources	Sound Power Level (dB(A)
	Compressors	102.0
	Fans	98.0
Solid waste management plant	Trucks	85.0
	Conveyors	101.0
	Loading equipment	90.0
	Compactors	92.0
Boiler, chiller & compressor	Boiler	98.0
	Compressor	102.0
Milk & Dairy Plant	Trucks	85.0
	Homogenizer	82.0
	Centrifuges	73.0
	Filling and packing machinery	90.0
Honey processing unit	-	-
Malt Plant / Brewery	Trucks	85.0
	Process and utility machinery	96.0
Cereals processing unit	-	-
Cereals anchor units	-	-
Cereal raw material storage		
Vegetable processing unit	-	-
Sesame processing unit	-	-
Sesame raw material storage	-	-
Sesame anchor unit	-	-
Poultry - egg processing unit	Compressor	102
Poultry - egg storage unit	-	-
Other animal products processing unit	-	-
Meat - deep freeze cold storage	Compressor	102
Meat anchor unit	-	-
Meat processing unit	Fans	98.0
	Rotary Saws	100.0
	Compressor	102.0
	Pumps	104.0
Meat rendering unit	-	-
Finished goods storage	-	-
Grading, packing and labelling	-	-
School	-	-
Crèche	-	-

Unit	Potential Significant Noise Sources	Sound Power Level (dB(A)
Playground	-	-
Place of worship	-	-
Certification lab	-	-
Retail space	-	-
Polyclinic	-	-
Substation	-	-
Extension centre	-	-
Administrative building	-	-
Training centre	-	-
Housing	-	-

8.11.4 MOTTA RTC

The Motta RTC site is surrounded by agricultural land (predominantly crops) with low to medium density residential areas. Based on the location of the site, the volume of vehicles utilising the road are not anticipated to be significant. Additionally no major industrial activities have been reported to be operational in close proximity to the site. As such, no major sources of noise are anticipated in close proximity to the site.

With limited associated noise sources from the proposed RTC, it is anticipated that acoustic impacts will be negligible and as such an acoustic assessment of the RTC site was not conducted.

8.12 TRANSPORT / ACCESS

8.12.1 BURE IAIP

ROAD NETWORK

The local road network primarily consist of Federal Highway No. A3_5, Section 504/1, which connects Addis Ababa and Bahir Dar; which are situated approximately 400km south and 150 km north respectively. The highway is a single carriageway surfaced road, with 1 lane per direction in the vicinity of the proposed IAIP access.

The road is suitable to provide vehicle access and connectivity to the development, pending the provision of a suitable local access that takes cognisance of vehicle and non-motorised transport (NMT) safety. Refer to Figure 8-34 and Figure 8-35 for images of the Federal Highway No. A3_5 at the proposed IAIP access.

Important note, the condition of the road was not assessed, therefore sections of this or other access roads to the IAIP may currently be in a poor condition, dangerous or partially impassable, for example the roadway width is reduced. The additional traffic due to the IAIP could therefore increase the road safety risks and accident potential in these areas.

Figure 8-34: Photo showing the Federal Highway No. A3_5 at the proposed IAIP entrance (south direction).

Figure 8-35: Photo showing the Federal Highway No. A3_5 at the proposed IAIP entrance (north direction).

EXISTING TRAFFIC FLOWS

Sample traffic counts were undertaken by MACE along the Federal Highway No. A3 near the proposed IAIP access. The recorded traffic flow was approximately 632 vehicles per hour (veh/hr), of which 478 veh/hr was local traffic, predominantly three wheel rickshaw taxis that travel back and forth along the highway. The remaining 144 veh/hr was other traffic, such as trucks.

ROAD NETWORK AND MASTER PLANNING

There are no known new or additional local roads or federal highways planned in the vicinity of the site or the study area. It is noted that a new section of road has been developed along north western boundary of the IAIP site. This road is planned to extend westward over the Yiser River to connect to the new section of road running through Motta.

8.12.2 MOTTA RTC

ROAD NETWORK DESCRIPTION

The local road network primarily consist of Federal Highway no. B_31, which links Dejen with Bahir Dar. The proposed RTC site set back approximately 100m from the federal highway, which continues through the centre of Motta Town.

Access to the RTC is to be obtained from the south-west corner of the site via a secondary road leading off the highway. Traffic from the RTC will exit the site at the south-east corner. Two additional entry and exit points are identified for future expansion along the northern boundary of the site.

The highway is a single carriageway gravel road, with 1 lane per direction in the vicinity of the proposed RTC access. The road is currently undergoing upgrades which will result in the road being an engineered asphalt road when complete.

The gravel highway is in a relatively good condition in the vicinity of the RTC however the connecting roads gravel providing access to the site are in a very poor state.

Note that NMT movement are very prevalent along the access road, with developments directly adjacent to it. Access must be maintained to these properties, refer to Figure 8-36 for an image of the current access road to the highway. Figure 8-37 shows the existing federal highway no. B_31 at the RTC site.

Note, the condition of the highway was not assessed, therefore sections of this or other access roads to the RTC may currently be in a poor condition, dangerous or partially impassable, for example the roadway width is reduced. The additional traffic due to the RTC could therefore increase the road safety risks and accident potential in these areas.

Figure 8-36: Image of current access road (Source: ESIA team site investigations)

Figure 8-37: Image federal highway no.B_31 (Source: ESIA team site investigations)

EXISTING TRAFFIC FLOWS

Traffic counts are not available for Federal Highway No. B_31 close to the RTC however, according to the Ethiopian Roads Authority (ERA) annual average daily traffic by road section for the 2016 year (ERA, 2016), the average daily traffic volumes for different routes from Motta are shown in **Table 8-32**.

Table 8-32: Traffic volumes for identified routes from Motta

Route	Cars	Buses	Truck	Truck Trailer	Total
Bichena – Motta	68	208	286	28	590
Motta – Bahir Dar	105	297	394	31	827

ROAD NETWORK AND MASTER PLANNING

There are no known new or additional local roads or federal highways planned in the vicinity of the site or the study area. However, the highway is currently being upgraded from a gravel road to an engineered asphalt surfaced road **Figure 8-38**.

Figure 8-38: Current upgrade activities of the Federal Highway No. B_31 within Motta

8.13 VISUAL

8.13.1 BURE IAIP

LANDSCAPE CHARACTER

The site is located on the outskirts of Bure with medium density residential areas as well as an industrial area located to the west and north of the site, with rural agricultural land, mixed vegetation and low density settlements to the south and east of the site. The site is used for agricultural activities with majority of the site under crop with the remaining open grassland areas utilised for grazing. To the west the site rises up to abut the federal highway no. 3. To the east the terrain falls to the Yiser River which runs parallel to the western boundary.

Overhead electrical power lines run across the site as well as a dirt road and various footpaths. The site undulates resulting in two drainage lines running across the site in a north south direction, limiting the visibility of the site from adjacent properties as well as from users of the Federal Highway to the east of the site and the residential areas to the west of the site.

The site has been completely transformed and no, or very little, natural vegetation remains. Open areas, have been cleared of natural vegetation to facilitate agricultural activities, mainly in the form of crop plantations and grazing. There are some residential huts located on the site, these are all single storey dwellings predominantly constructed of wood and mud with thatch or corrugated iron roofing.

Figure 8-39 provides photographs showing the typical characteristics of the IAIP site.

Figure 8-39: Images showing the typical characteristics of the Bure IAIP site including crop production, grassland, wetlands, plantations and mixed vegetation (Source: ESIA team site investigations)

ZONE OF INFLUENCE

The distance of a viewer from an object is an important determinant of the visibility, sometimes referred to as the visual exposure. This is due to the visual impact of an object diminishing/attenuating as the distance between the viewer and the object increases. The Zone of Visual Influence (ZVI) is the maximum extent around an object, beyond which the visual impact will be insignificant, primarily due to distance.

According to Hull and Bishop (1988) the visual impact can be said to decrease at an exponential rate and so at 1000m would, nominally, be 25% of the impact as viewed from 500m. At 2000m it would be 10% of the impact at 500m. More recent studies on viewing distance have built on these early estimations and all emphasise the role that elevation, the angle of the sun and landscape characteristics play in determining visibility over distance.

Given the low elevation of the proposed site, the maximum height prescribed for the proposed development and the undulating nature of the landscape, the suggested limit of assessment appropriate for this study area is defined as follows:

- Less than 1km – proposed development is likely to be a prominent feature, dominating perception;
- Between 1km and 2km – proposed development may be visible and dominate perception to some extent;
- Between 2km and 5km – proposed development may be marginally visible, but other objects would generally dominate perception; and
- Beyond 5km the proposed development will not be visually dominant and will only be visible from elevated viewpoints.

Potential viewers (visual receptors) included in this study are:

- Residents in the surrounding areas: Residents in the surrounding areas may be affected by the visual impacts of the proposed redevelopment and have shown an active interest in the site. However visibility will be very limited from most residential areas, as the site is obscured by vegetation or changes in topography. The residential areas located on the raised section to the west of the site have the clearest view of the development.
- Motorists: Only the western-most portion of the current site is discernible to motorists from the surrounding area, which is to be the main access point to the IAIP. View of the site is currently obstructed by Eucalyptus plantations and residential dwellings. With the development of the boundary wall and entrance area this portion of the site will become more visible to motorists, however this is only a small section of the site abuts the federal highway.

8.13.2 MOTTA RTC

The Motta RTC site consists of transformed land utilised for agricultural activities (crops and grazing) and is traversed by a single lane dirt track. The site and surrounding area has a very slight gradient. The site is set back from the main road, limiting the visibility of the site from the road and surrounding areas. The area around the site includes agricultural land and low density rural settlements.

Figure 8-40 provides photographs showing the typical characteristics of the RTC site.

Figure 8-40: Images showing the typical characteristics of the Motta RTC site and adjacent area (Source: ESIA team site investigations)

8.14 WASTE

8.14.1 BURE IAIP

The Amhara IAIP is located at the south-western portion of Bure town. The current municipal waste management practices of Bure town have not been organised in a formal manner.

CURRENT WASTE MANAGEMENT OF BURE TOWN

SOLID WASTE MANAGEMENT

Generation, Collection and Transportation

According to the Beautification and Sanitation Core process of Bure Municipality, the town lacks solid and liquid waste collection and disposal facilities. Solid waste from the town is largely managed by each household applying its own means. It is reported that there are some horse carts that provide waste collection service to some commercial establishments in the town and they provide this service upon direct payment from them. In an effort to assist in formalizing the waste collection practices of the town, the municipality has purchased two tipper rickshaws (three wheeler). The tipper rickshaws are specially designed for solid waste collection and are expected to start operation in the current year.

Waste Disposal

So far Bure town has no designated dumpsite for the solid and liquid waste collected. Solid waste is disposed in available open places. There are also no studies and assessments done to estimate the quantity of solid waste generated in the town.

However, according to the Beautification and Sanitation Core process of Bure municipality, the City administration has planned to designate a landfill site at the southern outskirts of the town this year. It is reported that preparations are underway to handover the designated landfill site and to fence it in the current fiscal year.

In a wider context, there appears to be no sanitary landfill in the area that can receive municipal solid wastes collected from the towns. Bigger towns such as Fenoteselam and Injibara that are located about 25km and 50km south and north of Bure town respectively also do not have properly designed and operated sanitary landfill. These towns also dump their solid wastes in pit wholes dug for that purpose and bury/cover it with soil material when filled.

Associated Solid Waste Management Plan

The town does not have any waste management strategy.

LIQUID WASTE MANAGEMENT

The municipality assists residents in contracting a vacuum truck from Bahir Dar to empty sewages from septic tanks. Residents of the town who seek vacuum truck service gets registered in the

municipality. When enough number of residents are registered the municipality calls vacuum truck service providers from Bahir Dar to empty the septic tanks upon payment of service charge by the residents. According to the Beautification and Sanitation Core process, the sewage collected is disposed into certain farmlands whose owners has agreed to receive it in order to fertilize their farmland.

8.14.2 MOTTA RTC

The RTC site is located at the western edge of Motta town. The current municipal waste management practices of the town have not been organised in a formal manner.

CURRENT WASTE MANAGEMENT OF MOTTA TOWN

SOLID WASTE MANAGEMENT

Generation, Collection and Transportation

According to the Motta Municipality, the town lacks formal solid and liquid waste collection and disposal facilities. Solid waste from the town is largely managed by each household applying its own means. It is reported that there are some horse carts that provide waste collection services in the town.

Solid and Liquid Waste Disposal

Motta town has two designated dumpsite for solid and liquid waste. These are located outside of town and consist of 3 pit wholes. The pits that have been excavated into the ground, measuring approximately 10m in length, 5m in width and 3m in depth. Once fill the pit is covered with soil material. Two pits at each site are allocated for solid waste and one pit for liquid waste.

According to the master plan the Motta municipality, the town administration has planned to designate a landfill site at the western outskirts of the town do be developed in the coming fiscal year. Details of the design of the landfill facility were not made available.

8.15 BIODIVERSITY

This section provides a description of the existing biodiversity components and associated key features which include typical flora and fauna, protected areas and non-protected sensitive resources that are found inside and within the vicinity of the project sites. The baseline conditions within the survey area have been determined through desk-based reviews of available information, field surveys and consultations with concerned authorities.

8.15.1 BURE IAIP SITE

The Bure area in general, and the IAIP site in particular, is located within the dry Evergreen Montane Forest and Evergreen Scrub Ecosystem. The evergreen scrubland vegetation occurs in the highlands of Ethiopia either as an intact scrub (i.e. in association with the dry evergreen montane forest) or usually as secondary growth after deforestation of the dry evergreen montane forest. The Dry Evergreen Montane Forest and Evergreen Scrubland vegetation's are the characteristic vegetation types of this ecosystem. In the Bure IAIP site there are some remnants of forest vegetation, having Evergreen Montane Forest and Evergreen Scrub Ecosystem characteristics, along the streams; small rivers; and scattered patches of tree species.

Most parts of the proposed project area have been transformed for agricultural land some time ago. Hence only little remnant dry land and wetland vegetation remains mainly within the central portion of the proposed IAIP site, where streams, wetlands and seasonal rivers are located. Scattered patches of tree species are also found in some parts of the proposed project site. The remaining part of the proposed project site is mainly dominated by weedy vegetation, which has emerged as a result of continuous farming practices and overgrazing.

Based on the survey conducted, a total of 24 plant species have been recorded (**Table 8-33**). It is noted that all of the species identified on the site are not threatened or endangered as per the IUCN Red List Category, as such no sensitive vegetation has been identified on the site.

Wetland habitat has been recorded in the Bure IAIP site in the form of closed systems and/or channelled wetland habitats (permanent or temporary wetlands), along the drainage lines (refer to section 8.8.3 for detail).

Portions of the site, predominantly in the central area portion of the project area, also include patches of temporary wetlands called Zagra Minch. This wetland system also has similar values and functions as identified above.

Table 8-33: Plant species on and around the project site

S.N	Scientific name	Local name (Amharic)	Remark (occurrence in and vicinity of the project area)
Terrestrial plant species			
1	*Ficus vasta*	Warka	Moderate
2	*Erythrina abssice*	Korch	Common
3	*Alvizia gomifera*	Sesa	Common
4	*Vernonia amygobalima*	Girawa	Very common
5	*Spathodea nilotica*	Chisha	Moderate
6	*Crton mycrostatus*	Bisana	Very common
7	*Cordia africana*	Wanza	Moderate
8	*Olia capensis*	Woyra	Moderate
9	*Juniperus procera*	Tid	Rare
10	*Carissa spinarum*	Agam	Common
11	*Syzigium guineense*	Dokima	Common
12	*Ficus patula*	Shola	Moderate
Wetland dependant plant species			
1	*Cyperus alopecuroides*	Ketema	Common
2	*C. rotundus*	Ketema	Common
3	*C. digitatus*	Ketema	Common
4	*C. sesquiflorus*	Ketema	Common
5	*C. laevigatus*	Ketema	Common
6	*Paspalidium geminatum*	Ye Sar Zer	Common
7	*Panicum hygrocharis*	Ye Sar Zer	Common
8	*Leersia hexandra*	Ye Sar Zer	Common
9	*Panicum subalbidum*	Ye Sar Zer	Common
10	*Leptochloa fusca*	Ye Sar Zer	Common
11	*Panicum repens*	Ye Sar Zer	Common
12	*Panicum spicatus*	Ye Sar Zer	Common

Very few bird species, in diversity as well as in number, were recorded during field visits. The recorded species are identified in **Table 8-34**. No vertebral amphibians and reptiles were recorded while **Table 8-35** lists the common mammal species around the project site. It is noted that all of the species identified on the site are not threatened or endangered as per the IUCN Red List Category, as such no sensitive fauna has been identified on the site.

Table 8-34: Common Bird Species on and around project site

S.N	Scientific Name	Common Name	Local Name	Remark	Habitat
1	*Egrettaardesica*	Black Heron	-	rare	Prefers lake margins, river edges, marshes and inundations
2	*Columba guinea*	Speckled pigeon	Ergib		Common
3	*Tockus erythrorhynchus*	Red-billed hornbill	Kutu	Common	Dry, wooded and bushed habitats and overgrazed grasslands
4	*Tockus flavirostris*	Yellow-billed hornbill	Kutu	rare	Dry, more or less bushed and wooded habitats
5	*Streptopelia decipiens*	African mourning dove	-	common	Dry wooded habitats with some grass, often near to streams also in gardens
6	*Lamprotornis chalybeus*	Greater blue-earned starling	-	common	more or less bushed and wooded natural and cultivated areas including parks
7	*Egretta garzetta*	Little Egret	-	Common	Shallow fresh water area

Table 8-35: Common mammal species around project site

S.N	English name	Amharic name	Scientific name	Occurrence around project area
1	Spotted Hyena	Tera Jib	Curocula curocula	Common
2	Abyssinian Hare	Tinchel	Lepus habesinicus	Common
3	Olive Baboon	Zinjero	Papio anubis	Rare

8.15.2 PROTECTED AND NON PROTECTED SITES IN THE AREA

The occurrence of threatened species including IUCN Red list flora and fauna, the presence of protected areas with the radius of 10km from the proposed project site and their status were assessed. Both the desktop review, and field survey together with consultation of stakeholders has identified that:

- No protected biodiversity sites within 10 km radius of the proposed project has found;
- Except for the wetland areas that passes through the proposed project site, no additional sensitive areas were identified;
- No IUCN red list fauna and flora species are found in this proposed project site;
- No potential sensitive biodiversity resources are found on this proposed project site.

8.15.3 MOTTA RTC

The entire project site was transformed for agricultural land some time ago. Hence only little remnant dry land vegetation remains on the site which is mainly dominated by weedy vegetation, which has emerged as a result of continuous farming practices.

It is noted that no species identified on the site are threatened or endangered as per the IUCN Red List Category, as such no sensitive vegetation and fauna has been identified on the site.

8.16 SOCIO-ECONOMIC ENVIRONMENT

8.16.1 GENERAL

This Chapter of the report provides a demographic, cultural and economic overview of the Project area and also describes the physical infrastructure and services available in the Social Study Area.

The description provided in this section is based on publically available, high level secondary and primary data, including the 2007 National Census data which in most cases was extrapolated by the regional governments to reflect the estimated population growth, and so forth. A full and more current account of the Project Site and area will be provided in the ESIA drawing on primary data collected for this site.

The proposed Bure IAIP and Motta RTC sites are located in the West and East Gojjam Zones, of the Amhara Region, respectively. The IAIP site is located within the wider footprint of the Bure town (around 1 km distance), with the Wam Gedam village being the closest. The RTC site is located within the wider footprint of the Motta town (around 1 km distance), with Hibresalam village being the closest

The proposed Bure IAIP footprint in the will occupy approximately 260.56 ha for the initial development and over 1,000 ha when reaching its full capacity and including all auxiliary infrastructure. The land planned for the IAIP development, was previously predominantly state-owned but used by local farmers for agricultural activities. After this project was taken forward, in early 2016 the Government initiated the resettlement process and to-date completed a census of affected people.

A number of PAPs were identified as those whose land will be fully or partially affected by the development of the Bure IAIP facilities.

The proposed Amhara Project, including the Bure IAIP and Motta RTC, will result in 369 individual parties being affected by the proposed development, including:

- 31 individuals whose residential properties will need to be moved (physical displacement),
- 2 Government entities' offices will also need to be moved (physical displacement),
- 263 individuals whose by-product and main season crops are going to be lost due to land take by the project (economic displacement),
- 35 individuals whose eucalyptus trees will be affected (economic displacement),
- 26 individuals whose high intensity/irrigated crops are going to be affected (economic displacement), and
- 3 individuals whose perennial crops will be affected (economic displacement).
- Additionally, 9 individuals were by mistake omitted by the local government officials from the PAPs list and had been added to the list with full compensation for their affected crops (economic displacement).

Details on the Government-led resettlement process have been included in the RAP report (Amhara) that has been delivered separately.

Based on the proposed design, the Area of Influence (AoI) for social impacts for the Amhara project area would comprise of the following:

- The area likely to be affected by the proposed Project activities during the pre-construction, construction operations and closure / decommissioning phases (noise, dust and congested roads, etc.);
- The IAIP and RTC sites will have PAPs whose land and assets will be affected by the project (economic displacement), and 31 individuals will have their houses to be moved as a result of the process that was started and finished by the local Government authorities;
- The area occupied by the IAIP's auxiliary infrastructure.

8.16.2 BASELINE ENVIRONMENT – BURE IAIP

DEMOGRAPHICS

Ethiopia experiences significant cross-border immigration from surrounding countries including farmers in search of grazing grounds and water, traders and merchants as well as frequent and significant influx from Somalia, Sudan, and Eritrea caused by conflict and drought. According to the United Nations High Commissioner for Refugees (UNHCR), Ethiopia received a substantial number of new immigrants in late 2014 (particularly from South Sudan), leading to a total population of more than 729,000 immigrants in early 2015, who are mainly accommodated in camps throughout the country (UNHCR, 2017).

As per the 2007 census undertaken by the Ethiopian Central Statistical Agency (CSA, 2007), the Amhara Region had a population of 17,221,976, with 8,641,580 men (50.2%) and 8,580,396 women (49.8%), and where urban population made up less than 13% of the region's population. 983,768 households were recorded in the Region, which results in an average 4.3 persons to a household, with urban households having on average 3.3 and rural households 4.5 people.

Based on the 2007 Census data and estimated population growth (data published by NCSA in 2014), as of 2017 there are anticipated to be a total of 21,134,988 people living in the region. Of the total population 10,585,995 (50%) are male and 10,548,993 (50%) are female. Less than 18% of the region's population live in the urban areas and close to 82% live in the rural areas.

The population of the West Gojjam Zone is 2,428,851 people (CSA, 2013) (14% of the total Regional population); with an area of 13,311.94 km^2 (8.36% of the Amhara area), and the Zone has a population density of 158.25 people per every km^2. A total of 480,255 households were counted in this Zone, which results in an average of 4.39 persons to a household. Based on the estimated population growth (data published by NCSA in 2014), as of 2017 there are anticipated to be a total of 2,542,221 people in the region.

Based on the estimated population growth (data published by NCSA in 2014), as of 2017 there are anticipated to be a total of 2,613,835 in the East Gojjam Zone.

ETHNICITY, RELIGION AND LANGUAGES

91% of the regional population is made of the Amhara people who speak the languages belonging to the Semitic group (Amharic). The main ethnic groups in the region are: Amhara (91%), Agaw/Awi (3.5%), Oromo (2.6) and others.

The main religions in the Region include: Orthodox Christians (82.5% of the Amhara population), Muslim (17.2%), Protestants (0.3%).

The largest ethnic group reported at the Zone level is the Amhara (99.42%); all other ethnic groups made up 0.58% of the population. Amharic is spoken as a first language by 99.43% of the zone population; the remaining 0.57% spoke all other primary languages reported. 98.68% of the population in the West Gojjam zone said they practiced Ethiopian Orthodox Christianity, and 1.19% was Muslim.

EDUCATION

Education plays a crucial role in the process of social and economic transformation and stands as a key poverty reduction. Taking into account the role education plays in the socio-economic development, the Ethiopian government has paid great attention to promoting education in various regions of the country including the study project area. Accordingly, the project area regional bureau has made also various efforts for the developments of education in the region to this end, general project Woredas are no exception.

There are four primary schools in Bure and it appears to be sufficient for the current population levels. However, there is no high school around Wan Gedam kebelle and students have to travel six to eight kilometres to main town Bure to receive high school education.

HOUSEHOLD INCOME AND EXPENDITURE

According to data obtained from the Finance and Economic Development Office within the general project areas, the household income level is low in the project area. Accordingly, the figures for low, middle and high levels in Ethiopian Birr are <150, 500-1500, and >1500. Cash income sources are mainly from sales of agricultural products (Sales of crops, livestock and their produces), which are the source of more than 80% of the cash income of financially comfortable households in the project area.

In Amhara Region, agriculture remains the base of the economy. It is practiced by more than 85% of the population residing in the rural areas. Agriculture is the major source of food, raw materials for local industries and export earnings. In 2010/11, the regional GDP growth rate was estimated to be 8.4% and the contribution of agriculture to the regional GDP was 55.4%. The region has diverse agricultural zones, fertile soil and reasonable water resources, and all this creates a huge potential for production of a variety of agricultural products including crops both for export and domestic consumption.

Livestock holdings in sheep and cattle are relatively modest, but livestock and butter sales make a substantial compliment to the dominant crop sales. Sheep are sold more often to earn income for regular expenses through the year and peaks during religious festivals in April (Easter), September and January (Christmas and Epiphany), when community members individually or collectively purchase animals for slaughter and there is peak demand in town markets. Cattle are high value assets mostly owned by middle and better-off households and they are sold sparingly, especially fertile females.

EXISTING INFRASTRUCTURE AND SERVICES

According to the CSA data, 28% of the regional population has access to safe drinking water, of whom 19.89% were rural inhabitants and 91.8% were urban. Values for other reported common indicators of the standard of living for Amhara as of 2007 include the following: 17.5% of the inhabitants fall into the lowest wealth quintile; adult literacy for men is 54% and for women 25.1%, and the Regional infant mortality rate is 94 infant deaths per 1,000 live births, which is greater than the nationwide average of 77; at least half of these deaths occurred in the infants' first month of life.

The Zonal Water Resource Development Office (West Gojjam) announced 29 July 2009 that it had completed construction of 943 wells and 89 springs, which will benefit 331,000 people. Using funds from the government, local NGOs and the public, in 2009 this program improved the rate of access to clean water for inhabitants in the Zone from 39% to 50.6% (Ethiopian News Agency, 2009).

There is a hospital five kilometres away from Bure but the residents say it does not have sufficient supply of medicines and equipment. Similarly, there is only one health centre in Bure and it does not have sufficient amount of medicines or professionals. **Table 8-36** identifies the top 10 diseases that are encountered in Bure, as per the town administration Health offices (August, 2017).

Table 8-36: Top ten diseases in encountered in Bure

Rank	Disease type (2007 EC)	Disease type (2008 EC)
1st	AFI	Urinary Tract Infection
2nd	Dyspepsia	Acute Febrile illness
3rd	Parasitic disease	Dyspepsia
4th	AURI	AURI
5th	Helminthiasis	Parasitic disease
6th	Pneumonia	Disease of muscular system
7th	Skin Infection	Pneumonia
8th	Urinary tract infection	Trauma
9th	Disease of muscular skeletal system (DMSS)	DMSS

10th	Unspecified other respiratory diseases	Infection of the skin

The road network throughout the Bure area varies in condition from very informal gravel roads in poor condition to engineered asphalt surfaced roads, including the Federal Highway No. A3_5. During consultation it was identified that the development of the IAIP and associated boundary wall will result in a main access road and several foot paths being obstructed. These access routes are utilised by the local communities residing to the south of the IAIP site, on a daily basis, to gain access to services in Bure such as schools, medical facilities, markets etc. **Figure 4-3** indicates the access routes across the IAIP site that will be obstructed by the development.

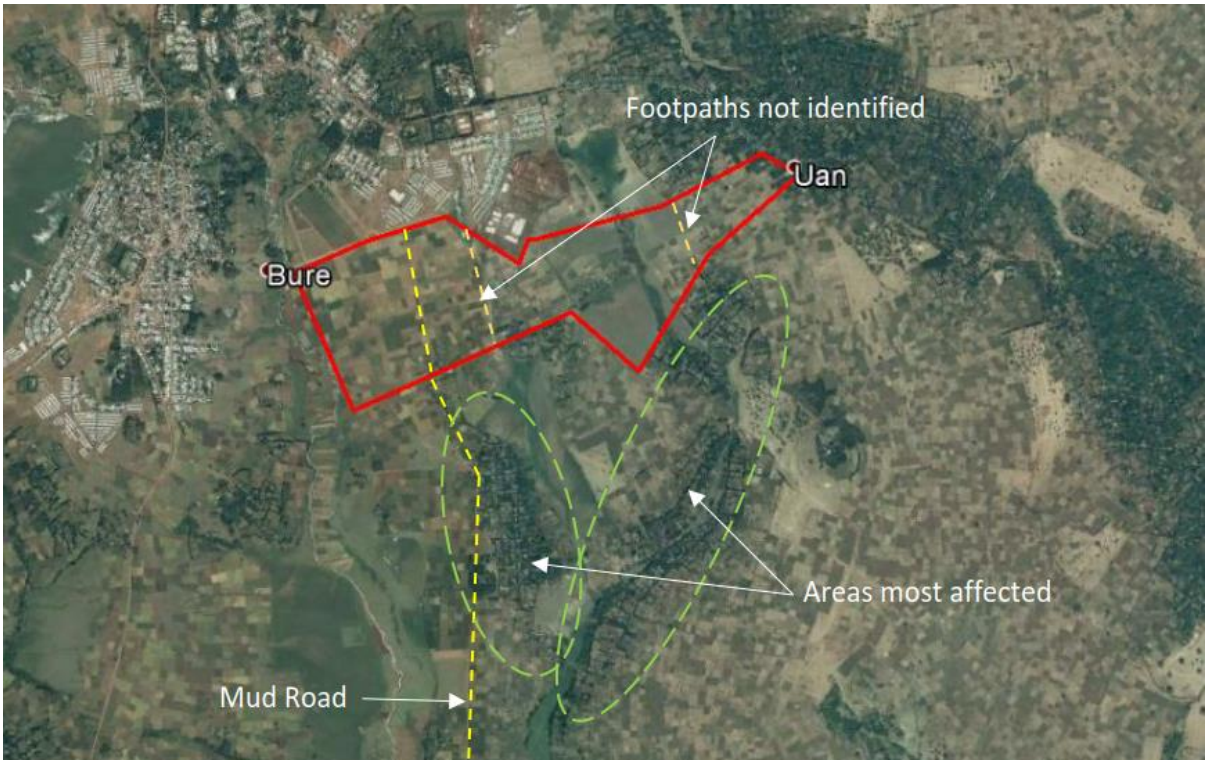

Figure 8-41: Image showing access routes across the IAIP site that will be obstructed

An alternative access road is being proposed to wrap around the western edge of the IAIP site connecting the communities in the south with those in the north. **Figure 4-4** indicates the proposed access road (yellow dashed line) from the existing gravel road from the south of the site, around the western boundary of the IAIP to connect to the existing gravel road at the North West corner of the site. This road will be a permanent engineered road resulting in an improved access road.

