Golomoti ESIA Baseline Field Investigations
Field work report
May 01, 2019

1. INTRODUCTION

JCM Power intends to construct a 20 to 40 megawatt (MW) solar power plant with the option of an energy storage system in the Republic of Malawi. Prior to the commencement of the solar power plant, an Environmental and Social Impact Assessment (ESIA) has to be conducted, as part of a feasibility study, which is being prepared by Power Engineers.

The overall aim of the ESIA is to assess the environmental and social impacts of the proposed project activities; and to develop an environmental and social management plan (ESMP) for enhancing or mitigating the potential positive and negative impacts respectively.

As part of the ESIA a household survey was conducted with the Project Affected Persons (PAPs) and Non PAPs, to gather information on social and economic conditions of the area. The survey covered the areas of agriculture, health, education and income sources, among others.

2. PROJECT AREA

The project will be implemented in Dedza District, in Traditional Authority Kachindamoto. The project area is less than 1 km from Golomoti Trading centre and can be accessed using the M5 road (Salima to Balaka road).

3. METHODOLOGY

According to the Scope Of Work (SOW) document, the project footprint is anticipated to affect land controlled or under use by approximately 135-160 people. Hence, the average between the numbers was considered as the total number of PAPs to be interviewed [(135+160)/2=148 people], this number was rounded up to 150 PAPs. The median was also computed based on the total of 160 people. This median was considered as the approximate maximum number of people to be affected by the project.

As the survey aims at establishing the social and economic status of the area, 20 percent of the 150 PAPs was surveyed as a control. Controls receive no intervention and are used to compare groups and assess the effect of intervention. Therefore, 30 Non-Project Affected Persons (Non PAPs) were interviewed as a control. To minimise the potential of the occurrence of data bias and the collection of non-representative data, the Non PAPs were selected randomly. This was achieved by placing a spacer of 3 households between one household and the next one to be interviewed.

Training enumerators for this survey was conducted on the 27th March 2019 and the household survey was conducted from the 28th March to 1st April 2019. The interviews were done as follows:

Table 1: Number of interviews done per day

Date	Number of interviews	Number of PAPs	Number of Non PAPs
28/03/2019	5	0	5
29/03/2019	29	24	5
30/03/2019	53	42	11
31/03/2019	59	57	2
1/3/2019	35	28	7
Total	181	151	30

4. ISSUES AND OBSERVATIONS

4.1. General observations

- The project area was not cultivated during the 2017/2018 growing season. The community claimed that they were told not to cultivate because the project was soon to be implemented. As a result, food insecurity was experienced by some of the community members, as the did not have alternative land to be utilized for farming.
- Land scarcity is a problem in the community. Hence, some of the PAPs complained that it will be hard for them to secure replacement land in the same village.
- From the field discussions, it was observed that people are expecting to receive high compensation amounts. This is likely the result of the close proximity between Salima and Dedza towns. Hence, sharing of prices between residents of the towns and the project site.

4.2. Agricultural observations

- Both animal and crop husbandry activities are performed in the community. Most of the people depend on farming as a source of income. However, agricultural seems to face challenges because of drought and lack of farm inputs, despite the households having reasonable land sizes. Charts 1 and 2 graphically illustrate the significance of farming as an income generating occupation.

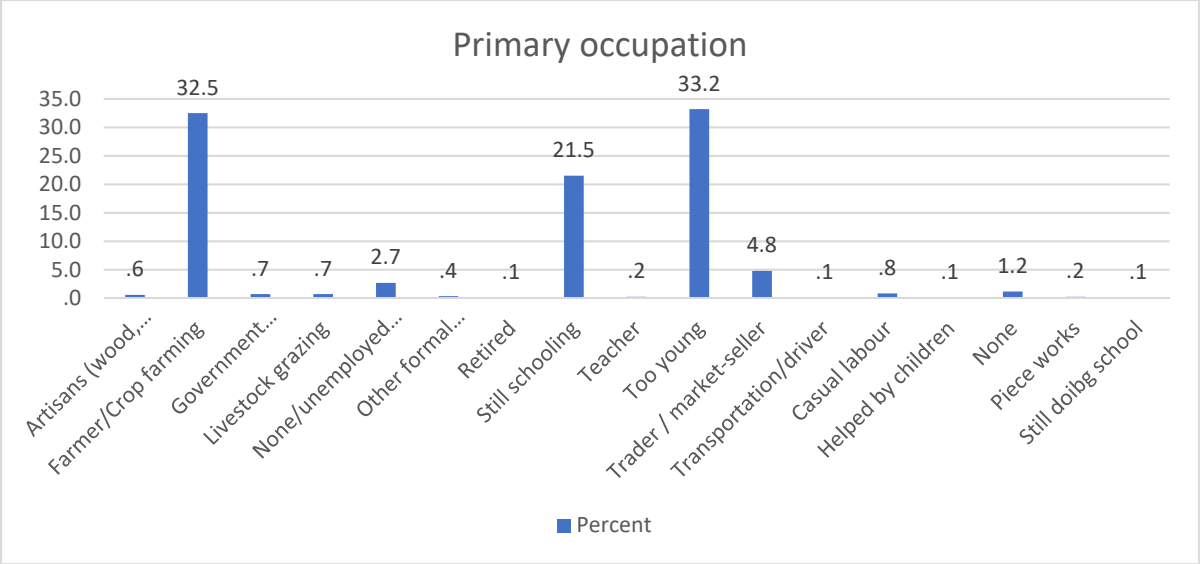


Chart 1: Primary Occupation

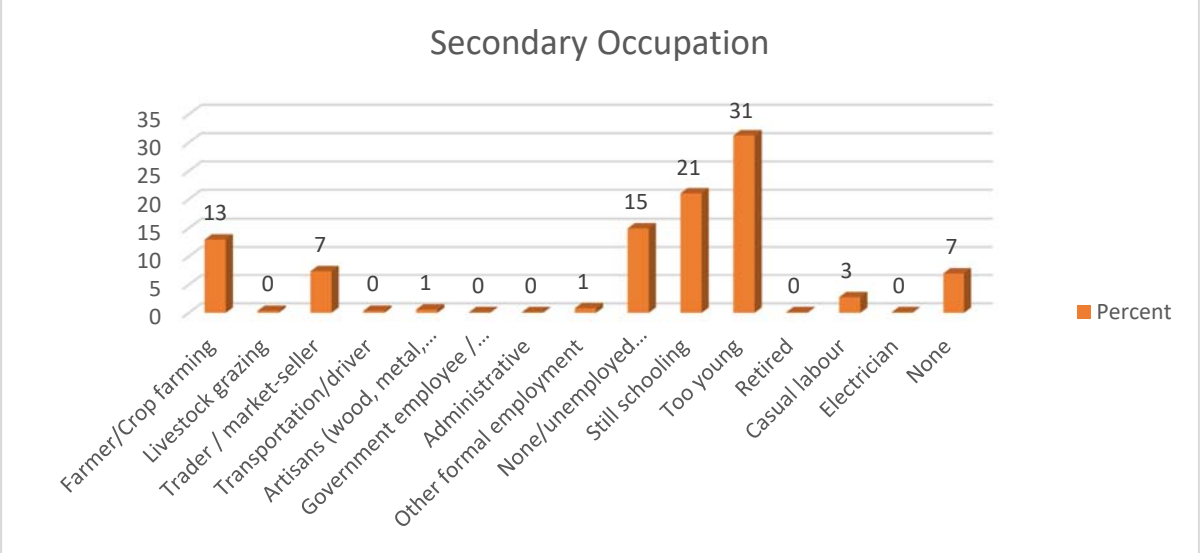


Chart 2: Secondary Occupation

- Maize, cowpeas, pigeon peas, groundnuts, finger millet, okra, watermelon, and pumpkins are some of the crops that were observed at the project area (Chart 3). Cow peas, groundnuts and cotton are mainly grown as cash crops.

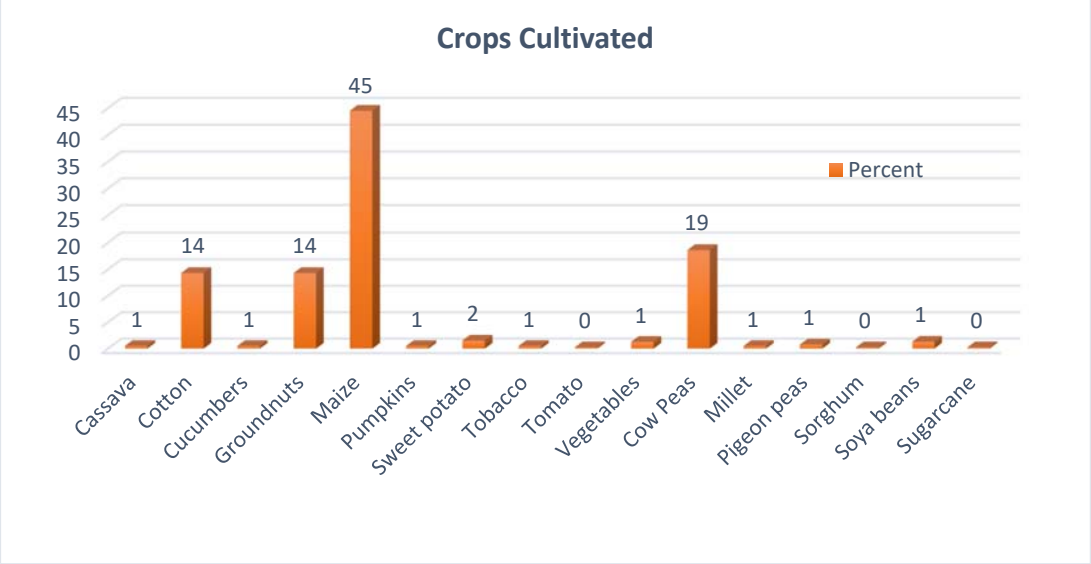


Chart 3: Crops Cultivated

- Cattle, goats, poultry and pigs are livestock that were observed in the project area. Livestock production is mostly affected by diseases such as new castle. The area has a community land that is used for livestock grazing.

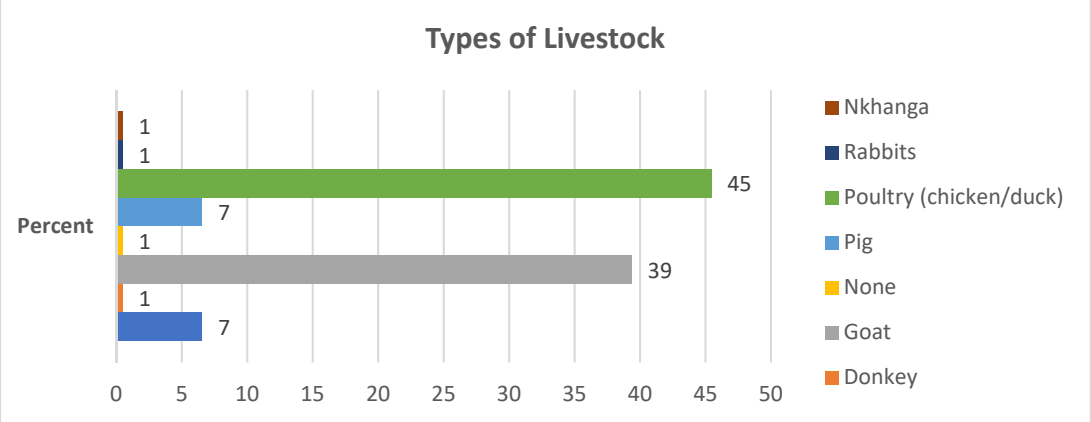


Chart 4: Types of Livestock

4.3. Housing and livelihood

- There is a variety of housing structures in the community. Burnt as well as unburnt bricks, bamboos and soil are some of the materials utilized for the construction of walls. The main floor types for the structures in the community are mud and cement. Roofing materials for the majority of the structures are grass and iron sheets. Charts 5, 6 and 7 illustrate the main building materials used in the community.

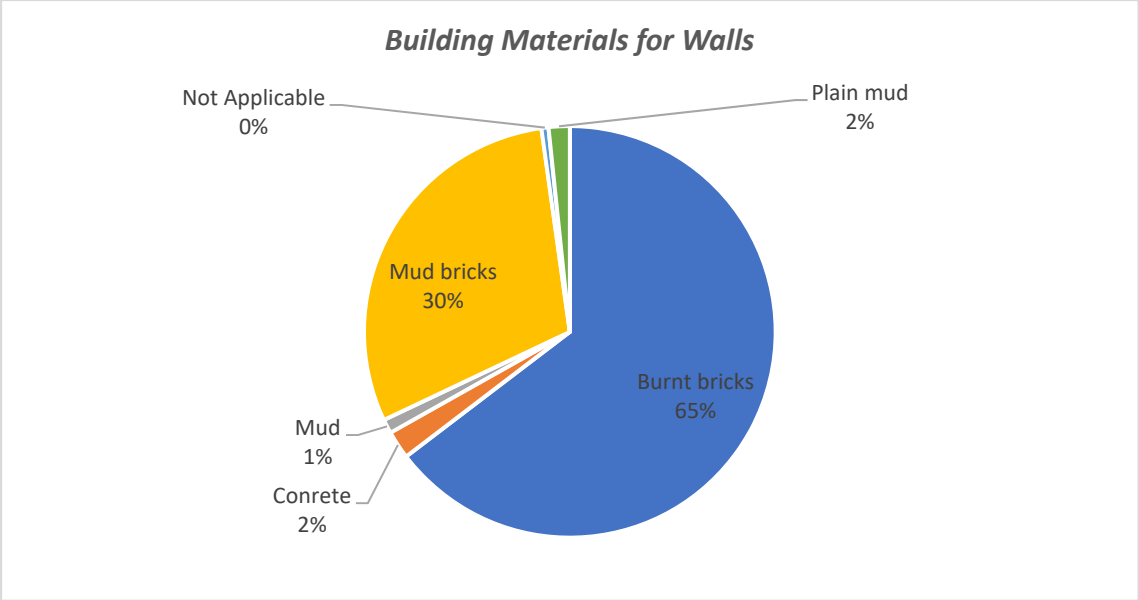


Chart 5: Building Materials for Walls

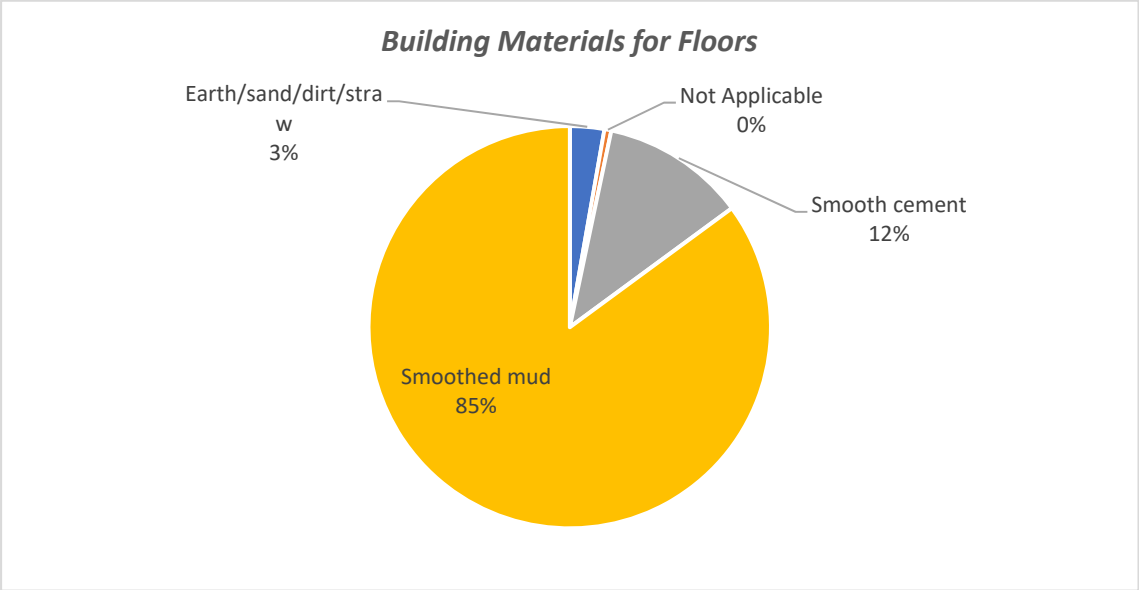


Chart 6: Building Materials for Floors

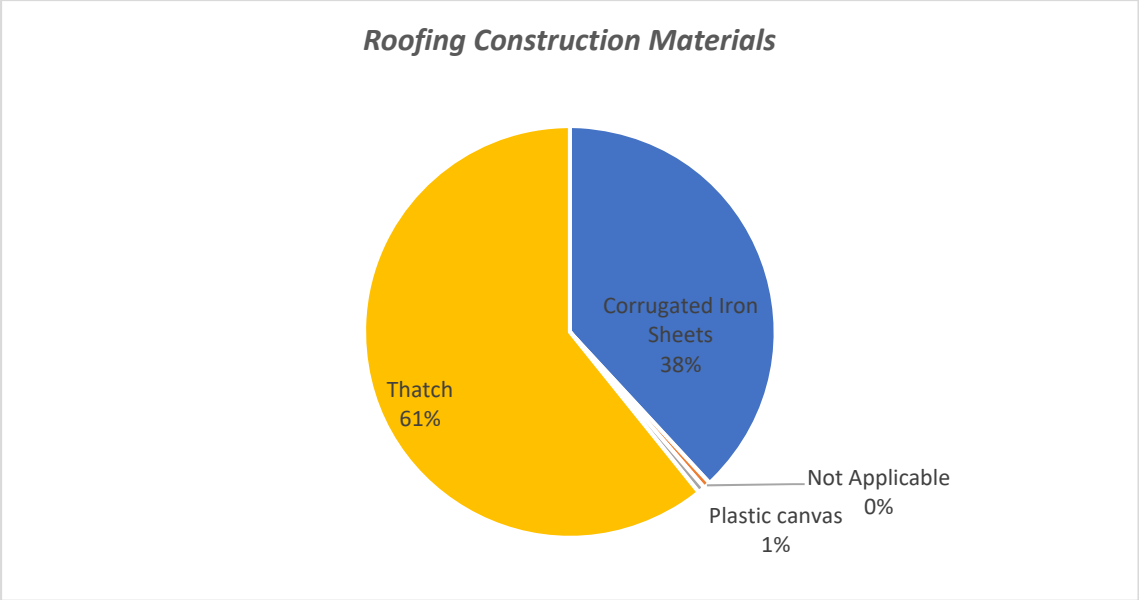
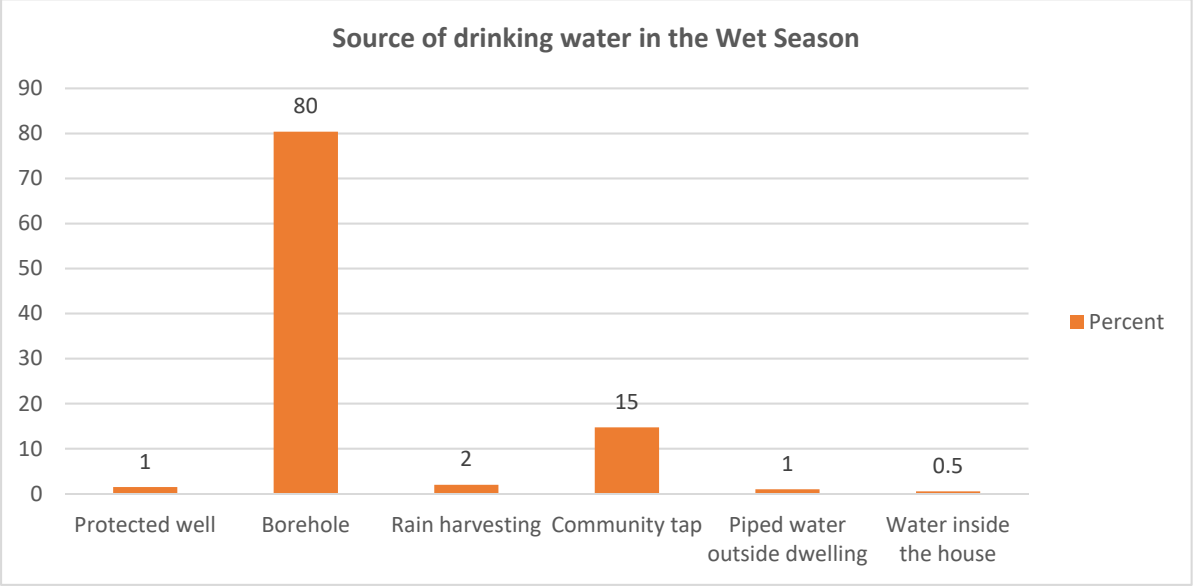


Chart 7: Roofing Construction Materials

4.4. Water and health

- It was also observed that there are few boreholes in the project area and as such the waiting times are long; This is the overwhelming reason most respondents reported water supply as an issue. On average the waiting time is about 30 minutes, but it goes up to 2 hours during the dry season, as the water levels drop, contributing to water shortages. Boreholes are the main source of water supply, regardless of the season (wet and dry).