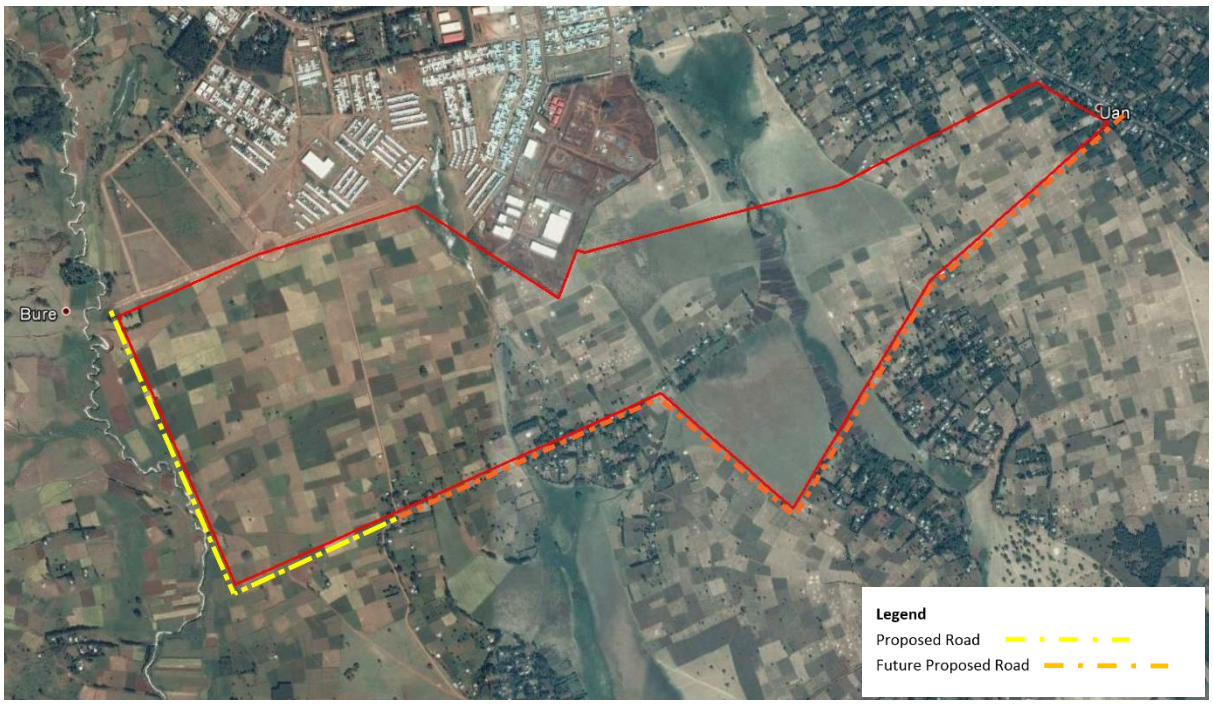

Figure 8-42: Image showing proposed access routes around the IAIP site.

It is noted that construction of the alternative road around the western boundary of the site is the responsibility of the FDRE and that construction of the road has commenced.

Figure 8-43: Alternative road along the western boundary of the IAIP

It is further noted that an additional stretch of road is being proposed along the south eastern boundary of the site. It is understood that this section of road is intended to be a temporary gravel road to provide access for the communities to the highway at the eastern boundary of the IAIP. This section of road was only recently proposed, therefore full details of this proposed road are not yet finalised. As such this section of road has not been included in the ESIA assessment.

CULTURAL HERITAGE

The Amhara National Regional state hosts three of the nine World Heritage sites found in Ethiopia which are registered by the UNESCO. These include the rock hewn churches of Lalibela, the Gondar

palaces and the Simien Mountain National Park. The Rock hewn churches of Lalibela are found in North Wollo zone of the Amhara Region and consist of 11 medieval monolithic cave churches that were built during the 12th Century. The Gondar palaces are situated in the capital city of north Gondar zone of the Amhara region, which is Gondar City itself. The world heritage site present in Gondar consists of the Fasillades Gibbi and its complementary facilities (i.e. Fasil bath, the horse house, and the poultry). Gondar town was Ethiopia's capital city in the 17th and 18th centuries and it is known for its castle building by emperor Fasillades and his successors from 1632-1730. The Simien Mountains National Park is also another world natural heritage located in the north Gondar zone of the Amhara Region. The park is home to some extremely rare animals in the world such as the Gelada baboon, the Simien fox and the Walia Ibex; a wild goat found nowhere else in the world. More than 50 species of birds inhabit the park, including the impressive Bearded Vulture, or Lammergeyer.

Even though not registered as World Heritage sites, there are also ancient monasteries and churches of remarkable historical and cultural significance in the Amhara Region which are mostly found around Lake Tana. Reports indicate that there are ancient monasteries in many of the 37 islands of Lake Tana.

According to Bure City Administration Culture and Tourism office, there are sites which are recognised by the office as sites of cultural and religious importance in the city. These include the Baguna Ambo Tsebel, St. Michael Church, Protestant and Muslim Cemeteries, and a Mosque. These sites of cultural and religious importance are generally situated outside the current boundaries of the Bure IAIP at a distance of 500m to 5km. Though, its historical significance is not well elucidated, the local community describes the existence of a cave built or used by the Italian during the war against the Italian occupation force in the 1940s.

8.16.3 BASELINE ENVIRONMENT - MOTTA RTC

GENERAL

All relevant socio-economic information can be found within the IAIP section above. The proposed Motta RTC site is located in the East Gojjam Zone of the Amhara Region, around 2 km distance from the Motta town, with Hibresalam village being the closest.

During the WSP team site reconnaissance, it was noted that the RTC site includes a total of 2 dwellings that require relocation with an unknown number of households (farmers) that will be directly affected by the proposed project due to loss of farmland. Initial communication has reportedly been undertaken with the affected parties and that a survey of the affected households identifying individuals, structures, extent of land and farming activities, has been undertaken.

It is understood that the affected households are to be relocated however, the land for relocation purposes has not yet been identified. The intention regarding farmland is to provide financial compensation without the provision of replacement farmland.

EDUCATION

There are three primary schools in Motta and they are sufficient for the current population levels. However, there is no high school in the village and students have to travel two to three kilometres to the main town Motta in order to find one.

EXISTING INFRASTRUCTURE AND SERVICES

There is a hospital in Motta town which is overstretched as it is the only one health centre in the village and it does not have sufficient amount of medicines and professionals/doctors or nurses. There is a police station in the village but the village is vast and the existing policemen are insufficient. **Table 8-37** identifies the top 10 diseases that are encountered in Motta, as per the town administration Health offices (August, 2017).

Table 8-37: Top ten diseases in encountered in Motta

Rank	Disease type (2007 EC)	Disease type (2008 EC)
1st	Acute upper respiratory infections (AURTI)	AURTI
2nd	Dyspepsia	Dyspepsia
3rd	Infection of the skin and subcutaneous tissue	Infection of the skin and subcutaneous tissue
4th	Acute Febrile Illness (AFI)	Infection of the skin and subcutaneous tissue
5th	Pneumonia	AFIR
6th	Trauma	Trauma
7th		Diarrhoea (non blood)
8th	Other unspecified infectious and parasitic diseases	Other unspecified infectious and parasitic diseases
9th	Diarrhoea (non blood)	Pneumonia
10th	Helminthiasis	Acute upper respiratory infections

The existing road network throughout the Motta Town consists of gravel and cobbled roads in varying states of condition. These include the Federal Highway no. B_31 which is currently being upgraded through Motta, extending to Bahir Dar. During consultation it was identified that the development of the RTC and associated boundary wall has resulted in an access road, utilised by communities residing to the north east of the site, being obstructed. This access route was utilised by the local communities, on a daily basis, to gain access to services in Motta such as schools, medical facilities, markets etc. **Figure 4-5** indicates the access routes across the IAIP site that will be obstructed by the development.

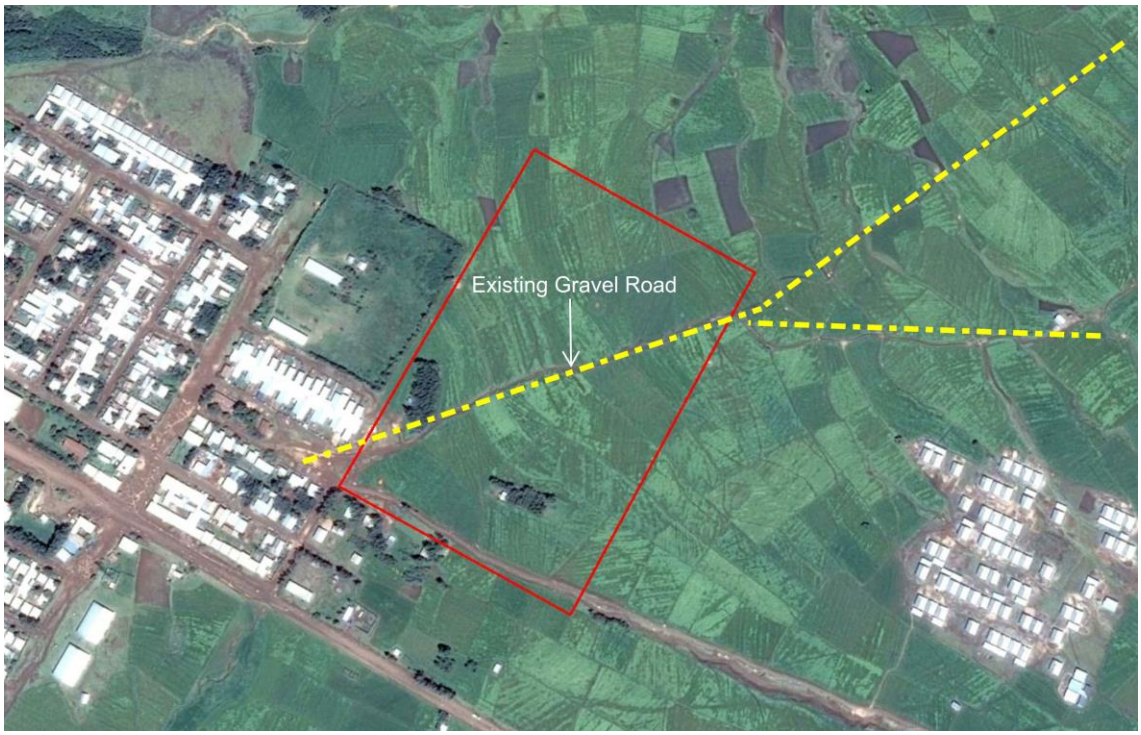

Figure 8-44: Image showing access routes across the RTC site that will be obstructed

An alternative access road is being proposed to connect the existing roads / gravel tracks to the highway on the south eastern side of the site. The proposed road forms part of the local administrations plans in terms of future development in the area as new residential areas are proposed to be established towards the north east of the RTC site (**Figure 4-6**).

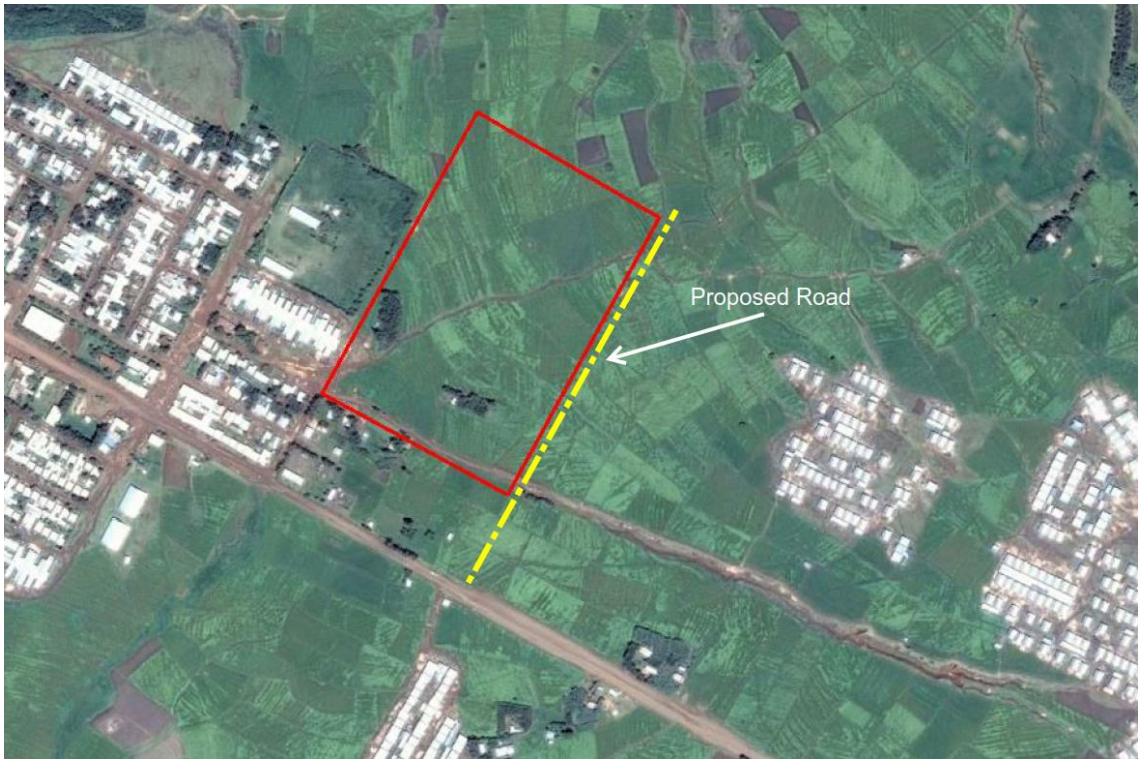

Figure 8-45: Image showing proposed access road

CULTURAL HERITAGE

No churches were identified to be located on the site and reportedly no burial tombs are located on the site. The area was not indicated to be known for palaeontological and/or archaeological resources.

8.16.4 SOCIO-ECONOMIC PROFILE OF PEOPLE IN THE PROJECT AREA (BASED ON WSP SURVEY)

A team of local specialists guided by the WSP team carried out a household survey in Bure and the Motta towns, where based on the resettlement process initiated by authorities, over 300 people will be economically and physically affected.

The ESIA team was targeting mainly those people who identified themselves as being affected by the project (and therefore involved in the resettlement process initiated by local authorities) and who still reside at the site. The ESIA team thus interviewed 85 people in total who are affected by the project and currently reside in the vicinity of either the Bure IAIP or Motta RTC sites.

The questions posed to the interviewees were aimed at collecting the relevant household and demographic information of not only the person who was interviewed but also members of his family, thus collecting the data on the wider circle of local residents.

GENDER AND AGE

Both women and men were encouraged to participate in the household survey which resulted in approximately 70.6% and 29.4% of the questionnaires being answered by men and women, respectively.

All of the respondents chose to disclose their age. 35.3% of the questionnaires were answered by people who were between 24-35 years of age, 27.1% were between 36-45 year olds, 17.6% were

between 46-55 year olds, 8.2% were between 56-65 year olds and 11.8% were >66. Over three quarters of all respondents were noted to be young, i.e. being in their mid-20s to mid-50s (80%) (see **Figure 8-46** below).

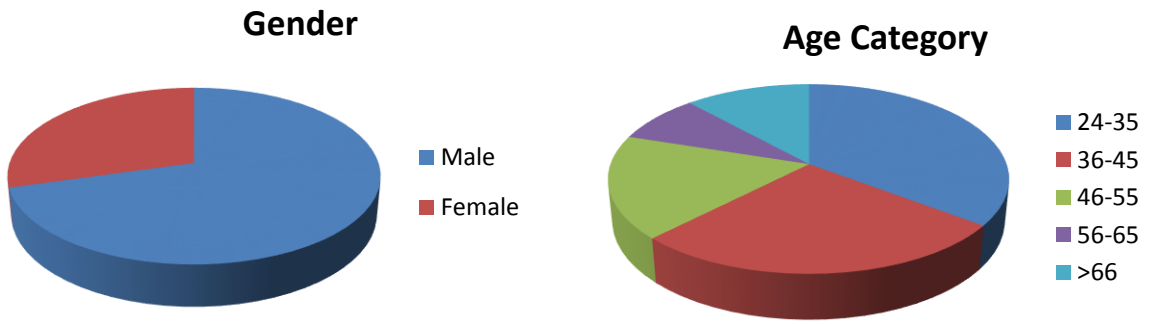

Figure 8-46: Respondents' gender and age

Of the respondents, 88.2% were residing in the Bure town for the proposed IAIP and 11.8% were residing in the Motta town for the proposed RTC.

EDUCATION

70% of respondents who are over 50 years old, and all of the respondents within the >66 age group reported having had no form of education. However, in the 24-35 year age bracket the majority had either a primary education (26.7%), high school education (3.3%), a Technical Diploma (16.7%) or a Higher/University Degree (23.3%). In other words, the opposite is true for the younger generation in the project area, where 70% of the younger category has received at least primary education, and a quarter have a University diploma. Only 30% of 24-35 year old respondents had received only some or no primary education.

The educational profile has been further enhanced by the additional analysis of the education level of the interviewee's family members within each household visited. The extended collection of the education data on other family members revealed that 40.6% had not finished their basic schooling or had no education. This figure is similar with the reported national statistics, with 48% of females and 37% of males having never attended school, receiving only some or no primary education.

Nearly a third of the family members (32.5%) included in the surveys finished a primary school education at a minimum.

The surveys showed that a much lower percentage of family members went on to further education, with 10.7%, 9.4% and 6.8% as having a high school education, a technical diploma and a Higher/University Degree education level, respectively. In summary, low education attainment levels were noted among the interviewed affected people in the project area, where the majority of interviewees and their immediate adult family members mostly had either no education or finished at primary school, while the opposite is true for the younger generation who received a much better level of education.

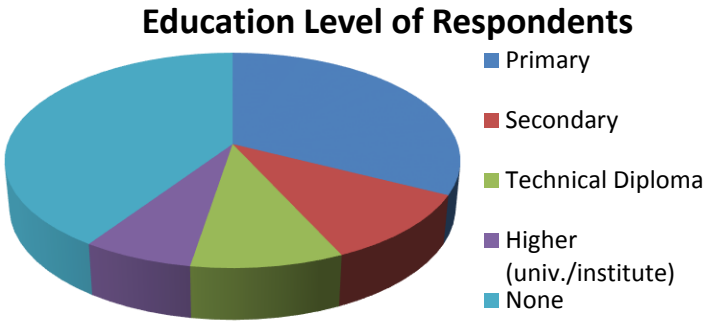

Figure 8-47: Reported educational level among respondents

EMPLOYMENT

The employment profile also has been further enhanced by asking about the employment situation of other family members, in addition to the employment data on interviewees themselves. Over a third (35.5%) of the respondents defined themselves as a farmer, while 19.2% of the respondents defined themselves as either a civil servant or employed within a business or trade (7.7%).

All of the respondents' spouses were employed, with 55.3% stating farming as their primary occupation. The questionnaires showed that 14.5% of the respondents were unemployed. This is a significantly lower level of unemployment that was expected in the project area.

In addition, 30.8% of the interviewees gave their occupation as 'Other'. Other occupations were mentioned, which included a driver, daily labourer, student, etc.

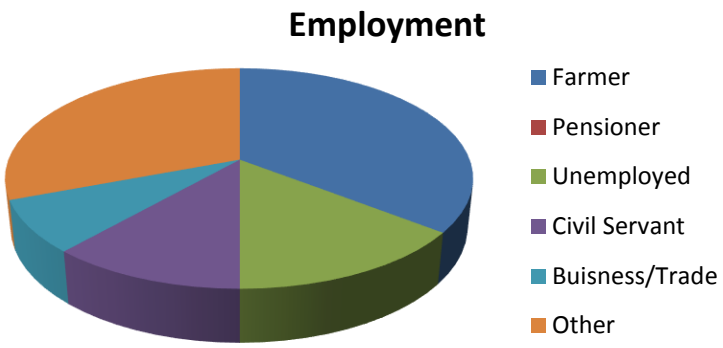

Figure 8-48: Reported employment among respondents

ASSET OWNERSHIP

Most of the respondents have irregular and unpredictable income (derived mainly through agricultural activities) and ownership of electronic goods in the interviewed households was low. Only 2.4%.

Whilst 80% of the surveyed respondents stated they owned a mobile phone, a much lower percentage of respondents confirmed they owned other electrical items, with a television owned by 32.9%, a satellite dish by 28.2%, a radio by 22.4% and only 7.1% of the respondents had access to a washing machine in their homes.

Furthermore, all of respondents stated that they didn't have any access to the internet in their homes or owned a refrigerator.

92.9% and 42.4% of the surveyed respondents are currently living in the houses or have land that they cultivate, respectively. Furthermore, 62.4% owned goats or chickens, which demonstrates how important animal husbandry is for supplementary income in the survey area.

All of the surveyed respondents did not own any form of personal transport (car or bike).

The survey asked respondents to list any areas of cultural heritage within the area. All of the respondents stated that there were no areas of cultural significance located nearby. Respondents were also asked the distance to the nearest cemetery from their home, this ranged from 0.5km to 3km, with an average of 1.28km.

HOUSEHOLD INCOME AND EXPENDITURES

Questions about people's income and expenses are traditionally challenging and a high percentage of people often opt out and chose not to answer such questions. In the case of this socio-economic survey, the survey team made an effort to engage with people and explained at length why this data is being collected. As a result all of the respondents agreed to share the details on their income. This is a much better response rate than could have been expected in such a survey.

The majority of respondents (97.7%) indicated that they derive most of their income from farming/ agricultural activities or from formal employment (civil servant, business or daily labourer). In addition, 37.6% of interviewed households supplemented their income from other economic undertakings. The alternative forms of income (separate from occupational/salaried employment) were reported by the

respondents who regularly source their income from one or more of these activities, as detailed in **Table 8-38** below. It must be noted that

Table 8-38: Details on Alternative Sources of Income

Alternative Source of Income	Households receiving income from these activities
Farming	3%
Chicken and Goats	11%
Rent of Property	6%
Social Security Benefits	2%
Money from Family Members	12%

Among the respondents, the average household income from all livelihood sources and obtained from all working age family members totals to approximately 3,716 Birr/month (equivalent to $136/month, Nov 2017 exchange rate). The estimated annual per capita/person household income data from the World Bank (2016) shows that an average per capita annual income in Ethiopia is $660/person. Assuming that there are two working persons in an average household (statistically, 4.8 people per household in Ethiopia), the obtained income data is in line with the World Bank 2016 data.

When asked about their monthly expenditures, 88.2% of respondents indicated that they spend most of their monthly income on food. Thus, most of the people cultivating land in the project area, will be severely affected if their access to land is disrupted, leading to significant reduction of their income and in most cases, future livelihood.

The next most important expenditures for the respondents appeared to be 'other', an answer given by 12.9% of respondents. All of the answers given as 'other' were relating to farming or fertiliser expenses, which ranged from 400 to 2,000 Birr/month depending on the size of the cultivated plot. Other expenditures included 'utilities' which was given by 1.2% of respondents and 'housing' which was also given by 1.2% of respondents.

SOURCES OF FRESHWATER

It was reported that only 3.5% of the households obtain freshwater from the lorry that regularly makes water deliveries. The main source of freshwater was identified as well water, with 48.2% of households stating it as their main source, whilst 5.9% obtained freshwater from a water pump and a further 42.4% reported that they attain freshwater through 'other' resources.

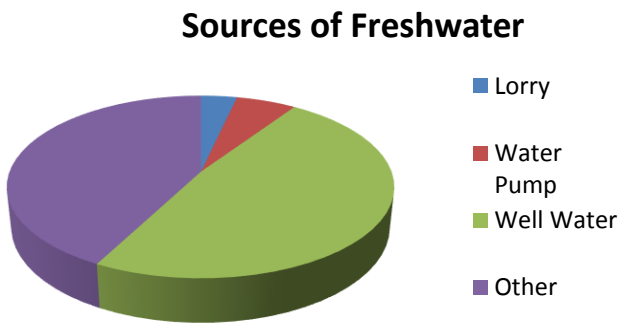

Figure 8-49: Sources of freshwater

HEALTH SITUATION

Only 2.4% of the respondents indicated that at least 1 member of their household has a disability or an illness. The disabilities within the households were noted down in the questionnaires as blindness and handicapped.

The respondents listed the following top diseases to have affected members of their household in the past three years: malaria, typhoid, influenza and bacterial infections. It should be noted that Tuberculosis was also recorded in 2 of the surveyed households.

The survey asked questions regarding recent deaths and births in families. 8% of the respondents reported that there had been one birth in the household within the last year, whilst only one household stated that 1 death had occurred within the last year. The cause of death was attributed to an accident.

PROJECT EXPECTATIONS

Most of the respondents (80%) were aware of the Project, of which most (72%) of them have primarily learnt about through a local authority announcement. Others respondents stated they learnt about the Project through other sources of information, including, the media (6%), the local community (5%) and a family member (1%). It should be mention that some respondents heard about the Project through more than one source of information.

91% of the respondents had a positive attitude towards the Project. The positive opinions were largely reported to be due to expectations related to an increase in the number of available jobs as well as the Project contributing to the development of area and market for agricultural products.

Only 1% of respondents reported expecting some negative impacts from the Project, which was due to the concern of displacing of farmers with little or no compensation. Other worries were noted amongst respondents, including, environmental pollution, the expected influx of people, increased chance of traffic accidents and one stating that there road is blocked and the compensation not being enough.

9 IDENTIFICATION OF POTENTIAL IMPACTS

The purpose of the ESIA process is to assess and investigate the identified potential impacts that are most likely to be significant. This chapter includes physical, biological and social impacts associated with the proposed project.

The information which is presented below is a consolidation of the identified impacts associated with the proposed Amhara IAIP and RTC developments. These impacts have been sourced from various specialist reports included within **Appendix C**, refer to Appendices C-1 to C-12 for the full reports.

The technical impact assessment ratings tables have been provided for all specialist studies within **Appendix D.**

9.1 SOILS

The purpose of this section is to establish the extent to which agricultural soils will be removed from the site as a result of the proposed Amhara IAIP and RTC site developments and to identify potential cumulative risks to the identified soils and the level of associated mitigation measures that will be needed. This was established by undertaking a fertility analysis of the soils sampled at the sites and calculating the potential risks that the proposed development will pose to the soils, with and without mitigation measures being put in place.

The description is based on primary data obtained from site investigations. **Table 10-1** summarises the impacts identified at both the Amhara IAIP and RTC sites as being significant in terms of soil, land use and land capability. To view the full report with regards to potential impacts on soils within the Amhara Region, refer to **Appendix C-1.**

Table 9-1: Potential Impacts on Soils in the Amhara Region

Impact number	Description	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Erosion Soil erosion is not a big problem at the Amhara IAIP site but the Vertic topsoil of the RTC site makes this a notable impact.	Negative	Low	Major	Moderate
2	Sedimentation Eroded soil particles may end up in a nearby watercourse as well as the wetland system which runs through the IAIP site resulting in sedimentation.	Negative	Low	Major	Moderate
3	Loss of topsoil Topsoil will be lost, however lost topsoil can be transferred to an	Negative	High	Moderate	Negligible

Impact number	Description	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	alternative area to continue cultivation.				
4	Compaction A change in the soils' original structure due to construction activities.	Negative	Moderate	Major	Moderate
5	Change in surface profile The surface profile of the sites will be changed to create a platform for the agri-industrial zone buildings.	Negative	Nil	Major	Major
6	Change in land use The land will undergo permanent changes as the land use will change from farming to an agri-industrial zone.	Negative	Nil	Major	Major
7	Change in land capability The proposed development will permanently alter the land capability of the site.	Negative	Nil	Major	Major
8	Dust creation Bare surfaces and soil stockpiles pose the risk for high amounts of dust creation.	Negative	Moderate	Moderate	Minor
9	Soil Contamination Contamination of the soils may occur due to the large vehicles; on-site pollutants' contact with the well-drained soils will need to be limited.	Negative	Moderate	Major	Minor
OPERATIONAL					
1	Erosion Soil erosion is not a big problem at the Amhara IAIP site but the Vertic topsoil of the RTC site makes this a notable impact.	Negative	Low	Moderate	Minor
2	Sedimentation Eroded soil particles may end up in a nearby watercourse as well as	Negative	Low	Moderate	Minor

Impact number	Description	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	the wetland system which runs through the IAIP site resulting in sedimentation.				
3	Compaction Large amounts of compaction occur during this phase, resulting in the soil structures to be permanently changed	Negative	Nil	Major	Major
4	Dust creation Bare surfaces and soil stockpiles pose the risk for high amounts of dust creation.	Negative	Moderate	Moderate	Minor
5	Contamination Contamination should be prevented otherwise well-drained after contact with the pollutants; the type of pollutants released in this phase differ to pollutants in other phases	Negative	Moderate	Moderate	Minor
DECOMMISSIONING					
1	Erosion Soil erosion is not a big problem at the Amhara IAIP site but the Vertic topsoil of the RTC site makes this a notable impact.	Negative	Low	Major	Moderate
2	Sedimentation Eroded soil particles may end up in a nearby watercourse as well as the wetland system which runs through the IAIP site resulting in sedimentation.	Negative	Low	Major	Moderate
3	Dust creation Bare surfaces and soil stockpiles pose the risk for high amounts of dust creation.	Negative	Moderate	Moderate	Minor
4	Soil Contamination Contamination of the soils may occur due to the large vehicles; on-site pollutants' contact	Negative	Moderate	Major	Minor

Impact number	Description	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	with the well-drained soils will need to be limited.				

The soil impacts identified above can be suitably mitigated through the implementation of protection strategies, refer to the Environmental and Social Management Plan (ESMP) included in **Chapter 11**. The residual impacts on the soil as a result of the development will include the following:

- Soil Erosion: Although mitigation is possible, excavation of soils is generally likely to lead to some erosion.
- Sedimentation: A residual soil erosion impact will lead to a residual sedimentation impact as eroded soil particles may enter the nearby watercourses as sediment.
- Compaction: All soils that have been compacted will have lost their original structure permanently.
- Change in surface profile: As the site will be levelled for the development, the land surface profile will be permanently altered.
- Change in land use: As the soils will be excavated, compacted and possibly sterilised, the land use will very likely change from arable permanently.
- Change in land capability: As the soils will be excavated, compacted and possibly sterilized, the land capability will very likely change from arable permanently.
- Soil Contamination: Contaminated soil is expensive to rehabilitate and contamination entering the soils of the Amhara sites may enter the surrounding water resources.

Mitigation measures can be very expensive and require appropriately-skilled personnel to be a part of an impact mitigation team.

9.2 SURFACE WATER

This section of the report is to identify the potential risks associated with the surface water at the proposed project site.

The storm water management plan developed by MACE was reviewed[7]. The objective of the storm water management plan review is to determine if the design appropriately manages the storm water runoff according to applicable legislation highlighted below[8].

- African Development Bank Group - Safeguards and sustainability series, Volume 2, Issue 1, December 2015: Integrated Safeguards System (ADBG, 2015);
- UNOPS - Design Planning Manual, Version 1, 2014 (UNOPS, 2014);
- IFC World Bank Group - Environmental Health and Safety (EHS) Guidelines: General Environmental Guidelines, 2007 (IFC, 2007);
- The water quality analysis was undertaken in accordance to the general liquid effluent quality with regards to discharge to surface water within the IFC World Bank Guidelines (IFC, 2007). The water quality monitoring programme was developed in accordance with the IFC World Bank Group Guidelines (IFC, 2007).

The main issues and potential impacts associated with the proposed project were determined at a desktop level, based on existing information, as well as from site investigations and specialist input.

The Amhara IAIP (Bure) drainage system has twelve discharge points. Clean water drains situated along the northern boundary of the site directs clean water into the Yiser River. Most of the runoff generated on the site is discharged to the surrounding environment. The northern section of the site

[7] For a comprehensive list of drawings and document that were reviewed refer to the specialist report attached as Appendix 9.2.
[8] Please note that the sizing of storm water infrastructure was not considered as part of the review.

drains towards a summer storage tank where captured runoff water will be used within the operations during the dry season. Any overflow of the summer storage tank will spill into the Yiser River. Runoff water from the sewage treatment plant will be captured within the summer storage tank

The Amhara RTC (Motta) drainage system is a collection of drains that direct water to two discharge points. No runoff water is captured on site and all runoff is discharged to the surrounding environment. The area of concern within this storm water design is that runoff generated on the sewage treatment plant is discharged to the surrounding environment.

Table 9-2 identifies the potential impacts on surface water and the significance of the impacts. To view the full report with regards to potential impacts on soils within the Amhara Region, refer to **Appendix C-2.**

Table 9-2: Potential Impacts on Surface Water in the Amhara Region

Impact number	Description	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Hydro-carbon contamination from the earth-moving machinery and vehicles	Negative	Moderate	Major	Minor
2	Sedimentation of the Yasmila River and drainage lines	Negative	Moderate	Moderate	Minor
OPERATIONAL					
1	Altering the hydrological regime- Change in Runoff Volume	Negative	Moderate	Major	Minor
2	Altering the hydrological regime-Change in runoff velocity	Negative	High	Moderate	Minor
DECOMMISSIONING					
1	Hydro-carbon contamination from the earth-moving machinery and vehicles	Negative	Moderate	Moderate	Minor
2	Sedimentation of the Yasmila River and drainage lines	Negative	Moderate	Moderate	Minor

The surface water impacts identified above can be suitably mitigated through the implementation of protection strategies, refer to the Environmental and Social Management Plan included in **Chapter 11**. Limited to none residual impacts on the surface water as a result of the development are anticipated if the mitigation measures are implemented correctly.

9.3 GROUNDWATER

Based on primary data obtained, groundwater use in the vicinity of the Bure IAIP and Motta RTC is relatively extensive. A total of nine groundwater points were identified at the IAIP Site and five groundwater points at the RTC Site. Water levels in these wells were relatively shallow, with water levels ranging from 0 mbgl to 8.27 mbgl.

The main source of potential groundwater contamination at both the IAIP and RTC sites is micro biological contamination from faecal waste originating from septic tank and sewage system discharge, infiltration of domestic waste and unlined pit latrines.

The potential impacts on the groundwater is presented in the table below. To view the full report with regards to potential impacts on ground water within the Amhara Region, refer to **Appendix C-3.**

Table 9-3: Potential Impacts on Ground Water in the Amhara Region

Impact number	Description	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
No construction phase impacts to the hydrogeological environment are expected					
OPERATIONAL					
1	Lowering of groundwater levels through abstraction of groundwater for use at the IAIP and RTC sites	Negative	High	Moderate	Minor
2	Contamination of groundwater resources from contaminated surface water runoff or subsurface leakages from underground chemical storage and/or effluent systems	Negative	Low	Moderate	Minor
3	Loss of recharge area for the springs through reduction of permeable surface	Negative	None	Moderate	Moderate
DECOMMISSIONING					
No decommissioning phase impacts to the hydrogeological environment are expected					

Based on the findings of the impact assessment, it has been concluded that the development and operation of the Amhara IAIP and RTC will have a minor impact on the receiving groundwater environment. The groundwater impacts identified above can be suitably mitigated through the implementation of protection strategies, refer to the ESMP included in **Chapter 11**.

9.4 WETLANDS

The Integrated Water Resource Management (IWRM) is an internationally-accepted approach to sustainable Water Resource Management. It recognises the inter-relatedness and relationship between watercourse level processes and components (resource quality characteristics). An activity associated with the existing development can impact any of the resource ecosystem drivers (flow regime, water quality, geomorphological) or responses (habitat, biota) and this will have a knock-on effect on potentially all the other drivers and or responses. Therefore, when assessing an activity, the impact that specific activity may have on all the resource quality characteristics is assessed. The majority of activities will not only affect one characteristic due to their complex interrelatedness.

The potential direct and indirect impacts of the proposed development on the identified wetland habitats are discussed below.

The proposed development will have a significant impact the wetland habitat within the site and potentially the systems downstream of site. The majority of the potential impacts will occur during the

construction phase. The long-term impacts that are likely to occur relate to the onsite stormwater management during the operational phase of the proposed development and pertain to the fragments of wetland habitat remaining onsite but especially to the systems located immediately downstream of the site boundary.

There is foreseen direct loss of wetland habitat (W1-3, & 1a-c) and biota relating to the construction activities only; this is based on the assumption that the determined buffer will be demarcated as a 'No-Go' area and adhered to during the operational phase. The Wetlands W1a-c will be completely lost and the majority of W2. There is foreseen temporary intrusion into the wetland habitat area (permanent zone of Wetland W1) designated to be retained within the footprint, for road construction, however with appropriate rehabilitation this impact would not be significant. The loss of wetland habitat will subsequently result in the loss of the goods and services currently provided by the wetland systems. Although the design shows that the surface water flow is being directed from above the system and discharged below the site, the natural flow regime is still being impacted upon. The flow regime is considered as the variability in the discharge throughout the course of a year in response to precipitation, temperature, evapotranspiration, and drainage basin characteristics.

The development of the IAIP will result in significant hardening of surfaces, reduced vegetation cover, and the installation of drainage systems. This will direct water away from subsurface pathways to overland flow into the stormwater drainage system. The difference in permeable area between the undeveloped site and that of the proposed development may result in: the increase in flood frequency and intensity, decrease infiltration, alter flow patterns, increase concentrated runoff (towards the remaining wetland habitats and watercourses downstream from the site), potential erosion (i.e. increase in flow velocity) and widening and deepening of channel banks within the site and watercourses downstream from the site. The seasonal pattern of higher baseflows during wet seasons may also not be retained. It is recognised that some level of permeability has been designed for within the drain structures. Effective stormwater management would allow for the release of the surface water runoff in a controlled manner, with minimal impact on the surrounding environment.

The quality of the surface water runoff from the proposed development may result in the degradation of water quality within the wetland habitat and/or downstream of the site. The runoff, containing hydrocarbons, from parking areas for example, is a potential contaminant source. Again an effective stormwater management plan for the proposed development, including structures such as grease traps, would mitigate against this impact.

Mitigation requires proactive planning that is enabled through a mitigation hierarchy. This is in line with relevant requirements in the AfDB safeguards. Its application, is intended to strive to first avoid disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided altogether, to minimise, rehabilitate, and then, as a last resort, compensate for and offset any remaining significant residual negative impacts on biodiversity.

The implementation of this mitigation hierarchy is required to be shown as the complete removal of the identified systems and compensation/offset (final step in hierarchy) of removed systems can only occur once the avoid, minimise and rehabilitate steps have been considered and proved to be not possible. Ideally 100% of the wetland systems would be maintained and incorporated into the detailed designs of the IAIP ('avoid' in the mitigation hierarchy), however it is noted that this may not be feasible due to social and economic factors and project viability criteria, however this cannot just be stated, there must be evidence to support this.

As per the AfDB operational safeguard:

- 'If projects are to be developed in natural habitats, or are to have potential adverse downstream impacts on natural habitats, they include mitigation measures to achieve either net benefit or no net loss of biodiversity. For example, ecological restoration of habitats, measures to reduce fragmentation, and restoration of ecosystem functioning.
- Any disruption and interruption of surface and groundwater distribution and flows, which may cause loss of supply to surrounding areas of wetland habitat', requires mitigation in the form of a 'water study conducted prior to activities, to inform design and avoid/reduce impacts to upstream/ downstream areas' and 'limit creation of sealed or compacted surfaces in the surrounding area as much as possible, to maintain natural recharge of the water table.
- Any 'loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways requires careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists' and 'wherever feasible, establishment of buffer zones

around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones'. Additionally 'rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.'

The specific impacts outlined in **Table 9-4**, are overarching general impact categories that may result as a consequence of the proposed development on the wetland systems. These are broad categories that encapsulate the impacts that could potentially affect the functioning of a wetland system. To view the full report with regards to potential wetland impacts within the Amhara Region, refer to **Appendix C-4**

Table 9-4: The Potential Impacts on wetlands in the Amhara IAIP

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Direct loss/ degradation of natural wetland habitat & biota (W1-3,6 &1a-c)	Negative	Low	Major	Moderate
2	Hydrological functioning/ regime modifications (W1-3,6 &1a-c)	Negative	Low	Major	Major
3	Erosion and Sedimentation (All)	Negative	Moderate	Major	Moderate
4	Water Quality (All)	Negative	Moderate	Major	Moderate
OPERATIONAL					
1	Direct loss/ degradation of natural wetland habitat & biota (W1, W3-5)	Negative	High	Major	Minor
2	Hydrological functioning/ regime modifications (W1, W4, W5)	Negative	High	Moderate	Minor
3	Erosion and Sedimentation (W1, W3-5)	Negative	Moderate	Major	Minor
4	Water Quality (W1, W3-5)	Negative	Moderate	Moderate	Minor
DECOMMISSIONING					
1	Direct loss/ degradation of natural wetland habitat & biota (W1, W3-5)	Negative	High	Major	Negligible
2	Hydrological functioning/ regime modifications (W1, W3-5)	Negative	Moderate	Moderate	Moderate
3	Erosion and Sedimentation (W1, W3-5)	Negative	Moderate	Major	Moderate

Based on the findings of the impact assessment, it has been concluded that the wetland impacts identified above can be suitably mitigated through the implementation of protection strategies. Refer to the ESMP included in **Chapter 11** for details on the required mitigation measures to be implemented.

9.5 AIR QUALITY

The purpose of the Air Quality Impact Assessment was to identify the potential impacts and associated risks posed by the proposed IAIP site on the air quality of the area and make informed decisions on the way forward in order to ensure that these risks do not result in unacceptable social or environmental risk.

Table 9-5 below provides a breakdown of potential construction, operational and decommissioning phase impacts on air quality and presents the associated ratings. To view the full report with regards to potential impacts on air quality within the Amhara Region, refer to **Appendix C-5**.

Table 9-5: The Potential Impacts on Air Quality in the Amhara Region

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Residential Receptors located within immediate vicinity of site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Moderate	Minor
2	Residential Receptors beyond site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Minor	Negligible
OPERATIONAL					
1	Residential Receptors within immediate vicinity of site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Moderate	Minor
2	Residential Receptors beyond site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Minor	Negligible
DECOMMISSIONING					
1	Residential Receptors within immediate vicinity of site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Moderate	Minor
2	Residential Receptors beyond site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Minor	Negligible

It should be noted that the below rating is based on a qualitative assessment of the potential impacts. Further quantification of the potential impacts with dispersion modelling is recommended once

detailed source and emissions information is available to accurately assess the potential impacts based on compliance/non-compliance with the applicable guidelines/standards.

9.6 CLIMATE CHANGE

Climate change will have key impacts on agriculture, livestock, water and human health in Ethiopia. In particular, this will result in:

- Reduced yields and/or crop failure, reduced soil moisture availability; and increased evapotranspiration and water stress;
- Increased incidence of pests and diseases, reduced feed and water sources, and increased livestock mortality;
- Changing ranges of vector-borne diseases and increased risk from waterborne diseases;
- Reduced water quality and quantity, drying of wetlands and freshwater sources, disruption of hydropower generation;
- Changing ranges of vector-borne diseases; and
- Increased risk from waterborne diseases.

Despite the challenges, Ethiopia hopes to capitalise on its current economic growth by becoming more resilient to the impacts of climate change while developing its economy in a carbon neutral way by transforming development planning, investments and outcomes.

The country's Climate Resilient Green Economy Strategy (CRGE), which was published in 2011, sets out this vision (International Institute for Environment and Development). It is viewed as an opportunity to transform the country's development model by leaping to modern energy-efficient development trajectories.

Ethiopia is one of the few countries to have formally merged its aims of developing a green economy and greater resilience to climate change under a single policy framework in support of its national development objectives. While the government is still preparing its climate resilience objective, the Green Economy component of the CRGE has already been developed (International Institute for Environment and Development). It aims to develop Ethiopia's green economy by:

- Improving crop and livestock production practices to improve food security and increase farmer's incomes while reducing emissions;
- Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks;
- Expanding electricity generation from renewable energy sources for domestic and regional markets; and
- Advancing to modern and energy-efficient technologies in transport, industrial sectors, and buildings.

Greenhouse gas emissions in Ethiopia increased by 86% from 1993 - 2011. Through the Intended Nationally Determined Contribution, Ethiopia pledges to cap 2030 greenhouse gas emissions at 145 $MtCO_2e$, a 64% reduction from projected business as usual emission levels in 2030. The pledge includes greenhouse gas reductions from agriculture, forestry, industry, transport and buildings sectors.

To view the full report with regards to potential impacts on climate change, refer to **Appendix C-6**.

9.7 NOISE

The current noise climate is typically rural, with various anthropogenic influences. The site currently consists of farming activities which do not generate significant levels of noise, however, the site is considered to fall within the Bure industrial area which is currently located directly north of the site. Construction activities are currently taking place within the industrial area. Other sources of noise include vehicles travelling along regional roads as well as the federal highway adjacent to the site on the eastern boundary.

In terms of the construction phase, based on a worst-case cumulative sound power level of 116.3 dB(A) stemming from all anticipated construction equipment to be operational during the construction phase (refer to **Table 8-30**, the resultant noise levels are anticipated to be highest closest to the source and tapers off as distance from the source increases, as would be expected. Beyond 50 m from the source, noise levels will reduce considerably, with noise levels at around 78 m from the source dropping to below the industrial guideline rating level of 70 dB(A). From 438 m from the construction activities, noise levels will decrease to below the residential guideline level of 55 dB(A).

Based on this worst-case assessment, there will be no resultant acoustic impacts on the surrounding towns, which are all located greater than 1 km from the site. Neighbouring homesteads (up to 500 m from the site boundary) will be directly impacted by construction activities, particularly when construction occurs on the nearest site boundary to a receptor in question. Receptors further than 500 m from the IAIP site will be minimally impacted by construction activities and owing to the low current background noise levels may experience slight increases in existing noise levels as a result of the construction activities.

Noise impacts are much more discernible at night, due to the lower existing noise levels. It is envisaged that the construction of the IAIP will only occur during the day-time hours and as such no project-related acoustic impacts are anticipated at night.

In terms of the operation phase, based on a worst-case cumulative noise level of 107.6 dB(A) stemming from activities at the meat processing unit (refer to **Table 8-31**), the resultant noise levels are anticipated to be highest closest to the source and tapers off as distance from the source increases, as would be expected. With noise levels at around 30 m from the source dropping to below the industrial guideline rating level of 70 dB(A). From 160 m from the processing activities, noise levels will decrease to below the residential guideline level of 55 dB(A). Noise impacts are much more discernible at night, due to the lower existing noise levels. It is understood that the operation of the IAIP will only occur during the day-time hours and as such no project-related acoustic impacts are anticipated at night.

It must be noted that these calculations are based on the fact that the noise sources are all exposed to the open air and not enclosed within a building. It is most likely that most units and processes will be enclosed within buildings with particular reference to the boiler and meat processing units. Boilers are generally enclosed within boiler houses. For hygiene purposes, any food processing facility will also be enclosed. This will result in significantly lower noise levels experienced in the ambient environment.

The table below identifies the potential impacts of noise levels which may be caused by the proposed project, as well as the severity of the impacts associated with each phase of the project.

To view the full report with regards to potential impacts on noise levels within the Amhara Region, refer to **Appendix C-7**.

Table 9-6: **Potential Impacts of Noise in the Amhara Region**

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Construction phase impacts of noise on residential receptors within 500 m of the site boundary	Negative	Moderate	Major	Moderate
2	Construction phase impacts of noise on residential receptors beyond 500 m of the site boundary	Negative	Moderate	Moderate	Minor

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
OPERATIONAL					
1	Operational phase impacts of noise on residential receptors within 200 m of the site boundary	Negative	Moderate	Moderate	Minor
2	Operational phase impacts of noise on residential receptors beyond 200 m of the site boundary	Negative	Moderate	Minor	Negligible
DECOMMISSIONING					
1	Decommissioning phase impacts of noise on residential receptors within 500 m of the site boundary	Negative	Moderate	Major	Moderate
2	Decommissioning phase impacts of noise on residential receptors beyond 500 m of the site boundary	Negative	Moderate	Moderate	Minor

The impact assessment has identified that the construction and decommissioning phases will generate the most significant impacts, however these can be effectively managed through the implementation of mitigation measures as identified in the ESMP (refer to Chapter 11).

9.8 TRANSPORT AND ACCESS

The expected produce through-put and related vehicle volumes for deliveries and distribution to and from the IAIP and the RTC is not known. However, the interaction between community members using these routes with the increased Project traffic from the construction phase onwards, may increase the risk of traffic accidents.

A breakdown of potential construction phase, operational phase and decommissioning phase traffic related impacts and ratings are provided in **Table 9-7**.

To view the full report with regards to potential impacts on transport and access within the Amhara Region, refer to **Appendix C-8**.

Table 9-7: Potential Impacts on Transport and Access in the Amhara IAIP

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Increased vehicle/vehicle and vehicle/NMT accident	Negative	Low	Minor	Minor

	risks due to increased traffic volumes.				
OPERATIONAL					
1	Increased vehicle/vehicle and vehicle/NMT accident risks due to increased traffic volumes.	Negative	Low	Moderate	Minor
DECOMMISSIONING					
1	Reduced vehicle/vehicle and vehicle/NMT accident risks due to increased traffic volumes.	Negative	Low	Minor	Minor

The vehicle accesses to the IAIP and the RTC must be designed to the relevant National standards, namely the Ethiopia Road Authority design standards.

It is recommended that a second vehicle and pedestrian access be provided to the IAIP via the adjacent road network to the north-west of the site.

All parking provision is to be provided on-site, and parking on individual erven will be subject to the Development Control Regulations of the sites. The parking provision will be in-line with the zoning of each internal erf of the IAIP and RTC.

There are residential areas in the vicinity of the Bure IAIP. Public transport may still be required due to the large number of workers that will be employed on the IAIP. The type and extent of the services cannot be assess at this stage, and may have to be provided in incremental stage as the number of workers on-site increases.

- A suitable public transport stop should be provided on-site, to ensure safety of passengers waiting for transport.
- Due to the location of the site, non-motorised transport will be present along the federal highway to the site.
- An additional NMT access should be provided off the roundabout located on the north-western edge of the site. This will allow a shorter and more direct access to the site from the town, and will also decrease NMT and public transport movements along the federal highway to the main access.

The Motta RTC is located directly adjacent to residential areas of the town of Motta. Public transport may therefore not be required to transport workers to the site.

- A suitable public transport stop should be provided on-site, to ensure safety of passengers waiting for transport.
- Due to the location of the site directly adjacent to the town, non-motorised transport is present along the access road and federal highway.
- It is recommended that NMT facilities (sidewalks) be provided along the access road between the RTC and the federal highway.

The impact assessment has identified that the identified impacts can be effectively managed through the implementation of mitigation measures as identified above and included within the ESMP (refer to Chapter 11).

9.9 WASTE MANAGEMENT

In the Bure and Motta towns, there are no organised and advanced waste management systems such as collection, transport and disposal; therefore identifying the risks associated with waste

management is necessary. **Table 9-8** below highlights the risks at each phase of the proposed project, by taking into account the current waste management programs at the IAIP site and RTC site.

Table 9-8: Potential Risks Associated with Waste Management in the Amhara Region

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Construction waste: discarded or broken bricks, packaging and hazard demarcation tape	Negative	High	Minor	Minor
2	Hazardous waste materials being stockpiled on bare ground presenting a potential for contamination of soils, surface and ground water.	Negative	Moderate	Moderate	Minor
3	Domestic waste such as food/meal debris, packaging and sanitary waste generated by construction staff	Negative	High	Major	Minor
OPERATIONAL					
1	Overfull waste bins littering streets and blockage of drainage channels	Negative	High	Major	Minor
2	Hazardous waste materials being stockpiled on bare ground presenting a potential for contamination of soils, surface and ground water.	Negative	Moderate	Moderate	Minor
3	Any wastes being ultimately disposed of at a landfill will contribute the volumes of waste and hence the lifespan of the landfill.	Negative	High	Major	Negligible
4	Where disposal occurs within an unlined landfill there is the potential for leachate to develop and drain into surface and groundwater resources.	Negative	Moderate	Major	Minor

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
DECOMMISSIONING					
1	Decommissioning waste: rubble, steel, glass, packaging and hazard demarcation tape	Negative	High	Major	Minor
2	Hazardous waste materials being stockpiled on bare ground presenting a potential for contamination of soils, surface and ground water.	Negative	Moderate	Major	Minor
3	Domestic waste such as food/meal debris, packaging and sanitary waste generated by construction staff	Negative	Moderate	Moderate	Minor

These impacts can be mitigated through proper management and control measures which are contained within a Waste Management Plan. A Waste Management Plan (WMP) has been developed for the Amhara IAIP and RTC sites. The WMP provides details on what waste management practices should be applied within the facilities, how waste will be managed and what responsibilities fall to the IPDC, Contractors and Enterprises. The WMP provides an order of preference for waste management options in line with the waste hierarchy. This is an organic document that will need to be regularly updated to include any changes that may occur in the science of waste management. Better waste management reduces environmental pollution; diversion of waste from landfill decreases the need for additional landfills; waste recovery, reuse and recycling reduce the consumption of natural resources, likewise the minimisation of waste. The WMP is included in **Appendix C-9**

9.10 VISUAL

The proposed IAIP facility is situated in a rural area on the outskirts of Bure Town. The visual absorption capacity is relatively good primarily due to the undulating nature of the topography. The regular horizontal nature of the warehouses and compound wall are of a scale and size that is highly congruent with the surround land uses to the north, the natural environment and agricultural activities.

In the context of the development level of Ethiopia, visual impacts arising from such mega projects are considered by the local community receptors to be positive in general. This is because the IAIP/RTC structures adds up to the overall modernization and development of the towns.

A breakdown of potential construction phase, operational phase and decommissioning phase visual related impacts and ratings are provided in **Table 9-7**.

To view the full report with regards to potential visual impacts within the Amhara Region, refer to **Appendix C-10**.

Table 9-9: Potential Visual Impacts in the Amhara IAIP

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					

1	Construction equipment and dust	Negative	Low	Minor	Minor
2	Site clearing	Negative	Low	Minor	Negligible
3	Physical impact on landforms	Negative	Low	Minor	Negligible
OPERATIONAL					
1	Intrusion on the sense of place and scenic landscape	Positive	Not applicable	Moderate	Moderate
	Light Pollution	Negative	Low	Moderate	Minor
	Roads and /or road widening	Negative	Low	Minor	Negligible
DECOMMISSIONING					
1	Construction equipment and dust	Negative	Low	Minor	Negligible

The impact assessment has identified that the identified impacts can be effectively managed through the implementation of mitigation measures identified within the ESMP (refer to Chapter 11).

9.11 BIODIVERSITY

The existing biodiversity components and associated key features which include typical flora and fauna, protected areas and non-protected sensitive resources that are found inside and within the vicinity of the project sites were identified in order to assess the potential impacts on the biodiversity of the IAIP and RTC site associated with the proposed project. The baseline conditions within the survey area have been determined through desk-based reviews of available information, field surveys and consultations with concerned authorities.

Table 9-10 below indicates how the biodiversity within the Bure IAIP region may be impacted by the proposed development.

To view the full report with regards to potential impacts on biodiversity within the Amhara Region, refer to **Appendix C-11**.

Table 9-10: Potential Impacts on Biodiversity at the Bure in the Amhara Region

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Wetland Loss/degradation of wetland	Negative	Moderate	Major	Minor
2	Biodiversity Loss/clearance of vegetation	Negative	Moderate	Minor	Negligible
3	Biodiversity Loss/clearance of vegetation / scattered tree stands	Negative	Low	Minor	Negligible

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
4	Biodiversity and habitat Impact on the underneath growth and shift on natural water course caused by the excavations, stockpiling of excavation soils, waste rubble and excess materials	Negative	Moderate	Major	Minor
5	Habitat / wetland Water quality deterioration	Negative	Moderate	Moderate	Minor
6	Habitat / wetland Lowering water table	Negative	High	Moderate	Minor
OPERATIONAL					
1	Wetland Loss/degradation of wetland	Negative	Moderate	Negligible	Negligible
2	Biodiversity Loss/clearance of vegetation	Negative	High	Negligible	Negligible
3	Biodiversity Revegetation of indigenous plant species in a buffer and greenery area	Positive	Low	Moderate	Major
4	Biodiversity and habitat Impact on the underneath growth and shift on natural water course	Negative	High	Negligible	Negligible
5	Habitat / streams Water quality deterioration / Pollution	Negative	Moderate	Moderate	Negligible
6	Habitat / wetland Lowering water table	Negative	Moderate	Negligible	Negligible
DECOMMISSIONING					
1	Wetland Loss/degradation of wetland	Negative	Moderate	Negligible	Negligible
2	Biodiversity Loss/clearance of vegetation	Negative	High	Negligible	Negligible
3	Biodiversity Maintaining revegetated indigenous plant species	Positive	Low	Minor	Major

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	in a buffer and greenery area				
4	Biodiversity and habitat Impact on the underneath growth and shift on natural water course	Negative	High	Negligible	Negligible
5	Habitat / streams Water quality deterioration / Pollution	Negative	Moderate	Minor	Negligible
6	Habitat / wetland Lowering water table	Negative	Moderate	Negligible	Negligible

Table 9-11 below indicates how the biodiversity within the Motta RTC region may be impacted by the proposed development.

Table 9-11: Potential Impacts on Biodiversity at the Motta RTC in the Amhara Region

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	Wetland No wetlands has been recorded in this proposed project area	Negative	Moderate	Negligible	Negligible
2	Biodiversity No natural vegetation has been recorded in this proposed project area except weeds that remained from farming activity	Negative	Moderate	Negligible	Negligible
OPERATIONAL					
1	Wetland No wetlands has been recorded in this proposed project area	Negative	Moderate	Negligible	Negligible
2	Biodiversity No natural vegetation has been recorded in this proposed project area except weeds that remained from farming activity	Negative	High	Negligible	Negligible
3	Biodiversity Revegetation of indigenous plant species in a greenery area	Positive	Low	Moderate	Major

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
DECOMMISSIONING					
1	Wetland Loss/degradation of wetland- no wetland habitat has been recorded	Negative	Moderate	Negligible	Negligible
2	Biodiversity Loss/clearance of vegetation- No natural vegetation has been recorded	Negative	High	Negligible	Negligible
3	Biodiversity Maintaining revegetated indigenous plant species in a buffer and greenery area	Positive	Low	Minor	Major

9.12 SOCIO-ECONOMIC

This section describes the potential impacts and consequences of interaction between the Project activities and receptors. Where significance of the impacts is assessed as moderate to major, mitigation measures, management and monitoring are proposed. The proposed mitigation and management measures will be implemented at the Bure IAIP and Motta RTC sites and by their contractors.