- Chart 8: Source of drinking water in the Wet Season.

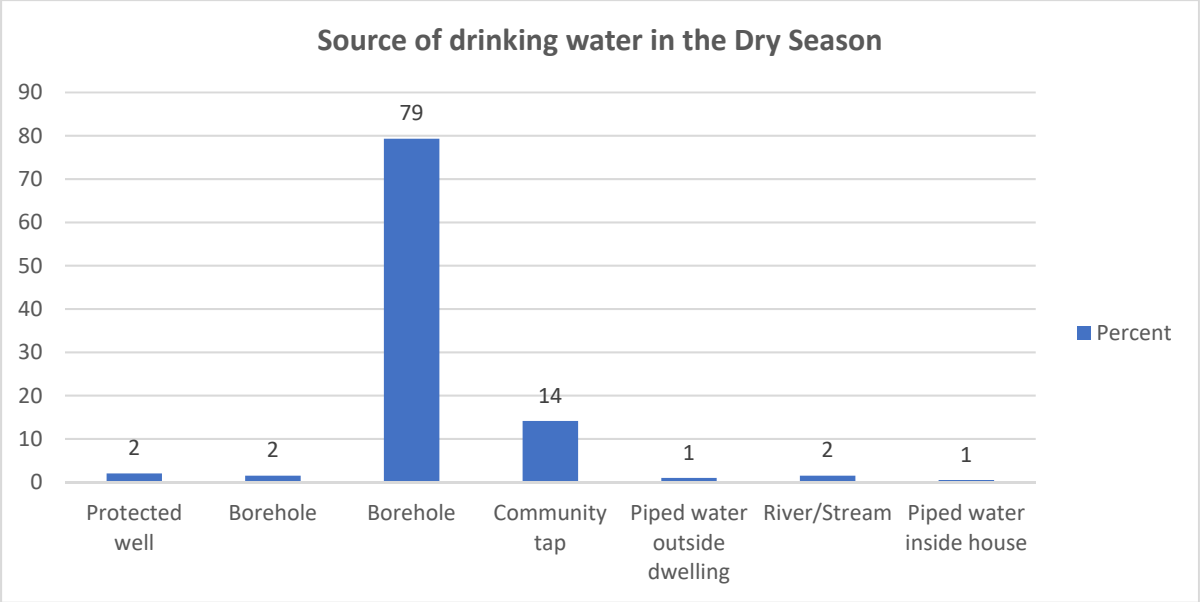


Chart 9: Source of drinking water in the Dry Season

Chart 10: Water Supply Challenges

5. CHALLENGES

- Some people were not very conversant with the project area as such it was difficult to identify them as PAPs or Non PAPs.
- Some of the project affected people stay away from the village which forced the personnel conducting the surveys to travel long distances in effort to locate them.
- Everyone within the community expected to be interviewed even those that were not sure if they were PAPs or not. In addition, some wanted more than one person to be interviewed within the same household.

6. CONCLUSION

In conclusion, the exercise would be considered a success as data of interest was retrieved from the households without any significant hurdles thanks to the cooperation and engagement of the parties involved. The community members are in favour of the project, and expressed how they were excited with the local and national gains from an infrastructure improvement project like this, especially since it is in the energy generation sector which is currently inadequate to meet demands in Malawi. Respondents also expressed that they were looking forward to being compensated for land lost/disturbed in order to purchase replacement land.

7. Appendix

Teams that conducted the household surveys

Name	**Qualifications**
Prisca Malenga	Degree Environmental science (Field Supervisor)
Alinafe Manjawira	Degree Agricultural Education (Research Assistant)
Chilimbikitso Kawinga	Degree Agricultural Economics (Data Manager)
Mphatso Zimba	Degree Social Studies (Research Assistant)
Arthur Baluwa	Degree in biometrics-pending (Research assistant)
Chifundo Kasowa	Diploma in ICT (Research assistant)

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1. INTRODUCTION

1.1 Background

More than 98 percent of Malawi's electricity is provided from hydropower. Electricity Supply Corporation of Malawi (ESCOM) is the national utility company charged with the responsibility for transmission and distribution of electricity to consumers throughout the country. It is also responsible for maintenance of the sector assets and planning for system expansion to meet growing demand for electricity in the country.

Currently, the Malawi's installed electricity generation capacity, which is produced by Energy Generation Company (Malawi) Limited (EGENCO) is approximately 287 megawatts (MW), of which only about 267 MW is available. In contrast, the estimated demand is approximately 325 MW. With a projected peak demand of 757 MW by 2020, hence electricity generation capacity needs to increase at an average annual growth rate of 10 percent (ICF International, 2010).

To address the current power supply challenges, the Republic of Malawi ("Malawi") is inviting power independent producers, to invest in the power sector, as one way of increasing power generation to meet the projected demand. In this regard, JCM Solar Corporation Limited, a subsidiary of JCM Power, proposes to construct a 20 to 40 MW Solar Power Plant on a 90.605 hectare (ha). piece of land located approximately 0.5 km from the Golomoti ESCOM Substation and less than 1 km from Golomoti Trading Centre in Dedza District, within Traditional Authority (TA) Kachindamoto. The proposed project will help improve accessibility and availability of electricity in the country, to contribute to meeting the high demand currently at over 325 MW.

1.2 Aims of This Report

The aims of this report are to:

- *assess and collect biodiversity baseline data for the Project Site.* This was aimed at assessing and identifying species of flora, mammals, birds, reptiles, amphibians and habitats; and/or vegetation cover types of the project site, against which the likely project impacts can be evaluated and future changes compared;

- *assess and collect baseline data for the Priority Ecosystem Services of the Project Site.* This included assessment of priority ecosystem services, regulating ecosystem services, supporting ecosystem services and cultural ecosystem services that maintain healthy functioning of the ecosystems and/or habitats of the Project Site and support livelihoods for local communities living around the Project Site and beyond;

- *assess potential impacts of the proposed project.* This included assessment and identification of the likely impacts of the proposed project on biodiversity and ecosystem services; in terms of their geographical extent, duration, severity, probability of occurrence and overall significance; and

- *determine mitigation measures for the potential impacts.* This entailed proposing practical measures (for mitigating the adverse impacts; and enhancing positive impacts where appropriate, of the proposed project on biodiversity and ecosystem services) to avoid and/or minimize loss of the biodiversity species and priority ecosystem services found on the Project Site and surrounding areas.

2. RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK

2.1 International Framework

2.1.1 Agenda 21 of 1992

Malawi is signatory to agenda 21, which came into force in 1992,which provides a policy framework and action plan for sustainable development at global, national and regional levels. Local agenda 21 entails participation and co-operation of local authorities to develop their own Local Agenda 21 plans and strategies according to the region's available specific priorities and resources. The Department of Environmental Affairs (EAD) developed the National Biodiversity Strategy and Action Plan, which provides a national framework, for sustainable development (EAD, 2006). The framework includes significant changes to land tenure, including granting full statutory recognition to customary land as free simple customary estate, registered and available for disposition under market conditions.

2.1.2 Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1982

Malawi has been a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which was enacted in 1982. The aim of the convention is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The convention also prohibits or restricts the commercial hunting of a number of animals such as the Nile Crocodile, Leopard, Elephant and Lion. Malawi has 127 species of fauna, some of which are listed under CITES, in either Appendices I, II or III). Some relevant species of fauna in the project area are all owl species, and Rock and Nile monitors. However, none of these species were recorded from the Project area.

2.1.3 Conservation of Migratory Species of Wild Animals, 1983

Malawi has been a signatory to the Convention of Migratory Species of Wild Animals (also known as the CMS or Bonn Convention), which came into force in 1983. This is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme that aims to conserve terrestrial, marine and avian migratory species throughout their range. Relevant mammals are Schreiber's Long-fringed bat and Straw coloured Fruit Bat; and relevant birds which include the Red-footed Falcon, Amur Falcon, Lesser Kestrel, Rufous-bellied Heron, Stork species, African Sacred Ibis, African Spoonbill, Common Quail, Corncrake, Black-winged Pratincole, all migratory wanders (sandpipers, plovers, etc), European Bee-eater and European Roller. Malawi is also a signatory to the Agreement on the Convention of African-Eurasian Migratory Waterbirds, which is a multilateral agreement for the conservation of migratory birds that are ecologically dependent on wetlands in Africa and Eurasia.

2.1.4 Convention on Biological Diversity, 1992

The Convention on Biological Diversity came into force in 1992. The main aim of this convention is to conserve biodiversity and use its products in ways that are both sustainable and equitable. An underlying principle of this convention is that states have sovereign rights to exploit their own resources. However, activities within a country

should not cause damage to their environments and those of other states. Article 8 states that *"Each Contracting party shall, as far as possible and as appropriate:*

> *(a) regulate or manage biological resources important for conservation of biological diversity, whether within or outside protected areas, with a view to ensuring their conservation and sustainable use; and*
>
> *(b) rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies.*

2.1.5 The Ramsar Convention on Wetlands, 1991

The Ramsar Convention on Wetlands came into force in 1991. Malawi has Lake Chilwa is presently designated as a Wetland site of International Importance in Malawi. However, contracting parties to the convention accept general obligations relating to the conservation and wise use of all wetlands throughout their territory. Broad aims of the convention are to stem the loss of wetlands, to ensure their conservation and wise use; and to promote special protection of listed wetlands.

2.1.6 International and Regional Conventions Ratified by the Government of Malawi

Malawi has either ratified or is a signatory to a number of international and regional conventions and treaties, which aim to protect the environment by contrilling pollution and protecting wildlife and natural resources. Table 1-1 lists the international conventions and treaties relevant to the proposed project, which Malawi has ratified and/or accepted:

Table 1-1. Relevant international conventions and treaties Malawi ratified and/or accepted

Stockholm Convention on Persistent Organic pollutants	2001
Kyoto Protocol to the United Nations Framework Convention on Climate Change (Ratified)	1997
Convention on Biological Diversity (Ratified)	1992
Convention on International Trade in Endangered Species of Wild Fauna and Flora «CITES» (Ratified)	1973
Convention relating to Wetlands of International Importance Especially as Waterfowl Habitat «RAMSAR Convention» (Ratified)	1971
African Convention on Conservation of Nature and Natural Resources (Ratified)	1968
Convention on Conservation of Wildlife Migratory Species (CMS) (Ratified)	2003
African Convention on the Conservation of Nature and Natural Resources (Accepted)	1973
Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (Ratified)	1994

2.2 National Framework

2.2.1 The Constitution of the Republic of Malawi, 1995

The Constitution of the Republic of Malawi provides a foundation for environmental management in Malawi. Section 13 (d) provides the principles of environmental management as to manage the environment responsibly in order to:

- prevent degradation of the environment;
- provide a healthy living and working environment for the people of Malawi;
- accord full recognition to the rights of future generations, by means of environmental protection and sustainable development of natural resources; and
- conserve and enhance the biodiversity of Malawi.

This implies that all activities undertaken in Malawi, including the construction of the solar power plant and the short transmission line for this project, must conform to these principles of environmental management as set out in the Constitution of the Republic of Malawi, to promote environmental sustainability and conservation of biological resources for the benefit of the present and future generations.

2.2.2 National Environmental Policy, 2004

The overall policy goal of the National Environmental Policy is to promote sustainable social and economic development, through sound management of the environment and natural resources. The specific policy goals include to:

(a) secure for all persons now and in the future, an environment suitable for the health and well-being of the people;
(b) promote sustainable utilization and management of the country's natural resources and encourage, where appropriate, long term self-sufficiency in food, fuelwood and other energy requirements; and
(c) promote ecosystems management approach to ensure sustainable environment and natural resources management.

Construction of the solar power plant and the transmission line must therefore, integrate the principles of this environmental policy into the project's activities; so that the project is implemented in an environmentally responsible manner, with the participation of all stakeholders. Trade-offs between economic development and environmental degradation can be minimized through this Environmental and Social Impact Assessment (ESIA) and environmental management and monitoring plans.

2.2.3 National Forestry Policy, 2016

This policy aims at promoting sustainable contribution of national forests, woodlands and trees towards the improvement of the quality of life in the country, by conserving the resources for the benefit of the nation and to the satisfaction of diverse and changing needs of Malawi population, particularly rural households. The policy further prohibits destruction of a list of protected species, which are gradually becoming rare; and prevents changes in land-uses, which promote deforestation, constrain farm forestry or endanger the protection of forests

with cultural, biodiversity or water catchment conservation values. It also discourages excisions in gazetted forests, except for purposes of developing environmentally friendly public utilities. It advocates environmental impact assessment where actions are likely to have significant adverse impacts on important forests and forest resources; and where such actions are subject to the decision of a compete authority.

Construction of the solar power plant and the transmission line shall conform to the principles of the National Forestry Policy, to ensure that forest resources that are found in the adjacent areas are protected; and that for every one tree to be cut down from the project site, five trees of the same species are planted in the vicinity of the project site. The project developer shall also ensure that wildlife species are safeguarded against poaching during construction and operation of the project.

2.2.4 National Parks and Wildlife Policy, 2000

The National Parks and Wildlife Policy advocates sustainable conservation and management of wildlife resources; and the sharing of benefits arising from use of the resources for both present and future generations. One of the policy objectives is to ensure adequate protection of ecosystems and their biological diversity, through promotion and adoption of appropriate practices that adhere to the principles of sustainable development.

The aim of the National Parks and Wildlife Policy is to ensure proper conservation and management of wildlife resources, to provide for sustainable utilization and equitable access to the resources; and the sharing of benefits arising from the use of the resources for both present and future generations. One of the policy objectives is to ensure adequate protection of ecosystems and their biological diversity, through promotion and adoption of appropriate land management practices that adhere to the principles of sustainable use.

The policy recognizes the Poverty Alleviation Program and any efforts that target eradication of poverty so as to remove poverty driven pressures on protected areas and wildlife reserves (Chapter 2, sub section (ix)). It empowers communities to manage wildlife resources on communal land, to support the management of national parks, wildlife and forest reserves and to be involved at all stages of project planning and implementation (Sub section 3.2).

The proposed project may affect habitats for some wildlife such as terrestrial birds, reptiles and amphibians that occur on the project site. Implementation of the proposed project should, therefore, adhere to the National Parks and Wildlife Policy to ensure that the project implementation protects wildlife resources that are found in the proposed project site.

2.2.5 The Malawi Growth and Development Strategy III (MGDS III), 2017-2022

The strategy recognises that the environment plays a very significant role in influencing social and economic development at both household and national levels. The success of many important sectors of the economy relies on environment and natural resources to enhance their productivity. Degradation of the environment and natural resources continues to be a major threat to the social and economic development of Malawi. This degradation includes deforestation, decreasing soil fertility and increasing erosion, water depletion, loss of biodiversity, increasing pollution and increased vulnerability to climate change. It is therefore, imperative that the environment and natural resources are sustainably managed by:

- promoting integrated afforestation for wood fuel, fruit production, windbreak and shade, timber and poles at household and community level to address wood fuel shortage and curb encroachment into reserves
- promoting environmental education, awareness and information sharing among stakeholders;
- increasing participation of the public in environmental management programs;
- enhancing community based natural resource management;
- conserving and sustainably use of water resources such as lakes, rivers and wetlands;
- enhancing biological diversity;
- promoting research, planning, monitoring and evaluation of Environmental and Natural Resources Management (ENRM) programs;
- enforcing Environmental and Social Impact Assessment (ESIA) and other related environmental laws;
- enhancing trans-boundary initiatives in environmental and natural resources programmes; and
- strengthening compliance on pollution control and waste management.

Construction of the proposed solar power plant, as well as the transmission line will have negative impact with regards to the aims of the MGDS III. Therefore, implementation of the proposed project should ensure that the environment and biodiversity of the project site and the surrounding environs are effectively protected for the sustainability of the project and the environment.

2.2.6 National Biodiversity Strategy and Action Plan II (2015-2025)

The goal of the National Biodiversity and Strategy Action Plan II (2015-2025) is to enhance conservation and sustainable use of biodiversity for the environment and human well-being. This goal will be achieved through the following specific strategic objectives aimed to:

a) improve capacity and knowledge on biodiversity issues;
b) mainstream biodiversity management into sectoral and local development plans;
c) reduce direct pressures on biodiversity; d) Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity; and
d) enhance access and benefits sharing from biodiversity and ecosystem services.

The following principles guide this strategy: a) Conservation of biodiversity is a form of natural resource management whose primary goal is to meet the needs and aspirations of both present and future generations; b) Biodiversity has an intrinsic value and is vital for agricultural, medicinal, scientific, research, tourism and other socioeconomic development; c) Every person in Malawi has the responsibility to fully participate and contribute to conservation and sustainable use of biodiversity; d) As custodians and users of biodiversity, local communities have knowledge, skills and information that can be utilized to promote sustainable management of biodiversity; e) Coordination among various stakeholders at all levels ensures successful conservation and sustainable use of the country's biodiversity; f) International, regional and national cooperation, including sharing of information and appropriate technology, is crucial for the conservation of biodiversity; g) Conservation of biodiversity is best done following the landscape and/or ecosystems approach; h) The Government is responsible for providing direction and leadership in biodiversity management in Malawi; i) Strategic and effective decision-making on conservation and sustainable use is possible when individuals and policy makers have a better understanding and appreciation of biodiversity.