The identified impacts include effects associated with in-migration. Rather than assessing in-migration separately, where in-migration is a contributing or driving factor for a particular impact, this is noted in the sections below.

To view the full report with regards to potential socio-economic impacts within the Amhara Region, refer to **Appendix C-12**.

9.12.1 EMPLOYMENT AND THE ECONOMY

Based on preliminary estimates, the construction stage of the Project will generate a range of new jobs/employment opportunities during construction and new jobs during operation. The estimated direct employment is presented in the table below based on the proposed phasing of the development, see **Table 9-12**. Although these are preliminary estimates and caution needs to be exercised when citing these numbers.

The construction stage of the Project will generate new jobs/employment opportunities during construction, estimates on employment numbers were not provided within the MACE Feasibility Report since the facility will be developed in a phased manner and therefore construction will happen concurrently with operation. The MACE Feasibility Report presented direct and indirect employment estimates, see **Table 9-12** for the first five years. Following this, the facilities would be operational, as such the number of people employed by the Project will decrease (the construction process lasting approximately 5 years).

Table 9-12: Predicted Employment Numbers as a result of the operational phase IAIP and RTC in the Amhara Region

Employment Type	Year 1	Year 2	Year 3	Year 4	Year 5
Direct employment	17,561	42,462	72,790	108,561	160,613

Employment Type	Year 1	Year 2	Year 3	Year 4	Year 5
Indirect Employment	26,342	63,693	109,185	162,841	240,920

Source: MACE

In addition, the proposed Bure IAIP and Motta RTC sites will require goods and services throughout their lifecycle. There are opportunities for local businesses to provide these goods and services (e.g. catering for the workers camp, office-related supply opportunities and services such as cleaning, etc.). As a result, existing local businesses may expand or new businesses may be established locally to meet these demands – providing further employment opportunities. This is referred to as indirect employment.

Although employment numbers are not available for the construction phase, it is reasonable to assume that the number of people employed by the Project will decrease at the end of the construction phase (the total phased construction process lasting approximately 15 years).

POTENTIAL IMPACT

The development will generate skilled and unskilled positions, with the number of unskilled positions dropping substantially after the construction period. Given that most working age local people are engaged in the agricultural farming activities, it is possible that the existing skills set among local people of working age would not always be a perfect match for the direct employment opportunities that will be created by the project.

Therefore, if the IPDC should consider organising training to create new skill set among local residents and also capitalising on some skills that are transferrable from the agricultural farming activities to the project in order to maximise local employment.

In terms of indirect employment, the realisation of opportunities will depend not only on the project, but also on the initiative and business abilities of local entrepreneurs. Given the potential on a much higher demand for new businesses in the region and the limited number of existing businesses, it is anticipated that the number of opportunities to create business development opportunities and/or indirect employment will be significant.

SIGNIFICANCE

The impacts on employment and economy that are likely to be triggered during the construction stages of the project would be **positive**, **direct**, **regional**, **long-term** and of **medium** severity. The probability of the impacts is considered to be **high** because the project is a significant and strategic development in the area. The significance of these positive impacts on employment and economy is therefore considered to be **major** and as a **major positive** impact does not need mitigation.

The operational impacts on economy and employment are also considered to be **positive**, **direct**, **regional**, **long-term** and of **low** to **medium** severity (as the number of new jobs generated by the project would tail off at the operation phase). The probability of the impacts occurring is considered to be **high**. The significance of the impacts is considered to be **moderate** and as moderate positive impact does not need mitigation.

For transparency purposes, the social impacts are presented in Appendix A of the Socio-economic report (refer to **Appendix C-12**) in a series of self-explanatory tables which if needed, could be used by the developer in their management reporting.

9.12.2 LAND ACQUISITION AND IMPACT ON LIVELIHOODS

The ESIA team conducted site observations and consultations with the affected people during the construction stage of the Amhara IAIP Project, through both economic and physical displacement. It is worth noting that although all land in Ethiopia belongs to the state, a number of individual farmers either officially (through a land rental agreement) or unofficially (often, a verbal or no agreement), still cultivate land and grow crops on the plots in the project area. The local authorities in Amhara started the resettlement process a year ago.

The proposed Amhara Project, including the Bure IAIP and Motta RTC, will result in 369 individual parties being affected by the proposed development, including:

- 31 individuals whose residential properties will need to be moved (physical displacement),
- 2 Government entities' offices will also need to be moved (physical displacement),
- 263 individuals whose by-product and main season crops are going to be lost due to land take by the project (economic displacement),
- 35 individuals whose eucalyptus trees will be affected (economic displacement),
- 26 individuals whose high intensity/irrigated crops are going to be affected (economic displacement), and
- 3 individuals whose perennial crops will be affected (economic displacement).
- Additionally, 9 individuals were by mistake omitted by the local government officials from the PAPs list and had been added to the list with full compensation for their affected crops (economic displacement).

Further impact and mitigation for the resettlement process has been provided in a separate Resettlement Action Plan (RAP).

POTENTIAL IMPACT

The land acquisition process that involves physical displacement will have a long term irreversible negative impact on the agricultural activities of local farmers. Although such farmers could be compensated for the lost crops (and residential buildings), they often lose at least one or two harvests while looking for an alternative plot which is not guaranteed to be of the same quality and size. This situation could have a long term impact on the entire household's livelihood and food security.

SIGNIFICANCE

The impacts on livelihood that are likely to be triggered during the construction and operation stages of the project would be **negative**, **direct**, **local**, **long-term** (15 years of concurrent construction and operation in total) and of **medium** severity (mainly due to the fact that some of the affected people received alternative plots and others are currently in the process of finding one). The probability of the impacts is considered to be **high** (the government already started the resettlement process a year ago). The significance of this negative impact on project affected people's (PAPs) livelihood is therefore considered to be **major** negative and will require mitigation.

Although the PAPs will receive compensation, further best international practice mitigation measures will be suggested in a separate Amhara RAP.

9.12.3 COMMUNITY HEALTH

Although it is currently unknown the total number of workers that will be employed during construction, there will be potential for the workforce to introduce and/or increase the rate of spread of communicable diseases in the project area. This includes the introduction of a new disease and/or a more virulent strain of an existing disease.

However, the workforce is not the only factor that may contribute to the transmission of communicable diseases. The project is also likely to result in in-migration (from other parts of Ethiopia). Similar to the workforce, there is potential for in-migration to introduce and increase the rate of spread of communicable diseases in the Project area (including sexually transmitted diseases/STDs).

There are a number of diseases that are already prevalent in the project area, which is contributing to the current rates of morbidity and mortality. This includes malaria, typhoid (communicable disease) and influenza (communicable disease) which during the household survey in the project area have been identified as a key contributor in the local communities' rates of morbidity.

Similarly to the community health impacts during the construction stage, there is potential for the workforce to introduce and/or increase the rate of spread of communicable diseases in the project area during operation. This includes the introduction of a new disease and/or a more virulent strain of an existing disease.

The transmission of communicable diseases in the project area during construction and operation can be exacerbated by a number of factors. Health care facilities are limited in the project area. Therefore, the capacity (e.g. availability of diagnostic equipment, availability of medicine) to respond to an increase in the transmission of communicable diseases could be limited.

POTENTIAL IMPACT

An increase in the transmission of communicable diseases may occur as the result of the introduction of workers into the area. In terms of communicable diseases and in addition to the existing prevalence of the malaria rates in the project area, of particular note and concern could be: tuberculosis and HIV/AIDS (mainly through drug abuse/blood transfusions/sexual relationship, etc.).

If left untreated communicable diseases can lead to long-term health issues and therefore the impact can be characterised as being long-term and in some instances permanent.

There is a new hospital located in Bure and a clinic centre adjacent to the proposed IAIP facility, however these existing local health care facilities do not have sufficient capacity to respond to an increase in the transmission of communicable diseases, potentially leaving the local residents vulnerable.

SIGNIFICANCE

The impact on community health that is likely to be triggered during the construction stage of the project would be **negative**, **direct**, **local**, **long-term** and of **low** severity (primarily due to low population density). The probability of the impacts is considered to be **medium**. The significance of this negative impact on community health is therefore considered to be **moderate** and requires mitigation.

The operational impact on community health is also considered to be **negative**, **direct**, **local**, **long-term** and of **low** severity (as the number of workers and associated in-migration would drop during the operation phase). The probability of the impacts occurring is considered to be **medium**. The significance of the impacts is considered to be **moderate** and requires mitigation.

9.12.4 COMMUNITY SAFETY AND SECURITY

There are a number of safety related issues that are likely to arise during the construction stage of the project. These include:

- Traffic accidents - given the relatively low level of current road use and the fact that the project will have separate and secure/fenced off access roads, this is unlikely to occur. Instead, the key issue is likely to be the potential for an increase in accidents or incidents (particularly during construction), which can lead to injuries and/ or fatalities;
- The presence of new infrastructure. There are often safety issues with the establishment of new infrastructure – for example, community members interacting with unsecured equipment. This can lead to onsite accidents and injuries; and
- The management of hazardous materials and waste. There are a number of Project activities that will generate hazardous waste or perishable waste that if not being properly managed, could contribute to spread of infectious and other diseases.

The Project will increase the number of vehicles on roads through the transport of workers, goods, materials and machinery to and from the project site during construction. With an increase in vehicles, particularly heavy haulage vehicles, comes the increased potential for accidents and injuries to occur.

In addition, the Project will require security. Security personnel will be employed during construction and operation.

POTENTIAL IMPACTS

Impacts on community safety (e.g. possibility of accidents) and security (e.g. incidence of crime) can result from an increase in traffic and in-migration in the project area, the establishment of onsite infrastructure and the management of hazardous materials.

SIGNIFICANCE

The impact on community safety and security that is likely to be triggered during the construction stage of the project would be **negative**, **direct**, **local**, **long-term** and of **low** severity (primarily due to low population density). The probability of the impacts is considered to be **low mainly** due to robust management plans that will be implemented by the IPDC.

The operational impact on community health is also considered to be **negative**, **direct**, **local**, **long-term** and of **low** severity (as the number of workers and associated in-migration would drop during the operation phase). The probability of the impacts occurring is considered to be **low**.

Due to the existing management measures, the local extent and significance of the potential impact, the overall impact is assessed as **minor negative** during construction and operation and requires mitigation.

9.12.5 ENVIRONMENTAL EMISSIONS

The construction activities will generate:

- Noise, which can result from a variety of onsite civil works activities (e.g. construction of infrastructure, reversing sensors on large vehicles);
- Vibration, which may result from construction activities; and
- Dust, which can be generated through site grading, driving on dry, dusty and dirty roads. This can impact the surrounding air quality, disrupting the amenity value of an area and potentially impacting community health (e.g. further aggravating respiratory illnesses).
- The noise levels at receptors close to the site (within 500 m of the site boundary) will exceed the IFC residential day-time noise guideline. Any receptors beyond 500m are expected to be below the guideline. The construction activities will not occur at night.

During the operation activities the levels of noise and vibration are expected to reduce. Operational noise levels are expected to meet the residential guideline at all receptors beyond 200 m from the site.

POTENTIAL IMPACTS

In terms of noise, a detailed noise impacts assessment has been completed and should be referred to. Increase in dust levels could generate impacts on local residents and the appropriate management measures will be put in place by subcontractors.

SIGNIFICANCE

The off-site construction noise impacts identified would be **negative**, **direct**, **local**, **short-term** and of **low** to **medium** severity. Given the variable nature of the construction activities and worst-case assumptions adopted, the probability of the impacts occurring is **medium** (i.e. there is a fair chance the impacts would be lower than predicted). The significance of the impacts is therefore considered to be **moderate**.

The off-site operational noise impacts identified would be **negative**, **direct**, **local**, and **long-term** in consideration of the baseline noise environment, the predicted levels are expected to be above the applicable guideline criteria, and the impact severity is therefore considered **medium**. Given the dependence on weather conditions and the worst-case assumptions adopted, the probability of the impacts occurring is **medium** (i.e. there is a fair chance the impacts would typically be lower than predicted). The significance of the impacts is therefore considered to be **moderate**.

9.12.6 COMMUNITY INFRASTRUCTURE AND SERVICES

The construction period will be phased with operation commencing while construction continues, this is expected to last 15 years until construction phases are completed entirely. The majority of construction workers will be from outside the area (as well as the influx associated with in-migration).

An increase in population in the wider Amhara Region (due to employment opportunities and in-migration during construction) is likely to place additional pressure on existing infrastructure and

services (e.g. healthcare). This often results in a reduction in capacity of existing infrastructure and services to meet the needs of the local residents (as well as the additional population added by the Project); leading to diminished quality of services as well as reduced access to the existing infrastructure.

However, during construction the workforce will be accommodated at camps and it is assumed that sub-contractors will provide a range of on-site amenities inside the camps. This will, to some extent minimise the need for the workforce to use (or rely on) local infrastructure, i.e. minimising the pressure that may be experienced by community infrastructure and services. It is anticipated that at the conclusion of the construction phase, the workers brought in from outside the area will leave.

In terms of the operation phase, it is anticipated that new direct and indirect jobs will be generated by the operational activities. Given the duration of the project, it is anticipated that the operational workforce will relocate to the region, potentially bringing their families with them which could place some additional pressure on the local infrastructure. However given the nature of the project, it has the potential to attract new and private investments in improved infrastructure, and assuming that some workers will be sourced from the local area, it is anticipated that this additional pressure can be accommodated.

POTENTIAL IMPACTS

During both the construction and operation phase, the project may place additional pressure on existing healthcare facilities, for instance, should a worker become sick or an incident on site resulting in an injury occur. However, there is limited capacity for the existing healthcare facilities to respond to this demand (due to the limited number of health care workers, number of existing hospitals and diagnostic equipment). For this reason, if healthcare is required, workers will likely need to use a medical point located within their workers' camp or other medical facilities located in Amhara Region. A Community Health Management Plan will help reduce any pressure that may be placed on local health care facilities.

In terms of the construction phase, the road infrastructure may be affected by increased traffic, however, this impact is expected to be local in terms of the extent and occur over a short period of time.

The above impacts may be greater depending on the degree of in-migration that occurs. This will need to be monitored closely – and the impact revisited if this become an issue.

SIGNIFICANCE

The potential strain on existing infrastructure (roads & infrastructure wear and tear, and reduced ability of local clinic to cope with the increased number of patients) would be **negative**, **direct**, **local**, **temporary** and of **low** to **medium** severity. Given the variable nature of the potential transportation activities (both timing-wise and with regards to precise identification of the roads that will be used most) and difficulty to predict the extent and the number of medical cases that would require medical facilities, worst-case assumptions were adopted. As such, the probability of the impacts occurring is **medium**. The significance of the impacts is therefore considered to be **moderate**.

The potential strain on existing infrastructure (congested and/or closed roads, infrastructure wear and tear, and reduced ability of local clinic to cope with the increased number of patients) would recede when the project moves into the operational stage. As such, the impact severity is therefore considered **very low** and the probability of the impacts occurring is **medium**. The significance of the impacts is therefore considered to be **minor**.

9.12.7 OBSTRUCTION OF EXISTING ACCESS ROUTES

Development of the IAIP and RTC sites includes the establishment of a boundary wall to secure the facilities. Due to the size of the proposed facilities the boundary walls will extend over a long distance.

In both Bure and Motta it has been identified that the IAIP and RTC developments, and associated boundary walls of the sites, cross main access routes used by local communities. The IAIP site cuts-off access of communities residing to the south of the Park from gaining access to Bure town. While the RTC site cuts off an existing road utilised by local communities located to the east of the site to access Motta.

POTENTIAL IMPACTS

Obstruction of the access routes will result in affected communities either not being able to access to services in the town or alternatively have to travel further distances through agricultural fields and undeveloped areas. This will potentially result in long delays and disruptions to the daily lives of the affected communities. Furthermore, the movement of peoples and animals through agricultural fields will result in damage to farmer's crops.

If the construction of the developments is not properly managed it could result in impacts on the natural environment due to poor construction practices.

SIGNIFICANCE

During the construction phase the potential disruption to the local communities would be **negative**, **direct**, **local**, **short to long-term** and of **medium to high** severity. The extent of disruption at the IAIP and RTC site varies with access along the existing road at the IAIP being maintained during construction of the boundary wall while at the RTC site the construction activities have resulted in the obstruction of the access road. Given the variable nature of the disruption activities at the two sites and resulting distances to be travelled by affected parties, worst-case assumptions were adopted. The probability of the impacts occurring is considered **high**. The significance of the impacts is therefore considered to be **Major**.

During the operation phase the potential disruption to the local communities would be **negative**, **direct**, **local**, **long-term** and of **high** severity. The probability of the impacts occurring is considered **high**. The significance of the impacts is therefore considered to be **major**.

9.12.8 SUMMARY OF SOCIO-ECONOMIC IMPACTS

Development of the proposed project has the potential to result in significant socio-economic impacts. **Table 9-13** provides a breakdown of the identified potential construction phase, operational phase and decommissioning phase socio-economic related impacts and ratings.

To view the full report with regards to potential impacts on socio-economics within the Amhara Region, refer to **Appendix C-12**.

Table 9-13: Potential Impacts on the Socio-Economic Sector in the Amhara Region

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
CONSTRUCTION					
1	**Employment and Economy** An increase in employment opportunities and demand for goods and services are positive. The impact is long-term because it occurs during the construction phase which will last for an estimated 15 year period. The Project will provide employment opportunities for the wider Amhara region; therefore, the impact is regional.	Positive	Not Applicable	Major	Major
2	**Land Acquisition**	Negative	Moderate	Major	Moderate

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	Loss of access to agricultural land plots and in some cases, loss of residential buildings and other assets (crops). The impact is long-term because the effect will be long-lasting. The Project will impact local farmers, where some of them received compensation and moved on to other areas, but others have stayed because they did not want to lose their harvest - as they had no information when the site clearing activities will start.				
3	**Community Health** Potential for the workforce to introduce and/or increase the rate of spread of communicable diseases in the project area. The project is also likely to result in in-migration (from other parts of Ethiopia). Similar to the workforce, there is potential for in-migration to introduce and increase the rate of spread of communicable diseases in the Project area (including sexually transmitted diseases/STDs).	Negative	Moderate	Moderate	Moderate
4	**Community Safety and Security** Potential safety and security risks in the local area. The impact is long-term due to 15 year construction period. The impact is limited to local settlements. The impact likely occurs during the construction phase with the rare frequency. The impact is limited to local settlements. Short-term impacts at relatively regular intervals during the construction phase.	Negative	Moderate	Minor	Minor

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
5	**Environmental Emissions** Noise, which can result from a variety of onsite civil works activities (e.g. construction of infrastructure, reversing sensors on large vehicles); Vibration, which may result from construction activities; and dust, which can be generated through site grading, driving on dry, dusty and dirty roads. This can impact the surrounding air quality, disrupting the amenity value of an area and potentially impacting community health (e.g. further aggravating respiratory illnesses).	Negative	Moderate	Moderate	Minor
6	**Community Infrastructure and Services** Potential strain, congestion, and wear and tear for roads and strain on medical facilities in the local area. The impact is limited to local settlements. Temporary impacts are expected at irregular intervals during the construction phase. This would happen due to workers influx.	Negative	High	Major	Moderate
7	**Obstruction of existing access routes.** Development of the site and associated infrastructure may result in the obstruction of existing access routes utilised by the local communities to access services such as schools, medical facilities and markets.	Negative	High	Major	Minor
OPERATIONAL					
1	**Employment and Economy**	Positive	Not Applicable	Moderate	Moderate

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	An increase in employment opportunities and demand for goods and services are positive. The impact is long-term because it occurs during the operation phase. The Project will provide employment opportunities for the wider Amhara region; therefore, the impact is regional.				
2	**Livelihood/Sources of Income** Loss of access to agricultural land plots and in some cases, loss of residential buildings and other assets (crops). The impact is long-term because the effect will be long-lasting. The Project will impact local farmers, where some of them received compensation and moved on to other areas, but others have stayed because they did not want to lose their harvest - as they had no information when the site clearing activities will start.	Negative	High	Major	Minor
3	**Community Health** There is potential for the workforce to introduce and/or increase the rate of spread of communicable diseases in the project area during operation. This includes the introduction of a new disease and/or a more virulent strain of an existing disease. The impact is long-term because if diseases are untreated the impact could be long-lasting.	Negative	Low	Moderate	Minor
4	**Pressure on existing services** The transmission of communicable diseases in the project area during operation can be exacerbated by a number	Negative	High	Moderate	Minor

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	of factors. Health care facilities are limited in the project area. Therefore, the capacity (e.g. availability of diagnostic equipment, availability of medicine) to respond to an increase in the transmission of communicable diseases could be limited.				
5	**Community Safety and Security** Potential safety and security risks in the local area. The impact is long-term due to 15 year construction period. The impact is limited to local settlements. The impact likely occurs during the operational phase with the rare frequency.	Negative	Moderate	Minor	Minor
6	**Environmental Emissions** The impact is limited to local settlements. Short-term impacts with the rare frequency during the operation phase. During the operation activities the levels of noise and vibration are expected to reduce. Operational noise levels are expected to meet the residential guideline at all receptors beyond 200 m from the site.	Negative	Moderate	Moderate	Minor
7	**Community Infrastructure and Services** Potential strain, congestion, and wear and tear for roads and strain on medical facilities in the local area. The impact is limited to local settlements. Temporary impacts are expected at irregular intervals during the construction phase.	Negative	High	Minor	Minor

Impact number	Receptor	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
8	**Obstruction of existing access routes.** Development of the site and associated infrastructure may result in the obstruction of existing access routes utilised by the local communities to access services such as schools, medical facilities and markets.	Negative	High	Major	Minor
DECOMMISSIONING					
1	Employment The impact is long-term because after decommissioning the permanent operation employment opportunities will be lost .It is expected that some training/ retrenchment will be provided prior during the decommissioning stage and thus people will be able to find other jobs The Project will provide employment opportunities for the wider Amhara region; therefore, the impact is regional.	Negative	Moderate	Major	Moderate

From the table it is clear that land acquisition caused by the project will have a major negative impact on the affected farmers, both during construction and operation phases. As a result of the land acquisition process commencing prior to an international consultant's involvement there is the potential that not all historical land acquisition activities carried by the local authorities, comply with the AfDB OS2 principals, although they are compliant with the national land acquisition regulations. This and other issues will be covered in detail in a separate Amhara RAP.

Based on the information collected during the field visit, consultation sessions and site observations the existing infrastructure and particular medical facilities are deemed inadequate even for the existing population of the area. As a result it is highly likely that the existing facilities and infrastructure in the project area will not be able to cope with the increased demand for services during the construction stage in particular.

10 CUMULATIVE IMPACTS

The ESIA should investigate potential cumulative impacts that could occur as a result of the proposed development. This chapter includes physical, biological and social cumulative impacts associated with the proposed project.

The information which is presented below is a consolidation of the identified impacts associated with the proposed Amhara IAIP and RTC. These impacts have been sourced from various specialist reports, refer to **Appendix C** for the full specialist reports. This chapter considers the cumulative effects that could arise from a combination of the Amhara IAIP and RTC project effects. In addition, consideration has been given to the project impacts in combination with those of other existing or planned developments in the surrounding area. The cumulative impact assessment includes consideration of other developments which might take place as a consequence of the project, e.g. to provide access, power or water supplies, sewage treatment or waste disposal, or to house or provide jobs for people attracted to the area by the project.

10.1 SOILS

The purpose of this section is to identify the likely project cumulative effects. The description is based on primary data obtained from site investigations. **Table 10-1** summarises the impacts identified at both the Amhara IAIP and RTC sites as being significant in terms of soil, land use and land capability. To view the full report with regards to potential impacts on soils within the Amhara Region, refer to **Appendix C.**

Table 10-1: Potential Cumulative Impacts on Soils in the Amhara Region

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Erosion Eroded areas will continue to spread, unless stopped, resulting in a cumulative negative effect on the site's identified soils resulting in large scale losses of valuable topsoil and erosion gullies forming.	Negative	Low	Major	Major
2	Sedimentation Eroded soil particles may end up in a nearby watercourse, which runs through the IAIP site, as sedimentation	Negative	Low	Major	Major
3	Loss of topsoil Topsoil will be lost, however lost topsoil can be transferred to an alternative area to continue cultivation; there is limited topsoil at the IAIP site	Negative	High	Moderate	Moderate

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
4	Compaction Soil compaction results in the change of the original structure	Negative	Low	Moderate	Minor
5	Change in surface profile The surface profile of the sites will be changes to create platform for the agri-industrial zone buildings	Negative	Nil	Minor	Minor
6	Change in land use The land will undergo permanent changes as the land use will change from farming to an agri-industrial zone	Negative	Nil	Moderate	Moderate
7	Change in land capability The proposed development will permanently alter the lands capability	Negative	Nil	Moderate	Moderate
8	Dust creation If bare surfaces and soil stockpiles are not watered and vegetated, there will be high amounts of dust creation	Negative	Moderate	Moderate	Minor
9	Contamination Contamination occurs due to the large vehicles on site; this should be prevented otherwise well-drained after contact with the pollutants to decrease chances of contaminating water resources	Negative	Low	Major	Minor

The most significant cumulative impacts relate to soil erosion and sedimentation, eroded areas will spread until measures are put in place to stop the erosion. As erosion is a risk at these sites and they are close to watercourses (and watercourses run through the IAIP site), so is sedimentation. As erosion will have a cumulative effect, so will sedimentation.

10.2 SURFACE WATER

This section of the report is to identify the potential risks associated with the surface water at the proposed project site. There is no permanent flowing surface water resource on the site. The Yasmila River, runs to the west of the IAIP site, flowing from Bure Town. This has a wide, large channel which is heavily affected by erosion. There are an additional two drainage lines which cross the site, both are seasonal water courses flowing in the heavy rainy season only. For the remainder of the year these drainage lines remain wetland areas in their northern reaches due to springs which daylight just north of the IAIP northern compound wall.

The table below identifies the potential impacts on surface water and the significance of the impact. To view the full report with regards to potential impacts on surface water within the Amhara Region, refer to **Appendix C-2.**

Table 10-2: Potential Cumulative Impacts on Surface Water in the Amhara Region

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Altering the hydrological regime of the Yasmila River and drainage lines.	Negative	Moderate	Major	Minor

The primary cumulative impact of concern relates to the potential for negative impacts to occur on the Yasmila River and drainage lines. The primary mitigation measures to implement in order to minimise this impact include keeping hard standing areas to a minimum. The implementation of the requirement set within Article 5(15) of the Industrial Parks Council of Ministers Regulation No 417/2017 will ensure that 25% of each of the development plots within the IAIP remain undeveloped. For the remaining 75% of the site that is developed the Enterprises should be required to make use of permeable paving. All pavements and car parks in communal areas will be built with the use of permeable paving. Finally, where surface water exists the site, energy dissipators should be incorporated in order to ensure erosion does not occur.

10.3 GROUNDWATER

Based on primary data obtained, groundwater use in the vicinity of the Bure IAIP site is extensive. The majority of the town's water supply is sourced from boreholes in and around the town. Two of the Town's water supply boreholes are located within relatively close proximity to the IAIP Project Site (approximately 1.2km and 1.3km respectively). Private groundwater use around the IAIP site is prolific, with five shallow hand dug wells and two springs being identified in the area. Water levels in these wells were relatively shallow, with water levels ranging from 0mbgl to 8.27mbgl.

Groundwater use in Mota Town is also extensive, with the majority of the town's water supply coming from boreholes in and around the town. One deep groundwater borehole was identified approximately 850m north east of the RTC Site. The groundwater level in this borehole was 13.30 mbgl. Private groundwater use around the IAIP site is prolific, with four shallow hand dug wells being identified in the area.

It is possible that activities at the IAIP site will lower the groundwater levels through abstraction of groundwater for use at the IAIP and RTC. The potential cumulative impacts on the groundwater is presented in the **Table 10-1** below. To view the full report with regards to potential impacts on ground water within the Amhara Region, refer to **Appendix C-3.**

Table 10-3: Potential Cumulative Impacts on Ground Water in the Amhara Region

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Contamination of groundwater resources from contaminated surface water runoff or subsurface leakages from underground chemical storage and/or effluent systems	Negative	Low	Moderate	Minor

In order to minimise this impact, the IPDC is required to contain and treat surface water runoff in order to prevent it entering the groundwater environment. The IPDC must continually monitor groundwater quality in the vicinity of the site in order to quickly identify if contamination has occured. Based on the findings of the impact assessment, it is concluded that the development and operation of the Amhara IAIP and RTC will have a minor impact on the receiving groundwater environment.

10.4 WETLANDS

The purpose of this section is to identify the likely project cumulative effects. The site spans across three (3) micro-catchments, with two drainage lines falling within the site boundary. These drainage lines contain both permanent and seasonal wetland habitats. There are riverine wetland systems located within the valley-bottom areas of the catchments. Additionally there are seasonal hygrophilous grasslands located on the slope of the catchments leading towards these valley-bottom systems. The RTC site showed no signs of wetland habitat within its boundary.

The Amhara IAIP site has a perennial river running along the western boundary of the site, with the RTC site having an eroded drainage line running along the southern boundary of the site.

According to Dixon and Wood (2003) wetlands in Ethiopia are often perceived as impediments to development and progress or as productive lands suitable for agriculture. The Ethiopian government encouraged farmers to cultivate wetlands to compensate for more drought-induced food shortages. The Rural Agricultural Development Department also developed its own programmes for draining some larger wetlands for agriculture (Wood, 2000). In southwest Ethiopia, for example, the area of wetlands converted to agricultural land increased from 28% in 2003 to 66% in 2006 (Legesse, 2007). Similarly, a number of microfinance initiative groups were established in several towns to cultivate peri-urban wetlands and produce bricks from wetland material. Consequently, several wetlands in Ethiopia, either disappeared or are on the verge of drying out (Shewaye, 2008), while others rapidly decline in water quality (Mereta et al., 2012).

In addition, the wetlands have been considered as wastelands and seen as nuisance to human development (Dixon and Wood 2003; Bezabih and Mosissa 2017). This view has led to considerable conversion of wetlands, which has usually been seen as a progressive public-spirited endeavor believed to enhance the health and welfare of society, alleviate flooding, improve sanitation and land reclamation. Moreover, the underlying causes of wetland loss are that they are assumed to be less important than other priorities or tend to be regarded as free goods (Bezabih and Mosissa 2017).

This continued conversion or degradation of individual wetland systems has resulted in a cumulative loss of wetland habitat at the landscape level within Ethiopia. The majority of the cumulative hydrological impacts manifest downstream due to altered stream flow processes, e.g. the loss of a wetland upstream which provided a function of streamflow regulation will result in water input into a downstream system containing higher volumes and velocity and therefore a higher erosive force. This will result in the erosion and potential loss of the downstream wetland, which then potentially will result in the wetland system further downstream being impacted and so forth (Johnston, 1994).

Table 10-4 summarises the impacts identified at both the Amhara IAIP and RTC sites as being significant in terms of wetlands. To view the full report with regards to potential impacts on wetlands within the Amhara Region, refer to **Appendix C-4.**

Table 10-4: Potential Cumulative Impacts on Wetlands in the Amhara Region

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Wetlands within greater landscape Direct loss/ degradation of natural wetland habitat & biota	Negative	Low	Moderate	Moderate
2	Wetlands within greater landscape Hydrological functioning/regime modifications	Negative	Moderate	Moderate	Minor
3	Wetlands within greater landscape Erosion and Sedimentation and Water Quality	Negative	Moderate	Moderate	Minor
4	Wetlands within greater landscape Loss of cumulative wetland function	Negative	Moderate/Low	Moderate	Moderate

The current proposed layout would result in the loss of seasonal/temporary wetland habitat, therefore required mitigation measures must be centred around ecological restoration or investing in improving the ecological functioning of habitats remaining onsite. It is vital that the development does not result in loss of wetland habitat outside of the proposed site boundary.

The regional hydrological functionality and connectivity must be encouraged through the use of controlled stormwater release into the remaining systems onsite, permeable paving and green areas within the development. The runoff regimes post-construction activities must match pre-construction regimes (i.e. without resulting in increased peak discharge to water resources, soil saturation in non-wetland areas and erosion/ sedimentation).

All stormwater outlets must be designed to dissipate the energy of outgoing flows to levels that present a low erosion risk.

It is important that the correct species be utilised when rehabilitating the W1&3 systems and the associated buffer and that an operational maintenance plan is developed to ensure these waterbodies are maintained in a state that will continue to provide habitat for aquatic-dependent species. The plan must include the control and maintenance of sediment and nutrient input into these systems to prevent sedimentation and potential eutrophication. The maintenance of the systems within the development will ensure that there are no negative impacts of the regional systems.

The rehabilitated remaining W1 & W3 systems and the buffer areas will potentially improve its current state and ecological functionality and therefore improving the quantity and quality of goods and services provided by the systems, regionally.

10.5 AIR QUALITY

The cumulative impacts of air quality include the residents living near the IAIP and RTC sites being affected by a change in atmospheric chemistry. The table below highlights the cumulative impacts of

air quality. To view the full report with regards to potential impacts on air quality within the Amhara Region, refer to **Appendix C-5**.

Table 10-5: The Potential Cumulative Impacts on Air Quality in the Amhara Region

Impact number	Description	Character	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Residential Receptors within immediate vicinity of site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Moderate	Minor
2	Residential Receptors beyond site boundary Increased particulate and gaseous concentrations	Negative	Moderate	Minor	Negligible

The cumulative interactions of the air quality impacts are deemed to be of moderate significance for receptors located within the immediate vicinity of the site boundary, however with mitigation this can be reduced to a minor significance. With mitigation the receptors beyond the site boundary will experience a negligible cumulative impact. Proposed mitigation measures include:

- Construction Phase: Wet suppression and wind speed reduction by use of wind barriers. In operation, ensuring all roads are paved and open land is either vegetated or covered with hardstanding will minimise dust suppression. In areas where open land will remain exposed for a long period of the construction phase applying chemical stabilisation
- Operational Phase:
  - Ensure that vehicles and other equipment are regularly inspected according to schedule maintenance for proper exhaust emission;
  - Train drivers to minimise speed limits on earthen roads especially in dry periods;
  - Avoid burning of biomass as much as possible and use fire only in situations where this is least environmentally damaging;
  - Speed control using speed bumps.
  - Bitumen surface all roads with speed controls;
  - Dense vegetation planted on the roadside; and
  - Work schedule to minimise disturbance.

Refer to Chapter 11 for the full Environmental and Social Management Plan to be applied at the Amhara IAIP and RTC.

10.6 NOISE

The current noise climate at the IAIP site is typical of a predominantly a rural location with limited anthropogenic activities occurring on the northern and western boundaries, therefore noise levels are anticipated to increase substantially within the area with the introduction of the Amhara IAIP, based on the fact that there is a lack of noise prior to the development of the proposed project.

The table below identifies the potential cumulative impacts of noise levels which may be caused by the proposed project, as well as the severity of the impacts. To view the full report with regards to potential impacts on noise levels within the Amhara Region, refer to **Appendix C-7**.

Table 10-6: Potential Cumulative Impacts of Noise in the Amhara Region

CUMULATIVE					
1	Residential receptors within 200m of the site boundary Degradation of noise climate / annoyance	Negative	Moderate	Moderate	Minor
2	Residential receptors beyond 200m of the site boundary Degradation of noise climate / annoyance	Negative	Moderate	Minor	Negligible

The cumulative interactions of the noise impacts are deemed to be of moderate significance for receptors located within the immediate vicinity of the site boundary, however with mitigation this can be reduced to a minor significance. With mitigation the receptors beyond the site boundary will experience a negligible cumulative impact. Proposed mitigation measures include:

- Construction Phase:
  - Plan construction activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding construction activities should be provided to all local communities. Such information includes: Proposed working times; Anticipated duration of activities; Explanations on activities to take place and reasons for activities; and contact details of a responsible person on site should complaints arise;
  - When working near a potential sensitive receptor, limit the number of simultaneous activities as far as possible; and
  - Using noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines.
- Operational Phase:
  - Select equipment with lower sound power levels;
  - Install silencers for fans;
  - Install suitable mufflers on engine exhausts and compressor components;
  - Install acoustic enclosures for equipment casing radiating noise;
  - Improve the acoustic performance of constructed buildings by applying sound insulation;
  - Ensure equipment is well-maintained to avoid additional noise generation; and
  - The use of ear protection equipment for personnel working onsite in close proximity to noise sources.

Refer to Chapter 11 for the full Environmental and Social Management Plan to be applied at the Amhara IAIP and RTC.

10.7 TRANSPORT AND ACCESS

There are no cumulative transport impacts expected on the local road network.

- The Bure Town Structural Plan (only layouts provided) provides an intended land use plan for the current extent of the town and future potential expansion areas. The current industrial development occurring to the north of the site is the only known development in the vicinity of this development, however given the smaller size of this development and its advanced stages it is not anticipated that the cumulative impact of the two development's traffic will result in significant cumulative transport impacts on the local road network.
- The Motta Town Structural Report provides an intended land use plan for the current extent of the town and future potential expansion areas. There are no known large-scale planned

developments in the vicinity of this development, therefore no cumulative transport impacts are expected on the local road network.

To view the full Traffic and transport report with regards to potential impacts within the Amhara Region, refer to **Appendix C-8**.

10.8 WASTE MANAGEMENT

In the Bure and Motta towns, there are no organized and advanced waste management systems such as collection, transport and disposal; therefore identifying the risks associated with waste management is necessary. The table below highlights the cumulative impacts of the proposed project, by taking into account the current waste management programs at the IAIP site and RTC site. To view the full Waste Management Plan with regards to potential cumulative impacts on biodiversity within the Amhara Region, refer to **Appendix C-9**.

Table 10-7: Potential Cumulative Impacts Associated with Waste Management in the Amhara Region

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Residual wastes and industrial hazardous waste and bio-medical wastes are the only wastes that will cumulate outside the IAIP and RTC. The remainder of the waste streams will be prevented, reused or recovered.	Negative	Low	Major	Moderate

No hazardous wastes shall be permitted to be disposed of outside the boundary of the IAIP or RTC unless being transported to a sanitary landfill. The IPDC must place the responsibility of safe disposal of hazardous waste on the generator. It will be the generators responsibility to ensure that the waste collector which will be transporting the waste for disposal has obtained a permit from the Urban Administration to do so in terms of Article 4(1) of the 'Solid Waste Management Proclamation 513/2007. In addition, the Generator will need to provide evidence in writing from the receiving disposal site of its capacity to recycle or dispose of the waste in an environmentally sound manner (Article 6(3)). Proof of safe disposal should be provided to the IPDC, such as a waste disposal ticket issued and date stamped by the sanitary landfill. This waste stream is anticipated to be small, limited to cleaning materials and small quantities of bio-medical waste since most of the processing to be undertaken on site is for the food industry and therefore hazardous process materials should be limited.

10.9 VISUAL

The potential visual impacts were assessed during the scoping phase and identified as requiring a visual impact assessment as visual impacts will occur as a result of the proposed. T

Table 10-8: Potential Cumulative Impacts Associated with Visual Impact Assessment in the Amhara Region

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	The existing construction related to the industrial site adjacent and to the	Negative	Moderate	Minor	Negligible

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
	north of the Amhara site will have a cumulative negative impact on the residential areas directly to the west. The impacts will be related to dust and noise and will be temporary in nature. During the operational stage the IAIP will be in keeping with the industrial warehouses to the north and will be marginally noticeable as urban creep.				
2	During the operational stage the IAIP will be in keeping with the industrial warehouses to the north and will be marginally noticeable as urban creep.	Negative	Moderate	Minor	Not applicable

he cumulative impacts identified related to the dust and noise community nuisance impacts being compounded with additional developments occurring in the area and given the size of the site the construction impacts will be for a long duration. This impact is easily mitigated and with mitigation the significance is negligible. The Amhara IAIP will contribute to the urban creep given its location adjacent to the newly developed industrial area on the fringe of Bure, resulting in loss of agricultural land which is more natural and more visually and aesthetically appealing. This impact is considered of minor significance but in the context of normal organic growth this is an acceptable impact. To view the full report with regards to potential cumulative impacts on the visibility of the site within the Amhara Region, refer to **Appendix C-10**.

10.10 BIODIVERSITY

The existing biodiversity components and associated key features which include typical flora and fauna, protected areas and non-protected sensitive resources that are found inside and within the vicinity of the project sites were identified in order to assess the potential impacts on the biodiversity of the IAIP and RTC site associated with the proposed project. The baseline conditions within the survey area have been determined through desk-based reviews of available information, field surveys and consultations with concerned authorities. To view the full report with regards to potential cumulative impacts on biodiversity within the Amhara Region, refer to **Appendix C-11**.

Table 10-9 below indicates how the biodiversity within the Bure IAIP and Motta RTC may be impacted by the proposed development, respectively.

Table 10-9: Potential Cumulative Impacts on Biodiversity in the Amhara Bure IAIP

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Wetlands and habitats	Negative	Low	Moderate	Moderate

	Direct loss/ degradation of natural wetland habitat & biota				
2	Biodiversity No cumulative impact has been observed	Negative	Moderate	Negligible	Negligible

Table 10-10 below indicates how the biodiversity within the Motta RTC region may be impacted by the proposed development.

Table 10-10: Potential Cumulative Impacts on Biodiversity in the Amhara Motta RTC

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Wetlands and habitats No wetland habitat has been recorded	Negative	Moderate	Negligible	Negligible
2	Biodiversity No cumulative impact has been observed	Negative	Moderate	Negligible	Negligible

10.11 SOCIO-ECONOMIC

Development of the proposed project has the potential to result in significant socio-economic impacts. The table below provides a summary of a demographic, cultural and economic overview of the Project Area and also describes the physical infrastructure and services available in the Social Study Area. The purpose of collecting this information is to provide baseline data for conducting the impact assessment and to monitor and measure changes against the potential future changes to the Social Study Area due to the presence of the Project.

To view the full report with regards to potential impacts on socio-economics within the Amhara Region, refer to **Appendix C-12**.

Table 10-11: Potential Cumulative Impacts on the Socio-Economic Sector in the Amhara Region

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
1	Pressure on existing infrastructure within Bure Town and Motta, in particular medical facilities and police services.	Negative	Moderate	Major	Minor
2	Resettlement and land acquisition displacing farmers, their agricultural activities including crops and other assets	Negative	Moderate	Major	Minor
3	An increase of employment and diversity of employment will benefit the next generation by generating alternative revenue streams	Positive	Not Applicable	Major	

Impact number	Description of Impact	Stage	Ease of Mitigation	Pre-mitigation Rating	Post-mitigation Rating
4	The combined impact on the economy of the regional IAIP site and the RTC sites will help diversify the Gross Domestic Product of Ethiopia from being primarily dependent on agriculture. The potential is great that these projects combined will uplift the economy.	Positive	Not Applicable	Major	

10.12 CUMULATIVE IMPACTS

10.12.1 CUMULATIVE EFFECT OF COMBINED PROJECT IMPACTS

Cumulative impacts are generated as a result of a number of project effects interacting as well as where an effect is not mitigated and continues causing increasing impacts. While some impacts may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources and can result in the degradation of important resources. Not all impacts will result in cumulative impacts, however those that have been identified and are predicted to potentially occur have been listed below in **Table 10-12**.

A cumulative interactions table illustrates how an impact on one variable can affect another and how severe the cumulative impact is. To read the table, follow the y-axis from the top to the bottom of the table, and see how severe the cumulative interactions are.

Table 10-12: Cumulative Interactions between Multiple Potential Impacts for the IAIP and RTC

	Soils	Surface water	Ground water	Air quality	Noise	Waste management	Biodiversity	Socio-economic
Socio-economic	Minor	Moderate	Moderate	Minor	Moderate	Minor	Minor	
Biodiversity	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible		Negligible
Waste management	Major	Major	Major	Moderate	Negligible		Moderate	Moderate
Noise	Negligible	Negligible	Negligible	Negligible		Negligible	Minor	Moderate
Air quality	Negligible	Moderate	Negligible		Negligible	Negligible	Moderate	Major
Ground water	Negligible	Moderate		Negligible	Negligible	Negligible	Major	Moderate

	Soils	Surface water	Ground water	Air quality	Noise	Waste management	Biodiversity	Socio-economic
Surface water	Low		Major	Negligible	Negligible	Negligible	Major	Major
Soils		Major	Moderate	Moderate	Negligible	Negligible	Major	Moderate

10.12.2 CONSIDERATION OF CUMULATIVE IMPACTS WITH OTHER DEVELOPMENTS

It is also important for the ESIA to analyse the proposed projects in light of the surrounding land uses and proposed developments. Both the Bure IAIP and Motta RTC sites selected are located on the fringe of an urban centre. The Bure IAIP site is located on a plot of land situated on the edge of Bure Town. Currently the land use of the site is agricultural where people living in the local vicinity are engaged in the production of the major crops grown in the area. The Motta RTC site is located on land that has been identified for manufacturing and warehouse uses although currently it is under cultivation.

Bure Town is located at a group of hot springs which were considered to hold therapeutic properties. The town has a popular market, known as the Bure market and two churches, three cemeteries, a primary and secondary school and a university. The information provided by the IPDC with respect to Bure Town's Structural Plan, does not indicate any known proposed developments or future expansion areas.

There will be associated infrastructure requirements such as roads, powerlines and sanitation services infrastructure required as a result of the IAIP. All of these infrastructure projects will have a limited footprint for which mitigation of impacts can be simply achieved. Each of these associated infrastructure projects will be subject to an Environmental Impact Assessment which will need to consider the IAIP and the impacts captured herein.

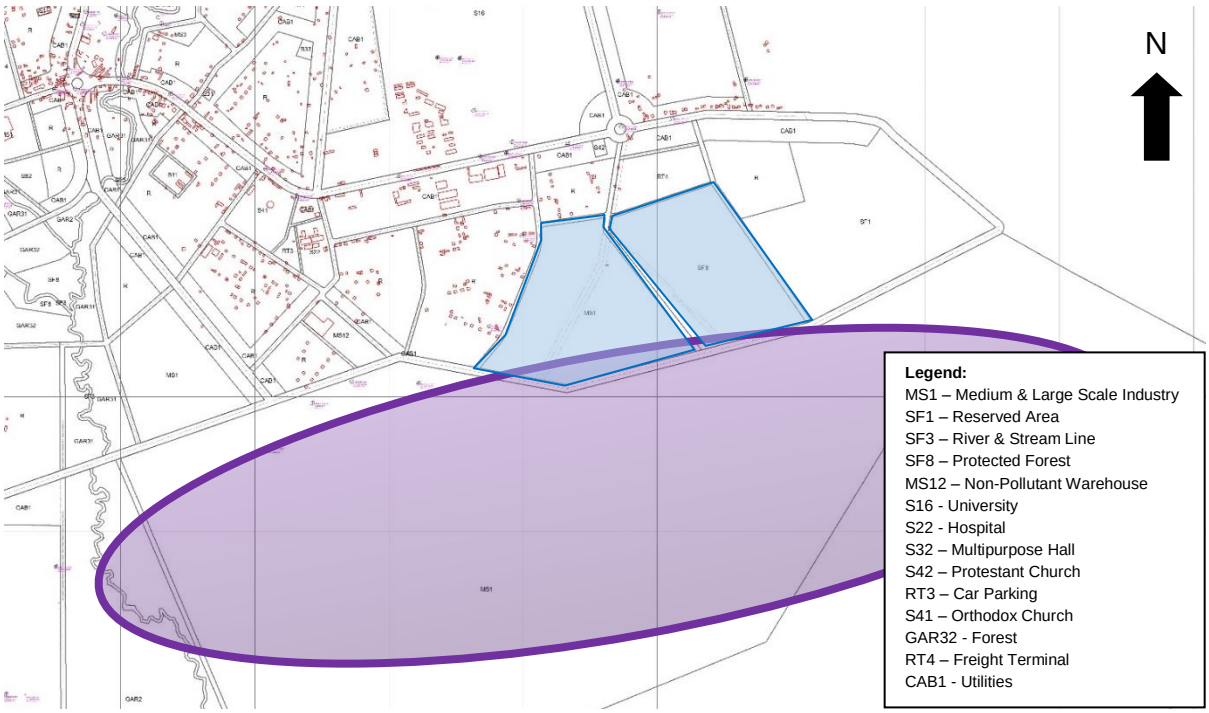

Figure 10-1 : Extract of the Bure Structure Plan

The proposed site is located within a large plot of land (MS1) which has an intended land use of medium and large scale industry, see **Figure 10-1**. The approximate location of the IAIP site is shown in purple. The site is well located for access to existing community services such as the Hospital, University and an Orthodox Church. The proposed site does fall within the area covered by the Structure Plan and will need to be incorporated in the future bland use planning for Bure. The proposed IAIP will generate a new large population that will place significant much pressure on some of the existing insufficient infrastructure and therefore the Park will incorporate community facilities such as a clinic, schools and churches. The existing population will be able to utilise these services as they will be placed outside the industrial parks compound wall. This will have a beneficial cumulative effect on the existing communities living close to the south eastern section of the site as well as to future new developments to the north.

There is currently construction occurring on the site immediately north of the IAIP in close proximity to the western drainage line, shown in blue on Figure 10-1. The continued construction of the industrial land north of the IAIP site will most likely occur simultaneously with the commencement of the IAIP and therefore create the potential for cumulative negative noise and air quality affects of a moderate significance to the local community. There is a residential area directly adjacent and to the north and west of the industrial area and therefore dust and noise control measures will need to be closely monitored and the ESMP implemented fully in order to manage the potential cumulative impacts. The grievance mechanism for the community must be well implemented and tracked to ensure any issues are dealt with in a timely manner.

- The Motta RTC site is proposed within the municipal planning area of Motta. The Motta Structure Plan includes the RTC site with a manufacturing and storage land use. Currently the site and the land to the north, east and much of the south is agricultural land under active operation. The site to the northeast is proposed to be recreation and therefore little to no development is anticipated on those sites. To the southeast is a planned land use mixture of recreation, manufacturing and storage and special function, see **Figure 10-2**. These uses will potentially result in development, however it is not clear when or if these sites will be developed in the next 5 years. As such it has been assumed that these developments will occur incrementally and most likely be triggered by the successes of the RTC. It is therefore not considered likely that the construction periods will overlap. If development does occur on these sites it is anticipated that these will not commence without due process being following and due consideration given to environmental and social issues. **Figure 10-3** provides the proposed distribution of manufacturing and storage land uses across Motta. Provision is made for these land uses on the west and east of Motta providing an even distribution of these services across the town, it is therefore not considered likely that significant cumulative negative impacts would occur as a result of the proposed Motta RTC. Therefore any future developments in the town are anticipated to have a negligible impact on the site.

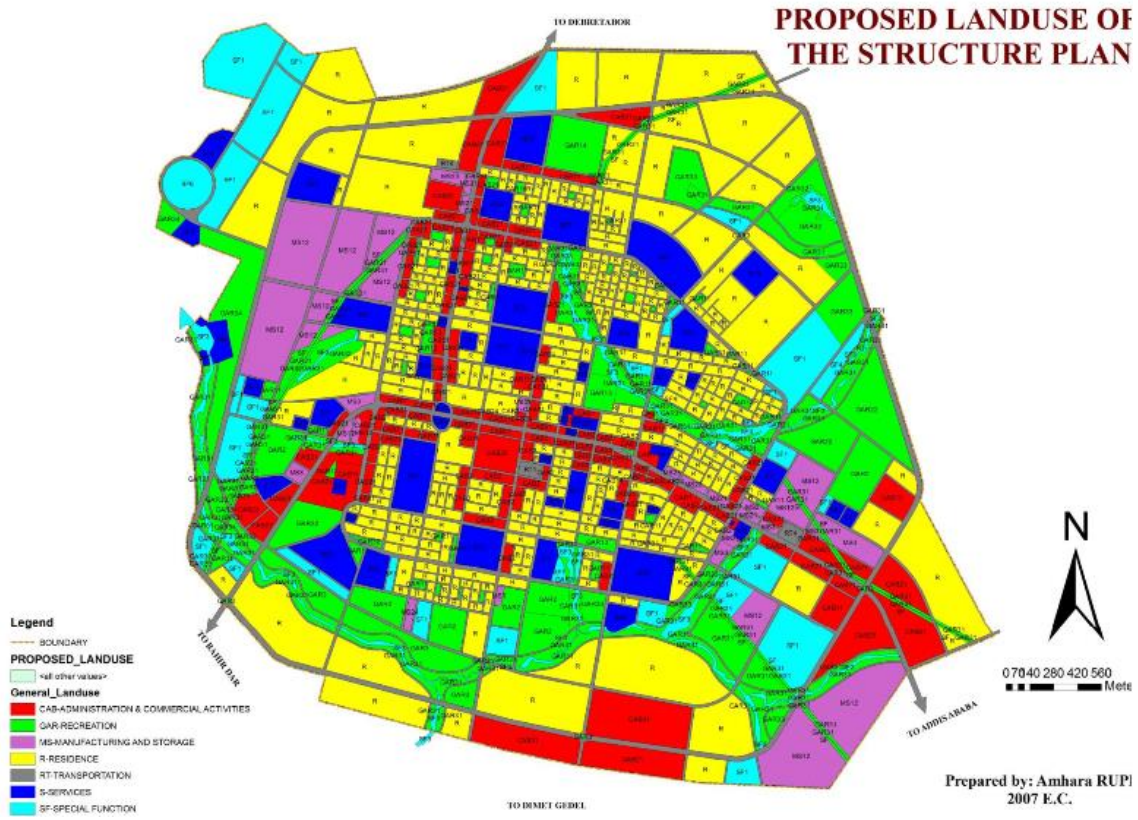

Figure 10-2: Proposed Motta Land Use Plan

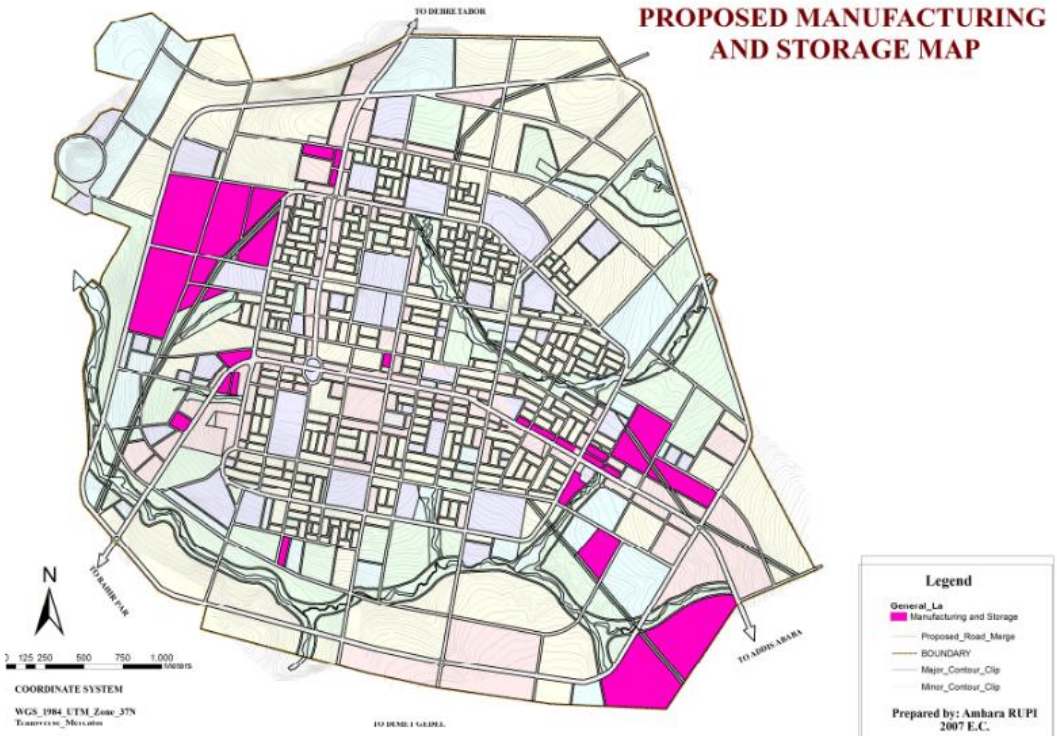

Figure 10-3: Proposed Manufacturing and Storage land use

11 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

11.1 INTRODUCTION AND OBJECTIVES

This chapter presents the Environmental and Social Management Plan (ESMP) which is aimed to prevent, minimise or mitigate any potential adverse environmental and social impacts, and enhance the Project's beneficial impacts throughout the design, construction and operational phases.

The purpose of the ESMP is to ensure that environmental and social impacts and risks identified during the ESIA process are effectively managed during the implementation of the proposed Project. This ESMP has been prepared to identify the environmental and social management and mitigation actions required to address any potential adverse impacts, enhance the Project's beneficial impacts, and monitoring requirements to ensure the implementation of the project is undertaken in accordance with the requirements of the AfDB and applicable national legislation and regulations of the FDRE.

The objectives of this ESMP are therefore to:

- Set out an action plan of environmental and social management measures to be implemented that aim to achieve the avoidance, minimisation or mitigation (including offset or compensation) of adverse environmental and social impacts and enhance positive impacts of the project;
- Define specific actions to be taken, responsibilities for these actions, timeframes for implementation; associated budget;
- Identify monitoring requirements in relation to positive and negative effects, environmental performance, and compliance with statutory environmental and social regulations requirements that are to be undertaken to ensure compliance or continued improvement throughout the specified periods; and
- Outline consultative requirements and training / capacity building requirements deemed necessary for effective implementation of the plan.

The ESMP is to be implemented and monitored by the Amhara IPDC as the project's implementing entity and will form the basis of site-specific management plans that will be prepared by the contractors and sub-contractors as part of their construction methodology prior to works commencing.

The ESMP forms an integral part of an ESIA. It is considered a dynamic instrument as its management actions may be subject to change as a result of feedback received during project implementation and/or in response to unexpected impacts or impacts with a magnitude different to that predicted in the ESIA. Monitoring will provide the information for periodic review and subsequent alteration of the ESMP as necessary. This will ensure that undesirable impacts are detected early and remedied effectively.

Best practice principles require that every reasonable effort is made to reduce and preferably to prevent negative impacts while enhancing the benefits. These principles have guided the ESIA process. In many cases, potential negative impacts have been avoided through careful design. The ESIA involved concurrent and ongoing data collection and public consultation activities to date.

Since an ESMP continues to evolve in scope and depth with subsequent stages of the Project preparation and implementation, the ESMP of this ESIA provides a first outline. Detailed stand-alone sub-plans may be developed to specify ESMP issues in its further progress, such as detailed Monitoring Plans, Emergency Response Plans, and Community Development Plans.

Annual monitoring reports will be compiled and made available to the relevant authorities and relevant financial lenders. The reports shall cover the status of environmental and social, including health and safety, related aspects like permits, status of compliance with obligations arising from such permits / licences, exceedances of regulatory environmental standards with root cause analyses and details of corrective measures implemented.

11.2 SUMMARY OF IMPACTS

Chapter 9 of the ESIA identifies the potential impacts, both positive and negative, associated with the proposed Project. **Table 11-1** summarises the identified potential impacts and the associated post-mitigation significance rating for the various phases of the Project.