Therefore, proposed project should adhere to the National Biodiversity Strategy and Action Plan II to ensure that the project activities do not cause negative impacts on biodiversity species and ensure that deliberate efforts are put in place to enhance biodiversity conservation in the project area.

2.3 National Legal Framework Relevant for this Project

2.3.1 Environment Management Act, 1996

The Environment Management Act (EMA) (No. 23 of 1996) aims to promote a clean environment and ensure the protection, management, conservation and sustainable use of natural resources in Malawi. Part IV of this Act outlines the purpose and requirements for national and district environmental action plans. The national targets for 2010 included the following, *inter alia,* to*:*

- increase the number and distribution of rare and threatened species and discourage their commercial use;
- develop programs related to invasive species;
- promote sustainable use of forest and aquatic resources;
- promote community participation, public awareness and capacity building (government and private sector), and
- promote awareness of the importance of biological diversity in economic development and livelihood of the people.

Section 24 of the Act outlines the Environm,ental Impact Assessment (EIA) processes to be followed in Malawi and requires that all project developers in both the public and private sectors comply with the process. The Act, under section 26 (3), further requires that no licensing authority issues any license for a project which an EIA is required, unless the Environmental Affairs Department (EAD) has given consent to proceed due to completion and approval of a satisfactory EIA or due to non-requirement of an EIA.

The Act prescribes the projects or activities that cannot be implemented without an EIA and these activities are outlined in the EIA Guidelines for Malawi (Government of Malawi, 1997). In line with the prescribed activities, the construction of the proposed solar power plant and the associated structures falls under the list of prescribed projects that require an EIA before implementation.

2.3.2 National Forestry Act, 1997

The purpose of the National Forestry Act (No. 4 of 1997) is, *inter alia,* to:

- identify and manage areas of permanent forest cover as protection or production forest in order to maintain environmental sustainability, to prevent resource degradation and to increase social and economic benefits;
- augment, protect and manage trees and forests on customary land in order to meet the basic fuelwood and forest needs of communities and for the conservation of water and soil;
- promote sustainable utilization of timber, fuelwood and other forest produce;
- control trafficking in wood and other forestry produce, including exportation and importation, and
- protect fragile areas such as steep slopes, river banks, water catchment; and conserve and enhance biodiversity.

According to Section 46 (a) of this Act, a license is needed to cut down/ fell, destroy, uproot, collect and remove forest produce from a forest reserve, customary land, public land and protected forest areas. Construction of the solar power plant and the transmission line will have to undertake measures to protect trees within and outside the project site. Therefore, the project shall avoid and/ or limit the cutting down of trees to cases where it is absolutely necessary to do so, in consultation with the relevant authority, the Forestry Department for Dedza district.

2.3.3 National Parks and Wildlife (Amendment) Act, 2016

The National Parks and Wildlife Act (Amendment of 2016) deals primarily with the protection and sustainable management of wildlife. Part VI of this Act requires Wildlife Impact Assessments to ensure protection of endangered and endemic wildlife species. The Amended Act permits any person to request the Minister to have a Wildlife Impact Assessment prepared where they have *"a good and sufficient reason to believe that any proposed or existing government process or activity may have adverse effect on wildlife species or community"*. Therefore, the project shall avoid and/or limit the cutting down of trees, including poaching of wildlife species during the construction and that any worker to commit an offense shall be guilty of the offense and punished in accordance to the relevant Sections in the Act.

2.3.4 Local Government (Amendment) Act, 2017

The Act outlines the decentralization of government control in Malawi. As a result, the natural resource management sector; mostly fisheries, forestry, wildlife and water resource management; has been decentralized to the local level. The Act details the requirements necessary for creation of District Councils in order to assist the government in sustainable management and conservation of natural resources in the country.

In this connection, the project developer should adhere to the Local Government Act of 2017, to ensure that biodiversity of the project site is protected at all times and that monitoring of the implementation of the project activities must be conducted in liaison with Dedza District Council staff.

3. STUDY AREA

3.1 General

The Proposed Golomoti Solar Photovoltaic (PV) Plant will be constructed on a 90.605 ha. of land located approximately 0.5 km from the Golomoti ESCOM Substation and less than 1 km from Golomoti Trading Centre in Dedza District within Traditional Authority (TA) Kachindamoto (Figure 1).

Figure 1: Satellite image of the proposed project site at Golomoti Trading Centre in Dedza District

The project will include construction of a short power transmission line, approximately 0.5 km from the Solar Power Plant Site, to the Golomoti ESCOM Substation; and two short access roads, extending from the highway, to the M5 road on the northeast and another one from the existing Golomoti Substation access road. The proposed project site is in Traditional Authority Kachindamoto and it shares boundaries with the following villages: Pitala, Msamala, Kalumo, Kapesi, Chtseko, Chisaka and Ching'anipa (Malawi Government, 2018).

The Project Site is located along the African Rift Valley floor, at altitudes ranging from 600 to 980 m above the sea level; whereas in the upper escarpments, the altitudes range from 850 m to 2,200 m above the sea level (Malawi Government, 2013). The major river in the district is Linthipe and some streams including Mwachakula (Malawi Government, 2018). The district has tropical continental climate, with a mean annual temperature of 21^{o}C. The highest temperatures, which reach as high as 28^{o}C, are experienced in the month of October; while the lowest temperatures, reaching 8^{o}C, are experienced between May and July.

An initial desktop assessment of the likely environmental issues associated with the proposed Solar Photovoltaic Plant Project was undertaken by JCM Solar Power Corporation Limited (JCM). The assessment identified

biodiversity as one of the key issues that would need more detailed investigation. In earlier 2019, JCM Solar Corporation Limited appointed Water Waste and Environment Consultants (WWEC) to undertake a baseline assessment for the proposed development. One of the assessments under this scope of work was Biodiversity Survey of the flora/vegetation, mammal, bird, reptile and amphibian species; and Priority Ecosystem Services Survey of the site. Therefore, this baseline survey report is part of the ESIA study, focusing on the terrestrial biodiversity and priority ecosystem services that may be impacted by the proposed project. The report is based on review of available information and field surveys undertaken by WWEC in March 2019.

Two ecologically sensitive areas are located in the vicinity of the proposed project site:

- A Graveyard is located about 200 m to the south east of the proposed solar power plant project site. This is a sacred place used for burying dead people and the Chewa people sometimes use these sacred places for performing in their traditional cult dances popularly known as “the Nyau Dance”. Another sensitive area located close to the proposed project site is the Kirk Range Forest Reserve, located 250 m to the south west and north-west of the proposed solar plant project site. This is public land that is used for conservation of different indigenous tree species. Forest reserves in Malawi are used for protecting water catchments and for prevention of soil erosion.

3.2 Exploration License Area

The exploration license area for the Golomoti JCM Solar Power Plant Project covers an area of 91.605 ha. of land (Figure 1-1). This report focuses on this potential footprint area only.

3.3 Terrestrial Ecoregions

Golomoti falls within a large terrestrial ecoregion known as Central Zambezian Miombo Woodland. This is one of Africa’s largest ecoregions, which stretches across Central Africa below the equator and includes most of Central and Northern Malawi. This ecoregion has the highest plant species richness and diversity within the miombo biome and has a higher proportion of evergreen trees compared to other miombo woodland types. Soils are highly weathered, well-drained, highly leached and nutrient-poor; and tend to be acidic with a low proportion of organic matter. In the undisturbed natural forest, the canopy cover is 10 to 20 m tall and is dominated by broad-leaved species of *Brachystegia*, *Julbernardia* and *Isoberlinia*. The understory is lush, comprising grasses, broad-leaved shrubs and geophytes (www.worldwildlife.org/profiles/terrestrial/at/at704_ full.html).

3.4 Vegetation Types

At a finer scale, the Study Area falls within a transition zone between three vegetation types as described by Wild and Fernandes (1967) and as indicated on the Vegetation map of the Flora Zambesiaca Area (Wild and barbosa, 1967):

i. *Brachystegia floribunda – Julbernardia paniculata Semi-Deciduous Northern Plateau Miombo Woodland*

This vegetation type comprises tall woodland on variable soils that are widespread in Zambia and also occurs mostly along the western half of Malawi. The trees *Brachystegia floribunda, B. longifolia, B. boehmii* and *Julbernardia paniculata* are dominant, with locally common evergreen species including *Erythrophloeum africanum* and *Marquesia acuminate*. *Uapaca kirkiana* is usually prominent below the canopy.

ii. *Brachystegia floribunda – Julbernardia globiflora Tardily Deciduous Northen Plateau Miombo Woodland*

This woodland is characteristic of the broken terrain of the central plateau, as opposed to the above vegetation type. This vegetation type is widespread over northern and north-western Zambia and occurs in southern Malawi, as well as along the eastern half of the central plateau. *Julbernardia globiflora* is prominent, while the dominant *Brachystegia* species are *B. floribunda, B. longifolia* and *B. manga*.

iii. *Pterocarpus – Combretum – Pericopsis* Deciduus (Basement Complex) Tree Savannah

This tree savannah woodland is largely confined to patches around the Kafue Flats and near Lusaka in Central Zambia. In Malawi, it occurs mostly between Lilongwe and Dedza on the Central Plateau, with an outlying area north-east of Kasungu. The deciduous trees *Pterocarpus angolensis* and various *Combretum* species are dominant, while other important trees are *Pericopsis angolensis, Terminalia sericea, Burkea africana, Markhamia obtusifolia, Xeroderris stuhlmannii* and *Acacia polyacantha*.

3.5 Aquatic Ecoregions

The Study Area falls within the Lake Malawi Ecoregion, which comprises Lake Malawi and influent rivers and streams. More than 200 rivers flow into Lake Malawi and most of these are annual and many flow in the rainy season (FEOW, 2010).

4. APPROACH AND METHODS

4.1 Approach

The approach to this study was to assess and confirm the status of the habitat of the proposed project area, assess and identify flora, mammal, bird, reptile and amphibian species of the proposed project area; and assess the priority ecosystem services of the project area. The following aspects were considered:

- Assess the Present Ecological State of the proposed project site, using the IFC PS 6 Criteria;
- Presence of endemic and threatened species and habitats;
- Key components of terrestrial ecosystems, including flora, mammals, birds, reptiles and amphibians; and
- Priority ecological services.

4.2 Desktop Studies

Important sources of available information that were used for this study included the following:

- National Guidelines for Environmental Impact Assessment (EIA) (Government of Malawi, 1997);
- Desktop Environmental Scoping Report for Golomoti JCM Solar Power Plant Project (ERM, 2019);
- Socio-economic Profile for Dedza District (2013-2018);
- Satellite image taken in February 2018; and
- Identification guides, including:
    - Terrestrial Vegetation: Baunman (2005), Msekandian & Mlangeni (2002);
    - Birds: Dowsett-Lemaire and Dowsett, (2006), Watson (2003), Stevenson & Fanshawe (2003);
    - Mammals: Monadjen, (2010);
    - Reptiles and Amphibians: Channing (2010), Frost (2010), Spawls *et al*., (2004);
- Various databases and websites, including:
    - Flora Zambesiaca (http://apps.kew.org/efloras/search.do)
    - The International Union for the Conservation of Nature (IUCN) Red list of Threatened species (http://www.iucnredlist.org);
    - Reptiles (http://tigr.org/reptiles);
    - Amphibians (http://amphibianweb.org);
    - Global Biodiversity Information Facility (GBIF) database (http://data.gbif.org);
    - Avibase (http://www.africanbirdclub.org/countries/checklists/download) and
    - https://www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES

4.3 Field Survey

One field survey was undertaken as follows:

Late wet season (29-31 March, 2019) survey. This field survey was aimed at collecting biodiversity baseline data; assessing sensitive habitats; assessing the ecological state of the habitat of the proposed project site and priority ecosystem services that are found on the proposed project site.

4.3.1 Flora

Assessment of flora species was done using transect walks across the proposed project site and in various vegetation communities. All flora species that were seen during the field survey were identified and recorded in a field notebook. Plants that could not be identified onsite were photographed or their specimens were collected for identification at the place of lodging, using the Flora Zambesiaca volumes and various field guides. Particular attention was paid to species of conservation concern (i.e. endemic, protected and endangered species).

4.3.2 Birds

The standardized search method of Watson (2003) was used to survey birds by walking slowly through various vegetation communities, preferably along paths or tracks and recording the species seen or heard within 20-minute segments in each vegetation community. Six transects of approximately 200 m apart were established

on the proposed project site. The bird species were surveyed twice in the morning, twice in midday and twice in the evening. This was done in order to capture all species of birds that reveal themselves at different times of a day. Playback calls were used to encourage cryptic species to reveal themselves. This was done to supplement visual observation data.

4.3.3 Mammals

Mammal species were recorded incidentally while surveying birds. Indirect evidence such as spoor or dung was used to confirm presence of mammal species in the proposed project area, in conjunction with limited visual or audio confirmation. Similarly, mammal species were surveyed twice in the morning, twice in midday and twice in the evening in all the six transects that were established on the proposed project site.

4.3.4 Reptiles and Amphibians

Reptiles and amphibians were surveyed during the day by visual scanning of likely habitat, investigating potential refuges such as under logs, between rocks, beneath the old bark of dead trees, leaf litter, etc.

4.3.5 Present Ecological State

Assessment of the Present Ecological State of the proposed project site was done using physical observation, professional judgement and based on subjective assessment of expected and observed abundance and diversity of flora and fauna species, including insects. The results were classified into one of the six categories, ranging from *Unimpaired* (Category A) to *Very Severely Impaired or Modified* (Category F) of the ecosystem. The assessment and classification of the present ecological state of the proposed habitat was adopted using Guidelines of IFS PS6 (Table 1-1).

Table 1-1. IFC Guidelines used to assess the Present Ecological State of the Habitat of the Proposed Project Site

Category	Description
A	*Unmodified* • natural diversity of taxa, and; • numerous sensitive taxa, and • abundance as expected under natural conditions; • no taxa dominating each other, and; • no alien invasive species
B	*Slightly Modified* • As above, but fewer sensitive taxa and slightly lower taxa, and; • No alien invasive species
C	*Moderately Modified* • Moderate diversity of taxa relative to diversity expected under natural conditions, and; • moderate numbers of sensitive taxa, or; • moderate reduction in abundance of some or all taxa relative to that expected under natural conditions, and; • alien invasive species may be present.
	Considerably Modified • low diversity of taxa relative to diversity expected under natural conditions, and;

D	• mostly tolerant taxa, and; • considerable reduction in abundance of some or all taxa relative to the expected under natural conditions, and; • more than one taxa dominating other taxa for extended periods, and; • alien invasive species may be common.
E	*Severely Modified* • very low diversity of taxa relative to diversity expected under natural conditions, and; • only tolerant taxa present, or; • severe reduction in abundance of some or all taxa relative to that expected under natural conditions, and; • only one taxon dominating other taxa for extended periods, and; • alien invasive species may be abundant.
F	*Very Severely Modified* • as above under Category E, but with Very Severe reduction in taxa diversity and abundance.

4.3.6 Ecosystem Services (ES)

Ecosystem Services were assessed and identified using adopted method developed by World Research Institute (WRI) (https://www.wri.org/sites/default/files/weaving_ecosystem_services_into_impact_assessment.pdf) coupled with data and information gathered during consultations held with local communities such as subsistence farmers, livestock herders and some local villagers.

5. BASELINE DESCRIPTION

5.1 Habitat of the Proposed Project Site

The proposed project site is generally flat land and is predominantly used for subsistence agriculture (Figure 2). Crops cultivated on the project site and surrounding areas include *Zea mays (*Maize), *Arachis hypogaea* (Groundnut), *Gossypium herbaceum* (Cotton), *Sorghum bicolour* (Sorghum), *Eleusine coracana* (Finger millet), *Cucubirta maxima (*Pumpkin), *Vigna unguiculata* (Cowpea), *Cajanus cajana* (Pegion pea) and *Hibiscus cannabinus* (Okra) among others. Trees on the site include natural, planted and fruit trees such as mangoes, which are harvested. Within the project site, residents also rear livestock such as *Bos taurus* (Cattle), *Capra aegarus hircus* (Goats) and *Ovis aries* (Sheep). One third of the project site is made up of seasonal wetland where livestock such as cattle, goats and sheep are fed on nutrient rich grasses such as *Urochloa mossambicensis* (Fig. 3).

Fig. 2: Pictorial Habitat Map of the Proposed Project Site

Figure 3: Part of the Seasonal Wetland of the Proposed Project Site Used for Livestock Grazing

5.2 Baseline Flora of Dedza District

Dedza District has three types of vegetation communities, namely; Miombo (*Brachystegia*) Woodland, Savannah Woodland and Mopane Woodland. The district has also perennial wet grasslands and open canopy woodlands of hills and scarps. The Miombo woodland comprises dry and semi-deciduous trees in the genera *Brachystegia* and *Julbernardia*. The common tree species that are found in these woodlands are *Brachystegia boehmii* (Mombo)*, B. Longifolia* (Tsamba)*, B. Floribunda* (Tsamba), *Burkea africana* (Mkalati)*, Pterocarpus angolensis* (Mlombwa)*, Adansonia digitata* (Malambe)*, Sclerocarya birrea* (Mfula), *Bauhinia thonningii* (Chitimbe), *Tereminalia sericea* (Naphini) *Dalbergia mexanoxylon* (Phingo), *Pericopsis angolensis* (Muwanga), *Faihderbia albida* (Msangu), *Colophospermum mopane* (Tsanya), *Stecurlia quinqueloba* (Kweranyani) and *Syzygium cordatum* (Katope) among others (Government of Malawi, 2013-2018).

5.3 Habitat Types of the Proposed Project Site

Three habitat types were recognised within the Study Site. These habitat types were Secondary Mixed Deciduous Woodland, Seasonal Wetland and Cultivated Mosaic Woodland. Mapping of this habitat types or vegetation communities is shown in Figure 1-2 and Figure 1-3, and photographs are included in Appendix A.

5.3.1 Cultivated Mosaic Woodland

Most of the Project site has been cultivated with dryland crops (Figure 4) such as *Zea mays* (Corn Maize), *Sorghum bicolor* (Sorghum), *Arachis hypogaea* (Groundnuts), *Gossypium arboreum* (Cotton), *Cucumis anguiria* (Maroon Cucumber), *Citrullus lanatus* (Water Melon), *Mandifera indica* (Mango), *Ipomoea batatas* (Sweet potato), *Cucumis melo* (Cucumber), *Vigna unguiculata* (Cowpea), *Cajanus cajana* (Pigeon peas) and *Cucumis*

maximum (Common Pumpkin). The area under cultivation has also some scattered indigenous trees and shrubs, including weed plants that are common in disturbed woodlands. Species include *Adansonia digitata* (Baobaba tree), *Sclerocarya birrea* (Marula tree), *Ocimum americanum* (American basil), *Faidherbia albida* (White acacia), *Piliostigma thonningii* (Monkey bread tree), *Combretum zeyheri* (Large fruited bushwillow), *Sterculia africana* (African star-chestnut tree), *Vangueria infausta* (Velvet wild medlar tree), *Ximenia caffra* (Sourplum tree), *Ximenia americana* (Yellow plum), *Ficus thonningii* (Chinese banyan), *Bauhinia petersiana* (Kalahari White Bauhinia), *Mangifera indica* (Mango tree), *Commelina benghalensis* (Tropical spiderwort), *Ageratum conyzoides* (Billygoat-weed), *Pennisetum unisetum* (Duncan grass), *Hibiscus cannabinus* (Okra), *Trichodesma zeylanicum* (cattle bush), and *Chrysopogon zizanioides* (Vetivar grass).