Table 11-1: Summary of impacts and post mitigation significance

Environment	No.	Impact	Character	Ease of Mitigation	Post-mitigation Rating		
					Construction	Operation	Decommission
Soils	1	Erosion	Negative	Low	Moderate	Minor	Moderate
	2	Sedimentation	Negative	Low	Moderate	Minor	Moderate
	3	Loss of topsoil	Negative	High	Negligible	Negligible	Negligible
	4	Compaction	Negative	Moderate	Moderate	Major	Negligible
	5	Change in surface profile	Negative	Nil	Major	Negligible	Negligible
	6	Change in land use	Negative	Nil	Major	Negligible	Negligible
	7	Change in land capability	Negative	Nil	Major	Negligible	Negligible
	8	Dust creation	Negative	Moderate	Minor	Minor	Minor
	9	Soil Contamination	Negative	Moderate	Minor	Minor	Minor
Surface Water	1	Hydro-carbon contamination from the earth-moving machinery and vehicles	Negative	Moderate	Minor	Negligible	Minor
	2	Sedimentation of the Yasmila River and drainage lines	Negative	Moderate	Minor	Negligible	Minor
	3	Altering the hydrological regime- Change in Runoff Volume	Negative	Moderate	Negligible	Minor	Negligible
	4	Altering the hydrological regime-Change in runoff velocity	Negative	High	Negligible	Minor	Negligible
Ground Water	1	Lowering of groundwater levels	Negative	Moderate	Negligible	Minor	Negligible
	2	Contamination of groundwater resources	Negative	Moderate	Negligible	Minor	Negligible
	3	Loss of recharge area for the springs through reduction of permeable surface	Negative	None	Negligible	Moderate	Negligible
	4	Contamination of groundwater resources from contaminated surface water runoff or subsurface leakages from underground chemical storage and/or effluent systems	Negative	None	Negligible	Minor	Negligible
Wetlands	1	Direct loss/ degradation of natural wetland habitat & biota	Negative	Low	Moderate	Minor	Negligible
	2	Hydrological functioning/regime modifications	Negative	Low	Major	Minor	Moderate
	3	Erosion and Sedimentation	Negative	Moderate	Moderate	Minor	Moderate
	4	Water Quality	Negative	Moderate	Moderate	Minor	Negligible

Environment	No.	Impact	Character	Ease of Mitigation	Post-mitigation Rating		
					Construction	Operation	Decommission
Air Quality	1	Increased particulate and gaseous concentrations within immediate vicinity of site boundary	Negative	Moderate	Minor	Minor	Minor
	2	Increased particulate and gaseous concentrations on surrounding receptors	Negative	Moderate	Negligible	Negligible	Negligible
Noise	1	Degradation of noise climate / annoyance (up to 500m from the site boundary)	Negative	Moderate	Moderate	Minor	Moderate
	2	Degradation of noise climate / annoyance levels (further than 500m from the site boundary)	Negative	Moderate	Minor	Negligible	Minor
Transport and Access	1	Impact on safety of the community in the area due to increased vehicle volumes	Negative	Low	Minor	Minor	Minor
Waste Management	1	Public Nuisance - Inappropriate disposal of construction waste	Negative	High	Minor	Negligible	Minor
	2	Hazardous waste materials being stockpiled on bare ground	Negative	High	Minor	Minor	Minor
	3	Domestic waste generated by construction staff	Negative	High	Minor	Negligible	Minor
	4	Overfull waste bins littering streets and blockage of drainage channels	Negative	High	Negligible	Minor	Negligible
	5	Hazardous waste materials being stockpiled on bare ground presenting a potential for contamination of soils, surface and ground water.	Negative	High	Negligible	Minor	Negligible
	6	Disposal to unlined landfill impacting surface and groundwater resources.	Negative	High	Negligible	Minor	Negligible
Visual	1	Construction equipment and dust	Negative	Low	Minor	Negligible	Negligible
	2	Site Clearing	Negative	Low	Negligible	Negligible	Negligible
	3	Physical impact on landforms	Negative	Low	Negligible	Negligible	Negligible
	4	Intrusion on the sense of place and scenic landscape	Negative	Low	Negligible	Moderate	Negligible
	5	Light Pollution	Negative	Low	Negligible	Minor	Negligible
	6	Roads and /or road widening	Negative	Low	Negligible	Negligible	Negligible
Biodiversity	1	Loss/degradation of wetland	Negative	Moderate	Minor	Negligible	Negligible

Environment	No.	Impact	Character	Ease of Mitigation	Post-mitigation Rating		
					Construction	Operation	Decommission
(Bure IAIP)	2	Loss/clearance of natural vegetation,	Negative	Moderate	Negligible	Negligible	Negligible
	3	Loss/clearance of natural vegetation/ trees	Negative	Low	Negligible	Major	Major
	4	Impact on the underneath growth and shift on natural water course	Negative	Moderate	Minor	Negligible	Negligible
	5	Water quality deterioration / pollution	Negative	Moderate	Minor	Minor	Negligible
	6	Lowering water table	Negative	High	Minor	Negligible	Negligible
Biodiversity (Motta RTC)	1	Loss/degradation of wetland	Negative	Moderate	Negligible	Negligible	Negligible
	2	Loss/clearance of natural vegetation	Negative	Moderate	Negligible	Negligible	Negligible
	3	Revegetation of indigenous vegetation	Positive	Low	Negligible	Major	Major
Socio-Economic	1	Employment and Economy An increase in employment opportunities and demand for goods and services (although this will reverse to moderate negative during the decommissioning stage)	Positive	Not Applicable	Major	Moderate	Moderate
	2	Land Acquisition / Resettlement Loss of access to agricultural land plots and in some cases, loss of residential buildings and other assets (crops).	Negative	Moderate	Moderate	Minor	Negligible
	3	Community Health Potential for the workforce to introduce and/or increase the rate of spread of communicable diseases in the project area.	Negative	Moderate	Moderate	Minor	Negligible
	4	Community Safety and Security Potential safety and security risks in the local area.	Negative	Moderate	Minor	Minor	Negligible
	5	Environmental Emissions Nuisance from noise; vibrations and dust.	Negative	Moderate	Minor	Minor	Negligible
	6	Community Infrastructure and Services Strain, congestion, and wear and tear for roads and strain on medical facilities in the local area.	Negative	High	Moderate	Minor	Negligible
	7	Obstruction of existing access routes.	Negative	High	Minor	Minor	Negligible

The **non-implementation** of the project will impede development and delay the industrialisation of the agricultural industry in the Amhara Region.

11.3 MITIGATION AND ENHANCEMENT MEASURES

The ESIA stipulates the environmental standards to be adhered to by the parties involved in the various phases of the project life cycle. As such the ESMP comprises of a section for each of the following project life cycle phases:

- Planning and design;
- Construction;
- Operation; and
- Decommissioning.

11.3.1 PLANNING AND DESIGN PHASE

The planning and design phase of the project is not expected to have any direct impacts on the environment. Consequently no management control measures are required and/or proposed.

Various layout options were considered to minimise the environmental impacts and the currently proposed layout plan has been chosen on the basis of these considerations.

11.3.2 CONSTRUCTION PHASE

The proposed mitigation measures for the construction phase are detailed in **Table 11-2.**

11.3.3 OPERATION PHASE

The proposed mitigation measures for the operation phase are detailed in **Table 11-3**.

11.3.4 DECOMISSIONING PHASE

As the project is considered to be a permanent facility, detailed Decommissioning activities have not been included. Consequently no management control measures are required and/or proposed at this stage. These are to be identified prior to decommissioning, should such activities be required in the future.

Table 11-2: Construction Phase Environmental and Social Management Plan

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
Soils	S1	Erosion Eroded areas will continue to spread, unless stopped, resulting in a cumulative effect on the site's identified soils	Soil protection strategies: (i) Placement of soil stockpiles so as to prevent exposure to wind and water erosion. (ii) Access and haul roads should have gradients or surface treatment to limit erosion, and road drainage systems should be provided. (iii) Terracing, slope reduction, runoff velocity limitation and the installation of appropriate drainage; should be incorporated into the site management plan to limit soil erosion. (iv) Reduce negative impacts to the site and surroundings by controlling erosion and sedimentation. (v) Soil erosion control measures shall conform to the best management practices highlighted in the appropriate code. (vi) Regular inspections will be undertaken to assess erosion and sediment migration from topsoil stockpiles. Where unacceptable rates of erosion are identified, remedial works will be undertaken, or the stockpile will be relocated. (vii) The size and area of stockpiles of soil will be minimised. Stockpiles that may be susceptible to erosion must be terraced, covered or have suitable erosion control measures such as silt fences. (viii) Soil stockpiles should be revegetated to protect the soils against erosion	IPDC / Contractor	During site clearing and throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.2	AFDB OS1 IFC (World Bank) EHS Guidelines for Mining, 2007 Development Corporation Regulations (Amhara), 2017
	S2	Sedimentation Eroded soil particles may end up in a nearby watercourse, which runs through the IAIP site, as sedimentation	Sedimentation control management measures: (i) Reduce and prevent off-site sediment transport by using measures such as settlement ponds and silt fences. (ii) The implementation of soil erosion mitigation measures will also mitigate against enhanced sedimentation.	IPDC / Contractor	During site clearing and throughout construction	Covered in Project Budget	See Monitoring Plan Ref.11.4.3.1	AFDB OS1 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	S3	Loss of topsoil Topsoil will be lost, however lost topsoil can be transferred to an alternative area to continue cultivation; there is limited topsoil at the IAIP site	Topsoil management measures: (i) Topsoil stripped should be stockpiled for rehabilitation. (ii) Irrespective of where topsoil is stockpiled, it should be kept moist and vegetated as soon as possible. (iii) Topsoil stockpiles should be kept low (between 3 and 5 meters tall). It is recommended that the top 50cm of soil be stripped, where possible according to the guidelines below; (iv) Demarcate the area to be stripped clearly, so that the contractor does not strip beyond the demarcated boundary. (v) The top 50cm of the entire area should be stripped, where the soils are deep enough, and relocated by truck along set removal paths. (vi) The area to be stripped requires storm water management; the in-flow of water should be prevented with suitable structures. (vii) Prepare the haul routes prior to stripping. (viii) Stripping should not begin in wet conditions.	IPDC / Contractor	During site clearing and throughout construction	Covered in Project Budget	See Monitoring Plan Ref.11.4.3.1	AFDB OS1 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
			(ix) Within each stripping unit, segments should be stripped progressively, ensuring that the dump truck used to move the soils does not drive over the area to be stripped, but rather behind it on the basal layer, in order to avoid compaction and degradation of the topsoil properties (Humphries Rowell Associates, 2000). (x) When stockpiled soils are to be used elsewhere, the soil fertility should be assessed to determine the level of fertilisation required to sustain normal plant growth. The fertility remediation requirements need to be verified at the time of rehabilitation. The topsoil should be uniformly spread onto the rehabilitated areas and care should be taken to minimise compaction that would result in soil loss and poor root penetration (Viljoen and Associates, 2012). (xi) The MEFCC generally requires that maximum stockpile heights for material management or resource recovery activities be in the range of 3 to 5 metres. These stockpile height limits are largely based on stockpile manageability, dust impacts, stability, potential impacts to underlying infrastructure and fire risk. The height of stockpiles should generally be lower than surrounding structures. Greater stockpile heights will need careful and adequate assessment of all the additional risks the increased height poses and it must be demonstrated that these risks can be managed, as excess height can also lead to other safety risks such as instability. (xii) Fertile topsoil is to be stockpiled before construction, for future reuse or donation. The term 'fertile' is not defined here, so in the case of the Amhara sites' topsoil, it would depend on the need for this soil elsewhere. The topsoil at the site had been successfully used to grow crops in previous years. (xiii) Topsoil within the top 25cm should be carefully extracted and secured. Please note that the IFC (2007) guidelines refer to the top 50cm being topsoil but the Industrial Parks Development Corporation Document should be adhered-to in this case as it is site-specific. Based on the soils identified at the sites, the deeper topsoil's are closer to 25cm in depth than 50cm and some are extremely shallow. (xiv) Topsoil mounds of 1-2m high are recommended. Please note that the IFC (2007) guidelines specify stockpiles of 3-5m high, but, again, as the Industrial Parks Development Corporation Document is site specific, it should be adhered-to. (xv) Stockpiled topsoil must be revegetated to protect against erosion, discourage weeds and maintain active soil microbes.					
	S4	Compaction Soil compaction results in the change of the original structure	Compaction management measures (i) Pre-defined, essential road routes should be clearly demarcated and adhered-to on site to restrict soil compaction to certain areas. (ii) Vehicles should not drive on soil when it is wet to avoid further soil compaction. Having said this, once soil is well-compacted, little further damage or rehabilitation can be done. (iii) Soils must not be stripped when they are wet as this can lead to compaction and loss of structure.	IPDC / Contractor	During site clearing and throughout construction	Covered in Project Budget	See Monitoring Plan Ref.11.4.3.1	AFDB OS1 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
	S7	Dust creation If bare surfaces and soil stockpiles are not watered and vegetated, there will be high amounts of dust creation	Dust suppression management measures: (i) When stockpiling soil one runs the risk of producing dust. The advised longer-term solution to this problem is to vegetate the soil as plant roots bind soil and protect the soil against the wind. Good vegetation coverage is necessary for this to be successful. (ii) As a shorter-term solution – for the period between stockpiling and plant growth – keeping the stockpiles damp will mitigate against the risk of dust creation. (iii) As mentioned, the MEFCC generally requires that maximum stockpile heights for material management or resource recovery activities be in the range of 3 to 5 metres. These stockpile height limits are largely based on stockpile manageability, dust impacts. (iv) Stockpiled soils should be located in areas where trees can act as buffers to prevent dust pollution.	IPDC / Contractor	During site clearing and throughout construction		See Monitoring Plan Ref.11.4.3.1	AFDB OS1 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	S8	Soil Contamination Contamination occurs due to the large vehicles on site; this should be prevented otherwise well-drained after contact with the pollutants to decrease chances of contaminating water resources	(i) On-site vehicles should be well-maintained, (ii) Drip trays should be placed under vehicles. (iii) On-site pollutants should be contained in a bunded area and on an impermeable surface. (iv) One should identify potentially toxic overburden and screen with a suitable material to prevent mobilisation of toxins. (v) Maintain control of substances entering the site, (vi) Provide adequate disposal facilities. (vii) Enforce a non-polluting environment.	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.1 and 11.4.3.8	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Surface Water	SW1	Hydro-carbon contamination of the Yasmila river	(i) Maintenance of on-site vehicles; (ii) Placement of drip trays under vehicles and relevant equipment when stationary; (iii) Fuel, lubricant and waste oil storage, dispensing and operating facilities must be designed and operated in a way to prevent contamination of water.	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.3	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	SW2	Sedimentation of the Yasmila river and drainage line	(i) Appropriate placement and terracing of soil stockpiles, (ii) Appropriate drainage to be in place before construction takes place; (iii) Minimise the movement of heavy machinery around the areas that are prone to erosion; (iv) Construct during the dry season in close proximity to the river and other surface water features.	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.3	AFDB OS1 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Air Quality	AQ1 AQ2	Air quality impacts Increased particulate and gaseous concentrations affecting residential receptors within immediate vicinity of site boundary and receptors beyond site boundary	(i) Apply methods to control open dust sources at construction sites, these include wet suppression and wind speed reduction measures as a source of water and material for wind barriers tend to be readily available. General control methods for open dust sources, as recommended by the USEPA, 1995) See **Appendix E-1** for general control methods	IPDC / Contractor	Throughout construction phase	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.4	AFDB OS1, OS4 USEPA, 1995 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Noise	N1	Acoustic impacts	Management and technical options	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.5	AFDB OS1, OS4

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
		Degradation of noise climate / annoyance on residential receptors within and beyond 200m of the site boundary	(i) Plan construction activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding construction activities should be provided to all local communities. Such information includes: - Proposed working times; - Anticipated duration of activities; - Explanations on activities to take place and reasons for activities; - Contact details of a responsible person on site should complaints arise; and (ii) Advise community on the grievance mechanism and grievance submission procedure. (iii) When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible; (iv) Using noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines when working in close proximity to sensitive receptors; (v) Selecting equipment with the lowest possible sound power levels as practically possible; (vi) Ensuring equipment is well-maintained to avoid additional noise generation; (vii) Provide and ensure the use of ear protection equipment for personnel working onsite in close proximity to noise sources; (viii) Ensure that noise emanating from machinery, vehicles and noisy construction activities (e.g. excavation, blasting) are kept at a minimum for safety, health and protection of workers in the vicinity of high noise levels and nearby communities; and (ix) Noise levels reaching the communities from blasting activities (if applicable) shall not exceed 90 dB(A).					World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Transport and Access	T1	Increased vehicle/vehicle & vehicle/NMT accident risks on the local road network	(i) It is recommended that due to the anticipated higher traffic volumes to and from the BURE IAIP during operation, a typical access configuration of at least one of the accesses should include the following: - Access with 2 lanes In and 2 lanes Out; - Main road with short (80 m) right-turn In lane; - Main road with short (80 m) left-turn In lane; - Additional road signage & markings along the main road at all the accesses; and - Street lighting along the main road along the full length of the property frontage. Note, the configuration must be approved by the roads authority. It is recommended that a second vehicle and pedestrian access be provided to the IAIP via the adjacent road network to the north-west of the site.	IPDC / Contractor	Throughout construction	FDRE to determine – outside of project budget	See Monitoring Plan Ref. 11.4.3.1	AFDB OS1 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
			These upgrades should be implemented for the construction phase to ensure safe access to all construction vehicles, and the future operation phase traffic					
Waste Management	WM1 WM2 WM3	Construction waste Hazardous waste Domestic waste	(i) Provide segregated waste receptacles within the construction camp. (ii) Provide dedicated bins for hazardous waste, located on hardstanding within the construction camp. (iii) Ensure waste receptacles are easily available. (iv) Operate a clean site policy. (v) All construction staff must be educated in waste management procedures. (vi) All staff must be responsible to keeping all food and packaging waste on them to be disposed of at the waste bins within the construction camp. (vii) Sufficient temporary ablution facilities must be provided for staff so they do not relieve themselves in the fields.	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.6	AFDB OS1. OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017 Waste Management Plan (Appendix C-9 of ESIA)
Biodiversity	B1 B2 B3 B4 B5 B6	Loss/degradation of wetlands; Loss/clearance of vegetation Impact on the underneath growth and shift on natural water course Water quality deterioration Lowering water table	The following mitigation measures are to be implemented. (i) Maximum effort is to be made to retain natural vegetation and natural habitats in all parts of the proposed project area, especially in wetland areas. Strict adherence to the identified wetland buffer area is to be maintained. (ii) Demarcate green buffer areas as no-go zones to retain natural habitat throughout construction period; (iii) Establish proper waste management, especially liquid effluents so as not to pollute the natural vegetation, habitat and recipients such as streams and seasonal rivers that pass through or in close proximity to the project areas; (iv) Plant indigenous trees in open spaces / green buffer areas, as well as retain as much natural vegetation as possible within the areas to regenerate; (v) All staff are to be educated on how to maintaining remnant vegetation and the importance the habitat plays in stabilising the microclimate of the proposed project site and surrounding areas. (vi) All streams or seasonal channels entering the site are to be accommodated in green buffer areas where indicated or alternatively water flow is to be maintained through the site to ensure flow is retained at discharge points.	IPDC / Contractor Ministry of Environment, Forest and Climate Change (MEFCC), Amhara Regional Environmental Agency and at woreda level	During site clearing and throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.7	AFDB OS1, OS3 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Socio-Economic	SE1	Employment and Economy	(i) IPDC, through its website, is to inform local businesses of contracting opportunities in a timely manner; (ii) The IPDC is to maintain and regularly update a separate web page on the developer website dedicated to local tenders for the provision of goods and services. Such webpage should be widely publicised by the developer. (iii) The IPDC is to develop a Community Relations/CSR Policy, detailing contributions to local employment, training of young local specialists and any other community-benefit initiatives. (iv) The IPDC is to ensure that contractors are aware of the grievance mechanism and grievance submittal process.	IPDC / Contractor	Prior to construction and throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.9	AFDB OS1, OS5 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
			(v) IPDC is to create and populate a database of all suitable local service providers, prior to construction, to encourage more opportunities for local businesses. (vi) A Worker Influx Management Plan will need to be prepared to define labour practices in line with international standards that will need to be applied by the Contractors and their subcontractors, as well as in the Project's supply chain. The Worker Influx Management Plan will need to be aligned with the developer's Grievance Mechanism to ensure that the procedure is consistently implemented across all Project activities.					
	SE2	Impact on Livelihoods through Land Acquisition	(i) Land acquisition and any displacement impacts on the project will be carried out in compliance with Ethiopian law and AfDB Operational Safeguard 2- Involuntary Resettlement (OS2). (ii) The MoI and the IPDC will seek to avoid physical displacement where possible, and to minimise economic displacement. (iii) Impacts on land and livelihoods shall be compensated. (iv) Any affected standing crops will be compensated at current market value to make sure that farmers to do lose harvest; (v) The affected Orphan land, i.e. the remaining portion of the land plot that remains with the farmer but made uneconomic and/or too small to use, will be compensated in full; (vi) Affected people will have access to an IPD, with the possibility for aggrieved individuals to resort to a second tier of independent review of the grievance. (vii) Vulnerable people will be identified and specifically assisted as needed. (viii) Stakeholder Engagement Plan (SEP) is to be developed and implemented with regards to keeping a regular dialogue with local communities, and in particular, with affected people. (ix) The IPDC/PIU need to follow the Resettlement Action Plan and monitor internally and externally the resettlement and land acquisition progress to ensure compliance the AfDB OS2 and National policies.	IPDC / PIU	Immediate	TBD	See Monitoring Plan Ref:	AfDB OS2
	SE3	Community Health	(i) A Community Health and Safety Plan will need to be prepared which addresses potential health risks to local residents. The plan will need to cover the following elements: - To minimise the impact, a number of steps can be taken – most of the measures largely include reducing the interaction between the workforce and local residents. It is assumed that the project will use dedicated workers camp to accommodate its workforce during construction. This will help to reduce the interaction between workers and local communities. - Implementation of Construction Environmental Management Plan (CEMP) procedures and schedule, as well as Environmental Monitoring Plan (Air Emissions, Dust) to see how air quality data is changing. - Early notification of local authorities on critical or exceptionally busy construction periods and air-polluting/dust- and noise-generating activities.	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.9	AFDB OS1, OS5 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
			- Dust suppression by water spraying, or other suitable means, in dry seasons, particularly in the areas close to sensitive residential and community receptors. (ii) As part of the induction process for new employees and workers, the Contractors are to provide training for all workers on the transmission routes and common symptoms of communicable diseases. This training will be supported by an ongoing awareness campaign (posters located in common areas within the camp). These measures can help reduce the potential for workers to unknowingly transmit communicable diseases. (iii) The workers camp is to include an internal first-aid ward and medical staff being present at the camp which to some extent will help to minimise the interaction between the workforce (particularly temporary construction workers) and local residents. (iv) The Community Health Management Plan is to be developed covering details on a Workforce Code of Conduct including code specific measures that target anti-social behaviour. (v) Contractors' are to comply with national HSE legislation and the UNDP HSE Policies. (vi) The project implementation team is to carry out regular audits of the HSE Management system implementation by Contractors. (vii) Implementation of the Health and Safety Management Policy and Worker Influx Management Plan. (viii) Provide the Project HSE Policies and Worker Influx Management Policies to all contractors and subcontractors during formal induction, including security contractors (if applicable). (ix) One "umbrella" Project Grievance Mechanism, is to be developed and accessible to all workers, including those who directly work for the IAIPs development and also employed by contractors. (x) The IPDC will ensure that Contractors will provide onsite first-aid tents (one tent per site) to ensure that basic medical attention and first aid treatment can be provided by a trained first-aider during the hours that the work is being undertaken at the Project site. For all medical incidents that require medical attention, the contractors will quickly provide transportation to the Workers' Camp clinic which will also help reduce the potential pressure on local healthcare facilities.					
	SE4	Community Safety and Security	(i) The project site is to be fenced, while any activities outside the main footprint are to be appropriately signposted. This will help ensure that accidents associated with new infrastructure will be minimised. (ii) Traffic Management Plans which will need to be prepared by Contractors during the construction phase will further minimise the potential risk of accidents, injuries and near misses. (iii) Provide the project HSE and Worker Management Plans to all subcontractors during formal induction, including the security contractors (if applicable). (iv) A Project Code of Conduct and appropriate training for security personnel are to be developed and implemented to ensure best practice in running a secure site and implementing the Code of	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.9	AFDB OS1, OS5 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility for Implementation	Timeframe / Due Date	Cost Estimates	Monitoring	Applicable Safeguards / Documents
			Conduct that fosters behaviours that helps to avoid, eliminate or minimise the use of excessive force in potential conflict situations. (v) The project Health, Safety and Security Management Plan is to be provided to, and implemented by, all Contractors and subcontractors. (vi) The project Health and Safety Management Policy is to include details of a 'no tolerance to drugs and alcohol policy', as well as details on HIV/AIDS prevention, etc. (vii) Stakeholder Engagement Plan (SEP) is to be developed and implemented with regards to keeping a regular dialogue with local communities. (viii) One "umbrella" Project Grievance Mechanism, is to be developed and accessible to all workers, including those who directly work for the IAIPs development and also employed by contractors, as well as the community.					
	SE5	Environmental Emissions	Refer to Air Quality Section of ESMP.					
	SE6	Community Infrastructure and Services	(i) The Workers Camp is to provide in-house laundry, first-aid, cooking, recreational, religious and common area facilities/rooms which will help to reduce the need for workers to use local infrastructure and services; (ii) The planned Workers Camp is to follow best practice guidance on workers' accommodation. (iii) Implement a community health management plan in consultation with relevant stakeholders (e.g. local doctors and the local authorities). This plan will ensure that appropriate and adequate health care services are provided on site and at the accommodation camp to address/ manage worker illnesses and injuries.	IPDC / Contractor	Throughout construction	Covered in Project Budget	See Monitoring Plan Ref. 11.4.3.9	AFDB OS1, OS5 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	SE7	Impacts on Livelihoods Due to Obstruction of Existing Access Routes	(i) Provide alternative access routes for affected communities to utilise to gain uninterrupted access to the required services.	IPDC / FDRE	During Construction	TBD	See Monitoring Plan Ref:	AFDB OS1