The presence of cultivated crops and weed plants such as *Ocimum americana, Mangifera indica*, *Ageratum conyzoides, Commelina benhalensis, Hibiscus cannabinus, Trichodesma zeylanicum* and *Chrysopogon zizanioides* on the propose project site suggest that the area has been totally transformed from its natural state with the remaining trees being present likely to remain as these provide benefits to the communities that utilise the area. This type of habitat is therefore, classified as *Considerably Modified Habitat*.

Figure 4: Cultivated Mosaic Woodland of the Project Site

(a) Species Composition

A total of fifty-nine (59) terrestrial flora or plant species were recorded from this habitat type of the project site as listed in Table 1-3.

Table 1-3: Flora Species Identified on the Cultivated Mosaic Woodland of the Project Site

Species Name	Local Name	Comment
Faidherbia albida	(Msangu) or Ana tree	Common tree typical of riparian habitat. Seed pods are eaten by livestock and the tree fix nitrogen in the soil.
Adansonia digitata	Baobab tree	Tree, typical of dry woodland
Zea mays	Maize	Cultivated annual grass used for food
Citrullus lanatus	Water melon	Cultivated annual climber used for food
Gossypium arborea	Cotton	Introduced annual herb, cultivated on farmland
Cucumis anguiria	Maroon Cucumber	Cultivated annual climber used for food
Cucumis melo	Cucumber	Cultivated annual climber used for food
Vigna unguiculata	Cowpea	Annual herb, cultivated for food
Cajanus cajana	Pigeon pea	Perennial shrub, cultivated for food
Cucumis maximum	Pumpkin	Annual climber, cultivated for food
Pennisetum unisetum	Udzu or Mission grass	Common grass, typically occurring in disturbed land and is invasive in some cases.
Commelina baanghelensis	Tropical spiderwort	Common weed, typically occurring in disturbed land and is invasive in some cases.
Acacia tortilis	Umbrella thorn Acacia	Common tree of dryland. Plant is used as feed for livestock
Senna obstusifolia	Sickle Senna	Alien tree, typically introduced by communities on farmlands.
Vernonia glabra	Cornflower	An annual herb, typical of secondary woodland
Trichodesma zeylanicum	Camel bush	Annual herb, typical of secondary woodland
Sclerocarya birrea	Marula tree	Common tree, typical of dry Savannah woodland
Melinis repens	Natal grass	Perennial grass, typical of dry land and used for thatching houses
Vernonia poskeana	Sandveld vernonia	Annual herb, typical of secondary woodland
Vernonia glabra	Conflower	Annual herb, typical of secondary woodland
Stereospermum kunthianum	Zana	Small tree occurring in open woodland
Ocimum americana	American basil	Small annual herb, typical of open cultivated land.
Corchorus olitorius	Bush Okra	Small annual herb, typical of open cultivated land.
Ceratotheca sesamoides	Sesame	Wild weed and locally grows in cultivated land
Merremia pinnata	Kosrae	Common annual climber
Siphonochilus aethiopicus	Wild ginger	Annual herb, typical of cultivated land
Combretum zeyheri	Large-fruited bushwillow	Tree, typical of open dry woodland
Leucas amartinicensis	Whitewort	Annual herb, typical of cultivated land
Pannicum maximum	Guinea grass	Grass, typical of cultivated and open woodland
Cucumis sativus	Cucumber	Cultivated fruit

Species Name	Local Name	Comment
Hibiscus subdariffa	Roselle	Annual woody-based Okra, used for making tonic drink
Vangueria infausta	African medlar	Tree, typical of open secondary or primary forest
Strychnos innocua	Monkey orange	Shrub, typical of cultivated land and natural secondary forest
Ximenia americana	Yellow plum	Tree, typical of cultivated land or natural secondary forest
Sorghum bicolour	Sorghum	Perennial grass usually cultivated
Eleusine coracana	Finger Millet	Annual grass usually cultivated for food.
Codyla africana	Wild Mango	Tree, typical of primary or secondary woodland
Andropogon shirensis	Beard Grass	Annual grass , typical of cultivated land
Senna spectabilis	Whitebark senna	Tree, introduced in cultivated land by humans
Hyparrhenia filipendula	Fine-hood Grass	Grass, typical of disturbed land used for thatching.
Digitaria milanjiana	Crabgrass	Grass, typical of disturbed land.
Bidens steppia	Beggarticks	Annual herb, typical of open cultivated land
Heteropogon contortus	Black spear grass	Perennial grass, typical of disturbed land.
Markhamia obtusifolia	Golden bell-bean	Tree, typical of closed and secondary woodland.
Biophytum kassneri	Reinwardit	Annual herb, typical of open cultivated land
Vitex mombasae	Chaste tree	Small tree, typical of open woodland and its fruits are edible
Hibiscus esculentus	Lady's fingers Okra	Annual herb, cultivated plant and is edible as relish
Bidens pilosa	Black jack	Introduced weed annual herb, present as a result of soil disturbances
Impatiens gomphophylla	Balfour	Annual herb, typical of moist condition and cultivated land.
Bauhinia thonningii	Camelfoot tree	Common tree, typical of dry conditions.
Sterculia quinqueloba	Large-leaved star chestnut	Tree, typical of open woodland.
Sida acuta	Wireween	Weed annual plant, present as a result of soil disturbances.
Cissus buchannii	Mwanmphepo	Annual herb, typical of dry conditions.
Tridax procumbens	Tridax daisy	Annual weed, present due to soil disturbances.
Crinum macowanii	Spider lily	Annual herb, typical of moist conditions.
Chrysopogon zizanioides	Vetivar grass	Introduced grass, typical of moist conditions.
Ficus thonningii	Common wild fig	Tree, typical of open dry woodland
Lagenaria sicenaria	Long melon	Cultivated climber used for food
Chloris vigata	Rhodes grass	Annual grass, typical of open and disturbed habitats
Abelmoschus esculentus	Okra	Annual herb, typical of disturbed land

b) Tree Density

The tree density in this habitat was estimated to be about 13 individual trees per ha. and over 4 individual trees of these belong to the genus *Faihderbia* and *Adansonia*.

c) Threatened, Endemic and Protected Species

None of species recorded from the cultivated degraded mosaic habitat were either threatened or endemic to the study area. However, *Adansonia digitata* (Baobab tree) was the only tree, which was recorded from this habitat of the Project site and is protected by the Forestry Laws and Regulations due to its over-exploitation.

d) Present Ecological State of the Habitat

The Present Ecological State of this habitat is *Considerably Modified* even though some natural trees still exist in this type of a habitat. Species composition had been severely transformed as a result of repetitive cultivation of the land for subsistence agriculture and hence, the potential to support biodiversity is moderate.

e) Invasive Alien Species

No invasive alien species was recorded from this habitat of the project site.

5.3.2 Secondary Mixed Deciduous Woodland of the Project Site

a) Species Composition

This was another vegetation community or type found on the of Study site at Golomoti (Figure 5). A total of 39 species were recorded from this vegetation type or community, which represents 30% of the total plant species of the Study site.

The most well represented families were Poaceae and Fabaceae subfamily Mimosoideae. Most trees were deciduous. Grasses were prominent and the herbaceous layer was noticeably diverse.

Figure 5: Secondary Mixed Deciduous Woodland of the Project Site

A total of thirty-nine (39) terrestrial flora or plant species was recorded from this habitat type of the project site as listed in Table 1-4.

Table 1-4: Flora Species Identified from Secondary Mixed Deciduous Woodland of the Project Site

Species Name	Local Name	Comment
Pterocarpus rotundifolius	(Round-leaved bloodwood	Common tree typical of dry habitat
Dalbergia nitidula	Purple wood tree	Common tree typical of dry habitat
Markhamia obtusifolia	Golden bell-bean	Tree, typical of closed and secondary woodland.
Combretum zeyheri	Large-fruited bushwillow	Tree, typical of open dry woodland
Sterculia quinqueloba	Large-leaved star chestnut	Tree, typical of open woodland
Sclerocarya birrea	Marula tree	Tree, typical of open dry woodland
Brachystegia spiciformis	Brachstegia	Tree, typical of closed canopy and open natural woodland
Acacia polyacantha	White thorn	Tree, typical of open dry woodland
Vitex payos	Chinese Chaste tree	Tree, typical of open woodland

Species Name	Local Name	Comment
Pennisetum unisetum	Udzu or Mission grass	Common grass, typically occurring in disturbed land and is invasive in some cases.
Solanum panduriforme	Bitter apple	Perennial herb, typical of open dry woodland and disturbed areas
Acacia tortilis	Umbrella thorn Acacia	Common tree of dryland. Plant is used as feed for livestock
Azanza garckeana	Slime apple	Tree, typical of open dry and secondary woodland
Vernonia glabra	Cornflower	An annual herb, typical of secondary woodland
Combretum adenogonium	Four-leaved bushwillow	Tree, typical of open dry and secondary woodland
Faihderbia albida	(Msangu) or Ana tree	Common tree typical of riparian habitat. Seed pods are eaten by livestock and the tree fix nitrogen in the soil.
Melinis repens	Natal grass	Perennial grass, typical of dry wodland and used for thatching houses
Piliostigma thonningii	Monkey bread tree	Tree, typical of dry woodland
Vernonia glabra	Conflower	Annual herb, typical of secondary woodland
Adansonia digitata	Baobab tree	Tree, typical of dry woodland
Sterculia quinqueloba	Large-leaved star-chestnut	Tree, typical of dry woodland
Eucalyptus camaldulensis	Bluegum	Introduced tree, typical of disturbed natural woodland
Annona senegalensis	African custard-apple	Shrub, typical of open dry woodland
Bauhinia petersiana	Kalahari White Bauhinia	Tree, typical of open dry woodland
Hyparrhenia rufa	Giant thatching grass	Annual grass, typical of open woodland
Markhamia obtusifolia	Golden bean tree	Tree, typical of open dry woodland
Senna siamea	Siamese cassia	Introduced tree
Pannicum maximum	Guinea grass	Grass, typical of cultivated and open woodland
Steganotaenia araliacea	Carrot tree	Shrub, typical of open woodland
Strychnos innocua	Monkey orange	Shrub, typical of dry open woodland
Vangueria infausta	African medlar	Tree, typical of open secondary or primary forest
Strychnos innocua	Monkey orange	Shrub, typical of cultivated land and natural secondary forest
Ximenia americana	Yellow plum	Tree, typical of cultivated land or natural secondary forest
Commiphora sansibarica	Corkwood tree	Tree, typical of dry open woodland
Trichodesma zeylanicum	Cattle bush	Annual herb, typical of open woodland
Crinum macuanum	Amaryllis	Perennial herb, typical of open and closed woodland
Lonchocarpus bussei	Small apple-leaf tree	Tree, typical of open dry woodland
Lonchocarpus violacea	Apple-leaf	Tree, typical of open dry woodland

Species Name	Local Name	Comment
Dichrostachys cinerea	Kalahari Christmas tree	Tree, typical of open dry mixed woodland

b) Tree Density

The tree density in this habitat was estimated to be about 35 individual trees per ha. and over 12 individual trees of these belong to the genus *Markhamia* and *Adansonia*.

c) Threatened, Endemic and Protected Species

None of species recorded from the cultivated degraded mosaic habitat were either threatened or endemic to the study area. However, *Adansonia digitata* (Baobab tree) was the only tree, which was recorded from this habitat of the Project site and is protected by the Forestry Laws and Regulations due to its over-exploitation.

d) Present Ecological State of the Habitat

The Present Ecological State of this habitat is *Moderately Modified* and that is why some natural trees still existed on this type of a habitat. Species composition had slightly been transformed due to felling of trees for fuelwood. However, this habitat has the great potential to support biodiversity of the Project Site.

f) Invasive Alien Species

No invasive alien species was recorded from this habitat of the project site.

5.3.3 Seasonal Wetland

a) Species Composition

This was the third vegetation community or type that occurs on the proposed Project Site at Golomoti (Figure 6). A total of 13 species were recorded from this vegetation type or community, which represents 16.5% of the total plant species of the Study site.

The most well represented families were Poaceae, Cyperaceae and Tiliaceae. Most trees were deciduous shrubs. Grasses were prominent and the herbaceous layer was noticeably diverse.

Figure 5: Seasonal Wetland of the Project Site

A total of twenty-one (21) terrestrial flora or plant species were recorded from this habitat type of the project site as listed in Table 1-5.

Table 1-5: Flora Species Identified from Seasonal Wetland of the Project Site

Species Name	Local Name	Comment
Urochloa mosambicensis	Bushveld signal grass	Grass, typical of dry seasonal wetland
Acacia polyacantha	White thorn	Tree, typical of open dry woodland
Pennisetum unisetum	Udzu or Mission grass	Common grass, typically occurring in disturbed land and is invasive in some cases.

Species Name	Local Name	Comment
Clematis simensis	Clematis	Annual herb, typical of mist conditions
Scleria bulbifera	Nutrushes	Sedge, typical of seasonal wetland
Vernonia glabra	Cornflower	An annual herb, typical of secondary open woodland
Combretum adenogonium	Four-leaved bushwillow	Tree, typical of open dry and secondary woodland
Scleria racemosa	Sword grass	Sedge, typical of seasonal wetland
Melinis repens	Natal grass	Perennial grass, typical of dry woodland and used for thatching houses
Hyparrhenia rufa	Giant thatching grass	Annual grass, typical of open moist woodland
Markhamia obtusifolia	Golden bean tree	Tree, typical of open dry moist woodland
Senna siamea	Siamese cassia	Introduced tree
Pannicum maximum	Guinea grass	Grass, typical of cultivated and open woodland
Cynodon dactylon	Dog's tooth grass	Grass, typical of moist conditions
Chloris gayana	Rhodes grass	Grass, typical of moist conditions
Cissus grisea	Wild grape	Climber, typical of open woodland
Cissus rubiginosa	Adamant creeper	Climber, typical of moist open woodland
Embelia schimperi	Amargna	Climber, typical of moist open woodland
Grewia asiatica	Phalsa	Shrub, typical of open woodland
Grewia villosa	Mallow raisin	Shrub, typical of open woodland
Grewia retusifolia	Emu-berry	Shrub, typical of open woodland

b) Tree Density

The tree density in this habitat was estimated to be about 17 individual trees per ha. and over 5 individual trees of these belong to the genus *Grewia*.

c) Threatened, Endemic and Protected Species

None of species recorded from the cultivated degraded mosaic habitat were either threatened or endemic to the study area.

d) Present Ecological State of the Habitat

The Present Ecological State of this habitat is *Moderately Modified* and that is why some natural trees still exist on this type of a habitat. Species composition had slightly been transformed due to livestock grazing. However, this habitat has the great potential to support biodiversity of the Project Site.

g) Invasive Alien Species

No invasive alien species was recorded from this habitat of the project site.

5.4. Mammals of Malawi

About 190 species of mammals (Ansell & Dowsett, 1988; Chitaukali, 2005) have been recorded for Malawi. Of these, 8 species representing 4.1% are threatened (Hilton-Taylor (IUCN) 2000). According to the IUCN 2000 report, Malawi has 8 threaten mammal species. One Critically Endangered, 2 Endangered and 5 Vulnerable. In descending order, these species are *Diceros bicornis* (Black rhino), *Loxodonto africana* (African Elephant), *Lycaon pitus* (Wild Dog), *Rhynchocyon cirnea* (Checkered Sengi), *Acinonyx jubatus* (Lion), *Panthera leo* (Lion), *Paraxerus palliates* (Red Bush Squirrel) and *Lutra amculicollis* (Spotted-Necked Otter). No endemic mammal species have been recorded in Malawi (Chitaukali, 2005).

5.4.1 Mammal Species of the Study area

(a) Species Composition

During the fieldwork, no single mammal was recorded from the project site. However, it was reported by local communities living around the Project Site that were interviewed that the following mammal species, presented in Table 1-6 below occur on the Project Site.

Table 1-6: Summary of mammal species reported to occur on the Project Site

Name	Status	Habitat encountered/Reported
Acomys spinosissimus (Rodent)	VC	Secondary Mixed Deciduous Woodland, Cultivated land
Lophuromys flavopunctatus (Mouse)	VC	Secondary Mixed Deciduous Woodland, Cultivated land
Mus triton (Mouse)	VC	Secondary Mixed Deciduous Woodland, Cultivated land
Mus musculus (Mouse)	C	Secondary Mixed Deciduous Woodland, Cultivated land
Crocuta crocuta (Spotted Hyena)	C	Secondary Mixed Deciduous Woodland, Cultivated land
Lepu saxatilis (Scrub Hare)	C	Secondary Mixed Deciduous Woodland, Cultivated land
Hystrix africaeaustralis (Cape porcupine)	C	Secondary Mixed Deciduous Woodland, Cultivated land
Sylvicapra grimmia	R	Secondary Mixed Deciduous Woodland

Legend: VC = Very common, C = Common, R = Rare

(b) Abundance

No trapping took place in this study, so no quantitative statement of mammal abundance can be made. The most abundant mammals on the Study site were those associated with cultivation of crops (e.g. mouse and rats) and a few species associated with Secondary Mixed Deciduous Woodland (e.g. Scrub hare).

(C) Present Ecological State

The low representation of typical woodland mammals and lack of resident large mammals attributed to hunting and loss of habitats indicate that the Present Ecological State of the woodland was *Considerably Modified* due to deforestation for charcoal production, firewood collection and continued subsistence farming.

(d) Threatened and Endemic Species

There were no either threatened or endemic species of mammals recorded from and/or reported to occur on the Project Site. Similarly, no threatened or endemic mammal species from the Study site were recorded in documents that were reviewed during this study. Nonetheless, because of lack of primary and thick secondary vegetation communities in the proposed project area, the site is considered to be of *LOW* conservation importance for both large and small mammals.

(e) Species of CITES List

No species of mammals that are on CITES list either of Appendix I, II or III were recorded from the Project Site during the field work (CITES, 2017).

(g) Alien Mammal Species

Three alien mammal species namely; *Bos taurus* (cattle), *Capra aegagrus hircus* (goat) and *Ovis aries* (sheep) were recorded from the Project Site during the survey.

5.5 Birds of Malawi

Malawi has approximately 650 species of birds. Of these, 107 are non-breeding migrants or vagrants, leaving more than 450 species which breed in the country. There are 7 species listed as threatened for Malawi and 12 species of conservation concern (BirdLife International, 2004). There are 4 endemic subspecies that have been recorded in country (Kaliba, 2005).