Table 11-3: Operation Phase Environmental and Social Management Plan

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility For Implementation	Timeframe / Due Date	Cost Estimates	Comments / Further Action & Monitoring	Applicable Safeguards / Documents
Soils	S1	Erosion Eroded areas will continue to spread, unless stopped, resulting in a cumulative effect on the site's identified soils	(i) Regular inspection will be undertaken of all discharge points from site for early detection of erosion areas; remedial works will be undertaken accordingly; (ii) Soil erosion control measures shall conform to the best management practices highlighted in the appropriate code.	IPDC	Throughout Operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.1	World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	S2	Contamination	(i) On-site vehicles should be well-maintained, (ii) Drip trays should be placed under stationary vehicles (iii) On-site pollutants should be contained in a bunded area and on an impermeable surface. (iv) One should maintain control of substances entering the site. (v) Provide adequate disposal facilities. (vi) Enforce a non-polluting environment. (vii) One should identify potentially toxic overburden and screen with a suitable material to prevent mobilisation of toxins.	IPDC	Throughout Operation	Covered in Project Budget	-	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Surface Water	SW1	Altering the hydrological regime- change in runoff volume	(i) Keep the hard standing areas as minimal as possible; (ii) Introduce pervious paving in areas such as parking bays.	IPDC / Enterprises	Throughout Operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.2	World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	SW2	Altering the hydrological regime-change in runoff velocity	(i) Energy dissipaters should be implemented and maintained at each discharge point.	IPDC	During construction and throughout operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.2	World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Ground Water	GW1	Lowering of groundwater levels	(i) Supply alternate water sources to affected community members should an impact be identified	IPDC	Throughout Operation	To be determined is required	See Monitoring Plan Ref. 11.4.4.3	World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	GW2	Contamination of groundwater resources	(i) Contain and treat surface water runoff in order to prevent it entering the groundwater environment; (ii) Monitor groundwater quality in the vicinity of the site; (iii) A groundwater monitoring programme should be initiated once the IAIP and RTC Sites become operational in order to identify any potential impacts to groundwater quality and quantity in the area; and (iv) Should negative groundwater related impacts be identified, alternative water supply options should be supplied to the affected communities.	IPDC	Throughout Operation	Covered in Project Budget See Monitoring Plan Ref. 11.4.4.3	See Monitoring Plan Ref. 11.4.4.3	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility For Implementation	Timeframe / Due Date	Cost Estimates	Comments / Further Action & Monitoring	Applicable Safeguards / Documents
	GW3	Loss of recharge area for the springs	(i) Monitor spring discharge in order to determine whether the Amhara IAIP site has had a detrimental impact. Provide alternate water source should an impact be identified.	IPDC	Throughout Operation	See Monitoring Plan Ref. 11.4.4.3	See Monitoring Plan Ref. 11.4.4.3	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	GW4	Contamination of groundwater resources	(i) Monitor spring discharge and groundwater quality	IPDC	Throughout Operation	See Monitoring Plan Ref. 11.4.4.3	See Monitoring Plan Ref. 11.4.4.3	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Air Quality	AQ1 AQ2	Air quality impacts Increased particulate and gaseous concentrations affecting residential receptors within immediate vicinity of site boundary and receptors beyond site boundary	General recommendations for air quality management have been provided in the draft Development Control Regulations for South West Amhara (2017) and include: (i) Water the roads immediately before compacting to strengthen the road surface, otherwise traffic will soon beat back the road surface to pre-bladed condition; (ii) When possible, delay compacting until the beginning of the wet season or when water becomes more available; (iii) Ensure that vehicles and other equipment are regularly inspected according to schedule maintenance for proper exhaust emission; (iv) Truck drivers to minimise speed limits on earthen roads, especially in dry periods; (v) Avoid burning of biomass as much as possible and use fire only in situations where this is least possible environmental damage; (vi) Speed control using speed bumps; with permanent speed bumps to be installed in villages and bazaars to reduce traffic speeds in inhabited areas; (vii) If water is available, the road surface can be sprayed on a frequent schedule; (viii) Bitumen surface roads to be constructed in bazaars, with speed controls implemented; (ix) Dense vegetation planted on the roadside; and (x) Schedule work activities to minimise disturbance. Preparation of an Environmental Management Plan is also required for formulation, implementation and monitoring of environmental protection measures during and after commissioning of the project. As part of this this, the following is applicable to air quality: (xi) Regular monitoring of fugitive emissions shall be conducted and any abnormalities reported for immediate corrective measures; (xii) Regular monitoring of ambient air quality in and around the site shall be conducted; (xiii) Unauthorised clearing and removal of vegetation should be prohibited;	IPDC / Enterprises	Throughout Operation	Covered in Project Budget See Monitoring Plan Ref. 11.4.4.4 Design costs to be determined by each enterprise at design stage	See Monitoring Plan Ref. 11.4.4.4	AFDB OS1, OS4 World Bank Group EHS Guidelines USEPA, 1995 Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility For Implementation	Timeframe / Due Date	Cost Estimates	Comments / Further Action & Monitoring	Applicable Safeguards / Documents
			(xiv) Normal means of dust suppression, including watering of roads, will be employed to minimise dust generation. (xv) Occupational dust levels are to be monitored and managed as required. (xvi) The size and area of stockpiles of soil will be minimised. Stockpiles that may be susceptible to erosion must be terraced, covered or have suitable erosion control measures such as silt fences; (xvii) Access routes will use established roads where possible; (xviii) The moisture content of access road surface layers will be maintained through routine directional spraying or the use of an appropriate dust suppressant as agreed with the Concerned Authority; and (xix) Off-road driving and the creation of new roads/tracks will be avoided wherever possible. (xx) Recommendations provided in the IFC EHS Guidelines for Air Emissions and Ambient Air Quality are to be considered during design of facilities to be established within the IAIP and RTC. Sectoral specific EHS guidelines have also been developed for the following: - Breweries; - Meat processing; - Dairy processing; and - Food and beverage processing. Refer to **Appendix E-2** for Sector Specific Guidelines					
Noise	N1	Acoustic impacts Degradation of noise climate / annoyance on residential receptors within and beyond 200m of the site boundary	(i) Units with significant noise generating potential are to be housed within closed-wall buildings to limit the transmission of noise to surrounding receptors. (ii) As per the IFC EHS Guidelines for Noise Management, the following noise reduction options should also be considered: - Selecting equipment with lower sound power levels; - Installing silencers for fans; - Installing suitable mufflers on engine exhausts and compressor components; - Installing acoustic enclosures for equipment casing radiating noise; - Improving the acoustic performance of constructed buildings by applying sound insulation; - Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective; - Installing vibration isolation for mechanical equipment; - Re-locating noise sources to less sensitive areas to take advantage of distance and shielding; - Siting permanent high noise generating facilities away from community areas if possible;	IPDC / Enterprises	Throughout Operation	Covered in Project Budget See Monitoring Plan Ref. 11.4.4.5	See Monitoring Plan Ref. 11.4.4.5	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility For Implementation	Timeframe / Due Date	Cost Estimates	Comments / Further Action & Monitoring	Applicable Safeguards / Documents
			- Taking advantage of the natural topography as a noise buffer during facility design; - Reducing project traffic routing through community areas wherever possible; and - Developing a mechanism to record and respond to complaints. As per the Development Control Regulation document for the Amhara site (MACE, 2017), the following site designs will be followed: (iii) Windows and openings to all building spaces intended for human occupancy shall be orientated away from sources of distractive noise or shall be provided with protections acceptable to the building official; (iv) Regular monitoring of ambient noise in and around the site shall be conducted; and (v) Alert public when loud noise will be generated.					
Transport and Access	T1	Traffic impacts	(i) It is recommended that due to the higher traffic volumes to and from the IAIP, the configuration of at least one of the accesses should be improved to improve safety and operation of the access. This will assist to decrease the risk of vehicle/vehicle and vehicle/NMT accidents in the vicinity of the site. The mitigation measures (intersection upgrades, etc.) are to be in place from the Construction phase. (ii) The required road signs, road markings and street lighting should also be implemented at the accesses to ensure good intersection operation and safety. (iii) A suitable public transport stop should be provided on-site, to ensure safety of passengers waiting for transport. (iv) It is recommended that the trip generation of the IAIP and RTC facilities be monitored annually to ensure that the access intersections operate safely and with sufficient capacity and acceptable levels of service. (v) If the intersection performance deteriorates to unacceptable levels in future, additional intersection upgrades should be implemented. (vi) An additional NMT access should be provided off the roundabout located on the north-western edge of the site. This will allow a shorter and more direct access to the site from the town, and will also decrease NMT and public transport movements along the federal highway to the main access.	IPDC / FDRE	During construction and throughout Operation	Covered in Project Budget See Monitoring Plan Ref. 11.4.4.6 TBD	See Monitoring Plan Ref. 11.4.4.6	AFDB OS1 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Waste Management	WM1		(i) Provide segregated waste receptacles to each Enterprise operating within the IAIP or RTC. (ii) Encourage Enterprises to operate a clean site policy and ensure waste receptacles are easily available and ensure all their staff are properly trained on the contents of the overarching Waste Management Plan (WMP). (iii) IPDC must ensure that waste is collected at least once a week for all Enterprises and where there is greater waste being generated by an Enterprise, waste collection must increase to twice a week for those specific Enterprises.	IPDC / Enterprises	Throughout Operation	Covered in Project Budget	-	AFDB OS1, OS4 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017 Waste Management Plan

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility For Implementation	Timeframe / Due Date	Cost Estimates	Comments / Further Action & Monitoring	Applicable Safeguards / Documents
			(iv) Provide dedicated bins for hazardous waste, located on hardstanding within the designated Waste Management Area. (v) All Enterprises that generate hazardous waste must be required to deliver this to the waste management area every third day. (vi) Apply the waste hierarchy and prevent waste from being generated. The site will operate on a zero waste discharge basis and therefore, no waste, with the exception of small quantities of hazardous waste will be permitted to be disposed of outside of the IAIP and RTC. (vii) Operate a 'Zero Waste Discharge' facility. (viii) Enforce the implementation of the Waste Hierarchy. (ix) Ensure all Enterprises are contractually committed to implementing the WMP. (x) No waste from the IAIP and RTC sites may be permitted to be disposed of within a landfill with the exception of small quantities of industrial hazardous Waste and bio-medical waste. Since there are no sanitary landfills within Bure and Motta which are the closest urban areas to the site, these wastes must be transported to the nearest sanitary landfill. (xi) Limit the volumes of residual wastes, industrial hazardous waste and bio-medical wastes streams. (xii) Encourage Enterprises to use alternative products to reduce hazardous rating. (xiii) Investigate and support the development of a Sanitary Landfill within the vicinity of the sites.					
Visual	V1	Light Pollution	The following mitigation measures can be implemented in order to minimise impacts from the lighting design of the facility: (i) Light spills can be completely avoided by careful lamp design selection and positioning. (ii) Lighting near or above the horizontal should be avoided to reduce glare and sky glow (the brightening of the night sky). (iii) Good design, correct installation and ongoing maintenance are essential to the effectiveness of lighting schemes. (iv) Lighting schemes should be designed to ensure unnecessary or superfluous lighting is turned off when not needed. Apply 'part-night lighting' to reduce any potential adverse effects e.g. when a business is closed or, in outdoor areas, switching-off at quiet times between midnight and 5am or 6am. (v) Impact on sensitive wildlife receptors throughout the year, or at particular times (e.g. on migration routes), may be mitigated by the design of the lighting or by turning it off or down at sensitive times.	IPDC	During Construction	Covered in Project Budget	See Monitoring Plan Ref.	
	V2	Roads and /or road widening	The following mitigation measures can be implemented in order to minimise impacts from permanent vegetation clearing and road construction: (i) Establish vegetative screens /shelterbelts along highly visible roads.	IPDC	During construction and operation	Covered in Project Budget	See Monitoring Plan Ref.	

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility For Implementation	Timeframe / Due Date	Cost Estimates	Comments / Further Action & Monitoring	Applicable Safeguards / Documents
			(ii) Natural vegetation must be re-established on disturbed areas after construction. (iii) Roads and drainage for runoff should be appropriately stabilised to avoid erosion and visual scars.					
Biodiversity	B1 B2	Natural habitats	The following mitigation measures are to be implemented. (i) Develop proper management measures for maintenance of the buffer and green areas to be protected on site. (ii) All staff are to be educated on how to maintaining remnant vegetation and the importance the habitat plays in stabilising the microclimate of the proposed project site and surrounding areas.	IPDC Amhara Regional Environmental Agency and at woreda level	Prior to operation and throughout operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.8	AFDB OS1, OS3 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
Socio-Economic	SE1	Employment and Economy	(i) Maintain and regularly update a separate web page on the developer website dedicated to local tenders for the provision of goods and services. Such webpage should be widely publicised by the developer. (ii) A Worker Influx Management Plan will need to be prepared to define labour practices in line with international standards that will need to be applied by EPC Contractors and their subcontractors, as well as in the Project's supply chain. The Worker Influx Management Plan will need to be aligned with the developer's Grievance Procedure to ensure that the procedure is consistently implemented across all Project activities.	IPDC	Throughout operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.7	AFDB OS1, OS5 World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	SE2	Community Health	(i) Implementation of a Health and Safety Management Policy and Worker Influx Management Plan. (ii) Provide the project HSE and Worker Influx Management Policies to all subcontractors during formal induction, including the security firms. (iii) One "umbrella" Project Grievance Mechanism, extended and accessible to all workers, those who directly work for the IAIPs development and also employed by contractors. (iv) On-going monitoring and evaluation of the community health situation will be needed. If monitoring indicates an increase in the transmission of communicable diseases, the mitigation measures will need to be revised.	IPDC	Throughout operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.7	AFDB OS1, OS5World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	SE3	Community Safety and Security	(i) Ensure that a Project Code of Conduct and appropriate training for security personnel are implemented to ensure best practice in running a secure site and implementing the Code of Conduct that fosters behaviours that help to avoid, eliminate or minimise the use of excessive force in potential conflict situation.	IPDC	Throughout operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.7	AFDB OS1, OS5World Bank Group EHS Guidelines Development Corporation Regulations (Amhara), 2017
	SE4	Environmental Emissions	Refer to Air Quality Section of ESMP.					
	SE5	Community Infrastructure and Services	(i) Develop and implement a community health management plan in consultation with relevant stakeholders (e.g. local doctors and the local authorities). This plan will ensure that appropriate and adequate health care services are provided on site and at the	IPDC	Throughout operation	Covered in Project Budget	See Monitoring Plan Ref. 11.4.4.7	AFDB OS1, OS5World Bank Group EHS Guidelines

Environment	No.	Potential Impacts	Proposed Mitigation and Benefit Enhancement Measures	Institutional Responsibility For Implementation	Timeframe / Due Date	Cost Estimates	Comments / Further Action & Monitoring	Applicable Safeguards / Documents
			accommodation camp to address/ manage worker illnesses and injuries.					Development Corporation Regulations (Amhara), 2017

11.4 ENVIRONMENTAL AND SOCIAL MONITORING PROGRAMME

11.4.1 OVERVIEW

Environmental monitoring is an essential tool in relation to environmental management as it provides the basis for rational management decisions regarding impact control. Monitoring should be performed during all stages of the project to verify the impact predictions and to ensure that the impacts are no greater than predicted.

By using the information collected through monitoring, environmental management plans can be improved when necessary (e.g. adapting mitigation measures to changing situations throughout the project construction and operation) to ensure that the anticipated impacts are mitigated. Should the environmental monitoring determine construction works or operations pose an environmental concern; the works or operation will be modified or halted.

The objectives of the environmental monitoring programme include the following:

- To monitor the changes in the environmental conditions by the construction and operation of the proposed Project;
- To check on whether mitigation and benefit enhancement measures have actually been adopted, and are proving effective in practice;
- To provide a means whereby any impacts which were subject to uncertainty at the time of preparation of the ESIA, or which were unforeseen, can be identified, and to provide a basis for formulating appropriate additional impact mitigation measures; and
- To provide information on the actual nature and extent of key impacts and the effectiveness of mitigation and benefit enhancement measures which, through a feedback mechanism, can improve the planning and execution of future, similar projects.

There are two basic forms of monitoring:

- Compliance monitoring, which checks whether prescribed actions have been carried out, usually by means of inspection or enquiries, and
- Effects monitoring which records the consequences of activities on one or more environmental components, and usually involves physical measurement of selected parameters or the execution of surveys to establish the nature and extent of induced changes.

For this project, it is recommended to carry out both compliance and effects monitoring. However, during construction compliance monitoring will play a major role in checking whether recommended impact mitigation and management plans have been carried out or not. This is because most impact control takes the form of measures incorporated in project designs and contract documents. The extent to which recommendations on these matters, as set out in the ESIA and ESMP, are complied with plays a major part in determining the overall environmental performance of the project.

The environmental monitoring plan outlined below and summarised in **Table 11-4** and **Table 11-6** describes the particular resources that will be monitored through the construction and operation phases of the project respectively. The types of data that will be collected to describe each resource are also included in these tables.

11.4.2 MONITORING TO ESTABLISH BASELINE

The quality of environmental assessment usually to a large extent constrained by limitation of baseline information and data time series. The environmental baseline conditions, which will form a basis for some of the monitoring activities, were determined by the ESIA studies during the pre-construction Phase. However, there is a need for additional information about present status and development trends for good predication of impacts of the project environment.

A monitoring regime is to begin at the earliest convenience to be established against which changes during construction, and on into operation, can be assessed.

Therefore, it is recommended for the IPDC to set-up an environmental and social monitoring system and establish a databases as well as support system for data storage and dissemination. Such system might be established for general state of the environment reporting.

11.4.3 MONITORING PLAN: CONSTRUCTION PHASE

11.4.3.1 GENERAL

Environmental monitoring during the construction phase will comprise two principal groups of activities:

- Review of the contractor's plans, method statements, temporary works designs, and arrangements so as to ensure that environmental protection measures specified in the contract documents are adopted, and that the contractor's proposals provide an acceptable level of impact control.
- Systematic observation of all site activities and the contractor's offsite facilities including stockpile areas, as a check that the contract requirements relating to environmental matters are in fact being complied with, and that no impacts foreseen and unforeseen are occurring.

Most of the monitoring will comprise visual observations during site inspection and will be carried out at the same time as the engineering monitoring activities. Site inspections will take place with emphasis on early identification of any environmental problems and the initiation of suitable remedial action. Where remedial actions have been required on the part of the contractor, further checks will need to be made to ensure that these are actually being implemented to the agreed schedule and in the required form. All sites where construction is taking place will be formally inspected from an environmental viewpoint on a regular basis.

These activities will also be integrated with other construction supervision and monitoring activities to be carried out by the IPDC. The IPDC will decide on the appropriate course of action to be taken in cases where unsatisfactory reports are received from field staff regarding environmental matters. In the case of relatively minor matters, advice to the contractor on the need for remedial action may suffice, but in all serious cases, the IPDC should issue a formal instruction to the EPC Contractor to take remedial action, depending on the extent of his delegated powers.

IPDC, as an implementing agency of this project, has the responsibility to be involved with the construction supervision team to see the implementation of this environmental monitoring plan. The IPDC will establish an Environmental Management Unit (EMU) at site office level and is responsible to coordinate the environmental management and monitoring activities on a day-to-day basis.

The EPC contractor will assign an Environmental Inspector and to undertake check monitoring on an intermittent basis.

Furthermore, condition 24(2) of the Industrial Park Proclamation No. 886/2015 states that, "The Ministry of Environment and Forest shall establish an office within industrial parks for the application, supervision, protection and enforcement of environmental norms, standards, safeguards, management and mitigation plans within the Industrial Parks".

In addition to visual observation, it is particularly important that monitoring should also include limited informal questioning of members of the local community and their leaders who live near to the project since they may be aware of matters which are unsatisfactory, but which may not be readily apparent or recognised during normal site inspection visits.

In the following sections, monitoring activities are presented for various impact components during the construction phase. **Table 11-6** below outlines the overall package of environmental monitoring that will be carried out in relation to the Project. The table also assigns responsibilities for each monitoring activity, and proposes parties capable of carrying out the monitoring on behalf of the IPDC.

11.4.3.2 SOIL EROSION

The EMU is to ensure the effectiveness of erosion and sedimentation control measures to be implemented during construction stage.

11.4.3.3 SURFACE WATER QUALITY

Monitoring of water quality will ensure proper implementation of the identified mitigation measures for the construction phase and complying with the Water Pollution control Regulation.

The water quality monitoring program should also include the potable water supplied to the construction work camps and work sites. Periodical water analysis of the drinking water provided to the workers and an awareness program on safe water shall be performed in order to limit waterborne diseases.

11.4.3.4 AIR QUALITY

Particulate matter (PM) at the constructions sites and roads used by trucks for haulage of materials, will be visually monitored. Monitoring will be carried out throughout the construction activities on a daily basis. If nuisance dust is generated around the site during the construction period, it will be the responsibility of EMU to ensure that appropriate control measure are taken.

Inspection of stock piled material sites is to be undertaken on a regular basis to ensure suitable mitigation measures are in place. In addition, trucks and machinery shall occasionally be inspected unannounced regarding engine emissions (i.e., when black clouds of soot are visible). Engine maintenance shall be requested in case of any deficiency noticed.

11.4.3.5 NOISE

The implementation of the identified mitigation measures will be monitored during construction activities. The noise level at construction sites will be monitored with portable sound level meters once a week and upon receipt of complaints. Thus compliance with the Regulation on the Assessment and Management of the Environmental Noise and Regulation of Worker's Health and Work Safety will be ensured.

If nuisance noise is generated around settlement areas during the construction period, it will be the responsibility of the EMU to ensure that appropriate control measure are taken.

11.4.3.6 WASTE MANAGEMENT

Wastes will be handled to ensure compliance with related Ethiopian Legislation, and internationally accepted standards. To handle all types of wastes properly during construction, a waste management plan has been prepared and implementation of the measures proposed in these plans will be monitored regularly to comply with all relevant legislation and standards.

All the records for storage, transportation and treatment of these wastes will be kept as required by the management plans. The EMU shall check on regular basis the activity in the waste management areas.

11.4.3.7 NATURAL VEGETATION

It is the responsibility of EMU together with the Woreda office of Agriculture and Rural Development to ensure that the recommended mitigation measures for natural vegetation are implemented. Parameters to be monitored include areas of woodland in the vicinity of the project sites to ensure deforestation does not take place. The monitoring would allow EMU to assess that the cutting and removal of trees and bush is carried out in accordance with proper forest conservation practices.

11.4.3.8 EQUIPMENT, FUEL STOAGE AND MAINTENANCE

It will be the responsibility of EMU to check on the proper storage and operations of equipment, fuel storage and handling facilities and maintenance areas to ensure these facilities are safe and secure.

11.4.3.9 SOCIO-ECONOMIC

COMMUNITY HEALTH

On-going monitoring and evaluation of the community health situation is to be undertaken. If monitoring indicates an increase in the transmission of communicable diseases, the mitigation measures will need to be revised.

SAFETY

Occupational health and safety issues of the IAIP and RTC operation will be monitored to ensure compliance with legislation related to occupational health and safety management.

COMPENSATION AND RESETTLEMENT

Monitoring of the following aspects are to be undertaken:

- Changes in economic and social status of compensated and resettled population including livelihood improvement, effectiveness and timing of public information/participation and consultation activities;
- Implementation and effectiveness of social development plans;
- Effectiveness of resettlement planning, complaints or grievances regarding resettlement and effectiveness of corrective/preventive activities performed for them.

The main type of monitoring to be adopted for the purpose of this project will be both internal and external performance monitoring. Accordingly, the IPDC will undertake continuous and systematic performance monitoring of the resettlement process.

Table 11-4: Monitoring Plan - Construction Phase

No.	Parameter to be monitored	Location	Measurement	Frequency	Institutional Responsibility	Cost (Birr)
1	Erosion and Sedimentation	Construction sites, stockpile areas, access roads	Observation and reporting regarding the provisions in Erosion and Sediment Control Plan	Continuous controls and monthly reporting	EPC Contractor, EMU	Covered in Project Budget
2	Air Quality	Construction sites, stockpile areas, access roads	Observation and inspection	Continuous throughout the construction period	EPC Contractor, EMU	Covered in Project Budget
3	Air Quality	Trucks and machinery exhausts	Observation and inspection	Occasionally throughout construction period	EPC Contractor, EMU	Covered in Project Budget
4	Noise	Near settlements and construction sites	Portable sound level meters for measuring noise levels	Once a week and upon complaints	EPC Contractor, EMU	200,000 for equipment
5	Waste Management	At construction sites and camp facilities	Observation and record keeping	Monthly	EPC Contractor, EMU	Covered in project budget
6	Natural Vegetation	IAIP site	Observation and record keeping	Monthly	EMU / ARD	Covered in project budget
6	Equipment, fuel storage and handling and maintenance	Construction camp and workshop	Visual inspection	Monthly	EPC Contractor, EMU	Covered in project budget

No.	Parameter to be monitored	Location	Measurement	Frequency	Institutional Responsibility	Cost (Birr)
7	Health and Safety	All work places	Observation inspection and reporting	Daily / Monthly	EPC Contractor, EMU	Covered in Project budget
8	Environmental Monitoring Coordination	-	Monitoring of the implementation and success of the mitigation measures (including the relevant environmental and health and safety plans) Reporting on monitoring results, and compliance with relevant legislation, contract and technical requirements	Monitoring continuously Reporting bi-annually	EMU / EPC Contractor	100,000 per year
9	Resettlement and Socioeconomic	Monitoring of the Resettlement Action Plan (for details see RAP Report)				

11.4.4 MONITORING PLAN: OPERATION PHASE

Monitoring will be an integrated part of operation of the project to comply with the standards and improve management practices.

The principal fields of interest requiring monitoring during operation phase are discussed below and summarized in **Table 11-6**.

11.4.4.1 SOIL EROSION

The EMU is to ensure the effectiveness of erosion control measures to be implemented during the operation phase.

11.4.4.2 SURFACE WATER QUALITY

Monitoring of water quality will ensure proper implementation of the identified mitigation measures for the construction phase and complying with the Water Pollution control Regulation.

The surrounding water courses must be monitored upstream and downstream of the IAIP site. Details of the monitoring protocols are defined below.

SAMPLING LOCATION AND FREQUENCY

The Yiser River must be monitored on a monthly basis upstream and downstream of the. Three surface water sampling locations have been identified and are summarised in **Table 11-5**.

Table 11-5: Surface Water Sampling Locations

Sample name	Sampling Point	Latitude	Longitude
AHASW01	Site boundary near SW discharge points	10.699300°N	37.067350°E
AHASW02	Perpendicular to site	10.693480°N	37.070740°E
AHASW06	Site boundary near SW discharge points	10.695383°N	37.081740°E
AHASW08	Downstream of site	10.686980°N	37.084440°E

SAMPLING METHODOLOGY

The surface water samples must be collected directly into laboratory supplied sample containers. Surface water samples must be obtained from at least 10cm below the water surface wherever possible, with the bottle opening facing upstream. Sample containers must be kept closed and in a clean condition up to the point of sampling.

Monitoring must be undertaken according to internationally accepted protocols, ensuring that the potential for cross contamination is minimised (i.e. during sampling, new disposable latex gloves must be worn at each sampling point).

For each sampling point, the temperature, pH and electrical conductivity must be measured in-situ using a calibrated multi-parameter and recorded. This information, as well as the physical and environmental information of each sampling point (e.g. visual, olfactory observations and flow conditions) must be recorded on designated field data sheet.

On each sample, the following must be recorded to ensure proper identification:

- Site Name (e.g. Amhara IAIP);
- Sample Location and Sample Type (e.g. Amhara SW01); and
- Sample Date and Time.

Sample containers must be kept closed and in a clean condition up to the point of sampling. Post sampling, all samples must be stored in a temperature controlled cooler box (below 4^{o}C), which is kept

sealed and dust-free, until samples are dispatched to the laboratory for analysis. Any glass sample vessels must be wrapped in bubble wrap to prevent breakages.

ANALYTICAL PROGRAMME

The analytical schedule for the surface water samples is included in the below:

- Metals and metalloids: aluminium, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, vanadium and zinc;
- Anions: chloride, cyanide, phosphate, sulphate fluoride, ammoniacal nitrogen as N and NH_3, TON, nitrate as N and nitrite as N;
- Chemical Oxygen Demand (COD);
- Biological Oxygen Demand (BOD);
- General: TOC, pH, electrical conductivity, DO, TDS and Total Suspended Solids (TSS).

The pH and electrical conductivity measured in-situ must be validated through laboratory testing.

DATA QUALITY

A factual and interpretive report should be drafted in accordance with the monitoring reporting requirements stipulated in the IFC guidelines. The report should include a description of the methodologies followed, the analytical results obtained and associated interpretation in line with the defined water quality guidelines.

The precision of the sampling and analysis must be assessed through a comparison of the original and duplicate sample analytical results. This must be done through a quality assurance/quality control programme (i.e. obtain the percentage variance of the duplicated sample).

Should negative surface water related impacts be identified at root cause investigation should be undertaken and corrective actions identified and implemented.

11.4.4.3 GROUNDWATER MONITORING

A water quality monitoring program with adequate resources and management oversight should be developed and implemented to meet the objective(s) of the monitoring program. The water quality monitoring program should consider the following elements:

- *Monitoring parameters:* The parameters selected for monitoring should be indicative of the pollutants of concern from the process, and should include parameters that are regulated under compliance requirements;
- *Monitoring type and frequency*: Wastewater monitoring should take into consideration the discharge characteristics from the process over time. Monitoring of discharges from processes with batch manufacturing or seasonal process variations should take into consideration of time-dependent variations in discharges and, therefore, is more complex than monitoring of continuous discharges. Effluents from highly variable processes may need to be sampled more frequently or through composite methods. Grab samples or, if automated equipment permits, composite samples may offer more insight on average concentrations of pollutants over a 24-hour period. Composite samplers may not be appropriate where analytes of concern are short-lived (e.g., quickly degraded or volatile).
- *Monitoring locations*: The monitoring location should be selected with the objective of providing representative monitoring data. Effluent sampling stations may be located at the final discharge, as well as at strategic upstream points prior to merging of different discharges. Process discharges should not be diluted prior or after treatment with the objective of meeting the discharge or ambient water quality standards. Monitoring boreholes should be placed both up gradient and down gradient of the operations, and take preferential groundwater flow paths into consideration
- *Data quality*: Monitoring programs should apply internationally approved methods for sample collection, preservation and analysis. Sampling should be conducted by or under the supervision of trained individuals. Analysis should be conducted by entities permitted or certified for this purpose. Sampling and Analysis Quality Assurance/Quality Control (QA/QC) plans should be prepared and, implemented. QA/QC documentation should be included in monitoring reports.

Groundwater monitoring should be conducted on a quarterly basis.

Should negative groundwater related impacts be identified, alternative water supply options should be supplied to the affected communities

11.4.4.4 AIR QUALITY MONITORING

Regular monitoring of ambient air quality in and around the site shall be conducted during the operation phase, following commencement of the park.

11.4.4.5 NOISE MONITORING

Regular monitoring of ambient noise in and around the site is to be conducted during the operation phase, following commencement of the park. Should complaints be received at any point noise monitoring is to be undertaken to determine the source of the noise and corrective actions are to be identified and implemented.

11.4.4.6 TRAFFIC MONITORING

The trip generation of the IAIP and RTC facilities be monitored annually, during the operational phase, to ensure that the access intersections operate safely and with sufficient capacity and acceptable levels of service.

11.4.4.7 SOCIO-ECONOMIC

COMMUNITY HEALTH

On-going monitoring and evaluation of the community health situation is to be undertaken. If monitoring indicates an increase in the transmission of communicable diseases, the mitigation measures will need to be revised.

SAFETY

Occupational health and safety issues of the IAIP and RTC operation will be monitored to ensure compliance with legislation related to occupational health and safety management.

COMPENSATION AND RESETTLEMENT

Monitoring of the following aspects are to be undertaken:

- Changes in economic and social status of compensated and resettled population including livelihood improvement, effectiveness and timing of public information/participation and consultation activities;
- Implementation and effectiveness of social development plans;
- Effectiveness of resettlement planning, complaints or grievances regarding resettlement and effectiveness of corrective/preventive activities performed for them.

The main type of monitoring to be adopted for the purpose of this project will be both internal and external performance monitoring. Accordingly, the IPDC will undertake continuous and systematic performance monitoring of the resettlement process.

11.4.4.8 CONSTRUCTION SITE RESTORATION

This programme will be maintained for only a short duration during the construction period and the clean-up of the construction site. The programme will have the responsibility of ensuring that the EPC contractor implement environmental precautions and that the required landscaping and re-vegetation programme are implemented as part of the construction demobilisation process.

11.4.5 CHECKING AND CORRECTIVE ACTION

INSPECTION OF ENVIRONMENTAL PERFORMANCE AND MONITORING

Environmental monitoring of site activities is undertaken through a set of inspection reports and incidents forms. An Environmental Inspection Reports (EIR) is to be issued to Site Management when the Environmental Inspector identifies negative impacts, poor environmental practices and/or breach of the standards and its procedures. This is normally supported by photographic evidence.

NON-CONFORMANCE, CORRECTIVE AND PREVENTIVE ACTION

When procedures are not followed, action is taken to prevent the occurrence of environmental problems.

Non-conformances include breach of environmental legislation and failure to follow ESMP procedures. The Environmental Inspectors and EMU are to investigate the cause of non-conformance in order to determine appropriate corrective actions. Once and corrective actions are complete, the non-conformance is closed and no further action is required.

RECORDS

The Environmental Inspectors and EMU keep records of the documentation of the environmental inspection and monitoring. These records include:

- Environmental Inspection Reports;
- Monthly Environmental Summary;
- Environmental Incidents and any no-conformance reports;
- Corrective and preventive actions;
- Complaints;
- Permits and approvals;
- Employer/Consultant and EPC Contractor internal minutes of meeting; and
- Environment audit findings.