5.5.1 Bird Species of the Study area

(a) Species Composition

A total of thirteen (13) bird species of was recorded from the Study area during the field survey. Of these, 59 species were identified during the field survey while 7 were reported to occur in the Study area by local communities. The ten most abundant bird species that were identified and/or reported by local communities are presented in Table 1-7.

Table 1-7: Summary of bird species recorded from and reported to occur on the Proposed Project Site

Name of Species	Status	Habitat encountered/Reported
Phyllastrephus flavostriatus (Yellow-streaked Bulbul)	C	Secondary mixed deciduous woodland, Cultivated land

Phyllastrephus placidus (Placid Bulbul)	C	Secondary mixed deciduous woodland, Cultivated land
Nectarinia olivacea (Olive Sunbird)	VC	Secondary mixed deciduous woodland
Nectarinia talatala (White-bellied Sunbird)	VC	Secondary mixed deciduous woodland
Uraeginthus angolensis (Blue Waxbill)	C	Secondary mixed deciduous woodland
Serinus gularis (Streaky-headed Canary)	VC	Secondary mixed deciduous woodland
Anthreptes collaris (Collared Sunbird)	C	Secondary mixed deciduous woodland
Streptopelia capicola (Cape Turtle Dove)	C	Secondary mixed deciduous woodland
Threskiornis aethiepicus (Scared Ibis)	R	Seasonal wetland
Numida meleagris (Helmeted Guinea fowl)	R	Secondary mixed deciduous woodland, Cultivated land, Seasonal wetland
Quelea quelea (Red headed Quelea)	VC	Secondary mixed deciduous woodland, Cultivated land, Seasonal wetland
Francolinus afer (Red-Necked Francolin)	R	Secondary mixed deciduous woodland, Cultivated land, Seasonal wetland
Bubo lacteus (Giant eagle Owl)	C	Secondary mixed deciduous woodland

Legend: VC = Very Common, C = Common, R = Rare

(b) Abundance

The most abundant species according to the standardized count data were Yellow-breasted Bulbul, Placid Bulbul, Olive Sunbird, and White-bellied Sunbird among other (Table 1-7). More intensive sampling around cultivated lands would have resulted in other seed-eating species being indicated as abundant, e.g. Pin-tailed Whydah.

(C) Present Ecological State

The strong dominance of generalist woodland species and paucity of closed-canopy Zambezian woodland endemics indicates a *Moderately to Considerably Modified* woodland bird community (Category C and D), and a *Moderately Modified* grassland bird community (category C) on seasonal wetland.

(d) Threatened and Endemic Species

No threatened bird species was recorded within the proposed Project Site (Table 1-7) according to the National and IUCN Red list.

(e) Species of CITES List

No species of birds recorded from the proposed Project Site are on CITES list either of Appendix I, II or III (CITES, 2017).

(g) Alien Species

No alien bird species was spotted and/or recorded from the Study area during the survey. In addition, no alien bird species had been reported to occur in the Study area by other researchers.

5.6 Reptiles of Malawi

There are about 145 species of reptiles in Malawi. There are 3 endangered species of reptiles in Malawi.

5.5.1 Reptile Species of the Study area

(a) Species Composition

No species of reptiles were recorded from the proposed Project Site during the survey. However, it was reported by local communities during the interviews conducted that the following species shown in Table 1-8 occur on the Project Site. In total five (5) species of reptiles were reported by local communities to occur on the Project Site.

Table 1-8: Summary of Reptile species reported to occur on the proposed Project Site

Name of Species	Status	Habitat encountered/Reported
Python natalensis (Lesser African Python)	R	Secondary mixed deciduous woodland, Cultivated land
Dendroaspins polylepis (Black mamba)	R	Secondary mixed deciduous woodland, Cultivated land
Ophiophagus hannah (King cobra)	R	Secondary mixed deciduous woodland
Bitis arietans (Puff Adder)	R	Secondary mixed deciduous woodland
Ahaetulla nasuta (Vine snake)	C	Secondary mixed deciduous woodland, Cultivated land
Chamaeleo chamaeleon (Common chameleon)	C	Secondary mixed deciduous woodland, Cultivated land

Legend: VC = Very Common, C = Common, R = Rare

(b) Abundance

The most abundant species according to the results of the interviews were *Ahaetulla nasuta* and *Chamaeleo chamaeleon* (Table 1-8).

(C) Present Ecological State

Low species diversity of reptiles indicates a *Considerably Modified* woodland (Category D), and hence cannot support more species of reptiles.

(d) Threatened and Endemic Species

No threatened reptile species was recorded within the proposed Project Site (Table 1-8) according to the National and IUCN Red list.

(e) Species of CITES List

Two species of reptile (*Python natalensis* and *Bitis arietans* which are on CITES list either of Appendix II (CITES, 2017) were reported to occur on the proposed Project Site are

(g) Alien Species

No alien reptile species was spotted and/or recorded from the Study area during the survey. In addition, no alien reptile species had been reported to occur in the Study area by other researchers.

5.6 Amphibians of Malawi

There are about 83 species of reptiles in Malawi. Some of these species are threatened while others are endemic to Malawi.

5.6.1 Amphibian Species of the Study area

(a) Species Composition

A total of 4 species of amphibians was recorded from the proposed Project Site during the survey. These species are shown in Table 1-9 below.

Table 1-9: Summary of Amphibian species reported to occur on the proposed Project Site

Name of Species	Status	Habitat encountered/Reported
Hyperolius pictus (Reiche's Squeaker)	R	Secondary mixed deciduous woodland, Cultivated land
Sclerophrys garmani (Garman's toad)	R	Secondary mixed deciduous woodland, Cultivated land
Sclerophyrs gitturalis (Guttural toad)	R	Secondary mixed deciduous woodland
Afrixalus delicatus (Delicate Spiny Reed Frog)	R	Secondary mixed deciduous woodland, Seasonal Wetland and Cultivated land

Legend: VC = Very Common, C = Common, R = Rare

(b) Abundance

The most abundant species that was encountered several times in both Secondary Mixed Woodland and Cultivated land was *Sclerophyrs gitturalis* (Table 1-9). Other species were very rare in the project site.

(C) Present Ecological State

Low species diversity of amphibian indicates a *Considerably Modified* habitat (Category D), and hence cannot support more species of amphibians.

(d) Threatened and Endemic Species

No threatened amphibian species was recorded within the proposed Project Site (Table 1-8) according to the National and IUCN Red list.

(e) Species of CITES List

No species of amphibian recorded from the Project Site was on CITES list either of Appendix II (CITES, 2017).

(g) Alien Species

No alien species was spotted and/or recorded from the Study area during the survey. In addition, no alien reptile species had been reported to occur in the Study area by other researchers.

5.7 Ecosystem Services of the Project Site

Ecosystem Services are the benefits that people derive from the ecosystem of the Project site. Besides provisioning services or goods like food, wood and other raw materials, plants, animals, fungi and micro-organisms provide essential regulating services such as pollinating crops, prevention of soil erosion and water purification, and a vast array of cultural services, like creation and a sense of place (Millennium Ecosystem Assessment, 2016).

During the field survey, various ecosystem services belonging to different categories were physically observed and also reported by local communities during the public consultations. Table 1-10 presents some of the ecosystem services that were present or occurring on the proposed project site.

Table 1-10: Ecosystem Services Offered and/or Found at the Proposed Project Site at Golomoti

ECOSYSTEM SERVICE	EXPLANATION
PROVISIONING ECOSYSTEM SERVICES	
Food crops	There are a number of cultivated food crops such as maize, groundnuts, cucumber, water melon, sorghum, finger millet, okra, cow peas, pigeon peas

	and others that are grown on the project site each year. These food crops are harvested by subsistence farmers for consumption and income.
Edible wild and exotic fruit trees	The project site is also a home to some wild and exotic fruit trees such as *Vitex payos*, cucumber, mangoes, *Annona senegalensis* (Mpoza), *Azanza garckeana* (Matowo), *Adansonia digitata* (Malambe) and *Ximenia caffra* which are harvested by local communities living around the Project site for food and income.
Livestock grazing land	The seasonal valleyhead wetland is used for livestock (cattle and goats) grazing. It was reported by communities that the project site support over 80 livestock that feed on grasses found on this seasonal wetland.
Bush meat	Wild animals that are hunted from the project site for bush meat include mice, common hare and birds. These animals are sources of proteins to local communities living around the project site.
Fuelwood	Some trees especially the exotic species are harvested for fuelwood for cooking.
Thatch grass	The project site has some thatch that communities harvest for thatching their houses.
Natural medicine	Some species of flora found on the project site are harvested by local communities for traditional medicine used to cure various illnesses.
Feeding and nesting ground for Sacred ibis and livestock	The project site has a seasonal wetland on the east, which is used as feeding and nesting ground for Sacred ibis and livestock.
REGULATING ECOSYSTEMS	
Regulation of water flows	The wetland grasses and sedges found on the eastern side of the project area are important in regulating floods.
Soil erosion control	The project site has grasses and which are important in prevention of loss of soil.
Regulation of soil quality	Tree species such as *Faidherbia albida* are kept by farmers a source of nitrogen in the soil. It was estimated that the project site has over 50 mature individual species of *Faidherbia albida*, which must be restored when cleared during the project implementation
Pollination of crops	The project site a good number of insects such as butterflies and bees which pollinate agricultural crops on the project site.
CULTURAL ECOSYSTEM SERRVICES	
Ethical values	The project site has some trees such as *Faidherbia albida* whch ethically influence peoples' desire to protect them as they fix nitrogen in the soil.
SUPPORTING ECOSYSTEM SERVICE	
Biodiversity maintenance	The project site has the potential to support biodiversity such as trees, small mammals, amphibians, reptiles, insects and birds.
Primary Production	The project site maintains formation of biological materials through photosynthesis and nutrient assimilation

5.7.1 Prioritization of Ecosystem Services

Ecosystem Services (ES) that were assessed on the project site were prioritized using the logical framework adapted from WRI are presented in Table 1-11.

Table 1-11: Prioritization of Ecosystem Services of the Project Site

Description of ES	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
Brief description of important attributes	Yes/No: Explanation of why ES will/will not be impacted	Yes/No: Explanation of why ES is/is not important	Yes/No: Explanation of availability/non-availability elsewhere	Priority/Non priority ES to the people/ecosystem
PROVISIONING ECOSYSTEM SERVICE				
Crops cultivated at the project site are source of food and income	Yes, the project will have impact on peoples' livelihoods due to turning of agricultural into industrial land	The crops cultivated such as *Zea mays, sorghum bicolor, Sorghum dochna, Arachis hypogaea, Gossypium arboretum,* etc are sources of food and income to farmers	Yes, some crops of similar varieties are found elsewhere and can be cultivated elsewhere if another piece of land is bought for displaced farmers	Non-priority ES
Wild and exotic fruit trees	Yes, the project will have impact on peoples' livelihoods due to turning of agricultural into industrial land	Wild plant fruits such as *Ximenia Americana, Vitex mombasae* found at the project site are source of food to communities around	Yes, the wild plant fruits can planted elsewhere and are also commonly found in other farmlands and bush areas nearby	Non-Priority ES
Livestock grazing land	No, the project will not have negative impact on livestock	There is another area such as Msamala hill on the western side where livestock can be grazed	Another potential grazing area is available where farmers can take their livestock to for grazing	Non-priority ES
Bush meat	Yes, the project will somehow have impact on peoples' lives as the project site is source of bush meat.	The birds, mice and grasshoppers found at the project site are also found in other areas around this project site	Yes, the birds, mice and grasshoppers can migrate to adjacent areas where they can seek refuge during the construction	Non-priority ES
Fuelwood	No, the project will not contribute to the scarcity of fuelwood in the area	Yes, the fuelwood of the project is important to the communities,	There are plenty of trees in adjacent areas of the project site and more trees	Non-priority ES

Description of ES	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
Brief description of important attributes	Yes/No: Explanation of why ES will/will not be impacted	Yes/No: Explanation of why ES is/is not important	Yes/No: Explanation of availability/non-availability elsewhere	Priority/Non priority ES to the people/ecosystem
		especially old women and young girls from surrounding villages.	for fuelwood can be planted at households.	
Thatch grass	Yes, clearing of grass such as *Hyparrhenia rufa, Panicum maximum, Melinis repens* to pay way for the construction of the project will have impact on people	Grass is used for thatching houses and livestock houses but is also sold for income by villagers	Yes, the thatch grass is also found on other customary lands found in the project area and on Kirki Range Mountain and Msamala hill which can be alternative sources of this ES	Non-priority ES
Natural medicine	Yes, the project will have impact on people due to loss of some medicinal plants	Medicinal plants are used to treat various illnesses at local level	Yes, the medicinal plant species found on the project site are also found in other agricultural and woodlands found around the project area	Non-priority ES
Seasonal wetland is feeding and nesting ground for Scared ibis and livestock	Yes, the project will have impact on the migratory bird and livestock due to loss of wetland	The seasonal wetland is important because it provides feeding and nesting ground for Sacred ibis and livestock	Yes, the seasonal wetlands are also found in other places within the Project site and along the Lake Malawi	Non-priority ES
REGULATING ECOSYTEM SERVICE				
Regulation of water flows	Yes, the project will have impact on regulation of water flows especially during rainy season due to clearing of the seasonal wetland	The seasonal wetland grasses such *Urochloa mosambicensis,* etc. regulate flow of water so that the water is not flooding which can be detrimental to lives and livestock	No, it is not possible to replace it.	Priority ES

Description of ES	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
Brief description of important attributes	Yes/No: Explanation of why ES will/will not be impacted	Yes/No: Explanation of why ES is/is not important	Yes/No: Explanation of availability/non-availability elsewhere	Priority/Non priority ES to the people/ecosystem
Soil erosion control	Yes, clearing of grasses on the project site will have impact on soil erosion	Clearing of grasses from the project site will not be of any benefit to farmers as fertile soil will get lost	Yes, it is possible to replace the loss of grasses through planting	Non-priority ES
Regulating of soil quality	Yes, cutting down of plants on the project site will have impact on quality of soil	Clearing of plants from the project site will affect the quality of soil on the project site and beyond	Yes, it is possible to replace plants to be cut down by planting them in adjacent areas	Non-priority ES
Pollination of crops	Yes, clearing of the project site will have impact on pollinating insects such as butterflies, bees	Pollinating insects are important for production and productivity of crops	Yes, it is possible to replace plants which are homes to insects to be lost during the construction by planting	Non-priority ES
CULTURAL ECOSYSTEM SERVICES				
Ethical values	Yes, the project will have impact on ethical values of communities	Clearing of plants such as *Faidherbia albida* and other trees that farmers protect because of their social value will have impact on ethical values of the people	Yes, it is possible to replace them and a lot of similar species are found on cultivated farmlands in the district	Non-priority ES

6. ASSESSMENT OF ENVIRONMENTAL IMPACTS ON BIODIVERSITY

6.1 Impact Assessment Methods

An “environmental matrix” (Table 1-13) and professional judgement were used to identify the potential environmental impacts of the proposed project on biodiversity. Potential sources of impacts from the project activities during planning and design, construction and operation were identified with reference to the biological components to be impacted. The impacts presented in subsequent sections were determined based on the following information:

- Technical aspects of the project: This enabled the identification of potential sources of impacts, based on the analysis of the technical characteristics of the infrastructures to be built, as well as the construction activities, methods and schedule.
- Environmental and socio-economic baseline data (environmental and social components): This information facilitated understanding of the biophysical, social and economic contexts in which the project will be implemented and identification of issues that should be considered. The environmental and social components; and
- Issues and concerns raised by relevant stakeholders and project affected persons (PAPs): These issues from stakeholder consultations assisted in identification of the main concerns and potential impacts related to the project.

Table 1-13: Example of Identification Method of Environmental Impacts Matrix on Biodiversity Species

Proposed Project Activities	Biological Components				
	Terrestrial flora	Terrestrial fauna	Terrestrial ecosystem	Aquatic ecosystem	Habitats
Land demarcating/pegging	x				x
Land clearing					
Right of Way (ROW) to substation pegging	x	x	x	x	x
Clearing of a Right of Way (ROW)	x	x	x	x	x
Erection of power lines	x	x			x
Construction of access roads	x	x	x	x	x
Construction of Campsites and Workshops	x		x	x	x
Waste management	x	x	x	x	x
Influx of job seekers	x	x	x	x	x
Maintenance of Right of Way (ROW)	x	x			x
Decommissioning phase					
Demolition and dismantling of structures (e.g. campsites & workshops)	x	x	x	x	x
Disposal of materials	x	x	x	x	x
Site restoration	x	x	x	x	x

6.1.1 Project Potential Impacts Identified

The following are the potential impacts of the proposed project on biodiversity of the project site:

- Loss or destruction of habitats for fauna and flora;
- Loss of flora species;
- Loss of fauna (small mammals, birds, reptiles and amphibians);
- Loss of threatened and endemic flora and fauna; and

- Loss or reduction of Ecosystem Services (ES) of the Project Site.

6.2 Impacts Rating and Evaluation

Potential environmental impacts of the proposed project on flora and fauna species, ecosystem services and habitats were evaluated using the Government of Malawi EIA Guidelines for Energy Generation and Transmission Projects as follows:

M = Magnitude or Scale: 1 = site only; 3 = within 3-5 km; 5 = regional;
D = Duration: 1 = short-term; 2 = medium-term; 4 = long-term; 5 = very long-term;
P = Probability: 1 = not likely to occur; 3 = likely to occur; 5 = very likely to occur.
S = Significance: 1 = low; 2 = moderate; 3 = high; 4 = very high; 5 = unknown.

6.3 Significance Rating of the Identified Potential Impacts on Biodiversity and ES

The potential environmental and social impacts were assessed and the significance ratings before the mitigation measures are applied are as presented in Table 1.14.

Table 1.14: Impact significance rating before and after the mitigation measures are applied

ID	Potential Environmental impacts o Biodiversity and Ecosystem Services	Severity	Reversibility	Duration	Areal Extent	Environmental Context	Probability	Total	Significance without mitigation/ enhancement	Significance with mitigation/ enhancement
1.	POTENTIAL IMPACTS									
1.1.	Construction Phase									
1.1.1.	Planting of indigenous side adaptive tree seedlings in vicinity of project site	5	3	4	2	5	4	23	Moderate	Very High
2.	NEGATIVE IMPACTS									
	Construction Phase									
2.1	Loss or destruction of habitats for fauna and flora	5	3	2	2	5	5	22	Very High	Very Low
2.2	Loss of threatened and endemic flora and fauna	1	1	1	1	1	1	6	Very Low	Low
2.3	Loss of flora species	5	3	2	2	4	3	19	Very High	Very low
2.4	Loss of fauna (mammals, birds, reptiles and amphibians)	4	2	2	2	4	2	16	High	Low
2.5	Loss or reduction of Ecosystem Services from the Project Site	5	2	5	5	5	5	27	Very High	Moderate

6.4 Mitigation/Enhancement Measures for the Identified Impacts

Positive Impacts

(a) Planting site specific and adaptive indigenous trees to offset the cleared ones: For every one tree to be cut down during the construction of the project, five trees of same indigenous species must be planted in the vicinity and/or in places earmarked for village forests. It is estimated that on average, over 600 both large

and small trees will be cut down from the project site. It is thus, expected that over 3,000 indigenous trees of various species, principally *Faidherbia albida* and *Adansonia digitata* will be planted in the vicinity of the project site to offset the net loss.

Enhancement measures:

- Plant fast growing indigenous tree species which are site specific and adaptive (e.g. *Adansonia digitata, Faidherbia albida,* etc;
- Avoid and/or minimize encroachment of areas not earmarked for the project;
- Manage planted tree seedlings until they reach reasonable size that they can sustain themselves; and
- Train Village Natural Resources Management Committees in tree seedlings raising and management.

Potential Negative Impacts

(a) Loss or destruction of habitats for fauna and flora: Clearing of vegetation for construction of the solar power plant, access and service roads is likely to result in destruction of habitats for fauna and flora. Excavation and compaction of soils may result in loss of habitats for species of small mammals, reptiles and amphibians. This may eventually compromise the survival of soil-based micro and macro-biodiversity that occur on the proposed project site.

Mitigation measures:

- Ensure that vegetation is selectively cleared from the project site and excavations are undertaken as per designs to avoid unwarranted clearing of vegetation;
- Rehabilitate affected land by tilling the soils to facilitate natural regeneration of vegetation from saplings and soil seed banks;
- Plant indigenous site specific and adaptive tree seedlings and grass immediately after the construction works to ensure restoration of lost flora; and
- Ensure that seasonal wetland grasses that are found on the eastern part of the project site are not completely cleared away.

(b) Loss of flora and fauna species from the project site: Clearing of vegetation from the project site to pave way for the construction of the solar power plant, access and service roads is likely to result in loss or reduction of flora and fauna species that occur on the project site. This may eventually result in loss of natural scenery and livelihoods for the local communities.

Mitigation measures:

- Ensure that vegetation is selectively cleared from the project site and excavations are undertaken as per designs to avoid unwarranted clearing of vegetation;
- Rehabilitate affected land by tilling the soils to facilitate natural regeneration of vegetation from saplings and soil seed banks;
- Plant indigenous site specific and adaptive tree seedlings and grass immediately after the construction works to ensure restoration of lost flora; and
- Ensure that seasonal wetland grasses that are found on the eastern part of the project site are not completely cleared away.

(c) Loss or reduction of Ecosystem Services (ES) from the project site: Clearing of vegetation from the project site for the construction of the solar power plant, access and service roads is likely to result in loss or reduction of biodiversity ecosystem services that occur at the project site. This may

eventually result in loss of livelihoods and habitats for fauna, birds and flash floods which can cause loss of life and peoples' property.

Mitigation measures:

- Ensure that vegetation is selectively cleared from the project site and excavations are undertaken as per designs to avoid unwarranted clearance of vegetation;
- Rehabilitate affected land by tilling the soils to facilitate natural regeneration of vegetation from saplings and soil seed banks;
- Plant indigenous site adaptive tree seedlings and grass immediately after construction works to ensure restoration of lost flora;
- Ensure that seasonal wetland grasses that are found on the western part of the project site are not completely cleared away;
- Prohibit workers from disturbing the seasonal wetland through complete clearing of vegetation and constructing campsites and maintenance vehicle works on this habitat.

7. CONCLUSION

The biodiversity baseline study conducted has established that the project site has a number of both indigenous and cultivated plant species, small mammals, birds, reptiles and amphibians, including other species such as butterflies and grasshoppers. There are also a number of Ecosystem Services (ES) that the proposed project site provides to both biodiversity species and local communities living around the project site.

It has been determined that the biodiversity species and ES of the project area will be negatively impacted by the project activities. Some of the impacts include loss of habitats for biodiversity species, loss of flora and fauna species through clearing and excavation of the project area, and loss of ecosystem services that support life and the integrity of the habitats.

In this regards, a number of practical mitigation and/or enhancement measures have been developed to guide the Client and the Contractor so that the aforesaid impacts are avoided and/or minimized to acceptable threshold levels. This will ensure environmental sustainability.

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Introduction

Environmental Resources Management (ERM) has been retained by Power Engineers, Inc. (Power Engineers) to conduct an Environmental and Social Impact Assessment (ESIA) for the proposed 20 to 40 megawatt (MW) solar power plant with the option of an energy storage system in the Republic of Malawi (the Project). The Project is being developed by Golomoti JCM Solar Corporation Limited (JCM), a subsidiary of JCM Power.

ERM is conducting the ESIA as part of a larger Feasibility Study being conducted by Power Engineers. Power Engineers is conducting the Feasibility Study under a grant from the United States Trade and Development Agency (USTDA). The USTDA requires that all work under the grant is conducted by residents of the United States and the host country, in this case Malawi. Residents of other countries cannot work on the Feasibility Study or ESIA.

The ESIA will be submitted to the Environmental Affairs Department (EAD) and must therefore comply with Malawi's laws and regulations. Since the ESIA is being funded by the USTDA, however, it must also align with international lender standards, specifically, the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012).

PROJECT AREA

The solar plant will be constructed on a 91.605 hectares (ha) site (Solar Plant Site) located between Latitudes 14° 20'S and 14° 30'S; Longitude 34° 30' E and 34° 40' E and approximately 0.5 km from the Golomoti Substation and less than 1 km from Golomoti Trading Centre in Ntcheu District (Figure 1), within the Masasa Traditional Authority. The Project will also include the construction of a short (approximately 0.5 km) transmission line from the Solar Plant Site to the Golomoti Substation, as well as a short access road or roads extending from the highway to the northeast (M5) and/or from the existing Golomoti Substation access road. For the purposes of this SOW, the Project Area includes the Solar Plant Site, the transmission line corridor, and the two potential access roads.

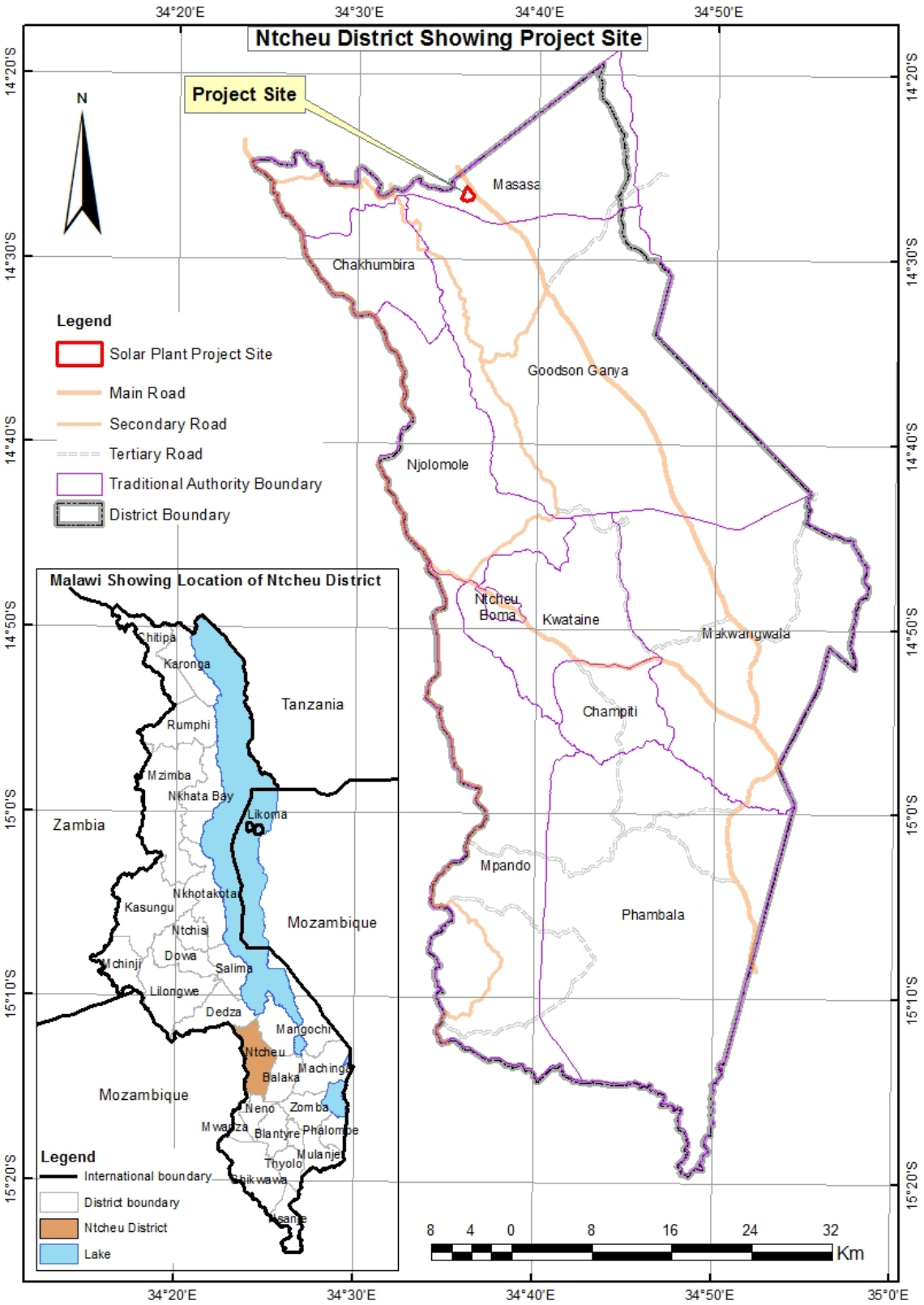

Figure1: Location of the Project Area

Main Objective

To conduct Biodiversity Survey within the Solar Plant Site and its surrounding

Specific Objectives

- To describe habitats and/or vegetation cover types in the Project Area.
- To create habitat map, using the satellite imagery of the Project Area to be provided by ERM as a base map, supported by photographs of plant species and animal species observed in the Project Area and the immediately surrounding vicinity.
- To confirm and identify habitat types and trees previously identified by satellite imagery. Of special interest is confirmation of the presence and distribution of Baobab trees (*Adansonia digitata*).

Methodology

A series of site walkovers was conducted to confirm the vegetation types and tree species of special interest in the project area using a handheld GPS. Field observations were made and have been used to verify and update the base map accordingly.

The base map involved integration in GIS of thematic layers acquired from the department of Surveys including land use data. The Satellite Imagery coupled with field observations were used to update the content from the thematic maps where the latter was considered out of date. For example, the latest land use map for the project Area does not show the Baobab trees grave yard and the Substation which can only be seen on Satellite data and through field observations.

Data Processing

The final maps are a product of desktop work (base maps) integrated with field observations. The GPS points were overlaid on the base maps and the recorded attribute information was useful for verification and updating of the final maps. The maps for the project area are presented and described below:

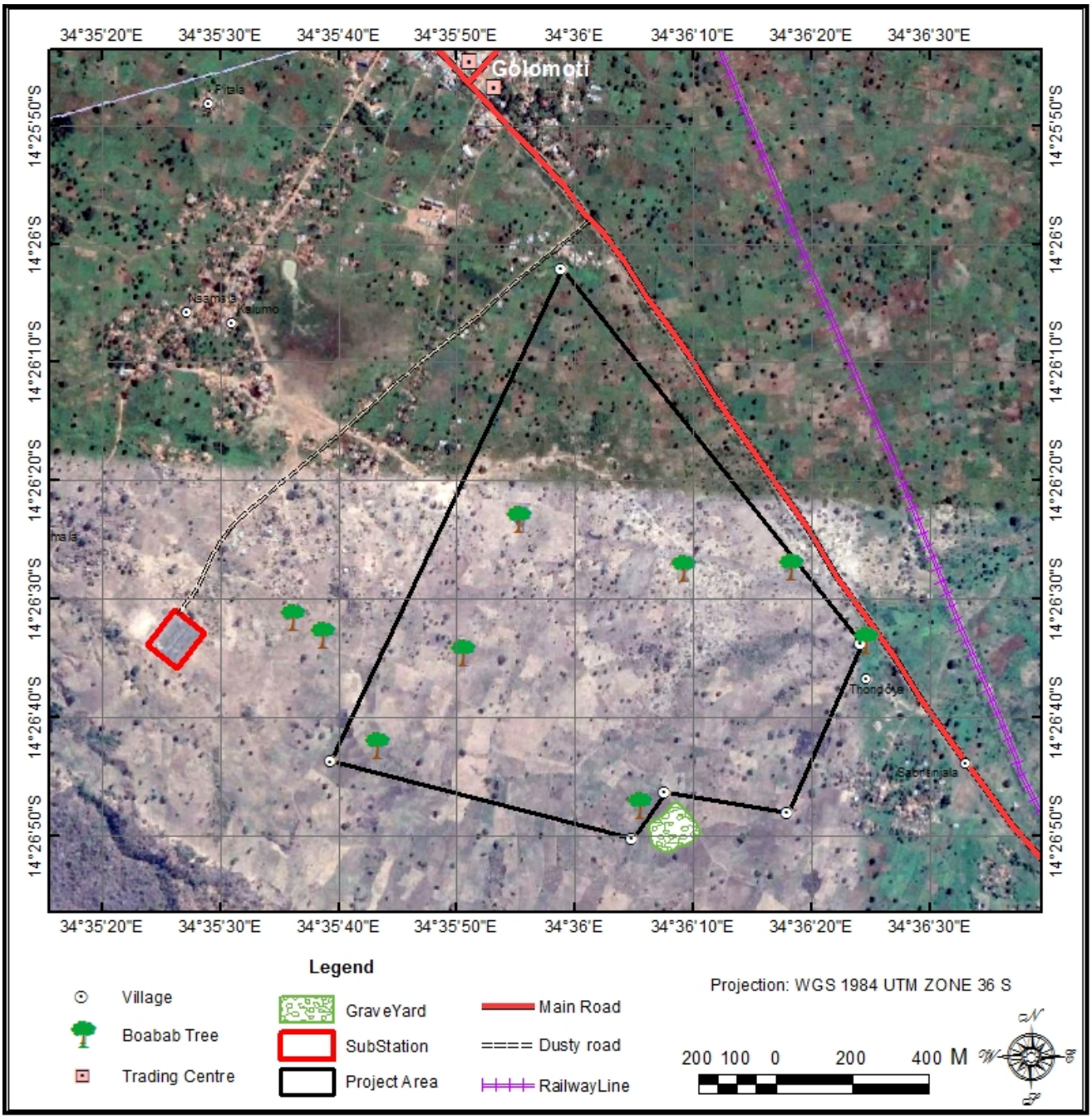

Figure 2: Base Map of the Project Area

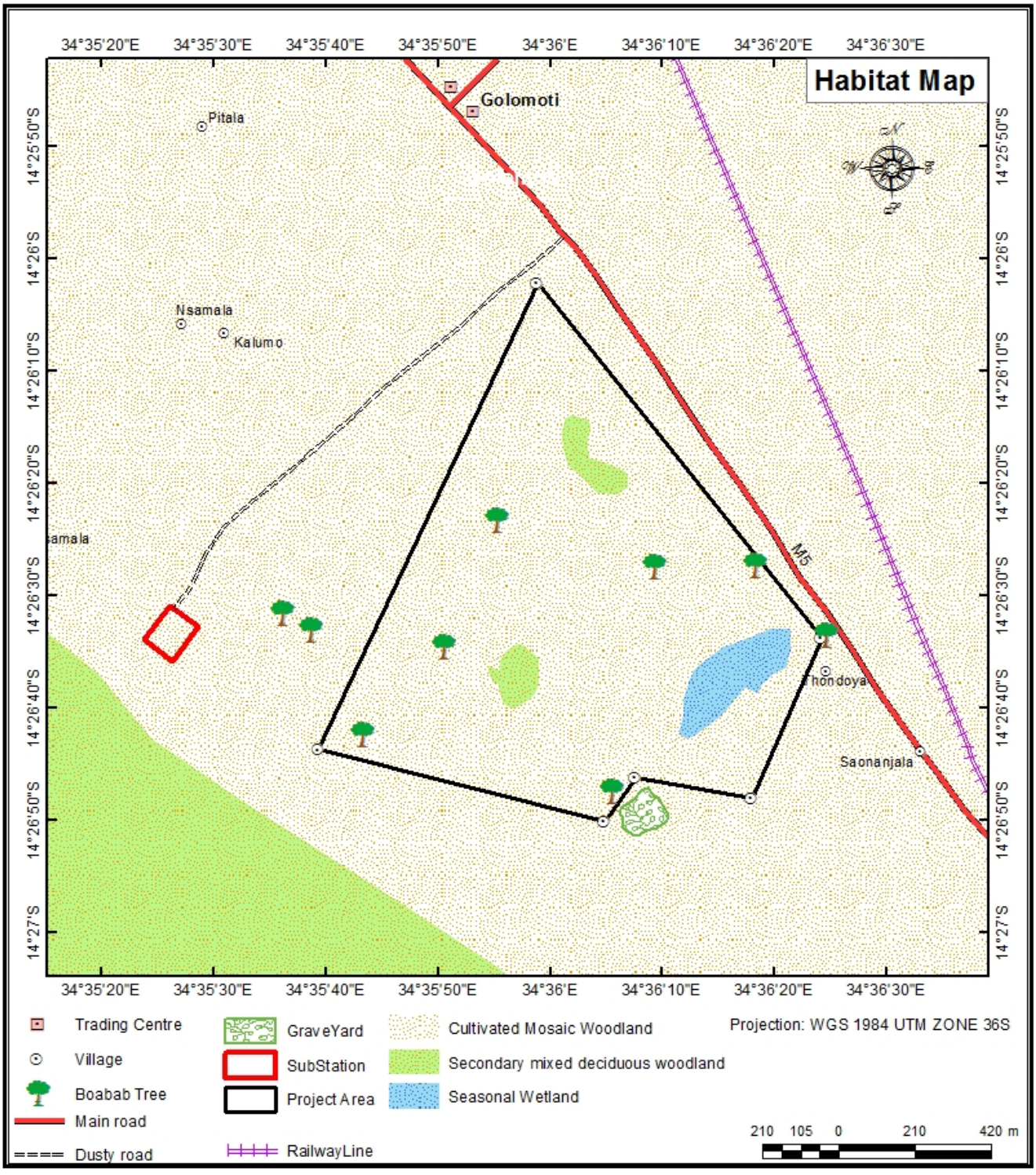

Figure 3: Habitat Map of the Project Site

Results

From a series of the field walkovers in the project site and its vicinity, it can now be confirmed that the area generally has an agriculture land with Maize and Cotton as the major crops currently being cultivated. Fewer areas along the M5 road are characterized by the regeneration of savanna woodland in a cultivated land. Of special interest is the presence of some Baobab trees in the project area. It has also been observed that the habitats north-western and south-eastern parts of the project area are mainly homestead and cultivation.

It has been observed that the project Site lies in the area of traditional Authority Masasa in Ntcheu district and not in Dedza as described under the area by the client

GOLOMOTI BASELINE CULTURAL HERITAGE IMPACT ASSESSMENT REPORT

April, 2019

EXECUTIVE SUMMARY

An identified site in Golomoti has the potential for setting up a Solar Power Plant project; comprising of solar panels and supporting structures, the associated transmission line and two potential access roads. The project, which is proposed for development at Golomoti, by JCM Solar Corporation Limited (JCM), a subsidiary of JCM Power has the potential to impact on the cultural heritage of the site, covering 91.605 hectare (ha).