Records shall be kept to demonstrate the environmental performance at the site. This serves as a basis for interested parties to evaluate the site's performance. The records shall be legible, identifiable and accessible.

11.4.6 MONITORING FRAMEWORK

Effective monitoring of all stages of the project could be managed through an environmental management team. The principal aim of the environmental management team would be advising the project authorities and local administration about the best practicable means for protecting the environment during all stages of the project's life span.

It would provide the IPDC with proposals for monitoring the environment, and indicate operational procedures for protecting the environment.

The primary responsibility of this monitoring plan is of the IPDC who is the Project Developer. The Environmental monitoring plan will be administered within the IPDC project coordination office. The EMU will begin the implementation of the programme by forming a team of specialists to assist in monitoring the environmental effects during the construction period.

Independent external environmental monitoring may also be considered by MEFCC for the activities that are not under the responsibility of the IPDC.

In addition, there are other agencies that have the responsibility and authority to monitor some of the measures. It is also recommended that the IPDC involves other Agencies (including MEFCC) and subcontractors as required to form the environmental management team.

During the construction phase, the EPC contractor will designate an Environmental Inspector who will be responsible for environmental monitoring issues regarding the Project.

It is recommended that a formal annual audit of environmental and social performance is undertaken by an independent body.

Table 11-6: Monitoring Plan - Operation Phase

No.	Parameter to be monitored	Location	Measurement	Frequency	Institutional Responsibility	Cost (Birr)
1	Surface Water Quality	Upstream and downstream of the IAIP at 4 identified locations	Sampling and analysis Physical, chemical parameters	Monthly	IPDC/EMU	100,000 per year
2	Groundwater	Both up gradient and down gradient of the operations	Sampling and analysis Physical, chemical parameters	Quarterly	IPDC/EMU	100,000 per year
3	Air Quality	Sensitive receptors around the IAIP site	Observation and inspection / sampling and analysis	Quarterly	IPDC/EMU	200,000 per year
4	Noise	Sensitive receptors around the IAIP site	Portable sound level meter for measuring noise levels	Once a week and upon complaints	EPC Contractor, EMU	Equipment cost included in construction budget
5	Traffic	Access intersections at IAIP and RTC sites	Observation and reporting	Annual	IPDC/EMU	Covered in operation cost
6	Health and Safety	All work places	Visual inspection and reporting / Health and safety survey	Monthly	EMU	Covered in operation cost
7	Environmental Monitoring Coordination	-	Monitoring of the implementation and success of the mitigation measures Reporting on monitoring results, and compliance with relevant legislation,	Monitoring continuously and Reporting bi-annually	EMU	Covered in operation cost

No.	Parameter to be monitored	Location	Measurement	Frequency	Institutional Responsibility	Cost (Birr)
			contract and technical requirements			
8	Resettlement and Socioeconomic	Monitoring of the Resettlement Action Plan (for details see RAP Report)				

11.5 PUBLIC CONSULTATION AND DISSEMINATION OF INFORMATION

Public Consultation was initiated in 2015 by the IPDC during the initial phase of the Project and continued in 2016 and 2017. The public consultation has been conducted to ensure that the project has taken full account of the priority concerns of PAPs and other relevant stakeholders in order to make the IPDC (the project developer) aware about the potential adverse impacts of the project and concerns raised by the stakeholders.

The FDRE Constitution, Article 92, states that; "*People have the right to full consultation and to the expression of their views in the planning and implementation of environmental policies and projects that affect them directly*".

Public consultations were held as part of the ESIA process with Federal, Regional, Zonal, Woreda and local officials and institutions, PAPs, community elders, etc. with the following key objectives among others:

- To develop and maintain avenues of communication between the project and stakeholders in order to ensure that their views and concerns are incorporated into the ESIA and associated management plans, with the objectives of reducing or offsetting negative impacts and enhancing benefits from the project;
- To inform and discuss about the nature and scale of adverse impacts and to identify and prioritise the remedial measures for the impacts in a more transparent and direct manner;
- Include the attitudes of the community and officials who will be affected by the project so that their views and proposals are mainstreamed to formulate mitigation and benefit enhancement measures;
- Increase public awareness and understanding of the project, and ensure its acceptance; and
- To inform local authorities of the impacts and solicit their views on the project and discuss their share of the responsibility

The stakeholder consultation process undertaken as part of the ESIA is discussed in Chapter 7.

11.6 ORGANISATIONS AND INSTITUTIONS RESPONSIBLE FOR IMPLEMENTATION OF THE ESMP

11.6.1 INTER-ORGANISATIONAL COORDINATION

It is recognised that effective Environmental Management will only be achieved only if it is undertaken as a fully integrated part of the overall project management. In order to effectively implement a comprehensive environmental management plan, the coordination of efforts of the various Federal and Regional Agencies is necessary with a concept comprising three sub-components, namely:

- A clear framework of inter-organisational coordination measures;
- A specific information strategy; and
- A tailored capacity building program.

The key organisations for the implementation of the ESMP during the construction phase are the IPDC and EPC contractor. During the operation phase the IPDC is the major responsible agency. There are other government agencies which will have the responsibility for implementation of certain mitigation and monitoring activities and their activities will be coordinated by the IPDC.

The main responsible institutions for implementation, coordination and administration of the Environmental management plan set out in this ESMP is summarised in **Table 11-7**.

Table 11-7: Main responsible institutions for implementation of the ESMP

Organisation	Role	Construction	Operation	Responsibility in ESMP
IPDC	Project Developer and Agency responsible for operating the IAIP and RTC	✓	✓	Implementation of RAP Coordination with other agencies Monitoring During operation phase responsible for the IAIP and RTC
EPC Contractor	Construction activities	✓		Implementation of mitigation measures Monitoring (For the construction phases)
MEFCC	Agency responsible for monitoring / auditing of environmental pollution	✓	✓	Monitoring/ auditing for compliance with Federal and Regional Environmental Regulations
Ministry of Health and Regional Health Bureau	Agency responsible for public health	✓	✓	Monitoring public health
Ministry of Labour and Social Security	Agency responsible for occupational health	✓	✓	Monitoring / auditing
IPDC and Federal Government	Agency responsible for resettlement and construction of relocation sites	✓	✓	Implementation of RAP Monitoring of compensated families

11.6.2 IPDC ENVIRONMENTAL MONITORING UNIT

The main responsibilities of the Environmental Monitoring Unit (EMU) include:

- Review and approve of the environmental components of the EPC contractor's project plan.
- Ensure that mitigation measures, conditions and specifications are fully implemented during construction and resolving problems as encountered.
- Supervise restoration of construction area that was affected during construction period of the project to its natural state.
- Conducting periodic environmental monitoring during construction and operation phases.

- Monitoring proper implementation during resettlement and post resettlement of communities.
- Liaise with members of the public, local organizations, government and non-governmental organizations; and,
- Report results of mitigation and monitoring activities to the MEFCC, Regional Environmental offices and other relevant parties.

11.6.3 MINISTRY OF ENVIRNMENT FORESTY AND CLIMATE CHANGE

As per Proclamation 803/2013 (amendment), the Ministry of Environment, Forestry and Climate Change (MEFCC) has the powers and duties to:

- Coordinate measures to ensure that the environmental objectives provided under the Constitution and the basic principles set out in the Environmental Policy of Ethiopia are realised.
- Establish a system for environmental impact assessment of public and private projects, as well as social and economic development policies, strategies, laws and programmes.
- Establish a system for the evaluation of the environmental impact assessment of investment projects submitted by their respective proponents by the concerned sectorial licensing organ prior to granting a permission for their implementation in accordance with the Environmental Impact Assessment Proclamation.

Article 24(2) of the Industrial Park Proclamation No. 886/2014 requires the MEFCC to establish offices within the industrial parks for the application, supervision, protection and enforcement of environmental norms and standards, safeguards, management and mitigation plans within the industrial parks.

11.6.4 EPC CONTRACTOR

The EPC contractor will assign an Environmental Inspector during the construction phase. The Environmental Inspector is responsible to:

- Check compliance with recommended conditions in the contract, ESIA and ESMP;
- Review the effectiveness of mitigation measures for proper management of construction risks and uncertainties;
- Review the effectiveness of environmental management plan for the construction activities.
- Recommend modifying or halting construction activities, or developing appropriate mitigation measures in case of unpredicted adverse effects on the environment or if environmental monitoring determine construction works pose environmental concern;
- Identify and liaise to promote social integration and the development of mutually satisfactory solutions to problems affecting local communities; and
- Provide advice and assistance, as and when required, on aspects of environmental management.

11.7 REPORTING AND REVIEWING

11.7.1 GENERAL

The management measures identified in the ESMP concern actions to be taken in order to prevent, or mitigate, environmental or social impacts, or to enhance positive impacts. A system of reporting and auditing of the ESMP commitments is required to assess the degree of success in terms of implementation of the ESMP. This will apply to IPDC and the EPC Contractor.

The expected reports include:

- Site Environmental Management Plan,

- Site Inspection and
- Progress Reports.

Each of these organisations will provide monthly reports on the actions taken in the previous month to fulfil the ESMP. The IPDC will be able to draw on the reports it receives from the contractor and augments these reports with a report of its own performance.

A complete set up to handle and manage data and information generated from the management plan and other monitoring activities will be established. Therefore, the EMU shall maintain all necessary records related to environmental management and monitoring.

The MEFCC will be required to randomly verify the actual performance of the EPC Contractor and the EMU Team.

It is recommended that a formal annual audit of environmental and social performance be carried out by an independent entity.

11.7.2 RECORD KEEPING AND REPORTING

Records of significant environmental matters, including monitoring data, accidents and occupational illness, and spills, fires and other emergencies shall be maintained.

Recorded information shall be reviewed and evaluated to improve the effectiveness of the ESMP. An annual summary of the above information shall be provided to statutory authorities, if required.

11.8 PROJECT FEEDBACK ADJUSTMENT

11.8.1 PROJECT FEEDBACK

The monitoring programme will establish effective feedback mechanisms so that the performance and effectiveness of the various elements of the ESMP can be evaluated, and if necessary corrective actions can be implemented.

The monitoring results as well as the report on environmental performance and the occurrences of unforeseen circumstance may also be used to modify and reshape the project's construction methods and/or operation.

The ESMP is to be available at the project offices for all employees of the project.

11.8.2 AMENDING THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The ESMP has been developed with project knowledge and information available to-date. As project scheduling plans are developed and changed, and construction techniques determined, components of the ESMP might require amending.

The IPDC may periodically revise the ESMP in consultation with the EPC Contractor, and subject to approval from the MEFCC, to accommodate changes in work and site conditions.

11.8.3 CHANGE MANAGEMENT

The ESMP is a working document that changes during the life of the project. Therefore, in the event that compliance regarding environmental requirements is determined to be inadequate, or to address unforeseen or unexpected conditions, changes to project design, procedures, process or activities can be proposed at any time during the project. Should the environmental monitoring also determine construction works or operation pose an environmental concern, the works or operation will be

modified or changed to adopt mitigation measures to changing situations throughout the project construction and operation phases.

The EMU is responsible to ensure operations are conducted as recommended in the ESMP and in accordance with statutory requirements and recommends any necessary changes to the plan. The change management processes include the following:

- Identification of item/situations potentially requiring change;
- List and document the reason for making changes to ESMP;
- Preparation of change request document that:
  - outlines the nature of the item/situation requiring change,
  - outlines impacts of the change (cost, schedule, safety, operability, etc.), and
  - identifies potential biophysical, socio-economic or health concerns.
- Review of the proposed changes to ensure that environmental protection measures will be adopted and the proposal provides an acceptable level of impact control;
- Documentation of the approval or rejection of the change request;
- Implementation of the approved change, including communication to appropriate parties concerning the nature, scope and timing of the change; and
- Summary of project changes and status to be included in the monthly reports and the annual environmental status report.

When a procedure is amended to suit a particular type of environment, both the IPDC and the EPC contractor are responsible for managing changes within their respective areas of responsibility. The EPC contractor is responsible for ensuring that construction staff are aware of any changes to the ESMP and revised procedures.

11.9 CONTINGENCY PLANS

The IPDC is to develop a contingency plan which is designed to take account of a possible future events or circumstance including accidents, fires, hazardous spills, natural disasters that may affect the IAIP and RTC facilities.

The IPDC are to ensure that each facility develops a site specific contingency plan for each development with the parks.

These plans are to be reviewed and updated on an annual basis.

11.10 PROJECT GRIEVANCE AND REDRESS MECHANISM

11.10.1 OS REQUIREMENT ON GRMS

In OS 1, the AfDB requires the establishment of a "*credible, independent and empowered local grievance and redress mechanism to receive, facilitate and follow up on the resolution of the affected people's grievances and concerns regarding the environmental and social performance of the project. The local grievance mechanism needs to be sufficiently independent, empowered and accessible to the stakeholders at all times during project cycle and all responses to grievances shall be recorded and included in project supervision formats and reports*."

The aim of a project Grievance and Redress Mechanism (GRM) is therefore to enable people fearing or suffering adverse impacts to be able to be heard and assisted.

11.10.2 OBJECTIVES AND SCOPE OF A GRM

A project GRM is a systematic process for receiving, evaluating and facilitating resolution of affected people's project-related concerns, complaints and grievances about the borrower's/client's social and environmental performance on a project.

The GRM provides a structured and managed way of allowing the concerns of affected people to be heard and addressed.

11.10.3 DEVELOPING AND IMPLEMENTING A GRM

DEVELOPING A GRM

The process by which a complaint will be accepted or rejected needs to be carefully designed, and should maximise interactivity and cultural sensitivity. The acceptance/rejection of a complaint should go through a discussion stage where the plaintiff and the GRM staff interact on the grounds and motives of the complaint, after which the plaintiff should clearly and transparently be told whether or not the complaint is eligible and will be processed. It is best if the acceptance/rejection of the complaint is based on objective criteria that are posted by the GRM, including a written copy displayed in the public access area of the GRM in an appropriate language.

The processing of the complaint, if accepted should go through various phases:

- Filing of the complaint and labelling with an identification code, communicated immediately to the plaintiff.
- Assessment of the complaint (including severity of the risk/impact).
- Formulation of the response.
- Selection of the grievance resolution approach is key. There are four general approaches to choose from:
  - The project's management proposes a solution.
  - The community and the project's management decide together.
  - The project's management and the community defer to a third party to decide.
  - The project's management and the community utilise traditional or customary practices to reach a solution.

"*Decide together*" approaches are usually the most accessible, natural and unthreatening ways for communities and a project's management to resolve differences. With the potential to resolve perhaps the majority of all grievances, "*decide together*" should be the centrepiece of any grievance mechanism's resolution options.

The relevant GRM is to be developed in line with Section 7 of the Industrial Parks Council of Ministers Regulations No. 417/2017.

IMPLEMENTING A GRM

During project implementation, five steps may be required:

- Establish human resources and logistics.
- Introduce the GRM to project staff.
- Communicate with the local communities to build awareness.
- Train and support participants.
- Develop a monitoring programme.

An internal communication campaign among the key project staff should highlight that the function of the GRM is not to put blame on individuals or to identify mistakes and other errors, but rather that it

identifies the risk of unintended negative impacts so as to avoid them altogether or, at worst, to compensate for them if intervention/warning comes too late.

Effective communication also needs to be established with the community itself to explain that the GRM, what the goals and roles of the GRM are and how GRM intervention can or should be triggered.

This effort should follow these key principles:

- Develop simple, visually engaging marketing materials;
- Provide materials in an understandable format and language; and
- Use face-to-face, informal meetings in local communities.

Finally an important element of implementation is monitoring and reporting, including evaluating success and identifying need for improvement.

11.10.4 LOCAL COMMUNITIES

The IPDC and the EPC contractor should be prepared to respond to the communities, concerns related Project. A grievance mechanism is proposed to be established to receive and facilitate resolution of the affected communities concerns. Liaison groups significantly reduce the aggravation and hostility of locals to the IPDC and the EPC contractor and their staff.

During construction phase, it is recommended that a community Liaison group be established. Therefore, both the IPDC and the EPC contractor should assign the responsibility of liaising with local communities and local authorities to their respective Community Development and Liaison (CDL) Officer. The CDL will be permanently on site and will provide effective liaison to promote social integration, and the development of mutually satisfactory solutions to problems affecting local communities.

Regular interaction with local communities by the CDL will ensure that many problems are dealt with at an early stage and effectively. Both the IPDC and the EPC contractor's PRs will be available to deal with issues arising out of construction sites. Therefore, it is recommended that the CDL be allocated an office at both sites.

Any aggrieved local residents can bring their grievance to the IPDC or the EPC contractor at any reasonable time and the matter will be discussed and dealt with in appropriate manner. The grievances shall be addressed promptly, using an understandable and transparent process, which shall be readily accessible to all segments of the neighbouring communities.

Complaints shall be resolved through negotiations with the community. In the negotiation it is recommended to involve existing community institutions like the Kebeles and others community leaders.

Appropriate public addressing systems shall be used as well as other means to announce certain events, such as programmed hours of explosions (if applicable) during construction, hazardous activities for the people to be aware of, closure of roads for certain hours due to construction activities, etc.

This office will deal with the day-to-day information needs of the local people. Furthermore, provision of information regarding the project shall circulate to the local population through their leaders.

11.10.5 CONSTRUCTION WORKERS

The EPC contractor shall develop a grievance mechanism for workers and their organizations to raise reasonable workplace concerns. The mechanism will involve an appropriate level of management and address concerns promptly, using a transparent process.

11.11 TRAINING AND CAPACITY BUILDING

If the environmental management and monitoring programme is to be successfully implemented it is recommended that a various training be provided. In general, training should be composed of workshops, in-service training, and in-service formal courses.

11.11.1 IPDC

IN-SERVICE TRAINING AND TECHNICAL ASSISTANCE

The technical assistance will facilitate adequate on-the-job training and technology transfer, enabling the EMU staff to undertake their monitoring activities during the Construction and Operation Phases of the Project.

The Technical Assistance Project will have the following overall aims:

- to help the EMU to implement the core obligations with respect to the Environmental Measures, including the continuous review of the ESMP;
- to help the EMU to monitor all obligations with respect to the environmental measures;
- to provide on-the-job training to EMU staff as well as the employees of the consultants involved in various activities. They shall participate in environmental awareness training seminars and workshops This will help to build technical expertise in the environmental and social aspects of the Project;
- to assist the EMU to coordinate its work with other government authorities and non-government agencies concerned with the Environmental Objectives; and
- to instruct EMU staffs in the proper techniques of Project inspection, monitoring, use of field monitoring equipment, data analysis and reporting.

It is proposed that the training should be aimed at IPDC personnel and in particular, the staff members of the EMU. Training arrangements would need to be discussed in detail with the IPDC to establish precise objectives and requirements, so that the course content can be specifically targeted at real needs.

11.11.2 OTHER FEDERAL AND REGIONAL LEVEL AGENCIES

In an effort to strengthen institutional capacity and environmental awareness, seminars and workshops to be organised under this project should also be open for individuals from concerned ministries and agencies such as the MEFCC, Amhara's office of Environmental Protection, the Regional Bureau of Agriculture and Rural Development, Regional and Woreda level Environment departments, etc. The objectives of the seminar-workshops are to ensure environmental awareness, knowledge and skill for the implementation of this ESMP.

11.11.3 TRAINING CONSTRUCTION WORKERS

The foremen, operators, and work crews (including any subcontractors) will be trained so that they understand the specific environmental issues on the work site and their responsibilities. All personnel are to receive a brief environmental and safety training course.

LOCAL RECRUITMENT PLAN

Condition 28(1) of the Industrial Park Proclamation No. 886/2015 states that the Labour Proclamation No. 377/2003 (as amended) is applicable in any Industrial Park. Additional condition 28(4) indicates that the Ministry of Industry shall organise technical and vocational training programs in collaboration with the concern government entities and IPDC whenever necessary.

A Local Recruitment Plan is to be prepared for both the construction and operations phases, aimed at maximising employment opportunities for the PAPs and local communities and to manage expectations and the potential for influx into the area during the construction and operation phase of the Project. The Plan is to take into account vulnerable groups such as women, youth and Project PAPs.

The Plan is to include details for job training and capacity building prior to and during the construction and operation activities. The Plan is to also include procedural guidelines and a code of conduct concerning employment and workforce in order to encourage appropriate work ethics and behaviour. This is particularly important where employment opportunities will be realised by individuals outside of the Project area.

Finally, this Plan is to include an on-going communication strategy to clearly and consistently disclose information regarding employment opportunities and contracting procedures, with the idea of managing expectations of job opportunities, and therefore influx of workers. Key messages may include the number of positions available, the timeframe for employment availability, and an explanation of the contracting process.

Influx management will also involve a coordinated approach which key stakeholders with responsibility for issues related to influx, including governmental offices and agencies, NGOs, and local communities, where relevant.

HEALTH AND SAFETY PLAN

To address both occupational and community health and safety risks, a Health and Safety (H&S) Plan is to be prepared for both the construction and operations phases. It is to include a company policy, and measures included within are to comply with national laws and the AFDB ISS. Aspects to be covered in this Plan include:

- Health and safety training for all employees;
- Health and safety training on the use of chemical and hazardous materials;
- Provision of the appropriate Personal Protective Equipment (PPE);
- Traffic management plan and driver training;
- Accident prevention monitoring;
- Training in the use of all equipment;
- Safeguards of environmental pollution of water resources;
- Safeguards in hazardous materials handling and transportation;
- First Aid access and communications; and
- Emergency Response Procedures.

In addition, health education with regard to communicable diseases is to be undertaken as part of the induction training for workforce members. This is to include health education on sexually transmitted diseases (STDs) as well as diseases such as malaria.

Provision is to be made for education awareness of communicable diseases within the wider community. If possible, this is to be undertaken in collaboration with NGOs relevant to health care, and the local administration.

COMMITMENT TO WORKERS' RIGHTS

The Project needs to ensure its policy and procedural consistency with international standards related to workers' rights. This includes:

- Observing statutory requirements relating to minimum age for employment of children and meeting international standards of not employing any persons under the age of 14 for general work and no persons under the age of 18 for work involving hazardous activity.

- Ensuring acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work.
- Meeting international standards related to paying all wages, including bonuses and premium pay for overtime work, to all employees in a timely fashion and in a manner consistent with ILO Convention 95
- There should be clearly benchmarked payment schedules in the Contractors" contracts.
- Having Contractors commit that they will not take any action to prevent employees from exercising their right of association and their right to organise and bargain collectively.
- Ensuring no workers are charged fees to gain employment on the Project.
- Ensuring rigorous standards for occupational health and safety are in place.
- Having Contractors base employment decisions on principles of non-discrimination and equal opportunity, in particular fair and equal pay, especially for women carrying out the same work as men.
- Having Contractors establish a labour grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal. Access to labour grievance mechanisms needs to stress its relevance for both genders.

As emphasised above, these commitments need to be passed on to Contractors and Sub-contractors via main and subcontract clauses, and requirements to address them in management systems and work procedures.

PROJECT CODE OF CONDUCT

It is recommended that the Project establish a Code of Conduct for the labour force. The Code of Conduct recognises the provision of resources by the employer and shares responsibilities among the workers for the use of equipment, procedures and training. It aims to contribute to a harmonious relationship with local communities, to reduce behaviours that could lead to social conflict, and to prevent further environmental degradation.

Typical issues to be addressed would include:

- Proper use of PPE and other work equipment that has been provided;
- Discreet sexual behaviour that takes into consideration messages about HIV/AIDs sexually transmitted diseases;
- Restrictions related to consumption of alcohol and drugs;
- Respect for the local community and its cultural norms in which labourers are working; and
- Professional behaviour and integrity when dealing with the public.

12 CONCLUSIONS

This ESIA has been undertaken in accordance with Ethiopian Legislation and the African Development Bank (AfDB) Operating Safeguards. Chapter 1 of this ESIA includes Table 1-3 which provides a summary of the contents of each chapter that is required in order for the ESIA to meet the AfDB requirements.

The scoping stage of the ESIA identified the need to consider potential impacts during the construction and operational phases of the Project on: soils, surface water, ground water, air quality, climate change, noise, transport and access, waste management, visual impacts, biodiversity and socioeconomic on the functionality of the Project.

The majority of impacts were assessed to be of minor negative significance with mitigation. The major and moderate residual negative effects of the project arise from the risk of soil erosion, sedimentation, soil compaction, ground water contamination and degradation of noise climate during construction. These impacts are anticipated to occur during the construction period but most will be removed during operation all will be removed with the exception of sedimentation and groundwater contamination. Both sedimentation and groundwater contamination remain risks throughout the life of the project. Ongoing monitoring of surface and groundwater will ensure these impacts are identified in a timely manner and dealt with immediately if they occur. Therefore these impacts are deemed appropriate for the size and extend of the project proposed and are accepted impacts of construction which if managed well can be minimised. The remaining moderate impact relates to loss of access to agricultural land plots and in some cases, loss of residential buildings and other assets (crops). These impacts have occurred as a result of the proposed site supporting existing agricultural practices. These impacts are being mitigated through payment of compensation, access to training and reallocation of land. The Amhara Resettlement Action Plan (RAP) deals with these issues and others and will be a live document that will be implemented post authorisation. In addition the Stakeholder Engagement Plan (**Appendix B-1**) contains a summary of consultation completed to date as well as the consultation that should occur into the Project Execution phase.

The major negative impacts identified relate to change in surface profile, land use and land capability. These impacts are expected and irreversible following development but are considered acceptable consequences of a transformation project such as this. In addition, the anticipated significant negative impact identified in relation to the potential lack of jobs in the even that the IAIP is decommissioned, highlights the value the employment opportunities being offered by this project are to the economy and the local communities. There will be a negative impact on the livelihoods of the local community gaining employment from the facility.

The major and moderate residual positive effects of the project arise from the revegetation of indigenous plant specialist in the buffer and greenery areas and an increase in employment opportunities and demand for goods and services in the region. In addition, there is a further positive impact associated with the IAIP and that relates to sense of place. Overall the community consultation process undertaken as part of this ESIA has shown an overwhelming support of the Amhara Regional project even by the project affected people. The community believe that a development of this scale and magnitude, offering large employment opportunities will uplift the whole community and make Bure Town a destination. The visual impact of the park is seen as positive, representing progression and advancement in the agricultural sector through industrialisation.

A number of measures have been identified as necessary to minimize and control the risk of erosion and water pollution to surrounding farming activities. Water use and pollution would need to be monitored in the future to limit residual effects on other water users and aquatic ecosystems.

The proposed Amhara Project, including the Bure IAIP and Motta RTC, will result in 369 individual parties being affected by the proposed development, including:

- 31 individuals whose residential properties will need to be moved (physical displacement),
- 2 Government entities' offices will also need to be moved (physical displacement),

- 263 individuals whose by-product and main season crops are going to be lost due to land take by the project (economic displacement),
- 35 individuals whose eucalyptus trees will be affected (economic displacement),
- 26 individuals whose high intensity/irrigated crops are going to be affected (economic displacement), and
- 3 individuals whose perennial crops will be affected (economic displacement).
- Additionally, 9 individuals were by mistake omitted by the local government officials from the PAPs list and had been added to the list with full compensation for their affected crops (economic displacement).

Resettlement Action Plan has been developed as part of the Project, which focuses on displacement issues in more detail.

The project also has a number of broader benefits that have been identified, mainly associated with economic well-being of the local community. The industrialisation of the agricultural sector provides employment transition opportunities for farmers and their children. The Bure IAIP and Motta RTC would increase incomes, provide greater food security and more employment opportunities.

It must be noted that during this ESIA process, construction works for the boundary wall had already commenced and therefore some of the impacts included in this report include impacts from existing construction activities. Commencement of construction without receiving an environmental certificate does not follow the traditional environmental certificate process and this issue should be looked into by IPDC.

Key significant changes to the design which occurred as a result of the ESIA relate to the protection and retention of the eastern drainage line which crosses the site in a north to south direction. The revised Masterplan incorporates this natural feature into the design and provides a suitable buffer to allow this area to maintain its ecosystem processes. Furthermore, through consultation discussions were held around the segregation of the primary access route for communities located to the south of the identified site to get to Bure. The IPDC is providing an access road to service the community's needs, see Chapter 4.

The Stakeholder Engagement process as part of the Project has been summarised in Chapter 7 of this ESIA and the Stakeholder Engagement Plan is included as **Appendix B-1**. The Stakeholder Engagement built on the existing work done by the local authority and has further established links with representatives for stakeholder groups; facilitated data collection; identified concerns and opportunities.

An Environment and Social Management Plan (ESMP) has been developed. The ESMP represents Amhara Industrial Parks Development Corporation's commitment to address and manage the potential negative and positive impacts associated with the Bure IAIP and Motta RTC projects. The key intent of the ESMP is to ensure that the environmental and social objectives of the project are met and it is based on the various components of the Project throughout design, construction and operational phases. The ESIA has not identified any fatal flaws which would restrict the development of the proposed Amhara IAIP and RTC.

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APPENDIX

A MEFCC LICENCE FOR ZGEC

APPENDIX

B STAKEHOLDER CONSULTATION

APPENDIX

B-1 *STAKEHOLDER ENGAGEMENT PLAN*

APPENDIX

B-2 *BACKGROUND INFORMATION DOCUMENT*

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C SPECIALIST REPORTS

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C-12 *SOCIO-ECONOMIC*

APPENDIX

D ESIA CONSOLIDATED IMPACT SIGNIFICANT MATRIX

APPENDIX

E AIR QUALITY MITIGATION RECOMMENDATION TABLES AS PER THE ESMP

APPENDIX

E-1 *RECOMMENDED MITIGATION MEASURES FOR GENERAL CONSTRUCTION*

APPENDIX

E-2 *RECOMMENDATIONS TO REDUCE EMISSIONS DURING THE OPERATIONAL PHASE*

APPENDIX