As a requirement by the Malawi Government and International Best Practices, the project feasibility study has incorporated an Environmental and Social Impact Assessment, where the Cultural Heritage assessment is a component. The preliminary cultural impact assessment commenced to identify archaeological resources (sites and isolated features and artefacts); built heritage (i.e., historic buildings and structures); and the cultural significance of the site to local communities (Living Heritage). The methodology applied Cultural Heritage survey included desk review, ethnographic patterns and a survey on the site and the surrounding areas.

The scope of the work focused on the fulfilment of all the legal requirements that safeguard the cultural resources of Malawi (i.e. the Monuments and Relics Act and the Cultural Policy) and the international standards to which Malawi is a signatory to the World Heritage Convention. This gave a clear outline for the resources to be identified and valued, the potential impacts on the resources by the project activities and the mitigation measures to safeguard the resources. The assessment provided an insight on the significance of the site, tangible and intangible resources to be potentially affected.

Baobab trees in the proposed project area have significance on the living heritage and archaeological heritage. The trees have been used for burial. Other than the past relevance of the baobab trees, nothing was highlighted on the current significance of the proposed site which is predominantly used for agricultural fields.

Current, the occupants of the villages around the proposed project site have no recollection with the earlier inhabitants. Other findings from the survey include; remains of homesteads; iron working site and clusters of pottery. The pottery can be relatively dated within 1200 to 1750 AD. The site also has the potential to illuminate on the Malawi's prehistory, on the expansion of the Maravi Kingdom. These findings highlight the significance of the site and further research can validate the assumption. The mitigation proposed is a rescue archaeology which would aid in safeguarding the cultural resource for Malawi on the proposed site.

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1. INTRODUCTION

The Environmental and Social Impact Assessment (ESIA) is in view of the proposed 20 to 40 megawatt (MW) solar power plant proposed for development developed at Golomoti by JCM Solar Corporation Limited (JCM), a subsidiary of JCM Power. The solar power plant will contribute to the generation and availability of electrical energy for the Republic of Malawi. Power Engineers is conducting the Feasibility Study under a grant from the United States Trade and Development Agency (USTDA).

The Project components include the solar power plant, the transmission line and two potential access roads, which can have an impact on the cultural heritage of the site covering 91.605 hectare (ha). Water Waste and Environment Consultants have been sub-contracted to conduct the baseline survey, including an assessment of the cultural heritage impact of the project, as part of the prefeasibility study.

This report presents the potential cultural heritage that may occur in the project area and identifies potential impacts that may result from the proposed clearing and construction activities. The report further provides recommendations for a comprehensive cultural heritage impact assessment to be conducted at a later stage as a mitigation measure in safeguarding the cultural resources on the site.

1.1. Description of Site

The site is located at edge of the boundary between Dedza and Ntcheu district with two ethnically distinct groups occupying the cultural ecological landscape. The proposed site is in Dedza (see map in figure 1) which Golomoti and the villages surrounding the site are predominantly of Ngoni ethnic affiliations. The villages across the boundary settled later than those in the villages around the site. From the preliminary analysis of the site, the earlier inhabitants could have been Chewa with affinities to the Mankhamba Kingdom. The site is a cultural landscape with both intangible and tangible heritage. Disturbance from of the soil layers risks loose of archaeological information which is pertinent in the understanding of Chewa expansions as part of the Maravi Empire. The intangible heritage connects the respective villages that occupied the cultural landscape of Golomoti.

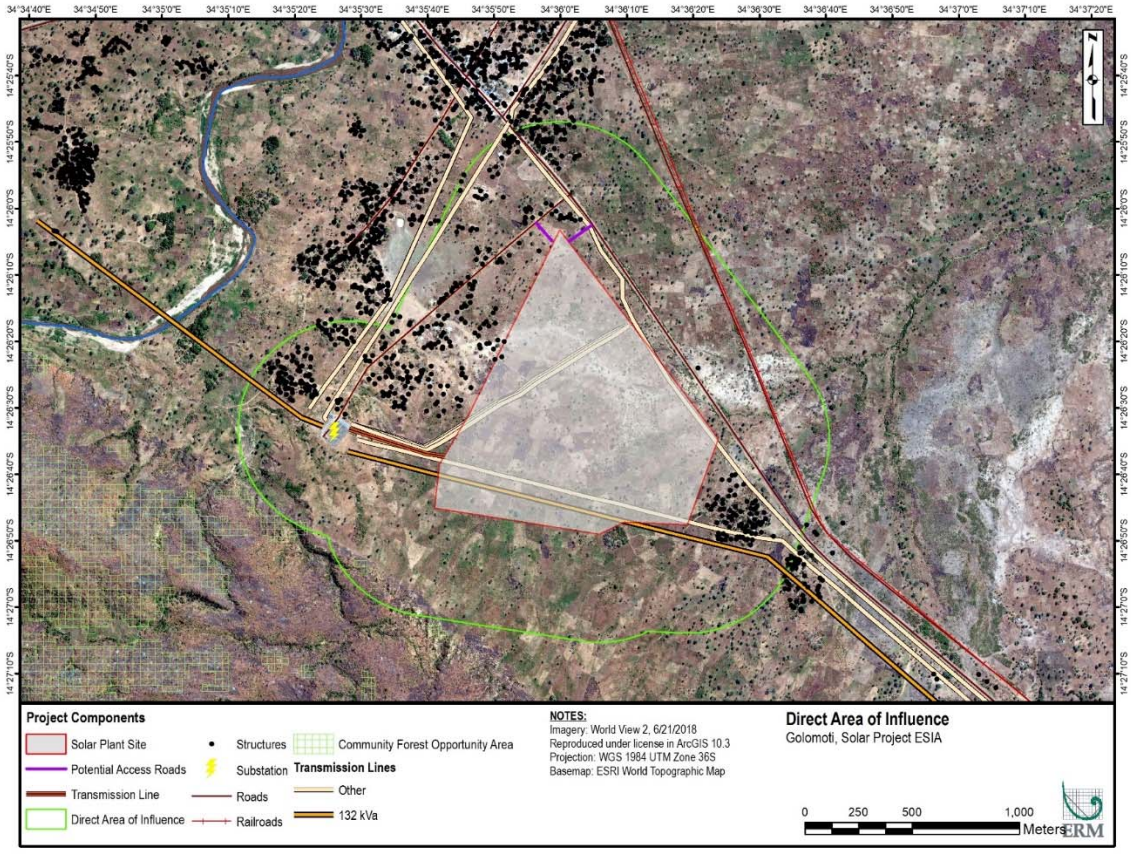

Figure 1: Map of the Golomoti Project Area (Sourced from WWEC ESIA proposal 2019)

1.2. Legal and Regulatory Framework

The survey complied with both the international and local regulations. The Malawi cultural heritage laws and regulations are mainly outlined in two legal documents i.e. Monuments and Relics Act of 1991 and the Cultural Policy (which was approved by the Government of Malawi in 2015). These two instruments clarify the legal mandate and procedures for all activities conducted for this cultural heritage survey. The Cultural policy highlights Malawi's main priority areas and this work is within the scope. Section 5.7.8, Objective 8, from the Cultural Policy requires project proponents "to take into account cultural factors in development projects, policies and programmes for the nation".

The main legal implications of the survey are from the Monuments and Relics Act, which defines culturally significant material as: cultural resources in their tangible forms, comprising both movable and immovable physical cultural heritage. The different types of cultural resource described in the Act are;

- Places, buildings and structures of cultural significance;
- Places and objects to which oral traditions are attached or which are associated with living heritage such as ethnographic art and objects ;
- Historical settlements, townscapes and sites of significance relating to the history of slavery;

- Landscapes and natural features of cultural significance;
- Geological sites of scientific or cultural importance; archaeological and paleontological sites and objects;
- Graves and burial grounds

According to the Monuments Relics Act, the activities to be done as part of an ESIA are stated in Section 29 as follow:

> Section 29.-1 states that a person in charge of any survey, excavation, exploration, construction or new development shall, at the earliest stages of planning for such activities, give notice to the Minister to enable, where necessary, rescue archaeology to be carried out in accordance with the subsection
>
> Section 29- 2 states that rescue of archaeology of a monument or relic shall be carried out by the Chief Antiquities Officer or any qualified person with an excavation permit issued by the Minister and the cost of such work shall, unless the Minister otherwise directs, be borne by the person in charge of any survey, excavation, exploration, construction or other development.

The Terms of Reference for this assignment require adherence to the policy on social and environmental sustainability of the International Finance Corporation (IFC). IFC Performance Standard 7 (Indigenous People) covers the intangible heritage and standard 8 (Cultural Heritage) deals with tangible cultural heritage. In addition, the World Bank OP 4.10 provides guidance on the adherence of the safeguard of cultural heritage.

The 1970 UNESCO Convention on the Protection of the World Cultural and Natural Heritage (World Heritage Convention, WHC) is clearly stated in the Standard 8 of IFC. Malawi is a signatory of the WHC and has to adhere to all its requirements.

2. METHODOLOGY

2.1. Terms of Reference

As part of the Environmental and Social Impact Assessment (ESIA) Baseline Field Investigations, cultural heritage survey of the Project Area has the following as the Terms of Reference:

- Identify archaeological resources (sites and isolated features and artefacts);
- Identify built heritage (i.e. historic buildings and structures); and
- Establish cultural significance of the site to local communities (living heritage)

An antiquities officer was present during the Cultural Heritage survey, to ascertain the relevance of the site, as required by the law.

2.2. Impact Assessment Methodology

In safeguarding the cultural ecological landscape of the proposed site in Golomoti, the aims of the survey included the following:

- Reviewing of existing information on the cultural heritage of the site

- Identifying and describing cultural resources
- Undertaking a field survey to collect baseline data
- Describing the values of the cultural resources
- Identifying impacts on cultural resources, of the proposed developments on the site
- Identifying mitigation measures to safeguard the identified cultural resource, from the proposed project activities.

Three respective methodologies have been applied to investigate the cultural significance of the site.

- Desk Research – literature review of archaeological landscape and ethnographic research done in areas close to the proposed site
- Ethnographic Patterns – this is in reference to both interviews done and observation from around the village and surrounding areas that have associations to the proposed site
- Survey Research – Transect walk around the site to identify possible archaeological materials

2.2.1. Desk Research

Nothing specifically on Golomoti was found in the preliminary desk research. Dedza is nonetheless rich with cultural heritage studies both anthropological and archaeological research. Past archaeological research works in Dedza have identified Later Stone Age (LSA) sites, Iron Age (IA) sites and rich rock paintings. The main documents/ research that were used for the purposes of this work which outline the archaeology of Dedza with closer affinities to Golomoti were few (Cole-King, 1973; Robinson, 1975; Mgomezulu, 1978; Juwayeyi, 2010; Boucher, 2012). A significant archaeological site close to Golomoti is Mtemankhokwe, an extensional location as part of Maravi Empire expansions. The site was excavated and reported by Juwayeyi (2010). The pottery found on the site was predominantly Mawudzu dating from 1200 to 1750. There can be a possible correlation that the sites have close affinities but this can only be verified if further research is done on the site.

2.2.2. Ethnographic Patterns

Cultural significance of the site was assessed from a brief ethnographic research in identifying any past and present memorable activities around the proposed project area. Two local key informants participated in the collection of the oral traditions and the survey. Permission was acquired from the chiefs in the area before conducting the interviews of people in the villages surrounding the site.

The sampling was done by age segmentation and one or more elderly persons were interviewed in relation to the size of the community. The elderly were purposefully sampled as custodians of the oral traditions in the area as the later generation hold little or no recollection of activities done on the site except as agricultural fields. Most of those interviewed nonetheless, did not recall much of other activities attached to the site pre-dating the agricultural fields.

2.2.3. Survey Research

As a process of identifying archaeological resources and built heritage, both surface inspection and subsurface testing were done on the proposed site, covering 91.605 hectare (ha). A systematic surface inspection by four persons[1] involved a foot traverse along the pre-defined linear transects which was spaced at systematic intervals across the survey area. Cultural materials found on the surface were recorded and nothing was collected from the site. Not much sub-surface testing (shovel testing) was done since most of the fields were still covered with crops. Only one unit was recorded but did not yield much on the understanding of the depth of the materials. The Site survey involved a complete surface inspection of the proposed project area.

2.3. Restrictions, Limitations and Gaps

Dedza is among the districts where vast archaeological research has been done with a concentration on the rock paints. LSA, IA and ethnographic research of the district is rich. The vastness of the information also highlighted the possibility that areas that surround Dedza can possibly yield relevant information, especially on the Chewa ethnic group migrations. Nevertheless, from most documents reviewed, less work has been done in and around the Golomoti area. No systematic studies have been done specifically for the Golomoti area, prior to this survey. The Department of Antiquities registry and other relevant documents have well documented information of areas (Mua and Mtemankhokwe) in the vicinity of Golomoti. The work presented on the characterisation of the cultural landscape of Golomoti is with reference to associated activities in the general surrounding areas.

The survey was restricted to areas which were visible, despite presence of the crops in the field. Manoeuvring through the fields was a problem as some of the fields were too densely covered for one to see the ground (see figure 2). Most of the site however, gave a clear view of what cultural resources are present at the site and the possible cultural landscape distribution. A clear view and proper mapping of the cultural resource distribution during months when it is cleared would yield more information.

3. GOLOMOTI CULTURAL LANDSCAPE

Golomoti cultural landscape seems to have associations with three respective ethnic groups of Yao, Ngoni and Chewa ethnic groups. Dedza is predominantly Chewa however, ethnic expansions pushed other Chewa groups from their villages and were occupied by the other ethnic groups. The Ngoni have however assimilated and borrowed most cultural beliefs and practices of the Chewa who were the original inhabitants of the area.

Currently, Golomoti is under the traditional rule of Traditional Authority Kachindamoto, who belongs to the Ngoni ethnic group; signifying the Ngoni conquerors of some of the Chewa tribe inhabited areas. The Kachindamoto reign has faced destabilizing effects from the surrounding areas due to the precariousness of the leadership in the Mtakataka area, which is dominated by 70% of Chewa and Yao villages (Boucher, 2009; Kalilangwe & Kalilangwe, 2002). The estimated

[1] The consultant, Antiquities officer and two key informants who were briefed on what to look for. The key informants had a closer upper hand information which was handy in the field and during interviews.

time period of Ngoni settlement in the Central Region of Malawi is in the 1850s, which verifies the early inhabitants of the site to have been the Chewa. In view of the history in occupation of the areas around Golomoti, the ethnographic information presented in this report was collected from the Ngoni inhabitants while the archaeological evidence might not be of the current inhabitants but rather the early Chewa inhabitants (Boucher, 2009; Pachai, 1972). Hence, the relevance and significance of the site, with reference to the site habitation history, might be different.

3.1. Ethnographic Patterns

The usage of the site can only be remembered as far back as an early gardening field. The respondents of the interviews, to the relevance of the site, were in relation to the pots and trees that are found in the maize fields. The main oral traditions that stood out from the interviews were about the baobab trees present in the fields and an old school. Most of the younger generations did not recall any significance of the area other than mere maize field gardens. From the oral discussions on the traditions, a cave in the hills, not on the proposed site but overlooking the site, has been mentioned in association to the past usage of the site.

3.1.1. The baobab trees

Baobab trees have relevance in most South Eastern Africa, although the significance can vary between societies[2]. In Malawi, especially in the Lower Shire, rain sacrificial sites at the foot of these trees have been reported (Welling, unpublished doctoral research 2005). Others have used the caving in the tree as a burial site for people suffering from leprosy and for other burial circumstances. However, the relevance of the trees to the villages in the site location is different. The trees are given names with stories that correlate to their significance. The proposed site has three trees, namely:

- Saimba Nluzu (Muluzu)
  Saimba Nluzu literally translates into English as “do not whistle”. Oral traditions have it that the area around the tree was dangerous. There is however no conclusive knowledge of what exactly made the place around the tree dangerous. Other things mentioned include that there was a possibility that the area was inhabited by either spirits, snakes, wild animals, and/or thieves. It is said that, no one was to make noise, or whistle when going past the tree, to avoid being attacked by those mentioned above. Figure 2a, b and c are pictures of the tree, both outside and inside the tree.

[2] https://www.gounesco.com/malawi-baobab/ highlights the spiritual significance of baobab trees in Malawi

Figure 2: a. Saimba Nluzu baobab tree b. inside the tree looking up c. the cave inside the tree

The tree is now known to have lost the mystical powers it was once revered for due, to the immoral acts done in the tree. Inside the tree is a big cave that can hold more than four people. Visibility around the tree was impossible due to the creeping plants around the tree, which we avoided scrapping off, due to the presence of bees up the tree. From discussions with people from other areas in Malawi, the presence of bees is commonly associated with the presence of spirits. An excavation inside the tree would be of interest, as a respondent highlighted a possible burial or other associated usage inside the tree.

- Mchiza Alendo
  Mchiza (Mchiritsa) Alendo, literally translates into English as "healer of visitors". The tree is within the boundary between Dedza and Ntcheu, where the boundary between the villages is distinct. Different narratives were given about the tree being the healer of visitors; the outstanding narrative was that it was the tree that gave baobab seeds for consumption to the newly inhabited area across the boundary between the two villages. The inhabitants on the Ntcheu side are known to have come later and begged for land from the current villages on the Dedza side. The tree was the resting place where people from the respective villages could meet. The other narrative was that the tree offered baobab seedlings to the boys that went grazing their livestock in the fields. Younger generations knew of the tree but not the etymology of the name of the tree. Figure 3 is a picture of the tree.

Figure 3: Mchiza Alendo tree

- Third Tree
  The tree (younger than the other two trees) was never given a name. The exceptional story was that there might have been a possibility that it was used for the burial of people deceased from leprosy. Across Malawi, those who died from leprosy were not buried in the graveyards but in a cave or in a baobab tree if it had a cave. The current mystical value (according to key informant 2 who spoke with skeptism, speaking with certainty attracts attention to the validity of the story and fear of accusing people in the community of witchcraft and sorcery) might be a grounding of beliefs associated with sorcery in the village. Owls loom around the tree which alludes to the mystical value of the tree. Owls are believed to foretell death, bring bad luck and are associated with witchcraft (Mikkola and Mikkola, 1997). Figure 4 is a picture of the tree.

Figure 4: Third Baobab tree

3.1.2. An Old School Shelter

During the colonial period, there was a shelter which is known to have been used as a school learning facility. Most people recall going to the school during the period it was in operation but the exact date was not verified. Nothing indicated the presence of the shelter which might have been used as the learning shelter on the site, other than the flat and plain ground that the key informants showed WWEC staff.

3.1.3. M'Bisa

M'bisa literally translates into English as "that which hides". It is a cave overlooking the site from the hills above; according to most of the oral interviews in association with the site. It is known that a village that once existed at the foot of the hill escaped the village to hide in a cave up the hills. Story has it that people were escaping from something in the low lands and ultimately the whole village disappeared inside the cave. The disappearance is surrounded with speculations that either they fell into the cave and died or spirits took them. The mystical value of the hill is in relation to the souls that were lost in the cave. M'bisa (the cave) got its name from hiding the people in the cave and it is believed that the souls still linger around the cave. Figure 5 shows the sight of the hills from the proposed site.

Figure 5: Sight of the hills hosting M'bisa cave

3.2. The Survey

Dedza has yielded archaeological information from all prehistoric time periods. Most research in the area has given information on the LSA and the full outline of all time periods of hunter/gather transitions. The Iron Age information of the area is also rich from the information of early Iron Age periods from third century AD to present. The rich rock art research has generated both archaeological and anthropological studies of the area. Possible finds from the proposed site varied from LSA materials and definite Iron Age materials. The preliminary survey indeed verified the assumption on the vast information that the site holds for the Iron Age materials present at the site. Quartz (stone type) which is a raw material that characterizes most LSA finds in Malawi is highly present in the stratigraphy of the site as noted in the gullies cutting through the site (see figure 6). Not much attention was given on the possible LSA, since the gullies might have reflected disturbed layers of archaeological materials.

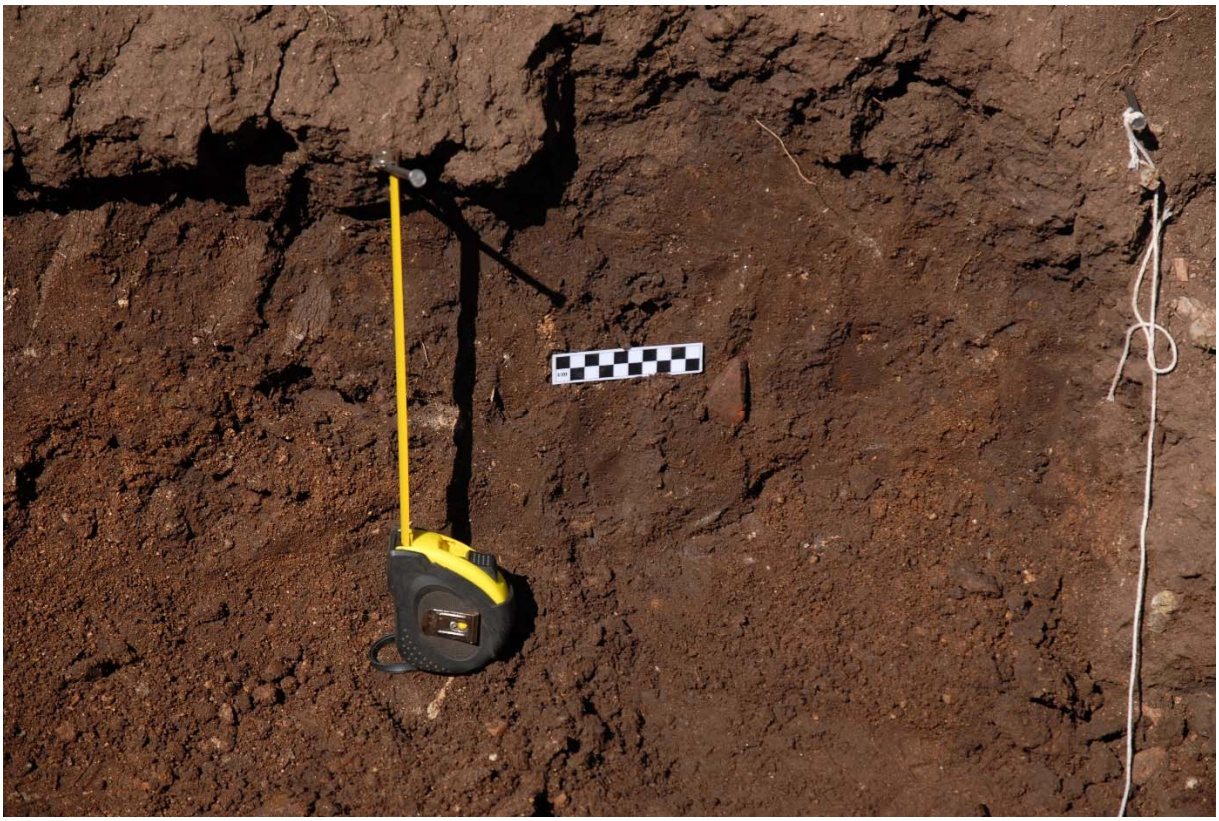
Figure 6: Section cutting with pottery fragments

Several pottery fragment clusters were found on the surface, a possible iron smelting/smiting site and remains of more than 10 houses have also been recorded. This evidently supports the assumption of early habitation at the site. The pottery found on the site was mostly undecorated pottery and one decorated pottery had affinities of Kapeni ware. Its estimated time period is from 9th to 15th Century. One pottery sherd cannot be a basis for conclusive evidence of in situ presence of the Kapeni ware. The closest excavated archaeological site is Mtemankhokwe which dates from 1200 to 1750 AD by the presence of Mawudzu ware (Juwayeyi, 2010). All the above-mentioned pottery speaks of an early Chewa settlement, after the second migration but can only be confirmed with an archaeological excavation research.

Most people in the surrounding villages do not recall that there was a village in the fields that referred to the possibility of an overlap in the settlement of the area between the Chewa and the Ngoni. One respondent remembers the area to have been habited. She once dug a whole pot from the ground. This corresponds to the hypothesis that the site might have been vacated abruptly, either because of the Ngoni or Yao raids; thus, an association to the oral traditions of M'bisa cave where people escaped to. The oral tradition might have been a remnant narration of the early inhabitants of the villages below the cave.

3.2.1. Pottery

The site has numerous clusters of pot sherds. Most of the pot sherds that were found were undiagnostic. Nonetheless, among the sherds, a few were noted to be decorated. Mtemankhokwe site yielded a lot of undecorated Mawudzu pottery (see figures 7, 8 and 9). Mawudzu ware is characterised with vessels that are usually simple. The pot vessels are spherical pots with constricted mouths and sometimes shouldered with conical or concave necks. Other pots are large U-shaped pots while most bowls are hemispherical or open and may have flat or pedestal bases, though less usual than rounded ones. Most pots excavated at Mtemankhokwe were undecorated; nonetheless when decorated, Mawudzu ware is characterized by impressed chevrons and scallops; tooth patterns that run around the very slightly shouldered u- part of the pot; incised herringbone; dentate motif in false relief; incised festoons around the slight and pendant arc and stamping, though it is rare. The finish is normally a polychrome burnish which sometimes occurs with an outline of incision. Most of the pot sherds out of the surface finds at Golomoti were undecorated, both as rim sherds and body sherds.

Figure 7: Mawudzu ware reconstructed (pictures taken from the repository)


Figure 8: Decorated Mawudzu ware (excavated by Juwayeyi)


Figure 9: Undecorated Mawudzu ware bowls

Only one sherd from surface finds had definite affinities of Kapeni ware that can be relatively dated to the second migration of the Chewa kingdoms from 9th to 15th Century. Another peculiar was a piece of pottery which was undiagnostic with a possibility of either being a pot handle or an addition placed on a pot as a decoration (see figure 10). Further research and radio carbon dates can help in understanding and estimating the age of the site.

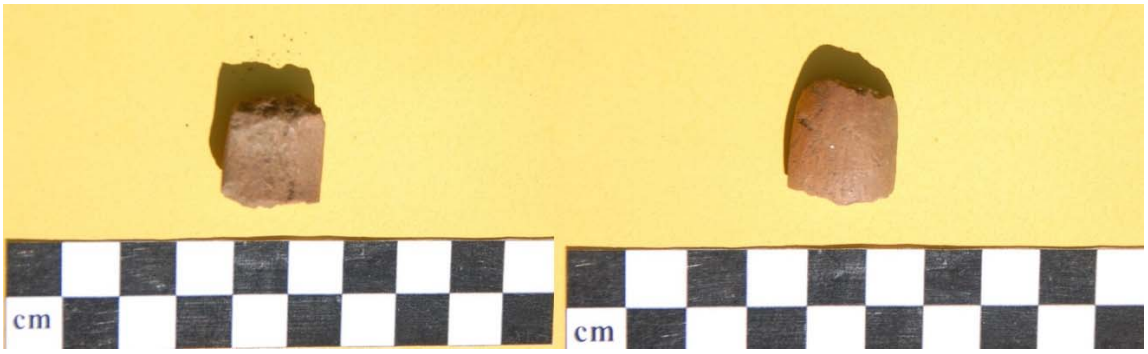

Figure 10: Pieces of pottery, possible a handle or an addition on pottery

3.2.2. Iron Slag

A piece of possible tuners pipe and accumulation of iron slag was found at (see figure 11). The site might have had the potential of iron-working. A water source is close by and the mountain might have been the source of timber. This gives a good geographic understanding of how relative the things might have been distributed around the site. Although there is a possibility of an iron-working station at the site, no iron furnace has been noticed close to the site. Juwayeyi's excavation at Mtemankhokwe found the possibility of iron smelting and locally made iron implements in the vicinity.

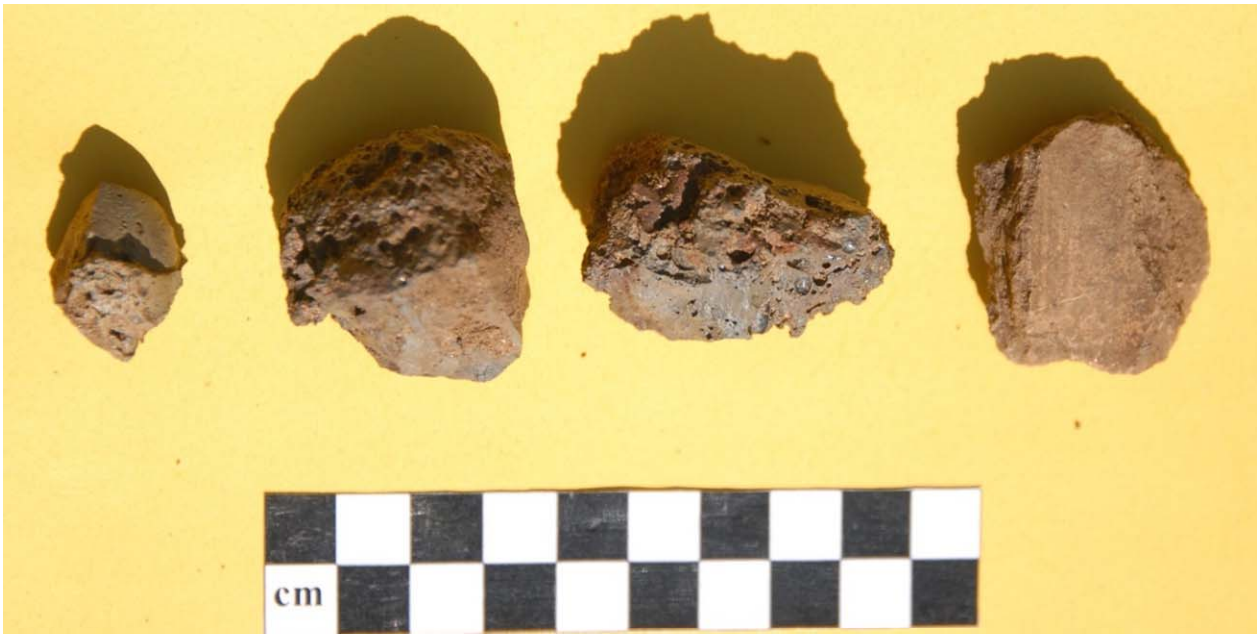

Figure 11: Pieces of iron slag and a piece of a tuyere pipe

3.2.3. Daga

Daga is burnt clay that is left from a fallen house. The survey recorded more than 10 houses that were in close proximity. This verifies a possibility of a village to have been in the area. The older generation in the communities surrounding the fields did not recall people living in the field. They

only remembered temporary shelters for people who went to their gardens for farming. Most of the respondents from the interviews, related the presence of the pot sherds to the temporary homesteads of the farming communities around the fields.

The house mounds had pottery scatters around them, which corresponds to an abrupt vacation from the site. It is rare for whole pieces of pottery or a lot of pottery scatter, to be found in cases where a habited site and belongings were left on a peaceful accord. Stories from M'bisa might support assumptions that the communities would have left abruptly, fled into the hills and never returned. Langworthy (1972) states that during the time he was doing his research, most of the Chewa remembered the middle and late nineteenth century wars of the Ngoni, Yao and Chikunda. Radio-carbon dates and a meticulous research can help in verifying the current assumption.

4. PRELIMINARY IMPACT ASSESSMENT

This Preliminary Impact Assessment on the proposed site suggests that Cultural heritage can be affected by deep excavations for construction and road construction.

4.1. Site Integrity

Most of the materials are in situ, despite the top layers of cultivation. The site has a terrain that might have a minimal possibility of washed artefacts to a secondary context. Understanding of the landscape, in relation to most of the clusters, would unveil the distribution and understanding of the site fully. Nonetheless, most materials are in their primary context with minimal disturbance.

4.2. Archaeological resources scientific value

Ten kilometers away from Golomoti is a site that was excavated as reported by Juwayeyi (2010) and the analysis yielded information on the Maravi Empire expansion of the Mtemankhokwe Kingdoms. From the assessment performed, this site might have been an extensional habited area from the Mtemankhokwe kingdom. This site would yield understanding on the second Chewa migrations. The site has neither public significance nor economic/monetary value as an archaeological site, but can be referenced.

4.3. Public significance

Malawi's prehistory remains scanty. Therefore information that can be retrieved from the voyages and coming of missionaries is of primary importance. The information from the site can add interpretive, educational and recreational potential on Malawi's prehistory.

4.4. Ethnic significance

The current inhabitants of the area are not closely aware of the early Chewa settlements. Therefore oral traditions on ethnic significance of the site can better be appreciated if additional information, where available, is collected from the nearest Chewa villages; assuming they have recollections of the early habitations at Golomoti.

4.5. Historic archaeological sites

The site is of high historic value. However, further research in the archives can contribute to the archaeological data for a better perspective of the Golomoti site in the Maravi Empire expansion.

5. RECOMMENDED TERMS OF REFERENCE

The preliminary research of the site has provided an insight for planning a proper Cultural Heritage Impact Assessment (CHIA). The CHIA should answer the following questions:

- Are there oral traditions that can correspond to the early Chewa habitation of the site?
- Is there any Later Stone Age significant site or any other related activities?
- How far extended was the habitation on the site and when was the site inhabited?

These questions can be answered through the following methodology:

- Interviews with (elderly) Chewa residents closest to the site (2 days; 1 person)
- A full cover archaeological survey in the proposed site (1 day; 4 persons)
- Archaeological excavations
    - Inside either of the trees (2 days; 2 persons)
    - Pottery Cluster areas (4 days; 2 persons)
    - At least two hut mounds (3 days; 2 persons)

Full excavation of the site would provide more clear information of the site. The site has potential of providing historical information from the second Chewa migrations and Maravi Empire expansion. Depending on the depth and density of the cultural materials, most of which has been retrieved, no further mitigation measures will be needed once a scientific archaeological research has been done to the site. The excavation should be done between the months of August and September when the fields are clear and the soil is dry.

6. SUMMARY AND CONCLUSION

An area covering 91.605 hectare (ha) has been identified in Golomoti for a potential to set up a Solar Plant and the transmission line corridor, and two potential access roads. A CHIA as a segment of the ESIA has been done to assess the impact on the cultural heritage of the site. The assessment covers the significance of both living heritage and archaeological heritage of the site and proposes possible mitigation measures. This follows from the requirements stated in the legal framework for Malawi and other applicable international standards.

The site has potential to add knowledge on Malawi's history and prehistory. The oral traditions have highlighted the living heritage, especially on the value of the baobab trees in the proposed site. The knowledge is nonetheless fading in the older generations.

The survey on the site has yielded archaeological information from the artefacts and features present on the site. This information, through further archaeological and ethnographic research of the site, can add knowledge on Malawi's history and prehistory, especially towards the understanding of the expansions of the Maravi Kingdom. This is among the priority areas in the cultural policy Section 5.3.1. b. which highlights the need to "conduct research in archaeology, material culture, history, traditional methods of education, vernacular languages, religion, traditional music, traditional dance, traditional medicine, traditional food and traditional games and document the results".

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8. APPENDICES

8.1. GPS Coordinates from Survey

	ELEVATION	36L	UTM	COMMENT
1	561	0672604	8402204	Starting point of survey
2	562	0672529	8402252	Pottery scatter
3	564	0672181	8402380	Perimeter way point
4	566	0672137	8402402	Pottery scatter
5	572	0671891	8402392	Perimeter way point
6	554	0672314	8403306	Perimeter way point
7	549	0673020	8402894	Perimeter way point
8	547	0673018	8402894	Perimeter way point
9	544	0673199	8402572	Perimeter way point
10	544	0673124	8402572	Perimeter way point
11	550	0673066	8402412	Perimeter way point
12	544	0673020	8402308	Perimeter way point
13	552	0673007	8402268	Perimeter way point
14	558	0672954	8402272	Perimeter way point
15	553	0672700	8402314	Perimeter way point
16	553	0672696	8402324	Perimeter way point
17	553	0673017	8402908	Saimba Nluzu (Baobab tree)
18	559	0672579	8403004	Mchiza Alendo (Baobab tree)
19	559	0672513	8403034	Old School Shelter ground
20	561	0672713	8402650	Baobab tree (Possible burial?)
21	560	0672895	8402348	Pottery (Possible Kapeni ware)
22	556	0672893	8402340	Fragment of a Tuyere Pipe (?) and Iron Slag
23	562	0672882	8402274	Cross Section Cutting
24	561	0672602	8402800	Daga
25	554	0672638	8402810	Daga
26	556	0672642	8402758	Pottery & Daga
27	556	0672615	8402662	Pottery & Daga
28	558	0672616	8402662	Pottery & Daga
29	557	0672550	8402594	Pottery & Daga
30	559	0672536	8402554	Pottery & Daga
31	560	0672504	8402536	Pottery & Daga
32	556	0672576	8402472	Pottery & Daga
33	554	0672488	8402474	Pottery & Daga
34	557	0672433	8402506	Pottery scatter
35	560	0672433	8402528	Daga
36	561	0672431	8402530	Pottery scatter
37	560	0672333	8402474	Pottery & Daga
38	561	0672303	8402502	Daga
39	564	0672217	8402502	Pottery & Daga

40	562	0672217	8402500	Daga
41	561	0672179	8402558	Daga
42	558	0672111	8402588	Daga
43	567	0672134	8402906	Daga

8.2. List of Respondents

Key Informants	Hermesi Jimu
	Wyson Witines
Chitseko Village	Mayamiko Yasoni
	Toneta Sementi
Msamala Village	Montifoti Kamtima
	Matilda Philipino
	Hamilton Chitimbe
Nsamala Village	Meleyi Wiladi
Ching'anipa Village	Danger Nelson
Chatsika Village	Farazia Maliko
Kapesi Village	Agness Adiyelo
Kalumo Village	Ketilia Mzembe
Pitala Village	Beleniya Amosi